

Oct. 29, 1929.

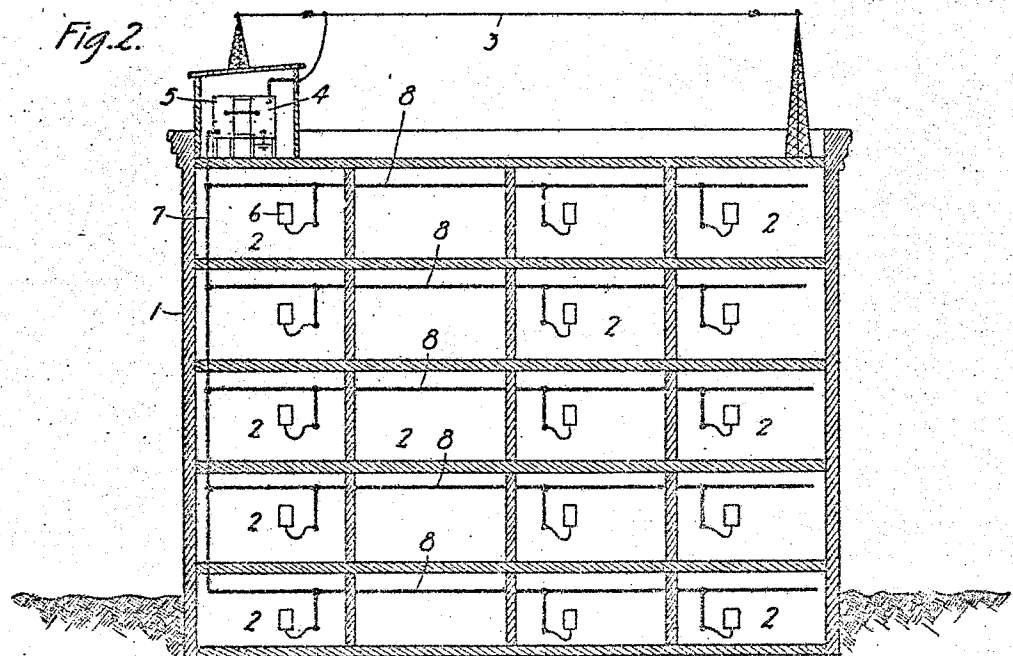
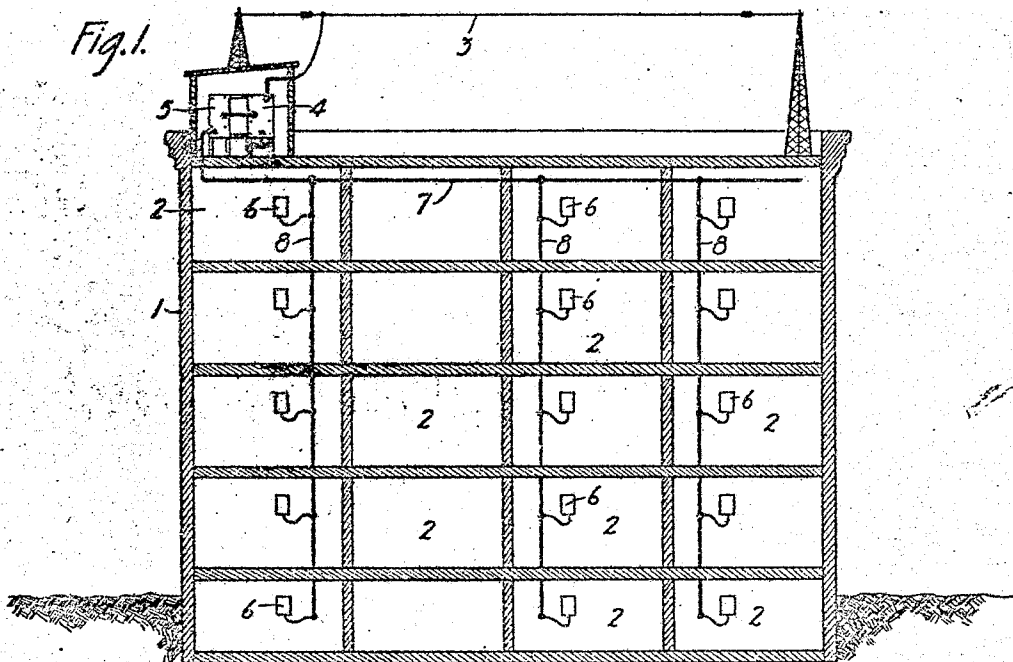
J. J. KUHN

1,733,609

TRANSMISSION SYSTEM

Filed July 2, 1923

3 Sheets-Sheet 1



Inventor:
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Oct. 29, 1929.

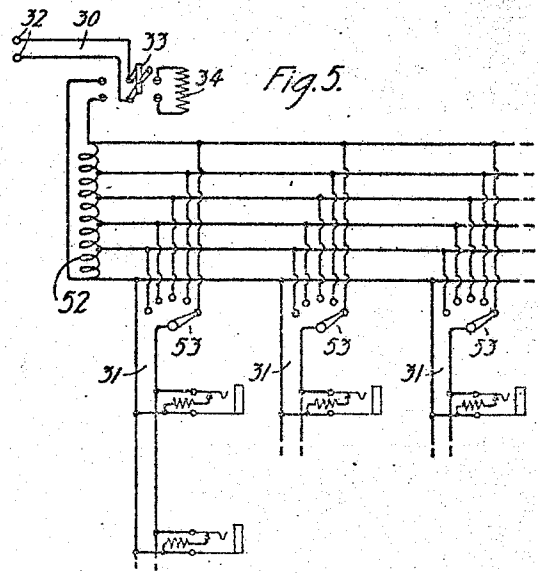
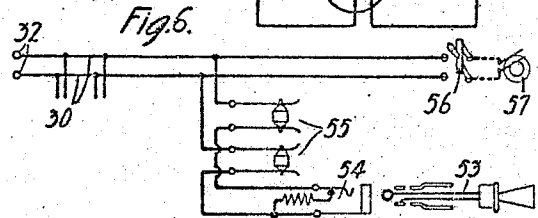
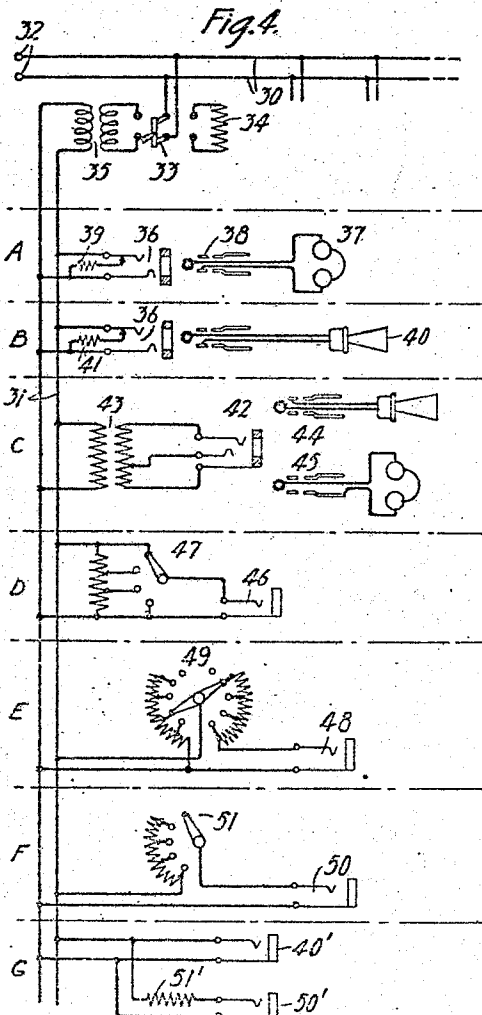
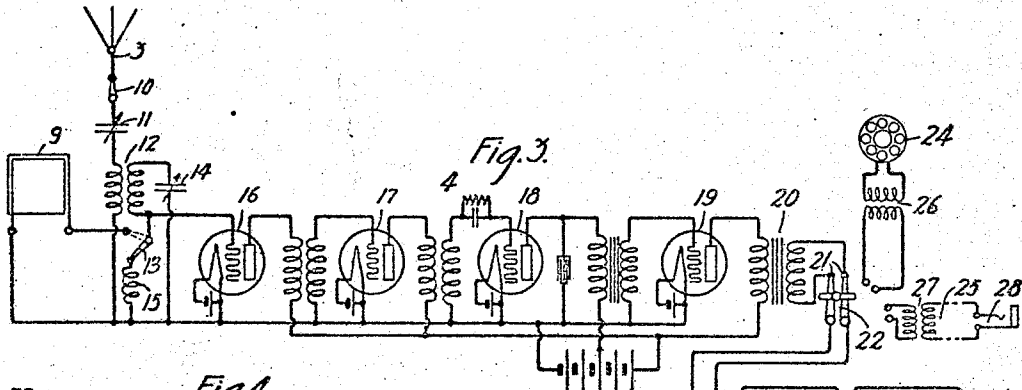
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TRANSMISSION SYSTEM

Filed July 2, 1923

3 Sheets-Sheet 2



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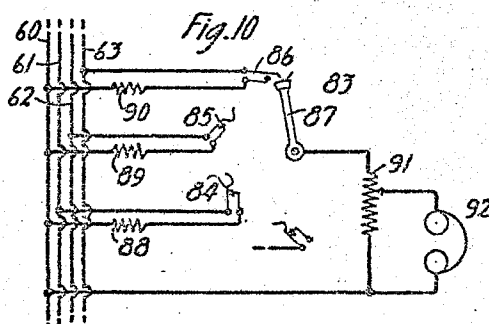
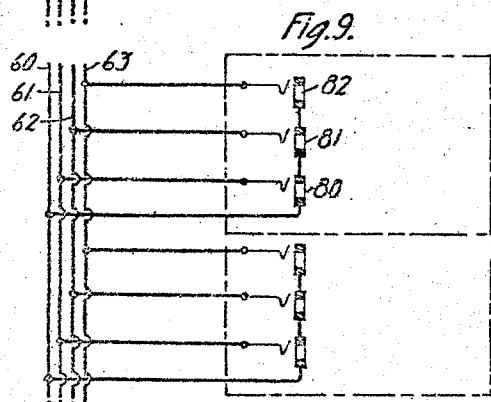
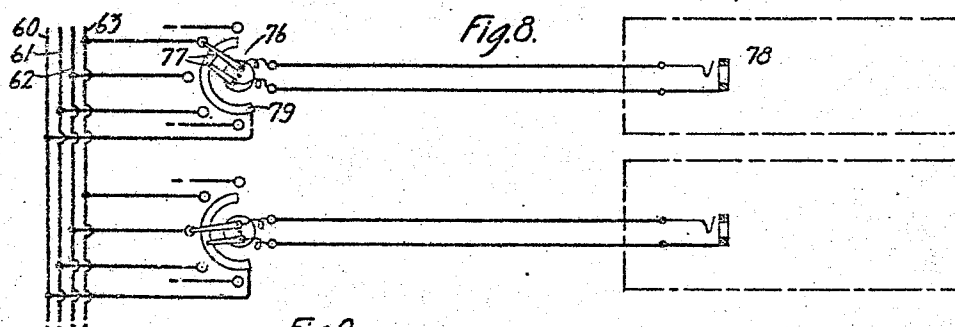
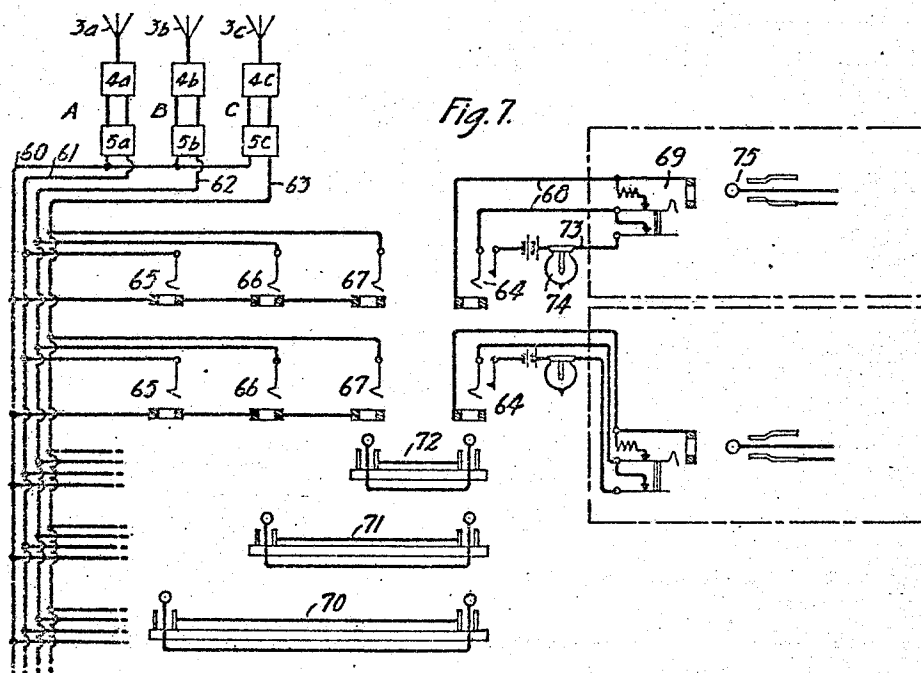
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1,733,609

TRANSMISSION SYSTEM

Filed July 2, 1923

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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TRANSMISSION SYSTEM

Application filed July 2, 1923. Serial No. 648,938.

This invention relates to a transmission system wherein music, speech or other signals broadcasted as guided or unguided waves with or without carrier waves are received, amplified and distributed to head phones, loud speakers or other receiving devices located in the various apartments of an apartment house or hotel or in the various offices or rooms of an office building, bank, factory or other building.

The invention contemplates a central receiving station at which radio frequencies modulated in accordance with signals may be received and the signals detected therefrom, or signals such as speech or music incoming over a telephone circuit from a distant station, such as a speaker's platform or a studio, may be received. The radio frequencies may be unguided such as those radiated through the ether from a radio transmitter, or guided such as those transmitted over wires. The signals, however obtained at the receiving station, are amplified and then distributed to various stations local to the central receiving station. Such distribution may be effected in various ways. For example, in a building of several floors on each of which are a plurality of rooms in each of which is located a local receiving device, conductors individual to each local receiver may extend therefrom to the central receiver; or there may be provided bus bars having connected thereto sub-bus bars from which extend conductors individual to each of a plurality of local stations served thereby. There may be a set of sub-bus bars for each floor or portion thereof, or for the rooms having the same relative position on the various floors.

The individual local stations may be connected permanently to the central receiving station or connected thereto under control of either the central station or the local stations whenever service is desired.

Should trouble develop on an individual line, sub-bus bars or main bus bars, the section on which there is trouble may be disconnected from the system and a compensating load substituted therefor and service continued to the other stations without interruption until the section is cleared of the trouble.

The volume of the signals delivered to the local stations may be controlled simultaneously from the central station or individually from either the central or local stations.

The invention further contemplates a receiving system wherein a plurality of radio frequencies of different wave lengths each modulated by different messages may be received, amplified and distributed so as to be available to the various local stations.

Permanent connections from each radio receiver to each local station may be provided, so that the local receiver may be connected to any desired radio receiver at the will of the occupant of the individual room. Or means may be provided at the central station whereby the attendant upon request from a local station may connect such local station to the desired radio receiver. In the latter case the number of conductors extending from the central station to the local stations is very materially reduced.

In the case where the connection of the local station to any desired radio receiver is under control of the central station attendant, each of the radio receivers and associated amplifying equipment may develop sufficient volume to supply all of the local stations or only a portion thereof. In case a radio receiver and its associated amplifying equipment can serve only a portion of the local stations, only a total number of local stations representing the capacity of such equipment should be connected thereto at the same time.

If the program being received on a radio receiver of such limited capacity is particularly good more than the proper number of local stations may desire to be connected thereto at the same time. To take care of such a contingency where there is a waiting list for connection to a radio receiver of limited capacity, a signaling arrangement is provided whereby when a local station disconnects from such a radio receiver a signal at the central station operates to notify the attendant of that fact. One of the local stations on the waiting list may thereupon be connected in place of the station which disconnected.

In the drawings:

Fig. 1 shows diagrammatically a building equipped with the signal receiving system wherein the signals are distributed to the various rooms by sub-bus bars extending vertically and each serving the rooms having the same location on each floor.

Fig. 2 shows an arrangement similar to that of Fig. 1 but differing therefrom in that each set of sub-bus bars serves all rooms or a portion thereof on the same floor.

Fig. 3 shows diagrammatically the central receiving and amplifying circuits and apparatus.

Fig. 4 shows diagrammatically circuits and apparatus for distributing the amplified received signals to the local stations, the connection to the central receiving apparatus being controlled at the local stations.

Fig. 5 shows diagrammatically a distributing system wherein the volume of the signals delivered to each set of sub-bus bars is controlled from the central station.

Fig. 6 shows diagrammatically an arrangement for clearing trouble from the distributing system.

Fig. 7 shows diagrammatically a receiving and distributing system wherein radio signals of three different wave lengths are received and distributed.

Fig. 8 shows diagrammatically a rotary switching arrangement at the central station for connecting a local station to any one of the central signal receiving sets.

Fig. 9 shows an arrangement whereby a local station may connect the local receiver directly to any one of the central signal receiving sets.

Fig. 10 shows an arrangement somewhat similar to that of Fig. 8 with the addition of means for regulating the volume of the received signals.

Fig. 1 represents a building 1 equipped with a radio receiver, and circuits and apparatus for distributing the signals to the various rooms or apartments 2.

An antenna 3 mounted on the roof of the building is connected to a radio receiver 4 wherein the signals are detected. The detected signals are impressed upon an amplifier 5. The amplified signals are then distributed to the individual signal receivers 6 located in the individual rooms or apartments.

In distributing the signals, the amplified detected signals are impressed upon a set of main bus bars 7 (represented by a single line) which extends around the building, so that each of the sets of sub-bus bars 8 connected thereto may serve rooms or apartments on the different floors located one above the other.

A building of any size and number of rooms or apartments may be provided with a signal

receiving and distributing system of the character disclosed herein.

The arrangement of Fig. 2 is similar to that shown in Fig. 1, but differs therefrom principally in the manner of distributing the amplified detected signals. The sets of main bus bars 7 extend vertically and each of the sets of sub-bus bars 8 serves all of the rooms or apartments on a floor.

The radio receiver 4 and amplifier 5 which are merely indicated in Figs. 1 and 2 are shown more in detail in Fig. 3, wherein is shown switch means whereby the radio receiver (indicated generally by 4) may be coupled to either an aerial antenna 3 or on a loop antenna 9 to receive radio signals and then deliver the detected signals to the coupled amplifier 5.

The antenna 3 has in series therewith a switch 10, variable tuning condenser 11 and the primary of a coupling coil 12, whose secondary is connected by switch 13, in a tuned loop circuit including a variable condenser 14 and a loading inductance 15. When the switch 13 is thrown to its dotted line position and switch 10 is opened the radio receiver is disconnected from the aerial antenna 3 and is connected to the loop antenna 9.

The radio signals intercepted by the connected antenna are amplified by high frequency amplifiers 16 and 17. The amplified radio signals are impressed upon a detector 18 wherein the radio frequency waves modulated in accordance with signals interact with the unmodulated carrier frequency waves to produce the signals. The signals so detected are amplified by a low frequency amplifier 19. The amplified audio signals pass through an impedance matching transformer 20 and are available on the terminals 21 of a switch 22.

The amplifiers 16, 17 and 18 and the detector 18 may be of any well known type, such, for example, as the usual three electrode space discharge tube amplifiers and detector. The impedance matching transformer 20 and switch 22 couple the output circuit of the radio receiver 4 to the input circuit of the amplifier 5.

The amplifier 5 may be of any well known type, such for example, as the amplifier disclosed in U. S. patent to Colpitts No. 1,123,292, February 16, 1915.

The output circuit of the amplifier 5 is coupled to an outgoing circuit having terminals 23.

By means of the switch 22, the input circuit of the amplifier 5 may have coupled thereto a transmitter 24 or an incoming circuit 25. The transmitter 24 has in circuit therewith an impedance matching transformer 26.

The incoming circuit 25, which may include an impedance matching transformer 27, may extend to a distant telephone exchange or stu-

dio at which it terminates in a jack 28. At the studio or telephone exchange, a transmitter similar to 24, with additional amplifier stages if desired, may be connected to the circuit or trunk 25. The attendant at the central receiving station may, by means of transmitter 24 when connected to the amplifier 5 and distributing system to be described, communicate directly with all of the local stations connected to the distributing system.

The trunk circuit 25 may serve to carry to the central receiving station, speeches, news, music or other signals of frequencies within the audible range of frequencies which when the circuit is connected to the amplifier 5 by switch 22 may be amplified and then distributed to the local stations.

Thus, by means of the apparatus and circuits at the central receiving station broadcasted radio programs, programs distributed over wires (incoming over circuit 25) may be received and then distributed to the local stations; or the central station attendant may make announcements to or otherwise communicate with the local stations.

Programs of music, news, etc., broadcasted by radio on different wave lengths may be received and distributed as will more fully hereinafter appear.

Likewise by providing more incoming trunk circuits, like circuit 25, any one of several programs of music, news, etc., transmitted over wires may be received and distributed.

Fig. 4 shows the distributing system by which the received signals amplified by amplifier 5 may be distributed to the local stations.

This distributing system comprises a pair of main bus bars 30, and a plurality of pairs of sub-bus bars 31 coupling the local stations to the main bus bars 30.

The terminals 32 of the main bus bars 30 may be connected to terminals 23 (Fig. 3) of the outgoing circuit from amplifier 5.

Each pair of sub-bus bars 31 may be connected to the main bus bars 30 by a two pole double throw switch 33. Should the sub-bus bars 31 or any apparatus connected thereto become grounded or short circuited or trouble of any other character develop thereon the sub-bus bars may be disconnected from the distributing system and a balancing load 34 substituted therefor by throwing the switch 33 to its second position. This balancing load maintains the volume of the signals constant, so that there is no change in the signals delivered to the other connected local stations.

The sub-bus bars 31 may have connected thereto an impedance matching transformer 35.

The sub-bus bars may be terminated in various ways at the local stations where either

loud speakers or head phones or both may be provided.

Several different ways of terminating the sub-bus bars 31 at the local stations are shown in Fig. 4.

For example at local stations A and B, the sub-bus bars terminate in jacks 36.

Station A is provided with a pair of head phones 37 connected to a plug 38 for connection to the jack. When the plug 38 is disconnected from the jack, a balancing resistance load 39 is substituted for the head phones.

Station B is provided with a loud speaker 40 connected to a plug for connection to the jack. When the plug is disconnected from the jack, a balancing load 41 is substituted for the loud speaker.

Station C is provided with a three contact jack 42 connected to the sub-bus bars 31 through a three winding transformer 43. One winding is connected to the bus bars, a second winding to the tip and ring contacts of the jack, and the third winding to the tip and sleeve contacts of the jack. Either a pair of head phones connected to the tip and ring contacts of three contact plug 44 or a loud speaker connected to the tip and sleeve contacts of a three contact plug 45 may be coupled to the bus bars. The impedance of either the head phones or the loud speaker and the bus bar circuit are properly matched by means of the transformer 43.

Station D is provided with a jack connected to the bus bars through a variable tap autotransformer 47 whereby the volume of the signals delivered to the local station may be regulated thereat. The presence of the autotransformer insures that the impedance of the bar bar circuit is not changed when the volume of the received signals is changed. Either head phones or loud speakers may be employed.

The jack 48 of station E is connected to the bus bar through a regulating rheostat 49 by which the volume of the received signals may be varied at the station. The regulating rheostat 49 is so constructed and connected in the circuit that when the bridged resistance is increased the series resistance is decreased by the same amount, and vice versa, whereby no change in impedance of the bus bar circuit results. Either head phones or loud speakers may be employed.

Station F is provided with a jack 50 connected to the bus bars through a simple rheostat 51 for regulating the volume of the received signals. Either head phones or loud speaker may be employed.

Station G is provided with two jacks 40' and 50' with a fixed resistance 51' connected permanently in circuit with the latter. A loud speaker may be connected to jack 40', and a pair of head phones to jack 50'. The

resistance 51' serves to reduce the volume of the signals delivered to the connected head phones.

While for purpose of illustration different forms of the local station terminating apparatus are shown connected to the sub-bus bars 31, such is not ordinarily the practice for a commercial system wherein probably all local stations would be provided with the same form of terminating apparatus.

Fig. 5 shows another form of connecting apparatus between the main bus bars and the local stations. Thus the main bus bars 30 may be connected by switch 33 to a variable tap autotransformer 52. The various pairs of sub-bus bars 31 are connected in multiple to the autotransformer 52, and each pair of sub-bus bars has associated therewith a switch 53 by which the associated sub-bus bars may be variably connected to the autotransformer 52. In this manner the central station attendant who may control the several switches 53 to separately regulate the volume of the signals delivered to the various pairs of sub-bus bars.

The distributing system, as shown in Fig. 6, may be provided with means by which the central station attendant may readily clear the system of trouble in any of the local station apparatus. For example should the conductors in the cord 53 connecting the loud speaker (or head phones) to the plug become short circuited, the loud speaker at that particular station will be put out of commission, and the volume of the signals received at the other local stations reduced very materially. In such a case it is very desirable that the central station attendant be able to clear the trouble quickly and easily.

Each local station jack 54 may therefore be connected to the sub-bus bars through fuses 55 (or heat coils) which will not blow due to the passage therethrough of the usual signal currents. The central station attendant upon being informed that there is trouble at one of the local stations, may throw switch 56 and connect to the bus bars 30 current, from source 57, of sufficient strength to blow the fuses or heat coils at the station where the short circuit exists. The fuses at other stations will not blow because of the high resistance (of the head phones or loud speaker) in series therewith.

Fig. 7 shows a signal receiving and distributing system wherein a plurality of different radio frequencies each modulated by different messages are received and distributed to the local stations.

This system comprises a plurality of receiving sets located at the central station, and means for distributing the detected signals or messages to the various local stations.

The several receiving sets, A B and C located at the central station are similar, so a description of one will suffice.

Receiving set A comprises an antenna 3A

(loop or aerial), a radio receiver 4A, an amplifier 5A and associated apparatus which may be similar to that described in connection with Fig. 3.

Each radio receiver may be tuned to receive a different wave length.

Several different ways of distributing the different detected messages may be employed, as indicated in Fig. 7.

The output from the several amplifiers is delivered to a set of main bus bars 60, 61, 62 and 63, bus bar 60 being common to the several amplifiers and each of the others being individual to an amplifier.

Connection of the local stations to the receiving sets may be controlled in several different ways by the central station attendant.

Thus there may be provided at the central station a jack 64 and associated jacks 65, 66 and 67 for each local station. Jack 64 is connected to conductors 68 extending to a local station and terminating thereat in a jack 69. Jacks 65, 66 and 67 are connected to the main bus bars so that there is available on each of these jacks the particular message delivered to the associated bus bars.

Connection of the jack 64 to the bus bar jacks 65, 66 and 67 is effected by means of twin plugs 70, 71 and 72, the plugs of which are spaced different distances apart corresponding to the spacing of the jacks which are to be connected thereby.

In order to effect a saving in the cost of the central station receiving equipment the amplifiers 5^a, 5^b, and 5^c may be designed to supply outputs of different values. Thus if the signal receiving and distributing system is to supply a total of 300 local stations, amplifier 5^a may be designed to supply but 100 local stations, 5^b to supply 200 local stations, and 5^c to supply the entire 300 local stations. In order that amplifiers 5^a and 5^b may not be overloaded at any time, the central station is provided with but 100 twin plugs like plug 70, 200 like plug 71 and with 300 like plug 72. Therefore, at no time, can more than 100 stations be connected to the receiving set A, nor more than 200 to receiving set B, although all local stations may be connected to receiving set C at the same time.

Should the central station attendant have more than the proper number of different kinds of plugs, it is possible that amplifiers 5^a or 5^b may be overloaded at some time due to the connection thereto of more than the proper number of local stations. In order to guard against such a condition, signaling means between the local stations and the central station is provided.

This signaling means, which is individual to each local station and its line, comprises a third conductor 73 extending from the central to the local station and a signal lamp 74; jointly controlled by the two stations.

The conductor 73 terminates at the central station in a normally open contact of the jack 64 and at the local station in a normally closed contact of jack 69. While a plug is in jack 64 and the plug 75 (at local station) is in jack 69, the signal lamp 74 is not lighted for its circuit is open at the local station.

The local station may be equipped with either head phones or a loud speaker connected to plug 75.

The central station operator, upon request from the local station communicated by telephone, speaking tube or otherwise, connects the local station line to the receiving set which is receiving and supplying the program specified by the local station.

Now if 100 local stations are connected to receiving set A when a request is received from another local station for connection thereto, the local station will be informed that the equipment is busy and that the request is being placed on the waiting list. Then when the plug 75 at one of the connected local stations is withdrawn from the jack 69, the corresponding signal lamp 74 lights indicating to the central station attendant that the local station has disconnected and that another local station may be connected to receiving set A in place thereof. The central station attendant may thereupon withdraw twin plug 70 from the jacks associated with the lighted signal lamp, which opens the circuit thereof, and insert such twin plug in the jacks of the local station on the waiting list. If such waiting local station is provided with a loud speaker it will usually be connected to the jack thereat, so it will not be necessary for the central station attendant to notify the local station that the connection has been made. However, if the local station is provided with head phones instead of a loud speaker the central station attendant will notify the local station at the time of making the connection.

Instead of the plug jack arrangement of making connections to the lines to the local stations, other switching arrangements may be employed.

Thus, Fig. 8 shows a switch 76 located at the central station and individual to each local station. The movable contacts 77 of the switch are connected to the line conductors extending to the local station and terminating thereat in a jack 78 with which head phones or a loud speaker may be connected by means of a plug (not shown). The switch 76 has stationary contacts, one of which (contact 79) is connected to the common bus bar 60 and the others respectively to the bus bars individual to the receiving sets.

A potentiometer, similar to that to be described in connection with Fig. 10, for regulating the volume of the signals may be associated with the switch 76.

Fig. 9 shows the main bus bars multiplied to each of the local stations and terminating thereat in jacks 80, 81 and 82 individual to the receiving sets.

Fig. 10 shows the main bus bars multiplied to each of the local stations and terminating thereat in terminals of a switch 83.

The switch has contacts 84, 85 and 86 respectively, individual to the receiving sets at the central station, and a cooperating rotatable contact 87. Balancing resistances 88, 89 and 90 are connected across the respective bus bar circuits through normally closed contacts of the switch. A potentiometer 91 for regulating the volume of the signals delivered to the head phones 92 (or loud speaker) is connected between the rotatable switch contact arm 87 and the common bus bar 60. The local station by rotating the switch arm 87 may connect the local signal receiver 92 to any one of the central station receiving sets and simultaneously connect the potentiometer across the circuit. When the contact arm 87 engages any of the contacts 84, 85 or 86, the associated balancing resistance is disconnected from the bus bar circuit.

Any of the various terminating arrangements for single wave length reception and distribution may be employed in a system wherein a plurality of wave lengths are received and distributed. Obviously, in the system wherein a plurality of wave lengths are received and distributed, the central station attendant may not only connect any of the local stations to any of the receiving sets, but may also regulate separately the volume of the signals delivered to the various connected local stations.

The invention set forth herein is of course susceptible of various other modifications and adaptations.

The invention claimed is:

1. A wave distributing system which comprises a radio receiving system, a transmitter and an incoming circuit over which signals are transmitted at a central point, an amplifier, switching means for connecting either the radio receiving system, the transmitter or the incoming circuit to the input circuit of the amplifier, a plurality of subscribers' stations comprising signal receivers at points at a distance from said central point, a plurality of branch lines arranged to be connected to certain of said receivers, a main line connected to said amplifier, means for connecting and disconnecting said branch lines and said main line, and means associated with said main line for compensating for the disconnection of each branch line.

2. In a signal distributing system, a radio receiving system, a transmitter, an incoming line over which signals are transmitted, an amplifier, switching means for connecting either the radio receiving system, the trans-

mitter or the incoming circuit to the input circuit of the amplifier, a main line connected to said amplifier, a plurality of branch lines connected to said main line, a plurality of stations having receivers supplied from each of said branch lines, said receivers being arranged to be disconnected from said branch lines, and means simulating the electrical characteristics of said receivers for maintaining the impedance of said branch lines unchanged when said receivers are disconnected.

3. A signal receiving system comprising a radio receiver including a detector, an amplifier, an impedance matching device coupling the output circuit of the radio receiver to the input circuit of the amplifier, a pair of main bus bars connected to the output circuit of the amplifier, a plurality of pairs of sub-bus bars connected to the main bus bars, a switch to connect each pair of sub-bus bars to the main bus bars, a plurality of receiving devices connectible to each pair of sub-bus bars, and a balancing load for each pair of sub-bus bars connectible to the main bus bars by the associated switch.

4. A signal receiving system comprising a radio receiver including a detector, an amplifier, an impedance matching device coupling the output circuit of the radio receiver to the input circuit of the amplifier, a pair of main bus bars connected to the output circuit of the amplifier, a plurality of pairs of sub-bus bars connected to the main bus bars, a plurality of local stations for each pair of sub-bus bars, terminals at each local station connected to sub-bus bars therefor, a signal receiver at each local station, a balancing load at each local station, and means to connect either the signal receiver or the balancing load across the terminals.

5. A signal receiving system comprising a radio receiver including a detector, an amplifier, an impedance matching device coupling the output circuit of the radio receiver to the input circuit of the amplifier, a pair of main bus bars connected to the output circuit of the amplifier, a plurality of pairs of sub-bus bars connected to the main bus bars, a plurality of local stations for each pair of sub-bus bars, terminals at each local station connected to sub-bus bars therefor, a signal receiver at each local station, a balancing load normally bridged across the terminals at each local station, and means to simultaneously connect the signal receiver across the terminals and disconnect the balancing load from bridged relation thereto.

6. A signal receiving system comprising a radio receiver including a detector, an amplifier, an impedance matching device coupling the output circuit of the radio receiver to the input circuit of the amplifier, a pair of main bus bars connected to the output circuit of the

amplifier, a plurality of pairs of sub-bus bars, a balancing load for each pair of sub-bus bars, a switch to connect either the balancing load or the corresponding pair of sub-bus bars to the main bus bars, and a plurality of signal receivers detachably connectible to each pair of sub-bus bars.

7. A signal receiving system comprising a radio receiver including a detector, an amplifier, a pair of main bus bars connected to the output circuit of the amplifier, a plurality of pairs of sub-bus bars, a balancing load for each pair of sub-bus bars, a switch to connect either the balancing load or the corresponding pair of sub-bus bars to the main bus bars, a plurality of signal receivers connectible to each pair of sub-bus bars, a plurality of local stations for each pair of sub-bus bars, terminals at each local station connected to the sub-bus bars therefor, a signal receiver at each local station, a balancing load at each local station, and means to connect either the signal receiver or the balancing load across the terminals.

8. A signal receiving system comprising a radio receiver including a detector, a transmitter, an incoming circuit over which signals are transmitted, an amplifier, means to connect said amplifier selectively to the detector, the transmitter and the incoming circuit, a pair of main bus bars connected to the output circuit of the amplifier, a plurality of pairs of sub-bus bars connected to the main bus bars, a plurality of local stations for each pair of sub-bus bars, two signal receivers of different impedances for each local station, terminals at the local station, means to connect either signal receiver to the terminals, and impedance matching means connecting the terminals to the corresponding pair of sub-bus bars.

9. A signal receiving system comprising a radio receiver including a detector, a transmitter, an incoming circuit over which signals are transmitted, an amplifier, means to connect said amplifier selectively to the detector, the transmitter and the incoming circuit, a pair of main bus bars connected to the output circuit of the amplifier, a plurality of pairs of sub-bus bars connected to the main bus bars, a plurality of signal receivers connected to each pair of sub-bus bars, and means associated with each signal receiver to regulate the strength of the signals delivered thereto.

10. A signal receiving system comprising a radio receiver including a detector, an amplifier, an impedance matching device coupling the output circuit of the radio receiver to the input circuit of the amplifier, a pair of main bus bars connected to the output circuit of the amplifier, a plurality of pairs of sub-bus bars connected to the main bus bars, a plurality of signal receivers connected to each pair of sub-bus bars, and means associated with each sig-

nal receiver to regulate the strength of the received signals and to maintain the sub-bus bar circuit impedance termination constant thereat.

5 In witness whereof, I hereunto subscribe my name this 27th day of June, A. D., 1923.

JOHN J. KUHN.

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