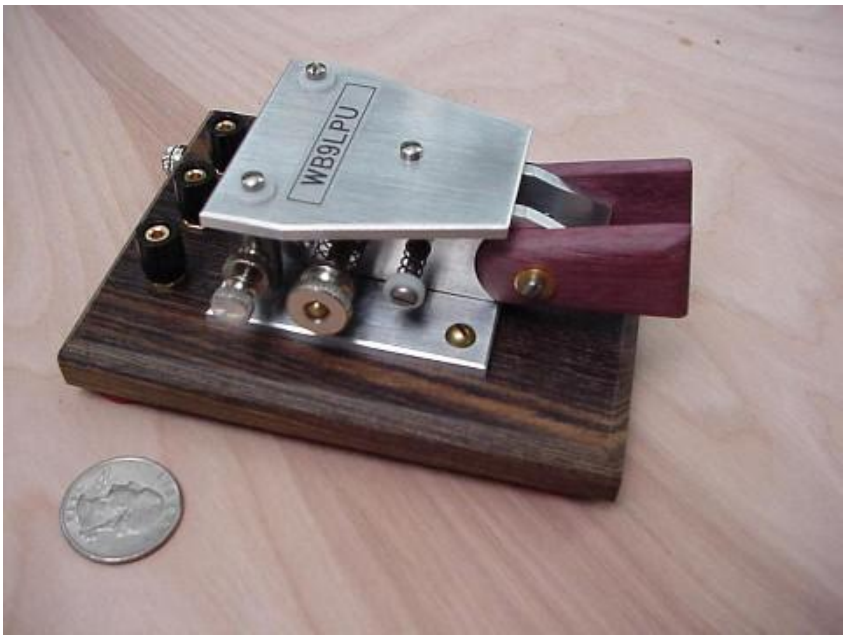
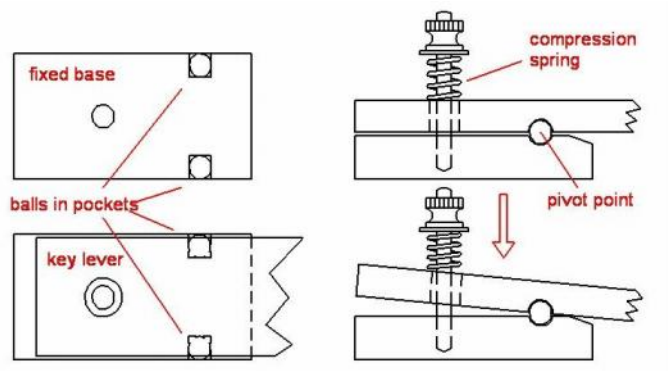


A Ball-Pivot Iambic Paddle

by Richard Meiss
WB9LPU

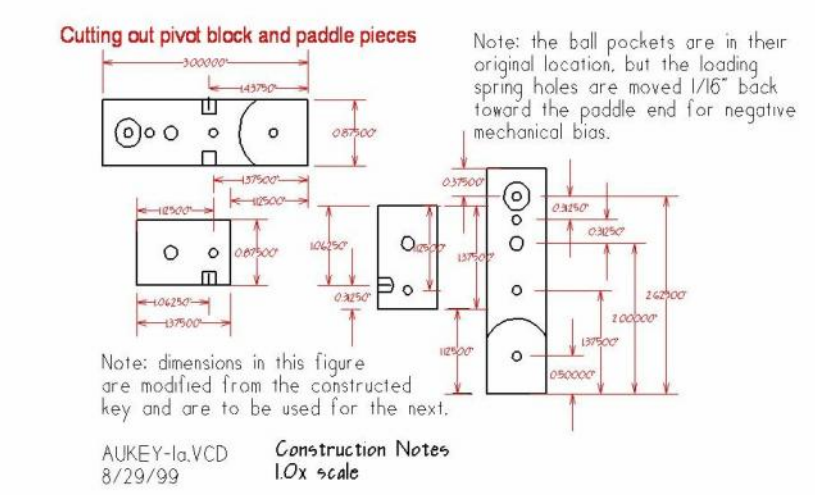
This set of drawings and photographs is intended to give some details about the design and construction of an iambic paddle of unique design. It is not a "set of plans" and is not complete in its details. The drawings are mostly my working documents, and may not be reflected accurately in the photographs (some of the changes made during construction are still in my head). However, careful reading and examination of this documentation should provide the essential features of the design and make it possible to construct a similar instrument.

The ball pivot is the central feature of the paddle design. It is self aligning and produces movement with a good "feel". The paddles shown here use 3/16 brass or teflon balls, obtained from Small Parts Incorporated (www.smallparts.com). Here is how to make it.



The BALL PIVOT key mechanism

One piece of aluminum is the support block for both paddles. It is 3/8" thick, 7/8" high, and 1 3/8" long. Each paddle arm is made from a piece of aluminum 1/4" thick, 7/8" high, and 3" long. To make the ball pockets, clamp the three pieces together in the proper alignment and drill the hole for the tension springs through all three pieces. This hole then can be used to bolt the pieces together and hold them in register for the drilling. The ball pockets are made by drilling, with a 3/16" bit (I prefer a Black and Decker bullet drill) exactly on the line between the pieces so that half of the hole is on a paddle arm and the other half is on the support block. A drill press is necessary (a milling machine with a 3/16" end mill is even better), and the pieces must be mounted in a sturdy vise, or the holes will not be truly round. Use plenty of lubricant and take it very easy. The holes should be exactly deep enough that when the ball is inserted its top is just flush with the top of the hole. Without unbolting the pieces, drill all four ball pocket holes. Do this drilling before you invest much work on the paddle arms and support block, because the pocket drilling is the easiest part of the job to mess up. When all four holes are drilled to the proper depth, mark the pieces with a scribe or magic marker so you can get them back together in the same order. Now you must mill about 1/32" from each side of the support block so that the paddles can pivot on the balls (see later pictures). I prefer a tapered support block. **Error!**



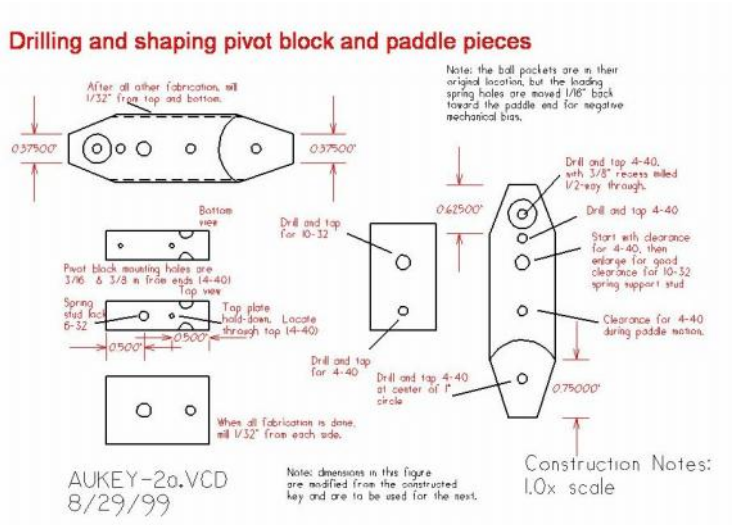
You must also shave about 1/16" from the top and bottom of each paddle arm so that it will clear the upper and lower mounting plates. Once these operations are done, you will be able to test how smooth the action is going to be. If the inner surfaces of the ball pockets are nice and smooth, the paddle will be a good one. In operation, the force to keep the paddle arms and the support block together is supplied by a pair of small springs.

Now you can do the rest of the drilling of the support block and the paddle arms. There will be some further milling on the paddle arms later on. Now cut out and drill the base plate and top plate. These fasten to the top and bottom of the support block. If the pockets have been drilled to the proper depth, the top and base plate will keep the balls in place and the paddle arms will work smoothly and without extra play. At this point you can finish shaping the paddle arms as shown in the drawing and pictures.

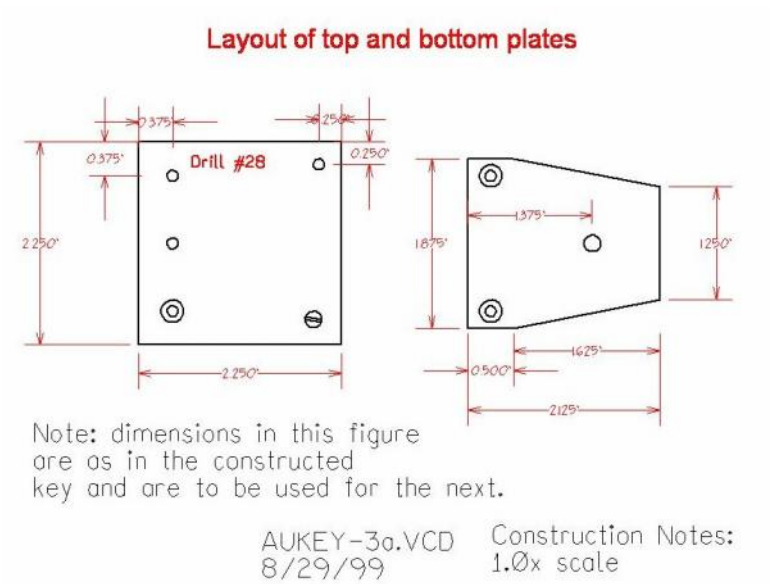
The contact supports (5/16 or 3/8 rod) are next. These must be insulated from the top and bottom plate using nylon shoulder washers, with the holes drilled to the proper size. The adjustable contact screws go through the exact center of the contact supports. On the paddle

arms, the contact surfaces are machined from threaded studs. You could also use filed-down brass screw heads for the contacts.

These comments are not complete, but I think careful study of the photographs will give you a good idea of how the paddle is made. There is nothing special about the particular dimensions, so you can change things around as you need to.

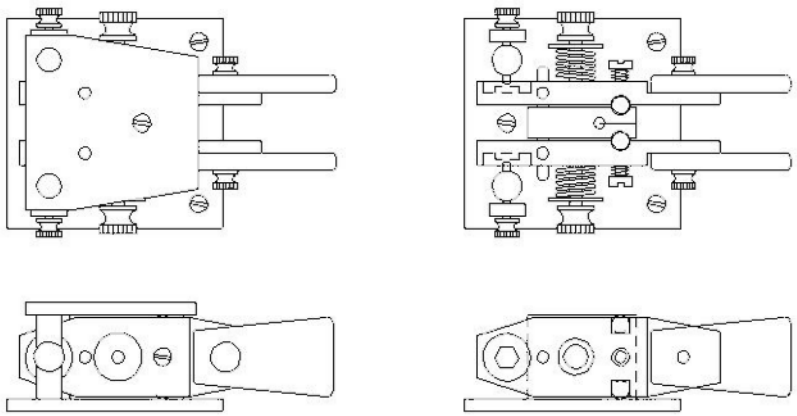


The drawing above shows further refinement of the pieces that make up the paddle arms and the pivot block. The most critical point is that the proper holes match up; this includes the ball pockets. You can insure proper alignment by clamping and bolting the parts together during the drilling operations (as outlined earlier).

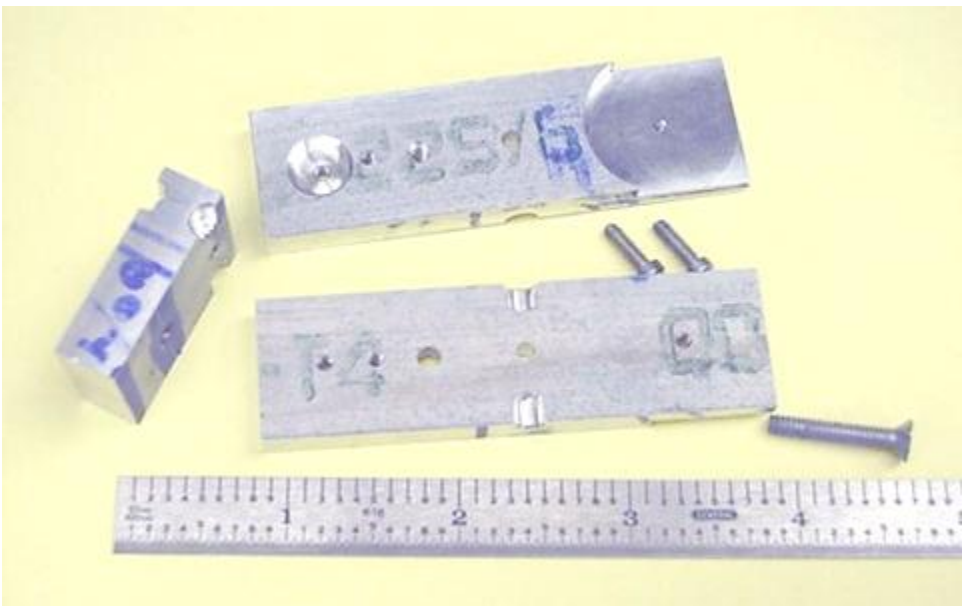


These are the top and bottom plates (above). Here again, alignment of the holes is critical. It is probably best to start out with two identical pieces of metal (1/8" thick aluminum or brass) and

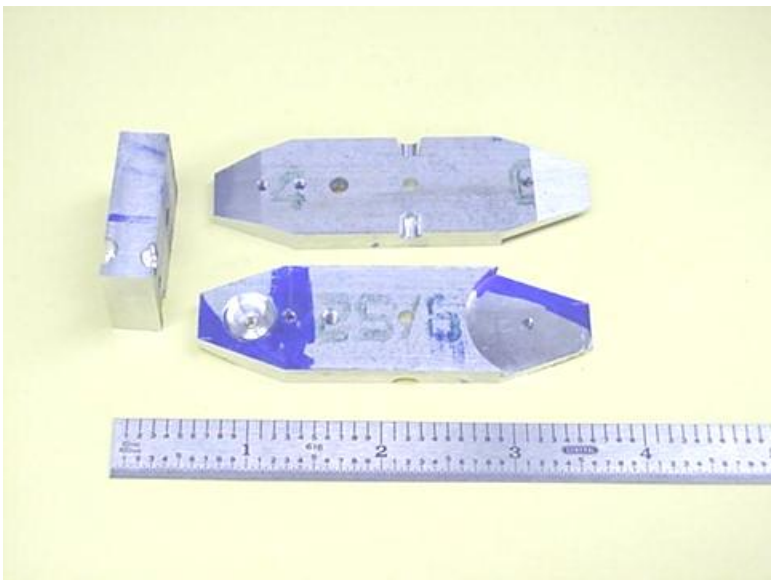
clamp them together as before. As more holes are drilled, they can be used as temporary bolt holes to hold the pieces in register more securely that clamps alone. Not all of the necessary holes are shown - the photographs will fill in the missing details. After the holes are all drilled the top plate can be sawed (filed, milled) to its final dimensions.



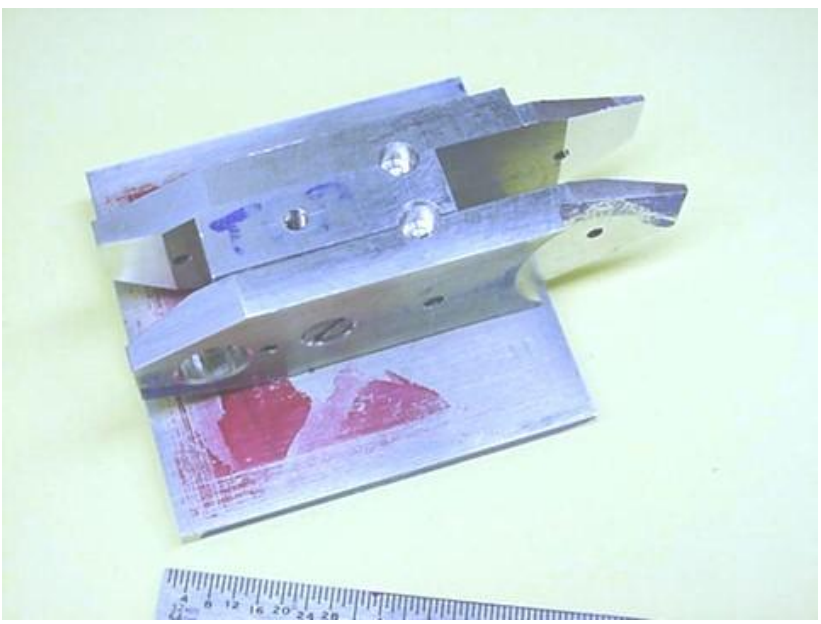
The drawing above shows the essential metal parts, without the wooden base. The large springs provide the keying tension, and the smaller springs at the pivot point serve to hold the paddle arms in register.



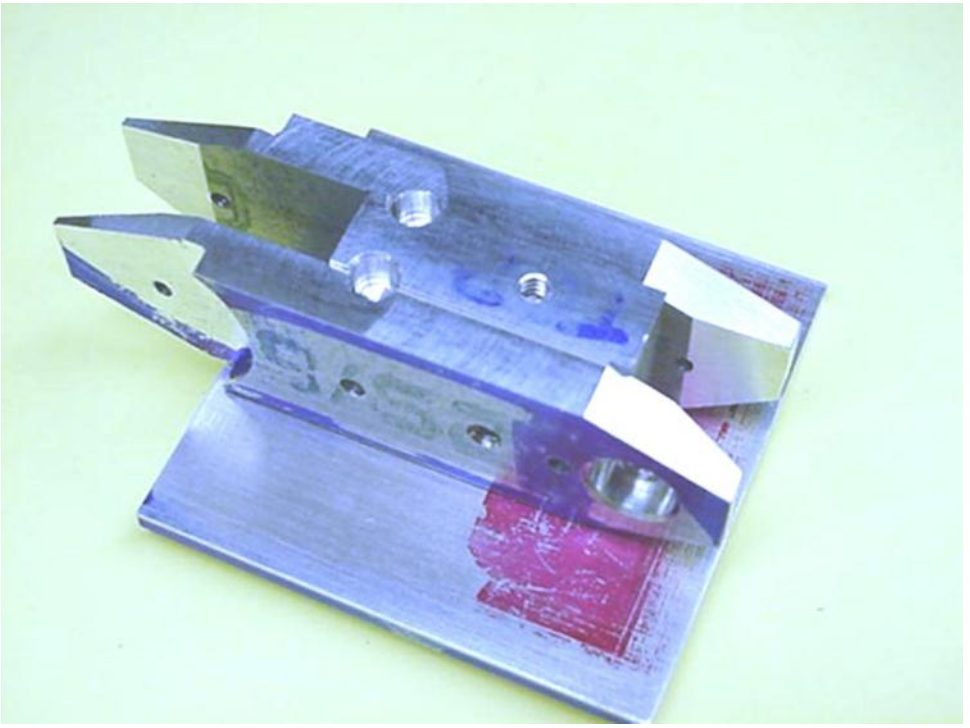
This view (previous page) shows the paddle arms and the support block in early stages of machining. The ball pockets have been drilled, the contacts have been mounted temporarily, and the attachment site for the wooden fingerpieces has been milled out. The top and bottom of each paddle arm need to be milled down by about 1/32" to allow them to clear the top and bottom plates. The support block must also be made thinner to allow pivoting action to take place.



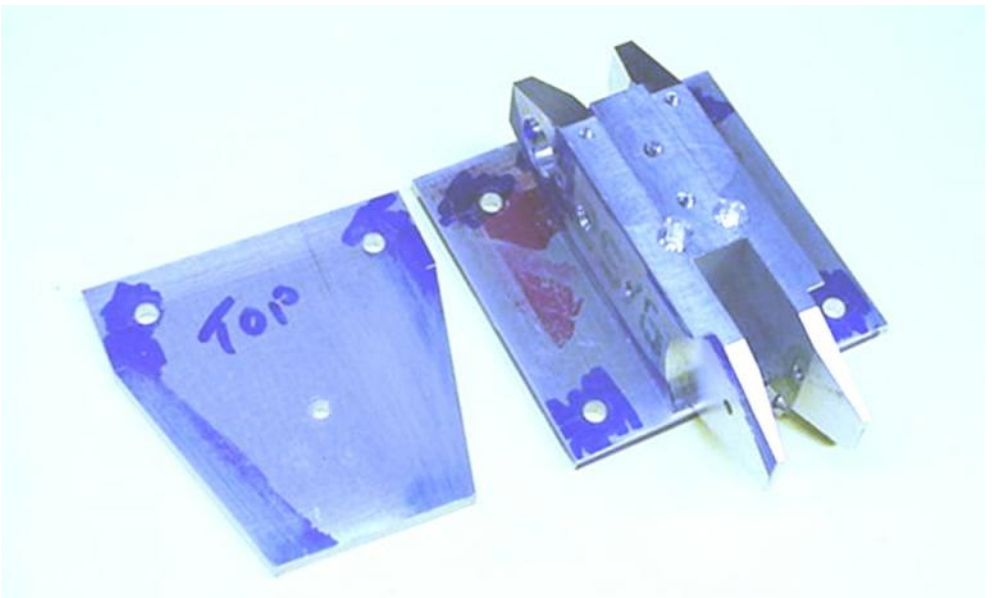
Here the ends of the paddle arms have been milled to their desired taper. This shaping is for aesthetic reasons and is not necessary for proper function.



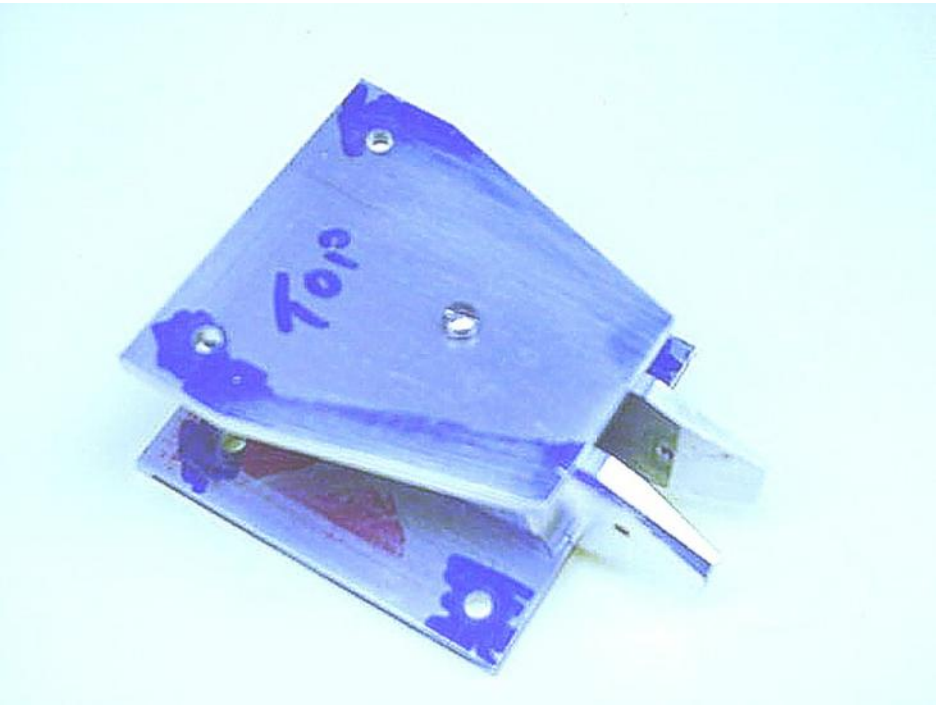
Here the parts are laid up to show how they will finally fit together. The tops and bottoms of the paddle arms are still not milled down.



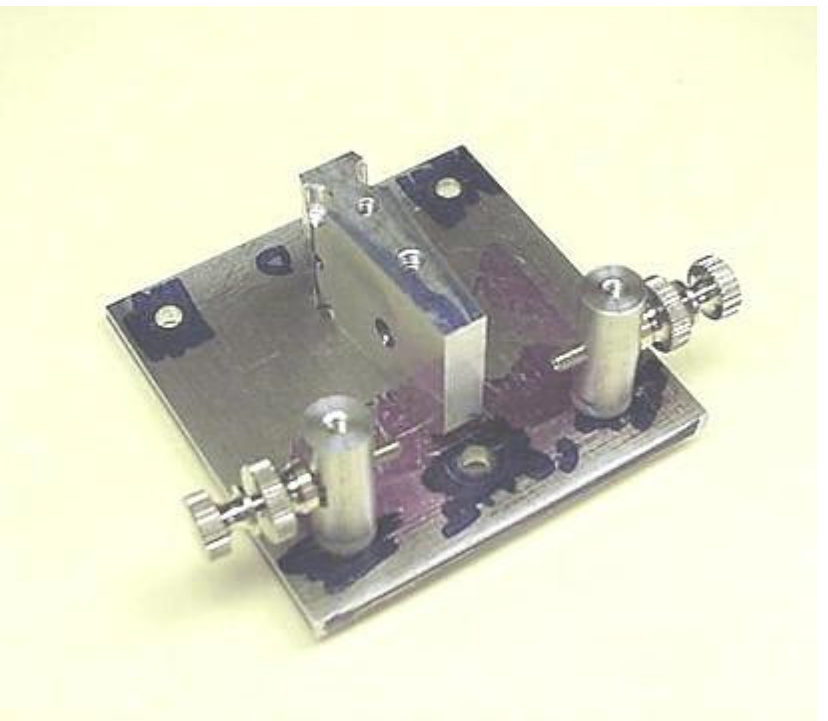
Another laid-up view. Here the paddle arms have been machined top and bottom - note that they are now lower than the support block. When the pivot balls are in place the paddle arms will be in the proper alignment.



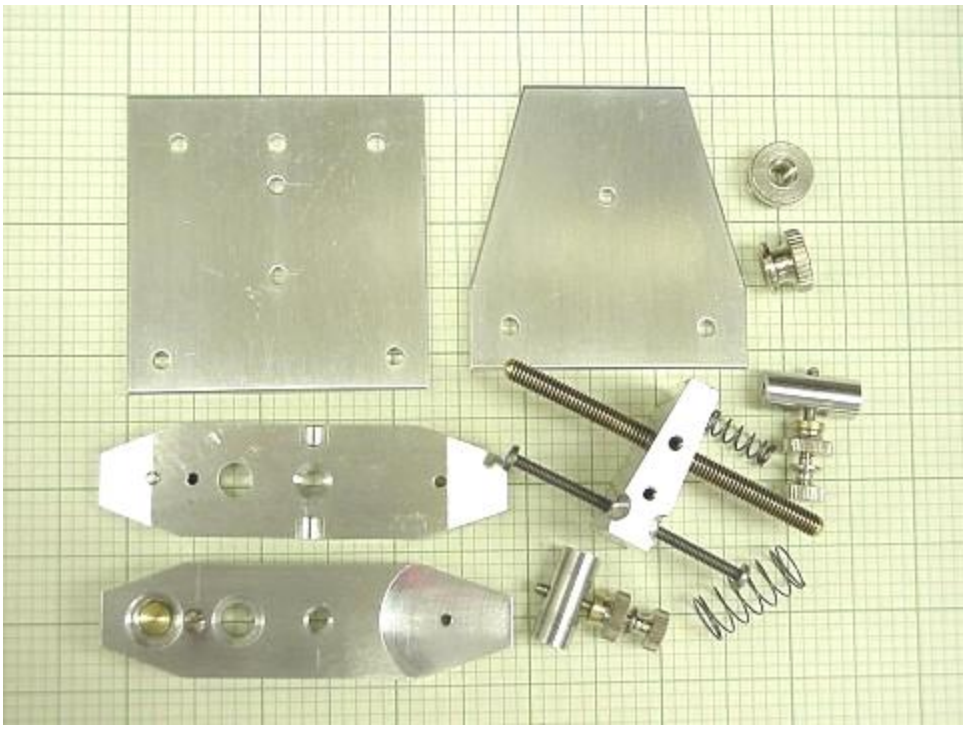
Here the top and bottom pieces have been added to the lay-up. These pieces will be held in place by being bolted to the support block and by the contact supports at the front.



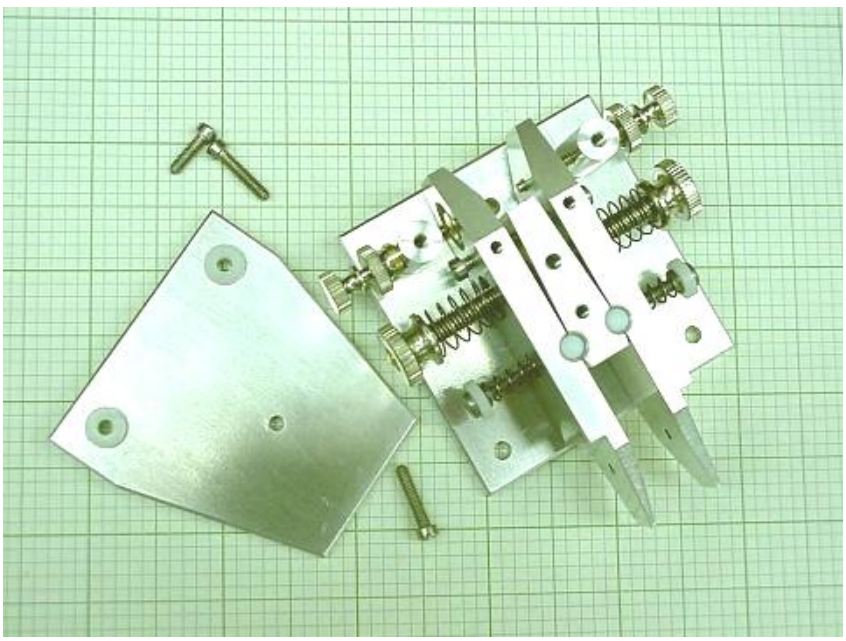
Another lay-up showing the final positioning of the top, bottom, and paddle arms.



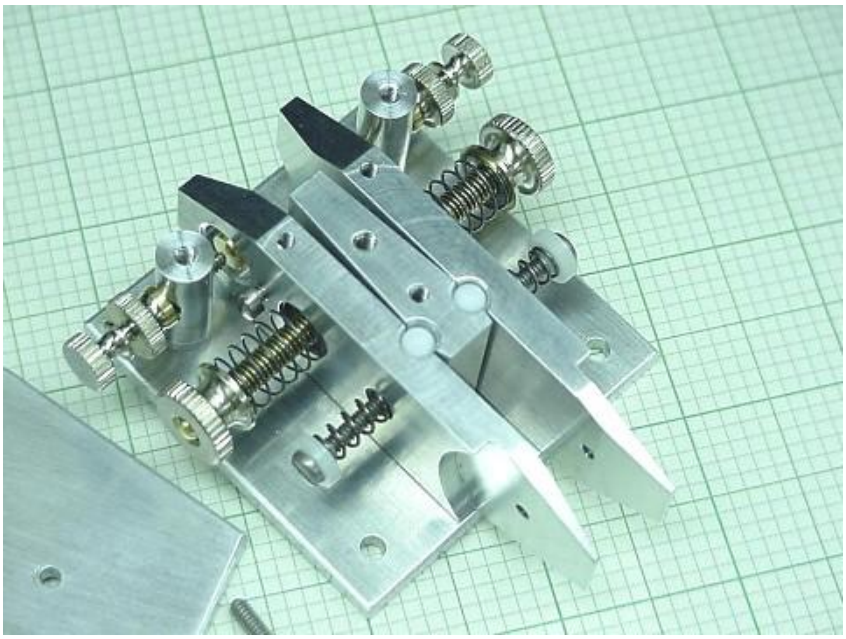
The support block has been milled to its final taper, and the contact supports are shown mounted to the base plate. A secure connection to both the bottom and top plates is necessary to keep the contact supports from rotating.



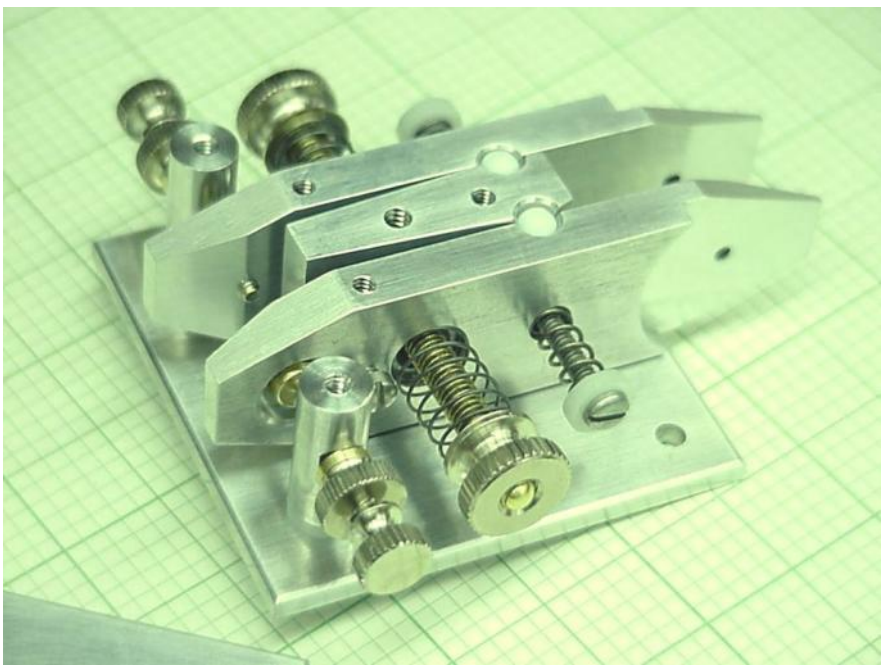
Here are all of the finished parts. The large screw through the support block will hold the main tension springs, and the smaller screws near the pivot point are to hold the paddle arms in alignment.



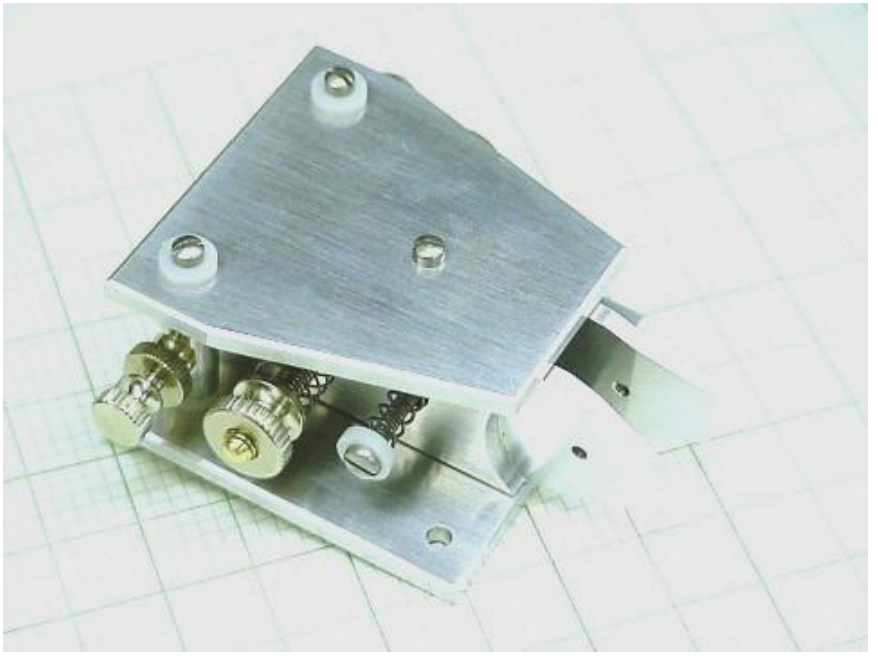
This show all of the parts assembled, with the top plate removed. The teflon balls may be seen in the upper pockets.



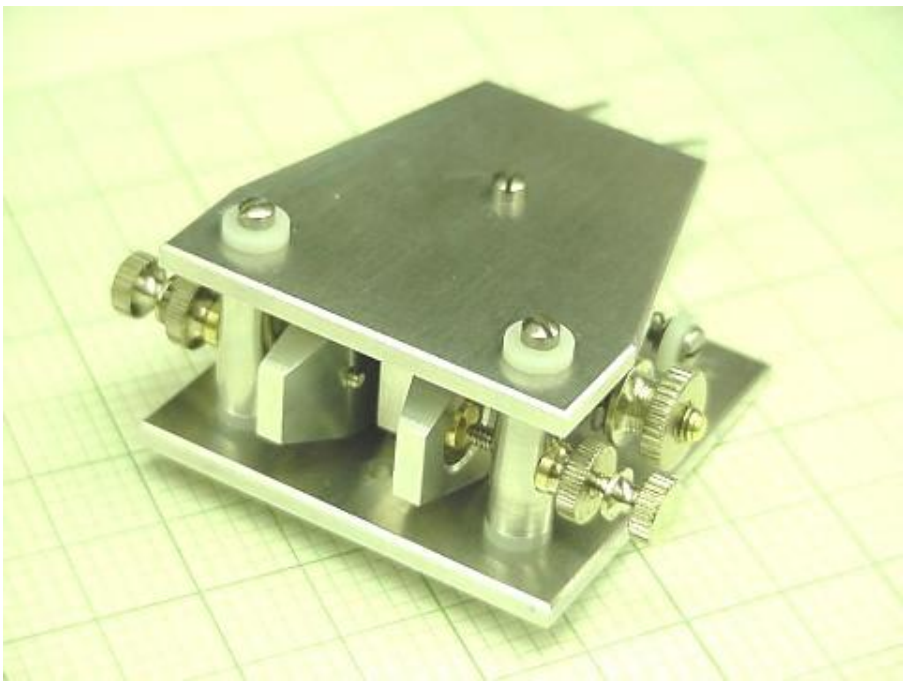
Here is a closer view, showing both the main tension springs and the smaller alignment springs. Note how the taper of the support block on either side of the ball pockets allows paddle arm movement. The thickness of the support block in the exact region of the ball pockets must be reduced by about 1/32” to allow for free movement without allowing the paddle arm to lift away from the pivot balls.



This view shows the adjustment screws. All of the thumbscrews and thumbnuts came from Small Parts, Inc.



The complete assembly of the metal parts is shown here. The paddle must now be mounted on a base of wood or plastic (or stone, as in some of my current models), and the wooden (or plastic) finger pieces must be fitted.



Front view of the finished assembly. Note the insulating shoulder washers above and below the contact supports. Electrical connections will be made (with solder lugs, after the wooden base is mounted) to the bottom of the contact supports.

Here is a finished paddle much like the one shown in the previous pictures. It should give suggestions as to the mounting on the base and how the fingerpieces are mounted. The height of the fingerpieces may be changed by loosening the thumbscrew and swiveling them to the desired angle.

I hope that this will give some idea of what is involved in constructing a paddle of this sort. This design is reliable and stable, but may be a bit difficult to construct. Hopefully I will have the simplified design worked out in the fairly near future.