

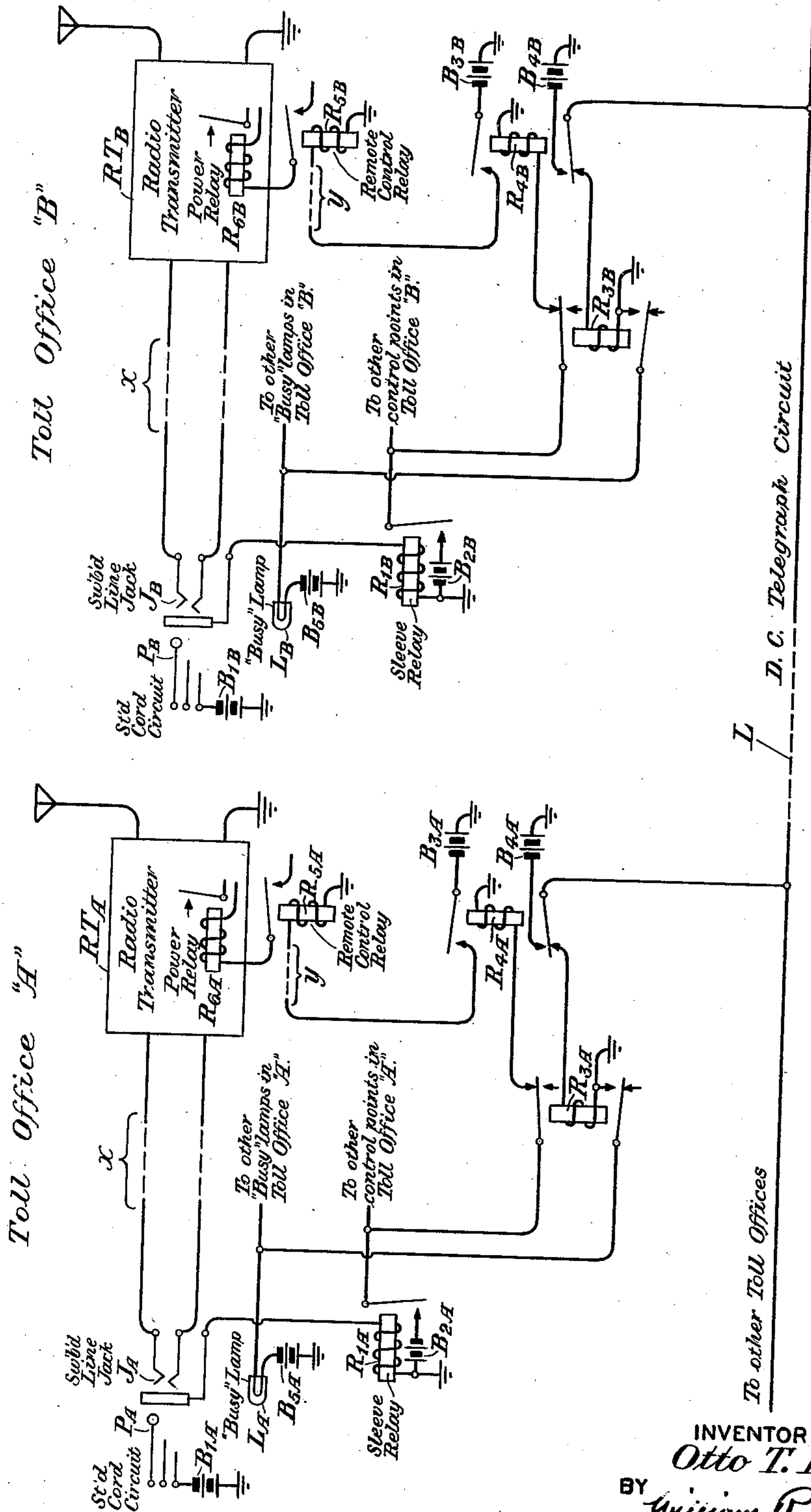
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RADIO CONTROL SYSTEM

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RADIO CONTROL SYSTEM

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This invention relates to electrical signaling systems and more particularly to radio transmitting systems. Still more particularly this invention relates to arrangements for interconnecting radio transmitters operating on the same frequency so that only one of the radio transmitters will be transmitting signals at a time.

In providing radio telephone service it is often desirable to have two or more radio transmitters share a common radio frequency. One example of this is radio telephone service to river boats in which several shore stations are provided along the river to insure complete coverage throughout its length. Each of these, complete with radio transmitter radio receivers and a control terminal, is operated from a toll switchboard in the area served.

In order to avoid mutual interference between the several transmitters it is necessary to have them share time so that no two transmitters will be in operation simultaneously. This, of course, requires very careful supervision to avoid overlapping operation. The arrangement commonly used at present is to have the radio operator monitor for a time to make sure that the channel is clear before putting a transmitter into operation. This method is obviously slow and is not always dependable.

This problem appears to be common to all "party line" or "forked" services operating on a single or common frequency. In the case of ship transmitters and other mobile units sharing a common frequency, there is, at present, no better method of preventing simultaneous operation and interference than the monitoring method above referred to. However, in the case of a plurality of land stations, it is possible, by employing the principles of this invention, which will be described hereinafter, to arrange for interlocking the various transmitter control circuits to insure the avoidance of simultaneous and overlapping operation by two or more transmitters.

It is one of the objects of this invention to provide an arrangement for interlocking two or more circuits associated with various radio transmitters to prevent their operation at the same time. Thus, this invention will provide a scheme for interlocking the circuits associated with two or more radio transmitters to permit their operation one at a time.

This invention will be better understood from the detailed description hereinafter following when read in connection with the accompanying drawing showing one embodiment of the invention merely for the purpose of illustration.

Referring to the drawing, the reference characters RTA and RTB designate two of a plurality of radio transmitters of well-known construction both of which may be adjusted to transmit signals modulated upon carrier waves of identical frequency. The input circuits of the radio transmitter RTA may be connected over a telephone designated X to a jack JA and a plug PA as is well understood in the art. Similarly, the radio transmitter RTB may be connected over a similar telephone line to a jack JB and plug PB. At toll office A there may be a plurality of jacks similar to the one designated JA and in multiple with it, in accordance with the well-known multiple jack switchboard arrangement. There may also be other positions in the office such as the test position of the technical attendant which would have access to the telephone line to the radio transmitter through keys or switches (not shown) instead of a plug and jack connection as shown. In reading the detailed description which follows it should be understood that where keys are used for switching, a suitable spring combination in the key, of well-known type, may be used to perform the function of the sleeve relay in the control circuit.

The apparatus at toll office A will now be described and it will be understood that the description thereof applies also to an apparatus located at the toll office B and at other toll offices (not shown).

The sleeve of the jack JA may be connected to the winding of a sleeve relay R1A, the current for which may be supplied by a battery B1A which is connected to the sleeve terminal of the plug PA. This relay is normally unoperated. But when it is operated, a battery B2A may supply current over the armature and make-contact of the sleeve relay R1A and over the upper armature and back contact of a relay designated R3A to the winding of a relay R4A. However, the relay R4A is normally unoperated. But, when it is operated by the current supplied by battery B2A, a battery B3A will supply current over the upper armature and make-contact of the relay R4A and over a circuit γ to the winding of a remote control relay R5A. When relay R5A is operated, it will complete the circuit of a power relay R6A which controls the radio transmitter RTA. Hence the radio transmitter RTA will then transmit signals through space, these signals being modulated on a carrier wave peculiar to the radio transmitter RTA. The manner in which the circuit prevents the operation of the two radio transmitters RTA and RTB at the same time will

be described hereinafter. But it is noted that the apparatus at both toll offices A and B are in the condition shown in the drawing when the two radio transmitters RT_A and RT_B are in an idle condition.

Now, suppose the operator at the toll office A wishes to transmit a call to a station at some remote point which may be located on one of the river boats. The operator will then merely pick up one of the plugs such as P_A over which the signals will be supplied and plug it into a jack such as J_A associated with the radio transmitter RT_A which is intended to supply the radio wave upon which the signals will be modulated. Immediately after the plug P_A engages the jack J_A, the sleeve relay R_{1A} will be operated by current supplied by battery B_{1A}. The operation of the relay R_{1A} will cause the operation of the relay R_{4A}, current for which is supplied by battery B_{2A} over the circuit including the armature and make contact of the relay R_{1A} and the upper armature and back contact of the relay R_{3A}. Immediately after the relay R_{4A} operates, the remote control relay R_{5A} will be operated, current for which is supplied by battery B_{3A} over the armature and make contact of the relay R_{4A}. And the remote control relay R_{5A} will in turn operate the power relay R_{6A} which in turn will cause the radio transmitter to go "on the air" and transmit the signals supplied thereto from the source of signals.

The operation of the relay R_{4A} will cause the battery B_{4A} to supply current over a line L which may be a D. C. telegraph circuit as indicated in the drawing, this line extending to all other toll offices which are connected to the various radio transmitters having the same frequency assignment as the transmitter RT_A of the toll office A. This current will cause the operation of the relay R_{3B} at the toll office B, the current from battery B_{1A}, flowing over the line L and over the lower armature and back contact of the relay R_{4B} and through the winding of the relay R_{3B}. The relay R_{3B} will become operated and remain operated as long as the plug P_A is in engagement with the jack J_A at the toll office A. Relays similar to relay R_{3B} will, of course, be operated at the other toll offices which are not specifically illustrated in the drawing.

The operation of the relay R_{3B} will cause the operation of the busy lamp L_B, current for which is supplied by battery B_{5B}, the circuit for lamp L_B being completed over the lower armature and make contact of the relay R_{3B}. As soon as lamp L_B lights up, it will indicate to the operator at the toll office B that the radio circuit is already in use elsewhere and that she may not use it.

The operation of the relay R_{3B} will also open up the local circuit between the sleeve relay R_{1B} and relay R_{4B}. This is because the circuit which supplies current from battery B_{2B} to the winding of relay R_{4B} is opened at the upper armature and back contact of relay R_{3B} at all times when the latter relay is operated. Thus, by inserting plug P_B into the jack J_B at the associated switchboard, the radio transmitter RT_B will remain "off the air." This is an important feature of this invention. Were the operator at the toll office B to disregard the busy signal indicated by the lighted lamp L_B and attempt to use the radio circuit she would be unable to do so.

It will be observed that the relay R_{4B}, when unoperated, prevents the battery B_{3B} from transmitting current to the winding of the remote control relay R_{5B} over the circuit which includes the

upper armature and make contact of relay R_{4B} and the circuit *y*. When the relay R_{5B} is unoperated, the power relay R_{6B} will also be unoperated and, hence, the radio transmitter RT_B will remain "off the air." It will thus be obvious that the transmitter RT_B and all other transmitters operating on the same frequency, which are connected to the line L, will remain "off the air" as long as the transmitter RT_A is "on the air."

When the call transmitted by the transmitter RT_A of toll office A is completed, the operator merely takes down the connection by removing the plug P_A from jack J_A, thus releasing relay R_{1A} which then removes battery from the line L and allows relay R_{3B} as well as all similar relays at other offices to fall back to the condition indicated in the drawing. All of the busy lamps such as L_B will be extinguished. Hence, any one of the various operators may thereafter take up the circuit in order to transmit signals via the radio transmitter controlled by the local operator without interference from any of the other transmitters operating on the same carrier frequency.

It will be clear that the arrangement illustrated in the drawing prevents the simultaneous operation of two or more radio transmitters sharing a common or single frequency. At the same time, the arrangement provides, through its busy lamps and the circuits connected thereto, means for rapidly notifying all of the operators associated with the system when any one of the several transmitters is in use.

The arrangement illustrated in the drawing obviates the different types of interference and crosstalk usually occurring when there is simultaneous operation of two or more transmitters sharing a common frequency. Two transmitters designed to transmit current of the same frequency generally do not emit exactly the same frequency and hence when both transmitters are "on the air," the receiving circuit will register an undesirable effect. This undesirable effect results from beating the waves emitted by two transmitters having somewhat different frequencies. The magnitude of the undesirable current received will depend upon the location of the receiving set. However, were it possible to obtain two exactly equal frequencies from two radio transmitters, the beating effect might be avoided but there would nevertheless be a certain amount of crosstalk. All this will be apparent to those skilled in the art.

While this invention has been illustrated and described in reference to the control of radio transmitters sharing a common frequency, it is equally applicable to other arrangements. The invention is, for instance, applicable to an arrangement in which there are a plurality of stations which share a common transmission medium, whether that medium be a radio channel, wire line or other electrical path.

While this invention has been shown and described in certain particular arrangements merely for the purpose of illustration, it will be understood that the general principles of this invention may be applied to other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. The combination of a plurality of radio transmitters each adjusted to emit current of the same frequency, means responsive to the operation of one of said radio transmitters for rendering the other transmitters inoperative, said means comprising a circuit interconnecting

the various radio transmitters over which current may be supplied originating at the station at which the transmitter is rendered operative, and a circuit associated with each transmitter and controlled by the current supplied over said interconnecting circuit, each control circuit including means to maintain the associated transmitter inoperative, and means to indicate that said transmitter is inoperative.

10 2. The combination of a plurality of stations having radio transmitters capable of emitting current of the same frequency, a control circuit for each transmitter for maintaining the associated transmitter unoperated, an indicating device for each transmitter, a circuit interconnecting the various stations, means responsive to the operation of any one of said transmitters for transmitting current over the interconnecting circuit originating at the station having the transmitter rendered operative, and means responsive to the current received at the various

stations over the interconnecting circuit for maintaining the control circuit unchanged, said latter means also including means to operate the indicating devices at the stations at which the transmitters are maintained unoperated.

5 3. The combination of a plurality of radio transmitters, a plurality of relay arrangements each associated with one of the radio transmitters and controlling its operation, a circuit interconnecting said relay arrangements, means responsive to the operation of one of said radio transmitters to supply current to said circuit to operate the relay arrangements associated with the other radio transmitters, means responsive to each operated relay arrangement to prevent the operation of the radio transmitter controlled by said relay arrangement, and means controlled by the operated relay arrangements to indicate that the radio transmitters controlled by the operated relay arrangements are inoperative.

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