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MOSSBAUER EFFECT: On the application of digital synthesis, in order to synchronise the frequency of the function generator of the transducer with the frequency of the channel opening commands, in "multiscale" operation.

by

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INTRODUCTION

During the operation of "multiscalers" for the obtention of spectra of the Mössbauer effect, a perfect synchronism must be established between the frequency of the opening of channels and the frequency of the motion generator.

With independent non synchronised generators, no matter how stable their frequencies, "jitters" in the addressing of pulses would be unavoidable, with resultant dispersion and consequently diminished resolution of spectra.

When the motion to be generated is to follow the law of constant speed or constant aceleration, the usual procedure is to use the output of the channel-opening flip-flops, as triggers for the production of gates, generating square or rectangular waves which, in turn, being integrated and shaped to triangle or sawtooth ramps, activate the motion of the transducers, assuring a common origin for the signals.

The generator developed at L.I.C.(*) can be used for the production of triangle or sawtooth ramps, plus senoids.

Senoidal movements, although requiring corrections, are more easy to generate, provided operation is maintained close to mecanical ressonance of the transducer.

Corrections are introduced in the program of the computer together with the treatment of the obtained results.

(*) Laboratory for Cientific Instruments

The earlier models of senoidal transducers employed by C.B.P.F.(*), of German origin, employed to separated oscillators, whose imperfect synchronisation was unable to completely eliminate the above mentioned "jitter".

In order to avoid this incovenience a new instrument for the command of channel openings, synchronised to the movement, was designed, developed and produced, completed with a new and complete amplifier for the activation of the transducer.

The prototype of this device produced spectra with a degree of resolution superior to the results obtained with the previously available equipment.

HOW IT WORKS

A high-stability variable frequency oscillator is used to command the opening of the "multiscaler" channels.

If the transducer's frequency of operation is to be -let us say - 20Hz, and there are 1024 channels to operate, the frequency of the oscillator should be maintained at 20480Hz. In order to obtain a better waveform, a frequency of 40960Hz is generated, and lowered by a divider-by-two.

The output of the generator feeds three SN7493 CIs (dividers by 16), with the first one dividing by 16, the second one by 8 and the last one by 16 again. The BCD of this last divider feeds a SN74154 ("one of 16" decodifier), which in turn acts as a digital/ analog converter generating a function for the activation of the transducer.

(*)Brazilian Center of Physical Research, an organ of the National Council of technology and Cientific Development (CNPq)

In the project the generated function is a senoid. If a different waveform is desired, it is enough to modify the values of the resistors and the capacitors of the filters on the DA converter.

For a small change on the frequency of the transductor, it is enough to change the frequency of the oscillator. For a larger variation of frequency, the time-constant of the filters would have to be changed also.

The synchronization will be maintained, independently of these changes.

DETAILS OF THE CIRCUIT

1. Pulse generator: Three NPN transistors, one PNP and one unijunction, generate a frequency controlled by the ten - turn Pot RV_1.

   Transistors Q_1 and Q_2 constitute a temperature - stabilised constant current generator, charging the 180 pF polystirene condenser, triggering the Q_3 unijunction, stabilised by resistors of 47Ω and 100Ω .

   Q_4 and Q_5 constitute an impedance coupler and signal shaper for the dividers.

2. Dividers: (Integrated circuits CI1, CI2 and CI3, previously described)

3. DA converter: The SN74154 being a "one-of-sixteen" decodifier, shifts the "high" state, one by one, along the

sixteen outputs, feeding the 16 resistors which generate the waveform, by segments.

The op-amp CI5 (741) acts as a summing amplifier, filter and level adjuster.

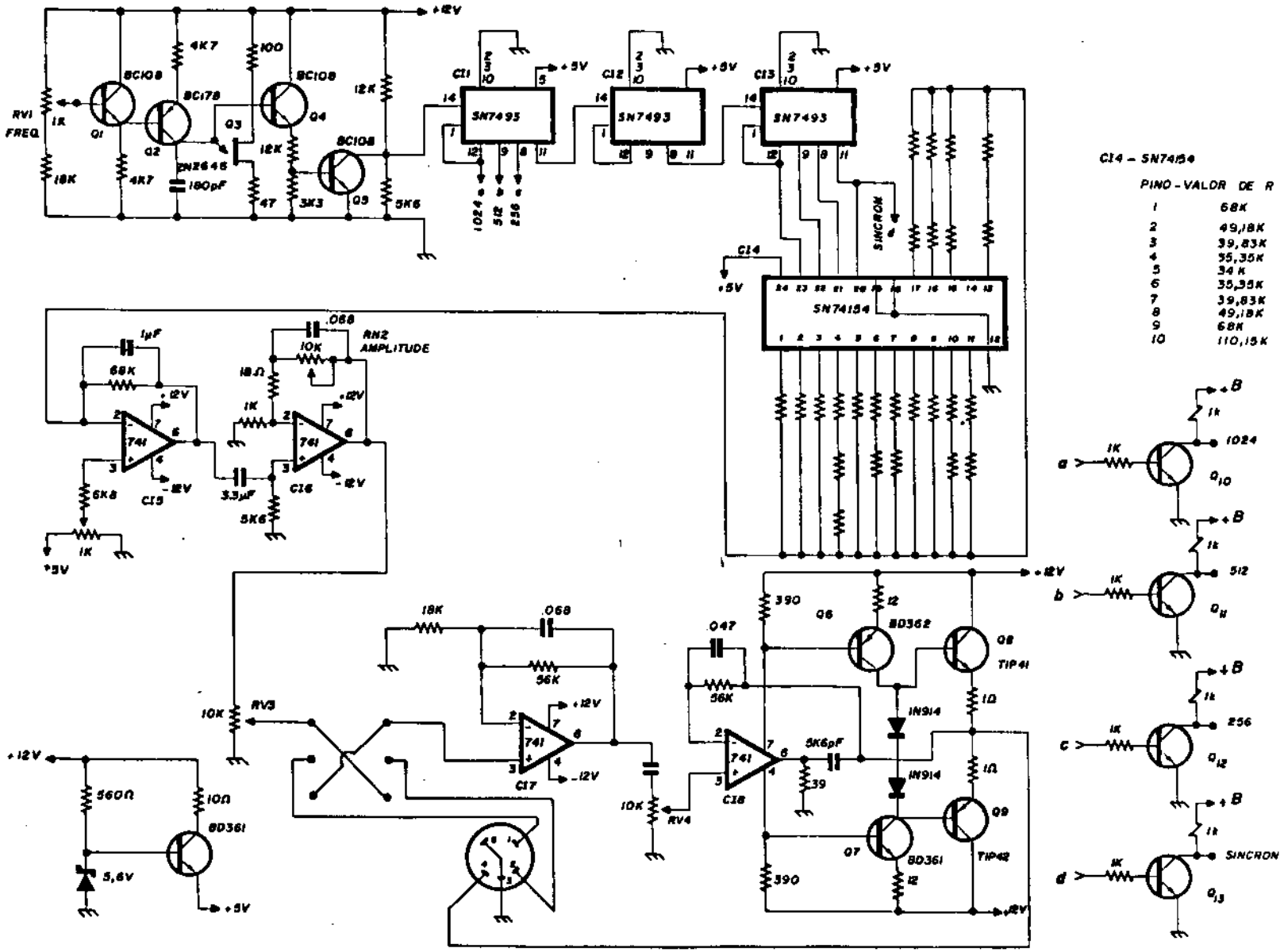
C15 amplifies and filters the generated wave - form and controls the amplitude of the transducer's swing through the RV_2 Pot.

The RV_3 Pot adjusts the negative feedback from the transducer to the input signal of the C17 amplifier and the RV_4 Pot controls the output of the power amplifier constituted by CI8, Q_6, Q_7, Q_8 and Q_9.

Transistors Q_{10}, Q_{11}, Q_{12} and Q_{13} provide the 1024, 512, 256 outputs and the synchronisation (20Hz) for the opening of the "multiscaler" channels.

REFERENCE

Digital Waveform Synthesis; Pawner, Green and Taylor Electr. Eng. - Aug. 1964.



C14 – SN74154

PINO	VALOR DE R		
1	68K		
2	49,18K		
3	39,83K		
4	35,35K		
5	34 K	11	232,17K
6	35,35K	13	893,52K
7	39,83K	14	∞
8	49,18K	15	893,23K
9	68K	16	232,17K
10	110,15K	17	110,15K