Subject: Dead field coils
Posted by Wayne Parham on Sat, 13 Mar 2004 20:17:51 GMT
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If you've got a radio that has all the filaments glowing but still doesn't make a sound, check the field coil. Since a lot of us have never seen a speaker with a field coil except in old tube radios, it's easy to forget it's there. Even a pretty good technician might overlook this if they're not used to working on the old stuff. So if you've got an old radio and it looks like everything should work but it doesn't - You've swapped all the tubes and caps and still no sound - It may have an open field coil.These old radios have four wires going into their speakers. Two of 'em are the voice coil but two are the field coil - An electromagnet that does the same job that the fixed magnet does on more modern speakers. This usually doubles as a power supply filter coil, and sometimes there is also a "humbucking coil" that has an out-of-phase AC signal to cancel hum. If something smoked in your radio's long life, then it may have presented an over-current situation to the supply. Your field coil may have passed current into a short circuit and opened up.So now what do you do? Do you replace the speaker with a modern fixed magnet kind and short the field coil connections to complete the power supply current? You can do this, but maybe use a resistor betwen 200 and 2K ohms instead. That will help filter the supply, providing the "R" part of an RC filter. But you might also consider rewinding the field coil.Yuck you say? Yes, yuck, you're right. But if you can unwrap the old field coil, you may be able to do it. And if you've actually gone through this process, you'll be really proud of this radio when it's playin' again.Field CoilNotice this speaker has four wires coming into it. Two go off to the left into a transformer, which is the output transformer that matches the high output impedance of the amplifier tube to the low impedance of the speaker's voice coil. The input of the transformer comes from the tube, and its output goes to the speaker's voice coil. This voice coil connection is just like any ol' speaker you'd get today.You can't see the voice coil in the photo above - It's inside the coil you can see, which is the field coil. The field coil looks just like a bobbin of thread, in this case, orange. Stock is usually brown laquer, but my re-wire job adds a touch of color. The two wires coming into this speaker on the right side connect to the field coil. So if you measure across those two wires in a working radio, you'll see 200 to 2000 ohms. If it's open, you've got a problem.Usually, there is tape covering the field coil. It's often a paper tape, sort of like brown wrapping paper or masking tape. If your field coil is poofed, remove that tape. You'll find a spool of very thin wire, just like the picture shows, but probably brown. Unwind it. And unwind it and unwind it and unwind it...If you're lucky, your bobbin rotates easily in the basket and is in good shape and sturdy. This will help you wind a new field coil. Your job now will be to procure some 24 or 28 guage enamel coated magnet wire and spend the next week hand winding this thing. Lots of places have it, you can probably get a spool locally. It comes in various sizes and types, different insulation materials, etc.Try to match up the size with what your radio had to begin with. If you don't know, 28 guage is probably good for small table radios, 24 might be better for larger radios and power hungry tubes. But the most important thing is to get a good color. If you can't find it locally, check Antique Electronics for 24 guage or 28 guage magnet wire. They've got it for sure.Now for the really fun part. Starting with a clean bobbin, use a very small, thin piece of tape to hold one end of your wire in place. Leave a good 6 inches sticking out and be careful not to cover it up as you wind. Then just start winding. Hopefully, once you get going, you can rotate the bobbin and pull the wire from one side. That's really the only way to do it, 'cause even doing it that way will take 20 or 30 hours by hand. If you try to thread it through, it will take even longer. So hopefully your bobbin will rotate and you can wind it that way.Don't worry about filling a layer before starting the next. Uniformity of winding is

desireable, but not required. If this were a high-fidelity speaker, then you might be more concerned with keeping it uniform. But in this case, just try to keep the wire from bulging too much in the center or anywhere. When you can see that you're thick in one area, focus on another so that the coil is reasonably uniform in thickness. Keep winding until you've matched the size of the original coil. That will usually be when the wire form is within 1/8" or 1/4" or so from the edge of the bobbin.I wound mine in spurts of an hour or two at a time. When you're watching TV in the evenings, make that a winding session and then put it away. That way you don't feel overwhelmed with the amount of turns. Just do an hour a day, or maybe two, and do it while watching TV or listening to some music or the radio. After a few days or a week or two, you'll have filled out the bobbin and you'll finish relatively painlessly.After it's wound, secure the open end by tacking it with a dab of glue. Just a spot of glue will do, something like weatherstrip adhesive or silicon sealant. Anything that will adhere and form a semi-permanent spot. We're not trying to cover the spool here, and while we want it to last fifty years, we also want to be able to remove it if someone ever has to do this again.Now you have two tiny little delicate wires sticking out of this thing, and you have to connect those to big ol' 18 guage stranded wires. My suggestion is to use a terminal strip, like the one shown in the photograph above. You can pick those up at Radio Shack, or get 'em at Antique Electronics along with your magnet wire. I soldered mine directly to the speaker basket, and that made the terminal strip a permanent part of the speaker. You can also screw it down. Either way, this gives you a convenient connetion method that protects the fragile magnet wire by acting as a strain relief.Now for the moment of truth. You've spent a week winding your field coil, and now you're going to see how fast you can burn it up and make it into a heap of bubbling enamel and melted copper. I trust you've checked the rest of the circuit, so you can be reasonably confident this won't happen. If not, you might consider checking it now. Even if you've already tested everything else out, this might be a good time to do a final double-check.You can always power up the radio using a resistor in place of the field coil. So temporarily install a 100 ohm half watt resistor in-circuit instead of the field coil. A couple of test leads with aligator clips will come in very handy right about now. Power up the radio and check the voltage across your 100 ohm resistor - That will tell us how much current your radio's pulling from the supply. Consider absolute maximum ratings of 0.5A for 28 guage wire and 1.3A for 24 guage. So if your 100 ohm test resistor has less than 50 volts across it, your coil will be fine.Now for the real moment of truth. Relax. If you've done all this stuff, your radio will work just fine. Remove the test resistor and connect the field coil in its place. Power it up and enjoy. I've never been more proud of any of my old restorations than the one with the bright orange field coil I wound. I'll bet you feel the same way.

Subject: Re: Dead field coils
Posted by wunhuanglo on Sat, 27 Mar 2004 01:30:50 GMT
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Interesting post. How do you know how many turns to go for? Do you target a length that gives around 1Kohm resistance? Or do you just fill up the bobbin?

Subject: Re: Dead field coils
Posted by Wayne Parham on Sat, 27 Mar 2004 08:50:30 GMT
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I just filled up the bobbin. I did test to make sure that current wouldn't be excessive, but beyond that, I just wound 'till I was sick of winding.