

## Characteristics Of The New 45 RPM Record By "Stylus"

**T**HERE has been widespread interest in the new 45 rpm RCA Victor record, often called "Madame X" or "X." A complete lack of official technical information has hindered public acceptance. Much of the unofficial information floating around in non-recording circles has been wildly inaccurate. Record manufacturers, radio-set designers, and record-changer manufacturers have received a certain amount of accurate information, which we have pooled to prepare this discussion.

### **What it is**

"X" is an attempt to develop a more compact, lower-cost record of higher quality than the ordinary shellac type. It is aimed chiefly at the popular market—which includes 80% of all disc sales.

The record is rather thin, 7 inches in diameter, and made of unfilled vinylite. The center hole is  $1\frac{1}{2}$  inches in diameter, and the label is surrounded by a raised plateau which keeps the recorded surfaces out of contact and free from scratches. The maximum playing time is about 5 minutes, but 3-minute records are made with the same diameter. The stop groove is concentric with the center. The price will be about ten cents less than that of a conventional shellac of the same playing time. The groove has an included angle of 83 degrees and a radius of about .25 mil; it can be played by the same recording stylus as used for LP, one with a tip radius of .9 to 1 mil.

### **How it is Used**

The large center hole is designed to permit the use of a new record changer design. The record stack is carried on a  $1\frac{1}{2}$ -inch diameter center spindle, and there are no knife blades to support the outer edges. The center spindle contains most of the changing mechanism. The entire changer is therefore ultracompact—it will fit in the palm of your hand. The concentric stop groove permits the use of a lower-cost, faster-trip mechanism. As a result, the changing cycle is very rapid: The cycle itself takes about  $1\frac{1}{2}$  seconds. The entire changing time is longer than this by the time to play the lead-out and lead-in grooves, so that observers have checked the total at three to four seconds. The simplicity of the mechanism leads to much lower cost—a list price of about twenty-five dollars.

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## 45 RPM Records

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### The New Speed

The new speed of 45 rpm was not adopted to complicate the commercial situation; it was picked after considerable testing, to permit of better sound quality than could be achieved at 33½ rpm. The engineering reasoning is best developed through a comparison with a 7" 33½ rpm LP. If we assume both have a maximum recording diameter of 6½ inches, and a pitch of 240 lines per inch, we find that at the outer groove X has 1.35 times the linear groove velocity of the 7" LP. If we record for 5 minutes we find that the LP will be recorded in to 5½ inches diameter, and X is in to 4½ inches. The groove velocity at the inside will be 22% higher in the case of X. If the LP recordings were made at a finer pitch, the advantage of X could be reduced. For a 3-minute record, the advantage in favor of X is 28%. Further out, the advantage will approach 35% as a limit.

We find, then, that for equal processing care, the Victor record will have a 22 to 35% greater frequency range available. This assumes, correctly, that both manufacturers use recording equipment with wide-frequency range, and that the reproducing stylus tip is the bottleneck.

The increase in available frequency range is interesting, but nowhere near as significant as the decrease in distortion. We may expect processing to cause some increase in distortion, and "tracing distortion" at high levels will be of importance. Both these factors are reduced by an increase in linear groove speed, and the reduction in distortion will be proportional to the square or cube of the increase in groove velocity. This means that the amount of distortion in the reproduction of X will be 40 to 55% of that incurred in reproducing LP, at the same diameter, if both processing plants are equally careful (or careless). It is believed that the improvement in fidelity was the factor which led Victor to retain the higher speed, in spite of the sales advantage of 33½ rpm.

### Comparison of LP and X

A most thankless task is that of making an engineering comparison of the two seven-inch designs. No matter what we say, both sides will complain vigorously about the author's astigmatism.

The comparison is valid only if we study nominally similar discs, that is, seven-inch against seven-inch. Some of

the unwary have compared seven-inch RCA with twelve-inch Columbia. This is incorrect, for they fall in entirely different price classes, fit different markets, and cannot fairly be compared. It should also be pointed out that almost no ten- or twelve-inch LP records have been recorded to five-inch diameter. Most of those seen by the writer stop at six or seven inches.

At the risk of being classed as a hopeless cynic, we are inclined to look on Columbia's seven-inch LP as an RCA X with most of the original features removed to make it easier to market. This is not meant to be critical, for the present slump in the phonograph record field makes expediency more significant than it usually is.

#### **Processing**

It is easier to get acceptable processing quality in X, but this is not a guaranty. Processing quality in America has always been erratic, and poor processing can ruin a record in spite of the original design engineering. In short, the contest between LP and X is a battle of processing departments as much as of recording rooms. The low price of the seven-inch record will not permit scrapping many pressings, so quality control must anticipate rather than follow production. In this respect particularly the citation of factory experience with twelve-inch LP production is fallacious, for there is a 500% difference in list price. A factory simply cannot pamper a ninety-cent record as much as one selling at nearly five dollars.

In all the argument three men have been pretty well ignored. It was the rigorous mathematical study of tracing distortion by Pierce and Hunt, in 1938, which gave a firm foundation of fundamentals to ideas of groove dimensional change. René Snepvangers played a significant part in the development of X just before the war. This was put on the shelf when war conditions made vinylite in short supply. After the war, with the brilliant Peter Goldmark, he again played a part in fine groove development. This time it was in the Columbia research laboratory.

It was predicted that the author would earn the obloquy of both sides of the argument. Now for a suggestion which will get the third side (the public) angry too. Why not reduce the radius of the standard 78-rpm record groove to  $\frac{1}{4}$  mil? This could be played interchangeably by a standard 3 mil needle, or by a 1 mil micro-groove stylus. Under the latter condition, the quality would be simply superb.