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THE MELOCHORD OF THE COLOGNE STUDIO FOR ELECTRONIC MUSIC

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THE MELOCHORD OF THE COLOGNE STUDIO FOR ELECTRONIC MUSIC

Summary

A description is given of a two-tone electronic musical instrument equipped with keyboards, the upper keyboard being used also as a step-by-step filter.

The melochord, an electronic, keyed instrument with two independent monophonic playing ranges, has been known as a normal musical instrument for conventional interpretation of musical sounds for broadcasting of plays and light music in the German broadcasting system.

However, the task of opening up an absolutely new musical field by the use of electronic sound producers in conjunction with known instruments, aids and methods of broadcasting and telecommunication technique goes beyond the narrow bounds of conventional interpretation of music. With a view to accomplishing such a task the melochord of the NWDR Cologne was developed and has become an indispensible part of the Studio for Electronic Music.

The basic idea in designing this instrument was to have outside the instrument the controlling apparatus for all the sound parameters which may be represented by known aids, while the latter should contain only the elements which are characteristic of it.

Normally, each playing range of a melochord contains a separate tonal generator, assigned to a separate keyboard, or part thereof, a separator stage for preventing reactive effects from the consecutive sound-determining devices on the generator,

and the sound filters (i.e., four-pole circuits, which, for example, are connected as resonant circuits, band-pass filters, low-pass filters or high-pass filters). Each playing range also contains a control device for the artificial simulation of known build-up and fall-off processes (sounds produced by wind and pluck-string instruments), a vibrato generator which has a frequency of approximately 6 to 8 c.p.s. and which may be variably connected to the two tonal generators in such a way that it produces a variable frequency fluctuation here, and finally crescendo pedals for controlling the volume.

A particularly interesting feature of the melochord is the fact that it is equipped with a step-by-step sound filter, which can be tuned with the pitch. For example, when the pitch of the fundamental tone is varied the frequency of the formant may vary with it. Additional improvements in the musical tones may be obtained in a two-tone instrument, if the alternating voltages from the two sound channels are conducted into a modulator and are mixed in multiplication. Furthermore, it is also possible to modulate the tonal generator with white noise or with any arbitrary portion from the spectrum of a noise generator, or, with the generators turned off, to transmit white noise to the other parts determining the sound.

All additional aids by which it is possible to produce sounds in great variety are not discussed here, since they have been described in great detail in the literature. These aids include above all the utilization of magnetic tape techniques, both old and new, and the inclusion of a resonant volume.

The block diagram in Fig. 1 shows the sound-producing and sound-affecting devices, and their coordination with one another, of the melochord of the NWDR Cologne. It will be seen that the fixed sound filters and the vibrato generators of standard design have been omitted here and that a step-by-step filter for presenting the travelling formants has been installed.

The sound channels, which are shown superposed in the diagram, are assigned to the two keyboards of the instrument (Fig. 2). Across the modulation inputs 1 and 2, the alternating voltage required for the frequency modulation (e.g. vibrato modulation) of the tonal generators arrives from the outside, across voltage regulators and input stages, at generators 1 and 2, which are connected as multivibrators. As frequency-determining elements, each of these alternating-voltage sources, which are exceedingly rich in overtones, contains a series of resistances in 37 steps corresponding to the 37 semitones of the keyboard, encompassing three octaves, and a condenser whose value can be changed in the ratio 1:2:8 by release keys at the left-hand side of the keyboard. In this manner four pitch ranges which are in octave relationship with another are obtained. Since the lowest note in the lowest range of one keyboard is an octave below the corresponding note of the other keyboard, a total tonal range of seven octaves is obtained.

In addition to the closing contacts, which lead to the resistance taps and determine the pitch, opening contacts are also coupled to the keys of one of the keyboards. By means of these opening contacts all the condensers which happen to be on the left-hand side of the melody key touched are separated from a series of condensers connected in parallel (again 37, corresponding to the number of the semitones on the keyboard). The total number of condensers thus remaining on the right (...C_F, C_0) serve to tune the parallel resonant circuit formed by these condensers and the resonant choke. The formant travelling along is produced by this parallel resonant circuit. The damping of the formant is made variable by the adjustable resistor R_0. The formant circuit has been inserted in the total circuit by a buffer stage at the input and output. Since resonance choke L can be tuned in stages, the frequency of the formant relative to the fundamental may be varied within wide limits.

The alternating voltages, which are rich in overtones, pass from generators 1 and 2 across the switched-over buffer stages to switches S_1 and S_2, whence they pass to switches S_3 and S_4. Depending on the way these switches have been set, the alternating voltages pass across externally connected separate filters, or across the built-in step-by-step filter, or pass directly (or by changing over to the other channel) to switches S_5 and S_6, whence they pass to control stages 1 and 2 for producing the build-up and fall-off processes artificially. The control stages are in push-pull arrangement, rather than single-ended, since otherwise sudden release would result in a direct-voltage impulse which would sound like a thunderclap in the loudspeaker. In order to obtain the controlling direct voltages required for opening and closing of the control stages, i.e., to obtain the desired non-steady processes, condensers are charged and discharged across resistors, the processes being initiated and controlled by means of switches connected to the keys by a mechanism.

The sounds whose non-steady structures are influenced in control stages 1 and 2, are fed to control resistances in order to determine the volume of the fundamental tone, whence they are fed to the crescendo potentiometers. These in turn are connected to the inputs of separator stages V_1 and V_2, whence the voice-frequency alternating voltages pass to the other devices of the studio.

Selection of the various feed paths on operating switches S_1 to S_6 provides a number of possible variations. A few examples are given here. (1) By blocking generator 2 (S_2 to 1) and by including the step-by-step filter in channel 1 (S_3 and S_5 to 2) it is possible to determine the pitch and the nonsteady processes by playing the keys of channel 1, while by playing the keys of channel 2 the timbre is influenced. (2) By blocking channel 1 (switch S_1 to 1) and by linking up with a noise generator (S_2 to 3), then on setting S_4 to 2 (step-by-step filter) a play of pitch with noise having timbre variation may be produced,

with a wind instrument or plucked string effect depending on the setting of control stage 2. If, for example, using identical switch positions, orchestra music is fed to the noise generator input, the music appears to be "modulated" with vocal colouring.

These examples could be multiplied indefinitely owing to the many possible combinations of the different feed paths and the diversity of the externally connected auxiliary devices. However, as mentioned above, the possibilities are by no means exhausted in directly performed creations. By clever application of indirect methods, e.g. signal storing, particularly the magnetic tape technique, new possibilities of creating music may be discovered.

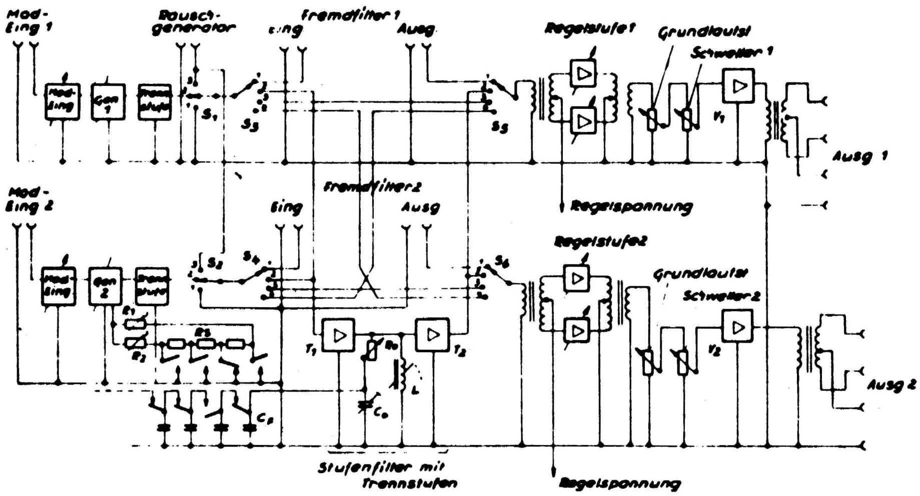

Fig. 1

Block diagram of the melochord of the Cologne Broadcasting Station

Ausg.	= output	Regelspannung	= control potential
Eing.	= input	Regelstufe	= control stage
Fremdfilter	= separate filter	Schweller	= crescendo pedal
Gen.	= generator	Stufenfilter mit Trenn-stufen	= step-by-step filter with separator stages
Grundlautst	= volume of funda-mental tone	Trennstufe	= separator stage
Mod. Eing.	= modulation input		
Rausch-generator	= noise generator		

Fig. 2

Keyboard of the melochord.