

TALK

SOUND

FROM THE MAKERS OF "SCOTCH" BRAND MAGNETIC TAPE

Bulletin No. 24

July, 1953

A. C. ERASURE OF MAGNETIC TAPE

The most widely accepted method of erasing magnetic tape is by the use of alternating magnetic fields. These fields may be applied to the moving tape by a conventional erase head just prior to recording, or to a complete roll of tape by a large electromagnet. While this method offers a very satisfactory and non-critical means of removing recordings from the tape, nevertheless it has certain limitations and peculiarities which can be most easily understood by referring to the fundamental principles of erasure.

Theory -- A good A.C. erasing system should remove all traces of previous signals, and also leave the tape completely demagnetized to minimize noise and distortion. The first of these requirements is accomplished by "saturating" the tape in a strong magnetic field which essentially orients all of the magnetic domains regardless of their previous magnetic histories. Upon removal of the field the tape magnetization may change, but will no longer assume any ordered pattern associated with a previous signal. In order to fulfill the second requirement, the removal of the tape from the saturating field must be accomplished while the field is cycling and gradually diminishing in amplitude. If the reduction in amplitude does not exceed about 10%

during any complete cycle, the tape will emerge completely demagnetized. In A.C. erasure, the tape is passed near a stationary electromagnet and the gradually diminishing amplitude results from the fringing field in the region where the tape leaves the magnet.

Practice -- In passing from this simple description of erasure to actual practice, one must take into account a few complicating factors. In the first place, there is no such happy condition as "saturation" in practical tapes. This is particularly true when considering erase problems where a residual signal even 60 db below normal levels may be troublesome. Most erase systems are designed to reduce any normally recorded signal to a level somewhat below that of the tape noise, but this does not assure that a heavily recorded signal, such as a switching transient, will be completely obliterated. At the same time, one cannot correctly call such a heavily recorded signal "unerasureable", for it can be easily removed by a more intense erase.

Of course, it goes without saying that the erasing head must cover the entire track occupied by the signal in order to accomplish erasure. Many cases of poor erasure can be traced to mis-

Magnetic Products Division



"SCOTCH" is a registered trademark of the 3M Co., St. Paul 19, Minn.

alignment of the erase head, or incompatibility of the system, such as in playing a dual track recording on a full track machine.

If the erase head current has any extraneous signals or distortion, these may be recorded on the tape, or may prevent complete demagnetization. Particularly troublesome are 60 cycle and D.C. signals which may enter the system through leaky coupling capacitors.

Orientation -- It has been demonstrated experimentally that the direction of the erasing field is a matter of considerable importance in the effectiveness of the erase. There is a very definite "easy" direction of erase coinciding with the longitudinal axis of the tape. Whereas field intensities in the range of 1,000 to 1,500 gauss are usually sufficient to erase the tape in the easy direction, transverse or thicknesswise fields must be well over 2,000 gauss to accomplish this same effect. This explains why 60 cycle bulk type erasers require rotation of the reel to expose each segment of the tape to a longitudinal field. If a sliding motion were employed, certain segments would be exposed only to thicknesswise fields, and incomplete erasure would result. There is, of course, no problem with orientation when using a conventional erase head.

Speed -- The matter of slow removal from the A.C. field mentioned previously is an important consideration in the use of a 60 cycle bulk eraser. Careful experiments reveal that the linear speed of tape should not exceed about 1 or 2 inches per second when using such a device. Higher speeds result in actual recording of the 60 cycle field, and should the motion be jerky, annoying noise "bursts" which repeat each revolution of the reel may result. When removing the reel it is important to slide it carefully away from the eraser, avoiding an abrupt "break away" from the field. Turning the eraser off while the tape is in close proximity should be avoided as it may leave very large amplitude pulses on the tape. In the case of a 10-1/2" reel of tape this erasing process will re-

quire at least half a minute if properly done.

Two passes -- Failure to achieve complete erasure in a conventional erase head system may be due to regeneration effects taking place just after the tape leaves the erase gap. The fringe erase field may act as bias, and cause rerecording of the weak field resulting from proximity to the fully magnetized tape entering the gap a short distance away. This effect is most pronounced when the erase head gap is small, and usually cannot be eliminated by increasing the erase current. However, such a residual signal is easily erased in a subsequent pass through the same system because the fully recorded signal has been previously removed. This simple two pass test will easily distinguish regeneration trouble from inadequate field intensity which may also cause faulty erasure. Several commercial recorders have dual erase head gaps which eliminate trouble from this cause.

Summarizing the above discussion, the following hints may be helpful in obtaining the best erasing results.

On machines:

- Check alignment of the erase head with respect to that of the record-play head.
- Check erase head current for proper form, and absence of hum and D.C.
- Check oscillator tubes and tuning to assure proper amplitude of erase current.
- If recordings are not erased clean in one pass, repeat the erasure.
- Avoid recording heavily overloaded passages and switching transients.

On 60 cycle bulk erasers:

- Use only a slow steady rotating motion.
- Slide the tape from the eraser when removing.
- Avoid turning off the eraser with tape in contact.