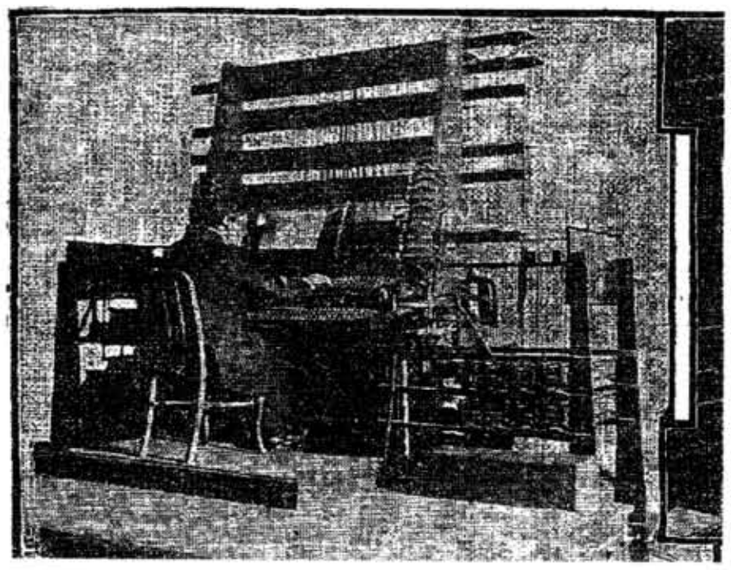
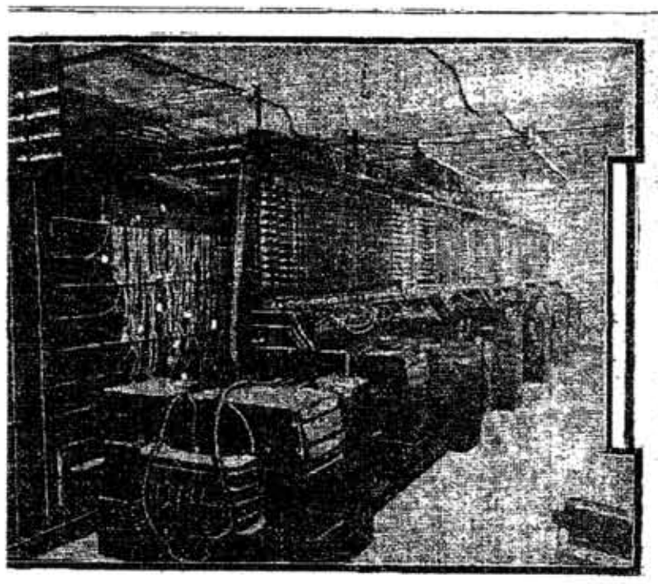
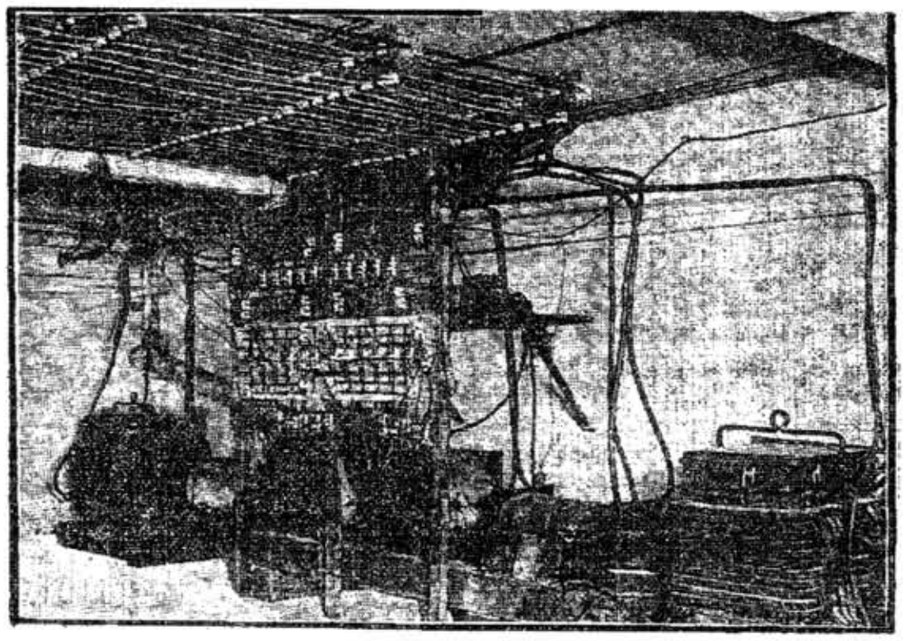
MAGIC MUSIC FROM THE TELHARMONIUM

Dr. Cahill's Electrical Machine Creates Musical Sound Without an Instrument and Puts Opera, Symphony and Rag-time on Tap at the Telephone. Harmony Made to Issue From Flow-ers and Lights





THE KEYBOARD.



THE TELHARMONIUM OR TONE MIXER.

WITHIN a month in various private residences in New York City it will be possible by touching a switch or button similar to that by which one lights his electric lamps to throw on a current of electricity and have issue from a specially devised telephone the sweet strains of a Chopin waltz or a sonata by Liszt. Or if one's taste prefers the lighter vein, he may have Herbert's "Mlle. Modiste" or "The Red Mill" or plain ragtime. At luncheon or at dinner, or during an evening's entertainment of friends, one may switch on his circuit and get an hour's music and then switch it off. All at the cost of 20 cents.

Within the past week there have been expositions of the system in two prominent restaurants. They were not the first demonstrations, but were the initial installations of the system whereby dinner music is to be furnished to their patrons by the new electrical instrument, the Cahill telharmonium.

As yet the Cahill system is furnishing music only intermittently. But its conduits are installed, and through them run cables which can be tapped and the service installed in any private house, exactly in the manner one secures one's electric light supply or one's telephone service. It has now only one musical circuit, which must furnish all varieties of music—the heavy and the lighter classics, dance music, light operas, and other popular airs. And these are only furnished from 12:30 to 2 o'clock at the luncheon hour and from 6 to 8 at dinner. Soon, however, when other keyboards are installed, there will be a separate circuit for each variety of music, so that the subscriber can take his choice and switch on the one he lists. Then it will provide music for twenty-four hours in every day. At present limited facilities make this impossible.

It is intended to furnish this service, as much and as little as one wishes to use, precisely as electric light is furnished, at an approximate cost of 20 cents an hour. Of course, that is not true of restaurants, where more than one telephone is necessary to get the volume and where a much greater flow of power is needed. But even this is graded according to the consumption. Amazing, isn't it?

The central station of the telharmonic plant is at Thirty-ninth Street and Broadway. There the dynamos revolve, connections are made, and currents set in motion. But the music is made right in the telephone receiver in one's own house. It is not reproduced music that is heard, but an original production. There is, strictly speaking, no musical instrument save that little telephonic diaphragm. There may be 25,000 diaphragms operating at once, at distances varying from a hundred yards to a hundred miles. It is all the same. Distance and multiplicity of production make no difference to the telharmonium.

And it is scientifically perfect music, capable of reproducing any sound produced by any musical instrument and many more that no musical instrument produces. Sounds like the extravagant exaggeration of a charlatan, doesn't it?

It is safe to say that those who have only heard of the telharmonium, or simply have read of it, have no conception of its characteristics. It is not too much to say that many who have seen and heard it have failed signally to comprehend its mystery. Remarkable as it is, it is yet crude compared with its full possibilities, and is played by performers who are as yet comparatively unskilled. It should be looked upon as a precocious infant that needs years of growth to reach its full strength. It is not a finished product in any sense. But it can produce any musical sound, provided the physical characteristics of that sound can be ascertained.

In the office building at the corner of Thirty-ninth Street and Broadway, within a stone's throw of the Metropolitan Opera House, the centre of music in America, the instrument is installed, and daily performs before scores of visitors. One enters a large salon, arranged like a private conservatory, with divans and easy chairs, ornamented by banks of potted plants and hung with great baskets of flowers. At the far end of the room, seated on a high stool as at an organ, are one or two musicians playing upon a double-banked keyboard, arranged with stops. Behind them rises such a structure, bearing hundreds of wires, as might well pass for the interior of a complicated musical instrument, with the ornamental cover which would naturally hide its mechanism purposely omitted to aid its demonstration. The room is filled with the full, sweet tones of a Beethoven symphony or a Mendelssohn sonata, interpreted in notes wonderfully like the reed tones of an organ, but sharper, clearer, sweeter, purer. The sound is charming, and it is not until explanations follow in an interim of changing numbers that one learns that the instrument one sees gives forth no sound. The fact is amazing, but perfectly true. The music actually issues from quite another part of the room, and the players might just as well be in Yonkers.

Incredulous, yet impressed, one approaches the players to find that aside from the slight metallic click of an electric connection there is no sound from the keys. To emphasize this the blue flash of an electric spark occasionally accompanies the click. Then one realizes that here is only the impulse which starts the flowing of the electric currents which, passing over a wire like an ordinary telephone carrier, may proceed a hundred yards or a hundred miles before being translated into music, as the telephone receiver translates an electric current into sound. Then and then only the first realization comes that this is electric music, but the conception is still vague, as are so many born of the magic of wonder-working electric forces.

Searching the room for the source of the sound, it is found to proceed from the bank of flowers in the centre, where, hidden in its depths is a horn, from the mouth of which issue the full organ tones, as from a chamber below. And again from above one hears the musical notes. Looking closely at the hanging flower vases a tiny telephone receiver can be seen, which, too, is singing forth its melodies in concert with the horn, notes that are caught, amplified, and repeated to the listeners below.

There is a suggestion of magic in it all that lends color to the wonder impression, but the kernel is still missing. For all that has been seen the music might be the reproduction of a wonderfully versatile and sweet-toned phonograph. But it is not reproduction. On the contrary, it is the original production of music in a simple telephone receiver. The secret of what produces the sounds is in the hidden chambers below.

These serve, however, to intensify the mystery. Directly below the auditorium is a great room, where is located an arrangement of wires such as is seen in a telephone exchange, viewing a switchboard from behind. Here is board after board, banked with wires, and the same click of connections made and broken that was suggested at the keyboards above is now heard intensified and unrestrained. Here is where the currents thrown on by the touch of the keys above are received and passed on to form music. But how far a cry is this from music!

As key after key is pressed above there is the rhythmic click, followed intermittently by a rapid succession of broken connections as a run is performed. Below the boards, in juxtaposition, are machines that look like the conventional motor, but are in verity "tone mixers," which, as subsequently develops, prove a most essential feature of the instrument. But even here the producer of music is not to be found. These, too, are mere transmitters. The real source is reached through double doors in a vault beyond, where at last is discovered the sweet singer.

Approaching the door a low rumbling is heard. Once the doors are opened this is transformed into the whirring of revolving shafts and dynamos. One might have been transplanted to a busy machine shop, with all its deafening noises. There is still no music. Yet on these eight shafts, revolving 145 armatures of dynamos, are generated the electrical currents, so arranged and tempered as to vibrate the sounding disks at given velocities that enable them to give forth musical notes. Here at last is music made.

Every one knows that when one talks into a telephone the sounds which he utters vibrate the diaphragm in the transmitter. He knows that these vibrations are translated into electric currents which pass over a wire, and, reaching a similar diaphragm in the receiver at the other end of the telephone line, the electric impulses are again translated into sound by vibrating the diaphragm in precisely the same way as the sounds spoken caused the first diaphragm to vibrate.

Now, what Dr. Cahill has done is to cut the telephone circuit exactly in half, midway between the speaker and the listener, and by producing electric conditions precisely similar to those which a flute would produce if played into a telephone he has been able to get from the receiver of the telephone the music of the fluto. So, without having the flute or any other instrument, he has, by studying what electric conditions represent these sounds, been able to simulate the sounds. That is why it is an original production of sound, not a reproduction. The reproduction is of electric conditions, either hitherto produced or scientifically determined. To produce any sound whatever, therefore, all that is needed is to know what electric conditions will produce them and then furnish the electrical conditions.

This explains at once the present limitations of the machine. Scientific investigation has revealed the physical character of the notes of most instruments. Helmholdt, for instance, by a system of tuning fork experiments, learned just how many vibrations there were in the note middle C which we know on the piano. It is a simple matter to produce an electric current which will vibrate a telephone disk that frequently and get middle C. But the same note on piano, violin, flute, or whatever instrument one takes is not the same. In basic character it is, no doubt, but the imperfections of the instrument vary it, often so markedly that the instant we hear it we say, "That is a flute," or "That is a violin."

To simulate any of these instruments it is necessary to know just what other combinations of sound are simultaneously made and to introduce the other sounds in conjunction with the pure C.

It is a well-known fact in music, but a fact often overlooked, that a note has three characteristics—volume or intensity, pitch, and quality or timbre. The volume is determined by the violence or force of the vibrations, the pitch depends on the number of vibrations, and the quality upon the number of auxiliary tones—overtones, as they are called. On the relative power of the ground tones and the overtones depends the effect. If the overtones are in certain prescribed mathematical relation to the ground tones, harmonics are produced. If they are irregular they cause anharmonics. It is in combining these ground tones and overtones that the telharmonium meets with difficulty in imitating the violin, for instance. It is the difficulty of the telharmonium to mix these vibratory impulses before they reach the sounding diaphragm in order to produce the combined sound. This is done by the "tone mixer," which takes the various separate currents supplied from the individual dynamo and, by means of an electrical transformer, combines them.

Now, by an arrangement of teeth on the various armatures in the dynamos each separate pure tone is produced. The eight shafts correspond to the notes of a scale. One is arranged to produce B flat, another C, another D, and so on—E, E flat, F, G, and A. On each shaft are eighteen armatures, arranged with teeth to produce, 4, 6, 8, 10, 12, 14, 16, 20, 24, 28, 32, 40, 48, 56, 64, 80, 96, 128 alternations. One shaft has an arrangement of five teeth. The shafts revolve 745 times a minute, which will produce alternations or vibrations when the current reaches the diaphragm varying from 16 a second to 8,000 a second. The latter is twice the greatest number possible to secure from a note of the ordinary pianoforte.

Now, by having each separate dynamo connected with its own key on the keyboard, it is possible to throw that dynamo into the circuit and get its pure note. By pressing several keys or stops several are thrown in at once. These impulses are mixed in the transformer, and a resultant combination note is heard. That, in brief, is the simple arrangement of the whole machine.

The inventor and his assistants are most anxious to reproduce the violin. There has been no scientific physical analysis of the violin to aid them, such as is available for all wind instruments. These are mathematically exact and easily analyzed. It is necessary to study the violin by practice, trying certain combinations of currents and gradually approaching the effect, guided by the ear. One musician who has practiced assiduously two years has been able to get an approximation of it, but the others, less well acquainted with the keyboard, cannot imitate him. As these effects are produced they are recorded, and gradually, as practice perfects the performer, he can increase the effectiveness of the instrument immeasurably. When it is realized that this whole invention represents only fourteen years since the idea was conceived and only four years of actual work on it in its present form, one can readily see, knowing its multiplicity of detail, its complexity, why there is still much to be done. The wonder is that it has developed so far.

During the many visits of the writer to the plant the musicians produced certain effects. The pure ground tones alone were used to simulate the piping of a fife. A ground tone with its first and second partials produced an approximation of both the oboe and the English horn. Omitting the first partial from this combination produces an imitation of the clarinet. Emphasizing the ground tones abnormally produced the 'cello, and so on through the gamut of known musical instruments. To increase and diminish the volume of a note the expedient of introducing resistance through a simple rheostat is employed. By throwing the resistance into and out of the circuit very rapidly the tremolo effect is secured. So by various other similar devices the sound produced is affected and controlled. These mechanical devices are being constantly improved. For instance, Dr. Cahill is now at work on a keyboard which will automatically swell and diminish a note by increasing and decreasing the pressure on the key.

To show how easy it is to introduce the music in any circuit a most interesting novel experiment was made at the Cahill plant. There was an ordinary arc light there. From carbon to carbon an electric current jumped, producing the familiar flame of light. By switching this lamp into the musical circuit while the instrument was playing, the organ notes issued from between the carbons, out of the very light itself. The electric impulse started the ether vibrating as a sounding board as it passed through it, and the music was distinctly heard. In theory this music should have been 4,000 times louder than that issuing from the telephone receiver—but it was not.

If one starts to tell all the wonders of the telharmonium the skeptics will begin to suspect it is a device of Kellar. So other experiences had best be left to the reader to secure himself, either by a visit to the Cahill plant or to one of the several cafes that are installing it to provide their dinner music.