SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) ..... $3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Monthly (Established 1885) ..... 2.50 "
Scientific American Export Edition (Established 1878) ..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, MARCH 8, 1902.

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.

THE FASTEST LONG DISTANCE TRAIN IN THE WORLD.

We are informed that a new train has lately been placed on the Paris-Calais run, for the convenience of travel between Paris and London, which is scheduled to cover the distance of 184½ miles in three hours. This very fine performance is accomplished in spite of the fact that there is a stop of four minutes at Amiens, and that the speed is greatly reduced in running through the city of Calais to the pier where passengers embark for Dover. The announcement will give no surprise to those of us who have watched with interest the development of express train service on the leading French railroads. It is only of late years that France has brought her railroad system up to a pitch of perfection in comfort and speed at which it has ranked with the best railroads of the world. The improvement has been so rapid that, for the past three or four years, the French roads have not only surpassed in speed the trains for which Great Britain has been justly noted for half a century, but they have instituted a schedule of fast passenger trains which is absolutely without a rival either in Europe or America. There are over fifty express trains on the various French railroads with a speed including stops of over 50 miles an hour, and more than half of these run at an average speed of over 55 miles an hour. They have also been running during the past two years a few trains that reach an average of 60 miles an hour, but the distance was comparatively short. The Paris-Calais run, however, is made at a higher average speed than that of any express train in France, and although the distance run without a stop is less than that covered without a stop by the Empire State Express, the fastest long-distance train in this country, the average speed, 61½ miles an hour, is 7 miles an hour greater. The weight of the regular Empire State train behind the engine is 200 tons. We have no particulars as to the weight of the French train, but it is probably something less than that. There is food for thought, in the fact that the best work on these trains is being done by the four-cylinder express engines of the compound type.

COST OF WIRELESS TELEGRAPHY.

Successive steps in the establishment of wireless telegraphy follow each other with a rapidity which is quite unprecedented in the development of a new invention. It is not many weeks since the first successful signals were transmitted across the Atlantic, and in the interim the inventor has returned to England, completed his arrangements, and is now on his way back to America for the purpose of establishing a permanent station for the regular transmission of commercial wireless messages. Furthermore, it is announced that a contract has been made with the Canadian government for the transmission of ordinary transatlantic messages for ten cents a word, with a press rate of five cents a word. In accordance with this contract, the Canadian government will contribute $80,000 toward the erection of a station in Nova Scotia. At present the rate for general messages is 25 cents; so that the general public in Canada reap the immediate benefit of a reduction in the rate of fully 60 per cent.

Thus again do we see the indomitable patience of one man bring to fruition, after years of patient investigation, another of those epoch-making inventions, which are destined from the very first to bring untold benefit to the world at large and well-earned prestige and wealth to the inventor himself. In this age of increasing travel and multiplying international interests of a political, commercial and private character, this facilitating of communication between the old and new world will be beneficial to a degree that can scarcely be estimated. To the private individual particularly, will this great cheapening of telegraphic communication be welcome, as it brings the transatlantic "cablegram" within reach of a vast number of people to whom it is an impossible luxury at the present price. It is true the commercial success of the system has yet to be demonstrated; but Mr. Marconi has been so uniformly modest and conservative in his claims, and has evidently been careful never to announce his achievements until he had proved beyond a doubt their practicability, that the public will have every confidence in the inventor's ability to carry out to the letter his contract with the Canadian government.

A 70,000 HORSE POWER PLANT.

Another notable step has been taken in the development and application of the steam turbine. The Metropolitan District Railway, London, which is about to substitute electrical traction for the old steam locomotives that for several decades have rendered travel on this line hideous, is to make use of the steam turbine in a great central generating station, which will be located at Chelsea. The minimum output will be 70,000 horse power, and the plant will consist of ten Westinghouse-Parsons steam turbines, each of 7,000 minimum horse power capacity. Not only will this be the largest aggregation of steam turbines in the world, but it is scarcely necessary to say that the turbines themselves will be by far the largest ever built. At present the 2,000-horse power turbine at the generating station of the Hartford Electric Light Company is the most powerful in existence; two are also being constructed in Europe for electric lighting at Frankfort and Milan, each of which will be of 5,000 horse power.

The advantages of a steam turbine plant for electric lighting are many and valuable. In the present case the three-phase generators, each of 5,000 kilowatts capacity, will be mounted direct on the turbine shafts, and will be driven at the high speed of 750 revolutions per minute—a high speed for electrical work, but a low speed in comparison with those to which we have been accustomed in the steam turbine. An immediate advantage of the high speed, electrically considered, is that much smaller dynamos can be employed than would be necessary if slow-speed, reciprocating steam engines were used. If our readers refer to the description of the power station of the Manhattan Elevated Railroad given in the SCIENTIFIC AMERICAN of January 11, they will notice that the electrical units used at that station are of the same capacity, namely, 5,000 kilowatts, but that the speed of revolution is only 75 per minute. Consequently the generators are huge constructions, 42 feet in diameter and 445½ tons in weight, with 40 field-magnet poles. Compare this with the compact generators in the District Railway turbine plant, which, because they revolve at ten times the speed, will require only four poles and will have an external diameter of only 9 feet. It is evident from these figures that there will be a great economy in space and material secured by the use of the steam turbine in an installation of this kind. It has been proved furthermore in the experience that has been gained with large turbine units, that the economy of steam consumption is lower than that which has been obtained with the best types of reciprocating engine, the conditions of steam generation being of course the same. It has further been shown that the economy increases with the increase in size of the unit; and hence it is reasonable to look for very favorable results from a plant made up of 5,000-horse power generators. Other advantages that would be realized are the entire absence of vibration and the absence of oil from the water of condensation.

There is another benefit derived from the use of the steam turbine in an electrical power plant; we refer to the perfectly uniform turning moment. It is well understood that in a system which generates three-phase currents for transmission and conversion at substations, it is of importance to secure as perfect an angular velocity of the engine and generator as possible. Should there be any variation, there is a confusion of the phases which, if it exceeds a certain degree, is liable to throw the rotary converters out of step and tie up the line. In the Metropolitan Street Railway plant, it will be remembered, the problem is solved by placing the two cranks at an angle of 135 degrees with each other, so as to secure eight impulses at equal intervals in each revolution of the shaft. In the steam turbine, the dead center of the reciprocating engine is of course entirely eliminated, and there is a perfectly constant turning moment throughout the entire revolution. As regards the question of speed regulation, under the fluctuating load imposed on a central electrical power station, such as this, the turbine is well equipped, the steam being admitted to it in a series of well-regulated and continuous admissions, which at full load are so close as to constitute what is practically a continuous feed. Finally, the turbine has a distinct advantage from the fact that a much higher vacuum can be used than is possible in the case of the reciprocating engine, the exhaust from the lower-pressure turbine being at zero.

There is no denying that the question of both the steam engine and the electric generator for large central power plants has reached an extremely interesting if not critical stage. The compact steam turbine and four-pole generator running at 750 revolutions per minute stand out in very strong contrast to the giant four-cylinder reciprocating engine and the 40-pole, 445-ton generator running at only 75 revolutions per minute. One or other of these is bound to become the permanent type for future work of this kind; and we must confess that judged by its past performance and its future promise, the turbo-electric plant would seem to be the standard for the future. Unless the matter of equipping the central power station for the Rapid Transit Subway has progressed too far to admit of any change of plans, the Commissioners and their engineers should carefully weigh the merits of the turbo-electric installation before committing themselves to the erection of one more of the costly reciprocating-engine power stations, of which three have been built lately in this city.

HOW VARIOUS COUNTRIES SUBSIDIZE THEIR MERCANTILE MARINE.

In view of the interest aroused in our shipping subsidy bill to be brought before Congress during the next session, it is interesting to observe the various means adopted by European nations to encourage their mercantile marine. The steamship lines of Great Britain receive no state assistance beyond, in certain cases, a subvention, which is in reality too insignificant to be worthy of notice, for employing particular vessels as auxiliary cruisers in time of war, and for postal work. Since, however, the carriage of mails involves the allocation of a certain amount of space for the mail bags, and officials attached thereto, and is somewhat similar to freight, this payment can scarcely be termed a subsidy. The German lines are the most heavily state-subsidized steamship lines in the world, and but for this government assistance, it is very doubtful if Germany would have attained its present position in the mercantile marine among the maritime nations of the world. Certainly no fast steamships such as the "Deutschland," "Kronprinz Wilhelm," and "Kaiser Wilhelm der Grosse," would have come into existence. The total imperial subsidy granted by Germany to steamship lines amounts to $1,737,500 per annum, and is distributed among the North German Lloyd, of Bremen, and the German East Africa Company, at Hamburg. There is in addition to this a small imperial subsidy granted for a service recently established to compete for the West African trade. The German East Africa line receives $337,500 a year for a fortnightly service circumnavigating Africa in alternate directions. The North German Lloyd receives $825,000 per annum for a fortnightly service direct to China and Japan, and $575,000 for a monthly service to Australia. In addition to this there is an amount of $325,000 paid to the Hamburg-American and North German Lloyd companies for the carriage of mails. As before stated, the British government extends no pecuniary assistance to the various steamship lines, beyond a postal subvention, though it is often erroneously stated that this remuneration is equivalent to a subsidy. Comparison therefore between a German and English steamship company is scarcely possible. Both the P. & O., the largest steamship company in Great Britain, and the North German Lloyd run a large fleet of vessels in addition to those employed exclusively in carrying mails on the Australian and Eastern service. The total tonnage of the North German Lloyd fleet at the end of 1900 was 405,987 tons, and that of the Peninsular and Oriental Company, of London, 340,000 tons. The P. & O. Company receive the sum of $1,750,000 per annum for a fortnightly service from Brindisi to Shanghai, a weekly service from Brindisi to Bombay, and a fortnightly service from Brindisi to Adelaide. Of this sum approximately $425,000 is allotted to the Australian service, Brindisi to Adelaide, covering about 9,100 miles, including ports of call. If 2,500 miles, about the distance from London to Brindisi—the P. & O. are obliged to run to Brindisi to pick up the mails—and 1,075 miles, representing the mileage from Adelaide to Sydney, are added, a total distance of 12,675 miles, the nearest possible approach to an absolutely comparative basis is obtained. The North German Lloyd receive $575,000 per annum for a monthy service from Bremerhaven to Sydney, a distance of about 13,100 miles, including ports of call. The P. & O. Company run fifty-two voyages in a year, and the North German Lloyd run under their contract, at least twenty-six voyages a year. This works out at 66.105 cents per mile for the P. & O. and Orient companies, and $1.68819 per mile for the North German Lloyd. And as the Colonies and India contribute from their postal receipts a sum equal to half the total P. & O. postal subsidy of $1,750,000, it is not perhaps too much to assume that the British Post Office collects at least a similar amount from the carriage of mails outward, the deduction being that the postal matter carried by the P. & O. pays for itself, and is no burden whatever upon the British taxpayer. The North German Lloyd have within the last two years, distributed dividends of 7 per cent and 8½ per cent. The P. & O. average a divi-

dend on preferred stock of over 11 per cent, and nearly 8 per cent all round. It is quite open to say that the German company receive 7 per cent of the 8½ per cent in subsidy, and the P. & O. 10 per cent out of the 11 per cent. Both mail services, however, are in consequence of this subsidy run in a more extravagant manner than a purely commercial line would be, and the mileage comparison shows that the English company give the greater value for their subsidy than the German, or in other words the latter probably apply a much larger proportion of their subsidy to dividend purposes than the English company. It is only by means of this state assistance that Germany has been able to compete with England in the mail trade in the East—since Great Britain had such a firm monopoly that other than subsidized lines could not have run against them profitably. German competition, however, has not affected the English trade, but has rather developed it. Other European countries do not subsidize their steamship lines in the way that Germany does. Russia grants special subsidies to certain lines, which, however, chiefly trade within the Russian empire. There is also the volunteer fleet which plies between the Black Sea and eastern Siberian ports. This line calls at some Eastern ports, but carries little cargo, and is chiefly devoted to government political purposes. Japan grants general subsidies upon construction, mileage runs, and also special subsidies to the Nippon Yusen Kaisha to India and Europe, and the Toyo Kisen to San Francisco. The subsidy of the Nippon Yusen Kaisha averages an amount equal to two-thirds of the expenses per voyage, a very large subsidy. Austria grants a subsidy on shipping which, assuming that the freights earned covered expenses, would permit an average dividend of about 15 per cent to be distributed. The bounties of France are equal to about 12½ per cent on the value of the mercantile marine. It is a curious fact, however, that in none of these European countries is the state subvention regarded with satisfaction. Germany, which has been lavish in this direction, is indeed looking forward to the day when traffic with the East and Australasia will be sufficiently remunerative to enable the subsidy to be withdrawn. Such a state of affairs is very remote, however, at present, since English trade in those parts is so secure that the German competition has no effect upon it, whatever. Germany, in fact, has to create a new and special trade for her steamships, and the work is proving difficult, since the English lines offer more frequent services, and, on the whole, are much faster than the German boats plying between Europe and the East.

THE HEAVENS IN MARCH.

BY HENRY NORRIS RUSSELL, PH.D.

As we regard the evening sky at the present season we cannot help being impressed by the greater brightness of the western half in comparison with the eastern. Following the Milky Way up from the northern horizon we pass in succession the zigzag line of Cassiopeia, the bright group of Perseus, the irregular pentagon of Auriga, the parallel lines of Gemini, the lonely Procyon, and the brilliant Sirius, till we reach the southern horizon among the stars of Argo.

Below Auriga and Gemini to the west lie Taurus and Orion, perhaps the most familiar constellations of all. Aries and Andromeda are just setting in the northwest below Perseus.

The brightest stars in the eastern sky are Arcturus, in Boötes, and Spica, in Virgo. At our usual hour of 9 P. M. in the middle of the month they are both low down in the east. The former is the brightest star, except Sirius, in our skies, and may at once be recognized by its reddish color.

The sky east of the meridian is occupied by three large constellations. Ursa Major is the northernmost, extending north and east from the zenith. Leo comes next, with its familiar "sickle," and the bright star Regulus. The head of Hydra is midway between Regulus and Procyon, and from it the long line of the constellation stretches southeastward toward Spica. A small but conspicuous group to the right of the latter star forms the constellation of Corvus, or the Raven.

In the circum-polar sky Cepheus is below the pole, and Draco and Ursa Minor are east of it.

The most interesting recent astronomical news has to do with the nebula which surrounds the new star in Perseus, of which we spoke a few months ago. Traces of it have been discovered on a photograph taken at the Lick Observatory last March, which, like those obtained last autumn and winter, shows that the nebula has been steadily expanding, starting from the star itself at the time of its outburst. It is now nearly equal to the moon in apparent diameter, and is still growing. Recent observations also show that the star has no sensible parallax; that is, that it is by no means one of our nearest neighbors.

The enormous rate at which the nebula appears to move has been very simply explained by Prof. Kapteya, an English astronomer, as follows: Suppose that the new star is surrounded by a great cloud of meteoric dust, or something of that sort. The light sent out by the star during its short period of brilliancy will light up this dust as it travels through it, so that it will appear, when seen from a great distance, as a faintly luminous ring surrounding the star. This ring will appear to move outward in all directions with the velocity of light—186,000 miles per second—which is certainly fast enough. The irregularities of the nebula as photographed can be accounted for by assuming that the dust is thicker in some places than in others.

On this hypothesis the distance of the Nova may be calculated from the apparent size of the nebula. We give only the results here, referring for the proofs to a letter by Mr. W. E. Wilson in Nature for January 30.

It appears that the new star is so far off that it takes its light about 250 years to reach us. Its actual brightness, during the few days when it was at its best, was about 10,000 times that of the sun. It still gives out ten times as much light as the sun does, though it is now invisible to the naked eye. Finally, the outburst which we saw last year must have taken place about the year 1650, its light having taken all the intervening centuries to reach us.

THE PLANETS.

Mercury is morning star in Aquarius, rising about an hour before the sun. On the 16th he reaches his greatest western elongation. He is farther from the sun than usual, but, being south of him, is not as easy to see as he was at his recent evening appearance. Venus is also morning star, and is in a situation very much like Mercury's, but farther from the sun, so that she rises from one and a half to two hours before sunrise. She is rapidly growing brighter, and on the 20th is at her greatest brilliancy, being once more easily visible in the daytime, if one knows just where to look for her. Mars is within a few degrees of the sun, and therefore cannot be seen. The sun, whose apparent eastward motion among the stars is faster than his, overtakes him on the 29th, and he becomes a morning star, though he will not be visible in that capacity for some time to come.

Jupiter and Saturn are morning stars in Sagittarius. On the 15th the former rises over two hours before the sun, and the latter nearly three.

Uranus is morning star in Scorpio. On the 12th he is in quadrature with the sun, and is due south at 6 A. M. Neptune is in Gemini. On the 19th he is in quadrature, but since he is 90 deg. east of the sun, while Uranus is 90 deg. west of him, the two planets are in almost exactly opposite parts of the heavens.

THE MOON.

Last quarter occurs on the morning of the 2d, new moon on the afternoon of the 9th, first quarter on that of the 16th, full moon on the evening of the 23d, and last quarter again on the night of the 31st, or, properly speaking, on the morning of April 1, since the phase occurs at 1 A. M.

The moon is nearest us on the 13th, and farthest off on the 1st. She is in conjunction with Uranus on the 3d, Saturn on the 5th, Jupiter on the 6th, Venus on the afternoon of the 7th, Mercury the following night, Mars on the 11th, Neptune on the 16th, and Uranus again on the 30th. None of these conjunctions are close except that with Venus, which will be about 1½ deg. south of the moon.

At 8 A. M. on March 21 the sun enters the sign of Aries, and, according to the almanac, "spring begins."

Princeton, February 18, 1902.

EARTH TELEPHONE EXPERIMENTS OF M. DUCRETET.

M. E. Ducretet, a well-known electrician of Paris, has been making some interesting experiments in telephonic transmission by using the earth alone as a conductor. The transmitter in this case consists of a microphone and a few cells of battery connected directly to two earth plates of considerable surface and buried 6 feet below the ground. The plates are placed facing each other and only a few yards apart. For the receiver he makes use of a quarry well about 60 feet deep which communicates below with the Catacombs. The orifice terminates at the ground level by a cast-iron pipe 4 inches in diameter and 12 feet long. An insulated conductor descends in the vertical well and brings a metal sphere 3 inches in diameter in contact with the soil of the Catacombs. On coming out of the well the wire is fixed to one end of an ordinary telephone receiver, whose other end is connected with the iron pipe at the surface of the ground. The two earth circuits which are thus made are separated by a building with cellars and thick walls, and therefore the layer which separates the two parts is considerable. When the microphone is spoken into, all the vibrations of the voice, even the feeblest, give rise to variations of current in the circuit which is closed through the earth, without any metallic connection between the two parts, and in spite of the multiple variations of the currents and the nature of the medium, earth, which is used, the reproduction of the voice is made at the receiving end with remarkable sharpness, and besides, there are none of the extraneous noises which are so common in the ordinary circuits. The dynamos which are working in the neighboring building, both continuous and alternating current, have no effect upon the circuit. It is difficult to give a satisfactory explanation of this phenomenon of earth transmission, but M. Ducretet thinks that the current is diffused from the transmitting station by derivations from the principal circuit between the plates, and that this current is sufficient to operate a certain number of receivers placed at different distances. With the arrangement of circuits described above, the experimenter was able to send through the earth a current sufficiently strong to operate a relay and electric bell. If the sphere which rests upon the soil of the Catacombs is raised from the ground, all reception ceases, but recommences when the contact is again made with the earth, which, it should be remarked, is dry. M. Ducretet is continuing his experiments over greater distances and under varying conditions.

SCIENCE NOTES.

The North German Lloyd steamer "Krefeld" has just brought to Germany 175 ancient Chinese bronze guns, which formerly stood on the walls of Pekin, and, according to inscriptions upon them, were cast between 200 and 250 years ago in Chinese arsenals under the superintendence of the Jesuits. It is stated that the more highly ornamented pieces of cannon are to be placed in the Naval Museum, while the remainder are to be melted for the sake of the bronze.

M. Sibillot, a Parisian aeronaut, has devised a new principle of aerial navigation which, he anticipates, will solve the problem of traveling through the air. He has completed the plans of a new dirigible balloon which, he maintains, will be manageable in any weather. He proposes to carry in his aerial machine a refrigerator and a heating apparatus. By simply pressing a lever of the former he thus reduces the temperature of the gas, the condensation causing the balloon to descend. On heating the hydrogen the gas expands, and thus the balloon ascends. By this alternative heating or cooling of the gas in his balloon he can rise or fall at will without allowing any of his hydrogen to escape.

Australia is proving a formidable rival in the butter industry of the world, and the rapid growth of the export trade of that country has advanced steadily during the past few years. From the colony of Victoria alone there were exported to Great Britain during 1899-1900 17,107 tons, representing a gross value of $8,023,000. The export of butter from Victoria commenced in 1889. During the first year the quantity exported was 369½ tons, representing a monetary value of $255,000. In the following year it had risen to 759¼ tons, of a value of $495,000. The remarkable growth of the industry continued during the succeeding years, and as the demand for the article is so great there is every appearance of the colonial produce supplanting that of other countries, especially when the rich and extensive pastoral resources of Victoria are remembered. For the ten years during which the trade has existed the total exports of butter have reached 79,426 tons, aggregating a value of $38,533,475.

Dr. A. Wynter Blyth, barrister-at-law and medical officer of health for Marylebone, had a startling proposition to make in his capacity of new president of the Incorporated Society of Medical Officers of Health, who held their annual gathering at the Hotel Cecil. In his presidential address he discussed the subject of "Ventilation" in all its bearings, says the London Chronicle. To improper ventilation he attributed the low state of public health, which conduced to the spread of tubercular and other maladies. After dilating upon the atmosphere and excellent ventilation of the tube railway, he said it was within the possibilities of modern science to make the deepest mine not only habitable, but agreeable and healthy. It might be hereafter a contribution to the solution of the housing question to build downward in the depths instead of upward on the mountain. One could imagine a Jules Verne cavernous city, where the sky was the ever-white, changeless chalk, where no rain fell, where no frost penetrated, where the light never failed, and where dry, warm, filtered, purified, ozonized air bathed the lungs and fanned the cheeks of the denizens in the constant white glare of a never-dying summer's day. In tenement-houses and workplaces it was better to deal with each individual room and give them their own ventilating system. With regard to the ordinary tenement-house it was doubtless at the present time hopeless to suggest any mechanical appliance. They must seek the great factor in the propagation of tubercle in the constant breathing of bad air added to close contact of the healthy and diseased. If some of the great expert talent now employed in the investigation and discussion of problems relating to sewage and sewage-disposal were diverted to the study of ventilation, our factories and workshops would put out more work in a given time, and the mean duration of human life in the country would be appreciably lengthened.