ringing notes in the whole of the compass with ease, the author says he should attempt to sustain the various vowels. In the first instance this can best be accomplished by prefixing "pat-a-wat" to them, thus: "pat-a-wat-way," "pat-a-wat-wee," "pat-a-wat-wy," "pat-a-wat-woh," etc. Afterward they must be practised by themselves, and when perfected, words, phrases, etc., should be tried in the whole of the compass. It should be noted that the vowel "Ah" must not be used until the voice is thoroughly under control. When this is so, Austin admits, there is no better vowel for practice, for it helps to give the open throat so very necessary for good voice production, but if used too early in the training, it tends to force the vocal cords apart.

In the above method no attention is paid to breathing, the whole of the mind being concentrated at first on getting a loud, sustained, metallic ringing tone. When the habit of contracting quickly and fully has, so to speak, been impressed upon the adductor muscles of the cords, gradations of tone can be carried out with safety and delightful ease, and it will be found that whatever amount of breathing is required for phrasing, etc., can now be taken in and scientifically dealt with without having to worry about breath control.

THE RAILWAY AROUND LAKE BAIKAL.

Lake Baikal has hitherto made a very troublesome break in the continuity of the great Siberian railway. This large sheet of water, one of the biggest lakes in the world, has had to be traversed by various means, according to the season of the year—by steam ferry, ice-breaker, and, when the ice was strong enough, by carriage; and finally, since the outbreak of war, by a railway laid on the ice. This line round the lake has been under contemplation from the outset, but the natural conditions of the country through which it had to pass offered a multitude of obstacles to the engineers, and several distinct plans have been under consideration. This should be taken as only applying to the section as far as Kultuk, beyond which place the direction of the line was decided upon as early as 1899, while the former section could not be taken in hand till 1901. The railway was not expected to be ready before the beginning of next year, but the work has progressed so fast since the beginning of the war that it is now practically complete. Although water supply and the full complement of sidings allow of fourteen trains per day in each direction, it was proposed to run only seven trains a day in each direction and to use the ferry, the arrangements for which have been improved, as a kind of auxiliary and reserve.

The line eventually chosen is the one proceeding from the station called Baikal to Kultuk, and from thence to what is now the town of Myssowek along the shore of Lake Baikal. Proposals were made in favor of an alternative line passing over the elevated country between Irkutsk and Kultuk, which at places rises more than 2,000 feet above the level of Lake Baikal, which is again some 2,000 feet above the sea. Among the reasons why this plan was discarded were the heavy gradients, in some places over 17 per cent; and the unfavorable quality of the rock. The total length of the shore line which was eventually chosen is 161 miles, while the calculated expenditure is $27,049,803, part of the aggregate expenditure including some works connected with the extension of the harbor at Tanchoi, which materially increase the capacity of the ferry traffic. The railway is thus the most expensive line ever built within the Russian empire, and the one which has presented the most serious engineering difficulties, its building necessitating a large number of special constructions, such as tunnels, bridges, viaducts, etc. The coast of Lake Baikal, from the mouth of the River Angara to Kultuk, a distance of about 530 miles, is very mountainous, the rocks in many places leaving but a narrow strip of foreshore, while in others they descend sheer into the lake, rising to a height of 1,000 feet above the level of the water. These mountains are, besides, in many places intersected by awkward crevices and clefts. On this section of the line there are no fewer than 32 tunnels, in addition to which there are 210 bridges, viaducts, special supports, etc. The railway, like a huge snake, crawls along the side or makes its way through the mountain in a variety of twists and bends, at one place having to cross an inlet of the lake. It has often been necessary to take special precautions against the falling upon the line of pieces of loose rock, as the mountains in this region have been much affected by volcanic eruptions. Water is apt to make its way into the tunnels from the same cause. The looseness of the rock in many places has also necessitated the bricking up of the tunnels to a far greater extent than was originally calculated. The amount of rock and earth work is enormous, the former even reaching the figure of 10,000 cubic saschen (70,000 cubic feet) per verst.

The other section of the new line, from Kultuk to Myssowek, runs over an entirely different kind of country and has in every respect been much easier to build, nor has there been any wavering as to its direction. Beyond Kultuk the mountains on the whole recede further from the shore, leaving ample flat land for the railway, which, on the whole of this section, only passes one tunnel. On the other hand, several large streams have to be crossed, necessitating the building of bridges up to 500 feet in length. The country is almost uninhabited, and the soil is always frozen; the mean temperature of the year is half a degree Centigrade of frost. The bridges are all built of stone and iron, as are the viaducts. The railway has the ordinary Russian gage and only one line of rails, but the tunnels are constructed wide enough for a double track. The traffic, under ordinary circumstances, is calculated to comprise seven trains daily in each direction, a number which, however, as already mentioned, can be doubled. The maximum gradient is 8 per cent (in the tunnels considerably less), and the smallest radius of curve is about 1,080 feet.

The whole of the railway round Lake Baikal has been built by contractors, and has not been split up in such small portions as was the trans-Baikal Railway, nor partly built by the government itself, as was also the case with portions of that line, and there is every reason to believe that it has been satisfactorily constructed.—London Times.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1536, is opened with an excellent article by Emile Guarini on the new Jungfrau locomotive. The first installment of a good review by Sir William H. White on submarines is presented. How modern geodetic rules are corrected for expansion of metals is explained in a thorough article. The methods followed in the manufacture of ferro metals in general, and the result of four years' study of ferro-titanium in particular, are presented by Auguste J. Rossi. Dr. O. Schott writes on a new ultra-violet mercury lamp which is primarily intended for the production of therapeutic ultra-violet rays. The demands made upon locomotives in point of speed and tractive power have steadily increased. Still, their size and weight are limited. The efforts of locomotive builders have, therefore, long been directed toward increasing the efficiency of the steam and thus obtaining a greater power from a given boiler capacity. How German builders have used the superheater for this purpose is clearly explained in a well-illustrated article. The result of an investigation of the oscillations of railway vehicles is published. Mr. Cowper-Coles has recently made a series of experiments on the electrolytic piercing of metals. These experiments are described. One of the men who ran the 130-mile-an-hour Berlin-Zossen train was an American engineer, Mr. Charles A. Mudge. His critical tabulation of the results obtained in that famous run are of interest. Charles E. Benham describes a curious induction experiment. In the SUPPLEMENT of February 27, 1904, we presented a copiously illustrated paper on clock escapements. In the current SUPPLEMENT will be found a counterpart to this paper on watch escapements. The usual science notes, electrical notes, and engineering notes are also published.

A NEW STAR.

Harvard announces the apparent discovery of a new star, R. S. Ophiuchi. Miss Cannon, from an examination of the light curves, called attention to the remarkable increase in the light of this star which took place in 1898. The star has been photographed every year since 1888, except 1889. The star appears to have had about the tenth magnitude before 1891, gradually increasing in brightness from the year 1893 to 1897.

In 1898 it was somewhat fainter, until May 31, and one month later, on June 30, it was more than three magnitudes brighter. Then it gradually grew fainter, until October 8, when it was again at about the tenth magnitude. During 1899 it remained faint, but in 1900 became brighter, diminishing again to the tenth magnitude in September of that year.

Since then the variations have been slight. An examination of several good chart plates shows only one star in this position. Both spectrum and light curves indicate this object should be regarded as a new star rather than a variable star, and its proper designation would be Nova Ophiuchi No. 3. The new stars of 1604 and 1848 appeared in this same constellation.

METEOROLOGICAL SUMMARY, NEW YORK, N. Y., MAY, 1905.

Atmospheric pressure: Highest, 30.38; lowest, 29.65; mean, 29.99. Temperature: Highest, 80, date, 7th; lowest, 41, date, 2d; mean, 60.5; normal, 59.8; excess over mean of 35 years, + 0.7. Warmest mean temperature, 65, 1880. Coldest mean, 54, 1882. Absolute maximum and minimum for this month for 35 years, 95 and 34. Average daily temperature deficiency since January 1, — 0.8. Wind: Prevailing direction, South; total movement, 8,632 miles; average hourly velocity, 11.6 miles; maximum velocity, 48 miles per hour. Precipitation, 1.12. Average for 35 years, 3.11. Deficiency, — 1.99; since January 1, — 4.10. Greatest precipitation, 7.01, 1901; least, 0.33, 1903. Thunderstorms, 13th, 15th, 18th, 28th. Clear days, 9; partly cloudy, 14; cloudy, 8.

SCIENCE NOTES.

What is believed by antiquarians to be the oldest paper book in existence is the "Red Book of Lynn," an ancient register belonging to the Corporation of King's Lynn (England). This volume is known as the "Red Book" from its original binding having been of that color. The first entry is a transcript of the will of Peter de Thorndon, burgess of Lynn, dated 1309; the latest entry is on folio 100, and is dated 15 Richard II. Some fifty years ago it was repaired and rebound, and the leaves, which age had reduced to a loose, fibrous substance, were carefully resized as an aid to preservation.

Pursuing his studies on the presence of methyl aldehyde in smoke, in the course of which he has established the fact that it is found in all usual combustions, M. Trillat has communicated to the Académie des Sciences these conclusions: Formic aldehyde exists in the soot of our chimneys and in the air of cities. It is found in noticeable quantities in the combustion of sugar, juniper berries, sweet roots, benzoin; in particular, when the combustion occurs in contact with hot metallic surfaces, whose catalytic effect intervenes to increase the yield. The constant presence of formic aldehyde in the gaseous or solid part of fumes explains their disinfecting action, in which the good effects of formic aldehyde were utilized long before they were known or studied.

M. Leduc has presented to the Académie des Sciences the course and results of his experiments, and draws the following conclusions: (1) Muscular contraction raises the osmotic pressure in the muscle; (2) this elevation of the pressure may exceed 2.521 atmospheres, 2.604 kilogrammes per square meter of surface; (3) the elevation of the intramuscular pressure is the greater as the excitations are stronger and more prolonged; (4) the elevation of the osmotic pressure in a contracting muscle is, for the same excitations, the greater as the resistance met by the contraction is the greater; and (5) these considerable changes of the osmotic pressure in a contracting muscle necessarily exercise a preponderating, if not a unique influence, in causing fatigue.

Many astronomers have sought to photograph the solar corona when not totally eclipsed, but have not secured a satisfactory result. M. Hansky, in a communication to the Académie des Sciences, describes his success in operating at the summit of Mont Blanc, where in the rarity and purity of the atmosphere the red rays in the spectrum are feeble as compared with the yellow rays and the green. By combining colored lenses, suitably selected, employing plates very sensitive to the red, and profiting from these facts, (1) that the rays appertaining to the red part of the solar spectrum traverse an atmosphere without sensible absorption or dispersion, (2) that the continuous spectrum of the corona is very intense in its least refrangible part, and (3) that photographs render very sensitive the slight difference in luminous intensity of objects photographed, and that processes permit even of increasing these contrasts, he succeeded in photographing the corona of the sun in the red part of its spectrum. The photographs which he presented exhibited the solar corona with an intensity and perfection not hitherto attained, except during solar eclipses.

The results of the geological surveys that were carried out by Mr. H. H. Hayden, of the Geological Survey of India, who was attached to the recent British expedition to Lhasa, have been published. From his investigations the country is strikingly poor in minerals of economic value, the only one found *in situ* being gold, which is obtainable in very small quantities from the coarse gravel beds of the Tsangpo. The largest yield obtained by panning was only at the rate of 28 grains of gold per ton of gravel. Concentrates were found to contain, in addition to much magnetite and zircon, a small quantity of rutile and hercynite, and probably uraninite. During his sojourn at Lhasa the geologist purchased varied samples of the gem stones employed by the local jewelers, among them being turquoise, ruby, tourmaline, emerald, and sapphire. The jewelers stated that all these stones were brought from a considerable distance, some coming from Ladak and Mongolia, and others from India. Mr. Hayden could obtain no trustworthy information as to the existence of any native sources of gems, and concludes that turquoise is practically the only native gem stone. He also succeeded in disproving the general belief that coal is to be found at Lhasa.

The production of all kinds of rails in the United States in 1904 amounted to 2,284,711 gross tons, against 2,992,477 tons in 1903, a decrease of 707,766 tons, or 23.6 per cent. The production of Bessemer steel rails in 1904 amounted to 2,137,957 gross tons, against 2,946,756 tons in 1903, a decrease of 808,799 tons, or over 27.4 per cent.