SOUND TALK

FROM THE MAKERS OF "SCOTCH" BRAND MAGNETIC TAPE

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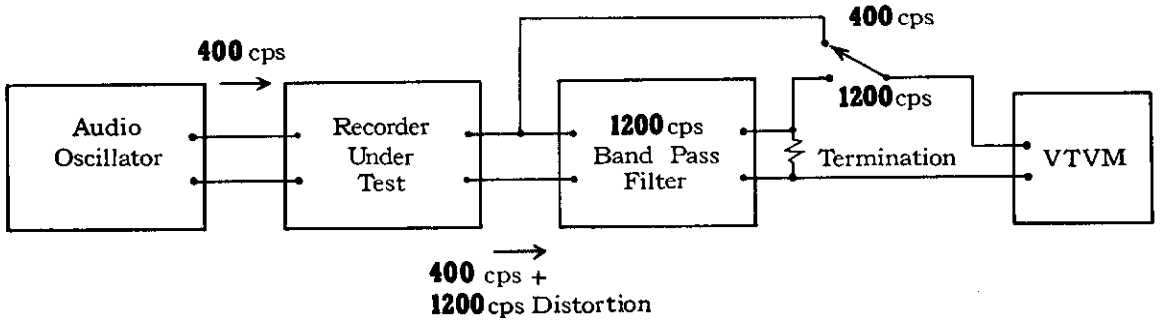
MEASUREMENT OF HARMONIC DISTORTION WITH A FILTER

There are many occasions when it is desirable to measure the amount of distortion in a magnetic recording system. For instance, in determining the maximum permissable recording level which can be utilized in a recording machine, or in evaluating different tapes, the distortion is an important consideration. It is customary to operate a recorder at the highest possible recording level without exceeding the allowable distortion limits. Since this level depends upon many variable factors such as the properties of the magnetic medium, the bias current, the recording heads, and the gain characteristic of the recording amplifier, the accurate setting of level in a professional recording machine is a field adjustment which should be checked periodically. The method of measuring distortion with a band pass filter greatly simplifies this operation, and can be accomplished with a minimum of equipment.

It has been well established that the principal distortion resulting from magnetic tape overload is the third harmonic component. Therefore, a most satisfactory test for this condition is to record a pure sine wave signal and to measure the resulting third harmonic distortion. This is most easily accomplished by separating the third harmonic component from the fundamental with a filter and measuring it directly wih a vacuum tube voltmeter. A typical setup is shown in Figure 1.

Fig. 1
Block Diagram of Distortion Measuring System



The equipment required is an audio oscillator with good waveshape, a vacuum tube voltmeter capable of reading over a fairly wide range of voltage, and the band pass filter. Since it is customary to measure distortion at 400 cps, a 1200 cps filter is ideal for this use. However, a 100 cps or a 5000 cps filter, these being more common types, can easily be substituted if the test frequency is suitably adjusted. The filter should have a rejection of at least 60 db at the fundamental test frequency if highest accuracy is to be obtained.

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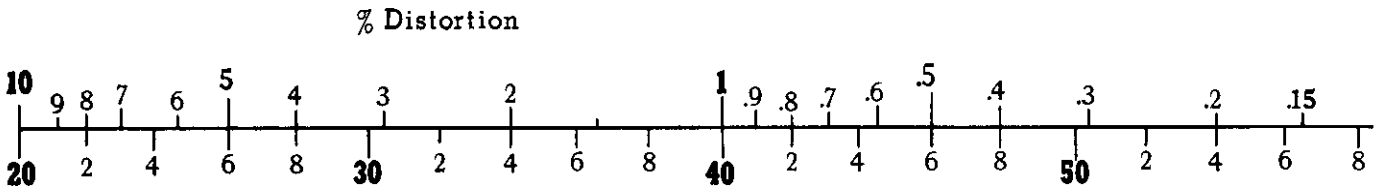
Before making the test it is necessary to calibrate the system to take into account the insertion loss of the filter. Since the input termination will affect this value, it is best to calibrate the filter from the actual recorder under test. To do this, the filter is disconnected and the output level of the recorder checked at 400 cps and 1200 cps to determine if it is the same at these frequencies. If not, the input to the recorder must be readjusted at one of the frequencies to compensate for this discrepancy. The filter is then connected to the recorder, and level reading taken at 400 cps at the input to the filter, and at 1200 cps at the output of the filter. (The input level to the recorder must be readjusted, if necessary, as previously determined.) The difference between these readings in decibels is the insertion loss of the filter.

In making the actual test, the 400 cps signal is fed through the recorder and level readings taken at both the input and output of the filter. The difference between these readings in db minus the insertion loss of the filter is the true ratio between the signal and the 3rd order harmonic component. This can be converted to percent by reference to the alignment chart of Figure 2.

Fig. 2
Alignment Chart for Converting Decibels
To % Distortion



Once a particular system is calibrated, and the insertion loss is known, this step need not be repeated in subsequent tests. With a little practice, distortion measurement can be taken very quickly. All that is necessary is to patch in the oscillator, filter and voltmeter and take two quick readings.