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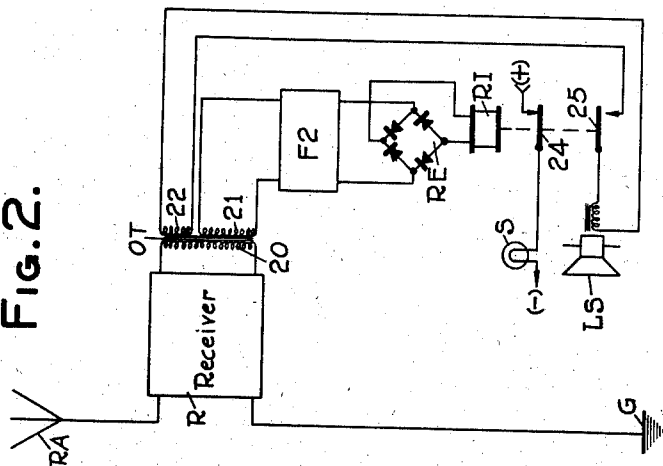
V. C. CHAPPELL

2,280,420

RADIO TELEPHONE SYSTEM

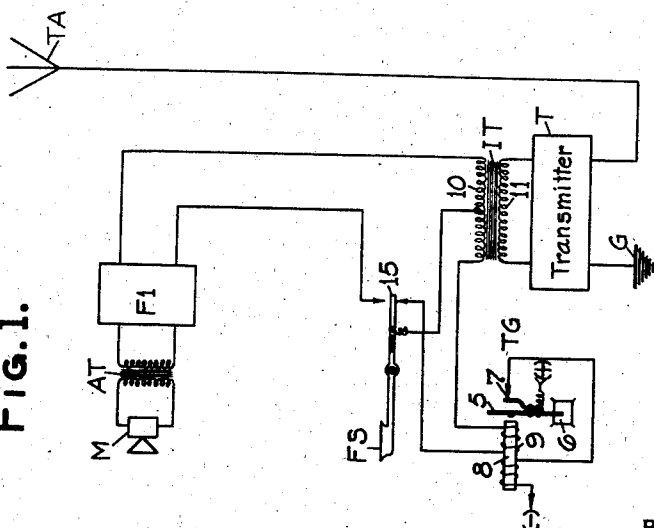
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FIG. 2.



Hump Engineer's Apparatus
on Locomotive

FIG. 1.



Hump Operators Apparatus

INVENTOR
V. C. Chappell,
BY
Neil H. Pector,
ATTORNEY

UNITED STATES PATENT OFFICE

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RADIO TELEPHONE SYSTEM

Vere C. Chappell, Greece, N. Y., assignor to General Railway Signal Company, Rochester, N. Y.

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8 Claims. (Cl. 250—6)

This invention relates to a radio telephone system, and more particularly to means for continuously indicating to the man at the receiving end that the apparatus is in working condition.

In a hump yard train classification system, such as disclosed in the prior patent to N. C. L. Brown, No. 2,045,695, granted June 30, 1936, it is customary for the hump operator with an assistant to uncouple the cars and to allow them to run down the hump either singly or in groups, called cuts, and it is necessary for him to be able to signal to the engineer to push up his train if and when required. This signalling is preferably carried out by a radio telephone, the transmitter of which is located on the ground near the top of the hump and the receiver of which is located in the locomotive cab of the locomotive which pushes the cars to the top of the hump. It is sometimes necessary for the hump operator to give the engineer instructions, such, for instance, as "push up your train at a speed of three miles per hour" which instructions are to remain effective until cancelled. If such an instruction is given to the engineer and if thereafter the hump operator tries to cancel such instruction it is important that the telephone communicating system be in working order and if not the engineer, who received the important instructions, be informed that it is not in working order.

In accordance with the present invention it is proposed to provide a signal lamp S in the locomotive cab which is controlled by the radio telephone communication system so as to be illuminated at all times except when the hump operator is speaking into his telephone transmitter, this being based on the assumption that the system is in working order. With such a construction the engineer will under all conditions, except when the apparatus is out of order, either receive a visual signal by having the signal lamp S illuminated or will receive an audible signal by receiving voice information over the loud speaker also located in the cab. If, however, the apparatus is out of order the signal lamp S will be dark and the loud speaker LS will be silent. In the latter case the engineer will immediately take the necessary steps to avoid improper operation of his locomotive as, for instance, by bringing his locomotive to a stop until the trouble has been corrected.

More specifically it is proposed to transmit a definite tone over the radio telephone communication system at all times except when the hump

operator is speaking into the transmitter, and to employ electric current of this tone at the receiving end to energize a tone responsive or tuned relay, which relay when energized closes a circuit for the signal lamp and which if deenergized closes a circuit for the loud speaker.

Other objects, purposes and characteristic features of the present invention will appear as the description progresses and is in part obvious from the accompanying drawing, in which:

Fig. 1 shows the telephone transmitting and associated apparatus; and

Fig. 2 shows the telephone receiving and associated apparatus.

Referring to Fig. 1 the letter M designates the usual microphone which is connected to the primary winding of an audio transformer AT, which transformer has its secondary winding connected to a filter F1. The reference character TG designates a tone generator which may be of any suitable construction and which is capable of generating an alternating current of approximately 250 cycles per second. In the particular construction shown this tone generator TG comprises a tuned reed 5 supported by a base 6 and having a normally closed contact 7. This reed 5 is preferably constructed of soft iron and may be attracted in one direction by an electro-magnet 8. This electro-magnet is preferably provided with a secondary coil 9 having the necessary turns to produce the desired voltage of 250 cycles per second to transmit the desired tone to the locomotive receiving apparatus. The transmitting apparatus also includes an in-put transformer IT having a primary winding 10 and a secondary winding 11. This transmitting apparatus also includes a suitable foot operated switch FS which is normally in a position to disconnect the microphone M and connect the tone generator TG to the primary winding 10 of the in-put transformer IT, but which will upon being depressed disconnect the tone generator from the in-put transformer IT and instead connect the filter F1 to the primary winding of this in-put transformer IT. In other words, the in-put transformer IT is normally energized by current of approximately 250 cycles per second, but upon the depression of the foot operated switch FS by the operator and upon his speaking into the microphone M it will be energized by alternating current of audio voice frequency. The secondary winding 11 of this in-put transformer IT is connected to the transmitter which in turn is connected between the transmitting antenna TA and ground.

This transmitter T includes the necessary apparatus and sources of current to generate a non-damped radio frequency current of say 39,000 kilocycles per second which is modulated either by the audio current originating at the microphone M or by the tone current originating at the tone generator TG dependent upon the position assumed by the foot switch FS.

Referring to Fig. 2 of the drawing, the receiver R is connected between the receiving antenna RA and ground and its out-put side is connected to the primary winding 20 of an out-put transformer OT. This out-put transformer is provided with two secondary windings 21 and 22, the secondary winding 21 of which is connected to a filter F2, which filter has its out-put leads connected to a rectifier RE which in turn has its direct current out-put wires connected to a relay RI. The filter F2 is rather sharply tuned to 250 cycle current so that the indicating relay RI will be energized only if current of this frequency is delivered by the out-put transformer OT, namely, only if current of the tone frequency of 250 cycles per second is received by the locomotive apparatus. This filter is of the type which offers a high impedance to all other and foreign frequencies than 250 cycles per second, such as might occur during circuit failures, such as an open grid circuit.

The indicating relay RI is provided with front contacts 24 and back contacts 25, these front contacts 24 being included in series with a source of current, conventionally shown by the symbols (+) and (-), and the indicating lamp S, whereas the back contacts 25 are included in series with the loud speaker and the secondary winding 22 of the out-put transformer OT. It is readily understood that if the tone current is of a frequency which makes the tone either inaudible or non-repulsive to the ear that the back contact 25 of relay RI may be omitted. It may be pointed out that the receiver R includes the necessary amplifying and detecting apparatus so that the out-put transformer OT is supplied with currents of the same character as are used to modulate the high frequency current at the transmitting station shown in Fig. 1.

Operation

Under normal conditions the foot switch FS is in its normal raised position so that it will maintain its back contact 15 closed. This back contact 15 is included in a circuit including the secondary winding 9 of the tone generator TG and one portion of the primary winding 10 of the in-put transformer IT. Under this condition the vibration of the reed and its intermittent breaking of the interrupter contact 7 will cause pulsating current of substantially 250 pulses per second to flow in the primary winding of the electro-magnet 8. This pulsating current will in turn induce an alternating current of 250 cycles per second in the secondary winding 9 of the electro-magnet 8 which alternating current is applied to the primary winding of the in-put transformer IT. The in-put transformer in turn through the medium of its secondary winding 11 allows this tone current to modulate the radio frequency current generated by the transmitter, so that the radio frequency waves emitted by the antenna TA will normally have superimposed thereon the alternating current tone of 250 cycles per second.

At the receiving end the radio frequency current received by the antenna RA is amplified

and rectified by the receiver R, so that in turn the audio component of this current is applied to the out-put transformer OT which in turn by its secondary winding 21 applies this current to the filter F2 which if the audio tone is a 250 cycle per second tone applies this current to the full-wave rectifier RE. This flow of tone current is permitted by the filter F2, this filter F2 rejecting currents of all other frequencies except those within a narrow band at and near 250 cycles per second. This tone current will, of course, energize the indicating relay RI and illuminate the indicating lamp S. The hump engineer is therefore informed that the apparatus in his cab and at the hump is in good working condition. As soon as this indicating lamp S is extinguished the engineer is informed that either the apparatus is out of order or the hump operator is going to give him instructions. If he hears no sounds from the loud speaker LS he knows that the apparatus is out of order and he will immediately act according to his best judgment and will disregard any standing order that may have been given to him over the telephone communicating apparatus earlier.

If now the hump operator wishes to speak to the hump engineer he will first depress his foot switch FS. This will, for reasons already explained, cause deenergization of the indicating relay RI and cause extinguishment of the indicating lamp S. Such operation of the foot switch FS will also connect his microphone M with the transmitter T. The hump operator may now speak to the engineer and in so doing the audio current generated in the microphone M, which is permitted to flow through the filter F1, the filter F1 rejecting all frequencies below 500 cycles per second to prevent the transmission of other than voice sounds, flows to the right-hand portion of the primary winding 10 of the in-put transformer IT and in turn induces a similar current in the secondary winding 11 thereof. This audio current then modulates the radio frequency current generated in the transmitter T and in turn causes the antenna current of high frequency to be modulated in conformity with the voice current generated by the microphone M. At the receiving end of the system this radio frequency current is in turn amplified and rectified by the receiver R and the audio component thereof is in turn applied through the medium of the out-put transformer OT to the loud speaker LS, since the back contact 25 of the indicating relay RI is now closed.

Although the tone generator TG has been shown and described as an alternating current generator of the interrupter type, it should be understood that any other form of tone generator may be employed. There are many audio-oscillators employing well known electron tubes and circuits available on the market, and any one of these may be employed instead of the tone generator illustrated and described. In this connection, it may be pointed out that for telephone work, a tone generator of the electronic tube type creates less undesirable noises and stray magnetic fields, and for this reason an electron tube type tone generator is preferable. It should also be understood that the tone transmitted over the telephone communication system from this tone generator TG need not be a continuous tone, but may be an intermittent tone. Not only would this save a considerable amount of energy but the intermittent tone may constitute a code to give information of a par-

ticular character. That is, suitable decoding apparatus might be employed to give several distinctive indications instead of only the single indication as given by the lamp S illustrated. In this connection, it should be understood that if the tone is intermittent, the relay RI would have to be sufficiently slow dropping so as not to drop between tone pulses.

Although the apparatus has been illustrated as being capable of transmitting voice only from the hump operator to the hump engineer, it should be understood that a transmitter may be employed in the locomotive cab and a receiver be employed in the hump operator's location through the medium of the same antennae TA and RA. In this latter case, the engineer would also be provided with a foot switch FS so that he could normally have his microphone disconnected. The radio frequency employed may be any suitable frequency which would be approved by the Federal Communication Commission, and although a frequency of 39,000 kilocycles has been mentioned, other frequencies may be employed if desired. If two-way communication is provided for two different carrier current frequencies are preferably employed one for each direction of communication.

Apparatus has thus been proposed in which the receiving apparatus is of a construction such that either an indicating lamp S is illuminated or a loud speaker LS is active unless the apparatus is out of order, so that the attendant at the locomotive cab end of this apparatus may take the necessary action when such an out-of-order signal is given.

Having thus shown and described only one rather specific embodiment of the present invention it should be understood that the specific embodiment illustrated has been illustrated for the purpose of disclosing the nature of the invention and its principles of operation, rather than to illustrate the specific construction preferably employed in practicing the invention, and it should be understood that various changes, modifications, and additions may be made to adapt the invention to the particular problem encountered in practicing the invention, except as demanded by the scope of the following claims.

What is claimed as new is:

1. In a radio telephone system for transmitting from a central station to a movable vehicle voice messages concerning how the vehicle should be manipulated, a radio transmitter, a tone generator and a microphone at the central station, switching means normally connecting said tone generator to said transmitter and operable by an operator at the central station to operatively connect said microphone instead of said tone generator to the transmitter and thereby enable the operator to send voice messages to the vehicle; and a receiving station on the vehicle including a radio receiver, a loud speaker, a visual signal device and relay means operatively connected to said receiver, said relay means being responsive to the tone frequency transmitted to said receiver and acting to render said signal device active only while said tone frequency is being received, whereby a person on the vehicle may detect from the failure to receive either the tone frequency as indicated by said signal device or a voice message from the loud speaker that the system may be out of order.

2. In a radio telephone system for transmitting from a central station to a movable vehicle voice messages relating to the manipulation of that

vehicle, transmitting equipment at the central station including a transmitter of a radio carrier frequency, a tone generator and a microphone, means at said central station normally rendering said tone generator effective to modulate said carrier frequency with a tone frequency and operable by an operator to disconnect said tone generator and render said microphone effective to modulate said carrier frequency with voice messages, a receiving station on a vehicle including a receiver, a loud speaker, and a signal device, relay means connected to said receiver and responsive only to the modulation of the carrier frequency by said tone frequency for rendering said signal device effective only while said tone frequency is being transmitted from the central station, whereby the operation of said signal device in conjunction with the loud speaker serves to inform a person on the vehicle that the system may not be in working order if neither said tone frequency nor a voice message is being received.

3. In a radio telephone system for transmitting from a central station to a movable vehicle voice message instructions concerning how the vehicle shall until contrary instructions are transmitted be manipulated, a radio transmitter, a tone generator for generating intermittent pulses of tone frequency current and a microphone at the central station, switching means at said central station normally connecting said tone generator to said transmitter and operable by an operator at the central station to operatively connect said microphone instead of said tone generator to the transmitter and thereby enable the operator to send voice message instructions to the vehicle; and a receiving station on said vehicle including a radio receiver, a loud speaker, a visual signal device and relay means operatively connected to said receiver, said relay means being responsive to the tone frequency current transmitted to said receiver and acting to render said signal device active continuously in spite of the intermittent nature of said tone current only while said tone current is being received, whereby a person on the vehicle may detect by receiving neither the tone frequency current as indicated by said signal device nor a voice message by the sounding of the loud speaker that the system may be out of order.

4. In a radio telephone system for transmitting from a central station to a movable vehicle voice message instructions relating to the manipulation of that vehicle until contrary instructions are transmitted, transmitting equipment at the central station including means for generating a radio carrier frequency, a tone generator and a microphone, means at said central station normally rendering said tone generator effective to modulate said carrier frequency with a tone frequency and operable to disconnect said tone generator and render said microphone effective to modulate said carrier frequency with voice messages, a receiving station on a vehicle including a receiver, a loud speaker, and a signal device, relay means connected to said receiver and responsive only to the carrier frequency when modulated by said tone frequency for rendering said signal device effective only while said tone frequency is being transmitted from the central station, whereby the operation of said signal device in conjunction with the loud speaker serves to inform a person on the vehicle that the system may not be in working order if neither said

tone frequency nor a voice message is being received.

5. In a radio telephone, the combination with a central station provided with transmitting apparatus for transmitting instructions to a distant railway vehicle how that vehicle shall be manipulated and including a tone generator for generating tone current, a microphone for generating voice current and a double-throw switch for at all times when said transmitting station is in service assuming either a position to transmit voice current or a position to transmit tone current; and receiving apparatus on a railway vehicle including a receiver, a visual signal, a loud speaker, and a filter for passing only said tone current; and relay means on said vehicle controlled by tone current passed by said filter and derived from said receiver to render said visual signal active only when tone current is received and for connecting said loud speaker to said receiver when no tone current is received; whereby the operator of said railway vehicle upon the absence of both a visual indication and voice sounds from said loud speaker is informed that said radiophone may be out of order.

6. A radio telephone system for transmitting instructions effective until cancelled from a central station to the operator of a railway vehicle comprising; a transmitter at said central station for generating alternating current of radio frequency which may be modulated in accordance with audio currents applied thereto; a receiver on said railway vehicle for amplifying received radio frequency currents and detecting the modulations thereof; a microphone, a tone generator and a switch at said central station, said switch at all times when said transmitter is in service connecting either said tone generator or said microphone but not both to said transmitter; a filter, a visual signal and a loud speaker associated with said receiver; and relay means controlled through said filter and responsive to the reception of tone current only for connecting said visual signal to a source of current to render it active; whereby if neither said visual signal is active nor sounds are emitted by said loud speaker said operator will consider said instructions to have been cancelled on the assumption that the radio telephone system is out of order.

7. A radio telephone system for transmitting instructions effective until cancelled from a transmitting station to the operator of a railway vehicle comprising; a transmitter at said transmit-

ting station for generating alternating current of radio frequency modulated in accordance with audio sounds applied thereto; a microphone at said transmitting station; a receiver for amplifying received modulated radio frequency currents and detecting the modulations thereof and a loud speaker on such railway vehicle and at times connected to said receiver; and checking apparatus for checking the operativeness of said radio telephone system including a tone generator and a switching means at said transmitting station, said switching means at all times connecting either said microphone or said tone generator to said transmitter to transmit either voice current or tone current in close succession and substantially without intermission; and a filter at said receiving station for passing only current of a frequency such as generated by said tone generator, a visual signal associated with said receiver; and relay means on said railway vehicle controlled through said filter and energized in response to the reception of current of tone frequency only received by said receiver, said relay means when in its actuated position connecting said visual signal to a source of current to render it active to manifest upon its deenergization that said radio telephone system may not be in proper working condition.

8. In a radio telephone system for transmitting from a central station to a movable vehicle voice messages concerning how the vehicle should be manipulated; a radio transmitter, a tone generator for generating intermittent pulses of tone frequency current and a microphone at the central station, switching means normally connecting said tone generator to said transmitter and operable by an operator at the central station to operatively connect said microphone instead of said tone generator to the transmitter and thereby enable the operator to send voice messages to the vehicle; and a receiving station on the vehicle including a radio receiver, a loud speaker, a visual signal device and relay means operatively connected to said receiver, said relay means being responsive to the tone frequency transmitted to said receiver and acting to render said signal device active only while said tone frequency is being received, whereby a person on the vehicle may detect from the failure to receive either the tone frequency as indicated by said signal device or a voice message from the loud speaker that the system may be out of order.

VERE C. CHAPPELL.