SOUND TALK

FROM THE MAKERS OF "SCOTCH" BRAND MAGNETIC TAPE

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PROBLEMS IN PLASTIC REEL DESIGN

In recent years, improved magnetic recorders and tapes have made possible the attainment of high quality recordings at the 7.5 inches per second tape speed. The natural result of this has been an increasing trend toward professional use of the 7 inch reel of tape, focusing considerable attention on some of the limitations of present 7 inch reel designs.

Recognizing this, Minnesota Mining & Mfg. Co. engineers have produced an improved 7 inch reel, designed to overcome many shortcomings of the reels now in use. This new reel design is based upon exhaustive studies and tests carried on in cooperation with leading recorder manufacturers and recording engineers over the past few years.

Historically, the present 7 inch reel designs were the first to be used for magnetic tape, and were adopted with only minor changes from the 8 mm motion picture reel. In the subsequent development of the magnetic recording industry many problems with this reel have become evident.

1. Timing errors -- It is most essential that the running time of recorded radio programs be accurate.

2. Warpage -- This "wandering" of the tape can also cause poor frequency response from misalignment at the play gap.

3. Uneven winding -- This uneven winding leaves unprotected turns of tape protruding from the roll resulting in nicked edges and possible breakage.

4. Insufficient room -- Studio experience indicates that the most desirable place for information about a recording is on the reel rather than on the box or a separate sheet.

5. Difficulties in fast threading of the tape on the reel -- A faster, more positive method of threading would save valuable time in cuing up a recording.

The timing error problem is perhaps the most serious consideration, and is illustrated in Figure 1, which shows typical speed changes for a number of recording machines. It can be seen that recorders tend to speed up at the beginning of a reel due to high tension on the wind-up side, and slow down at the end due to high tension on the supply reel. Larger hub diameters are definitely indicated as the solution to this problem. The amount of improvement can be estimated by comparing the speed variation corresponding to some larger hub diameter with that of the standard 1.75 inch hub.

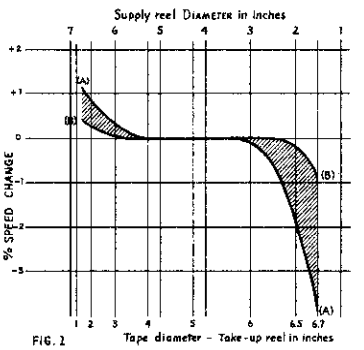

FIG. 2

However, increasing the hub diameter leads to still another serious consideration. Since the outside flange diameter is fixed at 7.00 inches due to the design features of many commercial machines, the larger hub can only be attained at the expense of winding space. This problem is illustrated by Figure 2, a nomograph showing the effect of hub diameter and tape thickness on the radial clearance between the outside turns and the reel flange ("E" value). The length in all cases is assumed to be 1,220 feet, the usual

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commercial practice for a 1200 foot minimum length. Since the maximum tape thickness has been standardized at 2.2 mils, this must be considered as the worst condition from which to view the reel space problem. It is apparent that under these conditions, the view 2.75 inches hub leaves only a dangerous .020 inch clearance, the 2.25 inch hub, a comfortable .10 inch and the old 1.75 inch hub a full .18. The problem then resolves itself around the question of a safe minimum E value, and it would appear that the .020 inches afforded by the 2.75 inch hub must be ruled out on this account. Indeed, the .10 clearance for a 2.25 inches hub may prove somewhat inconvenient, but in view of the attendant advantage in timing, this figure seem to be a good compromise. Therefore, a 2.25 inch hub diameter has been adopted for the new reel.

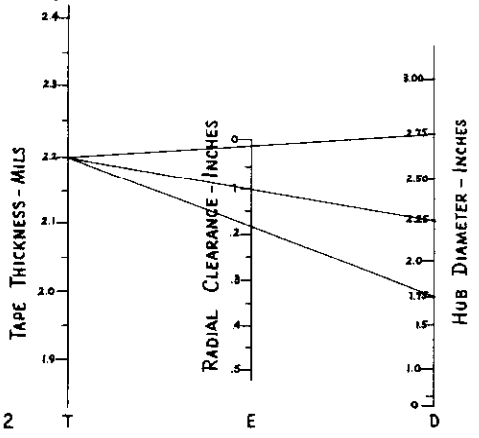
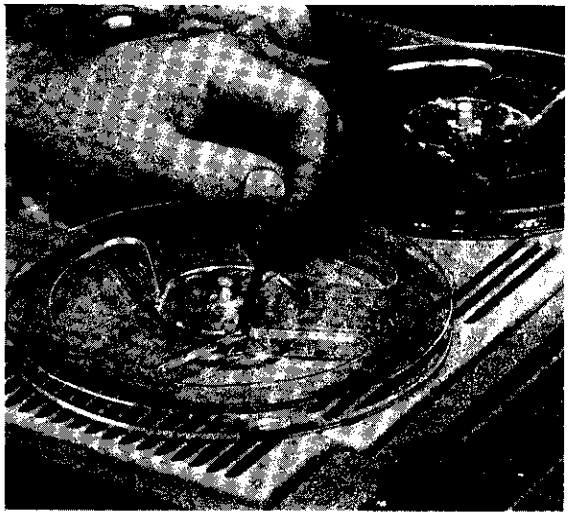


FIG. 2

The problem of warping again brings up consideration of metal reels. While metal is more heat stable than plastic, experience has shown that permanent deformation through bending is much more serious in metal reels. Metal reels also tend to be heavier and have greater inertia, thereby creating additional hazards in starting, stopping and rewinding. In addition, the fabrication of metal reels is somewhat more complicated than that of plastic molded reels, putting economic factors also on the plastic side.

All things considered, the best approach to this problem seems to be the redesign of the existing plastic reel with heavier cross sections, and in so doing, additional benefits can be gained. Widening the spokes simultaneously strengthens the reel and provides more labeling space. The over-all thickness must be maintained if the reel is to operate properly on existing machines, so any increase in spoke thickness must diminish the space between flanges. The spokes in the new reel have been thickened and tapered so that the space between flanges is only 0.306 at the hub and 0.336 at the outer edge. This accomplishes both a stiffening effect, and a smaller clearance to reduce uneven winding. As an additional feature of the redesign, the beading and raised lettering have been removed from the outside reel surfaces, leaving large flat areas for labeling. The lettering has been engraved on the inside surfaces of the spokes in such a way that it does not interfere with the smooth passage of the tape.

In considering the final problem of threading, it was found that a great many users of 7 inch reels, do not thread the tape into the existing slots at all, but merely draw the tape up between two spokes and rotate the reel a few turns to cinch the tape to the hub. This is a very rapid way of threading, but often leads to a bulky fold and eccentric winding. Recognizing the simplicity of this method, "V" diagonal slots have been provided in the hub of the new reel to accommodate this turned up end of the tape without bulging. Threading is easily accomplished as shown in Figure 3.



This new reel, then, while it must necessarily be a compromise design in view of the limitations imposed by standardization, does offer solutions to the specific problems mentioned above. The larger hub, narrower flange spacing and sturdier construction represent a new functional approach in reel design destined to improve the performance of tape on existing equipment, and to ease the mechanical requirements for future tape recorders.