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NEW MUSIC FOR AN OLD WORLD

Dr. Thaddeus Cahill's Extraordinary Electrical Invention for Producing Scientifically Perfect Music.

By
RAY STANNARD BAKER.

DR. Thaddeus Cahill's extraordinary invention will certainly attract wide popular attention and discussion. At first, and naturally enough, it astonishes chiefly by its unique physical aspects. No musical instrument ever departed further from the ordinary conception of what a musical instrument should be. Filling a large basement with steel machinery—shafts, dynamos, electric alternators, transformers, and switchboards, it gives the impression of nothing so much as a busy machine-shop, or the center of a considerable manufacturing industry.

Largest Musical Instrument Ever Built.

Of all musical instruments ever constructed it is certainly the largest and heaviest: none other, probably, ever cost so much money, over $200,000 having been expended in building the first machine; and none ever required, or gave opportunity for more human skill in playing.

But the physical appearance of the instrument, impressive as it is, does not compare for interest with its less evident, but more significant features. Suggestively enough, Dr. Cahill's invention is located in a building opposite the Metropolitan Opera House, the center of musical art in this country.

At the present time those who wish to listen to a Conried orchestra must themselves come to the music, they must pay high prices for their seats in the opera house and only a selected few—limited by the size of the auditorium and the cost of admission—can at any time hear the music.

Invention May Work Revolutionary Changes.

Dr. Cahill's new invention suggests, if it does not promise, a complete change in the system by which a comparatively few rich people enjoy the best music to the exclusion of all others. Instead of bringing the people to the music the new method sends the music to the people

The instrument itself produces no music, it merely gives out electrical waves of various sorts which are carried over wires like a telegraph message. Highly skilled musicians located in a quiet room distant from the whir of the machinery, regulate the production of these waves by playing upon keyboards similar to those of the pipe-organ. Connecting with the central plant, cables are laid, in the streets, from which wires may be run into your house or mine, or into restaurants, theaters, churches, schools, or wherever music is desired. Upon our table, or attached to the wall, we have an ordinary telephone receiver with a funnel attached. By opening a switch we may "turn on" the music. The electric waves sent out by the great central machine are transformed, by the familiar device of the telephone, into sound waves, and reach our ears as symphonies, lullabies or other music, at the will of the players. Louder tones and greater volume of music may be secured for theaters and churches, by the simple regulation of a switch. Of course the same selections, performed by the musicians, go over the wires at the same time, so that you and I may sit in our homes on Easter morning and hear the same music that is being produced in the churches, or in the evening, dining at the restaurant, we may enjoy the identical selections given in the opera house or the theater. It is the dream of the inventor that, in the future, we may be awakened by appropriate music in the morning, and go to bed at night with lullabies—sleep-music being a department of musical composition which he thinks has been sadly neglected. The machine as now constructed is, indeed, peculiarly adapted to the sweet, soft strains of sleep-music. It would be difficult to produce more exquisite effects than Dr. Cahill gets in such selections as "Traumerei."

Democracy of Music.

As the machine is developed, and as the players become more expert, we may enter upon quite a new era of music, what may be called, indeed, the democracy of music.

We cannot really herald the complete dominance of democracy until we have good music, great pictures, and the best books at the command of every citizen.

Museums, galleries, and process printing have gone far towards bringing that equal opportunity of all citizens for the enjoyment of great pictures, which is the dream of the social philosopher. Free libraries have placed the best and rarest books at the command of any man who wishes to use them. But music, by its nature ephemeral and costly of production, has not so easily submitted itself to such democracy of enjoyment. Poor music may be had anywhere: good music is rare: it is hived up in grand opera houses, and supported by playing upon the social vanity of the rich. It is a pastime for society. To this fact, indeed, may be traced the slow development, much deplored by critics, of musical taste in this country.

Dr. Cahill's instrument, without in any way overestimating its capabilities, or suggesting that it will displace the present forms of musical art, gives us a hint of what the music of the future may be like. With its wires spreading in every direction, not only in the streets of cities and into city homes, but by means of a system of long distance transmission, even now quite feasible, the best music may be delivered at towns, villages, and even farmhouses up to a hundred miles or more from the central station. Small country churches, town halls, schools, at present holding up no ideals of really good music, may be provided with the same high-class selections that are daily produced by the most skilful players in the cities.

One's first feeling, upon hearing of the new machine, is one of utter incredulity. When the telephone was invented the idea of talking over wires was just as inconceivable: and more recently the announcement that messages might be conveyed from Europe to America wholly without the use of wires, was looked upon with much the same skepticism. But Dr. Cahill's machine is actually in existence, players have been trained to perform upon it, and the music has really been conveyed over wires and produced in distant halls and houses, as it will soon be delivered through the streets of New York. When one is convinced that so much of the story is true his next impression—for we are of weak faith—is that this is only another device, like the phonograph, or the much advertised piano-player, for producing mechanical music. In other words, we imagine a sort of overgrown, hurdy-gurdy. The news of all great inventions seems at first too good to be true. It is amusing, the wistfulness with which the inquirer, eager to believe in the instrument, is sure to ask: "But is the music not mechanical? Cannot you hear the machinery? Is it possible that such a machine can be made to convey the emotion of the player?"

How the New Music Is Produced.

These were the questions uppermost in my own mind when I went to Holyoke, Massachusetts, where Dr. Cahill has his laboratory, and where he has just completed his second machine, the one now being installed in New York City. A wire runs from the laboratory to the Hamilton Hotel, about a mile away, and the telephone receiver, fitted with a big paper horn, was placed on a chair in the ball-room at the top of the building. A switch near at hand turned on the music and regulated its tones, either soft or loud, the musicians, of course, being located at the keyboard in their own small room at the laboratory, a mile away. I am not a musical critic, but of a few things any one may at once make sure. When the music began it seemed to fill the entire room with singularly clear, sweet, perfect tones. Although expecting somehow to hear the whir of machinery, or the scraping sounds common to the phonograph, I was at first so much interested in the music itself that I did not once recall its source. Afterwards, I listened especially for some evidence of the noisy dynamos which I had just seen, but without distinguishing a single jarring sound; nor was there any hollowness or strangeness traceable to the telephone or its horn attachment. It was pure music, conveying musical emotion without interference or diversion. As one listens, the marvel of it grows upon him—the marvel and the possibilities which it suggests. The music apparently comes out of nothingness, no players to be seen, no instrument, nothing but two wires running out of the wall; and in hundreds of different places widely separated—the present machine can supply over twenty thousand subscribers—the same music may be heard at the same moment.

A Hundred Instruments in One.

The first impression the music makes upon the listener is its singular difference from any music ever heard before: in the fullness, roundness, completeness, of its tones. And truly it is different and more perfect: but strangely enough, while it possesses ranges of tones all its own, it can be made to imitate closely other musical instruments: the flute, oboe, bugle, French horn and 'cello best of all, the piano and violin not as yet so perfectly. Ask the players for fife music and they play Dixie for you with the squealing of the pipes deceptively perfect. Indeed, the performer upon this marvelous machine, as I shall explain later, can "build up" any sort of tone he wishes: he can produce the perfect note of the flute or the imperfect note of the piano—though the present machine is not adapted to the production of all sorts of music, as future and more extensive machines may be.

It is quite as possible, indeed, to distinguish the individuality of the players upon this instrument as it is upon the piano or violin. The machine responds perfectly to the skill and emotion of the player; he gets out of it what he puts into it: so that the music is as much a human production as though the player performed upon a piano. In an hour's time we had many selections, varying all the way from Bach and Schubert to the "Arkansas Traveler" and a popular coon song.

How the Invention Was Made.

Dr. Cahill has made no great new discovery, he has established no new fundamental law; but by applying well-known principles and devoting twelve years of his life to toilsome experimentation he has produced a wonderful new instrument which should produce scientifically perfect tones.

What Is a Perfect Musical Instrument?

Most of us have no conception of how imperfect are all of our existing musical contrivances, especially the more complex ones like the violin, piano, pipe-organ. Dr. Cahill was brought up in Oberlin, Ohio, a town having a musical conservatory and much devoted to good music. He developed a keen interest in the scientific side of the art and he was impressed with the remarkable inefficiency of all sorts of instruments. The violin is marred by poverty of chord capacity, while the piano, having excellent chord capacity, cannot be kept in perfect tune, and suffers from the dwindling of the notes: that is, the sound is loud when the string is first struck, and gradually dies out. Dr. Cahill calls the pipe-organ a "dead instrument." It has no sympathy and gives little control of tones: when the key is down the tone cannot be further influenced by the player.

It occurred to Dr. Cahill that it should be possible to construct a machine which would give the player absolute control of the tones produced, thereby uniting all the perfections of the various instruments and eliminating their defects. The ideal instrument, to his mind, was one which would enable the player to express his emotion in all its power and intensity as nearly without mechanical hindrance as possible. He did not at first think of distributing music by wires; that was a later invention. His first desire was a perfect instrument, giving as he says "a sustained tone controlled by the touch." For example, after a piano player strikes a key, the sound, loud at first, dwindles rapidly away: he cannot control or regulate it: he must use it as it is. Suppose he could hold it as long as he pleased, in all its initial power and beauty: suppose he could cause it to swell or dwindle at will, suppose he could make it, at any moment, just as loud or soft as he desired; in other words, suppose he could mold that tone under his hands as a potter molds clay, would not his capacity as a musician be enormously increased? Would he not be able to express more perfectly the full emotion of his musical genius? Such control was what Dr. Cahill had in view in working out his invention.

Lord Kelvin Encourages the Inventor.

After many years of work Dr. Cahill in 1900 completed his first machine. The next two years he spent in experimenting with the machine, perfecting plans for a larger plant. During this period, he distributed the music from his laboratory, in one part of Washington, to his office or home in another. In 1902, he transmitted it to the residence of George Westinghouse, of air-brake fame, in Washington, and to the office of a friend in Baltimore. The musical effects were considered wonderful by those who heard them. Several capitalists became interested in the invention—foremost among them, O. T. Crosby, a pioneer of electric railroading, and F. C. Todd, of Baltimore. Their zealous advocacy and financial support of it have been of the greatest importance to the new art and its inventor. Several eminent scientists, among them Lord Kelvin, visited the inventor's laboratory and encouraged him to continue his work. The same year he opened a large laboratory at Holyoke, Massachusetts, and after four years more of work, Dr. Cahill is now nearly ready for the first public presentation of the results of his experiments. Few inventions have ever been so kept in darkness until they reached the perfection necessary for immediate commercial use.

How Does the New Machine Produce Music?

We may now come to the machine itself. What is it? How does it produce music?

A musical note, in its simplest sense, is a pleasant sound, produced by vibrations in the air. Strike a key of a piano: the string vibrates and sets the air to pulsating, sound waves are conveyed to our ears and we hear a musical note. Some strings produce rapid vibrations and give us high notes. Others, slower vibrations with low notes. By striking various keys in succession these vibrations may be blended or combined to produce music.

Every one knows how different is the music produced, for example, by the piano from that of the cornet or violin. The tones are wholly different. Why?

Helmholtz in his great work on "Sensations of Tone" analyzed musical tones as a chemist analyzes water. A tone which seems to us perfectly simple may be extremely complex. Helmholtz showed that, when a note is struck, we have first a "ground tone," consisting of a certain number of vibrations a second. But this is not all: accompanying the "ground tone" and co-existing with it are other vibrations called "harmonics," which are two, three, four, five or more times as rapid.

In some instruments the ground tone is strong and clear, and the harmonics much less distinct—as in the violin and the flute. In brass instruments the ground tone is weaker and the harmonics stronger. In other words, the quality of a musical instrument depends upon the combination of the original ground tone and its many harmonics.

Helmholtz and His Tuning Forks.

Helmholtz, by the use of many tuning forks, one giving the pure primary tone, the others yielding the pure harmonics, was actually able to "build up" or imitate the tones of various instruments.

Dr. Cahill using the scientific knowledge which Helmholtz and a host of others had developed, sought to create a new system of musical production that would be more plastic and expressive than anything known before. Later he set himself the further task of finding some way of distributing widely the music so produced.

It is impossible here to describe the tortuous and difficult pathway of his progress, or to tell of the obstacles which he was compelled to surmount. It will be sufficient to explain, simply—for it is really simple—how he finally solved the problem.

Electricity Used to Produce Music.

Electricity, like sound, travels in waves or vibrations, electricity in the ether, and sound in the air. Why should there not be a way, argued Dr. Cahill, for producing the various vibrations corresponding to the pitch of a musical note by electricity and then changing them into sound-vibrations? This was the problem he studied: and he finally hit upon the use of electric dynamos. Each dynamo was so built that it gave out alternating currents which vibrated (or alternated, as the electrician would say) at a certain rate. Each dynamo produced vibrations representing a single pure musical tone, or a single one of Helmholtz's tuning forks. Other dynamos or alternators were used to represent other pure tones, until in the present machine Dr. Cahill has not fewer than 145 such alternators. They are placed upon great steel shafts, and operated by power machinery. Each alternator is connected by wires with the playing keyboard in another room. When one key is pressed one alternator gives off its vibrations: when two are pressed, two alternators come into play. Let us suppose, now, that the player wishes to produce the peculiar sweet note of an A string (open) upon the violin. The ground tone of the A string has 435 vibrations a second. One key controlling one alternator will produce this ground tone, but it will sound more like a flute note than a violin note. Harmonics must be added—exactly as Helmholtz built up a tone with his tuning forks. Stops are drawn producing the first harmonic, 870 vibrations, the second harmonic, 1,305 vibrations and so on, until the approximate note of the violin is reached. In other words, the player, by using the proper keys and stops, can construct the tones of any instrument he wishes. He can have the clear note of the flute, the heavy burr of the 'cello or the squeal of the fife. The qualities of all instruments—the vivacity of the piano, the emotion of the violin, the purity of the clarinet, are thus within instant reach of the player upon a machine of this type. The present instrument with 145 alternators, while producing the most extraordinary results, will not reach all of the combinations necessary, let us say, to produce the marvelously complex music of an orchestra, but the inventor is already planning a much larger machine, with hundreds of alternators, upon which eight or ten musicians may perform together, making possible heights of musical harmony never before imagined.

The Grooming of an Electrical Current.

The fundamental feature of the machine, then, lies in these alternators, but many other devices, wonderful inventions in themselves, contribute to the production of musical sound. For example, the currents from various alternators must be combined to make a given tone: consequently the inventor has produced what he calls "tone-mixers" where the various sorts of vibrations, carried on wires, are combined. Leaving the mixer, mysterious as it is to the non-technical mind, the current is "refined" by passing it through other devices, from which it emerges ready for distribution by wire to the subscriber in his home or at his restaurant. It is perfectly marvelous, the way in which these currents are regulated and controlled—molded as it were, by the delicate touch of the artist's hand.

How the Music Is Telephoned.

One final device is necessary. So far we have only an electrical current, properly mixed and refined, to produce a given musical tone, but there is no sound whatever. The machine itself, as I have said, is silent. The inventor here has recourse to the simple device of the telephone receiver, the purpose of which is to translate an electric current, which comes to it over the wires, into sound waves. The familiar little black diaphragm of the telephone is made to vibrate by the current and that vibration is communicated to the air, producing sound waves which we hear, exactly as we hear the sound waves excited by a piano string. Thus the new music comes to us. It can be transmitted over ordinary telephone wires and received in our ordinary telephones, but inasmuch as the current used for the music is much stronger than that employed for carrying the human voice, it is the plan of the inventor to have separate wires laid in the streets, and a separate telephone apparatus in the theater or in the home of the subscriber. In New York the plan is ultimately to have four different sets of wires, one carrying operatic music, one classical music, one sacred music, and one popular airs, so that subscribers may take their choice.

The keyboard fills all one side of the music room. It is surrounded by a jungle of wires leading from the keyboard to the 2,000 or more switches which control the instrument.

The musician sits on a high bench, like that of a pipe-organ, with double-banked keyboard. Sixteen stops are used to regulate the harmonics, and there are other devices, pedals and "expression levers," for otherwise controlling the tones. One telephone with a funnel is arranged behind the player, so that by listening to his own music he may get exactly the proper effects.

Learning to Play the Dynamophone.

Learning to play the new instrument has been like some wonderful new discovery in an unknown musical world. Here were limitless musical possibilities waiting to be utilized. The musician uses his keys and stops to build up the voices of flute or clarinet, as the artist uses his brushes for mixing colors to obtain a certain hue.

It is like seeing a conjurer's trick to hear Mr. Pierce add tone to tone from the stops which represent the harmonics, only to have the whole suddenly blend in one perfect note at the drawing of the last stop. By combining, for example, the 1st, 2nd, 3rd, 4th and 5th partials with the 4th and 5th predominating he can produce a marvelously beautiful oboe tone.

The player uses one hand on the keys for giving the tones, and one at the stops for giving the quality. In future instruments there may be many players with one great leader, as in an orchestra, having the whole performance under his control and interpreting his own musical genius. And such players will not lack the stimulus of an audience, for it is the intent of the inventor to have the operating portion of the instrument located in a hall or opera house where the public may be admitted to hear the same music which is being rendered at the same moment in a thousand different places.

Effect of the New Music on Musical Art.

Will the new instrument tend to affect the present musical art?

If it reaches in practice anything like the perfection of its experimental performances it will undoubtedly become a most valuable addition to the range of musical possibilities. As a pure economic proposition, it will furnish really good music much cheaper than the ordinary small orchestras: and there will be little danger of strikes of musicians.

We Shall Keep the Old with the New.

But it would be absurd to say that the new instrument will even seriously interfere with the presentation of great music of any sort. It will rather add to the public interest in music and the appreciation of musical art. The automobile has not driven out the horse, and in an age of electric lights we still use gas and kerosene oil, not to mention candles. More people will become interested, and more musicians developed, and the possibilities of greater ranges of musical effect may encourage the development of an entirely new music, at present hardly imagined.

We welcome the new with eagerness: it has a great place to fill: it may revolutionize our musical art: but, in accepting the new, we shall not give up the old.

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