No user-serviceable parts inside, or resurrecting a dinosaur – the restoration of an early push-up piano player

Introduction

This project arose some 14 years ago when I was looking for something to restore without adding another piano to our household, and an advert for three early 65-note Orchestrelle Company push-up piano players available free of charge seemed the ideal opportunity to gain the serious restoration experience I was seeking (how very true!). The concept of a "push-up" is covered elsewhere in the present edition of the Journal so will not be duplicated here. The plan was to take on two of them and either restore both or (if necessary) use one for parts. I chose to restore initially the slightly later one of the two as it was in better condition – a relative term which here means "marginally less derelict". A cross-sectional diagram of the player is shown in Figure 1; it seems to have been built in around 1900 or slightly later.

I've heard it said since in a couple of places that "early push-up pianolas are pretty straightforward to restore as they're so simple", but I beg to differ for the following reasons:

1. Although some of the main subsystems and their components are screwed together, the valves are inaccessible without splitting glued joints in the main chest, requiring a fairly brutal approach to dismantling. In other words, the central core of the system was designed to be assembled irreversibly in the factory and left intact throughout its life. Rebuilding it beyond its intended life clearly didn't enter into the design considerations!
2. Unlike most players from the heyday of the pianola era, the system does not really break down into manageable chunks (bellows unit, expression box, governor, primary valves, secondary valves etc.) which can be rebuilt and tested individually before tubing them together. Instead, almost all the units screw together to form a single huge assembly, with only one short length of trunking for the motor, and it is impossible to test (for example) the primary valves or motor governor in isolation.

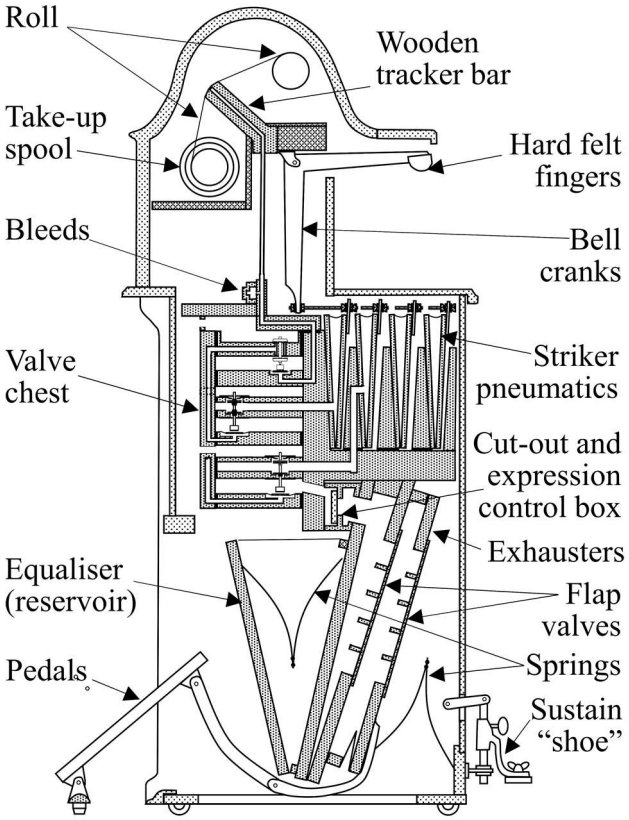

Figure 1: Simplified cross section through my piano player (approximately to scale)

3. At the time, the player was around 107 years old, and virtually everything perishable (e.g. gaskets, valve facings, let alone the cloth and tubing) had perished to some degree. Almost all such parts were replaced, except for leather nuts and secondary pouch leathers.

Just to add to the fun, someone had "raided" the hard felt finger pads which play the keys, and part of the sustain mechanism was also missing. Also, the wooden tracker bar is very fragile and can split though I have been lucky and that is one part that has not deteriorated.

Making a start

To break myself in gently, I began by restoring the air motor. Unfortunately the glued joints which needed to stay closed had split apart, and the joints holding the pneumatics onto the motor body remained very difficult to split. With careful application of a thin knife blade the pneumatics did come free (and the inevitable slivers of wood left behind could be steamed off and glued back on their respective boards), and I glued the pneumatics back with thin card gaskets. The gasket thickness did affect the geometry of the motor, requiring the crankshaft brackets to be slightly tilted with shims to avoid the pneumatics over-closing.

An immediate puzzle – what is in the box?

The first mystery facing the restorer is that nothing recognisable (other than the striker pneumatics) is visible when examining the valve chest – the unit consists of a heavy wooden box with several small exhaust vents and a large number of screws visible at the front. No valves or interconnecting tubes are visible. In fact, the front panel (held on with all those screws) contains all the windways connecting the primary valves to the secondary pouches. The chest itself is a ladder-like construction of six boards enclosing three vacuum chambers and two exhaust chambers vented to atmosphere, plus a top board which contains the channels from the tracker bar and carries the bleed chamber (Figure 2).

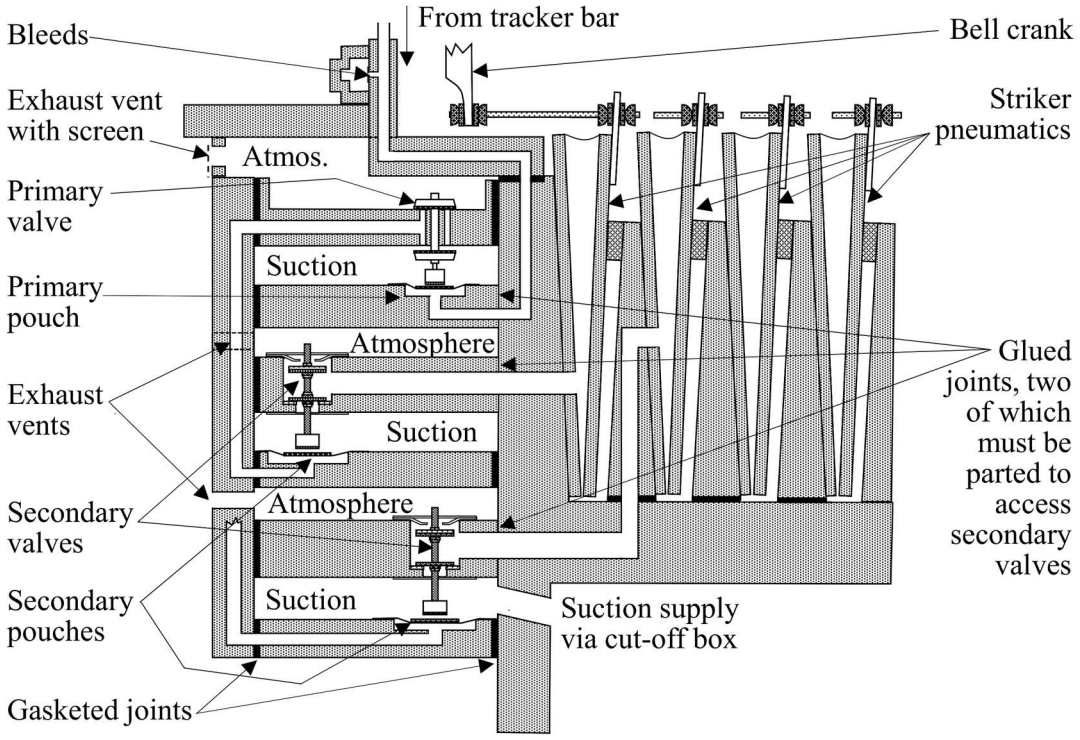

Figure 2: Section through main chest and stack (approximately to scale)

A job-stopper – the non-functioning but sealed main chest

With help from the then Technical Adviser David Wragg (who located some hidden screws), I managed to remove the three separate stack boards carrying the pneumatics (one board is a non-removable part of the structure) leaving the main chest as a stand-alone unit. At that point I thought it would be sensible to blank off the tracker bar ports and pneumatic wind-ways with tape and confirm that the valves were in good order by connecting the supply hole to a vacuum cleaner (again sealing the nozzle to the supply hole with tape). I was hoping the valves would seal (and operate smartly when a tracker bar connection was uncovered) and

perhaps to be able to hear sharp hissing from any small leaks. However, the leaks (almost certainly due to perished valve leathers) were so catastrophic that the chest could not hold any suction and the valves barely flickered. To make matters worse, the secondary valves are inaccessible in use so leaky valves cannot be identified! There was no obvious way forward.

Careful application of brute force

They say that rugby is a game of brute force played by civilised people, and some controlled brutality was needed here too. After consulting with various enthusiasts, it became apparent that the only option was to separate one or both of the secondary valve boards from the rest of the chest – even though they are firmly glued together. "Just pop them off" was one piece of advice (from the US), but they seemed firmly attached. By contrast, the primary pouch board fell off spontaneously, with soot marks indicating that the joint had always been suspect.

In the end, one of the secondary boards proved to be fairly weakly bonded at one end, and half of its length came away from the back board (with much prising using various blades) with little damage. The other half involved a lot of splintering, but with care (and a hot iron and a wet cloth) the splinters were steamed off where they remained glued and could be re-united with their parent material. I did not significantly smooth the resulting surface – this would have destroyed the necessary perfect fit against the back board. It might have been preferable to detach the upper valve board rather than the lower one, but more of that later.

New seats for the valves – a trick with Post-it notes

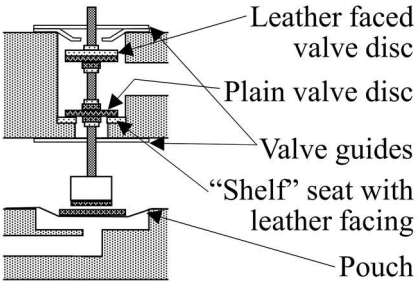

Figure 3: Secondary valve showing leather seat

With the valve boards now effectively independent units, it was possible to replace the leather seats. Unlike in most players, where leathered discs seal against plain seats both on the suction and atmospheric side, here the suction valve (only) is a plain disc sealing against a narrow ring of leather (1 inch diameter with a 5/8" hole), glued to a shelf at the bottom of a 1 inch diameter valve chamber (Figure 3). The original leather seats were torn out then the residual leather fluff soaked off with a wet paint brush and the shelf wiped clean. The choice of valve leather is critical and was covered well by Francis Bowdery in the Spring/Summer 2020 *Journal*, pp. 46-53; I used unidentified but excellent leather bought from David Wragg. A problem became apparent however – the new leather rings were too floppy to glue into place without distorting. A trick was developed to keep the rings in shape:

1. The 5/8" hole (actually 16 mm) was punched in the blank leather.
2. The sticky parts of Post-it notes were then stuck to the nap (sealing face) side of the leather, overlapping the hole, with edges butted.
3. A simple cardboard jig was used to centre a 25 mm punch so the outside of the ring could be cut concentrically with the hole. This left the ring stiffened by the weakly sticky paper and with the hole covered by the paper (Figure 4).
4. The wooden shelf was painted with hot glue and the valve seat placed on it, paper side up. A warmed cylindrical bar (faced in a lathe to give a completely flat end) was then used to iron the valve seat onto the shelf, flattening out any irregularities in the glue.
5. Once the glue had set, the sticky paper could be peeled off leaving the leather valve seat glued in place ready to receive the plain disc valve.

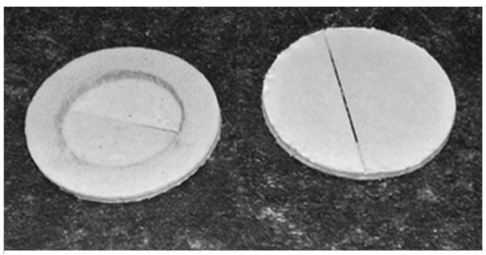
Figure 4: New valve seats with paper

This approach worked well for me, but I've since been told of an alternative approach used by another restorer on similar valve seats in a different player. If I recall correctly it involves a stepped bar which is used to push the new ring into its seat from below (with the valve board being held chamber downwards). I've not tried it but it sounds less tedious!

The metal valve stems were badly corroded near the various leather washers and were impossible to disassemble without destroying them, so I decided to leave the upper valve facings well alone and reinsert the valve assemblies as they were after cleaning them of verdigris. In retrospect perhaps it would have been better to put a thin additional facing of pouch leather on those facings to provide a better seal. In the end, they work *just* acceptably.

Testing the valves

Given the earlier leakage problems I was taking no chances with the new seat facings so it was necessary to test these thoroughly. A dummy chest was made up to go below each board and this was sealed onto each valve board with masking tape. Suction could then be applied to this dummy chest and leakage checked for each valve using a bubble jar (Figure 5). Most valves were satisfactory, though a few valve seats needed to be re-faced.

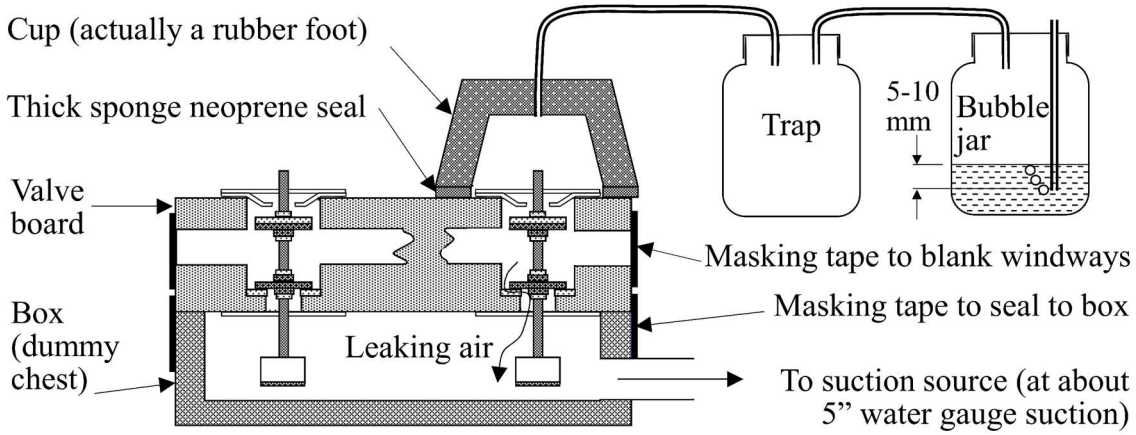

Figure 5: Testing of valves using a bubble jar before reassembly (not to scale)

Mending the chest after splitting apart

Once the seat facings were judged satisfactory, the challenge arose of turning the broken-apart chest back into an airtight box. It didn't seem a good idea to re-glue joints that had taken a lot of breaking apart (just in case they needed to come apart again!), so these were gasketed with Persian pallet leather, like most of the other renewed gaskets. However, there was nowhere obvious to screw one of the newly-gasketed joints together as the back board is integral with windway board behind it. The solution was to use long screws inserted diagonally (Figure 6), with the heads being recessed into pockets in the windway board. The primary pouch board, by contrast, was relatively easy to screw onto the back board by placing the screws in the gaps between the pneumatics, taking care to avoid windways.

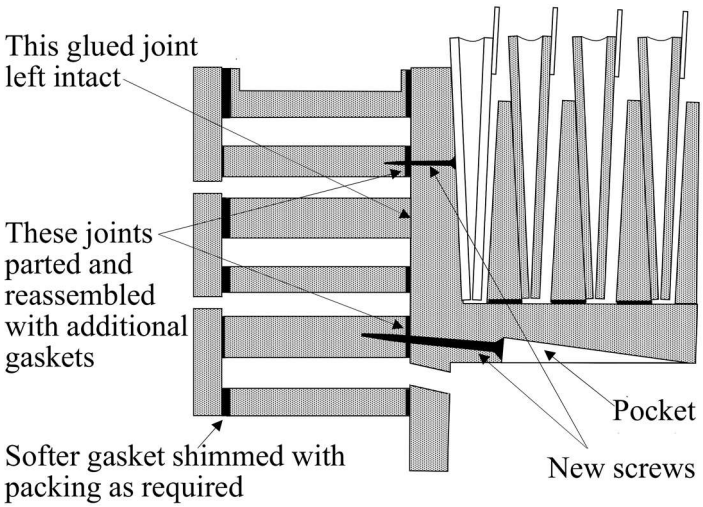

Figure 6: Reassembly of valve chest

Another challenge arose because the front board of the chest was originally fitted as the last stage of assembly after planing the assembled chest flat so that the thin leather gasket would seal properly. In fact so much had been planed off that some of the wood (on the pouch wells) was almost paper-thin! However, the introduction of new gaskets at the back of the chest meant that the front of the chest was no longer anywhere near flat. Re-planing the reassembled chest was clearly not an option and I had no faith in my ability to plane down the boards to compensate for the gaskets, so the front board was shimmed with card to match the irregularities in the chest, and thick sponge neoprene was used as a much more forgiving gasket than the original leather. This was an ugly but effective solution to an ugly problem.

Detaching and re-covering the striker pneumatics with thin rubber cloth ("tosh")

This should have been a routine task but the fixed boards of the pneumatics were glued directly onto the stack boards and I made the mistake of taking literally the advice in the literature to break the glued joints with a chisel or knife. Many of the boards broke, some into matchwood! I have since learned that in the UK's climate the glue remains far less brittle than in the US where the restoration books were mostly written, so joints don't break cleanly. I removed the last few by softening the glue with an iron (applied to the fixed board, taking care to avoid scorching) which is the best way in the UK; I live and (hopefully) learn. Many of the broken boards could be glued back together but perhaps a quarter needed to be re-made. Re-covering the pneumatics is a standard and straightforward procedure, though small cutouts had to be made in the pneumatic cloth to suit the flanges. I didn't re-glue the pneumatics directly to the stack boards but used a paper gasket to allow easy removal.

Main bellows unit

This was (in principle) straightforward to rebuild though one of the regulating pneumatics was glued in place and could not be re-covered in situ. The joint was split apart and the wood repaired as required then the unit was re-covered then screwed and gasketed on. For the exhausters (which were overhauled later) new flap valves were made, with new backing boards and springs as well as leather, as the originals were in very poor condition.

Expression/cut-off and governor boxes

These were held together with screws which were rusted solid and nothing would budge them. David Wragg again came to the rescue with the advice to saw along the gasket line with a hacksaw blade (obvious in retrospect, of course, but not initially to me!). This caused surprisingly little damage though some filling was needed. The seized screws remained immoveable so were left in situ and replacement screws were inserted next to them. Some fine additional screws were used to avoid leaks from long poorly-clamped gasketed joints.

Fingers and sustain shoe

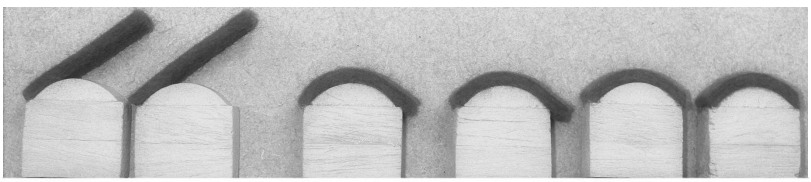

Figure 7: Replacement fingers during gluing and after trimming

Although the instrument was largely complete, the final stage of the pedal mechanism (the "shoe" that operates the sustain pedal of the piano) was lost, and the felt-covered fingers that play the piano keys had been removed. At least I had the other push-up from which to copy the overall shape of the fingers, and it was straightforward build up wooden blocks with a curved face from strips of hardwood including half-round section, and to cover these with green check felt for pianos (Figure 7). They are the wrong colour (the originals would have been off-white) but they work fine!

The missing shoe was more problematic, though fortunately at about this point I had acquired a lathe with a milling attachment, and I was able to make a new shoe and linkage which serve the same purpose as the original though (with the shoe being made from steel rather than an iron casting) look rather different (Figure 8). As it's hidden in use this is of no great importance.

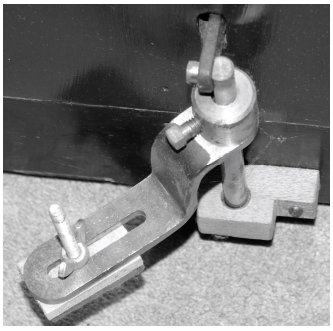

Figure 8: New shoe and linkage

Did it work?

An important rule is to test every component before trying to reassemble everything. The testing of the new valve seats has already been mentioned, but much other testing also took place, notably of the assembled valve chest before re-attaching the pneumatics. The windways to the tracker bar and for the pneumatics were blanked off with masking tape, and on applying suction to the chest (from a vacuum cleaner) it was reassuring that the valves could be heard working snappily when the tracker bar ports were uncovered.

Initial testing took place before overhauling the exhausters and I was able to get a rather wheezy tune out of the instrument. This acted as an encouraging light at the end of the tunnel but also dashed any hope of avoiding rebuilding the exhausters and flap valves, so they were rebuilt as described earlier and the results were infinitely better. In retrospect I should also have had a second attempt at the equalisers (reservoirs) as they were not as airtight as I would have liked, possibly due to wood porosity and/or imperfect materials, and the replacement for a broken equaliser spring wasn't quite as strong as it should have been. I'll redo these one day! The bell cranks rapidly worked loose at the right-angle joint and tended to break apart, so gusset plates were made from thin plywood and glued either side to reinforce all the joints. And the original single-acting motor should really be replaced with something a little more refined (I believe they were superseded by more smoothly-running motors), but it's useable.

Final thoughts

I have only described some of the jobs required, and have not covered things like tidying up the case, making a new back board to replace the badly damaged one, re-attaching peeled veneer, cleaning tarnished parts, making new hinge springs for the striker pneumatics etc. After all that hard work it is an effective, if very basic, instrument. Despite the imperfections in the equalisers it feels tighter than many pianolas, but there is no automated theming, no split stack to separate bass from treble, no Metrostyle pointer to aid with tempo, it can't play full-scale rolls and in practice all expression must be obtained using the pedals. Also, it is too high to be compatible with at least some pianos. Was it worth it? Well, it fully met its objective of giving me experience, and I learned a huge amount, including never to tackle an early push-up again! As I never did need the spare player for parts I later sold it unrestored. I wonder how the buyer got on with restoring it – seven years on I've heard nothing!

Acknowledgements

This project was undertaken with a great deal of encouragement from, and discussion with, other enthusiasts, notably Paul Morris, the late David Wragg, Jim Spriggs, Nicholas Simons and Francis Bowdery. I am sure I have missed others; apologies to anyone whom I've forgotten. The drawings are my own but are very loosely based upon a historic diagram (of uncertain origin) of a slightly later Metrostyle-equipped player, with some details being traced from the 1911 Encyclopaedia Britannica illustration of a scroll-top player.

Arthur Jones, October 2021