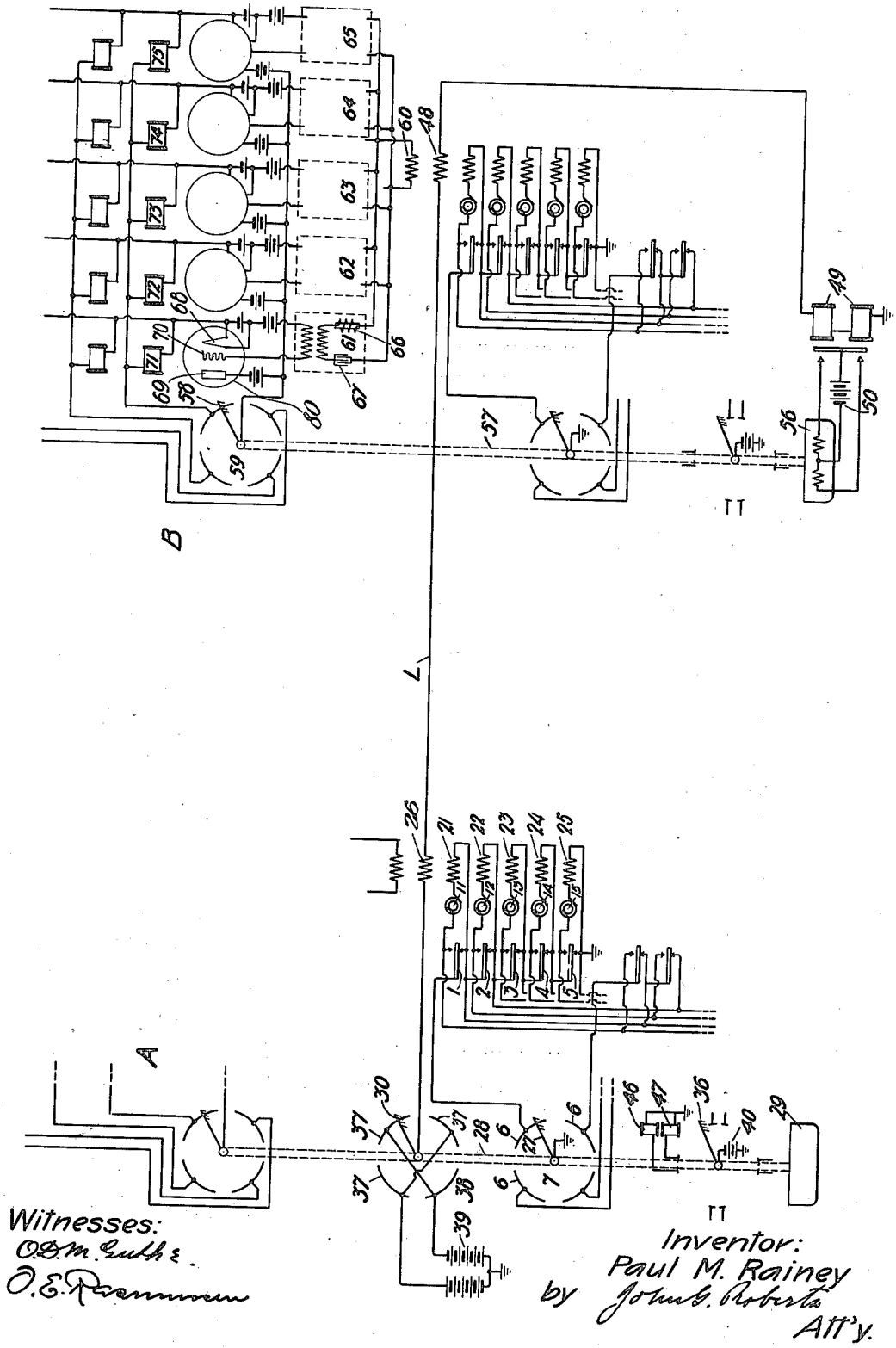
P. M. RAINEY.

TELEGRAPH SYSTEM.

APPLICATION FILED MAY 15, 1915.

1,261,290.

Patented Apr. 2, 1918.



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TELEGRAPH SYSTEM.

1,261,290. Specification of Letters Patent. Patented Apr. 2, 1918.

Application filed May 15, 1915. Serial No. 28,326.

To all whom it may concern:

Be it known that I, PAUL MILLER RAINEY, a citizen of the United States, residing at Glen Ridge, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Telegraph Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to telegraph systems, and its principal object is to provide an improved method and means for the transmission of intelligence by multiplex telegraphy.

In accordance with the general characteristics of the invention, a plurality of transmitters, each capable of selectively providing combinations of electric currents of different frequencies, are successively brought into operative relation with a transmission line to impart thereto successive selected groups of currents to act upon corresponding groups of devices, elements of which are selectively responsive to currents of particular frequencies, whose coöperative actions effect the production of the desired results. More specifically, there are a plurality of transmitters, each capable of providing various combinations of currents of different frequencies, successively brought into association with a transmission line; and an equal number of receivers, likewise successively brought into association with the transmission line and each comprising a plurality of electro-filtering devices responsive to currents of a particular frequency, but substantially unresponsive to currents of different frequencies, current converting systems for changing the filtered currents into corresponding unidirectional currents, and electro-mechanical selecting mechanism controlled by the converted currents to govern the production of the desired functions.

The above and other objects of this invention will be fully set forth in the following description and claims, and will be more readily understood by reference to the accompanying drawing wherein the system of connections is shown diagrammatically.

The transmission line L operatively interconnects stations A and B, which are preferably provided with duplicate sets of transmitting and receiving apparatus. In the drawing, however, the receiving apparatus at station A and the transmitting apparatus at station B are only partially shown, and in the following description it will be assumed that station A is signaling station B, although, as will be hereinafter pointed out, the faculty of transmitting and receiving is interchangeable, and, in fact, may proceed simultaneously at both stations.

Each of the transmitters which is adapted to selectably and simultaneously impart various combinations of currents of different frequencies, comprises a plurality of circuit controlling switches 1, 2, 3, 4 and 5, each consisting of a movable and two fixed contacts. Normally all of the movable contacts are in engagement with the lower fixed contacts and that of switch 1 is connected to one of a plurality of conducting segments 6 of a transmitting distributer 7. Each of the switches 1 to 5 inclusive is associated with a generator 11, 12, 13, 14 and 15, which preferably produce currents of sine wave form, in such a manner that when a switch or combination of switches is closed, one or a number of the corresponding generators 11 to 15 inclusive will be associated with transmission line L through corresponding primary windings 21, 22, 23, 24 and 25 of a transformer having a common secondary winding 26.

There may be as many transmitters, each composed of a group of switches 1 to 5 inclusive, as desired, each transmitter being provided with an individual segment 6 on distributer 7. The system illustrated in the drawing is arranged for four transmitters, all associated with the same generators 11 to 15 inclusive and the same transformer primaries 21 to 25 inclusive, the movable contacts of the switches being connected thereto in multiple as shown. The transmitters associated with the different quadrants of distributer 7 are successively brought into operative relation with transmission line L by a suitable rotatable brush 27.

The controller switches 1 to 5 inclusive of the various transmitters may be selectably actuated by any of the usual means, such, for example, as the well-known keyboard machines wherein character controlling keys are arranged in the form of the ordinary

type-writer keyboard, or automatic devices whose operations are controlled by a perforated paper tape or the like.

Brush 27 is carried upon a shaft 28 which is driven at the desired speed by any suitable source of power, as a motor 29. In addition to brush 27, shaft 28 is adapted to rotate a synchronizer brush 30, a local brush 36, and a brush associated with the receiving apparatus whose operation will be described in connection with station B. Brush 30 is adapted to successively connect line L with quadrant segments 37 of a synchronizing distributer 38. Alternate segments 37 are connected together and to the opposite poles of a divided and grounded source of energy 39, so that as brush 30 is rotated at a constant speed by motor 29, an alternating or periodically varying synchronizing current is transmitted to line L. Local brush 36 is adapted to successively connect a grounded source of energy 40 through a plurality of groups of local electro-magnets 46 and 47. One of these electromagnets of each group, as for example electromagnet 46, may be associated with the transmitter of the corresponding quadrant to assist in the actuation of the controller switches in the well-known manner.

At the receiving station B, the currents impressed upon the transmission line by source 39 of the various transmitters pass through a transformer winding 48, which may be in all respects similar to the transformer winding 26, and a polarized relay 49. The high frequency currents controlled by sources 11 to 15 inclusive do not affect the polarized relay 49, but the comparatively low-frequency periodically varying current supplied by source 39 through distributer 38 causes this relay, through its armature, to alternately connect a source of energy 50 to the different groups of windings of an impulse motor 56 which is preferably of the well-known La Cour type.

Motor 56 drives a shaft 57 which carries a transmitter and local brush similar to and functioning the same as those hereinbefore described for station A, and a receiver brush 58 of a suitable receiving distributer 59. Since, therefore, motor 56 is being driven by the effect of the impulses controlled by distributer 38, shafts 28 and 57 may be made to rotate at the same speed, and if the various brushes at station A and station B are placed substantially in the same phase relation, these brushes will traverse corresponding quadrants of associated distributers simultaneously.

The high frequency currents controlled by generators 11 to 15 inclusive cause the transformer winding 48 to induce in a coöperating secondary winding 60 alternating currents of the same frequency as those supplied over line L. These induced currents act upon a plurality of frequency selecting systems or filters 61, 62, 63, 64 and 65. Each filter comprises an inductance 66 and a capacity 67 which are so proportioned, in accordance with the well-known laws of alternating current phenomena, that each filter is responsive to currents of only a particular frequency, being practically unresponsive to currents of all other frequencies. In the system disclosed, it may be assumed that filter 61 is responsive only to currents of a frequency of that supplied by generator 11, filter 62 to currents of a frequency of that supplied by generator 12, etc.

Each filter 61 to 65 inclusive is associated with a coöperating current converting system 80 which changes the alternating current supplied to it by its corresponding filter into a unidirectional current which may be utilized to actuate an electromagnet forming a part of a selecting mechanism, such, for example, as the printing telegraph receiver disclosed in Patent 1,103,133, patented July 14, 1914. These converting systems may be in the form of the well-known audion arrangement wherein the audion comprises a cathode 68, an anode 69 and an input electrode 70 or any suitable form of rectifier. The unidirectional currents supplied by the converting systems cause the actuation of a plurality of selecting electromagnets 71, 72, 73, 74 and 75, there being one group of these electromagnets and their coöperating mechanical selecting mechanisms for each quadrant of the receiving distributer 59.

In operation, the controller switches 1 to 5 inclusive of one of the transmitters at station A are simultaneously and selectively operated by the proper keyboard or automatic controlling mechanism, and when brush 27 reaches the corresponding quadrant 6 of the transmitting distributer 7, one or more circuits will be completed through generators 11 to 15 inclusive and primary transformer windings 21 to 25 inclusive. A superimposed combination of selecting currents of different frequencies will thereupon traverse line L and transformer winding 48. Currents of corresponding frequencies will be induced in secondary transformer winding 60, and will flow in the local circuits including those filters 61 and 65 inclusive whose inductance and capacity are tuned to respond to the currents of the frequencies supplied. For example, if switch 1 only is operated, filter 61 will respond; if switches 1, 3 and 5 are actuated, filters 61, 63 and 65 will respond, and so on.

Since, as previously described, brush 58 is traveling at the same speed and in phase with brush 27, the filtered and converted currents supplied by the proper filters and converting systems will act upon the corresponding electromagnets 71 to 75 inclusive

of that quadrant of the receiving distributer 59 which corresponds to the coöperating quadrant of transmitting distributer 27, and the selecting mechanism associated with this quadrant is caused to perform its function. An electromagnet similar to 47 and adapted to be connected to grounded source similar to source 40 by local brush carried by shaft 57, may be the release magnet of the selecting mechanism disclosed in the above noted Patent 1,103,133.

In order that there may be intercommunication between stations A and stations B, station A is provided with a receiving distributer, filters, converting systems and selecting mechanisms similar to those already described in connection with station B, while station B is provided with a transmitting distributer and associated transmitters similar to those hereinbefore described for station A. The system may be duplexed in the ordinary manner and if it is desired that each station may simultaneously transmit and receive selecting currents without duplexing, the filters of station A should be tuned to respond to the current supplied by station B and not to those supplied through its own sources 11 to 15 inclusive. Likewise, the filters of station B should be tuned to respond to the currents supplied by sources 11 to 15 inclusive to station A, but not to the current supplied by its own transmitters. In this way, four messages may be simultaneously transmitted in each direction over one transmission line.

The invention claimed is:

1. The method of transmitting intelligence which consists in generating a plurality of alternating current frequencies, combining said frequencies into selective groups, transmitting said groups successively to a receiving station, distributing said transmitted groups of frequencies in order to a plurality of sets of receiving devices and filtering the frequencies of each group to actuate selectively the set of receiving devices corresponding to said group.

2. A telegraph system comprising a plurality of alternating current generators for producing a corresponding plurality of different frequencies, a plurality of sets of permutation switches for combining said frequencies into selective groups, a transmission line, means for successively connecting said sets of switches to said line, a plurality of sets of receiving devices associated with said line, a set of filters interposed between said receiving devices and said line for distributing the frequencies of each group to said receiving devices and distributing means whereby said sets of receiving devices are rendered successively responsive to said filter frequencies.

3. A telegraph system comprising a plurality of transmitters each adapted to selectively provide combinations of currents of different frequencies; a transmission line; means causing the successive association of said transmitters with said line; and a plurality of receivers brought successively into operative relation with said line, said receivers comprising a plurality of frequency selecting systems, and a selecting mechanism.

4. A telegraph system comprising a plurality of transmitters, each adapted to selectively provide combinations of currents of different frequencies, a transmission line, a source of periodically varying current associated therewith, means causing the successive association of said transmitters with said line, a plurality of receivers controlled by the multi-frequency currents, and means controlled by the periodic currents for successively bringing said receivers into operative relation with said line.

5. A telegraph system comprising a plurality of transmitters, each adapted to simultaneously and selectively provide various combinations of currents of different frequencies; a transmission line; a distributer for successively associating said transmitters with said line; a source of periodically varying current associated with said line; a receiver for each transmitter, said receivers consisting of a plurality of frequency selecting systems, current converting systems associated with each said selecting system, and electromechanical selecting mechanism controlled by said converting systems; and a distributer controlled by the periodic current for successively associating said receivers with said line.

6. A telegraph system comprising a plurality of transmitters each adapted to selectively provide combinations of currents of different frequencies, a transmission line, means causing the successive association of said transmitters with said line, a source of synchronizing current, means for impressing said synchronizing current upon the line, means for superimposing said current combinations upon said synchronizing current, a plurality of receivers controlled by said current combinations, and means controlled by the synchronizing current for successively bringing said receivers into operative relation with the said line.

In witness whereof, I hereunto subscribe my name this 13th day of May, A. D., 1915.

PAUL MILLER RAINEY.