THE RESPIRATION CORSET.

Børge Frøkjær-Jensen

In the days of the kymograph the respiratory movements were recorded by means of a pneumograph. This apparatus consists of a rubber belt containing air. During the respiratory movements of the chest or stomach the air in the belt was compressed and the pressure wave was conducted through a rubber tube to a kymographic recording device.

The apparatus has also been employed for investigations of the activity of the chest and stomach during speech.

We have under work a more up-to-date version of this instrument. Two coils, which function as primary and secondary coils of a transformer, are mounted on a springy belt placed around the chest of the subject in such a way that the distance between the coils varies with the circumference of the chest. A 10 kc/s transistorized oscillator supplies an ac-voltage to the primary coil. The secondary coil picks up the oscillations, the amplitude of which is proportional to the square of the distance between the coils. This voltage from the secondary coil is amplified in a three-stage transistorized amplifier with negative feed-back, which is made logarithmic by means of two silicon diodes in the feed-back loop. In this way it is possible to get an amplification, where the output voltage

$$V_{output} = A \cdot \sqrt{V_{input}}$$

in the desired range (11 cm variation of the distance between the coils). After the logarithmic amplification the 10 kc/s signal is rectified, and the output consists of a voltage, which is proportional to the circumference expansion of the subject's chest.

If we want to record the respiration movements of both the chest and the stomach it is necessary to use a system with two channels. In order to avoid interference between the coils of the two channels we employ different carrier frequencies for the two systems and employ tuned amplifiers. Frequencies such as 9 kc/s and 12 kc/s are suitable for this purpose. A block diagram of the whole system is shown in Fig. 1. The circuit diagram for each amplifier is shown in Fig. 2.

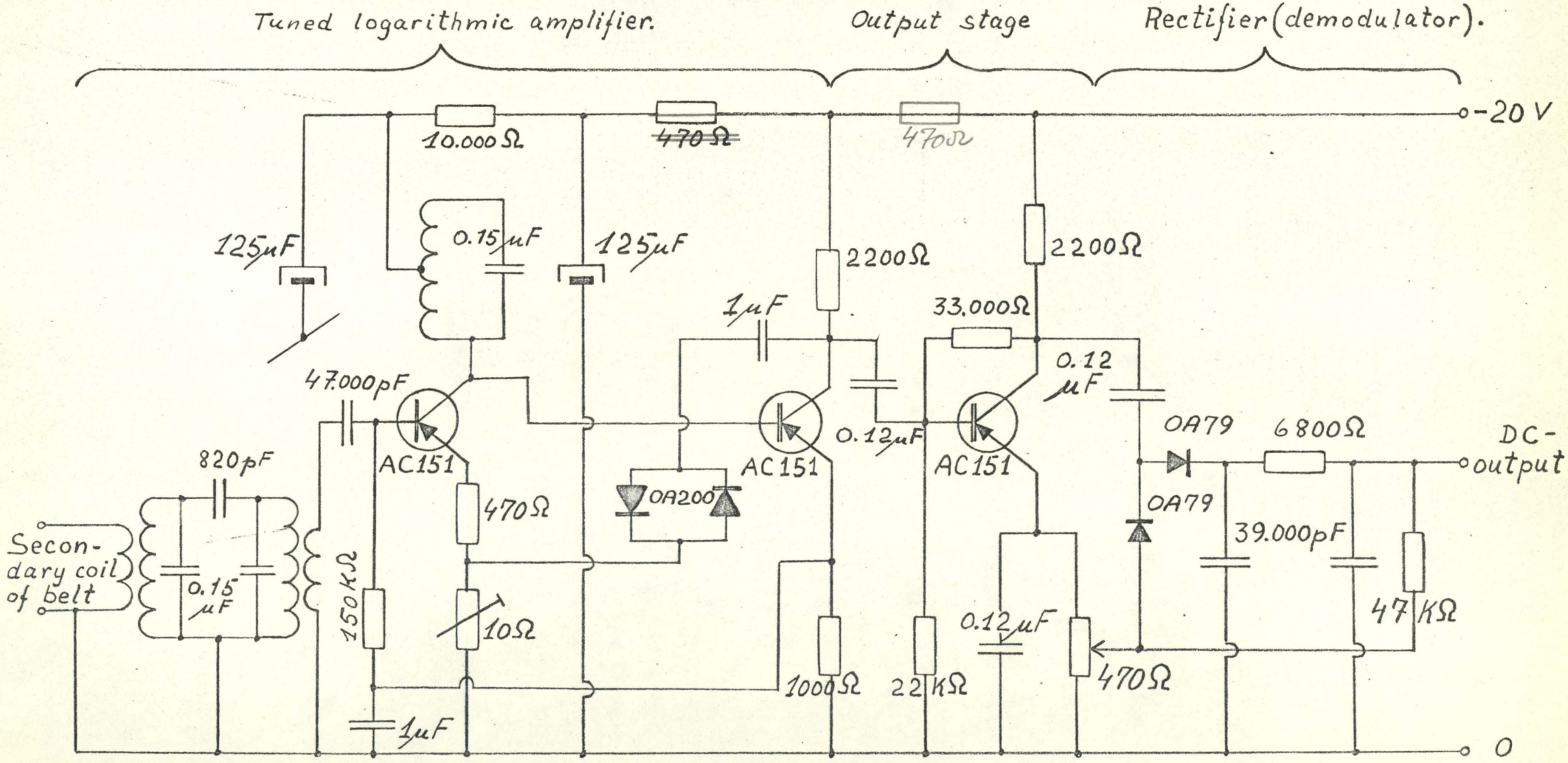

Fig.2: Tuned amplifier for logarithmic amplification. ($V_{output} = A \cdot \sqrt{V_{input}}$).

A visual recording device such as the mingograph or the oscilloscope may be coupled directly to the logarithmic amplifier. If we want to record the respiratory movements on a device which consumes effect, we can take the output signal through a specially constructed dc-amplifier. This transistorized amplifier gives a current amplification of 40 dB, and a voltage amplification of about 2 dB, depending on the input impedance of the recorder. (An example of such a recorder is the Siemens "Oscillomat", which has 16 channels. This instrument writes on UV-sensitive paper with light beams whose movements are controlled by small galvanometers with frequency responses up to 15 kc/s).

The instrument is under work. The electronic part has been finished, but some work still needs to be done at the belt in order to find the best way to fix the coils.

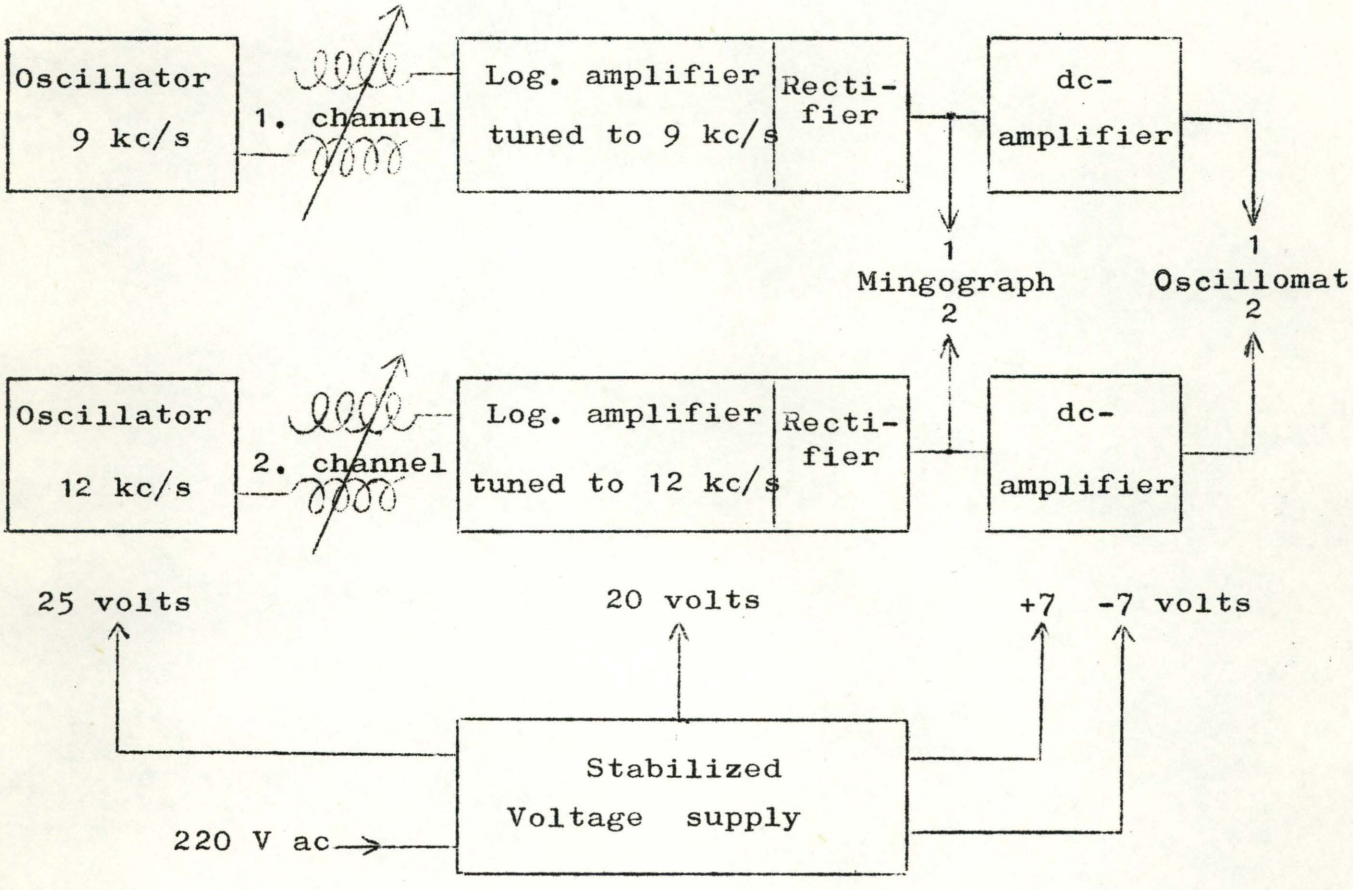

Fig. 1.

Block diagram of the two-channel Respiration Corset.