

Harpsichord Building

PREPARING THE ACTION FOR VOICING

by Dave Law

THIS article is intended to be of help to the many people who own or look after modern traditionally-based instruments. It is biased towards the kit-builder, who doesn't always have experience in understanding 'instruction-book language' which can be misleading when it comes to the finer points of voicing and regulation (due largely to the mass of other information which has to be included). Since the subject is thus obscured, a few words on what a good harpsichord action should be, and how to attain and then maintain it, should be useful to many people.

Firstly then, the action as it should be. The keys should be light, very free, with little or no side-play. Lead in the keys is therefore avoided as far as possible. The back touch of the

of layers of felt inside it, so that the jacks are stopped by their contacting the padded rail. This is very important - it's the last thing one does and it can transform the action of any instrument. The cover, too, should be securely fastened, preferably in a manner which allows easy removal.

Assuming that the instrument is strung and tuned roughly to British Standard pitch (or the

98

keys should be made up of thin layers of sewn-together felt, not a lump glued in place. The key-tops should be covered with doeskin roughside up stapled not glued in position for the bottoms of the jacks to rest on. There is then no lost motion due to felt compressing. Coupler dogs should touch similar leather under upper manual key-end. Many keys from old instruments were very light to start with, and were often tapered and cut away underneath to balance them, this is possible now only when the wood used is of a high enough quality. If two jacks are removed from a key end, the key should be at balance. This gives a nice playing weight. Kits are usually heavier to make regulation simpler—the action is thus positive when only one row of jacks is fitted. It is also easier to level the key-fronts when the keys 'lay back' without jacks being present. The jacks themselves should be a close fit in the guide or I register, and yet be absolutely free to move up and down even if they lean ten degrees or so to the right or left of the vertical. The key *dip* should be fine on the lower manual, but only 6mm the upper (measured at the front of the naturals). Any coupler mechanism should have 1½mm free play in the engaged position, measured at the key cover - it's very much less at the coupler dog.

This means that the jacks on the upper manual move the same distance vertically if either upper or lower keys are fully depressed. Short keys on a single-manual instrument are best given a key-dip of 6mm. Rather longer amounts of key dip are set up initially, when the keys are levelled and when the back-touch is set. The final key-dip must be set by adjusting the position of the jack cover rail, or the number

pitch at which it will mostly be played) the next stage in setting the action prior to voicing is to fit all the jacks into their respective positions. This is best done *before* fitting the plectra (or the tongues where these can be easily fitted later). When quilling with wooden jacks and real feathers, the operation of quilling is done before the jacks are fitted to the guides: the quills are cut off to leave say 1/2 in. protruding, and the order of the jacks in the row is then determined by feeling the strength of the quills with the fingers: the strongest quills are in the bass. When requilling an older instrument, the jacks are already numbered and so the quilling requires much greater care and experience.

The jack guides must now be set in an 'off' position. If a row of jacks plucks to the left, it is 'backed off' by moving the guide to the right until the jacks miss touching the nearest string to their right by as little as 1/32 in. Set both 8 ft. rows in this fashion, one backed off to the left, close to the 4 ft. strings if the instrument has any, the other row backed off to the right. Then look hard at *all* the string positions relative to the jacks: make sure that there are no glaringly wrong string positions. If there are, alter them by moving the pins at the nut. Don't allow the close pair of strings to sit too closely together in the bass, as this will allow the strings to jangle against each other—you

may like this interesting noise, but it's not required. When the geometry looks right, check the guide positions again, since some more space may now be available each side of the jacks. Jam the guide into this position so that it won't move during the next few operations.

If plastic jacks are used, now is the time to complete their assembly and to check each jack to see that the spring pressure is only just enough to hold the tongue forward against its stop, and that the tongue itself is absolutely free to move (sometimes a wooden tongue must be shaved a little).

If jacks fitted with a top adjusting screw are used, beware. The screw is there for setting the tongue position and thus the spring tension, not for adjusting the plectrum setting and the sound it makes. It is set now, and not touched again. The original reason for using such a device was to help when voicing plectra of modern hard leather, when in fact it is a godsend: but it is not used in this fashion with delrin or quill, as a reliable action needs each of the plectra to sit under the string by the same amount. All adjustment of the sound is done by cutting and scraping the underside of the plectra.

Spring tension is set by gently bending the spring if it is made of hog's-hair or wire, or by actually changing it. Plastic moulded springs are supposed

99

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to be adjusted in this way, but it is not very effective. It is often best to reshape the spring gently with a sharp scalpel to make it less massive. This makes a more reliable light spring than just bending it. Light spring tensions are required, so the physical size of the spring is important. There is however a limit to the injection moulding technique used, hence the size of some springs.

Don't forget that the more care and patient work is put into eliminating possible faults before voicing, the easier that operation becomes.

Incidentally, the best tool for shaping plastic springs and for voicing both delrin and quill plectra is a Swann-Morton No. 3 scalpel using No. 11 blades.

The next stage is to 'set for silence'. In order that the action of a harpsichord should feel light to play, the plectra must be fairly long. Short plectra will be more difficult to voice and will not last as long, as there is less material to do the same amount of work. Coupled with this the plectra must sit under the string by a reasonable amount—a little more than the thickness of the strings in the low tenor region. The looser the jack fits the guide, the more of the plectrum must show on the other side of the string it is plucking, in order that the note can repeat properly. Since it is clear that the amount the plectrum moves the string from rest will affect both volume and tone, it should be clear that this 'tip under' distance must be fairly even throughout. So, with the guides in the 'off' position, firmly wedged, cut all the plectra to JUST MISS the strings they should be plucking. Use a very sharp scalpel blade, and preferably cut on a block, as left-hand thumbnails only last for one instrument in any given month. This operation is best judged by eye, then checked by ear. You should end up with an absolutely silent instrument—well worth the trouble later, as it makes the actual voicing much easier. The cuts at the end of the plectra are made at 45° to help the plectra return past the string easily.

The next step is to un-jam one guide—I'd suggest the front 8ft. Adjust its position (without altering the 'off' position capstan screw) so that the plectra protrude the correct amount past the strings. This is done most easily by looking at the extreme bass where the strings are thickest, from vertically above. It should be just possible to see the tip of the plectra. Then adjust all of the jack heights by means of the screw or threaded weight usually provided at the bottom of the jack, so that the plectra are all roughly the same distance below the strings—about 1/16in. will do for now. Accurate adjustment should be left until all the voicing is done, and just before the dampers are fitted and cut. It should perhaps be pointed out

that the more the plectrum protrudes under the string, the greater the vertical distance between string and plectrum must be, to allow the plectrum room enough to pass the string on its return journey. Also, the 4ft. row, if fitted, will ideally protrude less far past the string, and thus be capable of a closer vertical setting than any 8ft. row, with the exception of an instrument fitted with a lute stop in its own gap running close to the nut. In this case the settings are as close as for any 4ft. row, of necessity since the jacks move only a short vertical distance due to the reduced leverage available from the keys.

When all this is done, the row of jacks should play from the keyboard fairly evenly. The sound will be rather loud, and the touch heavy, but this is an excellent starting point for voicing. Tune the instrument as best you can now, as this will help too. Make sure that the C's are in tune with one another. Remember that it's no good voicing at one pitch, then altering it to play, since the quality of the notes will alter when the pitch does, but maybe not so evenly.

VOICING AND REGULATING

Recently, 'Prevoiced' plectra in delrin have become available from Adam Swainson, who makes fine jacks. These plectra are made in four strengths, and theoretically need only to be cut to length. They do need to be voiced after, but they are much easier for the amateur to use, they are fast and there's much less chance of making mistakes. Most of the voicing can be done using scraping rather than cutting.

VOICING can now be started. Use a new blade for each row, as the blades don't last very long. The length of the plectrum is not altered during voicing, tone and volume being controlled by shaping the underside only. When correct the plectrum should bend evenly during the plucking action, in a parabolic curve. Its shape should be evenly tapered in both width and thickness. The width at the tip should change progressively from about 2/3 in the bass to 1/3 at the centre of the compass, and then 1/3 in the extreme treble, the fractions being relative to the width of the plectrum at the tongue. The thickness also varies progressively: the plectra should not be cut too thin as this will shorten their life. A happy medium between width and thickness is desirable. The 4ft. plectra will be smaller than the 8ft. ones, but in proportion to them. All the plectra will end at the tip with the 45° cut which

was made when 'setting the silence'. The top surface is left untouched. The bottom surface of the plectrum is rounded by scraping. This should be the operation whereby the sound quality and volume are made even throughout the entire row. Quill is easier to voice than delrin since it has a grain to help you: cutting straight through a delrin plectrum is remarkably easy until you gain confidence in the knife that you are using.

Now sound all the C's and tune them if necessary. [Cutting very carefully and looking at the plectrum (shapes, balance the sounds so that all the C's sound nice individually, and together no one note is more evident than the others. The best way of checking this is to sound four C's together, then leave one out, then another and so on. It is much easier, for some reason, to hear that a note is missing than to hear which one is louder. Any note not sounding is going to leave a big gap in the harmonic structure of the whole unison sound. Be very careful to apply this to the bass, as it is easy to voice the bass too loud, so that when the instrument is completed the tenor is overpowered. Now listen to the sound. If it is clear and pure and you like it, well and good: if it sounds forced and the pitch is higher at the beginning of a note than when the note has started to die away, then the plectra are plucking too hard and should probably be scraped a little thinner. When you are satisfied, starting from middle C, voice the naturals for one octave upwards, checking all the time that no one note sounds above the others (an interval of one tone between two notes played together can sound nice when you are used to it). Then do the next octave of naturals using the C's as a guide, and continue until you run out of notes. Now work down to middle C, voicing the accidentals. Next, repeat in reverse down to the bass and back to middle C. Now the row of strings should be tuned fairly accurately, so that you can hear what chords sound like. The row should sound beautiful. If any odd notes sound dead, lacking in upper harmonics, check that the pins in both bridges are both tight and clean of fluff or oil. A note that warbles and produces beats all on its own may be due to a twisted or kinked string: such a string must be changed. Making the plectra less wide will sometimes bring out more upper partials—this is how to make the bass more reedy in quality. What must be borne in mind is that all the possible variations in tone and volume are made within a fairly small range: the basic sound quality is built into the soundboard design at birth, as is the possible volume. All that voicing can do is bring out the best from what is already there—rather like clothes and women. A bad instrument can often sound better voiced more quietly, when the soundboard has less work to do. A well-voiced

row *feels* right: all the notes seem to require the same pressure on the keys to make them play. It is often easier to feel loud notes than to hear them at this stage.

With one row voiced, the rest becomes easier. Set the back 8ft. row in the 'on' position and set the C's as before, but also matching them to the front row. Then repeat the whole procedure. When you do the 4ft. row, you will find it needs to be a little quieter than you would think. This is because it will 'speak' or 'fire' before the other notes on that key and will thus be more apparent.

Now that the instrument is voiced, the firing order of the jacks must be adjusted. The distance of the plectra under the strings of the 4ft. row is set as close as possible (remembering that the notes must be able to repeat quickly and faultlessly). The back 8ft. jacks are set to fire soon after, but far enough behind for you to be able to hear the two notes individually if the key is moved very slowly. The row of jacks on the top keyboard of a double-manual instrument are set to fire almost as quickly as the 4ft. row, the idea being that when the keyboards are coupled, the play between upper and lower keys causes the front row when played from the lower manual to fire later than the back 8ft. row. Any other rows of jacks which may be fitted should be adjusted to fit into this pattern. The important things are that the jacks do not pluck simultaneously, and that the order of firing is the same throughout the compass. If all the jacks were to fire at the same instant on a 5-row instrument you'd need a sledge hammer to play it. The same instrument with a properly-staggered firing order would be light and even to play, since the after-movement from one pluck helps with the ones that follow. A key-dip of $\frac{1}{16}$ in. is enough to accommodate five staggered plucking heights without difficulty, so this operation is not unduly complicated.

The last stage is fitting the dampers. There are many types, mostly using a thin hard felt, known as 'bushing cloth' or a rather thicker -woven cloth called boxcloth: both are available in many finely-graded thicknesses from piano supply houses. Jacks from old instruments have one or two slots alongside the tongue to $\frac{1}{16}$ in. below the plectrum height for the damper felt to fit into.

Nowadays there are two methods of cutting damper felts - either as described below (at 45°) like most old instruments, or by the damper slot being cut to just above the quill slot; the damper flag being left at right angles to the jack body, and

hanging on the string at all times. This method has the advantage of allowing the soundboard to expand and contract a lot, moving the strings up and down, without any change to the damping; but the strings have to be spaced out more, since the damper must stay on the string when the row is 'off and 'on'. The beautiful sympathetic vibrations from an undamped, unplayed row of strings produced by the older method of damping is lost, however. I prefer the traditional way, but many modern 'traditional' harpsichords by fine makers use the 'square' method; anyway, you use whatever method the instrument is set up for.

The correct felt should be cut into strips fin. wide. It should fit the jack slot tightly without spreading the top of the slot. This ensures that the felt is gripped along the whole of the slot and is therefore less likely to work loose. The felt is trimmed close at the back of the jack and cut (using very sharp, straight nail scissors—the sort that cut right up to the tip) level with the end of the plectrum, so that it looks rather like a flag. The 4ft. row is tackled first since it is the hardest. Do them one at a time since then you don't have dozens of jacks everywhere. Fit the 'flag' and then cut the lower free corner off at 45°. The exact amount that is cut off is determined by trial and error at first. It becomes easier very quickly so that only one cut is necessary eventually. The correct cut is achieved when, the jack being replaced, the string can be moved away from the jack horizontally without the jack dropping vertically appreciably. The note must of course damp (when played) immediately the jack returns. If the jacks hang onto the strings by their dampers, and the row is moved to the 'off' position, when you try to move it back 'on', the dampers will press against the strings, thus not allowing the jacks to resume their correct playing positions. One piece of felt is easy to bend, but fifty or sixty are definitely not. The 4ft. dampers must be trimmed so that they do not touch the nearest 8ft. string on the way past it, and the top corner of the 4ft. damper is best cut off too, since this leaves less to foul the 8ft. string by accident. This operation is fairly important and critical. The rest of the dampers are simpler, so should give rise to no new problems.

The last part of the action to receive attention is the jack cover, which is not there just to stop the

jacks flying all over the room. When the cover is fitted, the jacks should actually touch the felt a fraction before the key-front 'bottoms'. This helps the jacks to return quicker, and keeps the action quiet. The felting should be built up to the required thickness using layers of 'display' felt, or old french army blanket material, sewn, not glued to a strip of card or wood which is then attached to the inside of the jack cover (I use small screws *at* each end, and at each side twice down the length). It is quite obvious that this cannot be done until after regulation is complete, since only then are the jacks at their correct and final height. In fact the jacks are best made a bit too long at the top, so that they can all be cut exactly to length after regulation. 4' jacks are often found to be lower than 8' jacks; then one is forced to do athletic things with battens and felt inside the cover.

Now the instrument must be played and tuned. It may sound perfect to your ears, but it's more likely that the odd note sticks out, or is too soft. (A soft note can be made louder by carefully pushing the plectrum through from the back of the tongue and cutting it off to the correct length again.) It will take a little time and a lot of playing to make it perfect. The string band may settle down in the first month if it's a new instrument, and you may have to re-adjust the heights of the jacks. If this happens, wait for the settling process to complete itself, then regulate the whole instrument again as methodically as the first time, and recheck the damping.

If the plectra are quill, when they are finally voiced they can be oiled sparingly with olive oil, applied with a cotton 'bud', being careful not to oil the dampers in the process. This makes them last longer, but they will become a lot harder quite quickly, & a second voicing is necessary. Quill should last two years or more, depending on how much the instrument is used; but the odd quill will split: the owner really should learn to fit new quills and be prepared to do it

at short notice. I have known quill to be still good after 5 years; but it's more often that the instrument needs six-monthly checkings if it's played *a lot*.

Delrin seems to workharden (there is some disagreement about this: maybe light hardens it). The usual position is that it needs voicing down a little every year in parts of the compass as it gets louder with age and gives a harder sound. A well-played instrument will need new plectra after about 4 years; the signal for a new set is when one or two plectra break off at the root, near the tongue. The rest won't be far behind. I've known delrin still working after ten years. The sound will become bad enough to merit new plectra long before the material actually breaks.