Conserving a pedal electric Duo-Art

Peter Phillips

I recently purchased an unrestored English pedal electric Duo-Art in a 1929 Weber upright. Oh boy, what fun lies ahead! I thought I would share my experiences in a series of articles in the ACMMI Bulletin as I work through this complex instrument and hopefully get it going. I'm doing this for several reasons, the main one being that so little is written about the PEDA, and what there is doesn't apply to mine. Julian Dyer has been an excellent source of information through a posting on his website, but as Julian points out, all PEDAs are different.

Another reason is to do what all club magazines do, or should do, and that is to share instrument restoration experiences, whether presented by an expert or beginner. And when it comes to a PEDA, meet Mr Ignorance. As Julian says, the best way to figure out how to tube, repair and restore a PEDA is to first figure out how it all works. And that is a task in progress. So I'll start at the beginning, and share with you what I have so far learned and achieved in my quest to bring this instrument back to life.

The piano

When the instrument was delivered, it was a poor, tired pathetic thing. Covered in 60 years of grime and dirt, all the tubing had disintegrated with most of it lying on the bottom of the piano. The piano action was frozen, the strings completely black, and every exposed part covered in what was probably smoke, either cigarette or open fire. But it was complete, totally original (well, almost, as I'll explain later), and had all the hallmarks of an instrument that would respond to conservation, not restoration. By conservation I mean bringing everything back to original condition through elbow grease, and only replacing parts or finishes that won't respond to polish, cleaning fluids and lots of rubbing. But I'm ahead of myself, first the piano.

I took the piano action to piano technician Richard Andreoni's workshop, where we both worked on it for about three hours. The work involved using compressed air to blow out the dust and dirt, a Dremmel to clean up the hammers and the most wonderful, magical liquid called Protak to free up the action. Richard imports this product, so I quickly purchased a bottle. Protak is applied with a syringe to each and every pivot point, a drop or two is usually enough.

Back home, I spent the next few days applying more Protak and regulating the action. The Weber has a Langer action, made in Germany, which is different from the piano actions shown in Aeolian publications. So even the piano action in this instrument is not mentioned in the literature. Great start. After doing all the usual regulating things, such as tightening every screw, travelling the hammers, adjusting letoff etc, bit by bit the action started to come to life. Nothing was broken, every adjustment was easy to use and thanks to Richard, the action was looking much smarter. It remains to replace the dampers, but these work well enough for now.

The piano keys were the big surprise. Every ivory is in virtually perfect condition, with only minor yellowing. This is typical of a player piano, in which the keyboard gets little use. The keys took some cleaning, but with spray cleaner and warm water gently applied, it took only a few hours to get the keyboard back to almost original condition. The strings were another matter, as they were all as black as soot. To clean these I used a piano string cleaning rubber and lots of energy. I was not trying to get them back to new condition, just to remove the grime.

None of the strings were rusty, and later when Richard tuned the piano, he remarked on its general condition. “What a find!” It’s currently tuned to somewhere between A435 and A440, but will eventually be brought up to pitch. Right now the piano gets played every day, and being in the front room sometimes brings passing visitors to the door. “Who’s the piano player?” I’m not sure what will happen when I start playing rolls on it, but for now the Weber is at least making music.

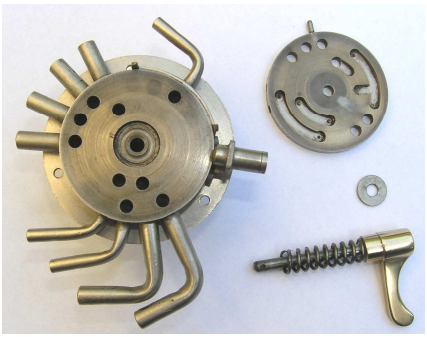
The upper action

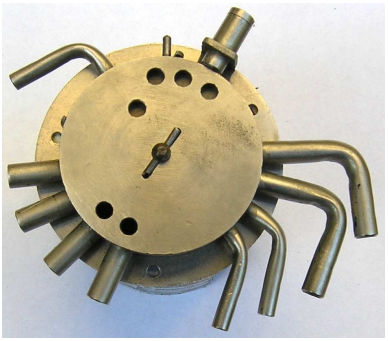
One of the first things I did was to remove the upper part of the player action, mainly so I could get access to the piano action, but also to start work on the player part, as this is the main reason I bought the instrument. What a shambles. Sitting before me was a complete mystery. There were few clues as to how everything connected together, as the rubber tubing was broken, or easily broken when trying to trace it out. My knowledge of genuine Duo-Art is relatively small, although I had learned a thing or two in the heady days of 1978 when I built the Duo-Art vorsetzer that Denis Condon and I used to record Percy Grainger. But, as I said at the time, the only Duo-Art part in that vorsetzer was the tracker bar. Now I was faced with the real thing, made more complex by being of the pedal-electric type.

It's at this point you might be excused for giving the job to someone who knows what they are doing. But I was encouraged by the thought that I might, just might, get away without recovering the stack, redoing the valves or breaking apart the expression box. Time will tell on that, but so far so good. The problem that lay before me was to determine where the tubing went. And that's when my learning curve started to ascend, at first very slowly and finally to a sufficient point to let me start pulling things apart and bringing them back to their original condition.

The main points of concern were the rotary Duo-Art/Pianola switch with nine tubing connections, and a block containing eight valves, with 26 connections. That's 35 tubes, and where do they go? Coffee… You see, Julian's description and drawings of a PEDA were close, but his switch shows 11 connections, and fewer connections to the valve block. Other PEDAs I have seen have different switches again, one with 10 connections, others as separate slide switches. And none have a valve block like the one I was staring at. Coffee…

It took me several weeks to decode this thing called a Pianola-Piano "Duo-Art" with Themodist and Metrostyle lever. I'm familiar with Ampico, but here's another language. I still don't fully understand the function of the wonderfully named Temponamic lever, and I guess I still don't know the full versatility of the PEDA. But that's all in the bottom action, which is yet to be explored. For now I realised it was time to get my hands dirty and dismantle the switch and the valve block so I could figure out what they do, and how they worked. But before I start explaining these (yes, I figured it out), it's appropriate to give an overview of the PEDA's operation, and what the rotary switch (shown below) is supposed to do.

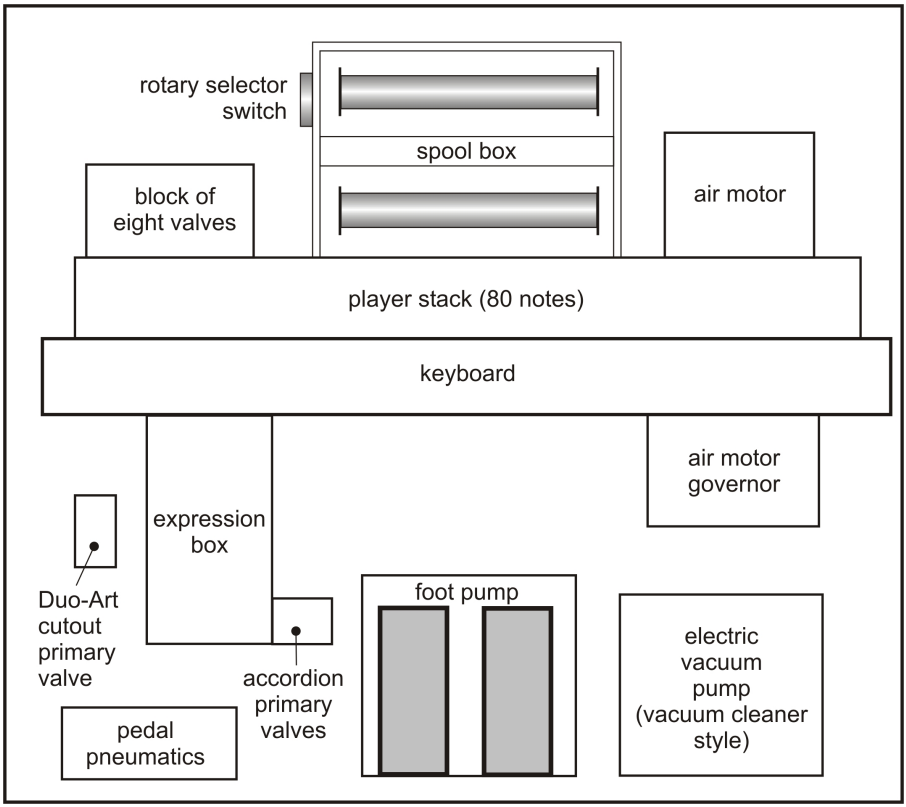




Overview of the PEDA

According to Julian Dyer, the PEDA was first manufactured in the UK around 1921 and proved very popular. There is also an American pedal electric instrument, but these are quite rare. Even so, it is the instrument featured in a service manual reprinted by Vestal Press. All PEDAs built in the UK are different in some way, having been constructed from whatever parts were in stock at the time.

The block diagram below shows the main parts and their location in my PEDA. All PEDAs have these parts, but not always of the same type, or in the same position. In this instrument, the pump is a vacuum cleaner type, the tracking system moves the tracker bar and there are 80 pneumatics in the stack (fortunately, as this simplifies things a little). It also has a transposer, a repeat switch and a soft switch, which simply switches on the soft pedal.



The rotary switch

This is a good place to start, as it helps explain what has to happen when the switch (of whatever variety) is set to either Duo-Art or Pianola. The switch has three functions: pedals on or off, to set a Themodist playing level when playing an 88-note roll, and switching various Duo-Art functions. The latter requires more explanation. The expression box in a PEDA has extra parts not found in a standard Duo-Art expression box, including mechanical connections to various levers on the front of the piano, and Themodist operation. So when an 88-note roll is being played, the Duo-Art part of the box has to be blocked off, so the Themodist part of the box can take over. This is achieved with the Duo-Art cutout primary valve shown in the diagram. It connects to two inputs on the expression box which connect to two valves in the expression box which when operated, block the flow of air through relevant parts of the box.

Next are the Themodist connections. The Duo-Art (and any Themodist player) has two theme holes in the tracker bar which in a Duo-Art determine how the stack is controlled, in which the choices include all notes at accompaniment level, all notes at solo (or theme) level, or half the stack receiving accompaniment, the other receiving solo level vacuum. That's ok for Duo-Art, but not for Themodist rolls. Instead there are now two more valves in the expression box that only function when the switch is set to Pianola. That is, there are four theme valves in the expression box, which are connected to four theme primary valves, which in my case are in the valve box mounted on the top action.

There's more. The four expression holes on either side of a Duo-Art tracker bar are mounted above the last four treble and last four bass note holes. A Duo-Art roll has 80 notes, so there are never any note holes to expose the expression holes. But in an 88-note roll, it's possible there will be note holes that could uncover the expression holes, and send the Duo-Art box into a frenzy. The accordion pneumatics which operate the Duo-Art expression box are operated by primary valves, which connect to the expression holes in the tracker bar. These eight valves have cutouts which connect to a single tube that connects to the rotary switch. On the Duo-Art setting, the cutout is disabled, allowing the accordions to respond to the expression information. On the Pianola setting, the cutout is operated and therefore prevents the accordions from operating.

That's the Duo-Art switching functions, now to the bit about setting a minimum playing level for 88-note rolls. It seems there are various ways this is achieved, including having an extra accordion on the accompaniment side which is only operated when playing 88-note rolls. On this PEDA you have a choice. There are two input connections, one to the power 2 accordion, and one to the power 4 accordion. A tube to either one (block off the other) goes to the rotary switch, so on the Pianola setting, either accompaniment accordion 2 or 4 is collapsed.

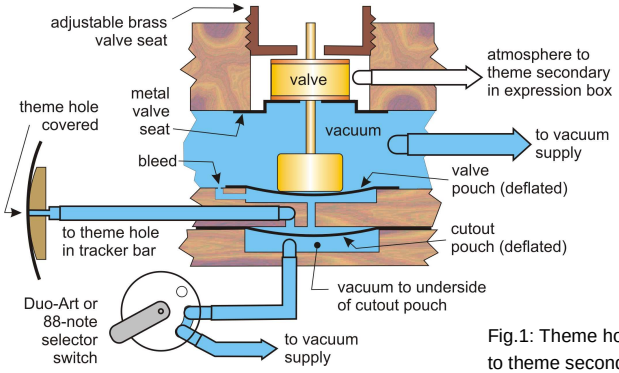
The pedal on-off connections are simple. The tracker bar pedal holes are either blocked by the switch (pedal off) or connected to the pedal primary valves (pedal on). But what of the switch itself? It's here the going suddenly got tougher, as unbeknown to me at the time, someone else had been fiddling with this instrument. In fact, the more I got into the dismantling, the more evidence I saw of on-going repairs, perhaps made by an Aeolian technician during the 1930s or 1940s. One of these was to cover a hole in the rotary switch, making me think this was correct. A red herring as it turned out.

Once I knew what had to happen with the three settings of the rotary switch, the next step was determine how the switch should be connected. This meant dismantling the switch and figuring out what happened to each of its nine connections for the three switch settings, which are: Duo-Art rolls electrically operated; foot operated 88-note rolls pedals on, and foot operated 88-note rolls pedals off. The Aeolian Instruction booklet No.3 for the UK PEDA shows four positions of this switch, wouldn't you know, where the fourth is quaintly called Personal Control, 'Pianola' and 'Duo-Art' Rolls. Perhaps this happens anyway with my switch, but it certainly only has three click positions.

The valve block

The literature on the PEDA, or any Duo-Art is remarkably lacking in information about the operation of the various valves I was about to encounter. This is not rocket science, but I could not figure out how these valves worked, even after disassembling the valve block. But, after some time, as the illustrations show, I have finally determined how the theme valves work (see next page) and the operation of the notoriously complex 4-hole tracker system (page after next).

Operation of PEDA theme valves



Figs 1 and 2: Switch set to Duo-Art, which applies vacuum to the Duo-Art theme cutout pouches allowing DA theme valves to operate. The Themodist theme valves (also connected to the theme holes) are prevented from operating by the switch applying atmosphere to their cutout pouches.

Fig.1: Theme hole covered, valve off, atmosphere to theme secondary, which is therefore closed.

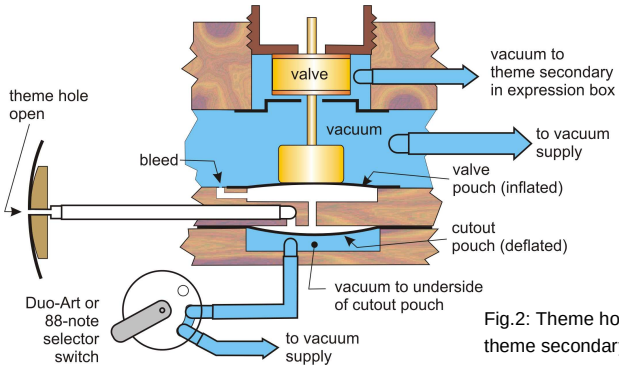


Fig.2: Theme hole open, valve raised, vacuum to theme secondary, causing it to operate (open).

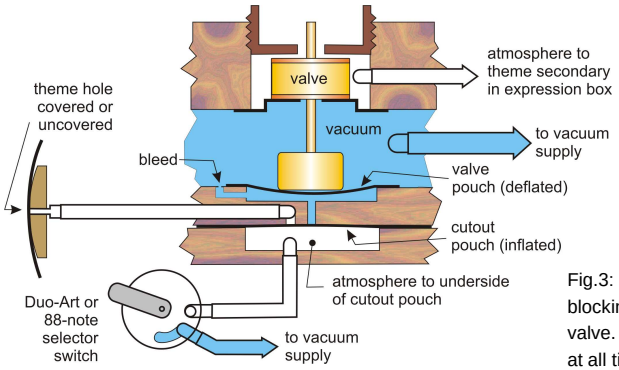


Fig.3: Cutout operated by switch, blocking connection from theme hole to valve. Atmosphere to theme secondary at all times, closing theme secondary.

Four-hole PEDA tracking system

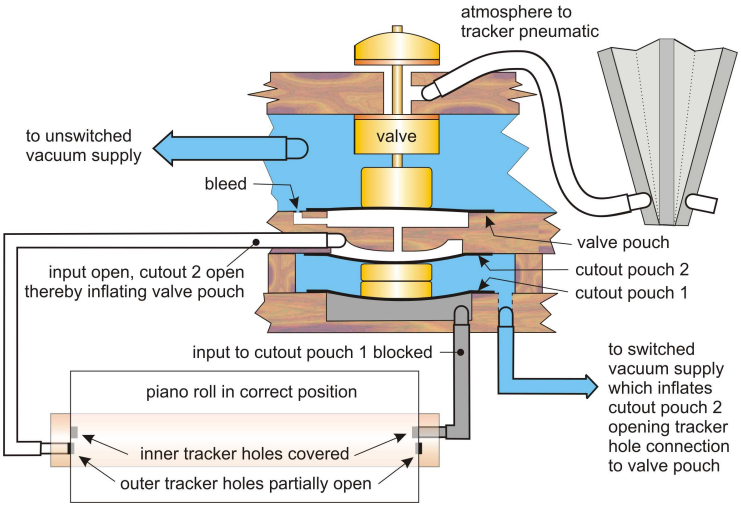


Fig.4: Roll in correct position

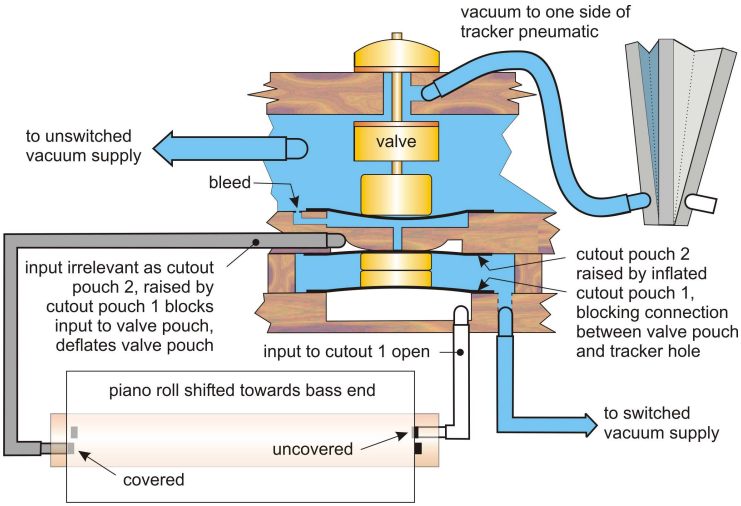


Fig.5: Roll tracking incorrectly

Operation: Cutout pouch 2 is operated as in Fig.5—blocking input to valve pouch—when: (a) cutout pouch 1 is inflated by open tracker hole, or (b) when the switched vacuum supply is off (to prevent tracking occurring during reroll). During reroll, both sides of the tracker pneumatic therefore receive vacuum to keep it stationary. During play, both sides of the tracker pneumatic are open to atmosphere (as in Fig 4) unless the roll shifts (Fig.5), causing vacuum to one side of the tracker pneumatic, which moves to correct the roll position. The inner tracker holes operate cutout pouch 1 which, when raised, pushes cutout pouch 2 against the connection to the valve pouch, preventing it from operating.

Perhaps the greatest mystery was this thing called a “cutout”, an extra pouch in the valve assembly. I assume the term “double membrane valve” is another way of describing these valves. The problem is that not all cutouts operate in the same way. One type requires inputs of either vacuum or atmosphere, another has inputs of atmosphere (open) or closed. This is important, as until I knew how the various cutouts operated in the valve block, I could not determine how the switch should be connected. After a lot of sketching, head scratching and coffee, I came up with diagrams of the three different types of valves in this valve block.

The valve block is actually in three sections and has four theme valves, two tracker valves, and two valves to do with pump motor on-off and reroll. The theme valves are the most critical, and have an adjustable throw to get the quickest response. The colour drawings on page 10 are my attempt to show how the theme valves work. Note that the cutout pouch requires either vacuum or atmosphere. The drawings on page 11 are an even braver attempt at deciphering how the four hole tracking system works. It’s just a pity that this form of tracking system is only good with new rolls. Note that its cutouts (there are actually two per valve) operate with either atmosphere or closed, different to the theme valves. I’ve produced these drawings in colour for best clarity, as it might just save you (and me later on) some head scratching when troubleshooting a faulty valve.

Above: The valve block. Left four valves are theme primaries, centre two are for tracking, right two for reroll, motor off.

Right: Theme valve “tosh” cutouts. One is removed to show how the cutout blocks the connection between the theme hole and theme valve pouch

Repairing the valves

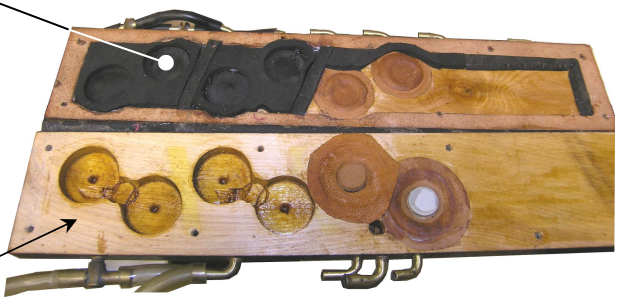
Before disassembling the valve block, I bench tested it, and found to my dismay that it did not do what it was supposed to do. In particular, the cutouts in the theme valves did not work, which meant both the Duo-Art and Themodist valves always operated together. After a phone call to a well known restorer (thanks Jim), I had the courage to pull the valve block apart, and yes, as suggested by Julian and Jim, there was the problem: the cutouts were made of "tosh" which had perished.

But there were other issues I began to discover, all pointing towards rough workmanship at the Aeolian factory. The inside of the valve block was not sealed in any way, making it very porous. The metal valve seats were in poor contact with the wooden surface, a great potential for leaks, and the various leather seals were obviously only partly effective. Perhaps I had found the problem the Aeolian technician all those years ago could not.

I wondered at the use of rubberised cloth, rather than leather as a cutout pouch, and decided the reason was to ensure a totally airtight seal. I decided to use rubber as the replacement material, the sort you can buy from a Physio shop for stretching exercises. I have been experimenting with this material for a while, and it certainly gives an airtight seal. The photo below shows the newly installed rubber pouches, and a closed cell neoprene sealing alongside the original leather to ensure a good seal with the bottom board. (Since replaced with split-skin leather. Ed 2016.) I've also coated the timber with two layers of shellac. The valves now work as they should, perhaps for the first time. The sealing I have applied should hopefully save leg muscles when pumping a roll. To be continued…

Thin rubber sheet, about the same thickness as pouch leather to replace the original "tosh" cutouts.

Surrounding the pouches is a layer of 3mm closed cell neoprene to give a good seal with the bottom board.



Conserving a pedal electric Duo-Art – Part 2

Peter Phillips

In the first part of this ongoing article, I described the PEDA's rotary switch and the valve block mounted on the top action. In this part, I'll connect them together. First a couple of corrections. UK member Denis Hall has pointed out that the PEDA was first marketed in 1923, not 1921, which helps date these instruments. Denis also pointed out the four-hole tracking system is actually very good with damaged rolls, not relatively useless as I had suggested. Denis points out, however, that it's essential to seal the pouches in the tracker valves.

Tubing connections

As I explained before, the problem I faced was how to connect the rotary switch to the rest of the instrument. I now have three different tubing diagrams of the PEDA, but none of these are correct for my instrument. And yet, as Denis Hall also pointed out, all PEDAs operate in much the same way. They have to. So why the many tubing variations? Why was there not a standard PEDA? There are probably all sorts of reasons, which ultimately don't matter. What matters is how to tube each part so it achieves its desired function. That the parts differ from PEDA to PEDA is the challenge.

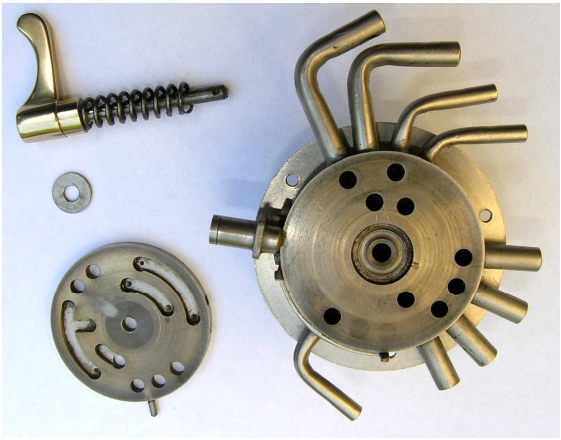
By now I had worked out the operation of the three different types of valves in the valve block mounted on the top action. Next I had to determine how the rotary switch is connected to achieve the required functions, which are:

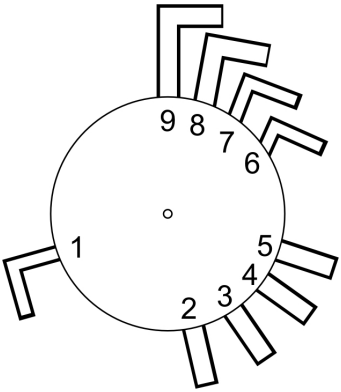
- Pedals on or off (Pianola position only)
- Duo-Art position:
  - allowing Duo-Art theme valves to respond to theme holes in the roll, and preventing the Pianola theme valves from responding, achieved by operating or not operating their related cutouts
  - allowing the expression accordion primary valves to respond to expression information on the roll, achieved through cutouts in the primary valve block
  - switching valves in the expression box for Duo-Art operation and isolating the part of the box for Pianola/Themodist operation (Duo-Art cutout off).

In the Pianola position, the switch has to:

- prevent Duo-Art operation by isolating the Duo-Art theme valves and allowing the Pianola theme valves to respond instead
- switch the expression box to Themodist operation (Duo-Art cutout on)
- operate an accordion in the accompaniment side to give a suitable playing volume
- prevent the accordion expression valves from operating

Having already worked out what was needed to operate a particular function, eg, its input open to atmosphere, closed or connected to vacuum, next was how the switch might achieve this. To do this I disassembled the switch and made a paper facsimile of the top part of the switch. The aim was to figure out the interconnections of the nine inputs to the switch, which is shown below.





To work this out I laid the paper version of the top part of the switch over the bottom part of the switch and noted what happened for each of the three switch positions. The possibilities were a switch input being connected to atmosphere, blocked, or connected to another input. At the time I did this, one of the holes in the top part of the switch was covered with tape, giving the appearance of having been done at the factory. This red herring caused a lot of head scratching, until I realised it was a modification done by a serviceman.

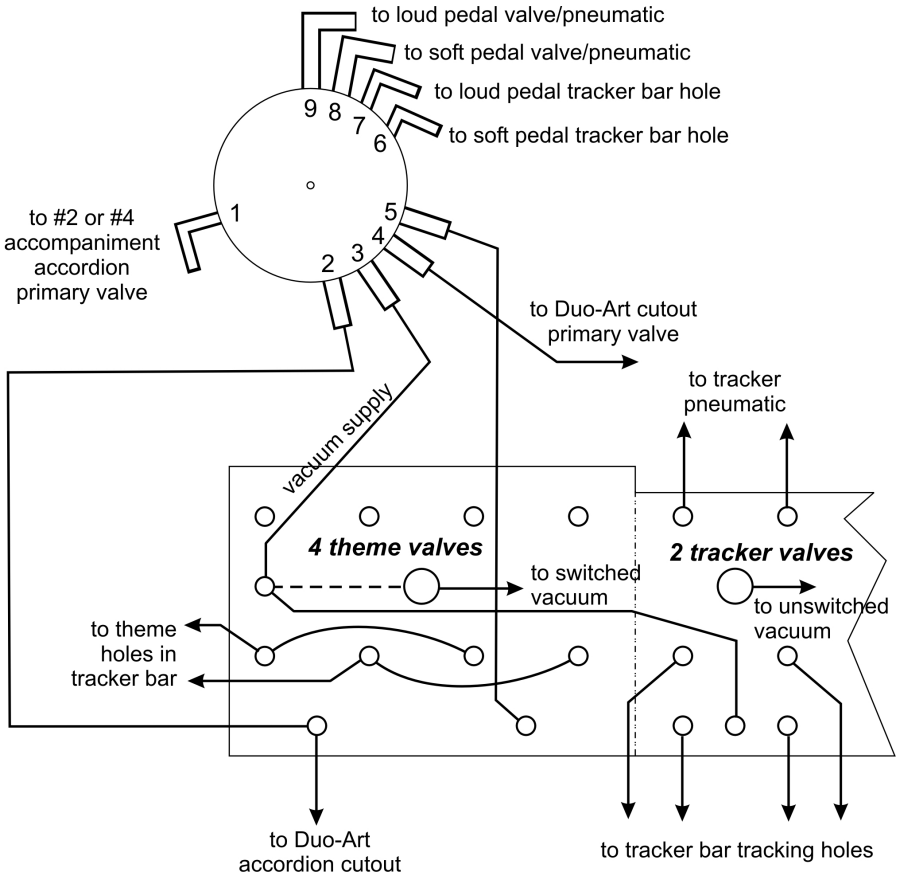
The tables below show the results I obtained:

Duo-Art position	**Pianola position (pedal on)**	**Pianola position (pedal off)**
9 connects to 7	9 connects to 7	9, 8, 7 and 6 blocked
8 connects to 6	8 connects to 6	5 and 4 connect to 3
5 open to atmosphere	5 and 4 connect to 3	2 blocked
4 open to atmosphere	2 blocked	1 open to atmosphere
3 connects to 2	1 open to atmosphere	
1 blocked		

From these results I was able to determine that:

- 9, 8, 7 and 6 operate the on-off function for the damper and soft pedals
- 5 operates the Themodist primary valve cutouts by applying vacuum in Pianola position (cutouts off), and atmosphere in DA position (cutouts on)
- 4 controls the Duo-Art cutout primary valve by applying vacuum or atmosphere. In DA position atmosphere is applied, turning on the primary valve and allowing air to flow through the DA expression box. Otherwise vacuum is applied, which turns off the box.
- 3 is the vacuum supply to the switch, taken from the switched vacuum source supplying the valve box
- 2 controls the cutouts for the DA theme valves and accordions by applying vacuum to the cutout pouch in DA position, blocked otherwise.
- 1 operates an accompaniment accordion (either #2 or #4) to set the minimum playing level on Pianola. (The hole to atmosphere had been blocked by a serviceman, thereby preventing this function from operating and causing me great confusion.)

The diagram on the next page shows the connections between the switch and the rest of the instrument. These connections differ from all the tubing diagrams I have, because of the different types of switches, some with 10 connections, others with 11. But in the end, they all achieve the same results, just differently.



Reaching the point where I could actually present the above connection diagram has taken an absurd amount of time. Now that this point is reached though, the rest of the work, while time consuming, is relatively straightforward. At this stage, work has progressed on the top action, which presently is in many parts stored in plastic bags. A question I need to answer is whether to reseal the primary valve leathers. It has been suggested this is essential for best operation, but it's invasive work I would rather avoid. It seems logical to do this work now while the top action is in bits, although another argument is to get it all going then see if the valves need to be resealed. After all, Aeolian player actions are nicely built and can be disassembled reasonably easily. More as work proceeds over coming months.

Conserving a pedal electric Duo-Art – Part 3

Peter Phillips

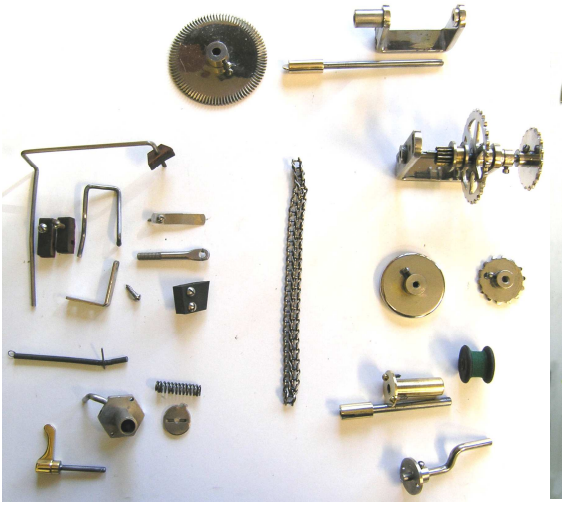
Having now sorted out where most of the tubes go in my Weber PEDA, I was able to start doing some restoration work, initially on the spool box. At first I thought this would be easy, if time consuming. In some ways it was easy, at least until it came time to put all the newly polished parts back together. In this article, I outline the restoration work and the problems I had to solve to get the spool box working properly. It seems that at the time, Aeolian had a quality control problem.

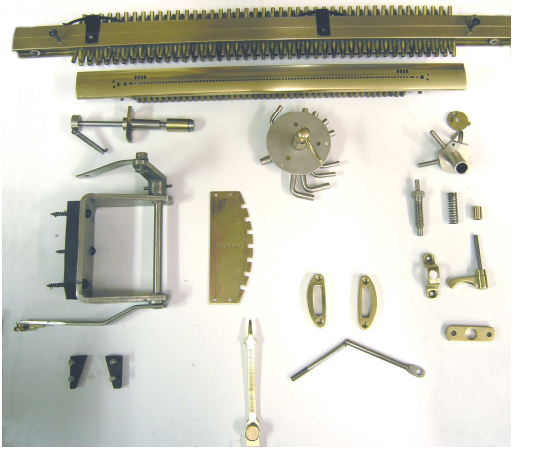
It's hard to believe how many parts there are in a typical spool box. You get to realise this when each one has to be restored, from tiny screws to timber panels. Spool boxes are generally fairly similar as they all do much the same thing, although a PEDA spool box possibly has more parts than most. As I knew I would be doing the restoration work over a period of time, rather than all at once, it was obvious I had to do this carefully, so I would not lose components or get them mixed up. I therefore started at one end of the box (bass) by removing each metal component, restoring it, then putting its various, now restored parts in labelled plastic bags. Prior to doing this, I took lots of photos, although I now realise, you can never take too many photos.

Restoring the metal work

The metal parts in a PEDA are all top quality and respond beautifully to polishing and restoring. Parts are made of brass or steel plated with chrome or nickel. Plated surfaces tend to deteriorate over time, and in many restorations, need to be replated. In this case, most of the plated parts were still in good condition, requiring only cleaning and polishing. Brass does not deteriorate with age, so no problems there, just lots of polishing.

My armoury of restoration products included *Brasso*, a tube of metal polish, and a brass polish from Howard Products (more on this later). These plus 0000 grade steel wool, fine grades of abrasive paper (glass and carborundum papers), a spray can of *Incralac* (made by Wattyl and called *Clear Lacquer Finish*) and a copious supply of clean cloths.





There are no real tricks I can pass on, although I found I got a better result with *Brasso* than with the more expensive Howard brass polish. Perhaps the most time-consuming part is polishing screw heads. In this case, the Aeolian employee who assembled the PEDA was either untrained, incompetent or just plain rough. All screw heads were burred, and of course rusted. Restoration meant filing the burrs, then polishing the screw heads with fine abrasive paper while the screw was being rotated in a lathe. Once shiny, the slot had be cleaned by carefully sanding it. Brass screws were similarly treated, then sprayed with *Incralac*. I found several brass-plated steel screws, which seemed a strange economy, given that the brass transposer alone weighs over 1kg. The photos above show most of the metal parts, but not the many screws or linkages to the controls.

Restoring the timber sections

My aim was to restore the black painted timber surfaces rather than respray them, and it's here I want to proclaim two products you may not have heard of. These are called *Restor-A-Finish* and *Feed-N-Wax*, both made by US company Howard Products. These are sometimes stocked by antique dealers, and can also be purchased on-line from Howard Products Australia (www.howardproducts.com.au) The process is simple enough and starts by applying *Restor-A-Finish* with either a cloth or 0000 grade steel wool to remove the grime and leave a semi-gloss finish.

The timber panels in the spool box, except the bottom panel

Sometimes two or three goes are needed to clean the surface fully. Once clean and dry, I applied a light coat of *Feed-N-Wax* and polished it into the surface to get a smooth, low gloss finish rather like the original. I chose restoration rather than repainting, as the timber work was in good condition, and I wanted to preserve the finish as it was 80 years ago. The celluloid labels also responded to the same treatment, although care has to be taken to avoid removing the black writing. As these are tacked on, I left them in position while cleaning the timber surface.

Problems putting it back together

I've mentioned before that this spool box was assembled very badly. Just how badly I was soon to discover as I reassembled it. I started by rebuilding the bass side of the box by refitting its metal components in the reverse order I had removed them. I had previously noted that the top bearing flange overlapped that of the Duo-Art/Pianola switch, and that the installer had ground a chamfer to give a degree of clearance. The effect however was to cause the bearing shaft to be at an angle, with the roll end of the shaft pointing skywards. This explained the wads of packing under the bearing support at the treble end, which would also cause its shaft to be at a similar angle.

The fix seemed simple enough, and after filing the brass bearing flange so it could sit correctly, I then proceeded with the rest of the assembly. It was only when the box was rebuilt that I found it impossible to put a roll on. The bass end shaft would not retract far enough, as it was hitting the bearing. Then it struck me. The bearing had been mounted back to front! Reversing the bearing now exposed the chromed section (previously hidden in the timber panel) and allowed it to fit perfectly in the available space. No filing, grinding or distorting needed. The photos show thebearing, and the grinding and filing applied to make it fit when it's mounted backwards!

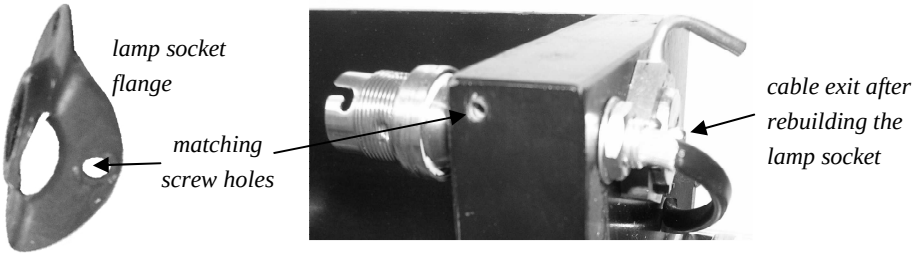
I wish now that I had tried to put a roll on before the box was disassembled, as although it must have been possible, it would have been difficult, and only made possible because the bearing shafts were at such a crazy angle. And this is from new, as I'm sure this spool box has never been previously worked on.

If this was the only issue, I might perhaps have forgiven the installer. But there were many more, such as the tracking. The tracker pneumatic had at once stage been set alight, I assume caused by a cigarette lighter used to light up the darkness behind the pneumatic. Recovering it was very fiddly, due to the way the cloth has to be cut. Prior to recovering the pneumatic I noticed its timbers had not been sealed internally, either due to Aeolian policy, or more likely slackness on someone's behalf. Once sealed and recovered, next came installation and connection to the tracker bar, as this pneumatic moves the tracker bar, not the supply spool.

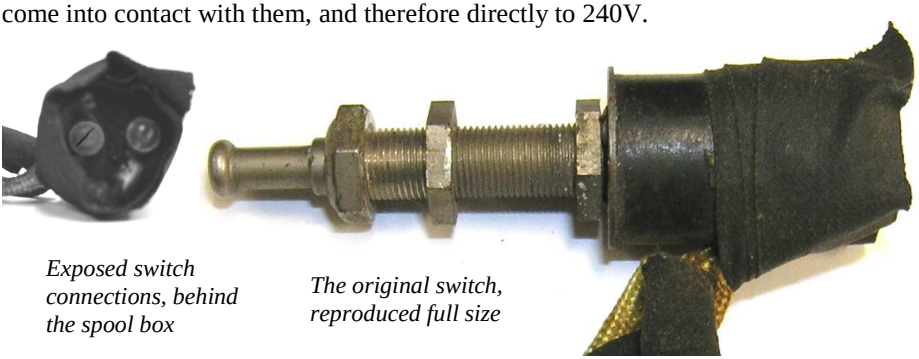
Previously, after fitting the tracker bar exactly as it had come out, I had to fit spacers to the tracker bar support bearings so the bar could move. Whether it had originally been free to move seems suspect. In any case, the link connecting the pneumatic and the bar was too short, which the installer had remedied by putting considerable packing under the connecting bracket on the pneumatic, causing it to sit at an acute angle. This would have made the linkage very stiff, and I doubt now if the tracker system ever worked at all.

Then there's the transposer. This massive contraption must have been expensive, as there's nearly 1.5kg of brass involved, plus considerable machining. In principle, it has two predrilled bars with one sliding over the other such that in each of the seven possible positions, tubing on one side connects to tubing on the other side. The position of the moveable bar is set by the transposer lever slotting into cutouts in the front panel. As you might have guessed by now, the alignment between the two bars was never right, caused by the way the front panel had been mounted. But this is nothing compared to the spool box light installation.

It's possible this light was retro-fitted, perhaps by the Sydney dealer who sold the piano. In any case, it uses the electrics of the times. The bayonet cap lamp socket was cobbled together from nearly compatible parts, and is made of brass. To fix it to the box, the installer hammered the socket's mounting flange (see photo) around the side of the box, such that a mounting screw was on the front, the other on the inside. (*The photo on the right below shows how the socket is now fitted.*)



The wiring from the socket was clamped between the top of the side panel and the socket's exit point, then stapled to the top of the side panel and connected to a large, metal push-pull switch fitted to the back of the spool box. The connections to the switch were exposed, and anyone reaching behind the spool box would easily have come into contact with them, and therefore directly to 240V.



Exposed switch connections, behind the spool box

The original switch, reproduced full size

That plus the potential for the lamp socket to cut into the wiring at the exit point meant it was essential to rework this arrangement, including getting rid of the ridiculously large on-off switch. Surprisingly, the 25W Philips lamp, possibly original, was still working. While originality is important, so too is safety, and there was no way I was going to keep the original wiring. Instead I used modern wiring, a new switch (toggle) and a re-engineered lamp socket made from the original. That plus a cover over the switch and clamps to hold the wiring.

There were other more minor issues that needed fixing, such as the position of the rear brass protector strip. The installer had mounted this strip too low, which required it to be tucked behind the quad beading at the back of the box. This meant the centre screw holding the piece of beading could not be inserted, as the brass was in the way. Raising the protector to its correct height solved this problem nicely, and returned the box to how it should have looked when first sold.

This completes the upper action, except for the valves. The key pneumatics are surprisingly air tight, and don't need recovering, nor does the air motor. However, advice from other collectors was proven correct when serious tests were applied to the valves. Yes, they need to be done, and they will be, but not by me. This is territory I'm too unfamiliar with. Instead, restorer Jim Nicholson has agreed to do them, which pleases me greatly, as he will do a far better job. To be continued...

Completed spool box, now better than new

Conserving a pedal electric Duo-Art – Part 4

Peter Phillips

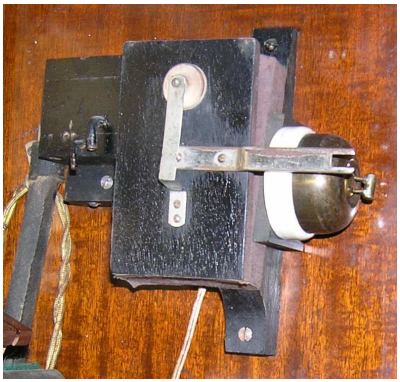
When I wrote Part 3 of this series, I figured the next part would be about the bottom action; the expression box and all the many pneumatic parts located in the bottom of the piano. But as it turned out there was still a way to go with the top action. By now the valves have been restored by Jim Nicholson (beautifully, might I add), so it seemed a straightforward task to assemble and tube the top action. I even had high hopes of having it ready for the August ACMMI meeting. But I had not counted on Aeolian engineering. Completing the top action therefore became a topic in itself, as it was far from the easy, if repetitive task I had envisaged.

Starting the tubing

There are three main components on the top deck of this PEDA action: air motor, spool box and the valve block on the bass end. As mentioned in previous parts, the valve block has four theme valves, two tracker valves and two more valves that I had not been able to put a use to. These unidentified valves are like a typical primary valve in that there's a pouch (with bleed) that lifts a wooden valve to send either suction or atmosphere to the output. Except… There are two valves, but only one output. Furthermore, the output is not exactly suction or atmosphere, it's actually either suction or a restricted connection to atmosphere. At the time I investigated these valves, I decided to put them in the too hard basket and wait until I had to really figure them out. That time came when I started the tubing.

Other than tubing the bar to the transposer, it was obvious that the *last* part of the tubing would be the connections from the transposer bar to the valves. This had to be done after I had completed all the many connections to the valve block, the manifolds on the bass and treble ends of the action, the tracker pneumatic and so forth. In other words, I now had to figure out how the reroll, repeat and motor off functions worked in this instrument, as the tubing for these parts has to go in first. And therein began a journey of discovery, frustration, many cups of coffee, phone calls to other club members, and of course reference to all the documentation I have assembled. None of this helped as it turned out. I had to figure it out myself.

Motor switch pneumatic

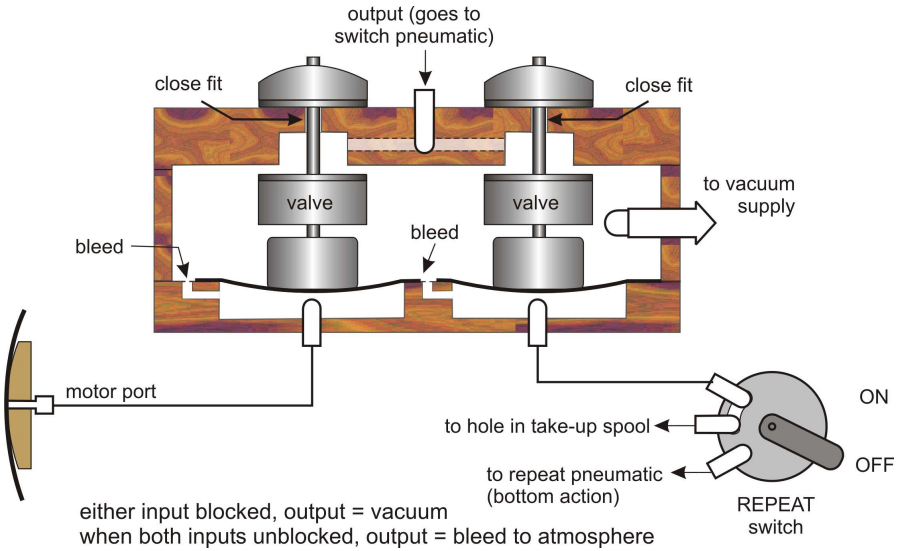


Reproducing pianos have an electric pump, which is switched on manually, and usually switched off automatically by a collapsing pneumatic. In an Ampico, switch off is achieved by a pneumatic that operates when a hole in the take-up spool is uncovered. If the repeat switch is on, this hole is diverted to the repeat pneumatic which causes the play mechanism to be engaged at the end of reroll. Simple and effective.

So I figured Aeolian would do something similar. But no, even though it too has a pneumatic to turn off the motor switch, a repeat pneumatic, and a hole in the take-up spool. For reasons I have yet to work out, the Duo-Art tracker bar has a hole called the "motor port", which is often a mystery to many people, as it was to me. Why another hole to operate the switch pneumatic? Isn't one enough?

Putting my questions aside, I examined the Duo-Art literature and slowly the light began to dawn as to how the switch pneumatic was controlled in this instrument. All the drawings I have show that the repeat switch is a wooden slide switch with four connections. In my instrument, the repeat switch is rotary, and has three connections. In the former, the connections from the motor port hole and the take-up spool hole have a restriction in the tubing. The idea is that opening one hole doesn't overcome the bleed in the switch pneumatic, which is only achieved when *both* holes are open. Apparently this is done so the pump motor won't switch off during reroll should the roll not maintain contact with the tracker bar, and also so it won't switch off until the roll has completely rewound, indicated by uncovering the take-up spool hole *and* the motor port.

While this arrangement is unnecessarily complex, at least I could figure it out. But what of these two unidentified valves? And where were the restrictions mentioned in the literature? You may have already figured it out. These two valves, with their single restricted output, operate the motor switch pneumatic. The motor port goes to one valve, the other valve is connected to the repeat switch (see diagram).



Construction of the valves controlling the motor switch pneumatic

When both valves are operated (motor port and take-up spool holes open), there is enough atmosphere allowed into the switch pneumatic to overcome its bleed and to cause it to operate. If the repeat switch is on, the take-up spool hole is now connected to the repeat pneumatic, so only the motor port is still active. Therefore only one valve will operate, giving an insufficient opening to atmosphere to operate the switch pneumatic.

The vacuum supply to operate these two valves comes from the switch pneumatic supply, requiring tubing to run from the treble end of the action to the valves at the bass end. To make it worse, Aeolian installed a 3/8" input nipple at the valve block, and a control size nipple at the treble manifold. The original tubing had a length of 3/8" tubing run almost to the manifold, coupled to the manifold with a short bit of control tubing stuffed inside the larger tubing. All to supply two primary valves. I replaced this excessive tubing size with control size tubing.

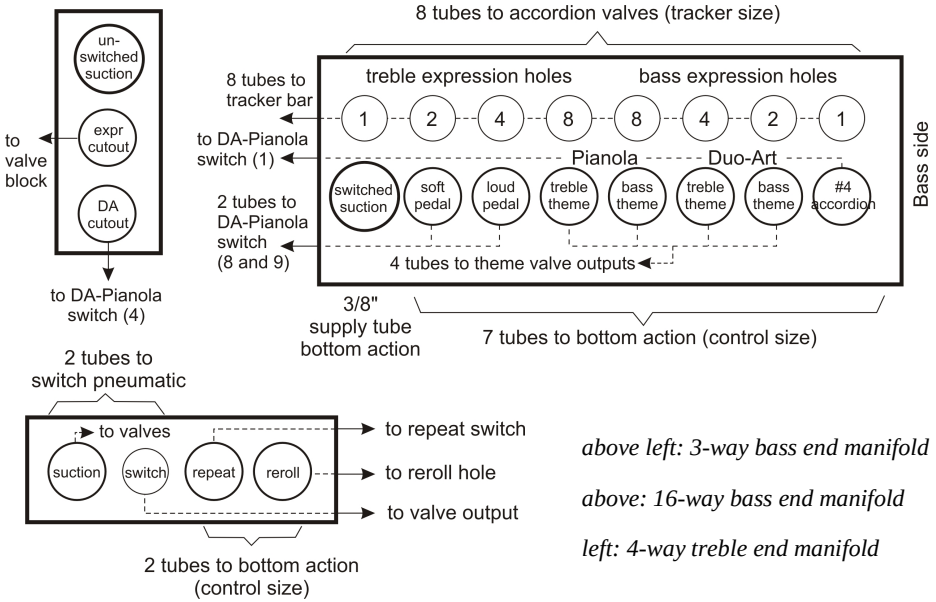
I am still scratching my head as to the complexity of this whole arrangement, given the additional cost it would have involved. This is surely a case of using a sledge hammer to crack a nut!

The manifolds

There are two manifolds mounted on the top deck of the action. The removable section of the 16-way manifold at the bass end is tubed to a 16-way manifold attached to the piano (see photo). The 3-way manifold in the photo is tubed directly to the action. The treble end manifold on the action has four connections, in all accounting for 23 tubes. So my next task was to determine if there is a standard way of identifying these connections. Again back to the literature. Fortunately this turned out to be easier to figure out, as most Duo-Arts have a similar arrangement.

Manifolds in the piano (bass end)

The diagrams below show the connections I have settled on. These are in general accordance with the drawings in my library, at least those that show the manifolds. The Duo-Art Service Manual identifies a few of the connections, and assumes you know the rest.



above left: 3-way bass end manifold

above: 16-way bass end manifold

left: 4-way treble end manifold

Tubing the action

With all the connections now identified (phew!), I could start tubing the entire top action. The first task was to connect the pedals to the tracker bar ports, in particular the soft pedal, as its tube needed to run under all the other tracker bar tubing. Then the tracker bar to the transposer bar, which had its own special issues. It wasn't until after about 10 connections that I realised the transposer bar *and* the tracker bar move horizontally, sometimes in opposite directions. My neat, just-long-enough tubing would not allow this movement, so back to the beginning, this time checking for freedom of movement as I went. Consistent with current practice, I am using rubber tubing for the tracker and control sizes, PVC for larger diameters.

Then came the tracker tubing, with its four connections to the valve block and two to the tracker pneumatic. I left the latter two tubes long enough to swap over if necessary (which proved later to be a good idea, they were connected the wrong way). Working inwards at each end of the tracker bar, next came the motor port and reroll connections, the latter going from a tracker size nipple to a control size nipple. This anomaly occurred several times, for no apparent reason, requiring custom made joining nipples to accommodate the two tube sizes.

Before I could start tubing the expression holes to the manifold, it was necessary to complete the connections to the valve block, about 16 in all. This was fiddly work, as the nipples are close together and the tubes intermingle. The connections to the valve block are shown in Part 2 of this series (*Bulletin 153*). Once done, the expression tubing went in next, with the treble tubing arranged across the back of the spool box. I had few clues as to how the tubing was installed in the original instrument, except for the presence of two brackets that seemed ideal for the purpose I put them to. This tubing goes to the 16-way manifold at the bass end.

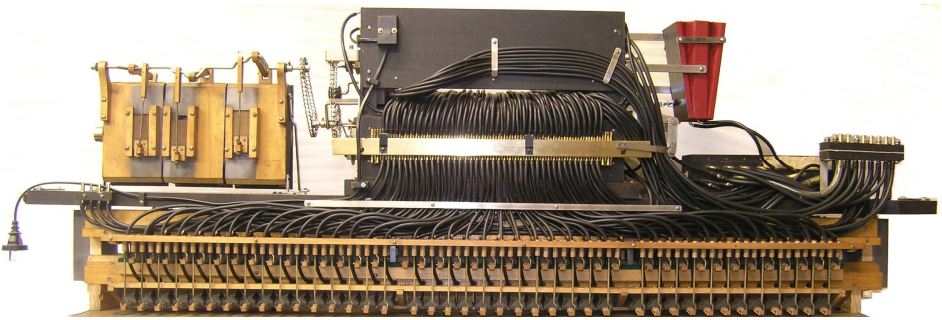
The treble end manifold has four tubes that all come from the bass end of the stack, and which lie under the stack tubing, requiring these to be installed first. Finally, the 80 tubes from the transposer bar to the valves, requiring about eight hours of poking and pushing recalcitrant rubber tubes over submerged nipples. Patience, spit and long nose pliers! (As a friend one remarked, like pushing a marshmallow into a money box.) Then a final tidy up, and lo, it's time for the ACMMI meeting.

Summing up

Feedback from readers of the Bulletin has shown that members appreciate reading about rebuilding experiences. In this instance, the instrument is particularly complex, but it also has components common to other Aeolian installations, making this restoration story relevant to many people. I hope also that I am not putting anyone off doing a restoration job. I can tell you that there's something therapeutic about an "Aeolian challenge." In the end it's simple, but the journey is another thing, and that's perhaps where the fun really is, at least in hindsight.

This completes the upper action. The valves were fully restored in that the valve block was completely disassembled (320 screws), the pouches were sealed, valves cleaned, then reassembled and sealed with shellac as required. The throw of each valve was set by adding spacers so all valves had the same travel of a bit over 1/32". One pouch had been eaten by an insect, otherwise the valves were in excellent condition. The cloth covering the striker pneumatics and air motor is original, but also in excellent condition. Tests show it is airtight and supple, testimony that the Aeolian purchasing department made up for the engineering department, in that parts and materials are all top quality.

The next job is to attack the awaiting horrors of the bottom action, where space is a premium, and mechanical linkages fight it out with the tubing. This might take more than coffee. To be continued…



Rear view of the top action, which is now completed

Conserving a pedal electric Duo-Art – Part 5

Peter Phillips

This part was intended for the next edition of the ACMMI Bulletin, but work has proceeded more quickly than I thought, largely because this part doesn't cover the expression box. Instead, it covers those components you might find in any Aeolian player, although as I've learnt, there is no such thing as a standard Aeolian anything. As well, I have decided that the term "Aeolian engineering" is an oxymoron, at least when compared to the Ampico, an instrument I have worked on many times over the years.

Up to this point, I had done absolutely nothing with the components in the bottom of the piano. When that time arrived, I first removed the MotorA turbine pump and its associated 240-110V transformer, a huge beast of a thing dated 1943, branded Admiralty. Why 1943, and not an earlier date is open to speculation, as the piano is dated 1929. Next came the foot pedal/reservoir assembly, which has two tubing connections; one to the bass side, another to the treble. The only way to remove this unit was to saw through the hardened rubber tubing, easier said than done. (*An engineer would not create such a dilemma for the serviceman and would have had a more sensible arrangement*.)

Removing the pump and pedal assembly instantly gave a much better view of the rest of the installation, allowing me to explore it more fully. I decided to start from the treble end, as that's where a cluster of pneumatics lay, these being the motor governor, the reroll-repeat pneumatic and associated valves, and a third unit that is peculiar to pedal-electric instruments, which I'll explain further on. Before getting into the pneumatics, I started with the electrics, a field I am more familiar with.

The original wiring was, of course, dangerously deteriorated, and if I was really keen for originality, I would have purchased new, braided wiring. But originality can sometimes be taken too far, in the belief that a particular instrument will be valuable in years to come, and therefore should be kept entirely original. However I doubt this instrument will ever be much sought after in the future. There are many better quality players, such as those installed in Steinways. These will always be valuable, unlike my old upright Weber.

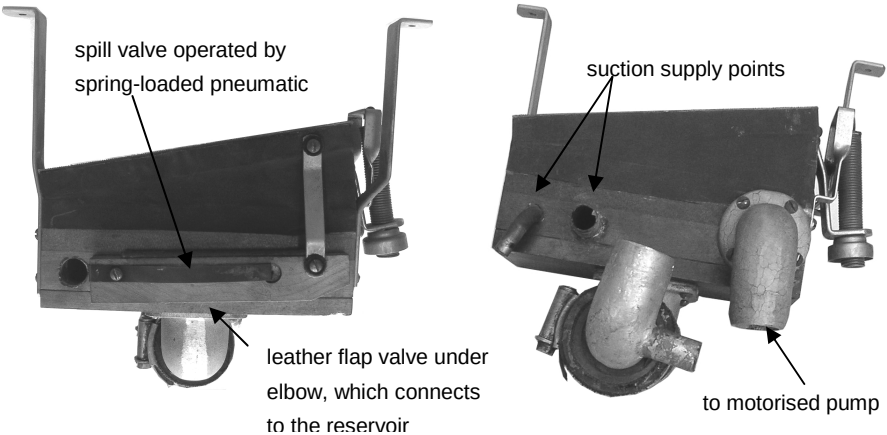
Nonetheless, I wanted to have a good looking job, for my own satisfaction, so my method was to make the wiring almost invisible. To this end I used black twin core cabling throughout, routed discreetly and held in place with black painted wooden clamps I made from old pneumatic timber. That plus a brown 3-pin bakelite socket for the connection to the spool box light, and another white PVC socket in the bottom of the piano for the pump motor. I retained the all-metal pump motor switch, as it's difficult to find a suitable replacement. As a precaution, I insulated the metal pull rod from the switch. I don't entirely trust old electrical hardware.

Next was the re-roll/repeat pneumatic, which is controlled from two valves mounted in an adjacent block (see photo). The cloth covering the pneumatic was airtight and supple, so no need to change. However I was surprised to see Aeolian cross valves in the valve block. I had thought these valves were only found in older instruments.

Reroll and repeat pneumatic valves

By now I was beginning to wonder about the history of this instrument. When was it built, and was it rebirthed at a later time (perhaps by Aeolian in Sydney) from a lesser instrument to a PEDA? In any case, the next pneumatic is a unit that has two functions, and is only required on a pedal-electric instrument. The first function is provided with a leather flap valve, such that under pedalled suction, the valve closes and prevents air flow through the motorised vacuum pump. When the motorised pump is running, the flap opens and connects the pump to the reservoir, which is mounted behind the foot pedals.

The other function is to provide a spill for the motorised pump. The idea is that under reroll or low pneumatic load conditions, the spill will operate and allow airflow, thereby reducing the load on the pump. This spill is most important when a turbine style pump is used (as in this instrument), because the airflow through the pump cools the motor. Without the airflow, the motor will quickly burn out. A final function for this unit is to provide unswitched suction supply to many and various parts of the instrument. See photos on next page.



Unit containing pump changeover valve and motorised pump spill valve

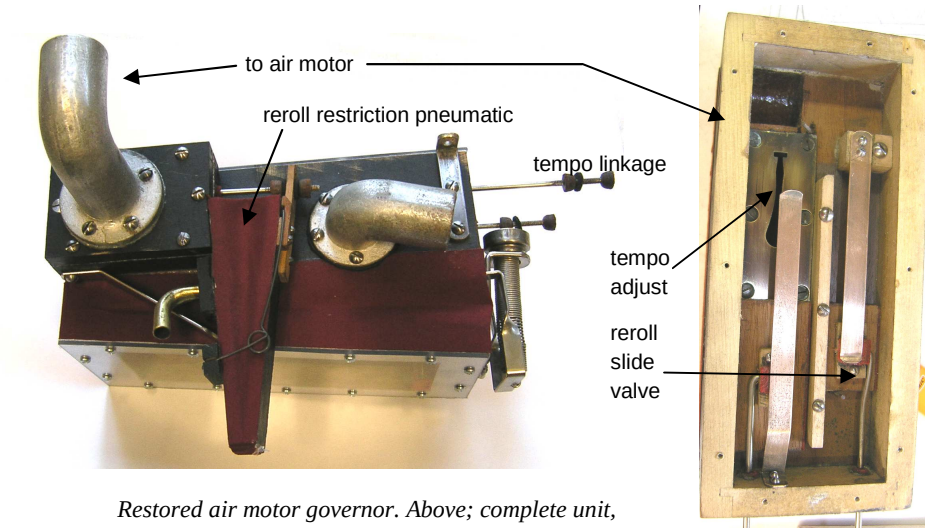
As you can see, there are many connections to this unit, including nipples supplying suction to the air motor governor, the reroll/repeat valve block, a valve controlling an as yet unidentified pneumatic attached to the governor, and another to a valve controlling a similarly unidentified pneumatic on the expression box. The main work was to completely disassemble the unit, recover the regulator pneumatic, make and fit new gaskets, and replace a crazed pot-metal elbow (strange, as all the other elbows so far have been made of aluminium). The pneumatic was tricky to recover, because it is part of the assembly, not a separate pneumatic attached to the assembly. (The photos above are of the unit prior to restoration, in case you're wondering at my recovering abilities.)

Then came the air motor governor, a unit mounted in an almost inaccessible place, only now accessible due to the removal of the change-over pneumatic. Although not shown in the above photos, there's a valve attached to one of the supporting legs of this unit, which operates a pneumatic mounted on the governor. The input to this valve, as I eventually discovered, connects to a port operated by the mechanical linkages for Play/Reroll. In fact there are several linkages involved with this play-reroll trap work, but more of that later. Right now, my task was to remove the governor without injury to it or self. (Hint. Use a pillow when lying in the bottom of an upright piano. It's amazing how many things there are in this crowded place that can cause injuries!)

Two views of the governor are shown below. This unit has little resemblance to the illustrations in the Duo-Art service manual, but works in much the same way. In play mode, airflow is from the air motor, through the key shaped slot covered by the tempo slide valve, through the knife valve operated by the regulator pneumatic, then to the pump. When reroll is selected, the slide valve on the right of the photo opens a large port, allowing full air flow to the motor.

But what of this little pneumatic? It's job is to slow the air motor during reroll, which is now being supplied with full suction. Summarising, when the mechanical linkage is in reroll position, a port is opened, operating the valve mounted on the change-over pneumatic. This valve operates the reroll pneumatic shown in the photos, which causes a slide valve to close, limiting supply to the air motor. This arrangement would not be required on foot impelled instruments, as the operator can control the reroll speed. All these many parts just add to the complexity and time taken to restore them. I'm sure a simpler arrangement could have been devised, but not in this case. Space prevents me describing the pedal valve/regulator assembly, which has similarities to the bits I've described here.

One last word. With all the above done, it was time to put on a roll. Except for a few minor issues needing correcting, all seemed well. It played! But after a few rolls it was obvious that the expression box needed to come out. Too many leaks, and too many mysteries that remained unsolved. And there's a story, yet to come.



Restored air motor governor. Above; complete unit, right; slide valves controlled by mechanical linkages

Conserving a pedal electric Duo-Art – Part 6

Peter Phillips

It seems this story will never end, as there are more parts to follow after this one, which is about the PEDA's expression box. You might recall in Part 5 I mentioned that when the top action was installed, there were air leaks that appeared to be coming from the expression box (as everything else had been attended to). I had therefore decided to bite the big bullet and refurbish the expression box, despite my fondly held hope that this would not be necessary. Fortunately Steve Rattle was staying, and in a trice he had removed the box, without either damage to himself, the box or the piano. I had been puzzling for weeks as to how to remove this box. Up in the workshop we noticed a quality control sticker dated 1925, and that this sticker was split where the box separates. Obviously it had been previously repaired (pouch replacement), which explained why it was now easy to pull apart.

With the box now separated, my first point of interest was to determine how this contraption worked. My knowledge of actual DA expression boxes was limited, being mainly gleaned from the literature, which shows rather fanciful drawings of what seems to be a rather hi-tech device. Quite the opposite in fact. The other point to make is that this box is probably like no other, as Aeolian constantly changed the design. Furthermore, this unit is for a pedal electric instrument, which makes it the most complex of all DA expression boxes. However, despite the differences in design, all DA expression boxes work the same way, with this one incorporating pedal player (Pianola) functions. See inside back cover for more photos of the box.

Basic operation

It's difficult to easily explain how this box functions, despite it being a very simple device. The photos on page 14 show the top and middle sections of the box, with most of the parts labelled. In principle, the box allows three types of operation: as a Pianola where the user provides pedalled suction, as a Themodist player where the motorised pump is on and probably augmented by the user pedalling as well, and finally as a Duo-Art where the user does nothing. The tricky bit is to show the airflow through the various parts of the box for each of these functions, as there are channels underneath those in the top section shown in Fig.1, page 14.

When Pianola mode is selected, the two Duo-Art cutout valves are opened, allowing air to flow through the cut-out ports at a rate determined by the suction level and the position of the slide valves that cover these ports. All other valves are closed. If the pianolist completely closes the slide valves, air flow will now occur through the two flap valves adjacent to the accompaniment suction outlet, as this suction (set by collapsing an accompaniment accordion) is now greater than the stack suction. If the roll has Themodist perforations, these will operate the Themodist theme valves, which open when the relevant theme hole in the tracker bar is opened. This allows full suction to flow to that side of the stack, depending on which theme valve has been operated. However, you will hear a difference only if the slide valves are almost fully covering the cutout ports.

When the motorised pump is turned on, an external pneumatic on the box closes, thereby moving a slide valve to uncover a port that connects the right hand side of the box to the suction supply. This side of the box has two spill valves (only one is shown in Fig.1). These are the Duo-Art spill valve and another operated by the Temponamic lever. If Pianola mode is selected, dynamic level is now determined by the amount of spill via both of the above mentioned spill valves. The Duo-Art spill valve will be partially open as it only closes at power 10, and the Temponamic spill valve is under pianolist control. The two manual dynamic slides operate as before, and the suction level can be increased by pumping the pedals, giving quite a lot of manual control over the dynamics.

Duo-Art operation is only practicable when the motorised pump is turned on, which operates the pneumatic described above, thereby supplying suction to the theme regulator. Selecting Duo-Art causes the Duo-Art cutout valves to close, so air flow to the stack is now via the flap valves adjacent to the accompaniment regulator. When a theme hole is opened in the tracker bar, a Duo-Art theme valve operates, connecting the selected side of the stack to theme suction via another flap valve. Because theme suction is intended to be higher than accompaniment suction, the themed notes or phrases will be louder than the accompaniment. If both theme valves are opened, the entire stack is now being controlled by the theme regulator. Otherwise it is normally controlled by the accompaniment regulator. This is all achieved with flap valves, pouch-operated valves and interconnecting airways. The valves are around one inch in diameter and travel about ¼", not exactly subtle.

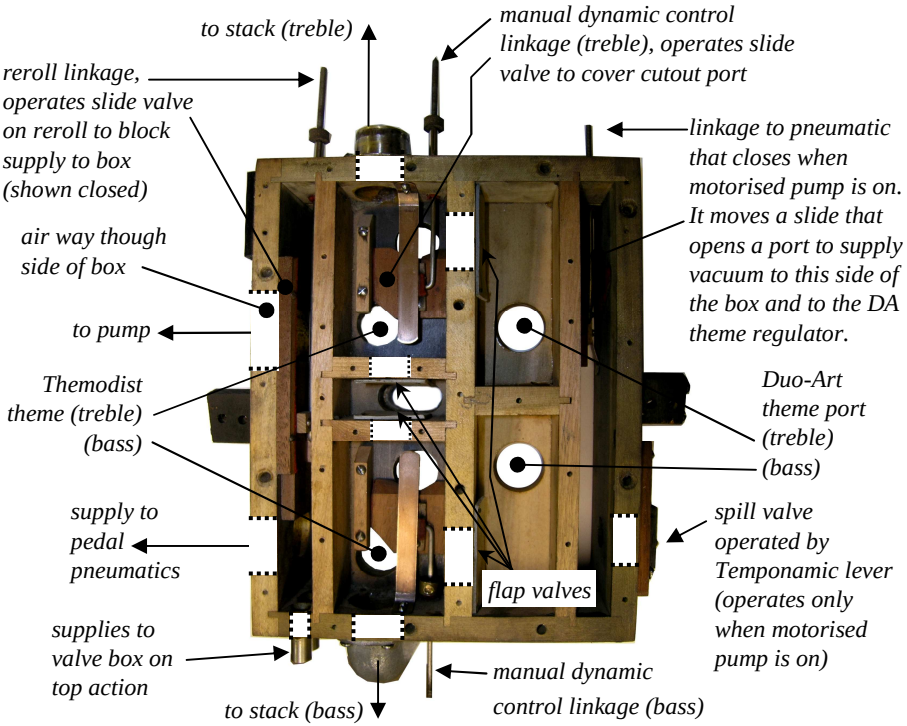


Fig 1: Top section PEDA expression box

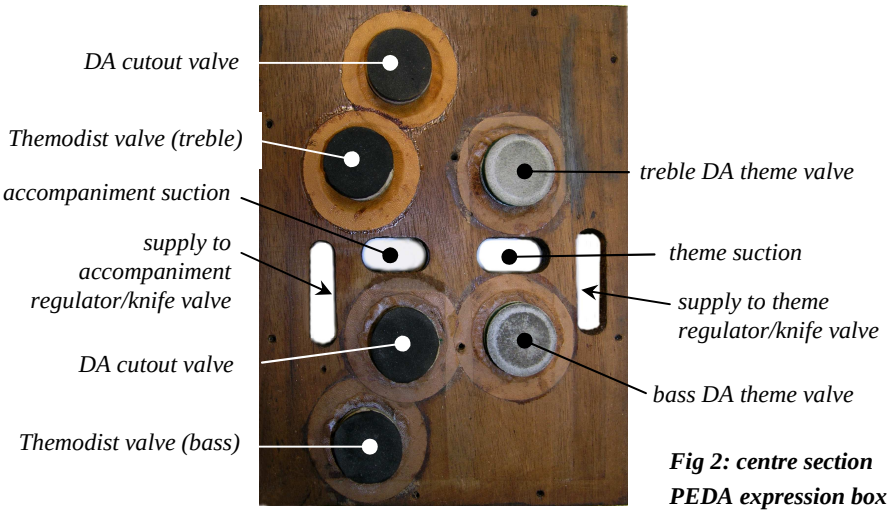


Fig 2: centre section PEDA expression box

Restoration work

In general the box was in reasonable condition. The pouches had been changed and the regulator pneumatic cloth covering appeared airtight. Nonetheless, I decided to do everything, starting with the slide valves, which all needed lapping on fine abrasive paper to ensure a good seal. While dealing with the slide valves, I fitted stops to the linkages so the slide valve travel was permanently set, making installation easier. I also had to re-engineer some of the connections (elbows and nipples), as some of these were screwed to the box such that their screws contacted other screws. Two take-off nipples were too small for the holes drilled in the box, so these needed replacing with larger size nipples. The pneumatic that closes a slide valve when the motorised pump is turned on was barely capable of doing its job, so I spent a lot of time adjusting spring tensions and the tension against the slide valve to get satisfactory operation. Because of the potential for air leakage around each of the many mechanical linkages, I glued closed-cell neoprene rubber washers to the outside of the box, such that a linkage passed through the central hole of the washer, which was punched to give a tight seal around the linkage.

Next came the valve block (see Fig.2). I accidentally tore one of the pouches, but this confirmed my view that these did not need replacing, as the old leather and my replacement leather had a similar strength, even though my leather was thicker. I ended up replacing two pouches, and simply re-sealed the rest. The valves themselves seemed in good condition, but to ensure a good airtight seal, I fitted closed-cell neoprene to the top of the cutout and Themodist valves. I left the original leather top on the Duo-Art theme valves.

The two regulator pneumatics were then recovered, and the knife valves removed and lapped. I spent a lot of time ensuring all moving parts did so without obstruction. The accordions did not need recovering (as they had previously been recovered), but the accordion valves needed considerable attention, in particular replacing the cutout pouches (these operate on Pianola mode to prevent the accordions responding to note information). There were many other fiddly things to do, such as cleaning all linkages to remove rust, fitting new seals so the various outlets were airtight, realigning accordion linkages, and generally going over the entire box to fix many small problems. One of these was to move the end stops for both #8 accordions, so they could now operate over the required ½" of travel.

Modifications

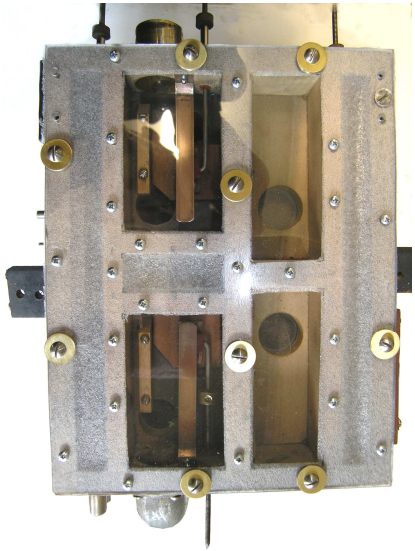
To make installation and future repairs easier, I decided to do a few modifications. A problem to fix was the placement of the elbows to the treble theme valves (Duo-Art and Themodist). The elbows were positioned so the connecting tubes passed through the spill valve and accordion springs. To prevent the tubing fouling the springs, I fitted brass tubing such that the end of the tubing was now in an accessible position at the rear of the box, and the tubing passed correctly through the springs. I also used brass tubing to interconnect the two cut-out valves, which both operate from the same primary valve. This tubing passes over the top of the box, and was positioned to prevent it hindering the operation of the Duo-Art spill valve mechanism. Another mod was to fit perspex covers to the top of the box and the underside of both regulators. These were attached with numerous screws and sealed with plastic foam gaskets. This turned out to be a great idea…

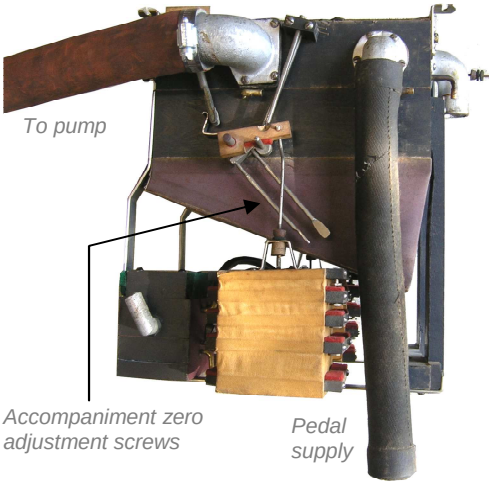
Getting it going

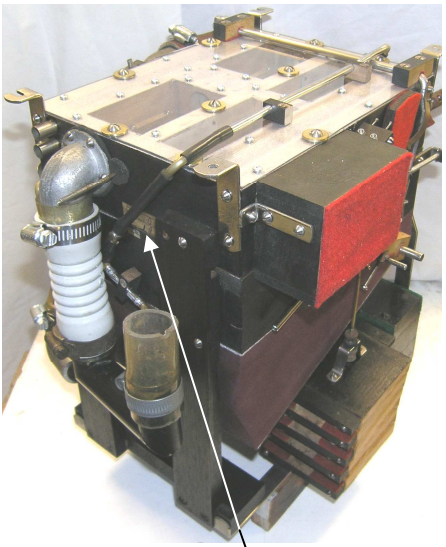
Bench testing soon showed I would need to move the knife valve positions, even though these had been set at the factory and not moved since then. This became apparent after realising that the accordion linkages had been previously adjusted to pull hard on the knife valve shaft and rotate it to a working position. This was clearly wrong, but was how the box was previously adjusted. In the end, after several attempts (and removal of the regulator perspex covers), I achieved what appeared to be correct operation. That is, when suction was applied to the box, the regulators closed by around ½", and the stack vacuum settled to 5.5". I spent a lot of time adjusting the accordions to get the correct throw, achieved by measurement with vernier callipers. The final test was to confirm a total throw of 15/16".

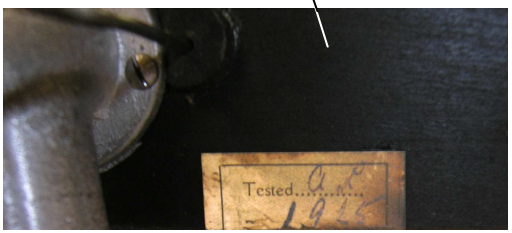
The most perplexing problem was how to obtain a theme vacuum level always higher than the accompaniment level. After much experimenting, I fitted the weaker of the two regulator springs to the theme regulator, and finally achieved readings that appeared correct. I cannot explain why a weaker spring was required, as the theory specifies a stronger spring. During testing, I also had to disassemble the entire box, as it was now apparent that the valve ports did not line up with the valves I had carefully positioned in the centre of the replaced pouches. In short, I spent weeks on this thing, but at least it seemed to work on the bench. In the next part, I'll describe what happened when the box was reinstalled in the piano.

Photos of Weber Duo-Art Pedal Electric expression box





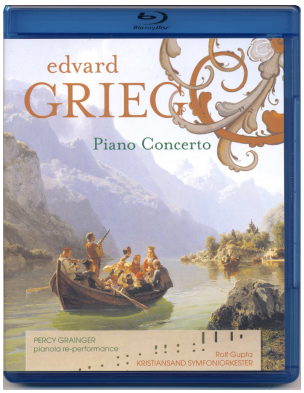




Above: Top view of box with its new perspex cover and plastic foam gasket. *Above right:* Looking at the accompaniment side. Box is unrestored and shows the original tubing and cloth coverings. Note the two 'zero' adjustment screws, which are extended to permit adjustment when the unit is in the piano.

Right: Complete box looking at theme side. *Below right:* Date label of 1925 on box.

Below left: CD cover of a new recording of Percy Grainger playing Grieg's piano concerto. See page 18.



Conserving a pedal electric Duo-Art – Part 7

Peter Phillips

Installing the expression box back into the piano took some doing. As mentioned in Part 6, my aim was to make the installation, removal and subsequent dismantling of the box much easier. To this end I used flexible tubing to the pump reservoir and similar tubing to the bass side of the stack. After several days of lying in the bottom of the piano, cussing and getting my hands into inaccessible places, I finally had it installed. Let's see how it pumps now. You might recall from Part 6 that prior to removing the expression box, it had become apparent that there were leaks somewhere in the instrument, hopefully in the box. But no! There was no difference, air was leaking as it was before. The best I could get was a pedalled suction of around 10" WG. What was going on? Everything was now restored, other than the pedal pneumatics, which were not the problem.

I decided to remove the top action, as it appeared the leaks were coming from the stack. By now I had also noticed that one note was coming on when it shouldn't, and others were not repeating properly. So there were many reasons to remove the top action and check it out. It turned out that the screws holding the stack together had worked loose. Easy enough to fix, and shame on me for not checking these before installing the action. But what of those notes that were not working correctly? I soon traced this to the transposer bar, which I had been suspicious of for a while. This over-the-top bit of hardware is often a problem, as it introduces considerable restriction to air flow from the tracker bar to the valve, let alone the potential for leaks. I decided to disable it mechanically, and to bypass it for those notes that were not repeating correctly. There were some dozen notes affected, which I found by applying a low suction to the stack and playing a repetition test roll. A similar test at a higher vacuum did not reveal these faulty notes, proof that the problem lay in the restriction offered by the transposer.

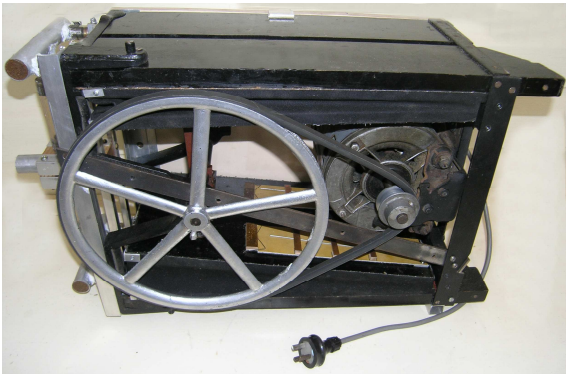
With the stack back in the piano, I then found it worked far better than before. I could now pedal a roll without working up a huge sweat. For the next few days I played the instrument (as a Pianola), and began to find a few more things I needed to fix. The tracker system was proving to be problematic, unless the roll was new. Also the damper pedal was very sluggish. But at least it played reasonably well.

Vacuum pump

But the main thing I was interested in was how it performed as a Duo-Art. Before I could do anything in this direction, I needed a motorised vacuum pump. The pump in the piano was a MotorA turbine unit, which electrical tests showed to be leaking to earth. Too dangerous, and too expensive to fix. As well, these pumps are generally very noisy. Fortunately, Jim Nicholson gave me a pump, possibly out of an Art Echo. It was incomplete and needed a manifold to connect its four pump pneumatics together into a single output, and it also needed a motor. After a few days I had the pump together, now driven by a ½ HP two-speed electric motor from a washing machine. So back inside with the pump to see what happens.

Nothing. The pump, despite having been previously restored, could not even drive the air motor. Back to the workshop where I disassembled and recovered the pump, on the way finding out why it was not working: faulty flap valves. The internal valves, which were virtually new, had curled around the snap spring, preventing them from sealing. I modified the flap valve arrangement by fitting three raised bridges across each leather flap to keep the leather flat, while still incorporating the original snap springs. Further tests also revealed that the pump construction was in dire need of strengthening, as although producing a vacuum, it was now bouncing across the room. This required fitting metal bracing to the pulley side and a hefty timber panel to the opposite side. To get a satisfactory vacuum level, the motor needed to run at its higher speed, resulting in an increased noise level. My solution to noisy pumps is to isolate them, in this case by installing it under the house.

This photo shows the completed pump, now ready to install. The lower two external flap valves can be seen, with three bridges on each flap to keep the leather flat against the timber. I can assure readers that this arrangement works.



Restoring the case and brass work

After installing the expression box, I set about polishing the brass levers and knobs that control the instrument. I also began work on renovating the piano case. The metal linkages under a PEDA keyboard are extensive. For example, the reroll lever has four offshoots in two different directions. While not visible, I wanted the linkages to look clean, and found that some of these were solid brass. But my focus was on the brass levers in front of the keyboard. Getting these out of the piano required considerable disassembly of the linkages, an effort only exceeded by replacing everything. Brasso and lacquer soon had the exposed brass parts looking shiny, and after replacing them, I was surprised how much it improved the appearance of the instrument. Also, they now worked more smoothly.

The piano case took far more doing. I had decided against relacquering, as preliminary work on the case suggested it would respond reasonably well to a treatment involving three products. These are all sold under the banner of Howard Products, which I obtained from www.howardproducts.com.au. The first is called *Restor-A-Finish*, a liquid (in this case mahogany colour) that is wiped on the timber surface to remove the many years of dirt, old polish and other build-ups. For some areas, I used 1000 grade steel wool, otherwise cloths to apply the liquid. Scratches disappear like magic, and sometimes this treatment is all that is required.

Where the finish appeared dull, which was most of the piano case, I used *Restor-A-Shine*, a polish similar to Brasso, but designed to polish timber surfaces. It's here the real work began, which I staged over a period of weeks. The polish is applied and removed with cloths, and I found the best results were obtained with a car polishing cloth from Repco. In some cases, repeated polishing was needed, but at times the surface just positively shone. And my wrists positively hurt! In hindsight, stripping and relacquering would have been quicker and less work, but the case would have lost something as a result, and my wrists are now much better.

The final work, still not good on the wrists, was to wax the polished surfaces using *Feed-N-Wax*. As the name implies, this is a wax, rather more liquid than wax, that is applied to the surface, left for a while, then completely removed. My test was to see if a residue was left after wiping a finger over the surface.

Fixing the remaining problems

While working on the case, I also worked on the player mechanism. Three major problems had become obvious: the damper pedal was far too slow, the tracking system was causing many problems, and the air motor needed recovering. The pedal pneumatics in this instrument are barely capable of doing their job, which is made even more difficult by the action of the Duo-Art spill valve. When this operates, which is most of the time, the available suction is around 15" WG. The pedal supply is also regulated, although I'm not sure why. In any case, it was becoming obvious that the single cross valve operating the damper pneumatic was not large enough to give the required rapid operation. My solution was to bypass the Aeolian arrangement and make up a unit of three Ampico secondary valves driven by an Ampico primary valve in such a way that it fitted nicely between the suction supply and the damper pneumatic. Even with this substantially bigger valve, the pneumatic was still struggling to fully lift the dampers, but could now drop the dampers quickly. In the future, I will probably install a larger pneumatic. (Update June 2016: it turned out the bleed in the original valve unit was blocked. All ok now!)

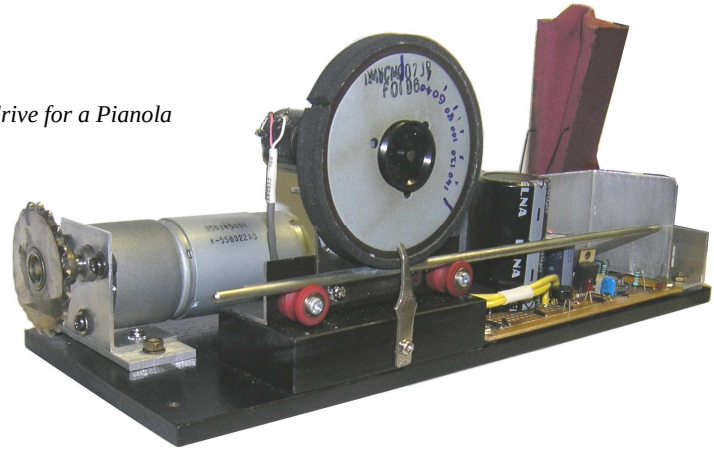
The tracking system, though fully functional with new rolls, was causing so many problems with original rolls, that I made up a switch to turn the tracker pneumatic on and off. This involved switching both tubes feeding the tracker pneumatic such that the tubes were either connected to atmosphere (off) or to the tracker valves. I found an original Aeolian brass lever and fitted it to the switch that is now mounted at the rear of the spool box. To obtain manual tracking control, it was necessary to make up a brass rod connected to the tracker pneumatic, with a brass knob on the end of the rod so the operator could push or pull as required to move the tracker bar to follow a badly mistracking roll. Tracker bar tracking is, in my opinion, the least satisfactory method. Tracking that moves the supply spool at least allows you to move the spool sideways during reroll to minimise damage to an old fragile roll.

The problem with the air motor was more difficult to fix, perhaps because I was making impossible demands of it. I had left it as original, as bench testing suggested it would be satisfactory, and in fact it was. But niggling in my memory were the benefits of an electric roll drive. I had fitted such a unit to a previous player, and I knew that no matter what I did to this air motor, it would never be as good as an electric roll drive.

Electric roll drive

Some readers might think adding such a roll drive motor is an unnecessary complication, and that my problems lie in adjusting the governor and recovering the air motor. And they are probably right. But being able to pedal a player really, really softly is only possible with an electric roll drive, and also the pianolist no longer has to power the air motor. It's simple in principle to fit an electric roll drive, but there can be difficulties integrating an electric motor so its speed matches the player's tempo indicator.

Electric roll drive for a Pianola



The photo needs some explaining. The large round disc is from a VCR video head motor and its circumference is covered with a strip of closed cell neoprene rubber. The sliding rod rubs against the rubber, and is connected to the tempo indicator rod (with a piece of rubber tracker tubing), so that adjusting the tempo causes the disc to rotate. The disc connects to a potentiometer which controls the speed of the motor. The electronics is relatively simple and is powered by a transformer (not visible in the photo). The motor is from Jaycar Electronics, and cost around $40.

The pneumatic at the rear of the assembly connects to the supply tube for the air motor, and is adjusted so it closes a switch (and therefore turns on the motor) when the suction supply is around 3" WG. To the casual observer there is no difference as to how the player is operated, except now the reroll speed can be adjusted. A spin-off benefit is that the spool box light is now also operated by the motor switch pneumatic, which means the light comes when a roll is being is played, either foot pumped or Duo-Art.

The end of the story

It took a year to bring this PEDA back to life. I've documented the process for several reasons, and I hope some of what I have explained is of use to other restorers. I titled the series "Conserving a Duo-Art" rather than "Restoring…", although much of the work is actual restoration. In the end the only new parts are the tubing, cloth coverings (except stack, reservoir and pump pneumatics), and of course, the modifications I have added. The player now gets used routinely, and is a source of great entertainment. The player stool came from the Bill Bradshaw estate, and required its top to be relacquered. So I guess the top of the stool has been 'restored', the rest of it has been 'conserved'.

My thanks go to the many people who helped me restore this complex instrument, which help is a good reason to be in a club such as ACMMI. Where else would one get such freely offered advice, parts and actual help? This, and sharing the fun with other members who, like me, enjoy pedalling an 88-note roll and playing Duo-Art rolls. At this stage the instrument is still 'settling down', and the expression needs further fine tuning to achieve the magical results that the Duo-Art can produce. It has been a long journey, and now it's time to enjoy the results. Phew…

Addendum

(2017) The pump is now an Aeolian 'Tug Boat' pump, and the spill valve in the piano is set to around 18" WG. To achieve this also meant slowing the pump, by reducing the size of the motor pulley bit by bit on a lathe. I found this level of suction allowed the pedals to operate properly, while the maximum volume was now bearable in the listening area. Otherwise, the instrument has had no further work other than tightening stack screws, which in some cases had worked loose.

I have also replaced the electric roll drive with the original air motor, mainly because Rex Lawson was visiting, and he was performing on the Pianola. However, I intend re-installing the electric roll drive, as it allows very soft playing without the roll slowing down.

Good luck with whatever work you might be doing on a Duo-Art. (Peter)