3.2 Technical Details of the Artificial Mouth

Figures 3.3, 3.4 and 3.5 show the schematic diagrams for the new artificial mouth.

The artificial mouth was principally made of aluminium, and constructed from

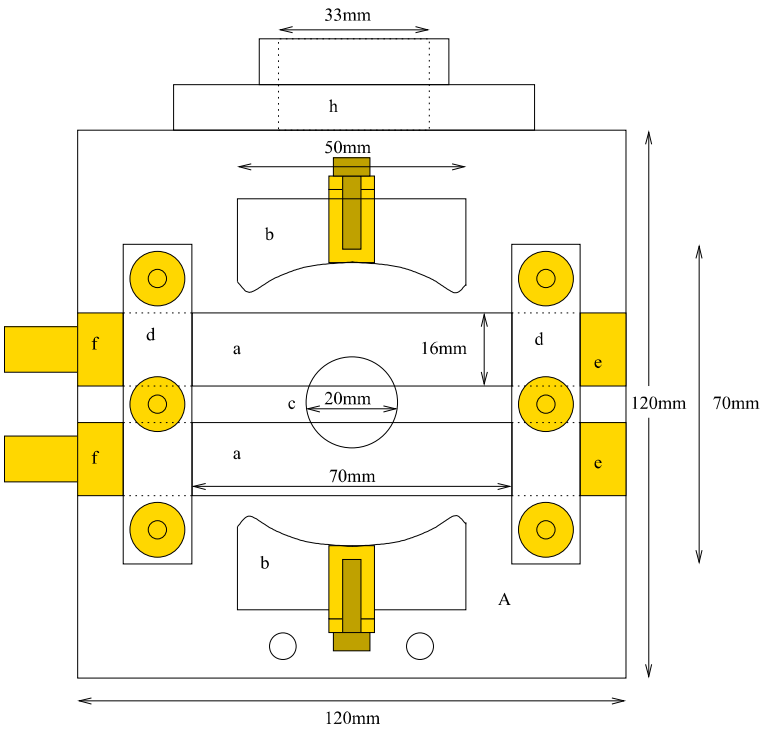

Figure 3.3: Schematic diagram of the artificial mouth (front view). The latex lips (a) were mounted on the front plate of the mouth (A) by the holding blocks (d), which held the brass mounts (e) and (f) which were slid inside the latex tubes of the lips. The lip guides (b) set the equilibrium position of the lips. The speaker mount (h) allowed a standard horn type speaker to be mounted. The hole (c) allows the air to flow from the mouth cavity through the lips.

a series of plates (A), (B), (C), (D), (E) and (F). The edges of these plates were liberally coated with vacuum grease and bolted together to form air–tight seals. The plates were 9.5mm in thickness. Plates (D) and (E) provided viewing windows allowing the mouth cavity to be observed. Plate (B) had two 8mm

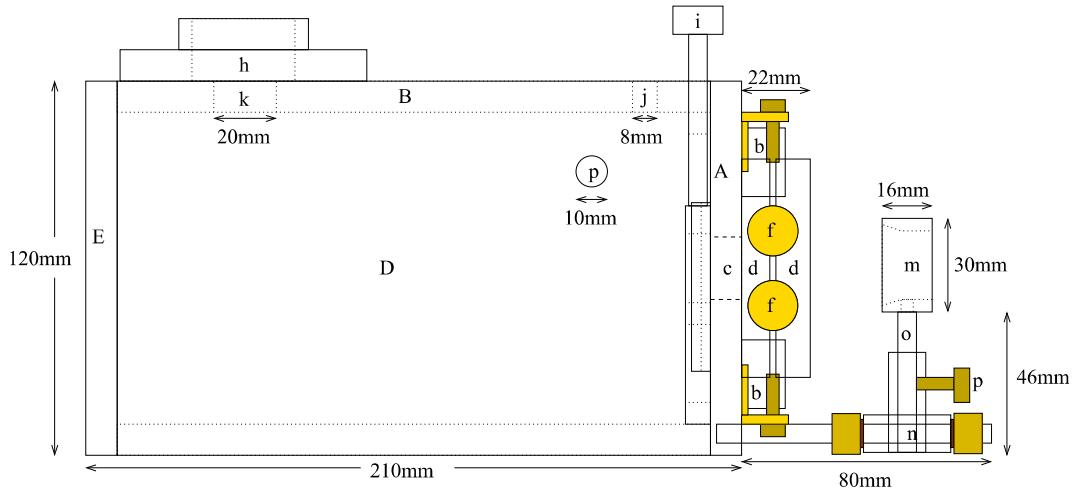

Figure 3.4: Schematic diagram of the artificial mouth (side view). The main plates of the mouth A, B, C (not visible), D, E and F were bolted together and sealed with vacuum grease. The speaker mount (h) was positioned over the hole (k) in the top plate to allow a loudspeaker to force air in and out of the mouth cavity. The hole (j) allowed measuring devices to measure the conditions inside the mouth cavity. The brass mounts (f) were placed inside the lips, and then held in place by the holding blocks (d). The lip guides (b) set the equilibrium opening position. The mouthpiece was held in the holder (m) which was mounted on a pole (o) secured in the transport mechanism (n). The height and angle of the holder was fixed with the PVC bolt (p). The "teeth" hole (c) allowed the air to flow from the mouth cavity through the lips. The "tongue" valve (i) provided a simple on/off control of the flow.

diameter holes (j) and one 20mm hole (k) cut in as shown. The (j) holes allowed microphones and manometers to be inserted into the mouth cavity.

A speaker mount (h) was used to mount a speaker over the hole (k). This mount was designed to accommodate a standard horn driver thread to allow a wide selection of speakers to be used. An adapter was also constructed to allow a standard cone loudspeaker to be attached to this speaker mount. This adapter is shown in figure 3.6. Plate (A) had a 20mm diameter hole cut in its centre (c) - the "teeth" hole, so called because it provided the support behind the lips

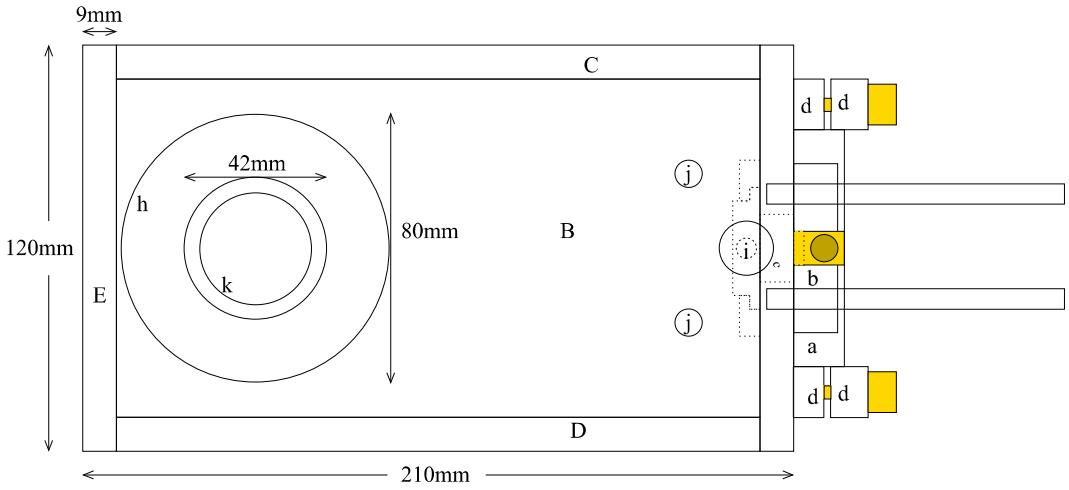

Figure 3.5: Schematic diagram of the artificial mouth (top view). The main plates of the mouth A, B, C, D, E and F (not visible) were bolted together and sealed with vacuum grease. The speaker mount (k) allowed a speaker to force air through the hole (k). The hole (c) allowed air to flow from the mouth cavity between the lips (a). The lips were held in place with the holding blocks (d), and their equilibrium position was set by the lip guides (b). The "tongue" valve (i) provided a simple on/off control of the flow.

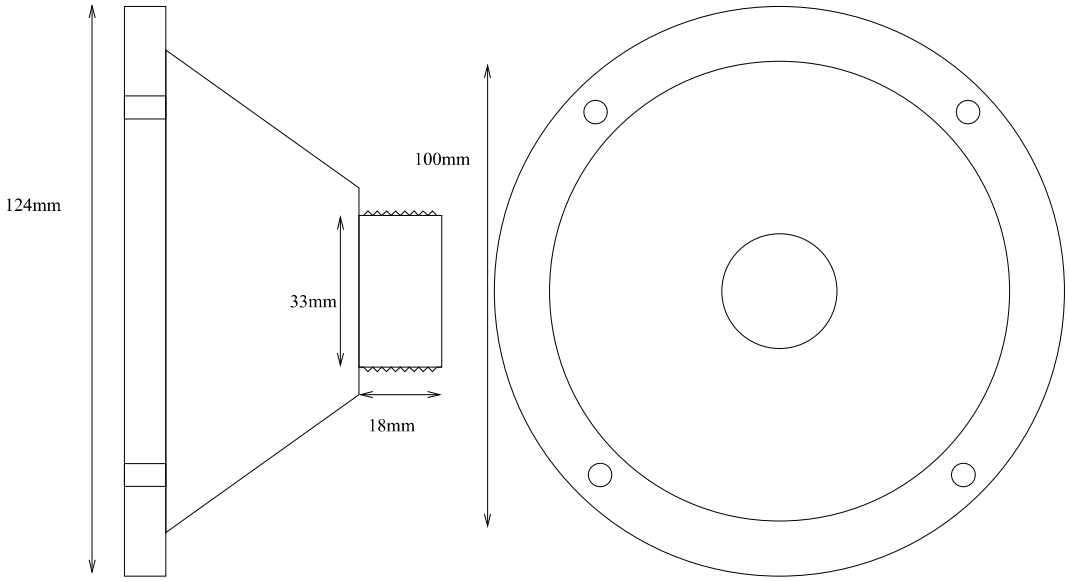

Figure 3.6: Loudspeaker adapter for mounting a cone speaker on the horn thread mount piece.

in a similar fashion to the teeth of a human player. The base plate (F) has a standard camera mount threaded hole partially drilled into it to assist with secure mounting.

The lips themselves (a) were latex tubes filled with water. Two different types of latex were used, with material thickness of 0.2mm and 0.3mm. These were provided by John Ward and Sons – an English manufacturer of latex rubber gloves. All lips were 16mm internal diameter. The latex tubes were coated in talcum powder and slipped over the brass mounts (e) and (f). These pieces were 16mm external diameter brass tubes. The right hand mounts (e) were closed at the external end, and open on the internal end. The left hand mounts (f) were open at both ends, but with a hose fitting on the external end. This allowed a hose to be attached to each lip to control and measure water pressure inside the lip. The hoses were raised up above the mouth to provide a water column of measurable height, which allowed calculation of the water pressure in the lips.

The lips were secured in place using the holding blocks (d). These blocks were made from from PVC, and were clamped together using the brass bolts and nuts (g). Once the lips were in place, they had an effective length of 70mm.

The lip equilibrium positions were controlled using the lip guides (b), again made from PVC. These allowed the equilibrium position of the lips to be easily controlled.

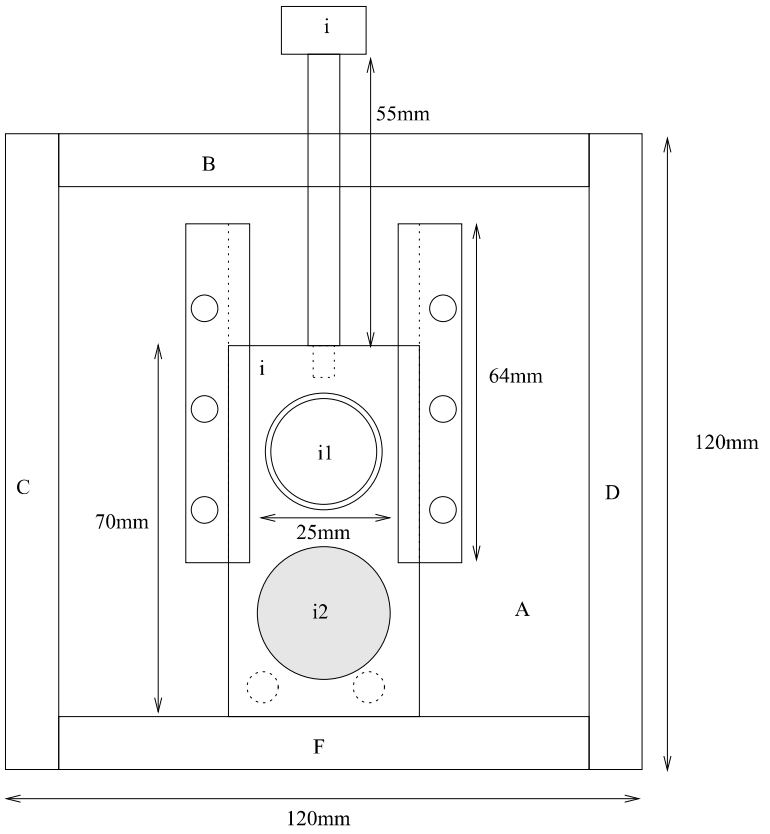

Figure 3.7: Schematic diagram of the artificial mouth (inside view). The "tongue" mechanism (i) provided a simple on/off control of the flow. The flow was stopped by sliding the perspex window (i2) into place over the "teeth" hole, and started by sliding the hole (i1) in front of the "teeth" hole.The front plate (A) was bolted to the plates B, C, D and F and sealed with vacuum grease.

A "tongue" mechanism (i) was also incorporated, and is shown in figure 3.7. This was a sliding panel on the inside of the front plate with two windows. One window was open (i1), while the other was closed off with a perspex window (i2).

The instrument mouthpiece was mounted in the holder (m), which was made from PVC, and was tapered at one side to accommodate the mouthpiece cup. The mouthpiece was held firmly in this mount by sealing it in with blu-tak. The holder (m) was then secured in the transport mechanism (n). This transport

mechanism consisted of a brass holder with a locking bolt and an aluminium base plate mounted on two rails. One of these rails was threaded, and had one nut on either side of the base plate to allow accurate and secure positioning of the mouthpiece. The threaded rail had a 1mm/rotation thread, and so any travel could be easily measured.

The mouth was designed to be modular, so that certain parts could be added or removed as necessary. For instance, in order to mount the transparent mouthpiece (discussed in section 3.3) one of the lip guides (b) had to be removed, and the mouthpiece holder (m) and transport mechanism (n) were removed and replaced with a special adapter designed to accommodate the transparent mouthpiece (see figure 3.8).

3.3 Transparent Mouthpiece

In order to view the motion of the lips a special transparent mouthpiece, shown in figures 3.8 and 3.9, was constructed. The design was inspired by similar mouthpieces used in similar studies [5] [16] [45] [68].

The mouthpiece cup was constructed from perspex, and the high-quality glass viewing window was fixed to the cup using silicon glue. A 2.2mm diameter hole was drilled into the side of the cup to allow a probe microphone to be inserted. The mouthpiece shank was cut from a Denis Wick 6BS trombone mouthpiece