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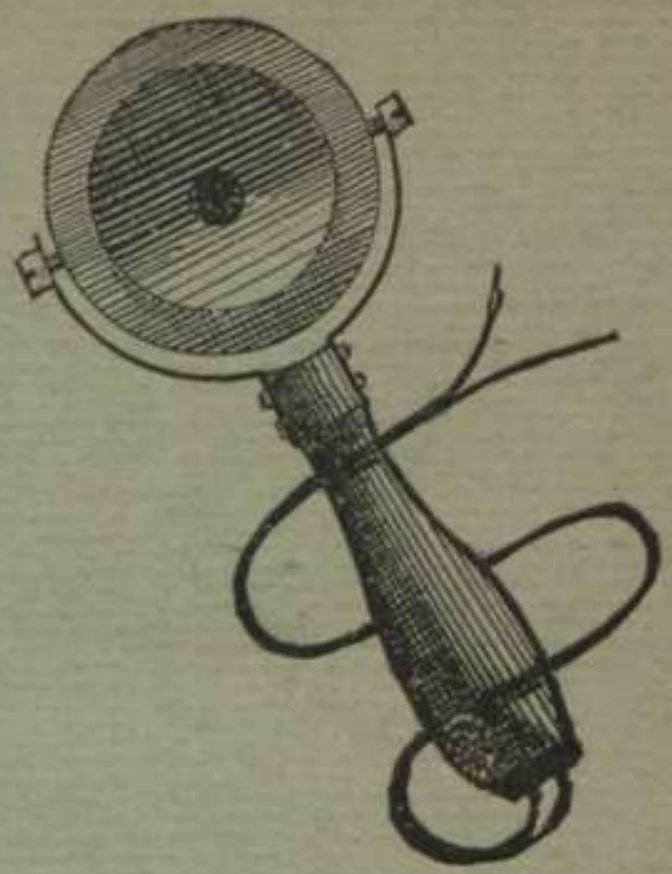

TELEPHONE

compiled from various papers, etc.

NEW YORK.

1884

THE LONG DISTANCE TELEPHONE COMPANY.

Organized under Laws of New York, July, 1884.

CAPITAL, - - - - - - - -	$10,000,000
No. SHARES, - - - - - - - -	200,000
PAR VALUE, - - - - - - - -	$50.00

PRESIDENT.

L. B. CLARK, - - - - - - - - NEW YORK.

VICE-PRESIDENT.

E. R. WIGGIN, - - - - - - - - - BOSTON.

Secretary and Treasurer.

CYRUS CLARK, - - - - - - - - NEW YORK.

Attorneys and Counsel.

FITHIAN & CLARK, - - - - - - - NEW YORK.

DIRECTORS.

GEORGE M. GROVES, Vice-President of Bank of the Metropolis, -	New York.
CHARLES H. T. COLLIS, of Collis & Levy, - - - - -	" "
JOHN H. REED, of Bates, Reed & Cooley, - - - - - -	" "
H. C. SKINNER, of Hazen, Todds & Co., - - - - -	" "
WILLIAM FOSTER, Jr., Late President Metropolitan E. R. R. Co., -	" "
CYRUS CLARK, late of Clark, Pardee, Bates & Co., - - -	" "
L. B. CLARK, - - - - - - - - - - -	" "
JAMES H. FREELAND, of Freeland, Loomis & Co., - - - - -	Boston.
E. R. WIGGIN, - - - - - - - - - -	"

OFFICES.

53 Broadway, - - - - - - - - - New York.

LIST OF PATENTS.

UNITED STATES.

October 15, 1872,	No.	132,278.
May 21, 1878,	"	204,024.
March 15, 1879,	"	213,283.
April 15, 1879,	"	214,248.
September 28, 1879,	"	232,705.
February 15, 1881,	"	237,856.
April 16, 1884,	"	296,829.

Another patent is pending before the United States Patent Office.

CANADA.

October 20, 1881,	No.	13,580.
January 24, 1884,	"	18,542.

ENGLAND.

October 30, 1883,	No.	5,141.

FRANCE.

October 30, 1883,	No.	158,394.

BELGIUM.

October 30, 1883,	No.	63,050

GERMANY.

Application made for two Patents.

THE vast importance and value of the telephone as a means for transacting business, is admitted by the most careless observer of the progress of events. It has become one of the most active elements in the world's advancement, and is claimed by some eminent scientists, as the greatest discovery of the nineteenth century.

It is a necessity. Its use for limited distances is increasing in a most marvellous manner. Already the American Bell Telephone Company have in use more than two hundred and fifty thousand of their transmitters in this country, and are putting them out at the rate of five thousand a month. The profits of that Company have been almost fabulous, and yet their business is confined chiefly to distances of less than fifty miles. So long as that Company holds its present monopoly, that is, until its Letters Patent shall have been properly before the U. S. Courts, its already enormous business must continue to increase, and that, too, although it has no machine capable of doing business satisfactorily between greatly distant points.

Nor is there any telephone now in general use which, can accomplish the wonderful, task of transmitting articulate speech for a distance of more than from fifty, to one hundred miles, in an intelligent and satisfactory manner.

The discovery of this most remarkable machine has been made by Mr. WEBSTER GILLETT, and is now for the first time brought to the notice of the public. For years Mr. Gillett has been endeavoring to solve the problem of long distance telephony, and with most remarkable persistence has kept at work in spite of the opposition of other inventors in the same field of inquiry, and in spite of the sneers and jibes of many professional electricians.

He has accomplished the result so long desired, and by the use of his transmitter, places a thousand miles apart are brought so near together, that ordinary conversation can be carried on between them, with as much ease as it can be, between places not more than five, or ten miles apart with the telephones now in general use.

What the greatest distance is, that this transmitter will reach is not now known, for no satisfactory wire over which to try it, can be obtained longer than one thousand and ten miles, but it is confidently believed that there is no limit to the distance over which conversation can be carried on, provided a first-class wire is strung, and the line carefully and thoroughly built.

The immense value of such an invention can hardly be estimated, for, while the value of short distance telephones is recognized as immense, what must be the value of a transmitter, which not only is superior for short distances, but which can transmit ordinary conversation for *thousands* of miles ?

The inventions of Mr. Gillett stand *alone*, with no rival in the field for long distance, and are protected by Letters Patent believed to be invulnerable; no invention can be found embodying the same, or similar ideas. His greatest invention, or discovery consists of a multiplication of points of contact on a single diaphragm, or more correctly speaking, of a multiplication of "variable resistances," by means of which an unlimited amount of electric force can be applied, to send the induced current over or along the wire. In ordinary telephones the *force* from only one, or at most three cells of battery can be used without burning the variable resistance, or carbon, and thus render useless the transmitter. With Mr. Gillett's transmitter any amount of force, from any number of cells of battery, can be used with perfect safety, when constructed in accordance with his plans, and thus give the *power* necessary for long distance talking.

No other principle than that used in the Gillett transmitter can accomplish such a result.

The owners of the Gillett patents have been experimenting for more than a year, to bring the inventions to a state of perfection before offering them to the public for its approval, and the statements of the gentlemen, eminent in the electrical world, published herewith, show most conclusively that the desired result has been attained. We ask a careful perusal of the various statements, and a critical examination of the illustrations of the "Multiplex Transmitter," taken from the *Electrical World* of April 19, 1884.

In connection with his transmitter, this company has a patent of Mr. Gillett by the use of which, a single wire can be used for *telegraphing* and *telephoning* at the same time, without any inconvenience, or interference of either system with the other.

It is not the intention of this company to interfere in any way with the rights of other corporations or of individuals. The field is large enough for all, and owning, as we do, the Letters Patent, or rights therefor for the WHOLE WORLD for the inventions of Mr. Gillett, we shall endeavor to so manage our business as not to incite legal controversies of any kind, anywhere, but we shall at all times and places, and under all circumstances, protect our rights under the laws of the country where those rights may be infringed.

It is confidently believed that the value of the foreign Letters Patent and "Rights," owned by this Company, is far greater than *twice* the amount of its capital stock, while the value of its American Patents, if judged by the money-making ability of similar, though inferior, inventions, can hardly be overestimated.

A full list of the Letters Patent issued to Mr. Gillett and of "Rights" to foreign patents, some of which have already been secured by the necessary "Patent Papers," is given herewith. Transfers of these have been duly and legally made to this company.

A limited amount of the capital stock of the company will be sold at *twenty dollars* per share for a limited time, for which receipts, entitling the holders thereof to certificates for full paid stock, will be given. The

stock is all held in trust by the financial agent of the company in New York, for the benefit of the shareholders, certificates for which stock will be issued after the expiration of six months from the date of the receipts given as above stated, and on the surrender of said receipts.

Negotiations are now in progress for the sale of the French and German Patents, which, if consummated, will give to this company a very large amount of money, when no additional stock will be offered at the present low price named.

It is believed that the names of the well-known gentlemen composing the board of directors, is a sufficient guaranty that the affairs of the company will be managed with integrity and ability, and for the true interests of the shareholders.

We invite attention to the following letters and extracts, being only a few of the many we have received :

LETTER OF MR. C. P. FLOOD.

HENRY CUMMINS, Vice-Pres. & Gen'l Manager. GEORGE R. WILLIAMSON, Secretary.
H. L. HORTON, Treasurer. W. H. FAIRBANK, General Supt.
JOHN W. MACKAY, President.

POSTAL TELEGRAPH COMPANY,

No. 49 Broadway.

NEW YORK, May 31, 1884.

E. R. WIGGIN.

DEAR SIR :

Since last November I have witnessed, and in a manner had charge of all experiments made by your Gillett Telephone, over the lines of the Postal Telegraph Co., and am free to state that the tests between the cities of

New York & Elmira, N. Y., 266 miles.
New York & Meadville, Pa., 509 miles,
New York & Cleveland, O., 621 miles,
New York & Washington, D. C., 352 miles.
New York & Chicago, Ill., 1,010 miles,

were highly successful both in an experimental and practical manner. The talking between the cities above mentioned was witnessed by a great many people, and as a test of what the telephone would do. I have myself talked a distance of 509 miles in a voice but little above a whisper, carrying on quite a lengthy conversation with your men.

As for New York & Elmira, I have stood ten feet away from the transmitter and got words through the Phone. I have whispered, whistled and done all sorts of things to test the sensitiveness of the machine, and all with much success. At times I have been able to read distinctly all messages passing over our other wires on same pole line, so great was the induction, or cross fire between the wire we would have telephone on, and the other wires that would be working " Morse system," This I consider a crucial test, and one that bat few, if any, Telephones would work over.

Yours truly,
C. P. FLOOD,
Chief Operator.
Postal Tel. Co.,
New York.

"Well, now," said the reporter, after he had talked all he liked and expressed satisfaction at the result, "what practical value do you suppose will attach to this new invention of Webster Gillett's? You certainly don't mean to say that it can be made to transmit sounds by ocean cables?"

"Why not?" asked Mr. Beale. "We have talked from New York to Chicago—over 1,000 miles—just about as clearly as from Elmira to New York; and all this has been done over a wire exposed to the influence of very strongly charged adjacent wires, any one of which carries a current of electricity sufficient to burn up a telephone instrument in a minute, if turned on direct. We have not only overcome these outward influences, but the undeniable obstacle of a cable under the North river, from Jersey to New York—over a mile. Now the great question remains to be answered, can we overcome the greater resistance in an ocean cable over 3,000 miles long?"

"Then you regard cable resistance much greater as an obstacle than the contending outward influences, such as the ticking we have clearly heard from the telegraph messages on the adjacent wires this evening?"

"Decidedly so,' said Mr. Beale.

[*Cleveland Leader Jan'y 15th*, 1884.]

HELLO, NEW YORK!

SUCCESSFUL EXPERIMENTS BETWEEN CLEVELAND AND THAT CITY

WITH A WONDERFUL TELEPHONE THAT PROMISES TO CONNECT THE HEMISPHERES.

From the moment that the telephone became an established fact, the question that has been paramount in the minds of electricians is whether it would ever become possible to speak from one hemisphere to the other. In fact the ambition of electrical inventors has been to devise a telephone that could be utilized for speaking through the Atlantic cable. There is but little question that a high seat in the temple of fame is awaiting the inventor who succeeds in that undertaking, however little practical worth is attached to the invention itself. The instrument that apparently approaches this much desired end, more closely than any hitherto devised, is now in use between Cleveland and New York. On Sunday evening Mr. Alfred Beale, of New York, a well-known electrician in that city, arrived here, bringing with him an instrument belonging to an organization lately formed in New York. The object of the company among other things is to establish a telephone line

BETWEEN AMERICA AND EUROPE,

and Mr. Beale's purpose in visiting Cleveland is to try one of their medium instruments between this city and New York. To facilitate his experiments, business on the Postal Telegraph line was suspended for two or three hours last night while the telephones were being experimented with. A LEADER reporter called at the office of the company, No. 9 Merwin street, last evening, while the experiments were going on. Mr. Beale receivod the caller very courteously, and kindly allowed him to examine the workings of the instrument. The telephone is constructed on an entirely new principle, and Mr. Beale says of it: "We expect to use it for practical business between Europe and America. We believe that the difficulties that have hitherto existed have been overcome. Our company has just finished a twenty-point instrument that we believe will do the work desired."

In the transmitter of this telephone is a

SMALL AND DELICATE NEEDLE

attached to a rubber disc and coming in contact with granulated carbon. This is held under compression to increase the conductibility for taking up loss by friction and from other causes. The telephone used between this city and New York was a ten-point instrument, although, as Mr. Beale explained, a single point instrument has been used for

distances of seventy-five and one hundred miles. Each point is like adding another telephone in power. Most instruments have a solid carbon button instead of the granulated carbon that is used in the new instrument. A feature of the receiver is the increased magnetic surface presented to the diaphragm. The experiments last night were very successful, conversation being carried on with the persons in the New York office in almost an ordinary tone, and sentences were very seldom of necessity repeated. At the New York end of the wire were Professor Webster Gillett, of Michigan, the inventor of the instrument, E. R. Wiggin, of Boston, L. B. Clark, a prominent attorney in New York, E. T. Bacon, and C. P. Flood, chief operator of the company. Mr. Beale and the LEADER reporter managed to

CARE FOR THE CLEVELAND END.

Politics, the weather, and other topics were discussed at length.

[*Boston Journal, Feb. 4th*, 1884.]

AN IMPORTANT INVENTION.

CONVERSATION BY TELEPHONE BETWEEN NEW YORK AND CHICAGO.

CONFIDENCE FELT THAT THE PRESIDENT OF THE UNITED STATES

WILL CONVERSE WITH QUEEN VICTORIA WITHIN A FEW MONTHS.

(Special Dispatch to The Boston Journal.)

NEW YORK, Feb. 3. For some months past there have been mysterious whispers that a very important discovery had been made which practically annihilated the distance which it was practicable to exchange communications by telephone. Sixty miles was thought to be the maximum, but instances, it is said, are recorded where conversation has been carried on between points one hundred miles apart, but not in the most satisfactory manner. The new telephone, it is reported on good authority, is wonderful from the fact that its capabilities appear to annihilate distance, and so far as tested it has accomplished wonders. The proprietors have very naturally kept their invention a secret. They wished to apply the severest tests before making any public announcement, and they have not as yet made any efforts to give publicity to their invention. During a portion of the summer and through the fall the instruments were put to trial work on the telegraphic wires located on Long Island, which are not in good condition. Ten, twenty and sixty miles were accomplished without difficulties, except those incidental to a new invention. Later the wires of the new postal telegraph line between New York and Chicago were utilized during the evenings, and a gentleman present states that the result was astonishing. Conversation in low tones was carried on between these two points, and between the intermediate stations and New York, which astonished those versed in such matters. It is said that the Chilian Government, through its agent, who has, with a practical electrician, witnessed the results of the new telephone, has closed a contract for its introduction in Chili. It appears to be evident that we are on the eve of an important advance in telephonic communication.

[*Boston Globe, March 3rd*, 1884.]

TO BE TRIED ON THE CABLE.

THE BIG TELEPHONE WITH WHICH IT IS PROPOSED TO TALK ACROSS THE ATLANTIC.

[Special Dispatch to The Boston Globe.]

NEW YORK, March 2.—In the building in which are the main offices of the Postal Telegraph Company a number of gentleman were experimenting yesterday with a tele-

phone, with which the inventor says he expects to talk across the ocean as soon as the Bennett-Mackey cable is laid. It is the invention of Webster Gillett of Ypsilanti, Mich., who claims to have solved the problem of adding battery to line almost without limit.

The experiments made yesterday were in speaking through the ten-point multiple telephone, over about 320 miles of wire, between this city and Washington. It was a wire of the Postal Telegraph Company's system, and close to it was a wire on which a Morse instrument was working. The induced current was so strong that a telegraph operator could read in the telephone receiver the message that was being clicked off. There was also some other derangement of currents resulting from damage to the wires by the gale of Friday. Notwithstanding these unfavorable conditions, conversation between the two cities was carried on.

The big twenty-point transmitter, which is to be tried on the ocean cable, is a formidable-looking telephone. With its strips of metal and its plugs for connecting the twenty currents, springing from forty cells, with the system of induction coils, its front looks like a switch-board in a telegraph office. "It is a double-decker," said Mr. Gillett; "there are two diaphragms. Ten of the points act on the inner one, and that acts simultaneously on the outer one."

[*Cleveland Leader, June 2d*, 1884.]

A LONG TALK.

SUCCESSFUL TELEPHONE EXPERIMENTS CONDUCTED YESTERDAY OVER SIX HUNDRED MILES OF WIRE.

SEVERAL SULTRY CLEVELANDERS EXCHANGE GREETINGS AND TALK POLITICS WITH CHILLY GOTHAMITES.

THE NEW GILLETT TELEPHONE SUBMITTED TO A THOROUGH TEST AND FOUND A SUCCESS.

"Hello, New York!"

The speaker was Alfred Beale, of New York, who represented the new Gillett telephone.

Three or four receivers were attached to the instrument yesterday, and as the LEADER reporter entered Mr. Beale requested him to place one of them to his ear. No sooner was this done than a voice was heard very distinctly, saying:

"Hello, Cleveland!"

"Hello," replied Mr. Beale, "how is the temperature down there?"

"Very chilly," came back the answer, while the listeners were sweltering in ordinary clothing.

"That gives you an idea of the distance," suggested Mr. Beale. "It is very cold there and very warm here, and yet the difference of time between an inquiry and the response is hardly perceptible."

While he was speaking Mr. J. H. Collins and Mr. Amos Champion entered the office, and the former talked briefly with Mr. Gillett and General Collis, who

WERE IN THE NEW YORK OFFICE.

"Who will be nominated at Chicago," asked General Collis of Mr. Collins.

"Why, Edmunds, of course," was the reply, "whom do you think will receive the nomination?"

"Chester A. Arthur," came back the reply as clear and distinct as if the telephones had been separated by a block instead of by over six hundred miles as they really were.

"There will be a bullish market to-morrow," said Mr. Gillett to Mr. Collins.

"What on?"

"Lackawanna," replied the New York gentleman.

The conversation is given to show how plainly it can be heard. Afterwards the wires became crossed and then the talking became less distinct. Soon after the line was again righted, and the experiments were resumed. The LEADER reporter spoke through the instrument, and his question was heard and answered very promptly by the listener in New York. The latter warbled a stanza from "Way Down Upon the Swanee River," and every syllable and word was plainly distinguished. It seemed difficult for the New Yorker to avoid politics, and he expressed the hope that the LEADER would have a chance to support Arthur. He said the boats had commenced running to Coney Island, and that immense crowds were

RUSHING DOWN IN THAT DIRECTION.

"This telephone differs from the Bell instrument," said Mr. Beale to the reporter, "in that more batteries may be used. The great difficulty in the way of long distance telephoning by the Bell Company is, that if more than two cells of battery are used, the carbon will be burned. If the current of electricity is greater than that induced by two ordinary battery jars, every vibration of the carbon burns away a particle. Now as more than that amount of electricity is required to convey the voice over a long stretch of wires, it follows, that until they devise some new scheme, they can never successfully speak for a great distance. Mr. Gillette, the inventor of this instrument, has overcome that difficulty. Instead of a carbon button, he has filled a cylinder with pulverized carbon. Into each end of this cylinder is set a small piece of rubber, and through one of these rubbers protrudes a needle. The other end of the needle rests against the button at the mouth of the tube. Thus it follows that every vibration of the voice compresses, or releases the cylinder of carbon. The instrument through which you were just speaking has ten of these cylinders, each of which is capable of sustaining more than two battery cells, or between twenty and thirty in all. Thus you see that the principal obstacle in the way has been overcome."

[*Cleveland Herald, June* 2, 1884.]

TALKING WITH NEW YORK.

TELEPHONE COMMUNICATION WITH THE BROADWAY OFFICE OF THE POSTAL TELEGRAPH COMPANY.

Experiments are continually being made in the Postal Telegraph Company's office with a view to perfecting the telephone controlled by that company. These experiments are under the supervision of the patentee, Mr. W. Gillett, at the general office of the company at No. 49 Broadway, New York. The office in this city, at No. 9 Merwin street, is in charge of Mr. Alfred Beale, Mr. Gillett's right-hand man, who makes Cleveland his headquarters, and travels back and forth along the line. The instruments are in better condition now than ever before, and yesterday Mr. Beale invited a number of gentlemen to the office, among whom were a HERALD reporter and several brokers, who had arranged to hold a conversation with General J. H. Collis, of Collis & Levy, the Philadelphia and New York brokers. The line was working in good shape with the exception of a slight rasping sound, caused by contact in some place, with the other wires of the company. Nothwithstanding this, the conversation at the other end of the line could be, at nearly all times, distinctly understood, and at no time was there any more inconvenience than when talking through the local exchange. There was an eighteen cell battery on. At the other end of the line were Messrs. Gillett, C. P. Flood, the chief operator of the office, and General Collis. When the General approached the instrument, the customary pleasantries of the day were exchanged, and he said:

"I'm a bull this week."

The three extra receivers which were prepared allowed three besides the speaker to get the conversation.

"What on?" was the question of one of the brokers.

"On Lackawanna," was the plain answer.

"When is Reading going to strike 10?" was asked.

"Tell me yourself," came back the reply pleasantly.

After each had taken a turn at the 'phone, Mr. Flood, at the other end, the possessor of a good baritone voice, treated the Cleveland audience to "Down on the Swanee River" and "The Hat My Father Wore," and at 12 o'clock Mr. Gillett said: "It's half an hour nearer our dinner time than yours, and I think we'll go home. Good-bye."

The plan of Mr. Gillett's telephone is to allow an increase of batteries, and it is so made that this increase has no effect on the instrument itself. In the Bell telephone a carbon point strikes a larger square of carbon at each vibration of the diaphragm, and when the vibration is very rapid, as when a person is talking very loudly, only a continuous roar is heard. On Mr. Gillett's 'phone there are, in place of one, ten points of contact. On the diaphragm is fixed a rubber cup on which are ten squares each containing one end of a needle. The other end of the needle perforates a piece of rubber in the end of a brass cylinder, which contains carbon in a powdered form. The needle forces itself into this bed of carbon with each vibration, and closes, or opens the circuit, and there being ten of these points acting simultaneously, a perfect current is formed. There is no noise of induction as is usual in the receiver, for the reason that Mr. Gillett's patent on that instrument, covers an improvement in the form of the double magnet. The north pole is wound with wire in an opposite direction to the south pole, and the current is thus neutralized and the induction noise is stilled.

[*Commercial World, April* 25, 1884.]

A WONDERFUL DEVELOPMENT OF THE TELEPHONE.

PERFECT COMMUNICATION FURNISHED WITH THE MOST DISTANT POINTS.

The telegraph has been frequently styled the most powerful engine of civilization, the most valuable aid to commerce, and one of the greatest inventions of our modern and progressive age, but even the telegraph must give place to the telephone so far as the importance of its future is concerned, in the light of a recent series of inventions in the field of long distance telephony.

The invention of a telephone, with the aid of which it would be possible to hold a conversation at any remote distance between two points, has been one of the prizes for which mechanics, electricians, and the ingenious of all classes have anxiously striven, only to meet with failure, owing chiefly to the amount of inductive resistance to the passage of a current that had to be overcome. To use a current powerful enough to transmit the message the required distance would destroy the conductor at the start, while if the conductor were made sufficiently strong, the message could not be transmitted and the current would be disastrously affected by induction. Modifications of receiver, transmitter, battery, conductor, etc., etc., were tried without number, but all failed to accomplish the desired purpose, all proved defective under practical test. At the same time it may readily be perceived that a long distance telephone, an instrument that would permit of communication between, say New York and Chicago, or more remote points, would be of incalculable value, and would outstrip the telegraph in general utility.

The first successful solution of this much investigated problem has been accomplished by Mr. Webster Gillett, of Ypsilanti, Mich., who employs a novel principle in overcoming the difficulty, other inventors have hitherto found insurmountable. In place of employing a single battery, or a number of cells, which, if of sufficient power to overcome the induction would burn up the conductor, he uses a number of independent local batteries, induction coils and deviating points. His instrument entirely revolutionizes the present single contact transmitter, his contact being entirely novel, and in his instruments, which are constructed variously with 2, 4, 10 and 20 deviating points, he has telephones capable of transmitting articulated sound correctly to various distances.

His 20 point instrument, for instance, presents 20 different points to the diaphragm, the vibrations induced by all these currents working together simultaneously. In this way a current of sufficient intensity may be transmitted, without injuring the conductor, to overcome the highest resistance known in telegraphy—that offered to the passage of a current by the Atlantic cable, for instance. In the receiving instrument both poles of

the magnet are presented to the diaphragm, which acts as a keeper, and consequently possesses a far greater amount of sensitiveness than any other receivers in use.

A minute technical description of the instrument would hardly interest our readers, but they will hear with interest that conversation has been carried on, even under the most unfavorable circumstances, between New York and Meadville, Pa., a distance of 509 miles, over the Postal Telegraph Company's wires, with the aid of a Gillett telephone, and could be clearly understood at either end. The articulation is as distinct and as loud as the best city telephones are capable of, and the same results were obtained in the course of experiments made between New York and Washington, and the tests will be continued until it is proved possible to hold intercourse with St. Louis, Mo., from New York, a distance of about 1,400 miles.

The manifold advantages of the system we need not enlarge on. The fact that by means of a series of inter-city exchanges a merchant will be enabled to transact business *viva voce* with correspondents and customers in all parts of the country, is in itself sufficient to stamp the invention as one of the most important of our times. On business, on official and on social intercourse, it must have a wonderful effect, and it is difficult to foresee where the utility of the discovery ends. Already patents covering the invention have been issued by England, France, Belgium, Germany and the United States, and the Company has been organized to control and introduce them.

[*The Electrical World of New York, April* 19, 1884.]

THE GILLETT LONG DISTANCE TELEPHONIC APPARATUS.

In the few years that have marked its growth the art of telephony has already fulfilled most extraordinary promises and realized most wonderful possibilities, and it may justly be ranked, even now, among the most valuable of the arts with which electricity has endowed our civilization thus far. Yet it is far from having exhausted its resources and reached the limit of its development. There is a new and almost boundless sphere of usefulness into which it had scarcely thought of entering before now, and where it is destined to play a role of the highest importance—the transmission of articulate speech to long distances. Before its task is completed the telephone must yet fufill this promise—It must conquer distance. The now indispensable conveniences and facilities which it places at our command for intercommunication between different parts of cities and neighboring towns, must also be made available between cities and towns widely distant from each other. It is, indeed, to this new development, this wider extension of the art, that the public is now looking forward with the most interest.

Long distance telephony has been the dream of both scientist and inventor ever since Bell inaugurated the art by demonstrating the possibility of the electrical transmission of speech. But it is only within a comparatively short time that we have begun to approach the realization of this dream. The art of telephony, like all others, "had to creep before it could walk." When the telephone left the hands of Bell its voice was too weak even for ordinary distances. In order to "cultivate" and strengthen it a certain process of evolution and improvement under the fostering care of the inventor was needed. The microphone transmitter had to be invented, the induction coil and other important accessory devices to be brought into requisition. It was only after the telephone had succeeded in attaining its natural growth by assimilating these necessary elements that the higher development tending to make its voice reach "over hill and dale" began. At first it was the successive improvements made in the transmitters and receivers intended for ordinary use that enabled the distance of transmission to be gradually increased. But the practical limit to this increase is reached usually within a few hundred miles, with these forms of apparatus. This has since led some inventors to experiment with modified forms of apparatus specially constructed for the purpose of transmitting speech to long distances.

Mr. Webster Gillett, of Ypsilanti, Michigan, appears to have been particularly successful in this line of invention. His "long distance" apparatus, the various types of which we take occasion to illustrate herewith, presents features of considerable novelty.

The special interest which attaches to this apparatus, from the very fact that it is designed for long distance transmission, is greatly embraced by the flattering success obtained with it in numerous long distance tests lately made over the wires of the Postal Telegraph Company. Mr. Gillett has been interested in the development of telephony almost from the very first, having obtained patents for improvements as early as 1878. Of late years it may be said that he has made a "specialty" of long distance, for all his efforts have been concentrated on the task of perfecting his apparatus, so as to make it powerful as well as sensitive.

The most important problem to be solved at the outset was to provide a suitable microphone contact, for, as we know, the clearness, the loudness, even of the articulation, depend greatly upon the manner in which this contact performs its function. In ordinary microphone transmitters all the sound vibrations which make the diaphragm vibrate cause the carbon of metallic pieces between which this delicate contact exists, to move relatively to each other so as to make the contact alternately looser and closer. The resistance to the passage of current through this contact diminishes considerably as the pieces are pressed more closely together; but it increases greatly, on the other hand, when they move away. The difference may amount to several ohms. It results therefore, that at each sound vibration, the resistance of the local circuit, through this contact and including a battery, and the primary coil of a transmitter, is increased and diminished, thus causing a fluctuation of the current. These fluctuations or "undulations" re-act upon the secondary wire of the induction coil, and give rise to impulses of current of higher electromotive force than are transmitted over the line. For the perfect transmission of speech each one of these impulses must act individually on the receiver at the other end, and for this they must be well defined.

The problem of long distance telephony consists precisely in giving to these impulses a sufficiently abrupt, sharply defined character, for they are expected to withstand a certain amount of retardation in transmission that tends to merge or prolong them into each other until they lose their individuality. But as these secondary impulses are but reproductions "on a higher scale" of the primary ones, it is plain that much depends on the microphonic contact. These primary impulses must themselves be made more abrupt and sharply defined, and for this the contact must be so constituted as to cause a greater variation of resistance. This can be accomplished in a certain measure in contacts such as those used in extraordinary transmitters by adjusting the points so they may bear more lightly against each other. But in so doing a difficulty arises, for the contact is then likely to be influenced by other movements than the vibrations of the voice transmitted, as, for instance, the impact of the air expelled from the mouth in speaking, the vibrations of the building, etc. These occasion a crackling, rattling sound that would greatly interfere with the transmission over long lines, in which frying from noises induction and other sources already exist.

To avoid these difficulties Mr. Gillett has devised a new and original form of contact, and in order to improve the results still further he has multiplied these contacts and grouped them in a peculiar way so that they may strengthen but especially "correct" each other. Each contact consists of a metallic needle attached to the diaphragm of the transmitter and moving with it, its free end passing through an opening into a small recess where it penetrates slightly into a mass of carbon grains or particles that are more or less compactly held together *under compression* between elastic cushions. In a contact of this construction there are doubtless several actions that conspire to accomplish the object desired—large variations of resistance. In addition to the variations of contact pressure produced at the point of the needle, it is not improbable that a certain amount of pressure is transmitted to the carbon particles, and also that a certain degree of molecular vibration must result in these particles themselves. It is quite certain that the microphonic action is not produced merely at the end of the needle, but that it involves the aggregation of carbon particles as well, for Mr. Gillett has found a special advantage in using these particles instead of fine powder. His experiments have led him to give a preference to rough-hewn granules that are covered with excrescences like ore, and he prepares them especially for this purpose from retort carbon. He subjects the carbon to a kind of stamping or crushing process in a mortar, after which the "grist" is sifted through a fine sieve having sixty meshes to the inch. By this operation the particles are freed from carbon dust and powder. They are now sifted through a thirty-

mesh sieve, and the particles which are small enough to go through are used in the transmitter contacts. When examined with the microscope these particles seem like so many craggy boulders full of rough and sharp edges. These projections when delicately compressed against each other must necessarily form sensitive microphone contacts.

Mr. Gillett has constructed several transmitters having only one of these contacts, and he has used them with success over much greater distances than the ordinary single-point transmitters can compass. But for longer distances his design contemplates the multiplication of the contact points. He has constructed long-distance transmitters having four points, others having ten points, and, finally, he has lately completed one with twenty points of contact. The manner of grouping the contacts deserves special attention. Thus far, in transmitters containing several contact points, the current was either divided equally through the points, which were connected in multiple manner, or else it was passed successfully through them in series. Mr. Gillett, however, proceeds differently. He has found it to be a great advantage to let each contact-point do its work individually, independently of its colleagues, and to give its own circuit, its own source of current. He does this by using a separate induction-coil for each contact-point. He then connects the secondary wires of these induction-coils together, not in series, as one would expect, but in multiple or divided circuit. In this case the electro-motive force of the induced current impulses sent over the line remains equal to that which one induction-coil alone would produce. So that in this respect there is no gain realized.

But on the other hand this " multiple " secondary coil, as it might be termed, adds much less resistance to the line, for each branch practically increases the total area of section. Thus with the ten point instrument, the resistance of each secondary coil being 175 ohms, the resultant resistance is only 17.5 ohms. If it were desired to increase the electromotive force, the length of wire in each could be doubled, and even then the total resistance would be only 35 ohms. Strange to say, however, Mr. Gillett has not yet found his " supply " of electromotive force deficient, even though these secondary coils are not materially different from those used with the Blake transmitters. The coils which he uses are about 4¾ inches long and 1¼ inches in diameter, the primary coil being of No. 20 (B. & S.) wire wound to about 4 ohms and the secondary of No. 36 wire wound, as just stated, to about 175 ohms. These coils, as used with the contact points of Mr. Gillett no doubt produce impulses of much higher electromotive force than they would otherwise, for much depends, as is well known, on the range of fluctuation produced in the primary coils.

The great advantage which Mr. Gillett has realized, however, by connecting his secondary coils in this manner, is that the impulses are rendered more distinct and defined, by a process of mutual correction and " trimming." It is not improbable that in such multiple instruments some of the contact points begin to act a little sooner—it might be even but the ten thousandth part of a second than the rest, and it is equally probable that some cease to act after the rest. Now, with the secondaries connected in series the impulse sent over the line would begin with the first to act and would end with the last to cease. It would be prolonged, which is the very effect that must be avoided in long-distance telephony. Its edges should be cut off instead, and this is what the arrangement of Mr. Gillett does. When the impulse begins to rise in one secondary coil before the rest it finds a " return conductor " by dividing through the other secondary coils instead of being compelled to pass over the line. Even if there are two, three or more of the secondary coils that failed to " wait " for the others their impulses are all short circuited in a measure by the coils remaining idle. Again, when the next phase of the vibration is about to begin, as soon as one secondary coil weakens or begins to give out it becomes a short circuiting path for the impulses remaining in the others, and thus each one that dies out helps to kill the rest. In other words, we may say that impulse over the line rises when the secondary coils have become "unanimous" in action, and ceases when some of them fail. These coils, in fact, fulfill for each other the office performed by a condenser to the primary circuit of the Ruhmkorff coil. They widen the interval between the impulses, and thus leave a wider margin for the " tailing " which these impulses must anticipate in long-distance telephony.

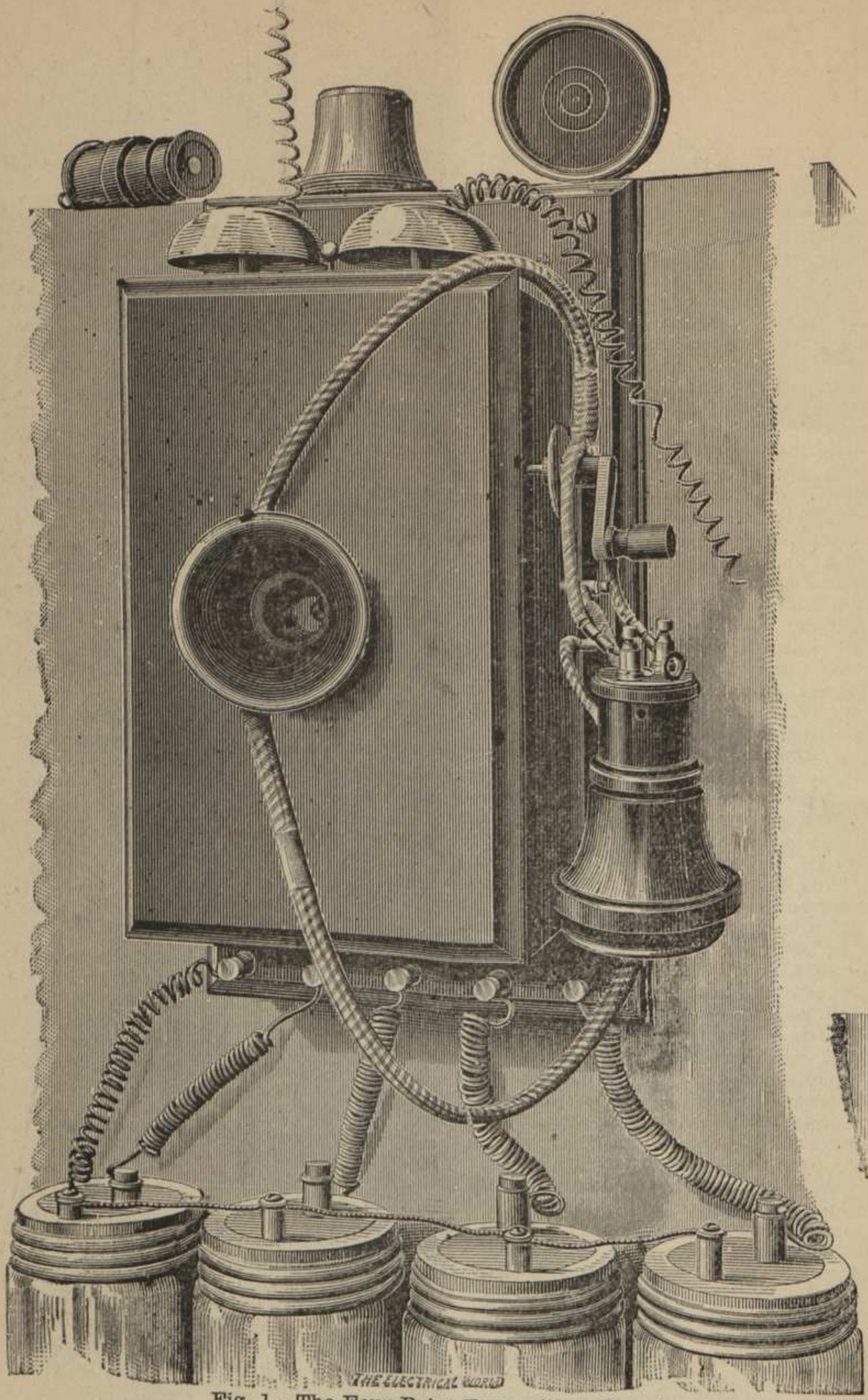

Fig. 1.—The Four-Point Transmitter—Closed.

Fig. 1, shows the interior the four-point instrument, and Fig. 2, shows its exterior arrangements. A screw passing through the centre of the diaphragm serves to hold in place a cup shaped disk to the margins of which, at equidistant points, the four contact needles are fastened. The carbon grains into which they penetrate are contained in a hollow, inside four screws, and these are held by four curved brass arms, screwed to the ring around the margin of the diaphragm, though insulated from it. The connections to the batteries and induction-coils are made through the hinges, the four longer ones being connected with the needles and the four shorter ones with the brass arms just described. There are four induction-coils, one for each contact point. Two of them are seen

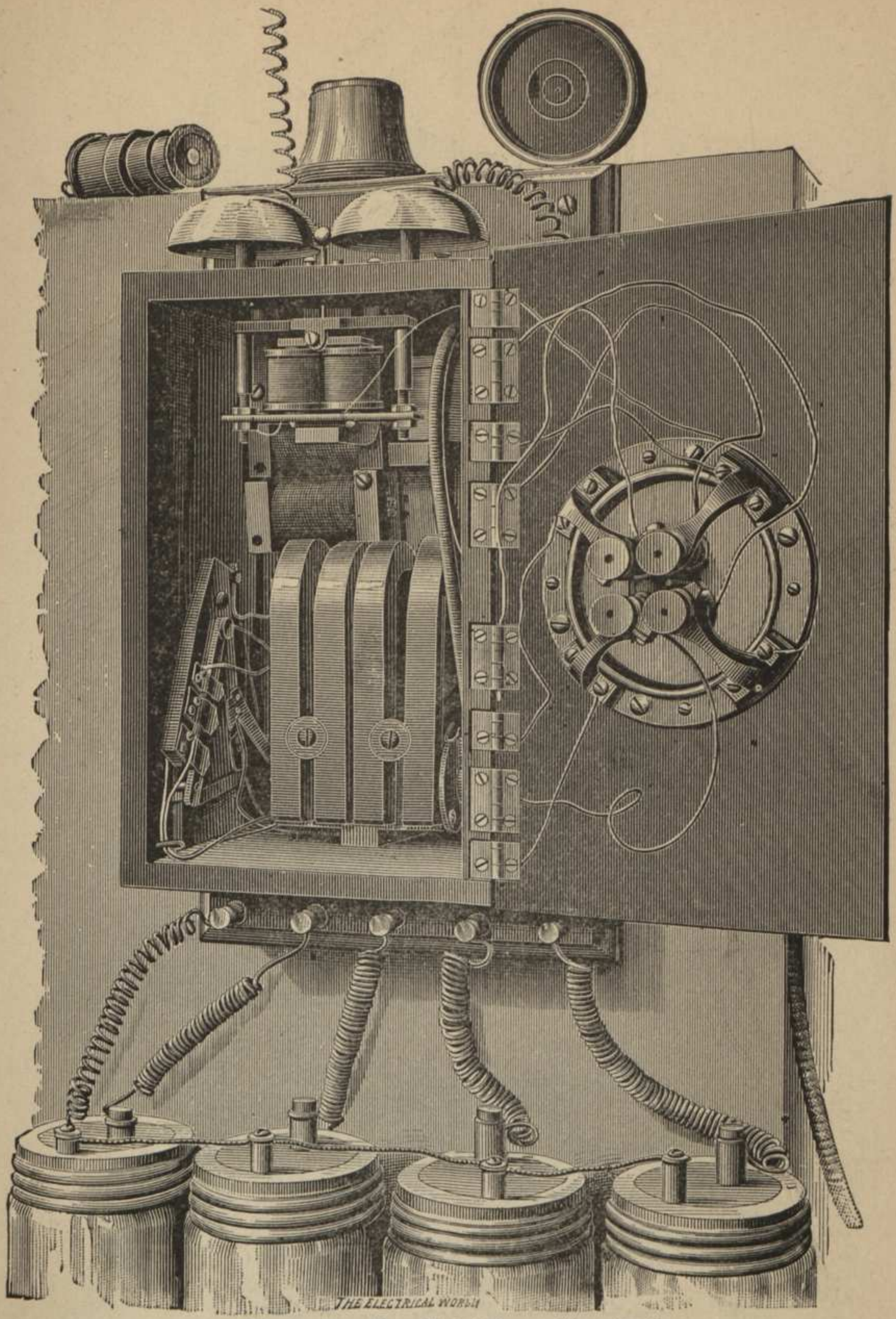

Fig. 2.—The Four-Point Transmitter—Open.

between the generator and bell magnets. One cell of battery is used for each primary circuit, one "return" conductor being used for all four cells, so as to simplify the connections. At the left side of the box is a switch by means of which the primary circuits may be closed or opened. Besides this the apparatus comprises a bell of the kind usually placed in telephone instruments, and also a magneto generator, whose armature contains a great length of wire, and whose magnets are large and strong, so that the impulses generated may be powerful enough for overcoming long distances. In connection with this and his other transmitters Mr. Gillett uses a receiver of special form, invented by himself. In Fig. 1, one of these receivers is shown complete at the right side and the parts

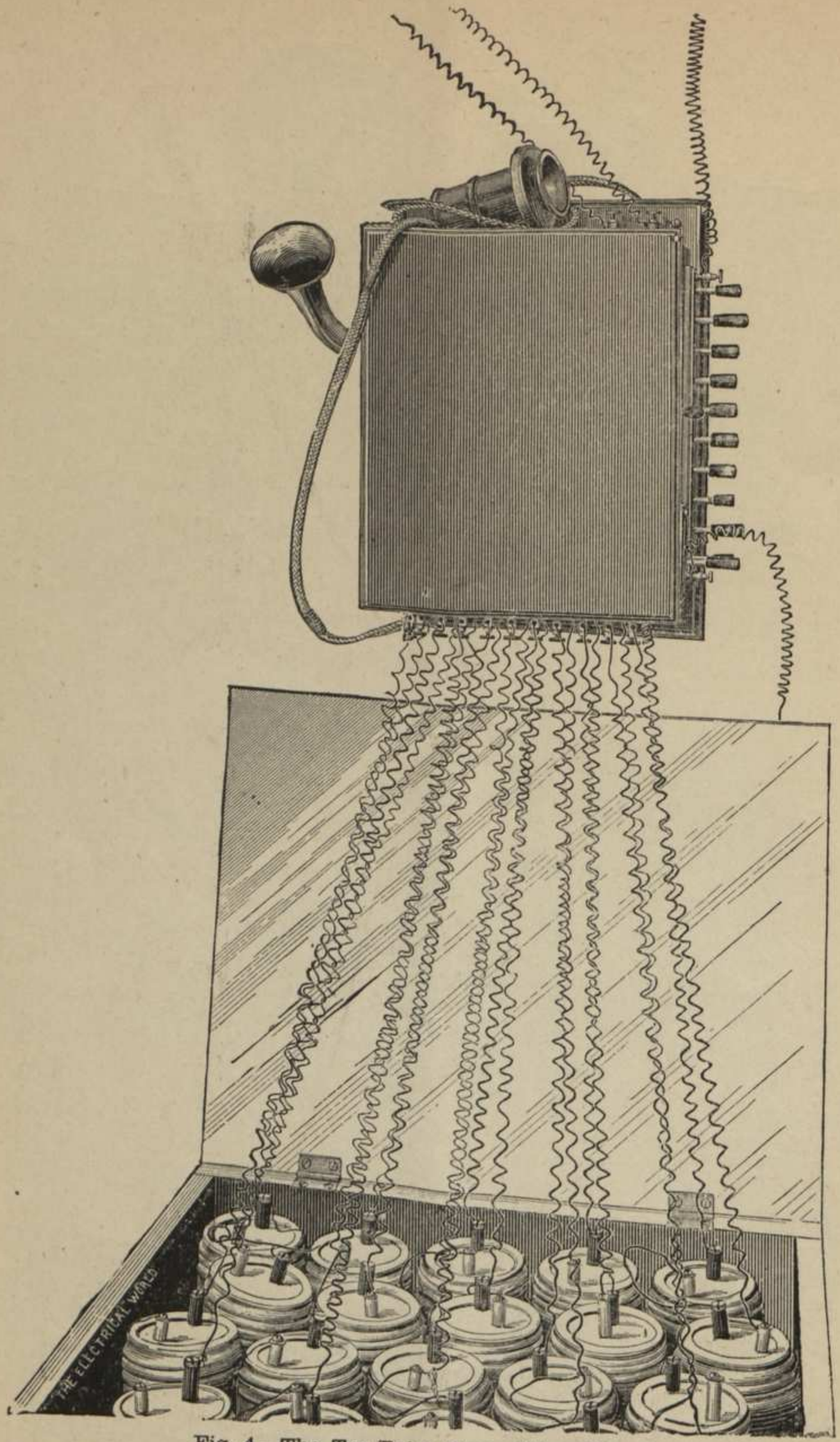

Fig. 4.—The Ten-Point Transmitter—Closed.

of another are shown at the top. It consists of a tubular or cylindrical magnet inclosing a central bar magnet. Around the pole presented to the diaphragm by this magnet is placed a spool of fine wire, as in the Bell receiver. Some fine wire wound is also on the outside of the tubular magnet around the pole presented to the diaphragm which is of a polarity opposite to that of the central bar magnet. With this form of receiver the magnetic attraction of the diaphragm is produced over a wider surface. Moreover as the action of both poles is made available, each radius of the diaphragm becomes practically the armature of a U magnet, and its "keeper" as well. The vibrations produced are more energetic and the articulation which results is therefore louder.

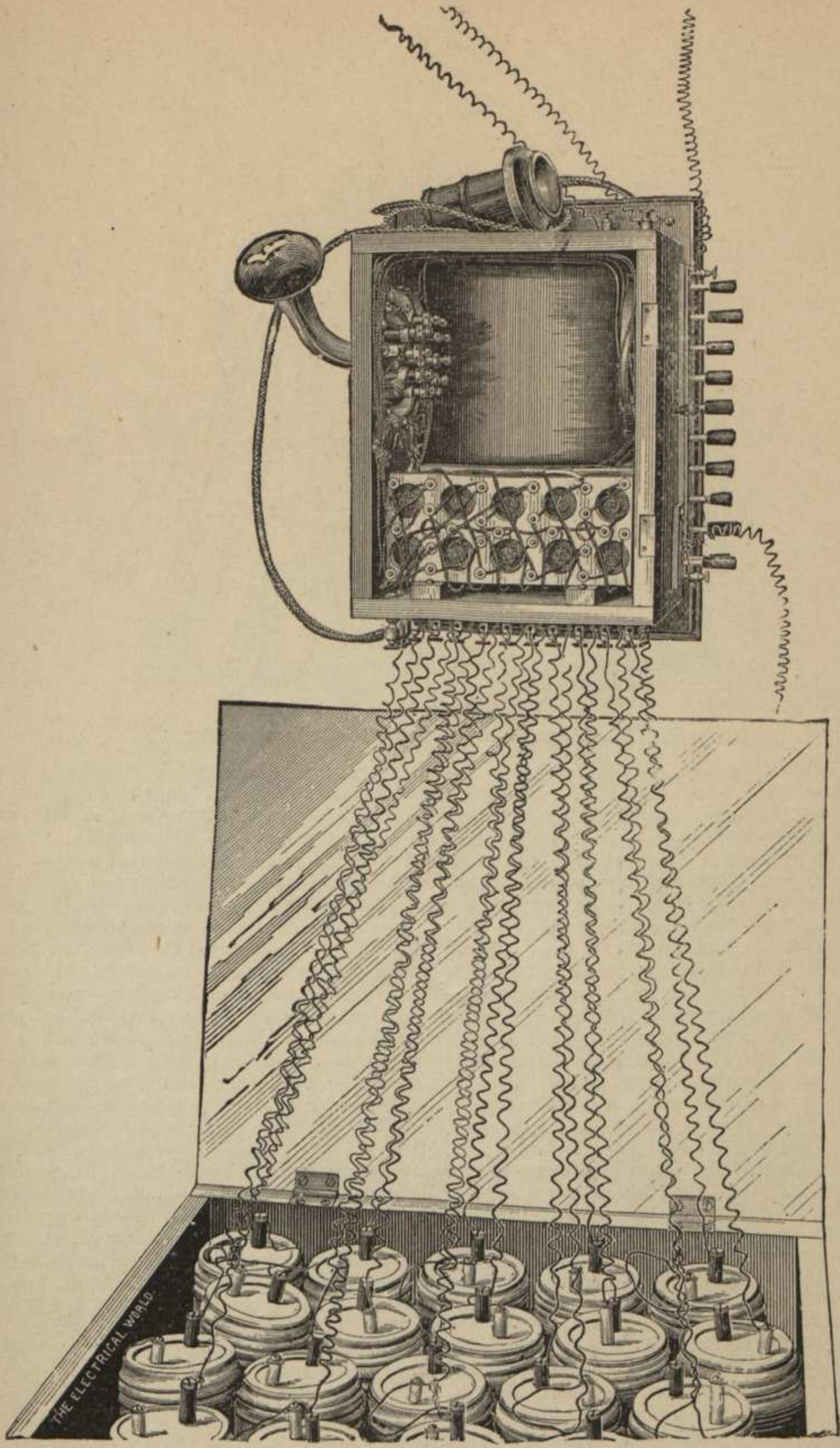

Fig. 5.—The Ten-Point Transmitter—Open.

Figs. 4 and 5 represent the ten-point transmitter. The diaphragm is in this case placed on the left side of the box instead of being placed in the door. The sound waves are conveyed to it by a speaking trumpet, as shown in the figure. The "ten points" are disposed in a circle.

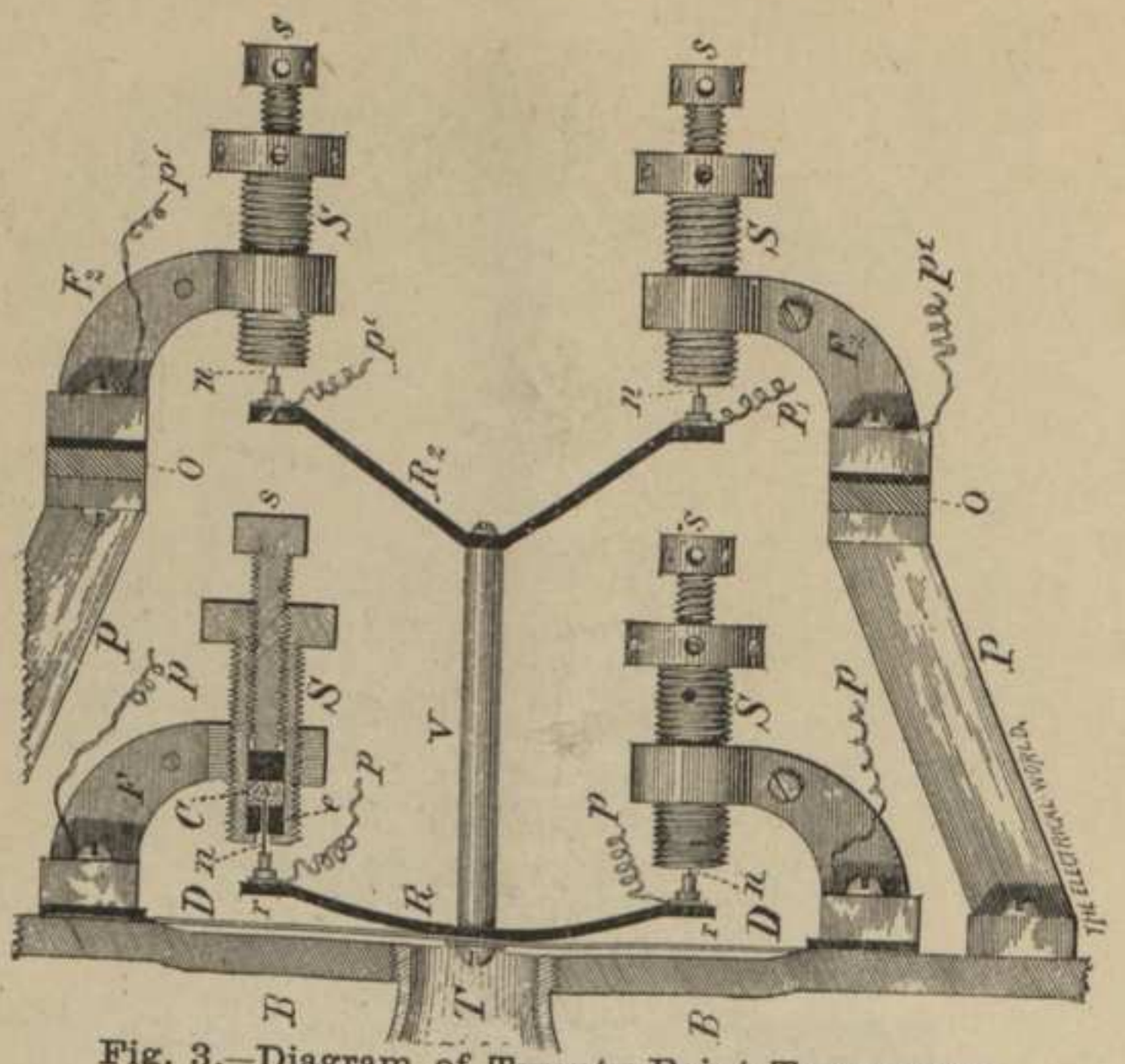

Fig. 3.—Diagram of Twenty-Point Transmitter.

When seen in vertical cross section through the centre of the diaphragm the arrangement is as shown in Fig. 3, with the stem *V* and the right-hand portions left out. The diaphragm *D D* is screwed to a metallic ring. By means of a screw passing through its centre it holds the cup-shaped disc *R* of india-rubber, whose rim is flattened. The needles *n n*, attached to shoulder pieces, are fastened in place by screws passing through the rim *r r*. Between the shoulder-pieces and the rim are interposed metal washers to which a wire *p*, intended for making the connections is soldered. The wires *p*, from the "other side" of the contacts are connected to curved brass arms *F* that hold the screws *S s* in line with the needles. The screw at the upper left-hand side is shown in section, in order that the exact manner in which the contact is made may be seen. First there is a plug of elastic rubber *e* shown in black, which is from one-eighth to a quarter of an inch in thickness. The carbon particles *C* occupy a space of about the same length left between this plug or cushion and another which is also shown in black. The screw *s* is free to turn inside the chambered screw *S*, and by turning it the compression of the carbon particles can be regulated. The needle *n* passes through the first rubber cushion (*e*) which is suitably bored for the purpose, and it projects into the mass of carbon particles, about one thirty-secondth of an inch more or less, according to the adjustment. The ten induction coils used with the ten points of contact are placed in the bottom of the transmitter box in a frame as seen in Fig. 5. Two cells of (Bergmann) battery are used for each contact point. At the right side is a kind of radial switch provided with a lever on the outside, by moving which the primary circuits may be closed or opened. Each of the secondary coils has a plug connection at the right side of the box, and by withdrawing this plug it can be excluded from the circuit. It is possible, therefore, to use the points of this instrument either singly or in any desired groups. At the lower part of the right side is also a plug switch by means of which the line may be transferred to a magneto and bell apparatus.

In the experiments which Mr. Gillett has been carrying on over the wires of the Postal Telegraph Company some very satisfactory results have been obtained with these ten point instruments. Between New York and Meadville, Pa., where Mr. Gillett's assistant is at present located, a distance of 509 miles, the transmission is a great success. The articulation is indeed quite as clear, as distinct, and as loud as between any two telephonic stations in a city. Conversation can be carried on with perfect ease, and it is not even necessary to raise the voice, for even a message in whispered tones can sometimes be understood. We have conversed successfully over that distance when using

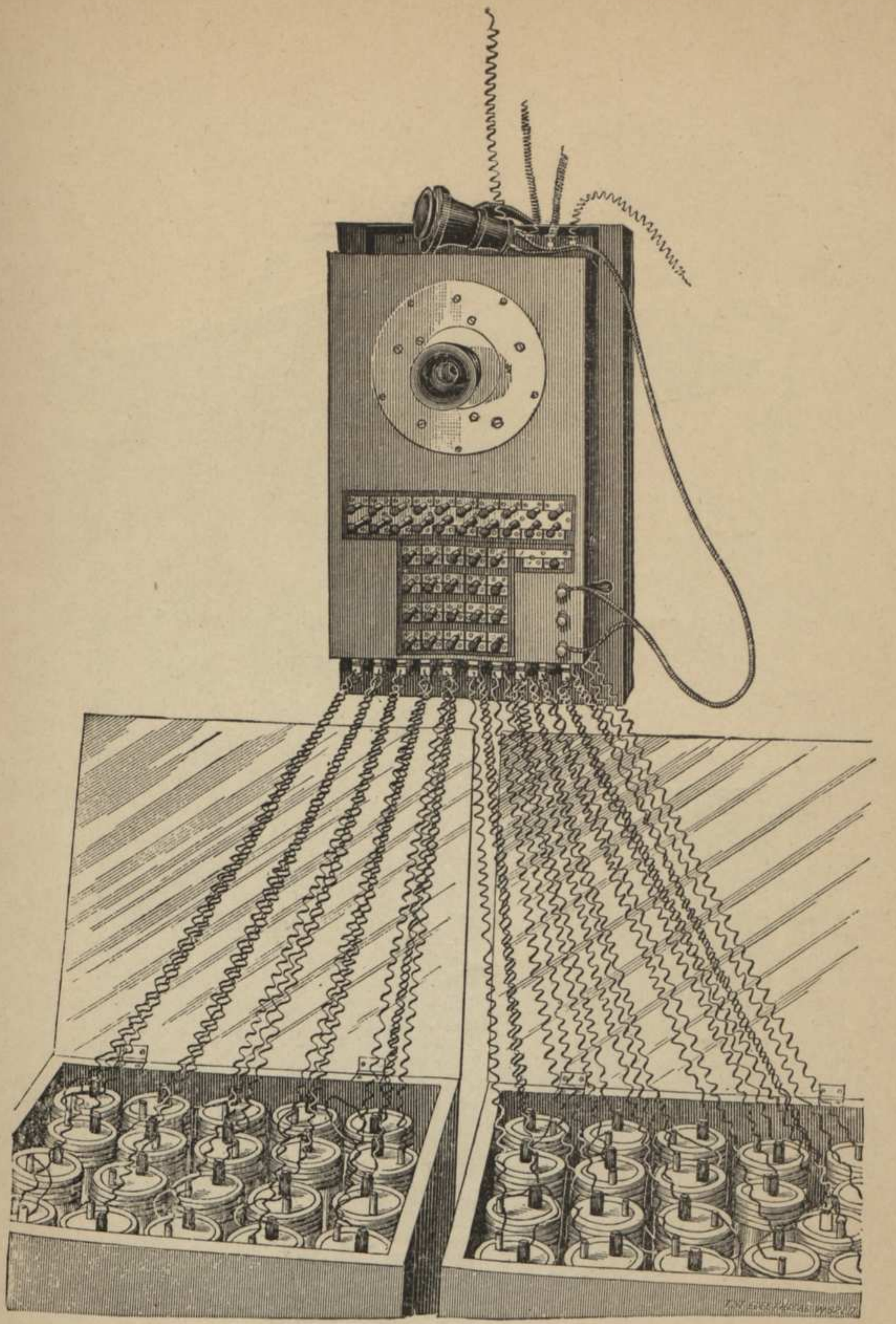

Fig. 6.—The Twenty-Point Transmitter—Closed.

only one point, though the articulation is not quite as clean or as loud—probably for the very reason that the impulses are not so well defined, as already explained.

Conversation has also been carried on between Washington and New York with equal success—320 miles. Experiments have been made between Cleveland and also between Chicago and New York with success, though the transmitters were not then fully adjusted. These experiments will soon be repeated over again, this time, it is hoped with as good success as between here and Meadville. The experiments will extend to St. Louis via Chicago—about 1,400 miles.

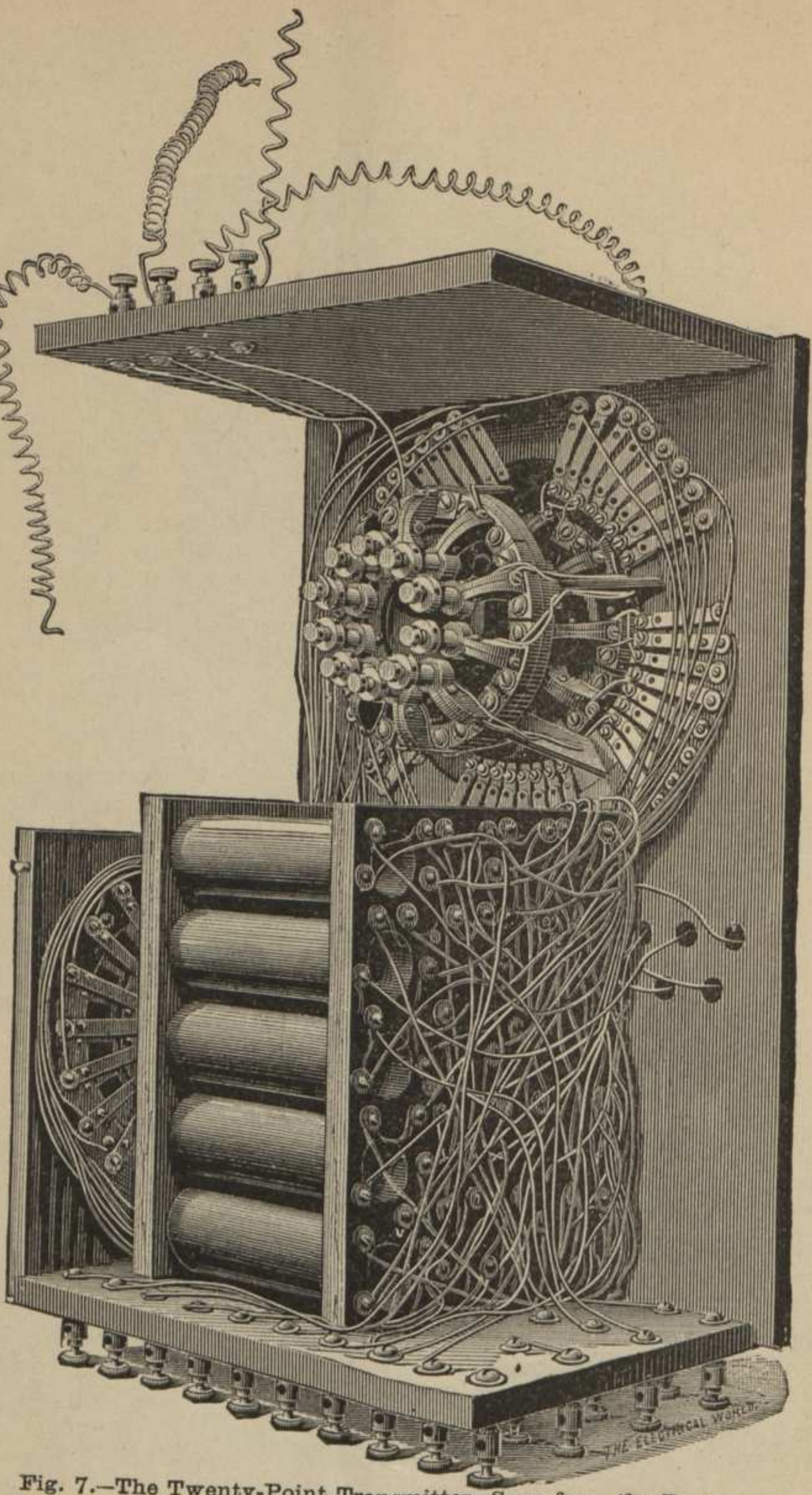

Fig. 7.—The Twenty-Point Transmitter—Seen from the Rear.

Last, but not least, of the instruments which Mr. Gillett has constructed, is the "twenty pointer," a giant among transmitters, and one with which inventor is expected to attempt the daring exploit of ocean telephony. This instrument is shown complets in Fig. 5. Fig. 6 is a rear view with the box partly removed to show its construction. This instrument is in reality a ten-point one doubled by the addition of an extra groupe of ten points behind and in a line with the first ten.

The exact manner in which this is contrived is shown in diagram in Fig. 3. The chambered screws (*S*) of the second group are held as before by curved arms (*F2*) which are screwed to a ring *O*, from which they are insulated. This ring is held by converging supports *PP*. The contact needles of this second group are attached like those of the first to a circular piece *R2*, which is hollowed out, but after the manner of a funnel instead of being cup-shaped. This funnel is crewed to stem *V*, which is itself held secure to the diaphragm by the same screw that holds the first disc. Thus it will be seen that the motion of the diaphragm must be conveyed simultaneously to all the contact points.

The structure which holds together the diaphragm and these chambered screws may be removed at pleasure, the connections to the points being made by metallic springs disposed radially around the margin of the opening in the box (Fig. 7). The induction coils are supported in a frame as in the ten-point instrument. There is also a radial switch, by means of which the primary circuits are manipulated, and in the front of the instrument a system of plug connections, the upper double row being for the secondary coils and the lower four rows for the primary circuits, which can thus be operated singly or in combinations. There are two cells of battery per contact in this case also.

This instrument has not yet been fully adjusted, and no special tests of its capabilities have been made. These tests, will doubtless, be made before long. The inventions of Mr. Gillett are covered by patents in England, France, Belgium and Germany.