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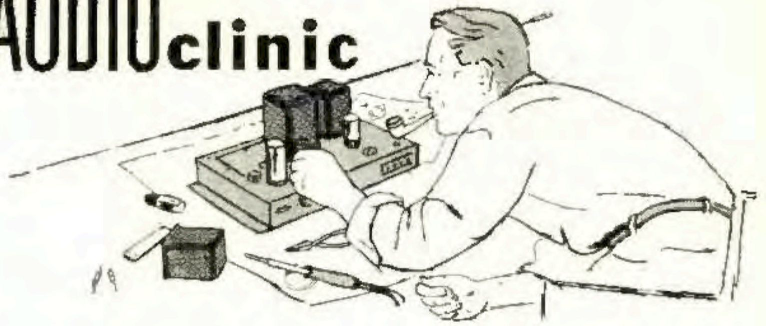

JOSEPH GIOVANELLI*

Measurement of Feedback

Q. How does one measure the amount of feedback that an amplifier possesses? S. Mogieleff, New York, New York.

A. It is very easy to find out how much feedback you are using. All you need to do is to connect an a.c. voltmeter to the output of the amplifier and connect an oscillator to the input. The amplifier's output should be loaded with a resistor whose value is equal to the impedance of the output transformer tap to which it is connected. Proceed as follows:

1. Disconnect the feedback circuit at the output transformer.
2. Temporarily return this feedback circuit to ground.
3. Set the oscillator to 1000 cps and gradually feed the tone into the amplifier until the meter reads full scale. In so doing, be sure that the amplifier is not producing more power under these conditions than can safely be handled by the tubes, output transformer, and external load resistor.
4. Without changing any knob setting, introduce feedback and read the voltage indicated on the a.c. meter.

The ratio of the voltage obtained without feedback to that of the voltage with feedback can be expressed in db when you remember that db equals 20 times the log of that ratio. Of course, if your a.c. meter has a db scale, all you need to do is to read that ratio directly in db.

If you wish to know whether the feedback is uniform at all frequencies, you may apply the above procedure to any frequency desired and note the different ratios.

Even though this information is interesting to know, it is not important in evaluating the overall performance of the amplifier. What's really important is that the amplifier should have a wide and flat frequency response, should be free from ringing, and should exhibit low distortion

What you must do to obtain maximum feedback without amplifier instability is to proceed as follows:

1. Adjust the value of the feedback resistor to produce feedback which is 6 db below the point at which the amplifier oscillates.
2. Then choose a value of capacitance large enough to eliminate high frequency ringing, but small enough to leave the upper frequency response unrestricted to as great a degree as possible.
3. At this point, it may be possible to increase the amount of feedback and still be 6 db below the point of instability.
4. Then further experimentation with the feedback capacitor is possible.

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Drift in FM Tuners

Q. After purchase of my tuner I noted that there was considerable drift for the first 30 to 45 minutes of operation. Does this suggest that this tuner has defective circuitry? If so, which circuit would most likely be involved? What suggestions can you offer to ascertain the cause of such drift in a new tuner that should have no drift according to the advertisements relating to it? What steps are necessary to improve the situation?

I was led to believe that with this tuner there would be no drift even from a cold start. The tuner has operated perfectly in all other respects.

I know that I should have notified the manufacturer of this defect during the warranty period, but I failed to do this and it is too late now. Edgar E. Hamer, M.D., Downey, California.

A. The drift of which you wrote is caused by improper temperature compensation—at least that is the most likely possibility. When a tuner warms up, the gradual buildup of heat causes expansion of the elements of the oscillator tuned circuit. This leads, in turn, to a change in circuit capacitance. The amount of this change will determine the drift of the particular circuit. To add to this, heating of the tubes (particularly the oscillator tube) will cause a change in interelectrode capacitance. This capacitance forms a part of the tuned circuit of the oscillator and, therefore, is contributory to the drift.

To offset these effects, we usually add a temperature-compensating capacitor either across the oscillator section of the variable capacitor or as the grid leak capacitor, or both. The capacitor placed across the variable capacitor should have a value of 1 or 2 mmf and should be negatively or positively compensated according to the direction of the drift.

If the oscillator frequency increases with temperature increase, it is an indication that the overall circuit capacitance decreases with an increase in temperature. To compensate for this a capacitor must be added whose value increases with increasing temperature. A capacitor designed for this purpose is said to have a positive temperature coefficient. Conversely, if the oscillator drifts downward with increasing temperature, it indicates that the overall circuit capacitance increases as temperature increases. This effect can be offset by the incorporation of a capacitor whose value decreases as temperature increases. Such a capacitor is said to have a negative temperature coefficient.

These temperature-compensating capacitors are available in a variety of different capacitance values and in various degrees of compensation. To illustrate, a 1-mmf capacitor would be designed to drift 0.001 mmf per degree centigrade; another might be designed to drift 0.0004 mmf per degree centigrade. The reference temperature is 20 degrees centigrade.

It is unlikely that this manufacturer failed to take this drift into account when designing your tuner. Probably one of the temperature-compensating devices in your tuner is defective.

Curing the difficulty consists of trying capacitors having various amounts of compensation until you hit upon the one which stabilizes your tuner. Realignment of the oscillator will probably be needed with the introduction of each new capacitor.

This, however, is not the only source of drift in an FM tuner. It is possible that the emission of the oscillator tube is falling off—changing as the tuner is warming up. This will cause a change in the effective interelectrode capacitance and hence lead to drift. The cure for this is to replace the oscillator tube.

Another possible source of drift stems from a weak rectifier tube. Changes in plate voltage applied to the oscillator will cause drift. Bear in mind that any thing done to an oscillator circuit will alter the frequency to some extent.

Noisy Power Transformers

Q. The power transformer on my power amplifier produces a loud and annoying buzzing sound that I assume is due to a loose lamination or winding. I cannot detect any vibration of the laminations by touching the outside of the transformer. My attempts to tighten the lamination and mounting nuts have had no effect on the sound.

I have never taken a power transformer apart and I wonder if by so doing I can locate the source of the trouble without ruining the transformer. This transformer has been in this condition since I bought my amplifier. H. H. Rosen, Montreal, Canada.

A. Some transformers are extremely noisy when they are mounted on a steel chassis because of their high magnetic fields. These fields induce voltages into the chassis which cause an attraction and repulsion between the transformer and the chassis. This condition can be cured by mounting the transformer on spacers to raise the transformer above the chassis, thereby cutting down on the attractive force between the two.

Sometimes transformers are loose because the core is not solidly held inside the coil. Frequently this condition can be cured by removing the outer shell and inserting fine wedges between the core material and

(Continued on page 100)

AUDIOCLINIC

(from page 4)

the coil. This must be done carefully, however, or the wedge will cut through the insulating paper and possibly break or short-circuit some of tho turns. This will ruin the transformer.

As a general rule it will do no good to pour resinous material into the laminations, for this is usually done in a vacuum which enables deeper penetration. It is occasionally possible, but it is very messy, and it is often impossible to separate the core from the laminations without completely dismantling the core. The dipping would then serve no purpose. Æ