<Horny>

The design and construction of this automated instrument started with the purchase of a brand new F-horn, made by Arnolds & Sons, model nr. AHR-301, serial number 121267. It came with an extra short piece of tubing, such that it can be turned into a Bb horn as well.

The horn has three rotary valves and force measurement revealed that the minimum force required to start movement of the valves was 2 Newtons. The required movement trajectory is 12 mm and the force required to fully push the valves raises to 2.5 Newtons. This determines the specification of the solenoid valves to be used. The physical placement of the valves on the instrument however, dictates a few more restrictions: the distances between the activation points of the valves are 30mm and 20mm, so the use of standard Lucas Ledex tubular solenoids (diameter 1" (25.4mm)) capable of meeting the specifications becomes problematic. Hence we went for August Laukhuff register magnets with a pivoting action and a force of 10 Newton.. The mounting width of these type is only 18mm. The solenoids are connected in series with a 24V halogen bulb (10W), operating as a voltage dependent resistor

As we power the solenoids from 48V, we now doubled the force developed at the start of the trajectory. The starting force of these solenoids, even after carefull adjustment of the anchor and the trajectory is only marginally large enough otherwize. The solenoids are mechanically coupled to the valves using tractures made of flexible M4 threaded nylon rod. Nuts and felt washers were used to minimalize mechanical noise production. The operation of the valves is controlled by a Microchip PIC controller type 18F2525. There are selectable lookup tables for both the fingering on the F-horn and the Bb horn.

For the excitation of the horn we once again used a compression driver followed with an acoustic impedance convertor. In this case we used the original mouthpiece of the horn without any modification other than the construction of a new clamping system to connect the mouthpiece firmly with the driver. The compression driver is steered -after amplification- by an ARM-microprocessor.

Horns are normally played with the bell pointing backwards. On occasions, composers do ask for the bell to be brought 'cor en haut', pointing to the audience. This request can for instance be found in the score of Strawinsky's 'Le Sacre du Printemps'. In our robot we also wanted to implement some form of control over the sound projection from the instrument. Since the mounting of the horn appeared to be quite complicated it was not possible to perform all calculations and drawings beforehand since for fluent motion it is mandatory to know the axis of equilibrium. Therefore we started by making the essential holding structure including the valve solenoids and the compression driver and only after that job was finished, we empirically found out where to place the balancing point. Unfortunately this balancing point appeared to come too close to the compression driver. Thus for technical reasons such as accessibility of mounting bolts and nuts and for ease of disassembly, we did move the axis of movement slightly to the backpoint. To restore equilibrium we sufficed by adding some extra weight. A stainless steel ladle at the same time serving as a protection cap for the compression driver fullfilled this function very well. As it came out, the final result is a bit crab like as the wheels had to be placed under a weird angle to the instrument.

Very probably this robotic horn is the very first horn player in music history that ever succeeded in playing his musical parts always perfectly in tune. Users and composers that like the 'out of tune-ness' of real hornplayers can always implement this as we gave the instrument ample possibilities to play in just about any imaginable tone system with high precision.