An Automatic Search System for EEG Records on Magnetic Tapes

(automatic search for EEG records/input of EEG into magnetic tape/computer analysis)

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We developed a new system by which the necessary EEG data can be automatically played back in a short time. This system consists of the 12-channel electroencephalograph (NIHON KODEN), the data recorder (TEAC R-280) and the function code generator (TEAC FC-2000) which is the instrument of automatic search for EEG record on the magnetic tapes.

When the EEG is recorded, one track out of 14 channels of magnetic tape is recorded with "function code". "Function code" is located both at the beginning and at the end of the each EEG record : the former is called "start frame", and the latter "stop frame". On playing back an EEG record on the magnetic tape, the function code generator searches for start frame of necessary EEG record, and then the data recorder stops at its start frame. Thus, we can play back the necessary part of the record.

Duration of each recording unit is one minute, and the number of units from one patient is limitless.

There are several methods to preserve and arrange EEG records ; for example, cutting off and eliminating unnecessary parts of EEG record paper, recording on microfilm, and so forth. The method of recording on magnetic tapes seems to be useful, but it is still troublesome to play back the necessary part of the record. This report is concerned with a method of our design by which the necessary EEG data can be reproduced in a short time.

MATERIALS AND METHODS

Ten healthy children were investigated. The EEG was recorded using an electroencephalograph of 12 channels (NIHON KODEN), and at the same time was recorded on 14-channels magnetic tape using the data recorder (TEAC R-280). Our system is shown in Fig. 1. Tape speed of the data recorder was 9.5 cm per second, and the length of the magnetic tape was about 500 meters. The 14th channel of the magnetic tape was used to record "function code" from the function code generator.

Function code consisted of four parts. The first was "Label number" of four figures, which was used to identify each EEG record. This was the
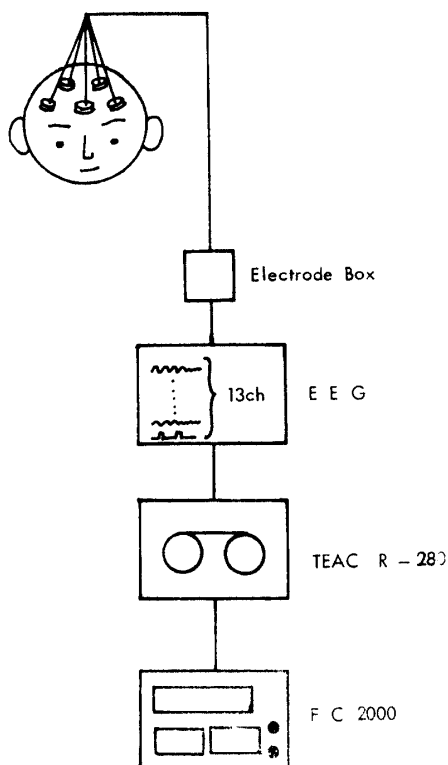
Fig. 1.System of search for EEG records. The data recorder is connected
to the electroencephalograph and the function code generator.

most important function of function code generator.

The second was "Patient ID number" of six figures, which is used in our
university hospital.

The third was "Month and day" of EEG recording of four figures.

The last part of two figures showed "Recording conditions" such as sleep
level, modes of activation, etc.

The function code was recorded together with EEG record on the magnetic
tape on "GEN" mode, and was located at the beginning and at the end of
each EEG record. The former was termed "start frame", and the latter
"stop frame". Therefore, EEG records were located between start and stop
frames (Fig. 2). On "search begin" mode, function code generator began to
search the code number of start frame which had been put into the generator
as "Begin Label" number before the start. Then, data recorder stopped at
the beginning of the EEG record we wished to obtain. Accordingly, we
could play back the EEG record data from the beginning (Fig. 3). As the
stop frame was located at the end of EEG record, we could continue to play
back the EEG record until the function code generator found the stop frame
label, the number of which had been previously put into the generator as
"End Label".

Every period of EEG recording (one unit) was limited in one minute,
for purposes of convenience, and it was possible to use several units for
one patient. Consequently, the length of EEG recordings could be chosen
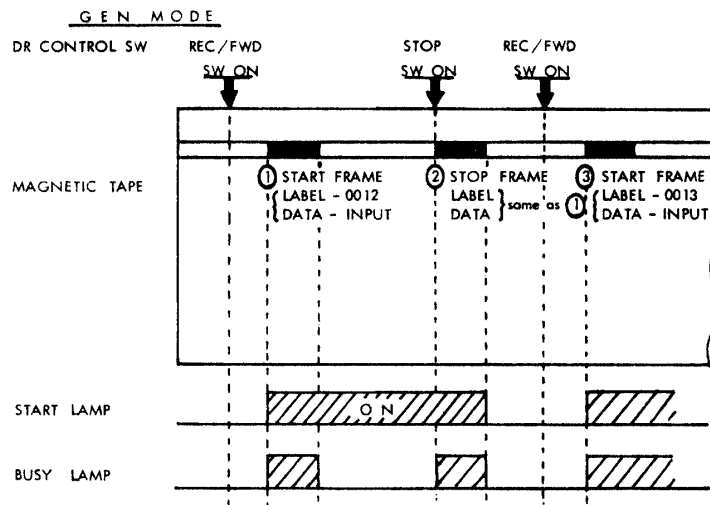freely and according to necessity.

Fig. 2. On "GEN" mode, EEGs are recorded between "start frame" and "stop frame" on magnetic tapes. "Start lamp" of the function code generator is on during the recording of the EEG on magnetic tape, and the "Busy lamp" is on during recording the start or stop frame on magnetic tape.
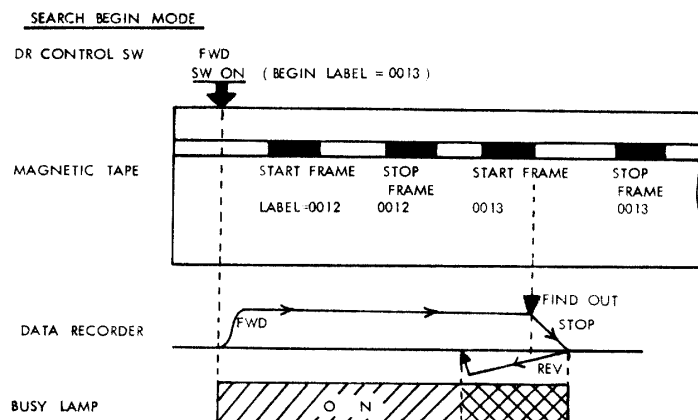

Fig. 3. EEGs are searched for on "Search Begin" mode. When the forward switch of the function code generator is on, the function code generator starts to search for the necessary EEG. When the start frame of the necessary data is found, the function code generator makes the data recorder stop moving and makes it re-wind a little.

RESULTS

We compared many EEGs from the monitor with those from the data recorder. EEG from monitor on input and the same EEG from data recorder are shown in Figs. 4 and 5, respectively. Both records are identical in practice. Moreover, we could find the necessary part of EEG record in a short time, and prevent disturbances associated with the recording and play-back.
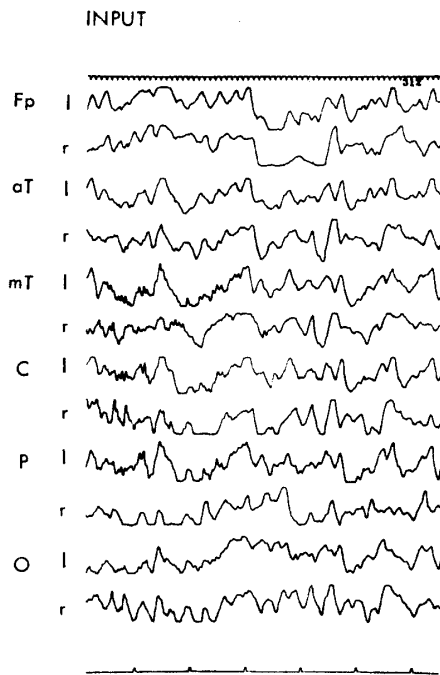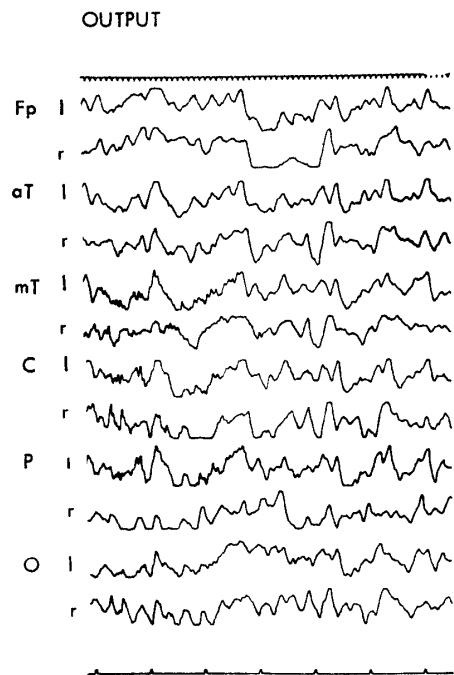
INPUT

OUTPUT

Fig. 4. EEG of input data.

Fig. 5. EEG of output data.

DISCUSSION

There are many reports concerning the studies of computer analysis of EEGs and evoked potentials, but apparently there is no documentation concerning the methodology of automatic search system for numerous EEG records (1—10). However, as a more precise analysis of routine EEG examinations is required, a new method of automatic search for EEG records must be developed in order to analyse those EEGs by computer. Our system is probably the first to search for routine EEG records automatically.

The data recorder was used at a tape speed of 9.5 cm per second. At this speed, the sound per noise ratio is 47 d. B. In general, the sound per noise ratio is considered good if it is over 42 d. B. with regard to ECG or EEG recording on magnetic tape. When we used a 500-meter-long magnetic tape at the speed of 9.5 cm per second, as in our study, about 80 EEG records could be recorded on one magnetic tape. Therefore, we could save large space required to store and arrange numerous EEG records.

When numerous EEG are analysed, it is convenient that records are of short duration (one minute), and the patient ID number and the code number of recording condition are simultaneously recorded on the same section of the magnetic tape.

We are now beginning to analyse numerous EEG records by computer. The function code generator has proved to be most convenient to find out promptly the necessary sections of EEGs. Moreover, magnetic tapes can be carried freely anywhere, and accordingly, we can alter numerous analog data of EEGs to digital ones with a microcomputer without using the main internal memory of the computer of our university hospital.

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