SOUND TALK

FROM THE MAKERS OF "SCOTCH" BRAND MAGNETIC TAPE

Bulletin No. 6

# EFFECTS OF TAPE CONTACT ON FREQUENCY RESPONSE

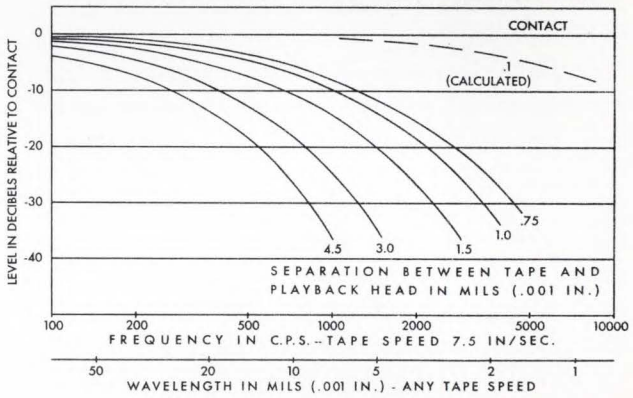
In magnetic tape recording with present day ring type record and reproduce heads, it is essential that the tape maintains an excellent and unvarying intimate contact with the head. This is generally recognized by everyone, but data on the consequences of poor contact have not been generally available. Some of the data in this bulletin was presented by Robert Herr of our Physics Laboratory at the May, 1948, convention of the Society of Motion Picture Engineers in a paper by Herr, Murphey, and Wetzel entitled, "Some Distinctive Properties of Magnetic Recording Media", but this has not yet appeared in the Journal of the S.M.P.E.

The principal effects of poor contact between tape and head in play back appear at high frequencies. This is because the field from poles in the tape falls off with distance from the tape more rapidly when the poles themselves are close together. There are also serious effects in recording which are more complex. They depend upon the geometry of the record head and include poor high frequency response due to a less abrupt decrease in fields at the second edge of the record gap and distortion from variations in bias from the optimum value. The data in this bulletin refer only to play back, but it should be recognized that there may also be approximately equal effects at the record head.

In these tests a tape was recorded with various frequencies and played back on a good system with good contact. Then the same tape was played back several times with various paper shims covering the playback head so as to separate tape and head by known amounts, and the level recorded for each frequency and separation. From these data, Figure 1 was plotted.

FIG. 1

SIGNAL ATTENUATION CAUSED BY POOR CONTACT IN PLAYBACK AS FUNCTION OF FREQUENCY (OR WAVELENGTH) FOR VARIOUS SEPARATIONS.




These curves show the attenuation caused by various separations of tape and playback head. On the frequency scale the data are plotted as for a tape speed of 7.5 in./sec., but it should

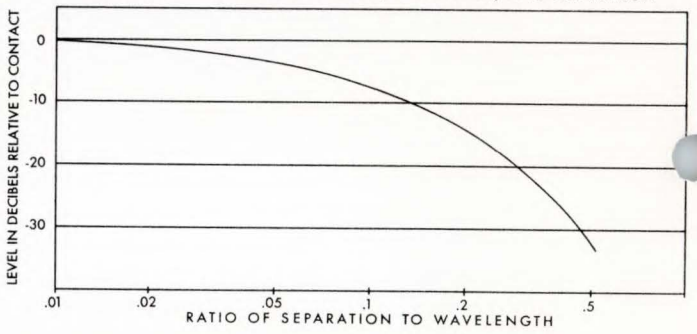
be remembered that this is not a frequency but a wavelength effect; for a given separation the same attenuation will result at 5000 c.p.s. and 7.5 in./sec., 10000 c.p.s. and 15 in./sec., 2500 c.p.s. and 3.75 in./sec., etc. The wavelength scale shown below the frequency scale is, therefore, more significant and is true for any tape speed.

Examination of these data shows that the attenuation depends most fundamentally upon the ratio of the separation to the wavelength. Thus, for example, the same attenuation results from a 10 mil wavelength and 1 mil separation as for a 45 mil wavelength and 4.5 mil separation. This consideration leads one to plot Figure 2, which the attenuation is plotted against this ratio of separation to wavelength. This curve is universally applicable for any speed, frequency, and separation. From it one can compute the data for very small separations and this was done in Figure 1 where the dashed curve for a separation of .1 mil (2.5 microns) is shown. This curve may not be strictly accurate, but shows an order of magnitude.

Of course, these attenuations are only part of the

FIG. 2

SIGNAL ATTENUATION CAUSED BY POOR CONTACT IN PLAYBACK
UNIVERSAL CURVE FOR ANY SPEED, FREQUENCY, AND SEPARATION




high frequency losses due to gap effects, demagnetization, head misalignment, etc., but it may be seen that extremely small deviations from perfect contact can have very serious results in the high frequency response. To minimize them the head must be smooth and have curvature in one plane only; the tension (or pressure) must be adequate, and the tape must be smooth and flexible. This latter requirement may best be met, while retaining adequate strength, by 3M plastic backed tape and is one reason (in addition to lower noise) that plastic tape gives results superior to those obtainable with a similar paper-backed tape.