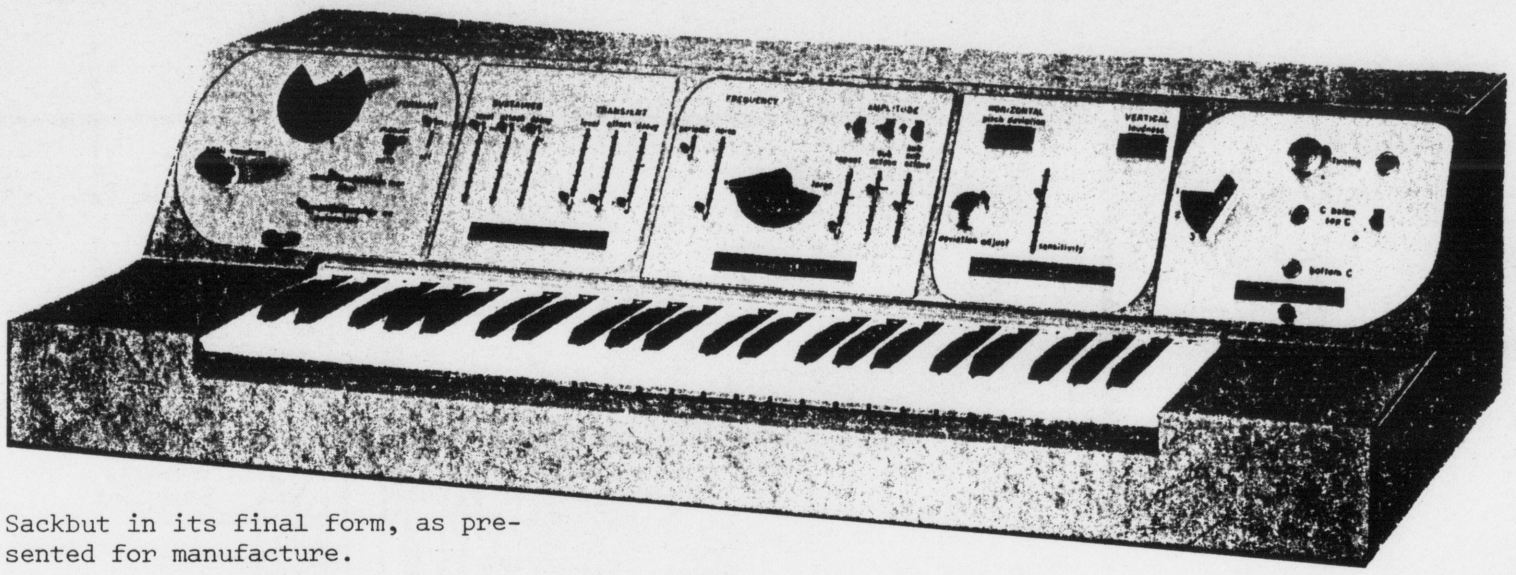

Sackbut in its final form, as presented for manufacture.

rate of pitch deviation caused by a given (lateral) force. There is also a meter and sensitivity control for vertical pressure (volume).

The four octave range of the keyboard can be shifted to different registers. This faciltates studio work with variable speed playback of a recording. To facilitate ensemble playing there is a fine tuning adjustment.

Continuous controls are provided so that the performer can change tone colour during the production of a note. Emphasis is placed on the plastic control of timbre, rather than on pre-set immitative timbres or on the provision of all conceivable timbres. All timbre controls are accessible to the left hand in one position, leaving the right hand free for keyboard work. (see diagram) Tone colour can be adapted by frequency modulation (noise or periodic voltage) and also by a means of amplitude modulation. A joy-stick controls basic waveform (pulse, square and octave related). The 'pulse width slider' and 'tone colour controls' can move the band of response frequencies over the audio range in ten steps. A 'formant slider' determines sharpness of resonance. The formant sound can be removed or changed by the performer as the note is being held or it can be set at 'auto' where the formant is swept over a band and back. The speed of the change is determined by 'attack' and 'decay' settings.

The 'envelope' panel is in two sections: sustain and transient. In sustain, the tone sounds as long as the key is down. An attack control gives an adjustable rate in increase, and the decay, also adjustable, begins when the key is released. Sustain can be used alone or with transient, where the tone begins to decay as soon as a pre-set limiting value has been reached. This adds a tone with a changing envelope to the sustained tone, using similar attach and decay controls. This mechanism can be used in conjunction with touch sensitive control and electronic envelope control.

The Sackbut was developed between 1945 and 1948. In 1948, work was stopped. The first published description was given in the *Proceedings of the I.R.E.* (Institute of Radio Engineers) in 1956, by which time work on the Sackbut had resumed at the National Research Council, to develop a method of continuous pitch control, presumably the glide strip, and a reverberation pedal operated by a magnetic tape feed-back loop, which is not mentioned in later discriptions. In spite of these adaptations, the Sackbut was never manufactured. We of the Hugh Le Caine Project can only express our amazement and bewilderment at this sequence of events. Comparable synthesizers (pre-patched, portable, monophonic--such as the Synthi VCS-3 or the Mini-Moog) did not appear on the commercial market until the early 1970's.

In his autobiography, Recherches au Temps Perdu, Hugh Le Caine recalls his first interest in 'scientific experiments' and 'musical instruments' to have begun in early childhood and continued throughout his years at school in Port Arthur with several experiments in building electronic instruments with the intention of obtaining 'beautiful sounds'. During this time, he also studied piano and guitar and sang in choirs. Although he had originally intended to pursue a career in music he changed to physical engineering at Queen's University after a short time at the Toronto Conservatory. However, he remained active in music and became interested in the new electronic organs, such as the Hammond and the Robb Wave Organ (the first electronic organ to be invented and manufactured in Canada). He had access to both instruments in Kingston and made a close study of their musical virtues and defects, much under discussion by both physics students and organists at the time.

He was doing well in his studies and found the laboratory work especially fascinating. After three years he was given a summer job in the Nuclear Physics lab of Dr. J.A. Gray. Nuclear physics was and is highly dependent on electronic instrumentation, and an early device developed by Le Caine was used both in the physics lab and in the electronic organ built in 1937. Le Caine considered it to have been his first successful electronic instrument. '...I had arrived at the required specifications through a clear formulation of what seemed to my ear as the outstanding defects in the sound of the Hammond Organ--lack of proper attack and decay process and a true and adequate chorus effect. The synthesis from harmonics derived from the equal temper scale seemed like a good feature and I retained that.' To resolve the problems he say, Le Caine decided to use what became the 'vibrating reed electrometer', an electrostatic coupling device that was very simple and inexpensive.

'My idea was to use air driven free-reeds from an old parlour organ which in those days could be bought for $5.00 (an important point for me...I was getting $50 a month...) The novel part of the idea was that all the reeds were blown all the time. They were translated electrostatically... that is, they gave a sound in the speaker when a voltage was applied to a vibrating reed by a key. A tremendous problem was keeping the noise (from the airblown reeds transmitted by vibration) down to as low a level as possible. Since I didn't have the space to get the reed assembly far away (in a basement or closet), I had

Arrangement of timbre controls in the electronic sackbut.