thermore, permit the selection of voltages according to the resistance which the final current will encounter.

Inasmuch as each keyboard controls ground-tone and overtone mixing devices, it is possible to produce notes of the same timbre or of different timbres. Excellent orchestral effects can, therefore, be obtained by causing the one keyboard to sound wind instruments, such as oboes, flutes, clarinets, or horns, and the other to sound the tones of the violin or other stringed instruments.

From this necessarily cursory consideration of the telharmonium, it is evident that the music is initiated as electrical vibrations, distributed in the form of electricity, and finally converted into aerial vibrations at a thousand different places separated hundreds of miles, it may be. No musical instruments in the sense in which we understand the word are used. Not a string, reed, or pipe is anywhere to be found. The vibrations produced by the performers' playing are wholly electrical, and not until they reach the telephone receiver can they be heard. The telephone receiver acts for us as a kind of electrical ear to hear oscillations to which our own ears are insensitive.

When Mark Twain heard the telharmonium, he fancifully suggested that the military parade of the future would be a more beautifully rhythmic procession than our present pageants. The usual military bands heading the various regiments and playing marches, not in unison, although the same in time, will give place to musical arcs disposed along the line of march, all crashing out their strains in perfect time. The soldiers who will march in that future parade will all hear the blare of invisible electrical trumpets and horns at the same moment; they will all raise their left feet at exactly the same instant, just as if they were but one company.

So far as the capabilities of the telharmonium are concerned, it may be stated that the New York installation is able to supply ten thousand subscribers, or more, with music of moderate volume at widely remote places. The very remarkable and rapid development of the invention has been thus eloquently set forth by Prof. A. S. McAllister in an article published in the Electrical World:

"From Hero, who first proposed to utilize the motive power of steam, to Watt's first successful engine, was almost two thousand years. And between the proposal of Hero and the accomplishment of Watt many inventors in different countries made ineffective attempts to attain the goal desired. From Huyghens's proposal of an explosive motor to Otto's successful machine two centuries elapsed, with scores of patents in the different countries of Europe. So from Sir Humphry Davy's experimental arc to the Brush and Edison arc lighting machines, three-quarters of a century elapsed, during which scores of inventors in different countries endeavored to solve the problem in vain. Similar remarks apply to the progress of most great inventions, electrical and mechanical. But the process of producing music from dynamos has been carried from the first conception to the successful working machine by one man—Thaddeus Cahill—in a few years. And when one hears the plant at Thirty-ninth Street and Broadway, with its musical tones already equaling, if not surpassing, the instruments of the orchestra, one wonders what cannot be expected in a few years to come when the inventor will have had time to do his best, and when his work in all its details will be known to the world and open to improvement by others, and when musicians will have learned to use the new powers which electricity is placing at their command. Clearly the world has, through the wonderful powers of the electrical forces and the skillful use made of them by Dr. Cahill, a new music, a music which can be produced in many thousand places simultaneously, and which in its very infancy seems destined to surpass in sympathy and responsiveness—in artistic worth—the existing music of pipe and string, the evolution of many centuries."

Official Meteorological Summary, New York, N. Y., February, 1907.

Atmospheric pressure: Highest, 30.77; lowest, 29.62; mean, 30.10. Temperature: Highest, 44; date, 14th; lowest, 1; date, 12th; mean of warmest day, 38; date, 2d; coolest day, 8; date, 12th; mean of maximum for the month, 31.7; mean of minimum, 17.1; absolute mean, 24.4; normal, 30.6; deficiency compared with mean of 37 years, —6.2. Warmest mean temperature of February, 40, in 1890. Coldest mean, 23, in 1875 and 1885. Absolute maximum and minimum of this month for 37 years, 69 and —6. Average daily deficiency since January 1, —2.1. Precipitation, 2.52; greatest in 24 hours, 1.07; date, 4th and 5th; average of this month for 37 years, 3.74. Deficiency, —1.22; deficiency since January 1, —1.72. Greatest precipitation, 7.81, in 1893; least, 0.82, in 1895. Snowfall, 20.3. Wind: Prevailing direction, N. W.; total movement, 9.357 miles; average hourly velocity, 13.9 miles; maximum velocity, 48 miles per hour. Weather: Clear days, 9; partly cloudy, 11; cloudy, 8. Fog, 2d. The temperature of December was 1.3 below, January 1.7 above, and February 6.2 below normal; an average of 1.93 degrees below normal for the winter. The total precipitation for the winter had a deficiency of 1.59 inches.

Henri Moissan.

With the death of Prof. Henri Moissan on February 24, the world lost one of the greatest of modern chemists, certainly one of the best known. Among the latest of the many honors which Prof. Moissan bore was the Nobel prize for contributions to science and chemistry, awarded last December for his famous experiments in the isolation of fluorine and his researches into its nature, and for his application of the electric furnace to scientific uses. Like the achievements of the Curies, much of Moissan's work was spectacular in the extreme, though never unworthily so. Among his best known experiments, and one which made his name familiar to practically all the civilized world, was the formation of artificial diamonds in the electric furnace in 1893. The great chemist was remarkable for the unselfish nature of his work. Had he patented his discoveries, he would doubtless have been enormously wealthy; but he gave all he learned to the sum of human knowledge freely and ungrudgingly. While his discoveries were almost uniformly without financial benefit to himself, he vastly assisted commerce and trade, and added to the wealth of the nations by teaching new applications of modern chemistry to the industries.

Henri Moissan was born at Paris on September 28, 1852. He obtained his education principally at the Museum of Natural History in Paris, and subsequently at the School of Pharmacy. For four years, until 1883, he taught at the Higher School of Pharmacy, and later, in 1886, he became professor of toxicology at this institution. In the following year he isolated and liquefied fluorine, and for this achievement, together with his investigations into the nature of the element, he won the Lacaze prize from the Academy of Sciences. In 1889 he took the chair of mineral chemistry in the School of Pharmacy, and there conducted his important and far-reaching experiments with the electric furnace. In 1892 he carried out a series of investigations which rendered the manufacture of acetylene practicable and commercially profitable. His was the discovery that calcium carbide results from the fusion of carbon and lime in the electric furnace, and that from the former acetylene gas can be liberated without difficulty. In the following year Prof. Moissan performed his sensational experiments in the manufacture of artificial diamonds. He melted iron in the electric furnace and saturated it with carbon, the furnace being at a temperature of over 4,000 deg. C., that is, more than 7,200 deg. F. At this high temperature the furnace was plunged into cold water, and the resulting ingot was subsequently attacked with hot aqua regia; this agent dissolved the iron and laid bare the diamonds. It will be remembered, however, that these diamonds were usually too minute in size for practical use, but they were genuine, being pure crystals of carbon.

The Current Supplement.

The opening article of the current SUPPLEMENT, No. 1627, is the second installment on the manufacture of gas, begun in the last number. The present installment deals with the manufacture of water-gas. Mr. C. W. Parmelee's paper on the technology and uses of peat is continued. The treatise on corn-harvesting machinery is continued, by Mr. C. J. C. Zintheo in a second installment. Much curious information is contained in an interesting article entitled "Swindling Alchemists of Bygone Days." Minor articles of interest are those entitled "What Demands Are We to Make on a Serviceable Preserve Glass?" "Transplantation in Surgery," "Old and New Theories of Lightning Conductors," "The Channel Tunnel." The paper on the advantages and applications of the electric drive by Prof. F. B. Crocker and M. R. Arendt is concluded. Most important is a discussion of apparatus and methods of distilling alcohol.

Portable Rotary Converter Substations.

The Illinois traction system, which has under construction several connecting lines of 40 or more miles in length, has found that portable rotary converter substations are quite useful at the time of first opening new lines. This company has five such substations, each consisting of a substantially-built box car carrying one 300-kilowatt rotary converter, together with transformers and switching apparatus. According to the Electric Railway Review, when a new line is to be opened, one of these sub-stations is set off on a temporary side track and a short pole, with standard high-tension cross-arms and insulators, is erected close to the end of the car. In this way the three-phase transmission wires may be brought to the high-tension disconnecting switches in the car.

Correspondence.

The Vagaries of Railway Time Tables.

To the Editor of the SCIENTIFIC AMERICAN:

If the subject is of sufficient importance, kindly allow me space to draw the attention of your readers to what appears to me a misuse of the 24-hour system of time, as given in many railroad time bills.

It is not unusual to find something like the following:

"This time bill will take effect at 24:01 on Saturday, February 16." When does that minute arrive? This being written at 15 o'clock on Friday, the 15th, nine hours from now will be 24 o'clock on Friday, the 15th, and the day and date is ended.

Now the notice of change in time bill given above is probably intended to take effect at one minute after midnight to-night. Certainly the one minute belongs to date 16th, but not the hour 24; because 24 o'clock on Saturday, the 16th, does not arrive until to-morrow night, and we have the hour belonging to one date and minute belonging to another used together.

It seems to me that when 24 o'clock arrives, the date and day terminate. Any time desired to be noted up to 1 o'clock following should be expressed as 0:01, 0:05, etc., and the notice first mentioned would read: "This time bill will take effect at 0:01 on Saturday, February 16."

I have spoken to different railroad managers and superintendents on the subject, but so far have failed to find any to admit the error which I have endeavored to explain. H. W. D. ARMSTRONG, M.C.S.C.E.

Saskatoon, Canada, February 15, 1907.

Tree Moss and Branches as Compasses.

To the Editor of the SCIENTIFIC AMERICAN:

Some time ago an article appeared in your paper—I do not now recall the writer's name—in which he denied the saying, or rather belief held by many, that the limb growth of trees and the growth of mosses at the base of tree trunks indicate, in a general way, the cardinal points of the compass; and cited in support of his statement, that extensive observations made by him in the forest districts of Kentucky, Tennessee, and I think he included Georgia, proved to his satisfaction that such was not the case.

I have been looking for some reply to this article, but as none has appeared, I venture a word or two.

That the growth of limbs and moss does indicate a general north and south line, is a fact not disputed by those who follow the trackless wilderness as hunters, trappers, explorers, or "cruisers," and is used by all true woodsmen as a successful guide in cases of emergency. This condition of growth does not apply to all sections of the country, hence we are not surprised that the writer of the article referred to failed to find this condition in the forests of Tennessee, Kentucky, or Georgia; but it does apply to the immense timbered district of the North, and here is where the saying originated. This condition of growth will not be found in cut-over or second-growth timber lands, but prevailed in the original pine, fir, and hemlock forests of Maine, Vermont, New York, Pennsylvania, Canada, and elsewhere in the forest districts east of the Mississippi and north of say latitude 42; and there still remain large tracts of timbered country, untouched by the lumberman's ax, where those who can read the signs of the woods have a sure guide to general direction in case of need. In northern Minnesota and Michigan this and other methods peculiar to woodcraft have been used over districts of high magnetic disturbance, where the compass is as likely to point west, east, or south as it is to point north.

It may be interesting to note some of the methods used by those accustomed to the woods to ascertain general direction in cases of emergency. First we have the growth of limbs and moss. This does not apply to every tree, but does in a general way, and to these generalities the woodsman's eye is trained, and he sees in the same general way, that the longest, largest, and greatest number of limbs grow on the southerly side of the trees; that the moss is more profuse on the northerly side and grows to a point, while on the southerly side, if it grows up on the trunk, it is not as high and is rounded at the point of highest growth. He will also find that the bark is thicker on the northerly side, and on pine and hemlock is rougher and more deeply corrugated. The woodsman always carries a watch, and when his compass fails and the signs of the woods are not plain, he points the hour hand of his watch toward the sun, and takes a line half-way between the sun and twelve on his watch as the south. If the sun is obscured, and he is unable to determine its position, he is still not without resource, for he places the point of his pocket-knife blade on his thumb and holds it in a vertical position, and if he does not perceive a shadow a slight rotatory movement of the knife will produce it, then with his watch he finds the north and south line as before, and goes on his way rejoicing. HENRY S. ELY.

Duluth, Minn., January 18, 1907.