

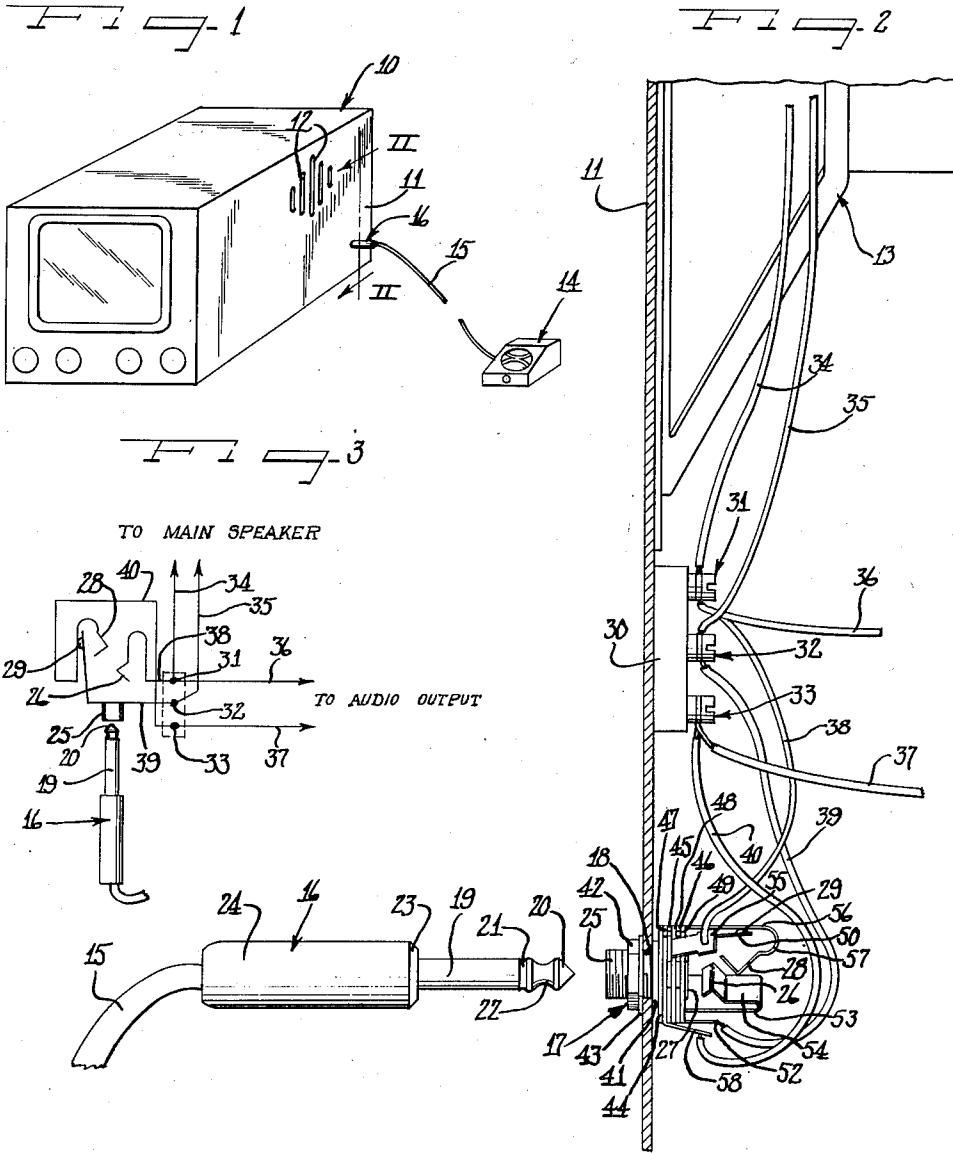
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ELECTRICAL SWITCHING APPARATUS

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ELECTRICAL SWITCHING APPARATUS

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This invention relates to electrical switching apparatus and more particularly to a plug and jack arrangement especially adapted to connect an auxiliary speaker or earphones in circuit with the audio output and main speaker of a radio or television receiver, a phonograph or the like.

It is oftentimes desirable to provide an extension speaker for a radio or television receiver in another room of a house. Also, to improve the quality of reproduction, it is sometimes desirable to provide an auxiliary speaker in the same room to act in place of the speaker of the radio or television receiver or phonograph or to act together with the main speaker. Further, it is oftentimes desired to connect earphones to a radio or television set either with the main speaker operating or with the main speaker disconnected.

This invention relates to a plug and jack arrangement which is especially adapted for satisfying the above mentioned requirements but which has general application as well.

According to this invention, a jack has terminals connected to an audio signal source such as the output of a radio receiver or phonograph and also connected to an electro-acoustical transducer such as the main speaker of the receiver or phonograph. A plug is connected to a second electro-acoustical transducer such as earphones or an auxiliary speaker and the plug is arranged to be inserted into the jack to connect the second transducer to the audio signal source.

In accordance with a more specific feature of the invention, the jack is arranged to connect the audio signal source and the first mentioned electro-acoustical transducer when the plug is removed from the jack and to disconnect the audio signal source and the first-mentioned transducer when the plug is inserted into the jack. This is particularly advantageous where it is desired to connect earphones to a radio with the speaker of the radio disconnected so that only the wearer of the earphones can hear the sounds.

In accordance with a still more specific feature of the invention, the plug is selectively movable between first and second positions within the jack with the jack being arranged to connect both of the transducers to the audio signal source in the first position of the plug and to connect only the second transducer to the audio signal source in the second position of the plug. This is, of course, highly advantageous since the mode of operation may be changed by merely moving the plug in the jack between the two positions.

Still another feature of the invention is in the construction of the jack itself. According to this feature, the jack is arranged for receiving a plug of the conventional type having a body of conductive material and a tip also of conductive material insulated from the body, the tip having a recess therein. The jack includes a sleeve of conductive material arranged for passage of the plug tip therethrough and arranged to embrace the plug body.

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This sleeve may be affixed within the opening in a panel, a cabinet wall or the like. A first contact is mounted on the jack and is spaced axially a predetermined distance from the inner end of the sleeve and is spring urged radially inwardly toward the axis of the sleeve for locking engagement with the recess in the plug tip in one position of the plug and for conductive engagement with the plug body in a second position of the plug. A second contact is mounted on the jack and spaced axially from the inner end of the sleeve a distance greater than the aforementioned predetermined distance and is urged radially inwardly toward the axis of the sleeve for locking engagement with the recess in the plug tip in the second position of the plug. By this feature, of course, the two contacts are selectively connected to the plug tip.

In accordance with a still more specific feature of the jack construction, a third contact is connected to the afore-mentioned second contact in the one position of the plug but disconnected therefrom in the second position of the plug. This third contact is preferably connected directly to the sleeve of the jack.

With this specific jack construction, the audio signal source may be connected between the first and second contacts of the jack, the first electro-acoustical transducer may be connected between the first contact and the sleeve and the second electro-acoustical transducer is, of course, connected between the plug body and the plug tip. When the plug is removed from the jack, the first transducer is connected to the audio signal source with the second transducer, of course, disconnected therefrom. When the plug is inserted into the jack and disposed in the one position, the transducers are connected in parallel to the audio signal source so that both will operate. In the second position of the plug relative to the jack, the second transducer is connected to the audio signal source but the first transducer is disconnected therefrom. Thus, any desired mode of operation may be obtained by merely manipulating the plug.

Although the jack construction of this invention is peculiarly advantageous when employed in combination with the audio signal source and electro-acoustical transducers in the manner as explained above, it will be appreciated that it has general application as well and may be used to selectively connect a first or second electrical circuit to a third circuit or to connect both the first and second circuits to the third circuit at the same time.

Still further features of the invention reside in specific details of the preferred embodiment of jack illustrated in the drawing by which it may be readily constructed and efficient in operation while being very rugged and extremely durable.

An object of this invention, accordingly, is to provide an improved plug and jack arrangement for connecting transducers to an audio signal source.

Another object of this invention is to provide an improved plug and jack arrangement for selectively connecting either one or both of a pair of circuits to a third circuit.

A further object of this invention is to provide an audio system including an audio signal source and a pair of electro-acoustical transducers with means for selectively connecting either one or both transducers to the audio signal source including a jack and a plug selectively movable between first and second positions within the jack.

A more specific object of the invention is to provide an improved jack for use with a plug of the type having a body and a recessed tip insulated from the body, the jack having a pair of spaced contacts both arranged for locking engagement with the recessed plug tip.

This invention contemplates other objects, features and advantages which will become more fully apparent from the following detailed description taken in conjunction

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with the accompanying drawing which illustrates a preferred embodiment and in which:

Figure 1 is a perspective view of a television receiver with an auxiliary speaker adapted to be connected thereto, according to the principles of this invention;

Figure 2 is a sectional view taken substantially along line II—II of Figure 1 and illustrating a plug and jack arrangement connected in the audio system of the television receiver, according to the principles of this invention; and

Figure 3 is a view illustrating diagrammatically the operation of the plug and jack arrangement of this invention.

Reference numeral 10 designates a table model television receiver which has a side wall 11 having openings 12 behind which is mounted a speaker 13. An auxiliary speaker 14 is connected through a cord 15 to a plug 16 which may be inserted into a jack 17 mounted in an opening 18 in the wall 11. When the plug 16 is inserted in the jack 17, the auxiliary speaker 14 is connected to the audio output of the television receiver 10.

The auxiliary speaker 14 may, of course, be placed in a separate room from the television receiver 10. If desired, earphones might be substituted for the auxiliary speaker 14 or the auxiliary speaker 14 might be mounted in a baffle for high quality reproduction of sound and might be in the same room with the television set 10 to take the place of or cooperate with the speaker 13. It will also be appreciated that any audio reproduction device such as a radio receiver or phonograph might be used in place of the television receiver 10.

According to a specific feature of the invention, the plug 16 may be selectively movable between first and second positions within the jack 17 with the jack 17 arranged so as to connect either the main speaker 13 or the auxiliary speaker 14, or both, to the output of the television receiver, depending upon whether the plug is removed from the jack or inserted into one or the other of the two positions within the jack.

The plug 16 is of conventional construction and comprises a cylindrical body portion 19 of conductive material and a tip portion 20 also of conductive material insulated from the body portion 19 through a spacer disk 21 of insulating material, the tip 20 having an annular groove or recess 22. The body 19 has an annular flange 23 which is threaded to receive a plastic sleeve 24 forming a handle for the plug 16. Within the sleeve 24 are terminals, not shown, one of which is connected to the body 19 and the other of which is connected to the tip 20, the cord 15 being connected to the two terminals.

The construction of the jack 17 forms an important feature of this invention. According to this feature, the jack 17 comprises a conventional sleeve 25 which is affixed in the opening 18 in the side wall 11 in a manner to be more specifically described hereinafter and which is adapted for passage of the plug tip 20 therethrough and is also adapted to conductively embrace the plug body 19. A first contact 26 is spaced axially a predetermined distance inwardly from the inner end 27 of the sleeve 25 and is resiliently urged toward the axis of the sleeve 25 for locking engagement with the recess 22 of the plug tip 20. When the plug tip 20 is moved inwardly past the contact 26, the contact 26 will be in conductive engagement with the plug body 19.

A second contact 28 is spaced axially inwardly from the inner end 27 of the sleeve 25 a distance greater than the aforementioned predetermined distance between the contact 26 and the inner end 27 and the contact 28 is resiliently urged inwardly toward the axis of the sleeve 25 for locking engagement with the recess 22 when the plug tip 20 is moved past the contact 26. Thus, the contact 26 is engaged with the tip 20 in one position of the plug 16 and the contact 28 is engaged with the tip 20 in a second position of the plug 16.

A third contact 29 is connected to the second contact

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28 in the one position of the plug 16 but is disconnected from the contact 28 in the second position of the plug 16 in which second position the second contact 28 engages the tip 20.

For interconnection of the speaker 13 and the audio output of the receiver with the jack 17, a terminal block 30 may be mounted on the inner surface of the side wall 11. This terminal block 30 has three terminals 31, 32 and 33. Lines 34 and 35, which are connected to the speaker 13, are respectively connected to the terminals 31 and 32 while lines 36 and 37, which are connected to the audio output of the receiver 10, are connected respectively to the terminals 31 and 33. The terminal 31 is connected to the first contact 26 through a lead 38. The terminal 32 is connected through a lead 39 to the sleeve 25 which, in turn, is connected to the third contact 29. The terminal 33 is connected to the second contact 28 through a line 40. These connections are all diagrammatically illustrated in Figure 3. The specific way in which the leads are connected to the contacts of the jack 17 will be described more in detail in a description of the specific details of the jack construction.

In operation, when the plug 16 is removed from the jack 17, the audio output is connected directly to the main speaker. As shown in Figure 3, the lead 36 which extends to the audio output is connected to the terminal 31 which, in turn, is connected to the lead 34 extending to the speaker 13. The lead 37 of the audio output is connected to the terminal 33, which is connected through the lead 40 to the second contact 28 which, in turn, is connected through the third contact 29 to the sleeve 25, the sleeve 25 being connected through the lead 39 to the terminal 32 which is connected to the lead 35 extending to the main speaker.

When the plug 16 is inserted into the one position within the jack 17, that is, with the tip 20 lockingly engaged by the first contact 26, the auxiliary speaker 14 and the main speaker 13 will be connected in parallel into the audio output. In this case, the circuit between the audio output and the main speaker will be the same as described above with the plug 16 removed from the jack 17. However, the body 19 of the plug 16, which is connected to one terminal of the auxiliary speaker 14, will be in electrically conductive engagement with the sleeve 25 while the tip 20 of the plug 16, which is connected to the other terminal of the auxiliary speaker 14, will be connected to the first contact 26 which, in turn, is connected through the lead 38 to the terminal 31. Thus, the auxiliary speaker 14 is connected in parallel with the main speaker 13.

When the plug 16 is inserted into its second position in the jack 17, the auxiliary speaker 14 will be connected to the audio output of the receiver but the main speaker 13 will be disconnected therefrom. In this case, the lead 36 extending to the audio output is connected to the terminal 31 which is connected through the lead 38 to the second contact 26, this contact 26 being in electrically conductive engagement with the plug body 19 in the second position of the plug 16 so that the audio output lead 36 is connected to one terminal of the auxiliary speaker 13. The other lead 37 of the audio output is connected to the terminal 33 which is connected through the lead 40 to the second contact 28, this contact 28 being in locking engagement with the plug tip 20 in the second position of the plug 16 so that the other terminal of the auxiliary speaker 14 is connected to the audio output lead 37. It will be noted that in this second position of the plug 16, the third contact 29 is disconnected from the second contact 28 so that there is no short-circuiting of the audio output and the main speaker 13 is disconnected.

Other important features of the invention reside in the specific constructional details of the jack 17. In particular, the sleeve 25 has an integral annular flange portion

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41 which seats against the inner surface of the side wall 11 about the opening 18 and a nut 42 is threaded on the outer end portion of the sleeve 25 to secure the sleeve 25 to the side wall 11. A washer 43 may, if desired, be disposed between the nut 42 and the outer surface of the side wall 11.

Disposed on the sleeve 25 inside the flange 41 are washers 44, 45 and 46 of insulating material with washers or discs 47 and 48 disposed respectively between the insulating washers 44 and 45 and between the insulating washers 45 and 46, a third disc 49 of conductive material being disposed inside the insulating washer 46. The washers and discs are all held in position by an out-turned annular flange portion at the inner end 27 of the sleeve 25. It will be noted that this flange is in electrically conductive engagement with the disc 49.

The disc 49 has an integral portion 50 projecting beyond the inner end 27 of the sleeve 25 and upon which is mounted the third contact 29. This disc 49 also has an integral lug portion 52 to which the end of the lead 39 is soldered.

The disc 48 has an integral portion 53 of spring metal which projects axially inwardly from the inner end 27 of the sleeve 25 and which has an inturned reversed end portion 54 terminated in a generally V-shaped portion forming the contact 26. In the unflexed position of the spring metal portions 53 and 54, the apex of the V-shaped portion forming the contact 26 is spaced from the axis of the sleeve 25 a distance less than the radius of the annular recess 22 so that when the plug is inserted into the jack, the contact 26 and portions 53 and 54 will be resiliently deflected radially outwardly and in pressure engagement with the tip 20 to lock the plug in position. The disc 48 also has an integral lug portion 55 to which the end of the lead 38 is soldered.

The disc 47 has an integral portion 56 of spring metal which has an in-turned reverse bend portion 57 terminated in a generally V-shaped portion forming the contact 28. In the unflexed position of the portions 56 and 57, the apex of the V-shaped portion forming the contact 28 is spaced a distance from the axis of the sleeve 25 less than the radius of the annular recess 22 in the plug tip 20 so that when the plug 16 is inserted into its second position within the jack 17, the contact 28 will be moved outwardly against the resilience of the portions 56 and 57 and will be in firm locking engagement in the recess 22. In this second position, the portion 56 will be moved radially outwardly out of contact with the contact 29. The disc 47 also has an integral lug portion 58 to which the end of the lead 40 is soldered.

This specific construction of the jack 17 is highly advantageous in that it is efficient and reliable in operation, very rugged and durable, requires a minimum number of parts and is readily constructed. It is especially adapted for use in the switching arrangement of this invention, particularly in that the disc 49, which integrally carries the contact 29 and the lug 52, is in electrically conductive engagement with the out-turned flange at the inner end 27 of the sleeve 25 and no separate connection between these members is required. Also, the electrically conductive engagement between the sleeve 25 and plug 19 is utilized to advantage and no separate contact for engaging the body 19 is required.

It will be understood that modifications and variations may be effected without departing from the spirit and scope of the novel concepts of the present invention.

I claim as my invention:

1. In an audio system including an audio signal source, a first electro-acoustical transducer, and a second electro-acoustical transducer, means for selectively connecting and disconnecting said transducers in circuit with said signal source, comprising: a jack having terminals connected to said audio signal source and said first transducer, and a plug connected to said second transducer and arranged to be inserted into said jack and selectively mov-

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able between first and second positions within said jack, said jack being arranged to connect both of said transducers to said source in said first position and to connect only said second transducer to said source in said second position with said first transducer connected to said source with said plug removed from said jack.

2. In an electrical system including first, second and third circuits, means for interconnecting said circuits, comprising: a jack having terminals connected to said first and second circuits, and a plug connected to said third circuit and arranged to be inserted into said jack and selectively movable between first and second positions within said jack, said jack being arranged to connect both of said second and third circuits to said first circuit in said first position of said plug and to connect only said third circuit to said first circuit in said second position of said plug with said first circuit being connected to said second circuit with said plug removed from said jack.

3. In a jack for receiving a plug of the type having a body of conductive material and a tip of conductive material insulated from the body, the tip having a recess therein, a sleeve of conductive material arranged for passage of the plug tip therethrough and arranged to embrace the plug body, a first contact spaced axially a predetermined distance from one end of said sleeve and urged radially inwardly toward the axis of said sleeve for locking engagement with the recess in the plug tip in one position of the plug and for engagement with the plug body in a second position of the plug, and a second contact spaced axially from said one end of said sleeve a distance greater than said predetermined distance and urged radially inwardly toward the axis of said sleeve for locking engagement with the recess in the plug tip in said second position of the plug.

4. In a jack for receiving a plug of the type having a body of conductive material and a tip of conductive material insulated from the body, the tip having a recess therein, a sleeve of conductive material arranged for passage of the plug tip therethrough and arranged to embrace the plug body, a first contact spaced axially a predetermined distance from one end of said sleeve and urged radially inwardly toward the axis of said sleeve for locking engagement with the recess in the plug tip in one position of the plug and for engagement with the plug body in a second position of the plug, a second contact spaced axially from said one end of said sleeve a distance greater than said predetermined distance and urged radially inwardly toward the axis of said sleeve for locking engagement with the recess in the plug tip in said second position of the plug, and a third contact connected to said second contact in said one position of the plug but disconnected therefrom in said second position of the plug.

5. In an electrical system including first, second and third circuits, means for interconnecting said circuits, comprising: a plug having a body of conductive material and a tip of conductive material insulated from said body and having a recess therein, a sleeve of conductive material arranged for passage of said plug tip therethrough and arranged to embrace said plug body, a first contact spaced axially a predetermined distance from one end of said sleeve and urged radially inwardly toward the axis of said sleeve for locking engagement with said recess in said plug tip in one position of said plug and for conductive engagement with said plug body in a second position of said plug, a second contact spaced axially from said one end of said sleeve a distance greater than said predetermined distance and urged radially inwardly toward the axis of said sleeve for locking engagement with said recess in said plug tip in said second position of said plug, a third contact connected to said sleeve and connected to said second contact in said one position of said plug but disconnected from said second contact in said second position of said plug, means for connecting said first circuit between said first and second contacts, means for connecting said second circuit between said first contact

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and said sleeve, and means for connecting said third circuit between said plug body and said plug tip.

6. In an electrical system including an audio signal source, a main electro-acoustical transducer and an auxiliary electro-acoustical transducer, means for interconnecting said source and said transducers, comprising: a plug having a body of conductive material and a tip insulated from said body and having a recess therein, a sleeve of conductive material arranged for passage of said plug tip therethrough and arranged to embrace said plug body, a first contact spaced axially a predetermined distance from one end of said sleeve and urged radially inwardly toward the axis of said sleeve for locking engagement with said recess in said plug tip in one position of said plug and for conductive engagement with said plug body in a second position of said plug, a second contact spaced axially from said one end of said sleeve a distance greater than said predetermined distance and urged radially inwardly toward the axis of said sleeve for locking engagement with said recess in said plug tip in said second position of said plug, a third contact connected to said sleeve and connected to said second contact in said one

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position of said plug but disconnected from said second contact in said second position of said plug, means for connecting said source between said first and second contacts, means for connecting said main transducer between said first contact and said sleeve, and means for connecting said auxiliary transducer between said plug body and said plug tip.

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