

C. L. CHISHOLM.  
TRANSMISSION OF ELECTRICAL POWER.  
APPLICATION FILED JAN. 9, 1908.

936,304.

Patented Oct. 12, 1909.

4 SHEETS—SHEET 1.

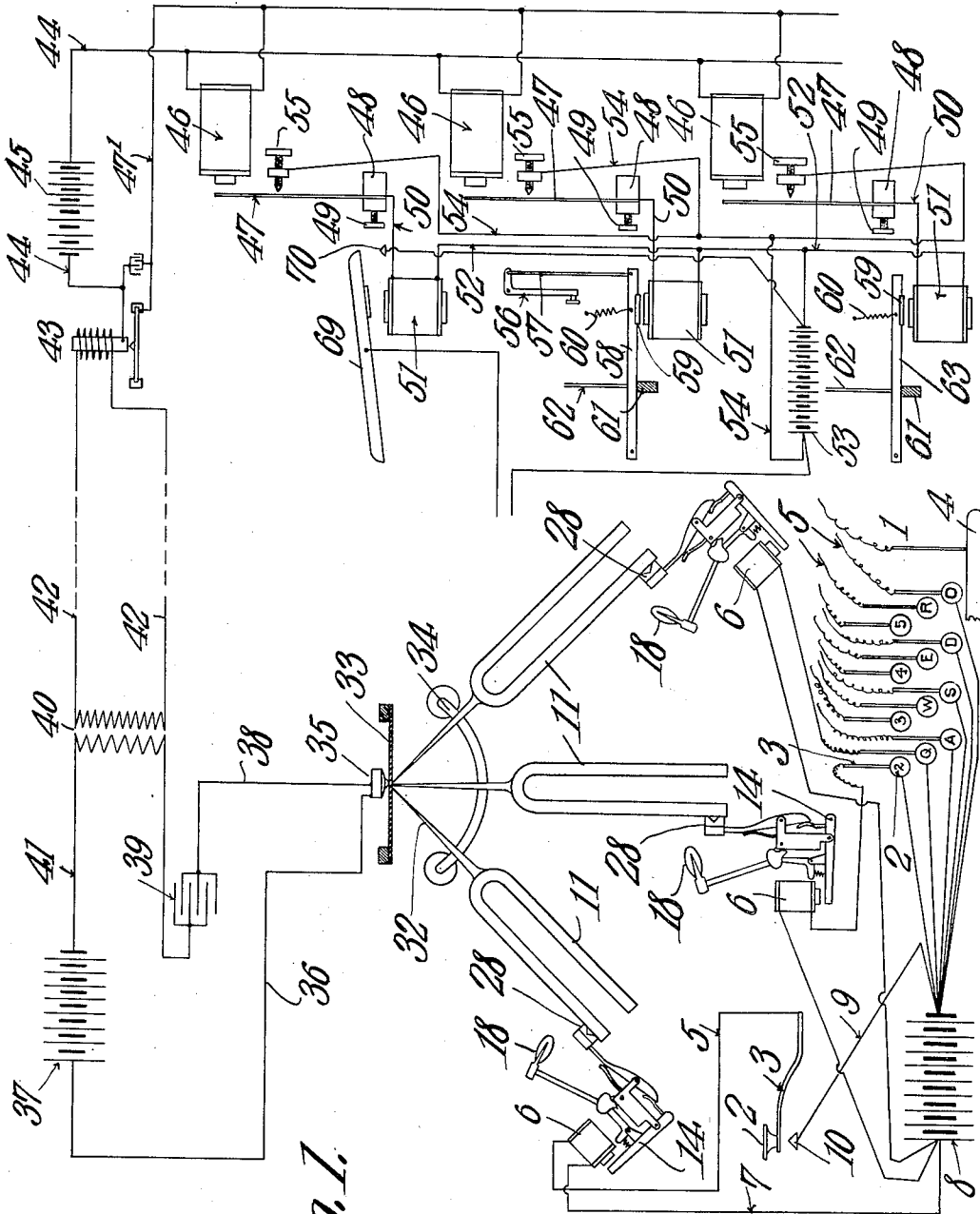


Fig. 1.

Witnesses

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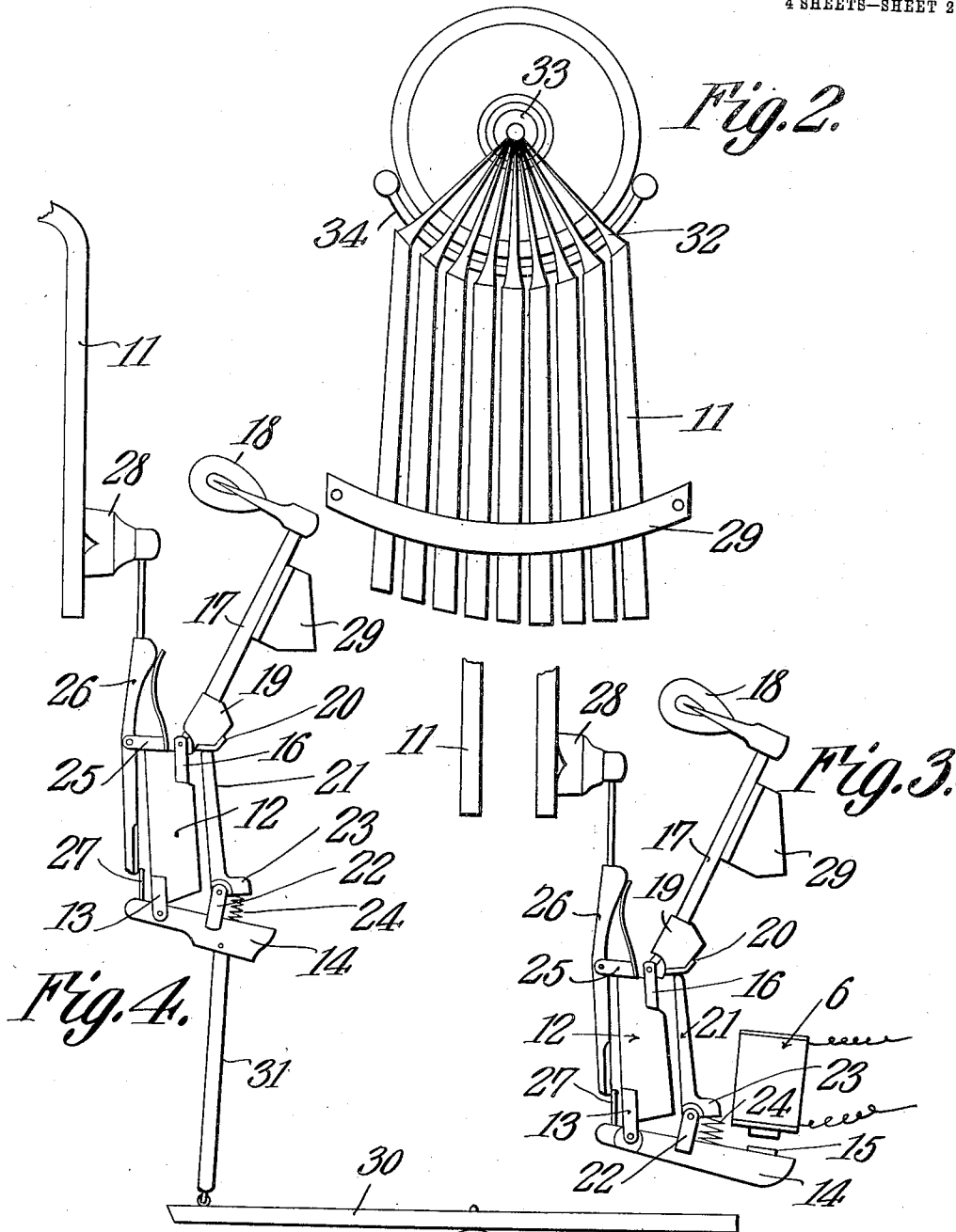
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4 SHEETS—SHEET 2.



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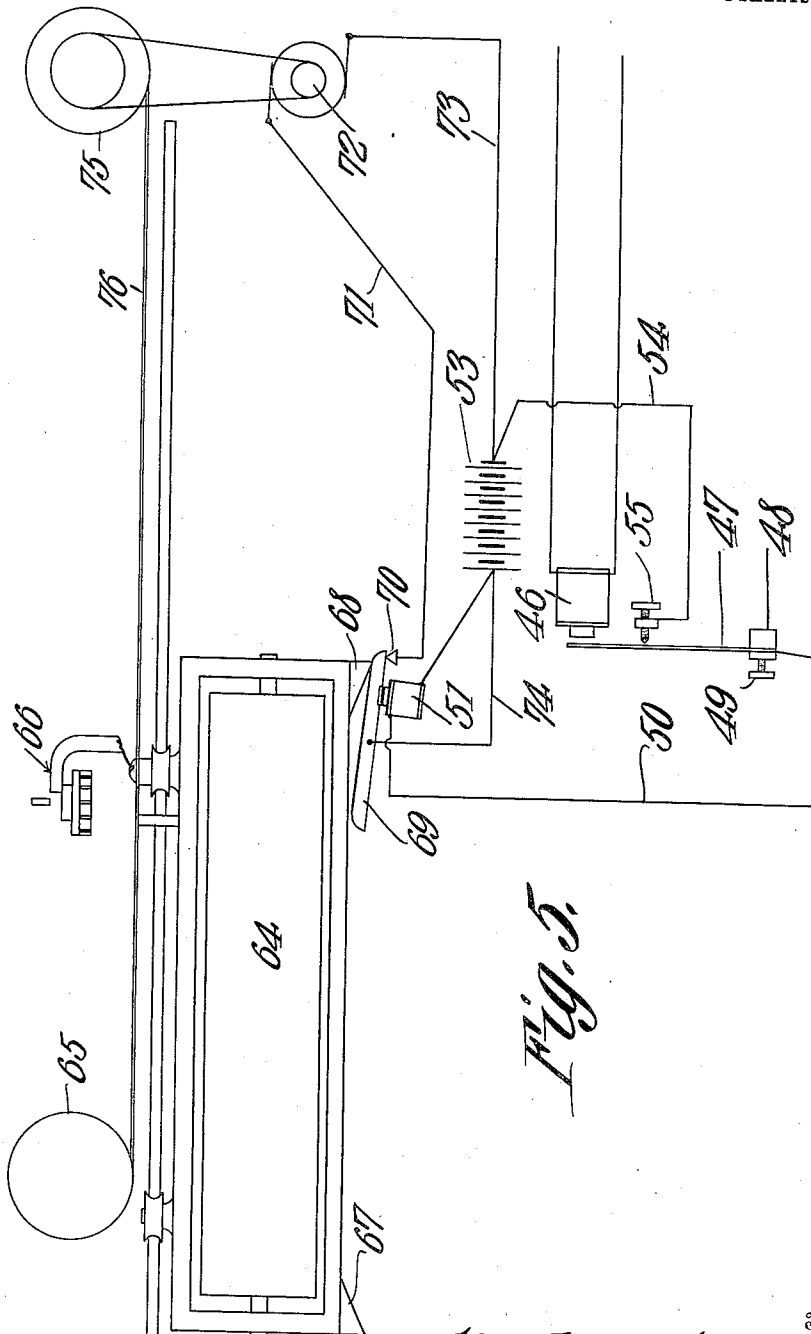


Fig. 5.

Witnesses

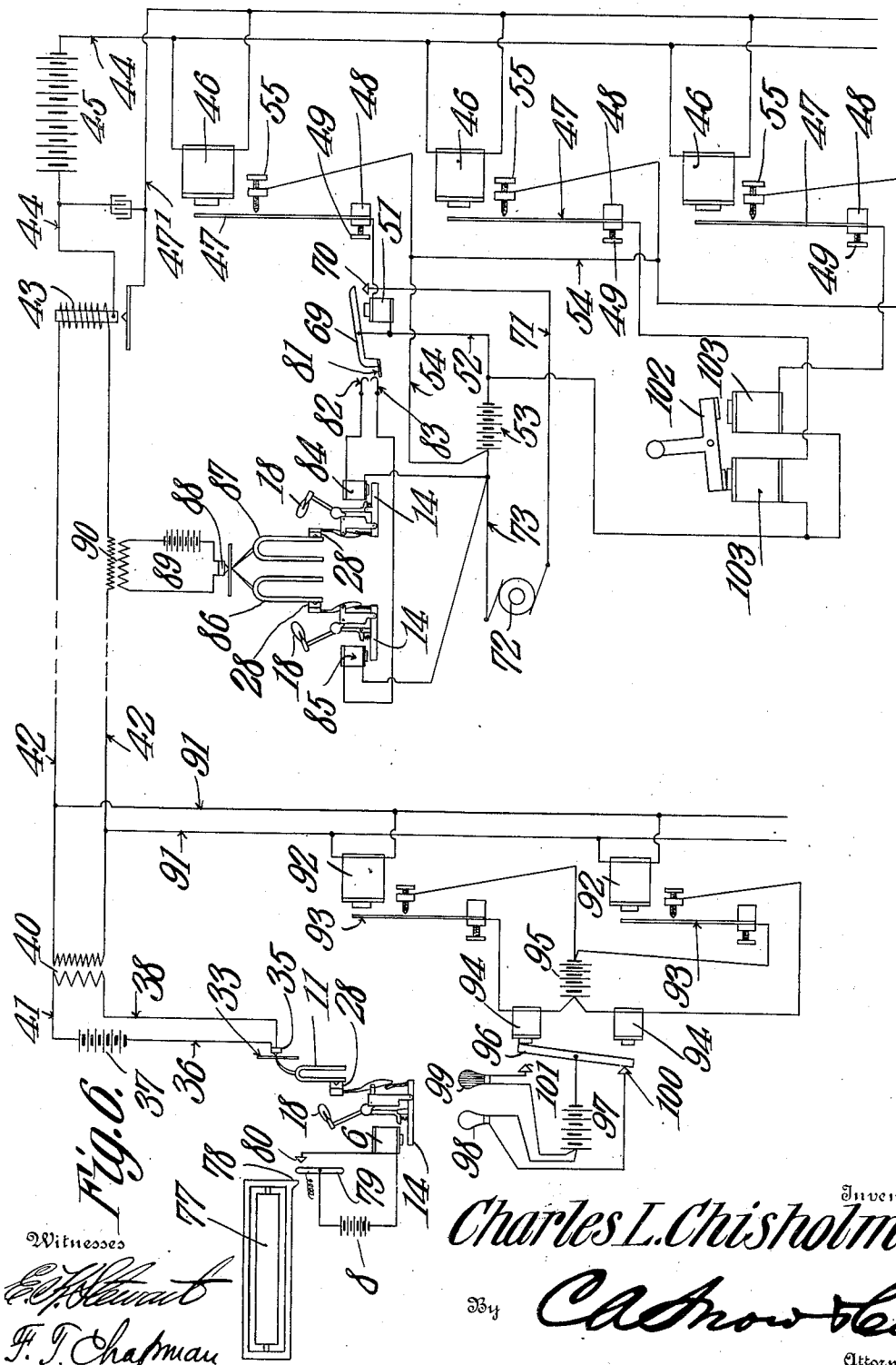
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936,304.

4 SHEETS--SHEET 4.



# UNITED STATES PATENT OFFICE.

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## TRANSMISSION OF ELECTRICAL POWER.

936,304.

Specification of Letters Patent.

Patented Oct. 12, 1909.

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*To all whom it may concern:*

Be it known that I, CHARLES L. CHISHOLM, a subject of the King of England, residing at Marysville, in the Province of New Brunswick, Dominion of Canada, have invented a new and useful Transmission of Electrical Power, of which the following is a specification.

This invention has reference to means for transmitting electric energy to a distance, and its object is to provide means for the selective actuation at a distant point of electrical translating devices, and more especially of a printing or other like mechanism by electro-harmonic influences transmitted over a single line and rendered active at the distant point in receivers tuned to respond each to a particular transmitter.

The present invention is based upon the known quality of a tuning fork or reed to respond readily to impulses having a rate of vibration synchronous with the fundamental of said tuning fork or reed. Since the vibration of a tuning fork is that of a simple harmonic without over-tones, it is possible to relay such vibrations, even though they be of comparatively high frequency, and thus the current sent over the line need only be of sufficient power to actuate a suitable relay, which latter may control a circuit containing a source of electrical energy so that there may be impressed upon the receiving circuit an amount of energy far in excess of that actuating the relay, or at least of sufficient power to operate the receiving instrument.

The present invention has nothing whatsoever to do with the transmission of sound *per se*, but only with the transmission of a train of electric waves of different frequencies so chosen as to be operative for the actuation of receivers, each tuned to a particular frequency but each receiver being tuned to a frequency differing from that of every other receiver.

It is designed in accordance with the present invention to provide at the sending station an appropriate key-board, which may form a part of a typewriter or a linotype machine or of other devices of like character designed to produce imprints or printing characters or other records or recording means of the intelligence to be transmitted to a distance so that a record of such intelligence may be kept at the transmitting sta-

tion. If under some circumstances it is not desirable to keep such record at the sending station, then a key-board separate from the recording machine may be employed. Usually the key-board employed should be of the usual type having the letters of the alphabet, the usual numerals and punctuation marks employed in typewriters, and other like machines.

At the receiving station a machine which may be the counterpart of the recording machine at the sending station or one adapted to work with the key-board of the sending station is installed so that a record of the message transmitted over the line to a distant point is automatically produced, whether that record be in the form of an ordinary typewritten reproduction upon paper or other material or in type lines, as in a linotype, or other forms according to the recording machine employed.

At the transmitting station each key of the key-board is provided with means whereby the active movement of each key will set in motion a corresponding tuning fork or other means of producing a series of vibrations individual to the particular key. The tuning fork or other generator of harmonic vibrations is connected to a microphonic element included in a local circuit such as is usually employed in telephonic transmission excepting that the microphone may be specially designed for carrying heavy currents, and in the microphone circuit there may be included a correspondingly powerful source of current. If the distance over which the impulses are to be transmitted be not too great, then the microphone may be connected directly to line instead of being included in a local circuit. When a local circuit is used, then the potential is raised by a suitable transformer, and the impulses are sent to line in the usual manner. At the receiving station these impulses pass through a suitable relay responsive to any and all of the frequencies employed, and this relay controls another local circuit including a sufficiently powerful source of current and as many electro-magnets as there are receiving units at the receiving station. Each one of the electro-magnets is provided with an armature in the shape of a tuned reed or tuning fork or similar device which will respond to the impulses acting over the line only when such impulses synchronize with the funda-

mental rate of vibration of the particular reed or tuning fork. Each reed controls a local circuit including an electro-magnet, which latter may be so wound as to respond to the impulses set up by the particular reed in such manner as to attract the armature controlling a typewriter key or other working portion of a typewriter or the corresponding mechanism of a linotype machine or whatever other type of receiving instrument is employed.

At the transmitting station there is provided suitable mechanism for setting up in the transmitting tuning fork or reed a limited number only of vibrations and then immediately damping the tuning fork or reed so that the train of impulses sent over the line is of short duration and only sufficiently long to cause the actuation of the receiving mechanism.

The system and the arrangement of construction of the several parts as well as the manner of operation of the invention will be best understood from a consideration of the following detail description taken in connection with the accompanying drawings forming a part of this specification, in which drawings,—

Figure 1 is a diagram illustrating the invention. Fig. 2 is a partial diagrammatic representation of a portion of the transmitting mechanism. Fig. 3 is a view of another portion of the transmitting mechanism. Fig. 4 is a modified form of the structure of Fig. 3. Fig. 5 is a detail, partially diagrammatic, representation of one form of receiving apparatus, and Fig. 6 is a diagram illustrating certain details of the system.

Referring to the drawings, there is shown a key-board 1 which may be taken as indicative of a portion of the key-board of a typewriter or a linotype machine, or of any type of machine whereby letters or characters may be produced upon paper or in the form of cast lines of type or as a single type, or in fact in any manner known in the art.

The key-board 1 may be used without the addition of the mechanism of a typewriter or other instrument unless it be desired to retain at the sending station a record of the matter transmitted to distant points.

In the following description the key-board 1 will simply be referred to as a key-board without reference to the particular instrument in which it may be, with the understanding that this key-board may be used either alone or in connection with any suitable recording instrument of the kinds named or of any other kind suited for the purpose.

The key-board 1 is provided with finger-keys 2 and key-levers 3, which when the key-board is not used in connection with the recording instrument, may be of the form shown at the left hand end of Fig. 1 where

a side view of one of these keys separated from the key-board is shown in order that the circuit connections may be more readily apparent. Connected to each key-lever 3 is a conductor 5 leading to one side of an electro-magnet 6 and the other side of this electro-magnet is connected by a conductor 7 to one side of a battery 8 or other suitable source of electric current. The other side of the battery 8 is connected by a conductor 9 to a terminal 10 in the path of the key-lever 3. The battery 8 is common to all the key-levers 3 and there are as many electro-magnets 6 as there are key-levers and there is also one provided for the spacing bar 4.

Each magnet 6 controls a mechanism for setting a tuning fork 11 in vibration and also for damping the vibration of the tuning fork at a predetermined short period of time after the tuning fork has been set in vibration. There are as many tuning forks 11 as there are electro-magnets 6, and each tuning fork has a rate of vibration of its own different from that of any other one of the tuning forks. The purpose of the tuning fork is to set up simple harmonic vibrations free from over-tones but so far as the present invention is concerned the sound emitted by the tuning fork has no purpose and the tuning fork is utilized simply as a means for setting up sustained mechanical vibrations, the periodicity of which may be accurately determined. It is true that this periodicity may vary somewhat with differences in temperature, but this difficulty can be overcome by maintaining the tuning forks at an approximately constant temperature. But, as will presently appear this need not interfere to any marked extent with the operation of the system although the best results are obtained when the rate of vibration of the transmitting and receiving instruments is maintained in close synchronism. This will be considered when the receiving instruments are described.

In order to set the tuning forks in vibration when desired and to limit the time period during which the vibration is maintained, there is provided a suitable means for striking a sudden blow upon the tuning fork and at a sufficient time thereafter damping the vibrations of the tuning fork so that its active vibrations are limited to a time period of short duration. For this purpose I may employ the mechanism illustrated in Fig. 3. At 12 there is shown what may be taken as a fixed structure, being part of the mechanism which is secured to the framework of the transmitter as a whole. This fixed structure or block 12 has near one end an extension 13 to which is pivoted a lever 14, and this lever carries near one end an armature 15 in operative relation to the magnet 6. At the upper end of the block 12 is a bracket 16 to which is pivoted an arm

17 terminating in a hammer head 18, while close to the pivot point of the arm 17 the latter carries another block 19 in normal engagement with the head 20 of another lever 21 pivoted at its lower end on a bracket 22 rising on the lever 14 between the bracket 13 and the armature 15. The lever 21 has a short angle extension 23 at its pivot end, and between this angle extension 23 and the lever 14 there is confined a spring 24. At the upper end of the block 12 is still another bracket 25 carrying a lever 26 about midway of its length, and this lever at its lower end is in the path of a finger 27 rising from the end of the lever 14 remote from that carrying the armature 15. The lever 26 carries at its upper end a damping block or head 28. The normal position of the arm 17 is that shown in Fig. 3 being there supported by a back stop 29. When the magnet 6 is energized the lever 14 is turned upon its pivot and acting on the lever 26 forces the damping head 28 away from its normal position of contact with one leg of the tuning fork 11. At the same time the movement of the lever 14 is transmitted through the lever 21 to the block 19 on the arm 17, and since the point of engagement of the lever 21 with the said block 19 is at one side of the pivot point of the arm 17, the latter is moved about its pivot in a direction to force the head 18 toward the tuning fork 11. The construction is such and the parts are so timed in operation that the damping head 28 is withdrawn from contact with the tuning fork and the head 18 is forced over against the tuning fork at high velocity and strikes the same a sudden violent blow, and immediately rebounds to the back stop 29. The parts are proportioned to cause the damping head to return to its initial position in contact with the tuning fork a short predetermined definite time after the fork has been set in vibration, even though the actuating force should still be maintained. By the mechanism described or by the use of other mechanism operating in a similar manner there is given to the tuning fork a sudden blow setting the same into vibration, the amplitude of which will be commensurate with the violence of the blow. The hammer head may be made of hard or semi-hard material such as hard rubber or metal or leather, and the damping head may be made of felt or other suitable material or of leather or even of metal. The purpose of the structure is to maintain the tuning forks in the normal damped position and the damper is withdrawn just prior to the blow delivered to the tuning fork and is restored to its normal position of contact after the tuning fork has been permitted to vibrate for the desired short time. The ordinary operation of the keys of the key-board will be found to provide ample time for the

setting up of mechanical vibrations in the respective tuning forks and of course as before explained the several tuning forks have each a characteristic rate of vibration each differing from that of any other one of the tuning forks.

In Fig. 4 is shown a slightly modified form of apparatus for imparting the blow to the tuning fork, and in this case the magnet 6 is omitted and is replaced by a lever 30 connected to the lever 14 by a link 31, so that upon a suitable manipulation of the lever 30 the blow is given to the tuning fork as in the structure shown in Fig. 3.

When the tuning fork structure or other suitable structure for setting up vibrations of different characteristic periodicity is built into or is next adjacent to the key-board or recording means, the structure of Fig. 4 may be employed, in which case the lever 30 is to be taken as indicative of any part of the machine is adapted to transmit motion to the hammer 18 when the corresponding key of the machine is depressed. However, since the tuning fork structures are susceptible to shocks and jars it is advisable, when the apparatus is used in locations where shocks and jars are unavoidable, to locate the key-board and the machine controlled thereby, when such is the case, at any convenient point while the tuning forks and magnets 6 with the intervening mechanism shown in Fig. 3 may be located at any point where it is not at all liable to shocks and jars, so that the deleterious effects of extraneous vibrations may be avoided. This of course means a corresponding number of conductors 5 and 7, but the distance between the key-board and the tuning fork operating means need not be excessive, and so the cost of additional conductors will be practically negligible.

Instead of forming the tuning forks with the regular standard, this may be replaced by a tapering stem 32 bearing upon or connected to the center of a diaphragm 33. A number of tuning forks 11 may thus be connected to a single diaphragm 33, and this is indicated in Fig. 2 where the tuning forks are arranged parallel one to another in progressive series with their stems 32 converging toward the center of the diaphragm 33, and a suitable support 34 is provided for holding the stem ends of the tuning forks in position.

In Fig. 1 but three tuning forks are displayed but it will be understood that as many tuning forks as may be conveniently grouped in contact with one diaphragm will be used.

In operative relation to the diaphragm 33 is a microphonic element 35 which may be of any suitable type and preferably such as will carry a rather heavy current. One side of the microphonic element is connected by

a conductor 36 to one side of a battery 37 or other suitable source of electric current. The other side of the microphonic element is connected by a conductor 38 through a condenser 39 to one side of the primary winding of an induction coil 40, the other side of which winding is connected by a conductor 41 to the other side of the battery 37. The fine wire winding of the induction coil 40 is included in the main line conductors including a relay 43, which may be of a type adapted to respond to any of the frequencies sent over the line. A relay consisting of an ordinary electro-magnet and suitably mounted diaphragm will answer this purpose and so is not illustrated in detail. One conductor 44 of the local relay circuit includes a battery 45 or other source of current, and the other leads to one side of each of a number of electro-magnets 46. The other conductor 47' of the relay circuit leads to the other side of each of the magnets 46.

In operative relation to each magnet 46 is a reed 47 supported at one end in a block 48 in which it may be adjusted and fixed by means of a set-screw 49. The block 48 and set screw 49 is to be taken as indicative of any suitable means for adjusting the length of the reed and so tuning the same, or more broadly it may be taken as indicative of any suitable means for establishing the fundamental rate of vibration of the reed.

For the purposes of this invention, the reeds 47 may be replaced by other tuning forks such as shown at 11 at the transmitting station, or the tuning forks 11 may be replaced by reeds such as shown at 47. Each reed 47 is connected by a conductor 50 to an electro-magnet 51, the other side of which is connected by a conductor 52 to one side of a battery 53 or other source of current common to all of the magnets 51. The other side of the battery is connected by branch conductors 54 to adjustable terminal screws 55 each in the path of a respective reed 47.

Now, assume that one of the keys on the key-port 1 is depressed so that there is a circuit from the battery 8 to one of the magnets 6 established. The corresponding hammer 18 is actuated and the tuning fork 11 is set in vibration by the blow imparted thereto, and this vibration is of a periodicity corresponding to the fundamental rate of vibration of the particular tuning fork. These mechanical vibrations are imparted to the diaphragm 33 and react upon a microphonic element 35 setting up in the primary winding of the coil 40 a series of impulses of a periodicity equal to the fundamental velocity of the tuning fork stroke. Because of the pulsating character of the impulses set up in the local microphonic circuit, these impulses will pass through the

condenser 39 but action of the battery 37 at other times is prevented by the presence of the condenser 39 in the microphone circuit.

Because of the pulsations thus set up in the microphone circuit, there are established upon the main line 42 similar pulsating or alternate currents of a much higher potential capable of transmitting the energy over a long distance.

Since it is the periodicity and not other characteristics of the current which is important in connection with this system, the energy may be transmitted over long distances and will then react through the relay 43 to set up currents of like periodicity in the distant local circuit. The relay 43 is of the make-and-break type so that there are distinct impulses to the magnets 46.

The impulses thus established in the distant local circuit will of course energize all of the magnets 46, but only that reed 47 or other tuned device which is responsive to the particular rate of vibration set up in the distant local circuit will respond to the same and begin to vibrate, which vibration is rapidly augmented so long as the impulses continue. Each terminal 55 may be so adjusted that the vibrations of the reeds 47 must attain a certain amplitude before the tertiary circuit through the corresponding magnet 51 is closed. The reason for this is that should there be any of the reeds 47 tuned an octave above any other one of the reeds 47, the first-named reed will respond to the rate of vibration set up in the distant local circuit though to a far less extent than the rate of vibration which is synchronous with that of the sending tuning fork.

Let it be assumed that the instrument at the receiving end of the system is an ordinary typewriter. Then the type bar 56 may be taken as indicative of all the type bars of the typewriter. These type bars are each connected by a link 57 to one end of a lever 58, the other end of which is pivoted. Near the link end of the lever 58 the latter carries an armature 59 in operation to a corresponding magnet 51 which attracts its armature in opposition to a spring 60 tending to maintain the type bar in its normal pendent position. All the levers 58 engage a common strip 61 by links 62 to the spacing mechanism of a typewriter, which spacing mechanism need not be either shown or described since it may be of the ordinary type.

Another one of the magnets 51 controls another lever 63 also controlling the strip 61 and links 62 of the spacing mechanism, and this lever 63 carries an armature 59 and is controlled by a spring 60 as before. The several magnets 51 actuating the type bars 56 are under the control each of a reed 47 individually tuned in synchronism of the rate of vibration of the corresponding one of

the tuning forks 11 controlled by the respective keys of the key-board 1. For instance, let it be supposed that the key-board key A controls the tuning fork having a fundamental rate of vibration of say 100. Then the reed 47, which controls the type bar carrying the A type of the distant receiving typewriter will be adjusted to a fundamental rate of 100. The other keys of the key-board will be correspondingly provided with tuning forks having each its own characteristic fundamental rate of vibration and the reeds 47 at the distant point are likewise attuned to the corresponding rates of vibration. When a letter is struck upon the key-board 1 the corresponding tuning fork is set in vibration by the hammer blow, and the tuning fork remains in vibration for a sufficient time to send a considerable number of impulses to line before the damping head 28 is again brought into contact with the tuning fork to stop its vibration. The actual time period is of course very short so that it is possible to actuate the key-board as rapidly or nearly as rapidly as is done in the ordinary use of the typewriter. The distant typewriter will of course respond, and being provided with the usual automatic attachments will have its paper carriage fed with relation to the type bars so that the line is imprinted in the usual manner. It is necessary, however, to modify the distant typewriter in order that when the end of a line is reached the carriage will be automatically returned to its initial position and rotated an extent sufficient to present a new surface for the next line.

In Fig. 5 a means is shown whereby the typewriter carriage 64 may be caused to return to its initial position for the beginning of a line automatically when a line has already been imprinted. In this figure the typewriter carriage spring is indicated at 65, the showing being largely diagrammatic, while the ordinary escapement of the typewriter carriage is indicated at 66. At the two ends of the carriage are mounted cam blocks 67 and 68, and in the path of these cam blocks is a lever 69 in the path of one end of which latter there is a terminal contact 70. This end of the lever is also under the control of an electro-magnet 51. The terminal 70 is connected by a conductor 71 to one brush of an electric motor 72, the other brush of which is connected to the battery 53 by a conductor 73, and this battery 53 is also connected by a conductor 74 to the lever 69. The motor 72 is coupled up to a winding drum 75 connected to the typewriter carriage by a flexible strap 76 in opposition to the action of the spring 65.

Suppose, now, that the typewriter carriage has been caused to travel in the usual manner until the end of the line is reached, then the cam 68 is brought into contact with the

lever 69 and moves it about its pivot until contact is made with the terminal 70. There is now a circuit completed from the lever 69 through the conductor 71, motor 72, battery 53 and conductor 74. Under these conditions the motor 72 begins to rotate and by winding the strap 76 upon the drum 75 causes the carriage 64 to be moved to its initial position against the action of the spring 65, thus rewinding the latter. The carriage is now at the beginning of a line ready to be propelled step-by-step under the action of the spring 65, as it is released by the escapement 66.

Though not so shown it is to be understood that the carriage is to be provided with any of the known automatic line spacing devices rendered active when the carriage is returned to its initial position at the beginning of a line. Suppose, however, that it is desirable to return the carriage before the end of a line is reached. Then the magnet 51 controlling the lever 69 is energized selectively through the appropriate key and the circuit to the motor is completed before the carriage had reached the end of the line, so that the motor is rendered active and the carriage is again returned to the beginning of the line, in which position the cam 67 is brought into engagement with the lever 69 in such manner as to break the motor circuit at the terminal 70.

Instead of using a key for the purpose of returning the carriage to its initial position at the beginning of the line, the return of the carriage of the typewriter at the sending station may automatically complete the circuit so as to cause the typewriter carriage at the receiving station to be returned to its normal position. In Fig. 6 the typewriter transmitting station is indicated at 77 by a diagrammatic view of the carriage only. In the path of a lug 78 on the carriage is a switch-lever 79 which, when the carriage is brought back to its initial position is forced over into contact with a circuit terminal 80 connected to an electro-magnet 6 energized by the battery 8, as in Fig. 1, and this electro-magnet through the mechanism best shown in Fig. 3, causes the actuation of a suitable tuning fork 11 by which the impulses are sent to line as in the system described with reference to Fig. 1. By this means the electro-magnet 51 shown in Fig. 5 is actuated in the manner already described and the typewriter carriage 64 at the receiving station is caused to be returned to its initial position in the manner already set forth. The parts 78 and 79 may be so timed that the impulses are sent to line just prior to the return of the carriage 77 to its initial position, thus giving time for the distant carriage to be brought back to its initial position by the time the carriage 77 has also reached the same position.

In Fig. 6 there is shown a means whereby indications are displayed at the sending station when the carriage of the typewriter at the receiving station has reached either limit of its travel, or as is customary in typewriters the indication for the end of the line may be displayed a few spaces in advance of or prior to the carriage reaching that point, the same as the ordinary typewriter bell operates. For this purpose the lever 69 carries a contact finger 81, in the path of which are two circuit terminals 82, 83. The circuit terminal 82 is connected to an electro-magnet 84, and the circuit terminal 83 is connected to an electro-magnet 85. These two magnets 84 and 85 actuate hammers, as shown in Fig. 3, to set suitable tuning forks 86 and 87 in vibration, and these tuning forks in turn act on a microphonic element 88 in a local circuit 89 including the primary coil of an inductorium 90, the secondary coil of which is in one branch of the main line 42. These parts are all located at the receiving station. At the sending station other conductors 91 are branched off from the main line and these conductors have included in multiple arc with them electro-magnets 92 acting on reeds 93 controlling the circuits of other electro-magnets 94 charged from a battery 95 or other suitable source of current. The magnets 94 are in operative relation to the two ends of a switch lever 96 connected to one side of a battery 97, the other side of which is branched to two electric lamps 98 and 99 which are respectively connected to circuit terminals 100 and 101 in the path of the opposite ends of the switch arm 96. It will be understood of course that the lamps are indicative of any type of indicating device which will give a visual or audible signal.

When the carriage 64 of the receiving station reaches a point near the end of the line, say two or three spaces therefrom, then the cam 68 begins to move the lever 69 toward the terminal 70. On the beginning of this movement the finger 81 is brought into engagement with the terminal 82 and completes the circuit through the electro-magnet 84 thus sending impulses to line which will act upon one of the magnets 92 to set its respective reed 93 in vibration and thus energize one of the magnets 94 which will attract the switch lever 96 in a direction to close the circuit at the terminal 101 and thus display the light of the lamp 98, which may be appropriately colored for the purpose. When the carriage at the receiving end has reached a position corresponding to the beginning of a line, then the finger 81 is brought into contact with the terminal 83 and the light of the lamp 98 is displayed, and the globe of this lamp may be of clear or plain glass or appropriately colored for the purpose. Of course other types of visual signals may

be used, or electric or other bells may be employed for the purpose of giving audible signals.

The shifting keys of the transmitting typewriter may control appropriate circuit terminals by means of which the shifting lever 102 at the receiving station typewriter may be controlled through suitable electro-magnets 103 so that the carriage of the receiving typewriter may be shifted from lower to upper case letters the same as the transmitting typewriter.

It will be understood, of course, that such changes as may be necessary to adapt the invention to other types of recording devices where the key-board differs more or less from the ordinary typewriter may be made.

Since as many transmitting tuning forks may be connected to a single microphonic element as may be practicable, and since even if a separate microphonic element were used for each tuning fork, still the impulses having different frequencies can be thrown from the line at one time, or as many thereof as desired, without interference, and all the frequencies will be selectively distributed at the receiving station. It is likewise possible to send impulses from a single transmitting station to several receiving stations or have the impulses of several transmitting stations received at one single receiving station.

The recording side of the receiving station may be, under some circumstances, necessarily located where the parts are subjected to shocks and jars, as for instance when instead of a typewriter the recording mechanism at the receiving station is a lino-type or a monotype machine or some other such recording apparatus, then the receiving reeds or tuning forks, if such be used, might be so affected by the shocks and jars as to be set in vibration and so cause the unintentional actuation of the receiving recording mechanisms. This may all be avoided by locating the receiving reeds or tuning forks at some point where they are relieved from shocks or jars while the less sensitive parts of the receiver may be located at a point quite remote from the sensitive reeds or tuning forks and where subjected to shocks and jars since such conditions will not affect such parts of the receiving structure.

Tuning forks, as before stated, are more or less subject to temperature changes, and their rates of vibration are affected to a greater or less extent by the temperature changes. The best effects and the most sensitive response of a tuning fork or reed to vibrations is at the critical point of synchronism, still a tuning fork or reed may be set in vibration by impulses close to but not in strict synchronism with the critical rate. So, temperature differences which are not too violent after the rates of vibration of the several forks or reeds have been established,

will not prevent the response of the receiving forks or reeds to the vibrations set up by the transmitting forks or reeds. To prevent violent temperature changes the tuning forks and reeds may be housed in a compartment where the temperature is maintained at substantially the same point at all times. While theoretically this precaution would seem to be necessary, still in practice it is found that slight variations on either side of the critical rate of vibration of the tuning fork is not sufficient to prevent the receiving instrument from responding to the desired extent. In practice, it is found that beyond a very few vibrations on each side of said critical point, the effect upon the receiving instruments lessens at a very rapid rate, so that the curve of synchronism has very steep sides and a very narrow peak. For these reasons tuning forks must be chosen with rates of vibration far enough apart so that no receiving instrument will respond to a transmitted set of impulses other than that to which it is tuned. In practice, however, it is found that it is not necessary to choose tuning forks a whole tone apart or even a half tone apart but several forks having different rates of vibration may be chosen within the scope of a single tone without danger of the rate of vibration of any fork being such as to be operative to the next fork pitched higher or lower.

From the foregoing description the scope of the invention has been limited to the transmission of the intelligence to a distance to there actuate mechanism capable of recording such intelligence in alphabetical or like characters. Of course other symbols than alphabetical symbols may be used. It is, however, possible to transmit energy for the actuation of other mechanisms than those described where selectivity is paramount and, therefore, the present invention is not limited to the transmission of electrical energy for the actuation of the particular mechanism described or other similar mechanisms for the recording of intelligence. There are conditions under which it is desirable to transmit power selectively for the operation of electric translating devices of various characters and, therefore, the invention while limited to the selective transmission of power is not to be considered as limited to the particular structures herewith described, but these structures may be varied in different manners so long as the resultant structures embody the principles upon which the invention is based.

What is claimed is:—

1. In a system of electric transmission of power, means for producing upon the line trains of electric impulses of different periodicities in any order at the will of an operator, means for automatically limiting the duration of each train of impulses to a pre-

determined time period irrespective of the will of the operator, and receiving means selectively responsive to the trains of electrical impulses of different periodicities and dependent for proper operation upon the limitation of the time period of duration of the trains of impulses.

2. In a system of electric transmission of power, vibratory elements having characteristically different rates of vibration, mechanical means for setting the said elements in vibration at the will of an operator, means for stilling the vibratory elements after a predetermined time period irrespective of the will of the operator, a charged circuit, means in said circuit responsive to the vibratory elements for setting up in said circuit electric impulses corresponding to the vibrations of the active vibratory elements, a distant charged circuit including electro magnetic means each tuned to respond to a characteristic periodicity, means under the control of the current generated at the transmitting station and sent to line for rendering the distant charged circuit active to actuate the distant receivers each in accordance with its characteristic rate of vibration.

3. In a system of electrical distribution, a vibratory element capable of sustained vibrations when once set in motion, means for imparting vibratory movement to the vibratory elements, means for automatically stilling the vibratory elements at predetermined time periods, an electric circuit, means responsive to the vibratory element for generating electrical impulses in the electric circuit, a distant charged electric circuit, means for setting up therein electrical impulses by and in accordance with the impulses on the line, and electrical translating devices tuned to predetermined frequencies and responsive to such frequencies when set up in the distant circuit.

4. In a system of electrical distribution, a plurality of tuning forks at a transmitting station, means for setting each fork in vibration for a definite predetermined time period, a microphonic element directly actuated by and common to all the tuning forks, an electric circuit controlled by said microphonic element, and distant receiving means each tuned to a characteristically different periodicity and controlled by a characteristic one of the frequencies sent over the line.

5. In a system of electrical distribution, a series of tuning forks, means for independently setting each tuning fork in vibration and for stopping the vibration thereof after a definite predetermined time period, a microphonic element directly actuated by and common to all the tuning forks of the series, means under the control of the microphonic element for throwing upon a line electric im-

pulses corresponding in periodicity to that of each active tuning fork, a distant charged circuit, means under the control of the currents on the line for establishing like periodicities in the distant circuit, and separate means under the control of the distant circuit each tuned to correspond to the characteristic one of the periodicities thrown upon the line.

6. In a system of electrical distribution, transmitting tuning forks, means for setting each tuning fork independently in vibration and for stilling the vibration thereof after an automatically determined time period, means for translating vibratory movements of the tuning forks into electrical impulses upon a transmission line, and means at a distant point controlled by the electrical impulses on the transmission line, and each tuned to respond to a characteristic one only of the periodicities thrown upon the transmission line.

7. In a system of electrical distribution, a number of tuning forks each having a characteristic rate of vibration, means for setting the tuning forks independently into vibration and for stilling the vibration after a predetermined time period, microphonic elements included in a local microphonic circuit and under the control of the tuning forks, a transmission line receiving current inductively from the local microphonic circuit or circuits, a distant charged circuit, means for setting up electric currents in said charged circuit by and in accordance with the currents upon the transmission line, receiving circuits tuned to respond each to a characteristic frequency set up in the distant local circuit, and electrical translating devices in each tuned circuit at the distant station.

8. In a system of electrical transmission of power, a means for setting up currents of different frequencies in the transmission line comprising a number of tuning forks having characteristically different rates of vibration, means for generating electrical impulses by and in accordance with the vibrations set up by the tuning forks, and means for setting the tuning forks in vibration and for stilling such vibrations after an automatically determined time period.

9. A means for transmitting intelligence to a distance comprising a suitable key-board, a vibratory element one for each key of the key-board, means under the control of each key for setting a corresponding vibratory element in motion, and for stilling its motion after a definite predetermined time period irrespective of the key, means for converting the vibratory movements into electrical impulses of like periodicity, a transmission line, electro-mechanical devices at the distant point responsive each to a characteristic one of the periodicities thrown

upon the line, and electro-mechanical devices each under the control of the corresponding circuit at the distant station for producing a character or symbol corresponding to the character or symbol of the respective key of the key-board at the transmitting station.

10. In a system of electrical distribution of power, a group of tuning forks at a transmitting station, means for setting said tuning forks into vibration individually, a single microphonic element mechanically connected to a group of tuning forks for actuation thereby, a charged electric circuit under the control of the microphonic element, and receivers at a distant point each under the control of the electrical impulses set up by the microphonic element and responsive only to a characteristic one of said impulses.

11. In a system of electrical distribution of power, a group of tuning forks each having a characteristic rate of vibration, means for individually setting said tuning forks into vibration and for stilling such vibration after a predetermined time period, a single microphonic element receiving mechanical impulses from any one of the group of tuning forks, a local charged circuit under the control of the microphonic element, a line receiving the electric impulses set up in the local circuit inductively therefrom, a distant charged circuit under the control of the line impulses, and electric circuits including translating devices each controlled by the impulses set up in the distant local circuit and responsive only to a characteristic one of the periodicities caused by the tuning forks.

12. A system of distribution of intelligence to a distance comprising a suitable key-board, electric circuits one for each key of the key-board, electro-magnets included each in one of the circuits, tuning forks each having a characteristic rate of vibration, means under the control of each of the electro-magnets for setting a corresponding one of the tuning forks in vibration and for then stilling the vibration after a predetermined time period, microphonic elements under the control of the tuning forks, local charged microphone circuits, means in said microphone circuits for throwing currents of corresponding periodicity to the rates of vibration of the tuning forks upon a transmission line, a relay at the receiving station, a local charged circuit under the control of the relay, other circuits at the receiving station under the control of the local relay circuit and each responsive to a characteristic one of the periodicities on the line, and means each under the control of one of the several local circuits at the receiving station for operating record-producing means at said receiving station.

13. A system of electrical distribution comprising tuning forks each having a character-

istic individual rate of vibration, means for independently setting the tuning forks into vibration and for automatically stilling such vibration after a definite predetermined time period, means for translating the mechanical vibrations of the tuning forks into electrical variations of corresponding periodicities on a transmission line, tuned reeds at a distant station, electro-magnets controlling said reeds and in turn controlled by the electrical impulses upon the line, and local circuits controlled by the reeds and each controlling a different device.

14. A system of transmission of intelligence comprising a suitable key-board, electrical circuits each controlled by a key of the key-board, tuning forks one for each key of the key-board and each having a characteristically different rate of vibration from the others, means controlled by the electric key circuits for setting the corresponding tuning fork in vibration and for stilling the same after a predetermined time period, a microphone circuit controlled by a number

of the tuning forks, a transmission line receiving impulses inductively from the microphone circuit, a relay at a distant point in the transmission line, a charged circuit at the said distant point controlled by the relay, a number of tuned reeds at the receiving station corresponding in their rates of vibration each to a particular one of the tuning forks, electro-magnets in a distant local circuit each controlling a reed, other charged electric circuits each under the control of a particular reed, and a printing mechanism having its elements each under the control of a reed circuit whereby they may be selectively operated by the key-board at the transmitting station.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

CHARLES L. CHISHOLM.

Witnesses:

F. T. CHAPMAN,  
FRANK S. APPLEMAN.