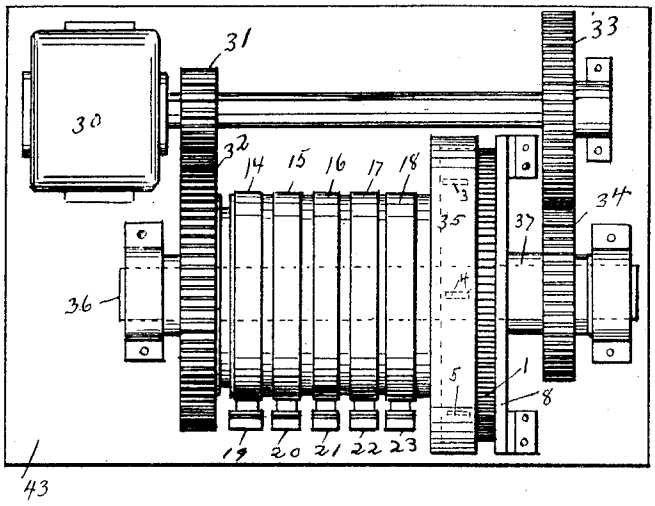
Feb. 26, 1929. 1,703,719

R. B. BRYANT

RADIO COMMUNICATION SYSTEM

Filed March 22, 1927

Fig. 2.



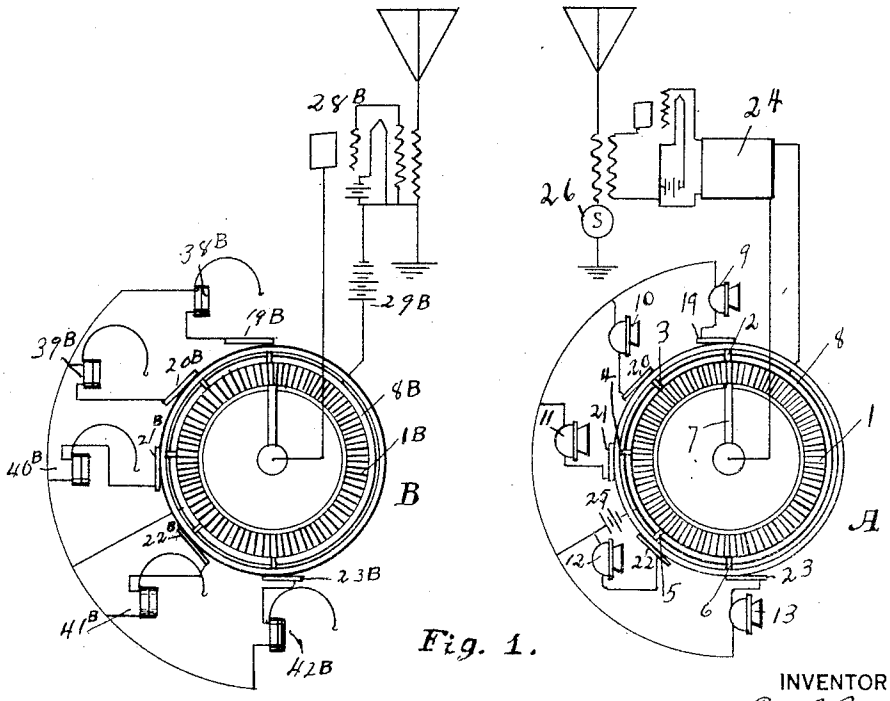


Fig. 1.

INVENTOR

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UNITED STATES PATENT OFFICE.

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RADIO COMMUNICATION SYSTEM.

Application filed March 22, 1927. Serial No. 177,339.

My present invention relates to radio transmission and reception systems and has for its objects the reduction of interference from atmospheric and other causes and the use of a single carrier wave to transmit a number of different messages or programs at the same time.

In carrying out my invention I make use of the usual sending and receiving stations which may employ any of the practical circuits adapted to this purpose, including a means of storing the energy of the audio frequency at the sending end and discharging it into the modulator circuit in a much shorter time and therefore at a much higher frequency. At the receiving end the operation is reversed, the audio current or frequency is received at a much higher frequency and in a much shorter time with relatively long intervals between periods corresponding to the frequency sent out from the sending station, this energy is stored and discharged at a much slower rate lowering the frequency to the corresponding audio frequency at the sending station and filling the intervals between periods. Thus the carrier wave is modulated at the sending station at intervals with a super audio wave and the super audio wave is received in the regular manner at the receiving end and then transformed into an audio wave corresponding to the sending audio wave.

It is evident that in reducing the super audio wave to audibility that the noises that are tuned in with the carrier wave will also have their frequency lowered also and if lowered sufficiently will be below the range of audibility. It is evident also that since the voice or audio wave is impressed on the carrier wave in short periods with relatively long intervals between them that these intervals may be used for other audio currents, thus a number of different messages or programs may be sent on a single carrier wave.

With reference to the drawing Fig. 1 is a simplified diagram showing the method of operation, at the receiving end the sound reproducing medium is represented as telephone receivers, however loud speakers may be used by employing the usual amplifying circuits, Fig. 2 is a practical form of the frequency changer. The frequency changer is the subject of another application by me and it is only intended to claim in this specification the special features which pertain to this invention.

With reference to Fig. 1, the sending station is designated as A and the receiving station as B, similar numbers refer to similar parts in both stations and figures, 1 is a commutator the segments of which are alternate condenser plates upon which the audio frequency brushes 2, 3, 4, 5, 6, and the high speed brush 7, rotate, the opposite condenser plates connect to a common ring 8, shown in Fig. 2, which also forms a support for the commutator which is fixed with the brushes for the audio frequency rotating on the outside and the high speed brush for the super audio frequency connecting with the same segments on the inside of the commutator, transmitters 9, 10, 11, 12, 13 are for five different programs and are connected to their corresponding brushes 2, 3, 4, 5, 6, through the slip rings 14, 15, 16, 17, 18 shown in Fig. 2, and the corresponding slip ring brushes 19, 20, 21, 22, 23. The audio brushes rotate around the commutator 1, at a suitable speed while the super audio brush 7 rotates at a speed in this particular case eight times as fast as the audio brushes. The brushes at both the sending and receiving stations are adjusted to rotate synchronously.

The method of operation is as follows: When the transmitters 9, 10, 11, 12, 13, are receiving sound impulses variable currents flow through their corresponding slip rings to their corresponding audio frequency brushes 2, 3, 4, 5, 6, and as these brushes wipe the successive condenser plates of the condenser commutator 1, separate charges of varying intensity are placed in the successive condenser plates, as the super audio brush 7, rotates eight times as fast as the brushes 2, 3, 4, 5, 6, it will discharge the plates of the condenser commutator 1 eight times as fast as the charges were placed there by the audio brushes 2, 3, 4, 5, 6, and the charges placed by the successive brushes will be discharged in time to prevent overlapping of the audio charges; the super audio brush 7, is connected through the modulator 24, to the ring 8, which connects with the opposite plates of the condenser commutator 1, the transmitters 9, 10, 11, 12, 13, are connected in multiple through a battery or source of current 25, to the ring 8, completing the circuit through their corresponding slip rings and audio brushes to the condenser commutator.

In practice the condenser plates which

form the commutator are very thin so as to get a large number within the commutator circumference thus dividing the audio wave into a large number of separate charges so as to give true reproduction, the brushes 2, 3, 4, 5, 6 and 7 are also made with minimum thickness for this purpose.

In this manner the carrier wave generated by the radio frequency source 26, is modulated by five separate super audio waves of eight times the frequency of the natural audio frequency. At the receiving end the incoming carrier wave is received modulated by the five separate super audio waves, the brush 7^B, is connected to the output of the detector tube 28^B, through the plate battery 29^B, and ring 8^B, and as it rotates it places charges in the condenser commutator 1^B, corresponding to the charges placed by the audio brushes 9, 10, 11, 12, 13, and in the same sequence, the receiving brushes 19^B, 20^B, 21^B, 22^B, 23^B, however are rotating at one eighth the speed of the brush 7^B, and consequently discharge the condensers one eighth as fast or at the same rate in which they were placed in the condenser commutator 1 at the sending station A, thus reproducing the audio wave.

The telephone receivers 38^B, 39^B, 40^B, 41^B, 42^B, are connected to their corresponding slip rings and brushes and the ring 8^B, thus forming local circuits for the discharge of the condenser plates of condenser commutator 1^B.

With reference to Fig. 2, 30, is a synchronous motor geared to rotate the brushes 2, 3, 4, 5, 6, and 7, at the proper speeds by means of the gear wheels 31, 32, and 33, 34, the brush holder ring 37 supports the brushes 2, 3, 4, 5, 6, in proper relation to the commutator condenser 1. The entire brush holder and slip ring assembly is attached to the gear wheel 32, and rotates around a fixed shaft 36; suitable insulating compound forms the support for the slip ring and brush assembly holding the various parts in proper relation and encasing the connecting wires from the slip rings to the brushes.

The gear wheel 34, has a collar 37, attached which supports the brush 7, this gear wheel and brush assembly also rotates around the fixed shaft 36, the ring 8 forms a common terminal for the alternate condenser plates which are not wiped by the brushes, it also forms a support for the condenser commutator. The different parts are supported in proper relation by suitable supports and bearings attached to a common base 43.

The frequency changer as shown in Fig. 2, is adapted to operate from a power system depending on the interconnected transmission lines to keep the sending and receiving stations in synchronous relation by the use of the synchronous motors 30. In the diagram only five transmitters and receivers are shown. However eight could be used at this particular speed ratio of the audio and super audio brushes to make use of the full carrier wave.

I do not desire to limit myself to any particular type of frequency changer since the principle employed may be used with other methods of changing the frequency.

I claim:

1. In a radio communication system, a continuous means of storing the modulating current for a definite period and releasing the stored energy to modulate the carrier wave in a much shorter period said means consisting of a storage element or elements with rotating members for transmitting energy to said elements and faster rotating members for discharging said stored energy periodically, a similar means working in the reverse order for receiving the high speed periods and discharging them at audio frequencies.

2. In a radio communication system, a continuous means of storing and discharging the modulating current while transmitting so as to condense the modulating current for a given period into a much shorter period so as to occupy a much shorter period on the carrier wave, said means consisting of storage elements adapted to store the modulating current as sent and discharge elements adapted to discharge the storage elements periodically all operating while the message is being transmitted and adjusted so that the modulating current will not overlap in the storage elements, a similar receiving means adapted to receive the high speed audio wave and store it sufficiently long to permit it to be discharged at its normal frequency into the audio receiving circuit.

3. In a radio communication system, a means of storing the energy of a number of audio waves in their true forms for brief periods and discharging said periods in much shorter periods on the carrier wave, said means consisting of storage elements for storing the energy, a means of transferring the energy of the audio wave to the storage elements in regular brief periods, a means of discharging said storage elements in shorter periods into the modulating circuit of the sending station, a similar receiving means working oppositely and in synchronous relation to said sending means adapted to receive and store the modulating energy in the same time period in which it was sent and a discharging means for discharging it at the corresponding audio frequencies of the sending station.

4. In a radio communication system, a means of storing the energy of a number of transmitters in their true form for brief regular periods of the same duration, a means of discharging the energy of each of

the said transmitters separately and in some sequence, the period of discharge being of sufficiently short duration to permit all of said separate modulating energies to be impressed on the carrier wave without interference or overlapping, a similar receiving means adapted to receive and store the separate modulating energy in the sequence and time period in which it was sent and to discharge said energies at their normal frequencies into corresponding receiving channels.

5. In a multiplex transmission system, a sending and receiving station each performing definite sending and receiving cycles operating in synchronism, the sending cycle consisting of a means of storing a number of separate energies of separate transmitters for the period of the cycle and a means for discharging all of the said separate transmitting energies in a certain sequence into the transmitting circuit during the period of the cycle, the receiving cycle being the reverse of the sending cycle receiving all of the separate energies in the sequence in which they were sent and discharging them at their normal frequencies into corresponding receiving circuits all in the period of the cycle.

6. In a multiplex communication system, a means of modulating a single carrier wave with a number of separate audio waves consisting of a means of storing the electrical energy of the audio waves in storage elements and discharging the energy of the separate waves in short successive periods forming a cycle of operation which is repeated over and over while transmission is in progress, the time of the discharge periods are such that all of the separate audio waves are impressed on the carrier wave successively or in a certain order without overlapping, similar means at the receiving station or stations operating in the reverse order and in synchronism with the sending station whereby the received audio periods are stored in the same order in which they were sent and discharged in the proper order through different receiving channels in their proper time periods.

7. In a multiplex communication system, a means of storing modulated audio currents in their true form in storage elements as they are produced, a means of discharging said elements periodically at high speeds in a non-interfering sequence or order into the transmitting circuit, the number and length of time period of the discharge of said elements corresponding to the number of transmitters, a corresponding receiving means operating in the reverse order whereby the high speed audio waves are stored in suitable storage elements in the same order and time period of the sending station and discharged at normal speed into separate receiving channels, said means being practically instantaneous, the storing and discharging operation occurring in rapid succession.

8. In a multiplex communication system, storage or recording elements for storing or recording continuously and separately in their true form a number of audio waves from a number of transmitters, a discharging or reproducing means for discharging or reproducing the audio waves in intervals at high speed, the speed and intervals of such duration that the audio waves pass into the transmitting circuit successively without interference and the slow speed waves are discharged or reproduced without overlapping on the storage or recording element, a similar receiving means for storing or recording the high speed audio currents and discharging them at their normal speed into seperate receiving channels.

9. In a multiplex communication system, electrostatic elements for storing the currents of a number of transmitters continuously as produced, a means for discharging said elements into the sending circuit in rapid successive intervals, the time period of said intervals being such that the storing of the transmitter currents does not overlap and all of said elements are discharged into the sending circuit in successive intervals without interference in a single cycle of operation, a corresponding receiving means utilizing electrostatic storage elements to receive and store the high speed transmitter currents in their proper sequence and discharge them continuously at their normal speed into separate receiving circuits.

10. In a radio communication system, a continuous means of storing the modulating current and releasing the stored energy to modulate the carrier wave, a storage element, said storage element having a rotary member for transmitting energy to said element and a faster rotating member for discharging said stored energy periodically, and means operating in the reverse order for receiving the high speed periods and discharging them at audio frequencies.

In testimony whereof I affix my signature.

ROY B. BRYANT.