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Trial Manufacture of Magnetic Tape Recorder to Record Electro-Cardiographic Changes of Moving Subject

By Hirokichi Tatsunuma,* *Masahiko Hyodo** *and Teppei Yuasa**

There may be three methods by which it will be possible to obtain electro-cardiograms of subject in motion: (1) wireless carrier transmission, (2) wired transmission, (3) keeping a recorder about a moving subject's person. Each method offers its own advantages and disadvantages. Our attention, however, has been on the third method because it allows the recorder to be used regardless of a distance between the moving subject and the recorder, and of geographical conditions. For the last few years, we have conducted extensive researches and introduced some improvements in the method.

Currents comprising 2500 c. p. s. carrier waves are produced from the oscillator circuit. These are modulated with cardiographic changes that have been given 2-stage amplification, and are changed into voice signals with varied amplitudes that allow recording. They are then recorded by a magnetic tape recorder operating at a speed of 3.75 inches per second. After the end of the subject's motion, the modulated electro-cardiographic tones recorded by the magnetic recorder are reproduced, amplified and detected for the demodulation of original waves. After further amplification, they are recorded in a pen recorder as electro-cardiographic changes.

So far a stage has been reached where the recorder can successfully be used in low-speed applications. However, troubles have been encountered in high-speed applications. Studies at the present stage are centered on the analysis and procedure of these trobles, which will be discussed only briefly below.

(1) Pick-up electrode

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One problem that remains yet to be solved is the inferior conduction of electrodes caused by perspiration. However, this has been considerably improved by the use of high-conductivity silver paint (such as ecobond solder, Dupont silver paint, etc.) which insures a superior conduction.

(2) Conductors for pick-up electrode

For some reason or other, electrode conductors develop infinitesimal voltages during the time a subject is moving. Their aspects include capacity changes due to mechanical vibrations, power generation, and development of static charges due to wind pressure. In some cases, they are likely to result in interference signals which will by no means be negligible. Generally, it is not an easy thing to keep a moving subject in constant grounded position. Also, cancellation of such potential differences by electronic means as homogeneous equivalents is difficult in actuality. Such being the case, studies are now being pushed forward to develop conductors that will not produce such interference signals.

(3) Time-constant circuit of amplifier

When a CR time-constant circuit in use for the conventional electro-cardiographic amplifier gets mixed even for one moment with interference signals like muscular electricity, a considerable disturbance is caused on the waveform of electro-cardiographic output. In order to obtain electro-cardiograms of a subject in motion, it may be unavoidable to some extent that the circuit gets mixed with various forms of interference signals. For this reason, the time-constant circuit being vulnerable to such disturbance poses a great problem. It is desirable that the circuit is made a carrier wave modulation type in the initial-stageamplifier of electro-cardiographic input and that the time constant of later-stage amplifier is reduced to a minimum. The possibility of such arrangement is now under study.

(4) Mechanical stability of tape recorder

Even a general small-sized tape recorder may successfully be used in some practical applications if it is provided with a powerful motor. However, it will develop flutter unless the vibrant motion of the supply reel is suppressed. At the present stage, it is of greater importance to insure the stability of electronic circuits than that of the tape recorder mechanism. However, we are planning to improve the stability of the tape recorder mechanism as well through the adoption of mechanical negative-feedback system.