sulted by some engineers of Florence who found it impossible to raise water in a pump barrel higher than thirty-four feet, told them that Nature's abhorrence of a vacuum extended only to a hight of thirty-four feet; and that beyond that hight, it had no objection to an empty space. Galileo's pupil Torricelli first demonstrated, by actual experiment, the cause of water rising in a pump barrel from which air had been exhausted, and his theory was firmly established by the experiments of Pascal. Torricelli's experiment can be readily reproduced. Take a glass tube, more than thirty inches long, filled with mercury, from which the air has been expelled Put the open end of this tube into a cup filled with the same liquid, and the mercury in the tube will fall until it has reached a night that can be balanced by the pressure of the atmosphere. The space in the tube above the mercury is called the "Torricellian vacuum," and is the most perfect vacuum that can be produced by mechanical means. By a perfect vacuum we mean empty space, and this space above the mercury is supposed to contain two substances: 1st. The vapor of mercury, which is there in virtue of the principle that evaporation takes place from the surface of all liquids, at all temperatures except that of absolute zero. 2nd. The subtle and elastic medium of ether, which is supposed to pervade all space. Many physicists have made experiments to determine the existence of this ether, but its effects are best observed in the motions of Encke's comet, whose periods of return to its perihelion are constantly diminishing. The undulating theory of light is also based on the existence of the ether.

It becomes interesting, then, to inquire whether a perfect vacuum can be produced in any manner. Admitting the existence of the ether, which has some tension, even though it be too small to be measured by the most delicate instrument, it will be seen that the problem cannot be solved, unless we can destroy the tension of this ether. There is a theoretical temperature, at which (if it could be produced) all vapors would lose their tension. This is the point of absolute zero, at which all heat motion ceases. This is a point which can never be reached in practice, but can readily be determined, and is marked on the thermometric scale as follows: —219·2° Réaumur's scale, —274° centigrade scale, —461·2°, Fahrenheit's scale.

Before closing, we will explain how a degree of exhaustion can be reached, which is almost perfect with the exception of the ether. In the use of an ordinary air pump, at each stroke a pump full of air is removed, and the remaining air expands and fills the whole space. Hence, with the most delicate machine, there will always be some tension in the receiver, unless other means are employed. Let the pump and receiver be filled with carbonic acid instead of ordinary air, and let this be exhausted by successive strokes of the pump until the tension is very slight. Then introduce potassa or caustic lime, which will absorb the rest of the carbonic acid, leaving a perfect vacuum, as far as can be ascertained by a measuring instrument or gage.

TIME AROUND THE WORLD.

We have received of late sundry queries from correspondents relative to the gain or loss of time in circumnavigating the globe. Those who have not found answers in the columns devoted to such purpose will receive a general response in the following rather amusing discussion recently carried on between two grave and learned French *savants* on the same rather paradoxical topic. M. Jules Verne, of the French Geographical Society, has written a book entitled a "Tour around the World in Twenty-four Hours." What the nature of the contents of the volume is, we know not; but at all events it excited M. J. Bertrand, of the Academy of Sciences, to attempt to pose M. Verne with the following conundrum: "A person, supposed to be furnished with the necessary means of transportation, leaves Paris at noon on Thursday; he travels to Brest, thence to New York, San Francisco, Jeddo, etc., returning to his starting point after twenty-four hours, that is, encircling the globe at the rate of 15° of longitude per hour. At every station, as he passes on his journey, he asks: "What time is it?" and he is invariably answered: "Noon." He then inquires "what day of the week is it?" At Brest, "Thursday" is the reply, at New York the same; but on his return, supposing he passes Paris from the east and stops at Pontoise, a town some 19 miles to the northwest of that city, he will be answered "Friday." Where does the transition happen? Or when, if our traveler is a good Catholic, should he consider Friday's abstinence from meat to begin? "It is evident," continues the questioner, "that the transition must be sudden, and may be considered to take place at sea or in a country where the names of week days are unknown; but," he continues, "suppose the parallel at which it happens should fall on a continent habited by civilized people speaking the same language, and that there should be two neighbors separated, say by a fence, on this very parallel. Then would not one say it was Thursday, at noon, while at the same moment the other would assert it to be Friday, at the like hour?"

M. Verne answers as follows: It is true that, whenever a person makes the tour of the globe to the east, he gains a day, and similarly when traveling to the west he loses a like period, that is to say, the twenty-four hours which the sun in his apparent motion occupies in describing a circle around the earth. This is so real and well recognized that the administration of the French navy gives a supplementary day's ration to vessels which, leaving Europe, double the Cape of Good Hope, while it retains on the contrary a similar provision from ships rounding the Horn. It is also true that, if a parallel existed, such as above described, across an inhabited region, there would be complete disagreement between the people adjacent thereto; but this parallel does not exist, for Nature has placed oceans and deserts in our path where transition is made and a day gained or lost unconsciously. Through an international convention, the point for making the days agree has been fixed at the meridian of Manilla. Captains of vessels, under the same rule, change the dates of their log books when they pass the 18th meridian.

Edgar A. Poe, if we are not mistaken, avails himself of this apparent puzzle, in one of his desultory sketches, to point the story of an individual whose would-be father in-law refuses him the hand of his adored, with her concomitant of an agreeably large dowry, until that time shall happen when "two Sundays fall in a week." The luckless lover in despair goes to sea, sails round the world, and returns to renew his suit exactly one year from his departure. In the course of events a discussion takes place between himself and the stern parent relative to the present day of the week, in which he insists that it is Monday, and the old gentleman is equally positive that it is Sunday. The one produces his diary, kept since his departure; the other falls back upon the calendar. Finally it transpires that the traveler in sailing round the globe to the east has gained a day in his reckoning; hence both disputants are right, two Sundays have come together, and the happy *dénouement* follows.

THE TEXAS PACIFIC RAILROAD.

The line of the Texas and Pacific Railroad, which is one of the youngest of the great transcontinental routes now in process of construction, is, with its connections, to connect New York with San Diego, on the Pacific coast, and thence with San Francisco. In extent, the road to its terminus will be four hundred and fifty miles shorter than any line now connecting the metropolis with San Francisco, or, with its branch to the latter city, will not exceed, in the distance passed over, any of the present routes.

The surveys across the continent, which have recently been made, indicate that the region chosen is especially adapted to the construction. Among the remarkable features, it may be noted that the summits to be crossed are about thirty-two per cent less than those on existing Pacific roads, while the grades and curvature will be about sixty-two per cent less. The climate through which the line is located is so favorable that no train need be delayed by snow or similar obstructions, common upon the northern roads; and an abundance of excellent coal for fuel is accessible at numerous points. The entire rail transportation between the waters of the Pacific and New Orleans will be less than 1,800 miles, and with ports in Texas, something under 1,500 miles. Adding to these advantages the bordering Mexican States, with their great mineral wealth, together with the immense traffic of Texas, California, New Mexico, and Arizona, it certainly seems that the enterprise will prove of great value, both nationally in opening to trade an almost unrivaled section of the country, and individually in the large profit which it must yield to its projectors.

As regards the progress of the road, we have before us the report of the President, Hon. Thomas A. Scott, in which it is stated that nearly four hundred miles of the line have been graded, and the bridging so far advanced as not to retard the laying of the iron. The greater portion of the ties needed have been distributed, and the rails, etc., for three hundred miles, are being forwarded to cities along the route as rapidly as possible. The labor has been accomplished since last October in the face of serious obstacles in the way of transporting material. Work has also been begun at San Diego, and is being rapidly pushed forward. The grant of six millions of dollars of bonds, made by the State of Texas, to the road was coupled with the condition that the line west from Marshall, and west from Texarkana, should be completed to a point of junction near Fort Worth, by January 1, 1874, so that by that date quite an extensive portion of the route will be finished.

President Scott considers that, judging from past progress, the entire road will be built within a period of five years' and consequently much within the time granted for its completion.

Fishing Tackle.

We were shown a few days ago a trout fishing rod, made for a friend of ours by Mr. Thomas Tout, of Kingston, Mass., which excels in beauty anything we have seen in this line for some time.

It was made of lance wood, and provided with a number of extra tips of the same material and of bamboo. The mountings were silver plate, finely finished and of chaste pattern. The rod possesses, in an unusual degree, that peculiar elastic quality which an expert fisherman readily understands by the handling, but which it is difficult to adequately describe. It was very light, weighing only 8 ounces, as flexible as a whip thong, and strong enough to land a grampus.

A Competitive Trial of Rock Drilling Machines.

It has been announced that a trial of apparatus used in quarrying and boring rock will be held at Pittsburgh, Pa., on July 8, 9 and 10 *proximo*. To this competition, owners and patentees of drilling apparatus, whether worked by hand, compressed air or steam, drilling bits and tools, electric and other fuses, and all other appliances used in rock cutting and mining are invited to send their inventions. Steam power will be furnished gratuitously, and the trials will take place in a quarry, so that really practical results will be obtained. These experiments are likely to be of great interest to the coal mining population, to whom the necessity of practical mechanical appliances is one of great importance. Further particulars will be found in our advertising columns.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE PROPER MOTION OF PROCYON.

M. Struve, director of the Russian Central Observatory at Pulkowa, has discovered a very small star, at a distance of about two seconds from Procyon. The position which this body occupied during the observations accords perfectly with the hypothesis of Dr. Auwers that the irregular movement of Procyon is due to its movement around some smaller and hitherto unknown companion, through a period of about forty years. The mass of this new star, it is concluded, cannot be less than half that of the sun.

PROGRESS OF THE ST. GOTHARD TUNNEL.

During the month of March last, the piercing of the St. Gothard tunnel advanced to 806·4 feet. The total number of workmen employed is 813. Considerable difficulty has been experienced owing to the percolation of water through the micaceous rock. At one time, the flow averaged 75 quarts per second, greatly delaying the progress of the work.

RUSSIAN OBSERVATION OF TRANSIT OF VENUS.

The Russian government has appropriated 70,000 roubles (about $55,000) for observation of the coming transit of Venus. Twenty-four expeditions will be dispatched to various parts of the globe.

A NEW BLUE COLOR.

A new shade of blue of great beauty has been obtained by Springmühl from a secondary product derived from the manufacture of artificial alizarine. The color is consequently extracted indirectly from anthracene, produced from tar. It is stated that, under certain conditions, it is superior to the aniline blues, but at present its cost is quite high.

CASTING THE STANDARD METERS.

The International Metric Commission, which met in Paris in October last, decided that each of the States represented should be supplied with a standard meter made from iridiated platinum, and that the manufacture of all the bars should take place at the same time and from one melting of the alloy. Before proceeding with this extensive and delicate operation, the French section of the commission, to which the work is entrusted, have recently caused to be made two type meters in order to test the processes which will be hereafter employed in forming the standards. M. Deville having succeeded in obtaining iridiated platinum in a perfectly pure state, the fusion and casting of the types recently took place in his laboratory in presence of the President of the Republic and many other distinguished personages. Nineteen and four fifths lbs. of platinum were, by the action of the oxyhydrogen flame, melted in 45 minutes with 2·2 lbs. of iridium, the latter, it may be here remarked, being by far the least fusible and hardest of the metals which accompany platinum in its natural state. The ingot was cast in a mold formed from a block of carbonate of lime, the interior surface of which was brought to the state of caustic lime under the excessive temperature therein developed. By this means all risk of fissures within was avoided. The metal cooled in the mold, retaining its brilliant surface, after which the bar was suitably rolled and finished. The operation was a complete success, and will be repeated with the 440 lbs. of alloy necessary to compose all the standards. This will be a metallurgical process, says *Les Mondes*, far exceeding in magnitude anything of similar nature that has yet been attempted with these inalterable metals.

NEW HORTICULTURAL FERTILIZER.

Some time since we called attention to a new chemical fertilizer for horticultural purposes, suggested by Dr. Jeannel of Paris. *Les Mondes* of recent date, in commenting on results obtained by its use, says that it represents the fertilizing principles of at least one hundred times its weight of concentrated animal manure, and supplies to the plants nitrogen, phosphorus, potash, sulphur, and iron in a completely soluble state. The compound consists of 400 parts of nitrate of ammonia; 200 parts biphosphate of ammonia; 250 parts nitrate of potash; 50 parts muriate of ammonia; 60 parts sulphate of lime, and 40 parts sulphate of iron. These ingredients are pulverized and mixed. One dram of the powder (about a teaspoonful) is then dissolved in a quart of water and a wineglassful of the solution given two or three times a week, in accordance with the health and luxuriance of the vegetation.

The plants may be placed in any kind of earth, however poor, even pure sand, or may not be potted at all. It is stated that certain flowers, the fuchsia, for example, may be cultivated without earth by simply placing the stalk in a jar, at the bottom of which is an inch or so of water, just sufficient to cover the ends of the roots. To the fluid a proportional quantity of the fertilizer is added, as above specified, once in eight days. The foliaceous development of plants treated with the substance is said to be truly wonderful, and yet the rapid growth of the leaves does not interfere with the most luxuriant flowering. To this we may add that quite recently we have tried a compound hastily composed of the majority of the substances above detailed, merely as an experiment, on a small and sickly fuchsia. The plant was drooping and little else remained than a half dry stalk. After two applications of the fertilizer, its effect was apparent, and at the end of ten days, during which probably half a pint of solution had been supplied to the earth, new shoots had sprung out, leaves formed, and the entire plant became perfectly loaded down with buds.

T. J. A. says: The SCIENTIFIC AMERICAN is the most valuable paper within my knowledge, and I have read all the foremost papers in the land.