SEPARATION OF TWO- CHANNEL RECORDINGS FOR VOCAL BEHAVIOR STUDIES¹

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Studies of vocal behavior in a two-person interview situation are more conveniently accomplished if the voice of each person is recorded on a separate channel of magnetic tape. When speakers are face to face, the usual recording arrangement of one microphone for each speaker results in incomplete separation of the two voices so that the voice of each speaker is heard to some extent on both channels. Magnetic tape recorders capable of separated but simultaneous recording from two microphones are increasingly available. Such machines allow preservation of the vocal interaction of two persons in a form appropriate for automatic analysis of each separate voice. Devices have been described (Hargreaves & Starkweather, 1959; Starkweather, 1960) which tabulate the duration of utterances and which indicate speech rate in a cumulative graph. These devices and others which might measure additional characteristics of the voice require a clean recording of a single voice without sound from the other speaker. In addition, studies in linguistics, particularly those related to intonation patterns and stress, would benefit from the ability to produce recordings from natural situations which are screened free of disturbing noise.

An approach to the problem which may help considerably is the use of either directional or noise-cancelling microphones. Highly directional microphones, however, require the availability of a recording room with minimal sound reflection, and may be difficult to keep centered on the speakers. Noise-cancelling microphones are constructed so as to discriminate against sound at a distance; and when held close to the speaker's mouth, they can produce good separation without additional apparatus. (Model BDO-1, manufactured by the Telex Corp., is a recent example which has the added advantage of being light in weight.)

Another approach would be an additional transducer, either a throat microphone or a strain gauge over the vocal apparatus, which would open the subject's microphone circuit only when he himself spoke. This procedure may be unwelcome because of the additional apparatus connected to the subject, and also the necessity to operate the switching mechanism during the recording procedure with consequent possibility of mishap.

The apparatus described here is arranged to silence Channel A when Speaker B is talking and vice versa. It has the considerable advantage of making operation possible during playback into analysis equipment; and, in addition, a well-separated secondary tape can be produced by a tape-duplicating process. While successful in eliminating interference, it has the possible disadvantage of silencing both channels if both speakers overlap in their conversation. This is not normally a problem, but could become so if heated arguments were the subject of investigation.

APPARATUS DESCRIPTION

Figure 1 shows a block diagram of the complete separation unit which frees each channel of interference from the other. The schematic diagram is for only one channel. This circuit must be duplicated for the complete apparatus. A voice-key circuit is used to switch from

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TWO-CHANNEL SEPARATION APPARATUS

Fig. 1. Schematic diagram.

forward to reverse bias in a diode modulator circuit.² This method obviates running the audio signal through the relay contacts, a more direct system but one which is much too noisy. Virtually any audio interstage transformers may be used in matched pairs, and appropriate biasing should be arranged to block the audio signal. A bias string from the available B⁺ supply of 160 volts is shown which works well with the 3:1 ratio transformers used here. One side of the transformers must be center-tapped in order to apply the DC bias. The specific diodes used are not critical, except that they should be capable of handling the expected signal peaks. As a further refinement of the circuit, contact bounce and the switching transients which result may be reduced by using a mercury-wetted relay in place of an open-type relay. (Clare No. HG-1002 is a relay with mercury-wetted contacts which operates well in the circuit as described.)

Although it may seem formidable to construct two such units in order to free both recorded channels from interference, the task is made easier by the use of a readily available voice key (Heathkit electronic voice control, Model VX-1). Modification is necessary, but the unit provides a power supply and convenient chassis layout along with most of the required parts. It allows operation from a high-impedance microphone if direct operation during recording is desired. This unit is not large, and two of them can be mounted side by side on a 19-inch relay-rack panel of 5.25-inch panel height. When so mounted, additional necessary parts, particularly the interstage transformers and diodes, can be mounted behind them on a U-shaped chassis (Bud panel-mounting chassis, Type CB-1372).

²Thanks are due to Dr. Jerome Singer of the University of California Department of Electrical Engineering for suggesting the use of this type circuit.

Front-panel controls consist of only sensitivity adjustments for each voice key. A neon indicator provides a signal of voice-key operation on each channel. Connections in and out for each channel are of course necessary. During use with a tape which is already recorded and which contains interference between channels, a two-channel recorder is connected during playback to the two LINE IN connections. A sensitivity level is then established for each voice key as follows: Consider the voice key which operates from Channel A but which switches off Channel B. Its purpose is to deaden Channel B whenever Voice A would intrude on that channel. It should therefore be adjusted to operate when A speaks, but to ignore the Channel A pickup of Voice B. The voice key which operates from Channel B is adjusted to switch Channel A in a similar fashion. The two sensitivity adjustments are independent and need not produce the same threshold unless desired.

SUMMARY

A two-way switching apparatus has been described for magnetic recording of the vocal interaction of two people with each voice on a separate recording channel. The device produces separated recordings of the individual voices without allowing interference of one from the other. It thus allows automatic analyses of the characteristics of each voice individually.

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