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Judging Jacks for Real Results

A Change of Connection Sometimes Brings Improvements

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CRYSTAL sets rarely use a telephone jack. The particular advantage of the crystal is that it is very inexpensive and gives good results. Since it is rare to work a crystal with an amplifier (unless it is reflex) there is no chance of using a jack to control the amplifier tube. That is the reason why this unit is seldom seen on a crystal set.

The next step up the ladder is the single tube radio. With such an equipment a jack is often included; as it is quite a convenience to be able to plug the phones in and out. Even here this apparatus is not required and many sets

consumed in tightening up the connections by binding posts, then the test is not of very much value, since the loudness of the music has very probably changed in that time. Of course, if one instrument is greatly superior to the other, such a trial is sufficient to pick out the better instrument. But in these days most all phones on the market work well, and in trying to find out which is the better we must look for small differences in tone. To do this it is absolutely necessary that the change from one to the other be made just as quickly as possible, and any time longer than that required to pull out one plug and push in another is likely to reduce the value of the experiment considerably.

There are other advantages to be gained from using a jack, even on only a single tube set. For instance, in families having small children it is better to pull out the plug and hang the phones up where they are out of the reach of little hands. Otherwise, it will be found that the ear pieces are fine dishes to make mud pies in. Of course, with binding posts the tips can be disconnected, but it is usually so much bother to do this that it is apt to be neglected. A jerk on the plug is all that is needed to remove the head phones when this scheme of connection is used.

Accident Insurance for Set

Still another reason for using this device is found in the fact that

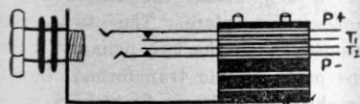


Fig. 1. The Most Popular Jack

use binding posts to hitch the phones to. They are quite satisfactory, but, of course, connecting and disconnecting requires several seconds of time, while plugging in the phones is a matter of half a second. When tests are made with different sets of phones or various loud speakers it is important to use as short a time as possible in shifting from one to the other. An orchestra plays its music with expression and one measure will often be several times as loud as the one before. The same applies to a singer, and even a good speaker will raise and lower his voice to avoid a monotone.

Quick Work for Tests

So if a change from one phone to another is made, when a few seconds are

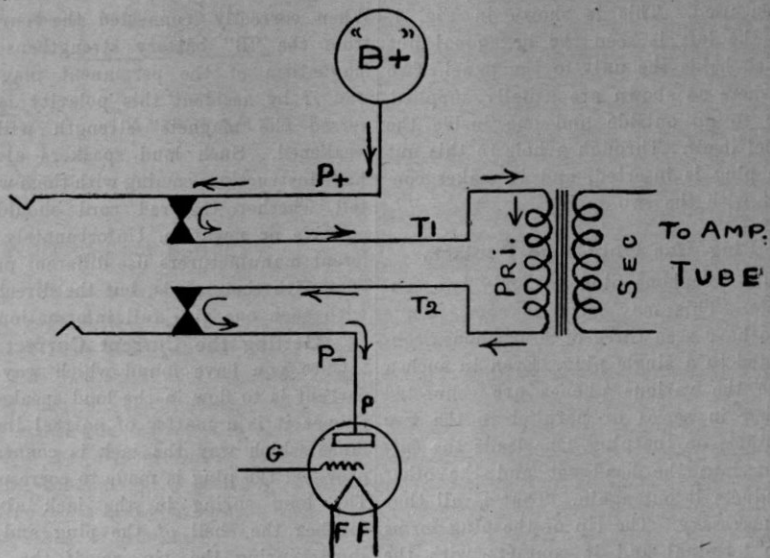


Fig. 2. Hook Up of Jack Shown in Fig. 1

sometimes the telephone cord will get caught in something or will perhaps get twisted around a person's arm or foot. If he makes a quick move the user of the phones will sometimes give quite a jerk to the cord. With the old style of binding post terminals it means that the radio set is very likely to be jerked off the table. But if a jack is used, the plug will flip right out of it long before the pull is heavy enough to shift the set itself. This is almost as good as accident insurance for the set, as it is probable that more radios are pulled off the shelf in this way than in any other.

When it comes to radios with two or more bulbs, it is customary to use jacks for connections for electrical reasons.

contacts with the upper spring. When a plug is inserted these two springs are bent away from the two center contacts and so no longer touch them.

The diagram of connections is shown in Fig. 2. Here the path of the current is traced when the jack is removed. This might represent the detector, or first step, in a two-amplifier set. The polarity is shown so that the shell or tube of the plug is positive and the tip is negative. This is the ordinary method of connection, but it need not be strictly followed. Many people connect up their sets without any regard for the polarity of this unit. In general it makes no difference. However, some of the phones and many of the loud speakers are designed so that the current should run

positive and the plus of the phone should be connected to the shell. In case the connections are reversed at the jack, it is only necessary to reverse the phone connections at the plug to accomplish the same result.

However, there is one advantage in making the long spring plus. Since this is a rather standard convention, it means that if you have several loud speakers to test, or if you wish to use your loud speaker with several sets, then all phones or plugs can be made interchangeable by using this same polarity. When you wish to test out a new speaker, just connect the positive to the shell and you can plug it in detector, first or second step of any set where this convention is observed, and there will be no danger of reversing the polarity of the horn. For this reason we shall maintain this convention through the rest of this article.

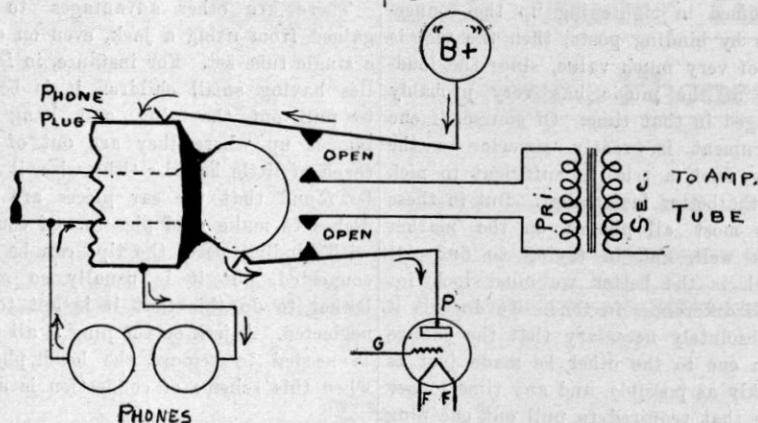


Fig. 3. How Plug Acts as Double Pole Switch

The four terminal unit is the one most often used. This is shown in Fig. 1. At the left is seen the hexagonal nut which holds the unit to the panel. Two washers as shown are usually supplied, one to go outside and one inside the panel itself. Through a hole in this nut the plug is inserted, and it makes contact with the two springs.

Plug Has Only Two Contacts

The telephone plug has only two contacts. This may surprise some people who have seen three or four phones connected to a single plug. Even in such a case the various phones are connected either in series or parallel to the two contacts on the plug. One leads the current into the head set and the other conducts it out again. That is all that is necessary. The tip of the plug forms one terminal and it contacts with the lower spring in the drawing. The shell or tube forms the other terminal, which

through them only in one direction. When correctly connected the current from the "B" battery strengthens the magnetism of the permanent magnets and if by accident this polarity is reversed the magnets' strength will be weakened. Such loud speakers always have instructions coming with them which tell whether the red cord should be positive or negative. Unfortunately different manufacturers use different polarities with their cords, but the directions with each one give full information.

Getting the Current Correct

Once you have found which way the current is to flow in the loud speaker or phones it is a matter of no real importance which way the jack is connected, provided the plug is made to correspond. The long spring in the jack always touches the shell of the plug and the short spring the tip, so if the long spring is made the positive, as shown in Fig. 2, then the shell will always be

How the Transformer Works

Getting back to Fig. 2, we notice that the long spring of the jack is connected to the "B" plus terminal, which will be 22 volts, if this is the detector, or maybe 45 to 90 volts, if an amplifier. The shorter spring runs to the plate of the vacuum tube. If this is the detector of a regenerative set the tickler coil is inserted between the jack and the plate. But in any event, the current finally reaches the plate. The two center springs run to the two primary connections of the audio transformer. Usually it makes no difference which is which. However, if the transformer terminals are labelled "B" and "P" then care may be taken to see that they run to the proper springs so that the battery and plate will correspond with "B" and "P." If these connections should happen to be reversed, our tests have shown that it is difficult to notice any difference.

When the phone plug is out, the course of the current is from the "B" battery plus to the long spring, center spring, then through the primary of the transformer, back to the jack, the short spring, and from there to the plate of the vacuum tube. When the phone plug is inserted as shown in Fig. 3, it raises the two springs and so opens the connections. You will notice that the primary of the transformer, and so the amplifier step just beyond, is entirely disconnected. The current now runs from the "B" plus and long spring to

the shell of the plug, then through the phone cord to the head set, back again to the tip of the plug, and so through the short spring to the plate.

Like Double Pole Switch

By comparing Figs. 2 and 3 it will be seen that the plug and jack act just like a double pole, double throw (d. p. d. t.) switch. When the plug is out it connects "B" plus and plate to the transformer; when plug is inserted it throws the same connections to the phones. In some of the older sets a d. p. d. t. switch was mounted on the panel to do this very thing and the phones and transformer were connected permanently to binding post. Of course, this construction gave just the same electrical results, but was not nearly as neat and required extra apparatus mounted in the cabinet. For that reason this switch idea has been abandoned.

Four-Prong Jacks Obsolete

Although a great many sets are using the four-spring jacks as just described, as a matter of fact they are going out

the "B" battery to point X, where it flows to the right through the primary, then to the center spring and short spring (since the contacts are closed) direct to the plate. When the phone plug is inserted, it opens the contacts just as before, and the short spring rests on the phone tip, as it did in Fig. 3. Since the long spring is omitted, contact is made between the frame of the jack and the plug where the latter is inserted through the hexagonal nut. The course of the electricity is as follows: Starting from the "B" plus, it goes to the left at point X, out through the shell of the plug (not shown), back through the tip, into short spring, and the tube plate. The audio transformer is disconnected, since the short spring is raised, so breaking the contact.

The advantages of this two-spring jack over the four-spring shown in Figs. 2 and 3 are twofold. In the first place, when the plug is withdrawn, thus connecting in the primary of the transformer, there is only one pair of springs and contacts in circuit instead of two. This cuts the contact resistance down to

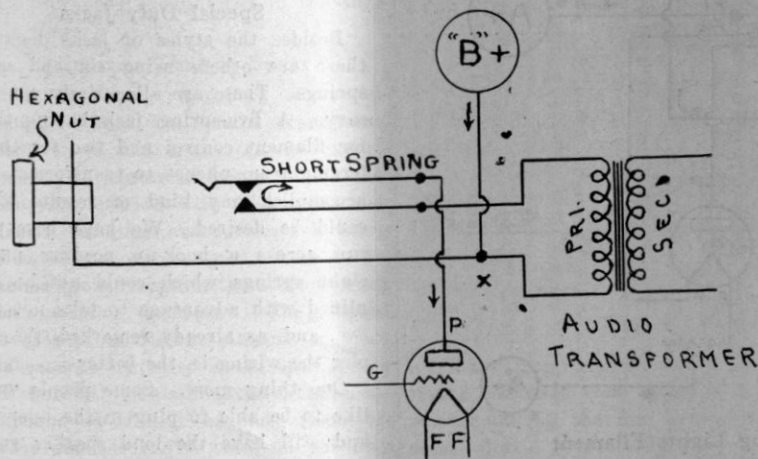


Fig. 4. A Two Spring Jack Does Work of Four Springs

of style as fast as radio fans realize that two-spring jacks are really a lot better. The connections for such a unit are shown in Fig. 4. This differs from the unit in Fig. 2 in that it omits the long contact spring, and the one that mates with it. The short spring is connected to the plate of the vacuum tube just as before. The frame or body of the jack runs to the "B" plus battery, and also to one of the primary terminals of the transformer. When the plug is withdrawn current runs from

half of what it was before, and also greatly reduces the chance of trouble at the jack. The other advantage is that when the jack plug is inserted, thus making use of the phones, only one spring contact is made. The shell does not have to depend on a spring for carrying the current. Instead, it uses the large brass hexagonal nut, which has a large area of contact.

Last Step Connections

It will be noticed that the hook-ups

of Figs. 3 and 4 were mentioned as being for the detector or first step. The last step of an amplifier, of course, can not run to a transformer beyond, because if it did it would not be the last step. If we assume that a three-tube radio is being considered, then two of the jacks will be connected as shown, but the third will have only two wires running to it, one from "B" plus and the other from "P." A jack like either Fig. 3 or Fig. 4 is suitable for use in

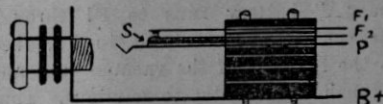


Fig. 5. Automatic Filament Control

the last step merely by leaving out the connections which are shown running to the transformer. As a matter of fact, we prefer to use the same kind of jack for both steps, since it saves getting two different styles of unit, and in case it were later decided to change the hook-up of the set, then such jacks could be used for either purpose. However, some builders prefer to use a special style of end jack. This looks like Fig. 4, except that the middle spring is omitted.

Control Jacks

In some sets the rheostat is used to turn off the filament current when the last station signs off. Others use a snap switch. But some people don't want to be bothered by these means, and so install an automatic control jack. Of course, one advantage of such control is that there is no danger of forgetting to snap off the switch, and so leaving the battery running all night. Once the phones are pulled out of the set you can be positive that everything is dead. Such a control device is shown in Fig. 5. Here only one spring is used, which means that this jack would be the last step in an amplifier circuit. Of course, if it were to be an intermediate jack, then another spring would be used, as was illustrated in Fig. 4. It is omitted here to simplify the appearance of the unit.

It will be observed that above the short spring "P" are two other springs carrying contacts which mate. This pair is separated from the lower part of the jack by a strip of insulation, "S," which is flexible. When the plug is withdrawn the contacts are separated, as shown, but when it is inserted it raises the

spring and with it strip "S," which makes contact F2 touch F1.

Hook-up of Control

The hook-up of such a control jack is shown in Fig. 6. The frame of the jack runs to "B" plus, just as it did in Fig. 4, and the short spring is connected to the plate. Thus the action of the "B" battery is no different from what it had been before. F1 and F2 are inserted in the filament circuit. The current from the "A" battery runs to F1 through the contacts when closed to F2, then to the filament of the vacuum tube and through the rheostat to A minus. Thus when the plug is inserted the filament is lighted and when it is withdrawn the set is turned off. Only one tube is shown in this drawing, but the same jack can control any number of filaments in parallel. If the set is a mod-

lighted, but only up as far as will be needed for use. That is, when the detector only is connected, then the other tubes will be extinguished. Such operation can not be obtained with the kind of jack illustrated in Fig. 6. This latter uses only two springs for filament control, whereas three are needed. A unit to take care of these conditions looks like that of Fig. 6, except that a third filament control spring is added on top. When the plug is out the middle and lower springs touch, but when it is in, the middle and top springs contact. The diagram of connections for this scheme is not shown here, as it is always included with the particular style of jack which is purchased.

We Do Not Recommend It

Personally, we are not particularly inclined to its use. In the first place, it is somewhat more complicated and the

for any ordinary stations there is no need of using anything but the last step. If, however, a loud local station is wanted, then the final step may give too much volume. This is a good place to change to a lower amplification, but about the same results may be obtained by cutting down on the feedback or reducing the coupling of the set or making some other adjustment which will reduce the volume of the sound.

In case it is felt that it is necessary to use the next to the last step, a filament control like that of Fig. 6 can still be used, provided there is no objection to leaving the last tube burning when not in use. This is not a serious objection, as the current taken by the modern tubes is small. However, it is admittedly a waste of electricity to have it lighted when the earlier step is being listened to. To get around this difficulty and still use simple connections it is possible to put a separate rheostat in the filament circuit of the last tube and turn it out by the rheostat when not in use. Of course, when the plug is withdrawn the last tube is disconnected like any of the others.

Special Duty Jacks

Besides the styles of jacks described there are others using six and seven springs. These are all entirely unnecessary. A five-spring jack having three for filament control and two for transferring from phones to transformer will accomplish any kind of results which could be desired. We have never yet run across a hook-up needing six to eight springs which could not be simplified with advantage to take not over five, and, as already remarked, the simpler the wiring is, the better.

One thing more. Some people would like to be able to plug in the telephone and still have the loud speaker going. It will be a surprise to many that this can be done very simply. All that is required is to use a double spring jack (any number more than this will do) and insert it in series with the primary of the audio frequency. When the phones are out the current will run through the jack contacts direct to the transformer and so operate the loud speaker. When the plug is inserted it will cut the phones into series connection with the transformer, but the latter will still be operating and so both phones and speaker will be heard at the same time.

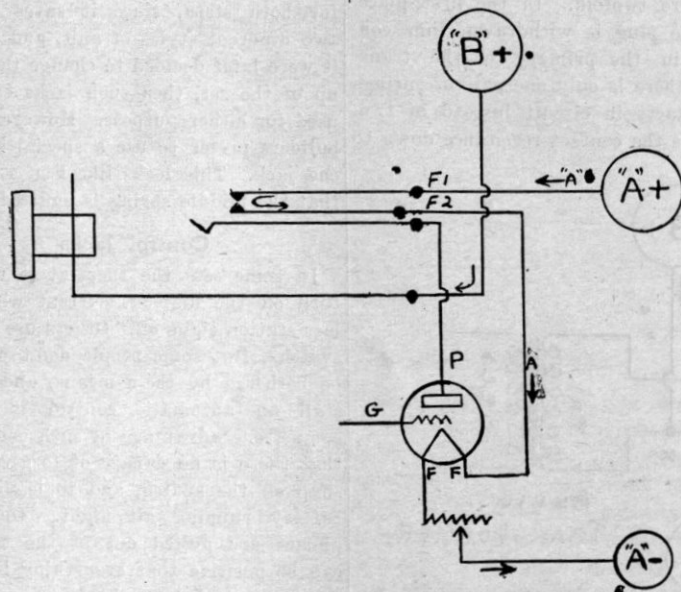


Fig. 6. Why Inserting Plug Lights Filament

ern one, which uses only one rheostat, as was described in the August 15 issue of RADIO PROGRESS, then the latter can be set to the proper point to give the right current to all the tubes, and when through using the radio the plug is pulled without touching the rheostat. When ready to listen again, inserting the phones turns on everything and the rheostat is not touched until the battery has dropped enough in voltage to require further adjustment.

Some sets are built so that by plugging into successive jacks the tubes are

general tendency is to simplify sets as much as possible. Furthermore, the majority of radios operate practically all the time on full strength. We have seen many a set with three or four jacks and only the last one shows any evidence of being used. It is rare that a receiver with a good loud speaker ever is used with phones except for getting the most distant stations which can not be heard well on the horn. In such a case, of course, the last step is always used, since the trouble is that the reception is not loud enough already, so