From the Author

During the past two decades, we have noted that the art of the kobzar has revived and developed at an unprecedented rate among Ukrainians not only in our native land, but in the diaspora of America, Canada, Australia and the Argentine.

Currently, many youth bandura ensembles have been established, schools for teaching bandura have opened, and new instructors have been developed.

But what can a bandurist do without a bandura? About as much as a general without an army.

In the meantime, we read in Ukrainian newspapers, as well as in others, that the tonal quality of the bandura charms the listener, penetrating the very depths of his heart and soul. Simultaneously our musicologists are turning their attention to the fact that modernization of the bandura in some measure negatively influences its touching timbre.

Mention must be made of Hnat Khotkevych's revival of the Zinkiwsky style of playing the bandura wherein the left hand plays not only the basses, but also the treble strings, which was later improved upon by his pupils, and by virtuoso players as well. Neither the old Kiev model nor the contemporary Chernihiv or Lviv bandura models lend themselves to this style of play.

Taking into consideration the aforementioned, my brother Peter and I, with the valuable assistance of Hnat Khotkevych's pupils, Harry Nazarenko, conductor of the Leontovich Choir, bandurist Joseph Panasenko, as well as other proponents of the bandura, developed a new form of bandura while adhering to the basic principles which preserve the depth of soul timbre of the bandura.

We provided a number of innovative ideas, a mechanism for switching to other tonalities on the bandura, a transference of pegs to the secondary or lower string mount, which make possible playing with the left hand according to Khotkevych's method. Over the years, from 1946 to the present time our persistence has resulted in obtaining all that is desired from the bandura for the present.

In order to develop further the art of the kobzar, we feel that our primary obligation at this time is to highlight the bandura and to foster schools for playing the bandura. The necessity therefore, of constructing modern, standard type, concert banduras which can switch keys while preserving the timbre inherent in the bandura becomes essential.

We decided that a significant contribution to this end would be to make plans of our models of bandura with all necessary cross sections, together with all parts of the switching mechanism, templets for the rim of the bandura, of the interior, of the peghead scrolls, of the upper and lower retaining ring mount for winding strings are provided. We give drawings of all fittings, including dimensions, for the fabrication of all parts of the bandura. Besides this, detailed instructions on the building of a bandura of the style made by the Honcharenko brothers in 1982 is included.

Our intention is to pass on to the next generation of bandura craftsmen, our research in the art of building the bandura so that it retains its melodic characteristics and its stature as an instrument grows.

Such a bandura would quite naturally be costly if it were to be crafted in some studio where it would require the expending of 200 to 240 hours of work. But, if someone desires to handcraft it, then the drawings, templets and instructions will assist greatly. For this reason we entitled the instruction, "The Home-made Way".

Should one wish to make banduras in quantity, then the costs expended on machines and accessories would be distributed proportionately through the whole series of banduras, and although the expenditure of the craftsman's time would not lessen significantly, the cost of one bandura would be notably reduced. Drawings of the bandura, templets, drawings for the jigs and fixtures for the production of switch parts, and instructions for making banduras may be obtained from us whenever needed. For these items, please apply to the address below:

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U. S. A.
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Commentary on Musical Instruments

The development and improvement of musical instruments moved at a pace dictated by composers as they created new compositions which necessitated better instruments on which it would be possible to communicate to the listener those deep spiritual sensations which the composer wanted reproduced in his works.

Whenever a notable composer was born, it seemed an outstanding craftsman was also born. The only difference between them was that the composer created new musical works constantly, while the craftsman, only bettered and improved upon already existing instruments.

As for craftsmen of stringed musical instruments, it is well worth recalling the Italian master of the violin, Stradivarius, who, in the year 1704 built a violin in his own original style and later, in the year 1720 improved upon it considerably, both these models excel in their strength of tone and beauty of timbre. Stradivarius came to the conclusion that the strongest and most melodius sound of stringed instruments is dependent upon the shape of the instrument, which creates the strength of resonance, and also upon the material from which it is made.

Insofar as the bandura is concerned, the back of the instrument should come from a maple stump with figured wood (under the bark the wood looks wavy or curly) and the face from tight-grained dry quartersawn spruce.

Vibration of the strings results in oscillation of the face, which transmits the sound waves to the bottom of the acoustically shaped bowl. These are reflected as sound waves through the openings in the face.

Both maple and spruce have inherent characteristics and it has been found through experience that it is best to use the lower portion of the tree trunks to a height of 10 feet from the ground where the tree has its greatest strength. See Figure 1.

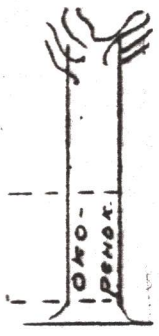


Figure 1

Maple is tough with waves across the grain (silk) and does not easily split while drying. Spruce has transverse, lustrous rays. For both maple and spruce, our recommendation is to choose an old tree with a diameter of no less than three feet, having an age of about 60 years.

Stradivarious, when selecting material for violins wandered through the forest axe in hand and by striking the trunk with the butt-end selected the ones which sounded best. In this age we do not have that advantage however it is worth knowing and should an opportunity present itself where material is available from standing timber, then it should be cut down in December or January, after the tree has consumed all its sap and stands dormant.

When cutting material for the bowl from the trunk in the sawmill, it is imperative to bypass both the pith and surface sapwood. These parts of the tree are too soft for musical instruments. It is also essential that knotted and damaged pieces of lumber be discarded. See Figure 2.

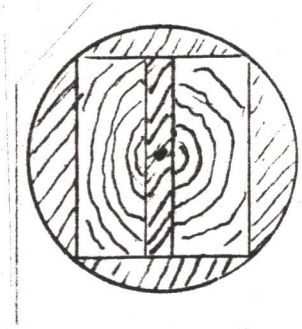


Figure 2

INSTRUCTIONS

Construction of a Honcharenko Brothers Chromatic Concert-type Bandura With Tone Keys

Initially our Ukrainian national musical instrument was the Kobza. Later, after improvements it acquired a new name for itself, the bandura. The kobza appeared in the Ukraine around the 16th century. Unfortunately there were no craftsmen to build this instrument as there was no great demand for this instrument or the bandura.

Kobars or bandurists were solitary individuals. Every kobzar was of necessity a bandura craftsman, in a situation where it was necessary for him to build his own bandura for nowhere could he purchase one. Usually it was made of willow, black poplar or linden and later, because of the influence of Stradivarius, this was altered, changed to maple for the bowl and spruce for the face which is why the bandura acquired a more melodious and emphatic sound.

In acquiring the material it is practical to cut the tree down near the ground. After it has fallen, cut off 4-5 feet, seal both ends with hot wax, and after some time paint over the wax with an oil paint, so that the wood, in seasoning, will not check. Later saw it up as shown in Figure 2, to give it a chance to dry evenly from all sides at the same time. Seasoning should take place in a cool and dry room.

The material for the face, if at all possible, should be procured from standing trees also, choosing old spruce and using the lowest portion of the trunk. Rather than sawing the spruce into planks, it is better to cut a length off from the stump, immediately split all pieces through the centre of the log, paint the ends, remove the superfluous wedges as shown in Figure 3, and allow them to dry in a warm room.

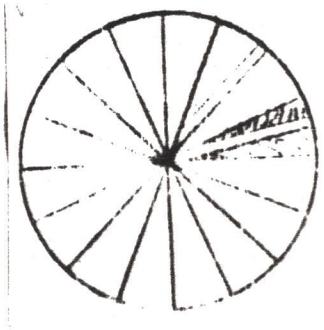


Figure 3

If we find it impossible to procure the material from standing timber, then it becomes necessary to find the material in lumber stores, but we must adhere to the above mentioned principles.

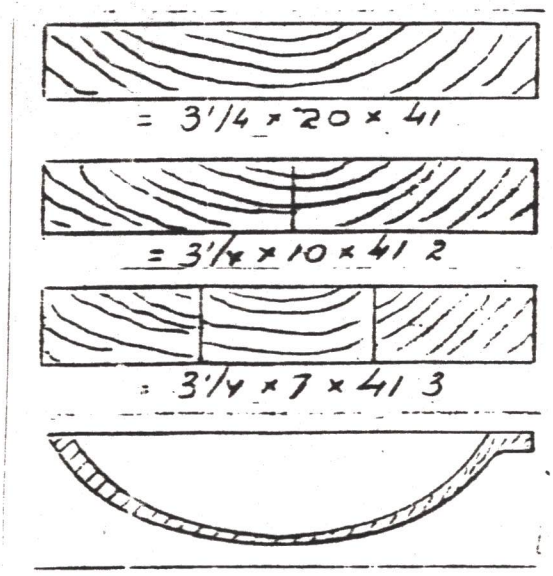
For the bowl of the bandura it is best to use material from one solid piece (Figure 4), however such a piece of maple is difficult to find. In which case, glue together two pieces as shown in Figure 5. Somestimes it becomes necessary to glue three pieces together as shown in Figure 6. In all instances remember to keep in mind the fact that the grain of the wood must remain parallel to the contour of the bowl of the bandura (Figure 7).

Figure 4

Figure 5

Figure 6

Figure 7



The spruce for the face is chosen from a standard spruce board, 3/4" X 5 3/4" X 12'. Examine the end. The grain (Figure 8) must be very close, about 1/32" apart, and the board should be very light. This board is cut into four equal parts, and two of these we saw in three longitudinally, as shown in Figure 9. This will be the material for the face. Later we will place them on the jointer to 1/8" thickness. The other two pieces we saw into strips about 3/16" thick, as shown in Figure 10, for bracing the face.

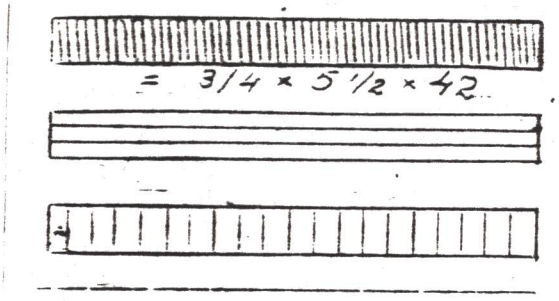


Figure 8

Figure 9

Figure 10

When the material for the bowl and the face is dry, then you may commence building the bandura.

The best maple for the bowl comes from the northwest part of the United States or from western Canada. This maple is called the Big Leaf or Oregon Maple.

In order to find out whether the board comes from a stump or not, clean a portion of the surface. If you can see waves or curls like on a violin, then you have a stump board.

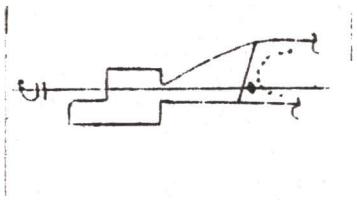


Figure 11

Forming the Bowl I

In construction of the bowl from one piece of wood, the piece must first be trued up on a planer from both sides, so that it will be square and 3 1/16" deep, allowing for 1/16" to be taken off in the final finishing. Keep in mind that however dry your material is during the forming of the external and internal sides of the bowl, the wood has a tendency to bend or warp towards the centre of the trunk.

Next lay the templet of the plan of the bandura on top of the board, fasten it with locators No. 1 and 2, and outline the left side of the contour of the bandura with a pencil, from the head to half of the lower curve on the outside, and all the way around on the inside.

Then pull out locator No. 2, shove the templet over to the right 3/16" and trace the right side of the outline. The extra 3/16" stock is allowance for shrinkage, which may occur after the surplus waste material is removed.

Next cut out the contour of the bandura on the band saw, again leaving 1/32" stock for finishing. If the material for the bowl is made up of two or three pieces it is useless at this stage to glue them together, for work on the head is much simpler with the smaller piece of wood. Smooth the material to 3 1/16", drill holes for locators No. 1 and 2 through the templet, and do the same as mentioned above.

After finishing off the head, glue the pieces together, and follow the instructions previously outlined. We would advise shaping the head first, whether you have one, two or three pieces of material. This is done, because in laying the centre line between locators No. 1 and 2, we have a solid base line, which will be the reference for all points in your future work on the bandura.

While perfecting the form of the bandura, and trying to improve the balance of the bass sounds, back in 1946, our research disclosed that lengthening the last two basses gave a much better and stronger sound necessitating a doublehead which was not a straight forward matter, resulting however in a very positive effect on the sound of the bass strings.

Shaping the Peg Head

For building a bandura, you should have a drill press with operating speeds of 180 to 3600 R.P.M. A tilting table, 10" X 10" (Figure 14) with an opening in the centre and lateral slots through which is fastened from below, an aluminum plate measuring 3/8" X 24" X 48", necessary for working on the bowl and the face. The screws, which fasten the plate, should be loose enough to travel along the slots, when necessary to search for position.

Fasten a 3" long 1/4" bit in the chuck. Place a piece of maple on the table. Lay a templet on top and fasten it with locators No. 1 and 2, first inserting a 1/16" thick lining between the templet and the maple (Figure 13). Set the machine in motion, press the templet against the spiral bit, and the cutting edge will clear away the waste wood stock. Moving from right to left, outline the shape of the head from "B" to "A", see Figures 14 and 15.

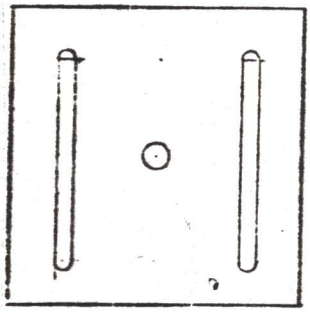


Figure 12

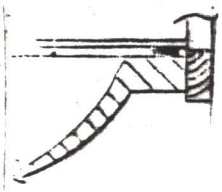


Figure 13

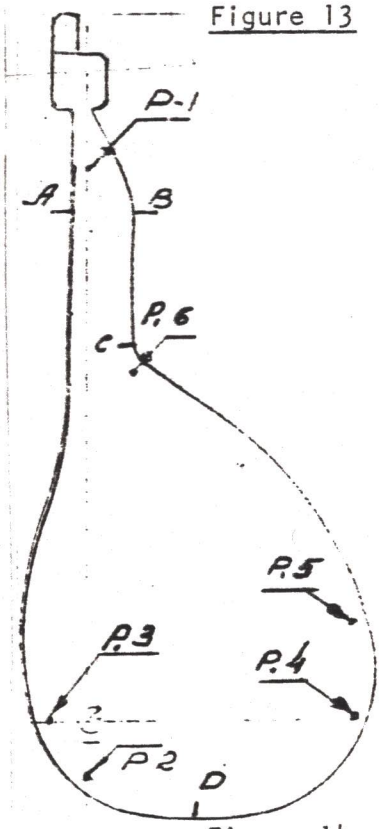


Figure 14

After this, remove the templet, turn the bowl 90°, and fasten the templet to the profile of the head. In this way, as mentioned earlier, we only use a guide in the centre of the iris of the small scroll, and a second in the iris of the large scroll and carve out the shape of the head in profile, see Figure 16.

Next replace the long spiral bit with a cover or core box bit, 1/8" diameter, from your router kit, and following the spiral curvatures of the templet, trace the shape of the fluting on both scrolls. See Figure 16. Turn the bowl over 180° and do the same to the other side of the head. Now with the limits of the shape of the scroll firmly set, you next finish them off by hand.

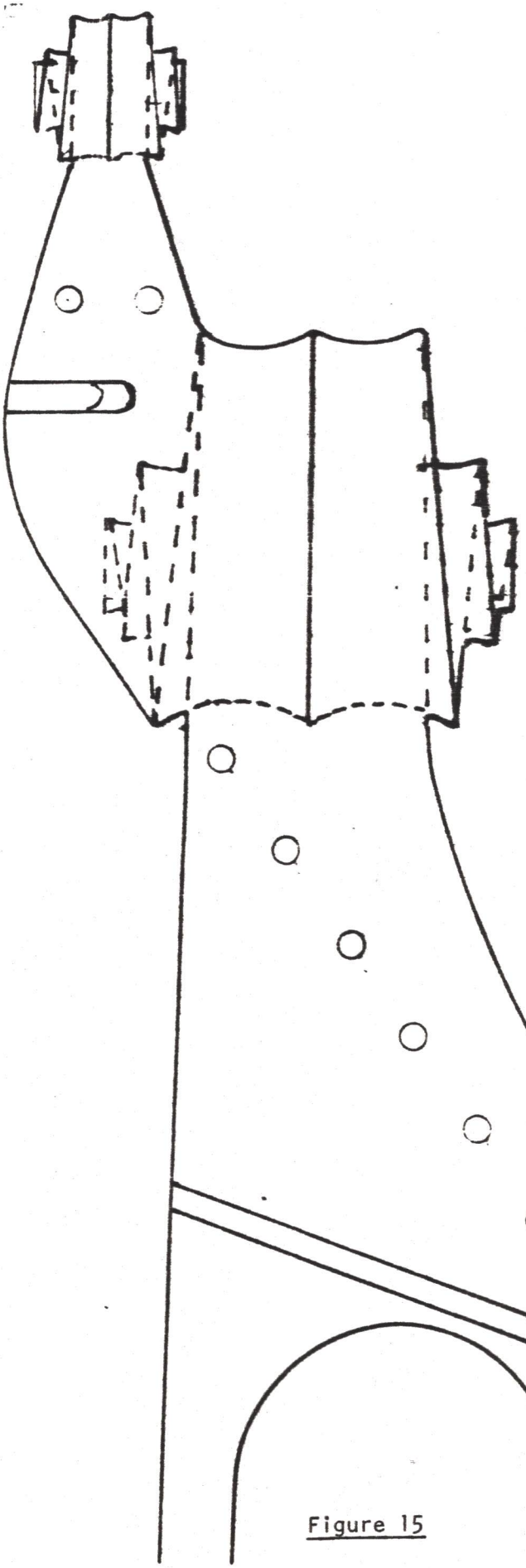


Figure 15

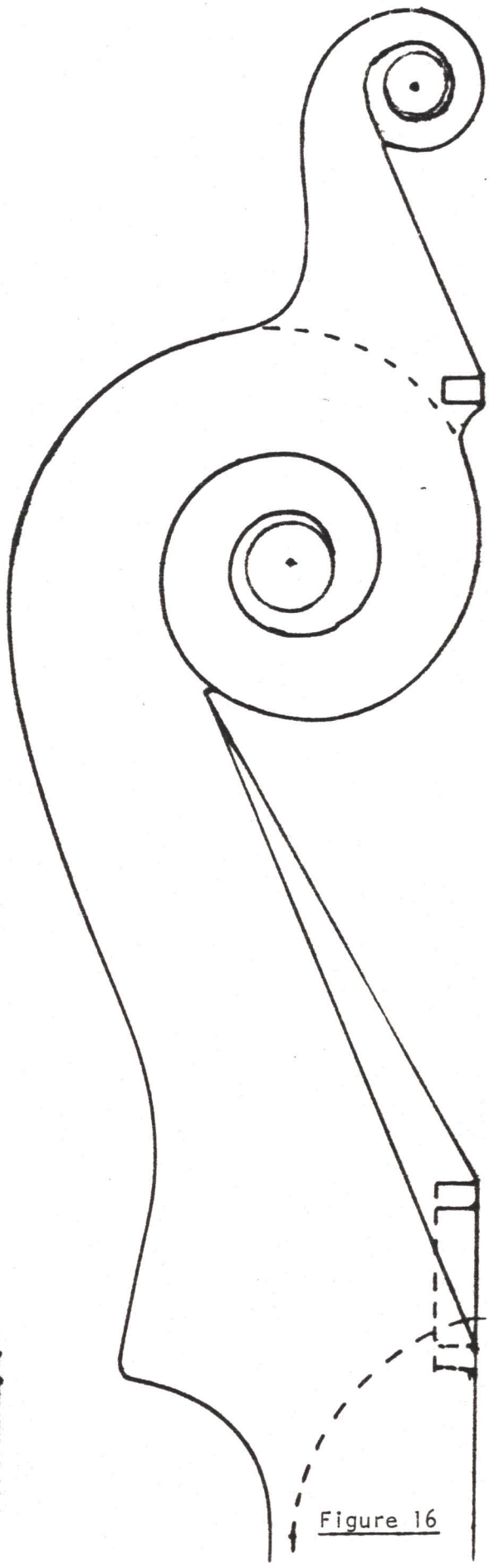


Figure 16

Forming the Bowl II

With the exterior and interior linesof the bandura established we now remove the excess lumber from the centre of the bowl, making sure to leave not less than 1/8" stock for finishing. Interior templets #8, #10, #12, #13 and #15 are used for this. See drawings. Then do the same to the exterior using templets #7, #9, #11, #14 and #16, again leaving 1/8" stock excess.

As you work on the surface of the bowl you will notice that it no longer lays level, therefore, it becomes necessary to glue on temporary supports to keep it level, see Figure 40. Placing the bowl face down on the plate of the drill press, raise the table until the straight router bit clears the middle of the bowl by 1/16" and then cut away the ends of the supports are now on the plate, lay the templet, complete with linings, on the bowl and fasten it to locators No. 1 and 2. Raise the table of the machine to the bit as shown in Figure 17 and remove the stock from "C" to "B" and from "A" to "D".

The neck may now be fully completed using templets #13, #14, #15 and #16 and a rolling pin (Figure 41).

The left side of the bowl may now also be finished, using templets #11 and #12 and from below #7 and #8. See drawing in section.

After removing the excess lumber the bowl will narrow a little and so now the right side of the bowl may be shaped with less stock. Holding the templet on locator No. 1 remove locator No. 2, shift the templet to the right 1/32", and fasten with locator No. 4. You may now partially shape the rest of the bowl, see Figure 17.

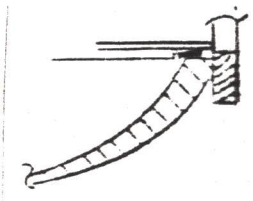


Figure 17

When the exterior outline of the bowl has been machined completely around, you may then shape the exterior curvature of the bowl. Using templet #11, shape the right and left sides, #9, the upper rim and #7, the lower curve, see Figures 18 and 19.

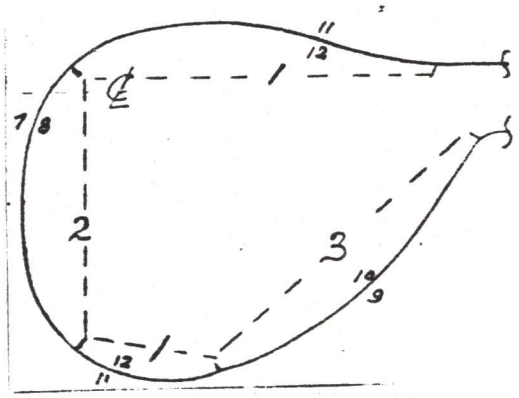


Figure 18

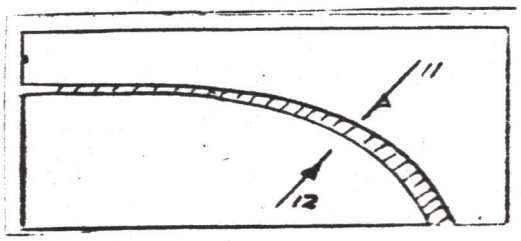


Figure 19

At the line of intersection of two curvatures (i.e. the transition from one templet to another) sharp ridges will be formed and these must be removed with a rasp by eye, see Figure 20.

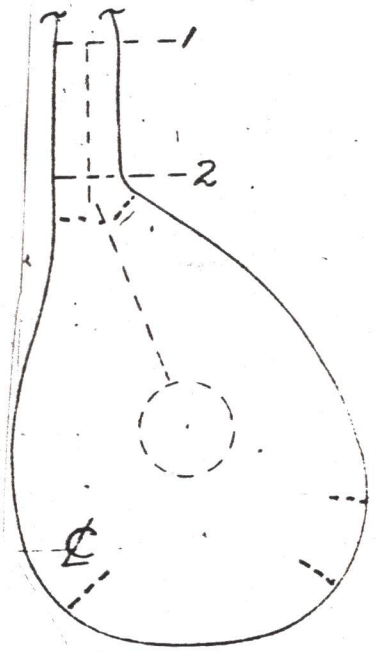


Figure 20

When the curvature of the outer surface of the bowl is finished, you may proceed to the shaping of the interior of the bowl. In order to gauge the thickness of the middle of the bowl or the neck, fasten the superstructure (the bowl with its supports) to the table of the drill press, as in Figure 21. Fasten a twistdrill or spur bit securely into the chuck (not an auger with a feed screw) and raise the table of drill press so that the space between the drill and the superstructure is about 3/16". Adjust the depth gauge to regulate the feed to 3/16". Drill closely spaced holes all over a 5" radius circle and then side by side up the handle and down the middle of the neck, as in Figure 20.

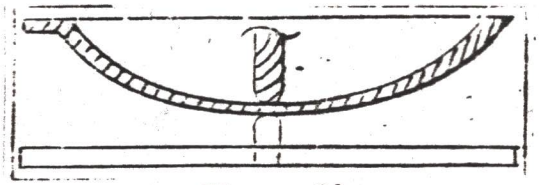


Figure 21

Following this, smooth out the curve in the middle of the bowl and the grooves to and in the neck. Using "A" and "B" as points of support, as shown in Figure 22, and employing templets #8, #10, #12, #13 and #15, finish off the interior of the bowl completely. Templets must be held at right angles (90°) to the outline of the bandura at all times and level with the surface of the bowl where the face will be glued. The other end of the templet must abut snugly against the depth of the curve or the channel (Figure 20).

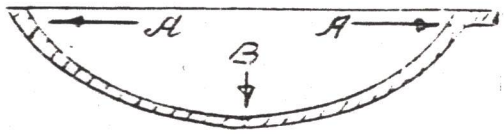


Figure 22

Preparing the Face

Take the four boards you cut for the face earlier, and plane them down to 1/8" thickness. Then assemble them so that the grain of each most closely blends with the grain of the one next to it, see Figure 23.

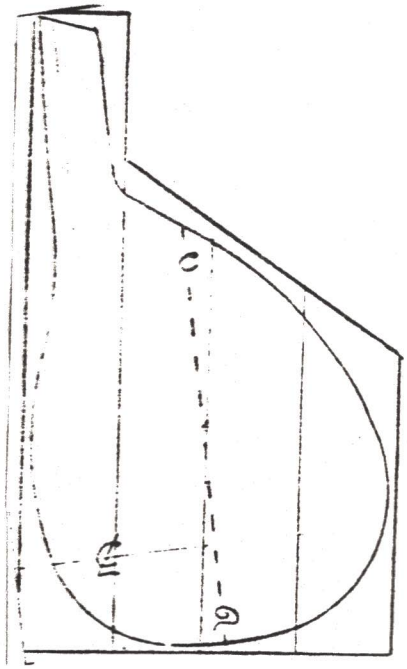


Figure 23

Place the templet of the bandura on the plan and layout the centre lines of the bandura, and from them the centre of the rosette (star) leaving enough stock around it for finishing. To decorate the rosette (flower), it is only necessary to glue together the two middle boards. Place the needle point of your compass on the centre mark of the rosette and lightly draw a circle of 3" radius (Figure 24). Divide the circle into six equal parts, starting at the centre line "C-D" of the rosette. Using templet #18 (see drawing) push a pin through the centre of the iris and fix it to the centre mark of the rosette. Line up the far corner of the lozenge (diamond) with the centre line and pin it down. With a sharp knife, cut around the outline of the petal and the lozenge to a depth of 1/32". Repeat this five times, transferring the templet to each of the lines you made in subdividing the circle.

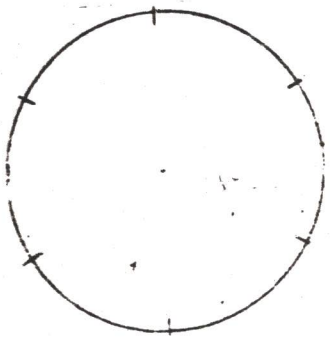


Figure 24

Next fasten a 3/16" straight router bit in the chuck of your drill press and lay the face on the plate of the press table. Adjust the depth gauge to a feed of .020"-.025", and cut out the petals and the lozenges. Then trim off the edges with a chisel or a sharp knife.

With the aid of templet #19, cut out six petals of walnut veneer and glue them into the rosette. The lozenges are filled according to the drawing using Figures 2 and 3. See the List of Materials for the filling material.

After this you may finish off the other boards of the face and glue the face together. Lay the templet of the bandura on the face centering it on the rosette and aligning it to "C-D" (Figure 23). Drill holes through locators No. 1 and 2 as in Figure 12. Now draw a line around the templet and then cut away the material keeping away from the line. Then finish off the face up to the templet as shown in Figures 15 and 17.

By using templet #17 in the same way (see drawing) we fit the walnut veneer to the neck surface. The inlaid purfling on the face of the bandura is done in the same way as the rosette. A retaining pin is placed on the plate of the drill press and the edge of the face is rested against it. Regulating your distance by means of the slots in the press table, make the shallow grooves for the inlay, as in Figure 27. The ogee or reverse curve (the two intersecting curves) at the base of the neck and the one below the upper rim are set according to their radii.

To make the inlay we use four special pairs of forms, in which we glue five sheets of different coloured woods (see List of Materials on the drawing) and then saw up into 1/32" thick strips which we glue under pressure into the channel in the face.

With the aid of templet #20 cut out the six openings in the centres of the rosette petals using a fretsaw, see Figure 25. These are the resonance openings for the face. Following this, clean up thoroughly with #120 sandpaper and after moistening the face with a damp rage, allow it to dry out. Repeat this two more times but now use #180 and then #240 paper.

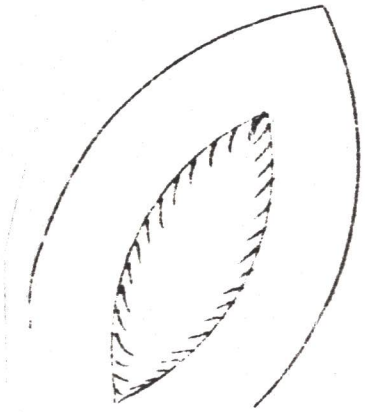


Figure 25

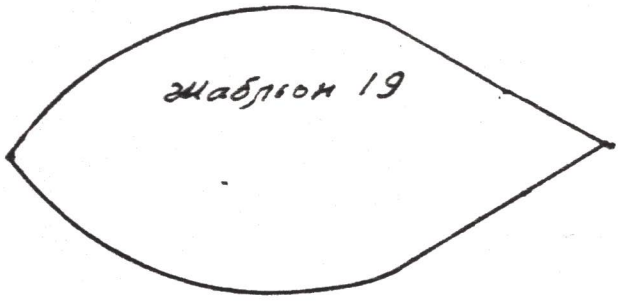


Figure 26

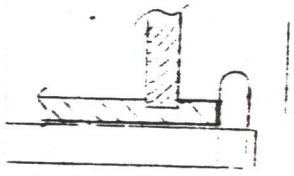


Figure 27

Bracing the Face

The placement of the struts on the face of the bandura is tightly bound to the distribution of the intersections of the cross bracing, strip reinforcing of the bowl, the rib supports of the bowl and the round post of the bandura. Therefore it is necessary to adhere strictly to the instructions about gluing them to the underside of the face as shown in the drawing.

They are to be spaced at 1 1/2" on centre at an angle of 30° to the horizontal centre line, starting from the centre of the rosette, see Figure 28. Fasten the face to the drafting table, so that the centre line of the bandura (i.e. locators No. 1 and 2) lie exactly parallel to the left edge of the table. Find the centre of the rosette, and with a 30°-60° triangle short edge to the centre line, draw a line through it. Flip the triangle over and draw another line through it. You will now have a broad "X". From these two lines, measure in both directions at right angles (90°) exactly and make marks 1 1/2" apart. Through these marks draw parallel lines as in Figure 28.

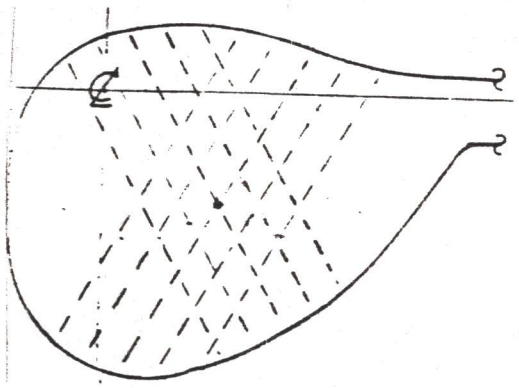


Figure 28

Now fasten the templet #1 by locators No. 1 and 2 to the underside of the face and trace the interior outline of the bowl on it, see

Figure 29. The end of each brace is cut at an angle of 45° and in such a manner that the end is short of the line of the bowl by 1/16", see Figure 29. At points of intersection, openings are from the top, and in braces 17-29, from the bottom, Figure 30. These openings are made with a 3/4" Forstner bit with a feed screw (see Figure 32). Fasten braces 1 and 17 so that their intersecting points line up, as on the plan. Clamp them together and bore the holes a pair at a time.

Figure 29

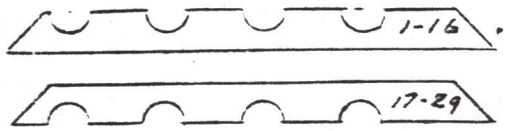


Figure 30

Three 1/2" high braces are attached to the neck face as in Section "H-H".

After making the braces, smooth them with a blockplane and then sand all edges except those which touch the face. When gluing the cross bracing to the face, first spread glue on the face where the braces will make contact, and then apply to the bottoms of the braces. Then clamp them together, each in turn, along their whole length. When gluing the upper layer of braces, be sure you apply enough glue to the semi circle cut out of the intersections to ensure bonding, otherwise you may have an annoying buzz when playing. After the glue has dried under pressure, apply glue around the base of all braces and on the intersections, as in Figure 31.

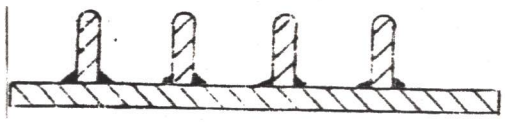


Figure 31

Figure 32

To preclude deformation or warping during drying, place the face on a level table, add plenty of weights for reinforcement and allow it to dry thoroughly.

Next glue in the soundpost (part No. 50 on the plans). The soundpost is a link between the face and the bowl. The upper end, cut to fit brace No. 8 is glued in place before affixing the face to the bowl. The other end, cut to the depth of the bowl is glued while the face is being attached, to the transverse brace of the bowl. It is positioned in the middle of the rosette.

Finishing Up the Bowl

During the bracing process on the face, the partially completed bowl would have sufficiently adjusted to humidity to the extent that final finishing steps could be considered. In the process of humidity adjustment (shrinkage), the bowl will become somewhat narrower and its rays will converge a little (Figure 33).

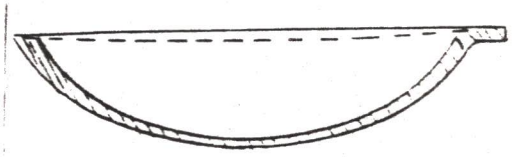


Figure 33

Place the bowl face down on a level table and check the amount of deformation. If it is more than 1/16", then you will have to glue in maple splinters at these spots. Where the openings are less than 1/16", then it will only be necessary to shave off a trifle at each side.

If you do not have a planer to level the surface of the bowl, then you must attach temporary supports which will be required later during finishing of the interior of the bowl. While smoothing the surface of the bowl, cut the supports down so that the cutting blade will just touch the bowl next to the head and the rest is cut away to the lowest point as in Figure 34. The location of the supports is shown in Figures 35 and 36. They should be 1/8" short of the outline of the bandura.

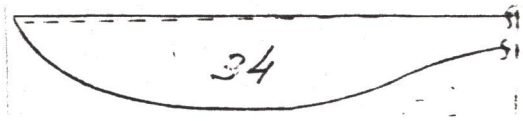
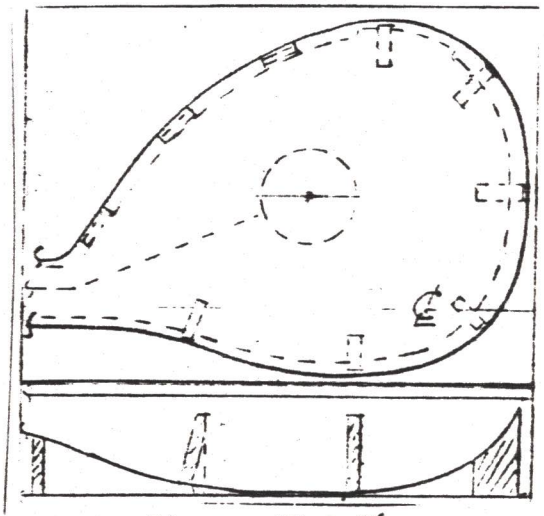


Figure 34



Figures 35 & 36

When the surface has been levelled place it on templet #1, fasten it with guides 1 and 2 and clean up all around according to the template as shown in Figures 15 and 17.

Now outline the interior of the bowl and finish it according to templets #8, #10 and #12 (see drawings). Be very careful not to

go deeper than shown in the middle of the bowl and along the line from the centre to the neck (see Figure 35). The interior of the bowl must be finished off as smooth as possible with curved scrapers and sandpaper.

The inside of the neck is finished with the help of a rolling pin as templet (see Figure 37). Smear it with soluble laundry bluing, which will show up the grooves missed when scraping. After scraping, smooth with sandpaper.

Where the interior has been finished, with no evidence of a gouge from plane or scraper, dampen it with a wet rag, being careful to avoid all glue lines. Allow it to dry thoroughly, and go over it once more with a #240 sandpaper, and then repeat the whole process once again.

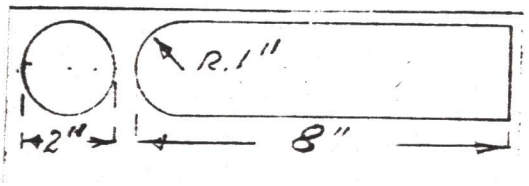


Figure 37

Reinforcing the Bowl

After many years of building experience and research done on banduras, it has been discovered that a thin hollow bowl gives a strong and sweet-timbred sound however over a period of time the bowl either cracks or warps at the ends which deforms and ruins the face.

In order to conserve the strength of sound and timbre and lengthen the life of the bandura, experience shows that it is necessary to place reinforcing in the bowl. Place six transverse braces of maple, 1/16" X 3/4", across the grain of the wood on the bottom of the bowl and three ribs in the neck according to the drawing.

To strengthen the end curves of the bowl, place 12 body ribs as shown in the drawing. The ribs are matched to the curvature of the bowl and glued so that the upper end protrudes somewhat above the surface of the bowl (Figure 38). After the glue as dried, the protrusion is cut off (Figure 39).

The sharp edges of the reinforcing braces and ribs should be rounded off and smoothed with sandpaper, so that no fibres would be left, and then the bottom covered in glue as in Figure 31.

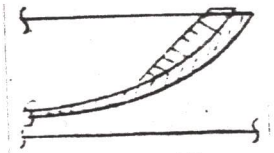


Figure 38

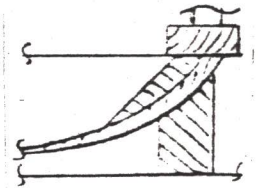


Figure 39

Gluing on the Face and Bindings

Resting the bowl on its supports, insert the wooden locators No. 1 and 2, which must protrude 3/32". Smear the surface, where the face and soundpost make contact, with glue, and then spread glue on the face, where the interior of the bowl has been outlined. Lay it on locators No. 1 and 2 and press gently with your fingers.

Now turn the assembly over, face down, and lay it on a level table. First clamp the neck in two places (See Figure 12, 1 and 2) and then the middle of the lower curve. Next clamp at each temporary support. If the glue does not squeeze out at any point between the supports, it is well to add clamps at these points.

Do not forget to cover the table with waxed paper before you begin this work. Leave the bandura under pressure over night.

Remove the bandura from the work table and accurately identify locator holes No. 1 and 2. Fasten templet #1 to locators No. 1 and 2 and drill holes for locators No. 3, 4, 5 and 6 through the templet.

When you have trimmed the body of the bandura up to templet #1 all the way around, you will still have a little stock on the surface of the bulge of the bowl. From the sides, this will present a perpendicular plane large enough to support the bowl while cutting away the rabbet for the bindings (Figure 40). Fasten the plate, to which you have attached a post with a plate support to the press table. Feed the bandura horizontally on the plate until the rabbeting route bit makes a 1/8" wide cut 5/16" deep into the edge of the face. Set the press in motion, and starting from the left go completely around the bandura as in Figure 40.

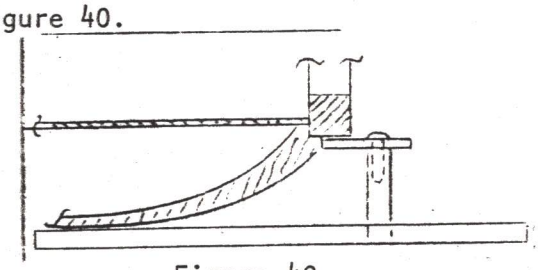


Figure 40

Now, raise the press table and drop the support post 5/8" from the surface of the face, and cut away only enough of the upper rim for the strings. See the drawing, Section "J-J" and templet #3.

Next route out the slots for the nuts with a straight, single flute bit, 3/16" diameter. Both slots are 3/8" deep, the upper one at 90° to ℄ and the lower one at 70°. See drawings and parts #23 and 24.

With a 3/4" spade bit (Figure 32) or a straight router bit, cut out the centre of the rosette to a depth of 1/32" for parts #19 and 20.

At this point we drill holes for the pegs in the pegheads. There are two in the upper head and six in the lower. Drill to a depth of 3/8" with a 5/32" bit, and then deepen 3/8" more with a 9/64" bit for the thread of the screw as per Figure 13.

Preparation of the Bridge and the Upper Rim

Experience has shown that the bridge and tailpiece, due to the position of the screws for fastening parts of the switches, of the bridge posts for raising the strings, and of the tuning pins which are very dense, often splits along the grain. This has been overcome by gluing a sheet of red fibre, 1/16" thick, to the surface.

Cut it from a 5/16" thick maple board and from 1/16" thick fibre according to templet #2, and parts #10 and 11 leaving 1/16" extra stock around the edges. Glue them together under pressure, and when the glue has dried, place the templet on top and drill holes for locators No. 3 and 4. With a lining between the templet and the fibre, cut around the outside and inside, as was shown in Figures 15 and 17. Drill 1/4" deep holes through templet #2 according to the dimensions shown.

With templet #3 as a guide, cut a piece from 3/16" stock, leaving enough around for finishing. Drill holes for locators No. 5 and 6, fasten with the guides and add three more locators in the 7/64" basting holes for reinforcing and then cut away all around as in templet #3. When doing the 7/64" holes through the templet, drill only halfway for the locators, but all the way through for the basting, see part 51. Now using templet #4 and a 1/4" board, do the same as in part 51, but this time drill the 7/64" holes for the principal treble strings only halfway. Use the same three hole locators for fastening. This will be part #52. Do for the strings of the upper rim as you did

for the bridge, rounding off all outside corners to 1/32" radius (see drawing).

Completion of the Exterior of the Bowl

When we finished off the peghead, we also finished the neck up to Section "A" as in templet #14 and Figure 41. Now we turn to templet #16 and Section "B". Take a straight 5" X 5" board, smear it with blue chalk in water and pressing it against the neck, slide it around the neck. Keep removing the blue spots with a block plane until the neck is smooth.

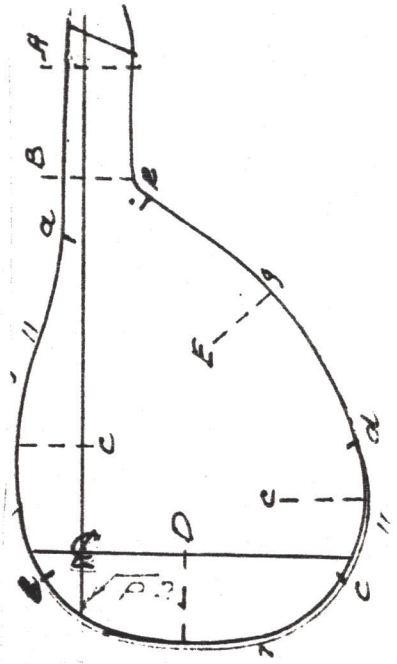


Figure 41

Next bring templet #7 to the middle of the lower curve and adjust it so that one end touches the middle of the bowl while the other approaches the line of intersection of face and bowl. Actual touching should happen only at line "D", see Figures 41 and 19. Now remove the temporary supports. Do the same at line "C" (two places) and at line "E".

Then place the bandura, face down, on the press plate, on which you have affixed peg stops behind the straight router bit. Slide

the plate close to the bit, so that it almost touches and then fasten the plate to the table. The table is now raised so that the bit is 5/8" away. Setting the drill press in motion, cut out a phase for the string holes at the distance shown on templet #3, and then push the press plate so that the bit will take out this plane which is 5/8" wide. Moving on, exchange this bit for a core box bit with radius of 1/8" and clean up the sharp inside corners. Then exchange the blade for a 1/4" beading bit and round off the outside edge as in templet #9. See Figures 42 and 43.

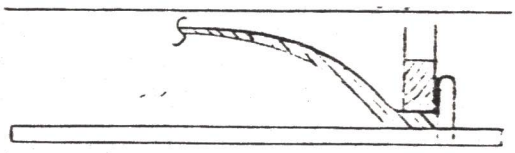


Figure 42

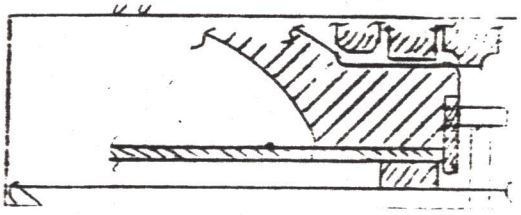


Figure 43

Following this you cut away the remaining excess slack on the surface of the bowl. Starting from the lower curve, from point "B" to "C" (see Figure 41). Press the edge of the binding on the bandura to the peg stops and raise the table of the drill press almost to the point where the viewing bit touches the bandura at the fitted place on line "D". Set the table at this height. Setting the machine in motion begin from the left from point "C" and advance to point "B". Repeat this, lowering the table by 1/4" increments, and move the plate up to the cutter, until you have removed the surplus waste. In this same manner work along line "E" between points "D" and "E" and then along line "C" between points "A" and "B" and "C" and "D".

Working with the machine will leave grooves with ridges between them. These must be removed with a plane until perfectly smooth. Points of intersection between one templet and another must be smoothed by eye to the craftsman's taste. After planning, use scrapers and sandpaper. Dampen with wet rag, dry out, and sandpaper again. Finally, repeat whole process once more.

Bill of Material

PART NO.	NAME OF PART	MATERIAL	REQUIRED	
1	Bodyshell	Maple or Pear Wood	{ 1 3	3 X 19 1/4 X 41 or 3 X 7 X 41: 24: 20
2	Neck Reinforcement Ribs	Maple or Pear Wood	3	1/16 X 3/4 X 2 3/4
3	Body Ribs	Maple or Pear Wood	12	1/4 X 3/4 X 3
4	Transverse Brace	Maple or Pear Wood	6	1/16 X 3/4 X 15 C.T.L.
5	Binding of Lower Curve	Vulcanized Fibre	1	1/8 X 1 1/16 X 23 1/2
6	Binding of Right Side	Vulcanized Fibre	1	1/8 X 1 1/16 X 23 1/2
7	Binding of Upper Curve	Vulcanized Fibre	1	1/8 X 1 3/16 X 20 1/2
8	Binding of Right Side of Neck	Vulcanized Fibre	1	1/8 X 5/16 X 8 1/4
9	Binding of Left Side	Vulcanized Fibre	1	1/8 X 5/16 X 28
10	Bridge	Maple or Pear Wood	1	5/16 X 6 1/4 X 18 1/4
11	Bridge Plate	Vulcanized Fibre	1	1/16 X 6 1/4 X 18 1/4
12	Sound Board	Fir or Spruce	4	1/8 X 5 X 35
13	Cross Bracing for Sound Board	Fir or Spruce	29	3/16 X 3/4 X 20 C.T.L.
14	Neck Bracing	Fir or Spruce	3	3/16 X 1/2 X 2 1/8
15	Neck Cover Decor	Walnut or Rosewood	1	1/32 X 4 X 11
16	Rosette Petal	Walnut or Rosewood	6	1/32 X 1 1/8 X 3
17	Rosette Lozenge	Mother-of-Pearl	24	1/32 X 5/16 X 2
18	Lozenge Trim	Ebony or Plastic	24	1/32 X 1 X 1
19	Rosette Centre	Mother-of-Pearl	1	3/4 dia. X 1/16 thick
20	Rosette Iris	Ebony or Plastic	1	1/32 X 1/4 dia.
21	Lower Nut	Stainless Steel Rod	1	3 X 1/16 dia.
22	Upper Nut	Stainless Steel Rod	1	3/4 X 1/16 dia.

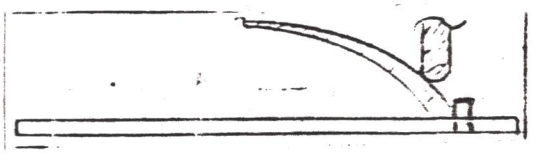


Figure 44

Gluing on the String Mounts and the Bindings

If you wish to secure the string mounts of the upper rim so that the dowels do not show then you must first lay part #52 on part #51. Fasten them together with locators No. 5 and 6, turn them over 180° and drill 5/32" holes for the dowels. Do not go clear through, but leave about 1/16" at the bottom (Figure 45).

Figure 45

To make the dowels (part #26) take a maple rod 3/16" diameter, cut off 26 - 1" lengths, round both ends and push through a .152" diameter hole in a steel plate on the drill press as in Figure 47.

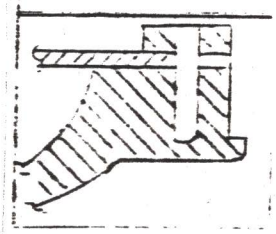


Figure 46

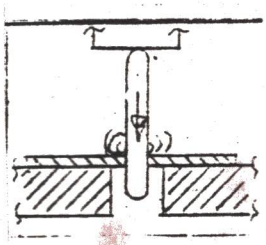


Figure 47

Next take part #51, place it on the bandura face and secure it by locators No. 5 and 6. Apply glue between the face and part #51, compress with clamps and allow plenty of drying time. The squeezed out glue from under part #51 will have to be removed and wiped off with a damp cloth (see Figure 45).

Once the glue has dried, place it on a cradle, which it must have for balance and for firm support for future tasks, and drill holes for the dowels (part #26) leaving 1/8" at the bottom as in Figure 46. Holding the bandura in the cradle on the press table, adjust the height of the table so that dowels will press into the bandura leaving 3/16" exposed (part #51) for part #52. Then, systematically press and glue in all 26 pins, one after the other, and without wasting time, immediatly apply glue between parts #51 and #52 and then carefully, slowly clamp down part #52 so as not to break it. Any extruded glue must be wiped and washed off with a damp cloth. It is advisable to put on several clamps and to allow it to dry thoroughly.

Now we take the bridge plate, parts #10 and 11, and securring it with locators No. 3 and 4, trace the outline lightly on the face. Apply glue, first to the maple and then to the spruce and lay the plate on the face. Push in locators No. 3 and 4 and apply load or pressure. Do not forget to wipe and wash off extruded glue before it dries.

Allowing the bandura to dry, we approach the preparation of the fibre bindings for the bandura. For these bindings, we use red fibre, which adheres well with cabinet maker's glue, and which protects the edges of the bandura from damage. For this purpose, you will need a piece of vulcanized fibre, 1/8" X 6" X 30".

First cut off a strip 1 1/8" wide and 24" long for part #5 (see drawing). Its upper edge is rounded off on both sides at 1/16" radius. Part #7 is also 1 1/8" wide by 21" long and its upper edge is also rounded off both sides on 1/16" radius. For parts #6, #8 and #9 cut strips 5/16" wide. The lengths are:

part #6 = 4"

part #8 = 9"

part #9 = 30".

On these three parts we round off the outer edge only to 1/16" radius. The exact lengths are fitted at the bandura.

Before gluing the bindings to the rabbet on the bandura, we would advise drilling 1/32" holes as shown on the drawing. Parts #5 and #7 have a double row, and parts #6, #8 and #9 a single row along the centre beginning 1/8" from each end and spaced every inch throughout the whole length for nails. Use 1/32" X 5/8" nails and to facilitate removal, add metal or fibre washers, 1/32" X 1/4" diameter with 1/32" holes.

First secure the binding into the rabbet by tapping the nails with a tack hammer but without glue. When the entire binding is completely matched, then carefully remove the nails, apply glue to the rabbet and using the same nail holes, firmly nail the binding back down with a tack hammer. After washing and wiping away the excess glue, allow it to dry thoroughly.

Drilling the Holes

In order to drill holes in the tail piece for the tuning pins, the mounts for the string bushings, and the bridge for the bridge posts, as well as for attaching pins and bushings, you must first secure the bandura to its cradle on the board so that the bandura face will be

absolutely level.

Then drill holes for the turning pins using a 13/64" bit and only feeding deep enough to penetrate the fibre. Change to a 3/16" bit and deepen the holes to 1 1/8" from the surface of the ring mount (see drawing in Section "L-L").

Now with a 1/8" bit, drill holes for the bushings, parts #39 and #40 (see figure in Section "J-J"), to a depth of 31/32" from the surface of part #52, and 23/32" from the surface of part #51. This will place their bottoms at the same level.

Next take a #38 (.101) twist drill and drill 46 holes for part #29, starting with the basses, and then a #43 (.089) drill for the other 14 holes, which are part #30. Tap the larger holes with a #38 tap drill for #5-40 screws and the smaller holes with a #43 tap drill for #4-40 screws. These holes may be drilled clear through the face. The holes for securring the switch mechanism, part #31, are made with a #50 (.070) twist drill to a depth of 3/8" and then tapped for #2-56 screws.

After drilling the holes in the bridge cleanse all surfaces with sandpaper to remove all traces of roughness for varnishing. The turning pieces are screwed in after varnishing, but the bushings, parts #39 and #40, are now attached with glue so that their tops protrude above the surface of parts #51 and #52 (see drawing, Section "J-J") serving as nuts for the strings.

Once the glue has dried, drill holes with a #54 (.055) drill, through the holes in the bushings, clear through the bandura, as in the drawing, Section "J-J". Then remove the bandura from its cradle, lay it face down upon the press table, across a couple of 1" thick rails which keep the binding (part #5) from touching the plate, and cut out

channels, 3/32" X 3/32" X 3/8" to receive the ball ends, part #27 (see drawing and Figure 50). After this, do your final cleanup around the bandura, add a decal frieze, if you so desire, and varnish it.

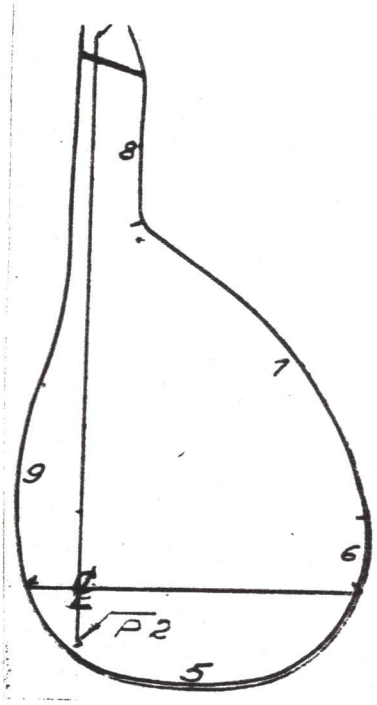


Figure 48

Figure 49

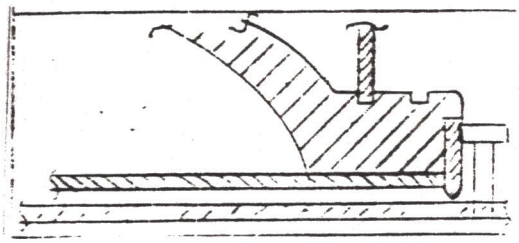


Figure 50

The varnish we recommend is a plastic varnish similar to Varathene Liquid Plastic Clear Gloss #90, which will not leave brush marks. The glue we advise using is a cabinet maker's yellow glue similar to Elmer's Carpenter's Wood Glue, 3500 p.s.i., which is not

affected by humidity and bonds well with both wood and fibre. Apply 2-3 coats of varnish allowing one or two hours drying time between coats.

Upon completion of the varnishing, attach the tuning pins (part #28). To do this you must first refasten the bandura in its cradle and place it on the press table. Now fasten the smooth part of the tuning pin into the key chuck (see Figure 51). With the pin firmly placed, feed the pin into the hole, and turning the chuck by hand, keep feeding until the hole for the string is about 1/16" above the surface of part #11. By doing this all other tuning pins will be on the same level.

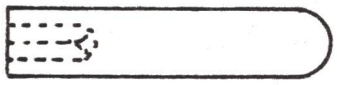


Figure 51

Now we screw in the string pegs for the basses. Fashion a key with a 1/16" wire, push it through the peg hole, and placing the butt end to the 5/32" hole, thread it in until the peg (part #25) is firmly in place (see drawing).

Finally, we affix the nuts for the basses (part #23) to the lower head, and part #24 to the upper head, as in the drawing.

Making the Attachments

1. The Tuning Pins - Part #28

   For the pins, use a 13/64" (.203) brass rod. Cut it into 60-1" pieces. Round off both ends to a radius of .100", and then compress them into squares in fixture No. 1 (see drawing). Trim the square, turning it over in the device four times. Finally, place it into device #12, fix it with a pin from each end and drill a 3/32" hole for the string.

2. The Bass String Pegs - Part #25

Take a 5/32" (.152) brass rod and cut it into eight pieces, 3/4" long. Round off one end on the lathe, cut a neck for the string, and drill a 1/16" hole in the centre of the head. The other end is tapped for a #8-36 thread (see drawing).

3. The Treble String Ball Ends - Part #27

For ball ends, use a 3/32" (.094) brass rod cut into 52 pieces, 3/8" long. Round both ends off on a lathe and cut a neck in the middle to the dimensions .020" wide by .015" deep. We advise chrome or nickel plating parts #25, #27 and #28.

4. The Neck Cover Decoration - Part #15

To decorate the neck of the bandura, use a walnut veneer, 1/32" (.025) thick, or better still a rosewood veneer. Arrange strips in a pattern at an angle of 45° to the centre line, for best appearance. Get ideas from a book on marquetry and use templet #17 for your limits. Draw a full size pattern on paper and cut each piece individually with a razor or Exacto Knife. Dampen veneer with wet tissue over night for best handling.

5. The Rosette Petal - Part #16

Use the same material you used for Part 15 but the petal's grain must run parallel to its centre line. Use templet #19 for cutting.

6. The Rosette Lozenges - Part #17

Mother-of-pearl is preferred, but if not available then use white brick veneer of the same thickness, 1/32" (.025). Cut this in strips .360" 923/64) wide, and, utilizing device No. 2 cut out six lozenges, .360" X .360".

7. The Lozenge Trim - Part #18

This is made from ebony, or black plastic, 1/32" (.025) thick, cut into strips 3/32" (.100) wide. Portions are cut off with the help of jig No. 3 (see drawing, part #18).

8. The Rosette Centre - Part #19

The centre should be of mother-of-pearl, but if not available an ordinary button, similar to mother-of-pearl, 3/4" diameter could be used. Drill a 1/4" hole in the centre of it for the iris, and shave away the bottom to 1/16" thickness.

9. The Rosette, Iris - Part #20

The iris is cut from black plastic or ebony, 1/32" thick by 1/4" diameter.

10. The Lower Nut Wire - Part #21

The wire, which is mounted on the nut at the head of the bass strings, is made from stainless steel wire, 1/16" diameter X 3" long.

11. The Upper Nut Wire - Part #22

This is the same as Part 21, except that it is only 3/4" long.

12. The Lower Nut - Part #23

The nut is cut from a piece of red fibre, 3/16" X 3/4" X 3 1/4", on the surface of which you cut grooves 1/16" wide by 1/32" deep.

13. The Upper Nut - Part #24

The same as part #23 but this time the length is 1". A shallow groove is cut in each nut to receive the fret wire.

14. The Bridge Posts - Part #29 and #30

The bridge posts which act as vertical saddles for the strings are ordinary headless cup point socket set screws. You need 46 units of #5-40 and 14 units of #4-40, all 1/2" long. On a lathe, cut a neck for the strings to root depth of the thread 1/16" from the top of the screw. This will prevent the strings from getting caught in the threads when stringing the instrument (see drawing).

15. Switch Mechanism Fastening Screws - Part #31

For fastening screws for the mechanism, we recommend self tapping metal screws, #2-56, 1/4" long. The mushroom or panhead socket screw is not only good looking but easy to work with.

16. The Switch Handles - Part #32

The handles are made from 3/16" plastic rod called Acetal Delrim Rod. Cut off 34-1/2" lengths, round off both ends in the lathe, and drill a 3/8" deep hole in one end with a #50 (.070) drill. Screw in the long threaded part of the shaft (part #34), and return the handle to the chuck. Taper off the lower portion at an angle of 10° from the top of the head to the shaft. Ten handles will have three identification grooves, ten will have two, nine will have one and the rest none. Half of them will receive red stripes and the rest will have black stripes (one less single stripe). When the paint has dried clean off the surplus on a lathe with a blockplane.

17. String Tensioners for Switching Tones - Part #33

The tensioners for the bass strings are cut from a 1/4" brass rod. You will need eight 1/2" pieces. The trebles require 26-1/2" pieces of 13/64" rod. Trim both ends to a length of .460" on the

lathe. Then place it in jig #13 and drill a hole half way through the tensioner with a #49 (.073) drill and the balance with a #53 (.059) drill. Thread this hole with a #1-72 tap drill.

18. The Shafts for the Switch Handles - Part #34

Use a .073" bronze rod for the shaft. Cut off 34 pieces 5/8" long, round off both ends on the lathe and thread it for six threads only with a #1-72 die from one end and for 15 threads with a #2-64 die on the other end.

19. The Locking Screw for the Tensioner Switch - Part #35

The locking screw is simply a headless cup point socket set screw, #2-56 X 1/16" (see Figure 53).

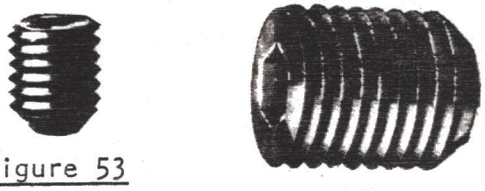


Figure 53

20. Protection Pads for Tensioners - Part #36

To prevent damage to the tensioner (part #33) when locking with the set screw (part #35) place a plastic pad made from #25 test nylon fishing line between them. To make the pad tie a knot in the line, pull it tight and cut the line on both sides of the knot. You will need 34 of them.

21. Fibre Bushing - Part #37

A fibre bushing is placed between the housing (part #38) and the tensioner (part #33) to stop any metallic rattling in the mechanism. Made of red fibre tubing, the one for the basses is sized 3/8" O.D. and 1/4" I.D., and the one for the trebles, 5/16" O.D. and 3/16" I.D. Cut 8-1/2" lengths for the basses and 26 for

the trebles, and then trim both ends to a length of .460". The treble bushings are then reamed out to 13/64" I.D.

22. The Housing for the Mechanism - Part #38

The housing for the mechanism is fabricated from stainless steel sheet of .025" thickness. First cut it into strips exactly .460" wide, and then cut off eight pieces 1.570" long for the basses and 26 pieces 1.410" long for the trebles. Next, round off all four corners on a radius of 3/16". Then punch holes just as shown on the drawing. The next item is the table. Here, when bending, you must bear down hard from above to bend the corners sharply (see drawing). After this, with jig #7 form the housing, and bend it for clasping the tensioner. All these operations are clearly shown on the drawings.

23. The Upper and Lower String Bushings - Part #39 and #40

The string bushings have two important tasks: 1. They fasten the bowl, the face and the mounting together. Without them the strings may pull the upper rim completely over.
2. They serve as a height control for the treble strings. They are made from 20 ga. brass tubing - 1/8" O.D. and .055" I.D. Cut 26 pieces 1" long for the full tone strings and 3/4" long for the semi tones. The sharp edges must be smoothed down somewhat, but very little. On the inside, round off the edges that faces the bottom of the bandura, or the strings will get cut.

24. Friction Pads - Part #41

When playing on the bandura, Zinkiwsky style, the bandura is placed on both knees, facing the audience. In this position,

the bandura slides off the knees, therefore, friction pads become necessary. Cut out 12-15 pads of rubber 1/16" or 3/32: thick and 3/8" or 1/2" in diameter, and fasten them in a row between the bowl and the fibre binding of the lower curve with rubber cement or Weldwood Contact Cement.

25. Purfling Inlay - Part #42, #43, #44 and #45

For ornamentation of the face, this bandura has a modest, straight outline, made up of five strips of veneer. The first strip is ebony or walnut, the second, white birch both 1/32" wide, then a 1/16" strip of mahogany, after which, birch and ebony, again in 1/32" stips. Altogether this totals to 3/16". To shape the purfling to the outline of the bandura, see parts #42 to #45, we make four forms. 1" high, out of wood. Cut the veneers into 1" strips, apply glue to their surfaces, and lay them in proper order in the forms. Compress them with clamps and allow to dry. Finally, cut across the layers in 1/32" slices with a small circular saw.

26. The Scroll Inlay - Part #46, #47, #48 and #49

To ornament the peg heads of the bandura we inlay the centres of the volutes (see drawing). The method of inlay follows the procedure outlined in Items #8 and #9 above, with the dimensions as given on the drawings.

27. The Soundpost - Part #50

A soundpost is placed inside the bandura to enhance the resonance and to create simultaneous vibrations between the face and the bowl. A 5/16" maple rod is glued to both the face and the bowl for this purpose (see part #50 on the drawing). Glue the split end of the post

to the cross bracing of the face, and measure the depth to the transverse brace at the bottom of the bowl. Allow 1/32" for thrust and cut off the post at that dimension. When gluing on the face, do not forget to apply glue to the end of the post and to its contact point in the bowl.

Mounting the Switch Mechanism

With all the parts of the switch mechanism at hand, we can begin to assemble them by pressing the fibre bushing into the middle of the housing.

Then place this sub-assembly into jig #9 and #10 and drill holes with a #50 (.020) drill for part #35. Use the right-handed jig for the treble strings and the left-handed jig for the bass strings.

Then take this sub-assembly over to jig #11 and thread the hole with tap #2-56, again right side for trebles, and left for basses. Tighten the lock screw (part #35) so that parts #37 and #38 are fastened together.

After this, take the sub-assembly over to jig #14 and cut a continuous hole .073" wide and 45° from top to bottom into the fibre bushing for the shaft of the handle (part #34). Nearly clean up the burrs in part #37 and then fasten in the tensioner (part #33).

Now take the sub-assembly over to jig #11 and using the right sides, drill pairs of holes with a 3/32" drill for the trebles, and using the left side, single holes for the basses. Next, number the strings in order on part #38 starting from the bass. Remove the upper plate with the holes from jig #11 and drill holes for strings according to the dimensions shown in column 4 of the String Data Chart on the plans.

In order to create semi tones when switching mechanisms 28 to 34, where there is no space you must remove the upper part of the tensioner. To do this screw the handle into part #33, turn it up to 45° and, from the upper part of the tensioner drill half way through part #33 with a 1/8" drill through the previously prepared hole. Study the drawing meticulously.

After this, carefully, so as not to damage the fibre bushings, dismantle the parts and clean up any and all burrs that may harm the switching operation. Then reassemble and mount the parts according to the directions on the drawings. Fasten the mechanisms to the mounted bridge plate with the pan head screws (part #31). Finally, screw in the bridge posts, parts #29 and #30 and you are ready to string your bandura.

Winding Bandura Strings

In our efforts to perfect the bandura in recent years, the idea occurred to us to achieve the ultimate dimension - the making and winding of bandura strings of proper length and thickness to obtain the strongest and sweetest sounds. With these principles in mind we draw up a chart, String Data, to produce strings for our type of bandura.

Beginning with the preparation of the steel wire, it is better not to use the dark (low carbon) steel which is brittle and breaks easily. We recommend the bright one called spring wire (#1045) or better still, music wire (#1085). Snip lengths off the various thicknesses according to the String Data Chart on the drawing. Then make 5/32" diameter eyelets for the basses, and 3/32" diameter eyelets for the trebles.

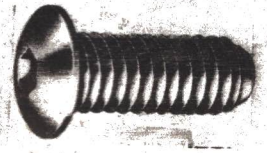


Figure 54

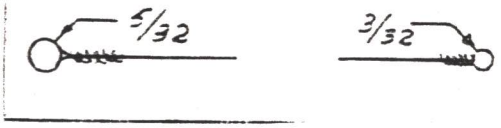


Figure 55

Figure 56

We recommend using a winder to keep the windings snug and tight. We made up a special little mill for putting windings on wound strings. On the left side we mounted a little motor from a shoemaker's machine which has a rheostat for regulating its speed, and on the right we placed a movable feeder for strings with a bead pick up in the centre.

Attach the string near the motor by the eyelet and stretch and secure the other end with the locking screw. To keep the winding from unravelling, crimp each end of the active part of the string as in Figure 57 and in the String Data Chart on the drawings.

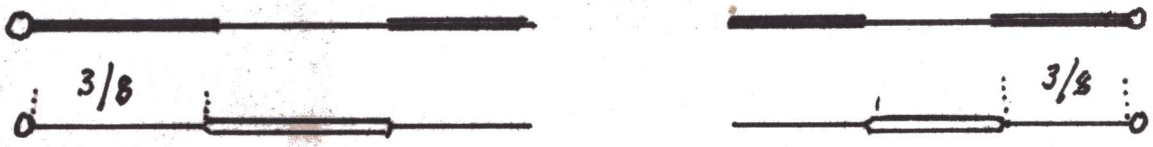


Figure 57

We have six jigs (see Figure 58) one for each thickness of wire and string, for tightly stalking the windings on the core:

1 - A - thickness of core -	.016"	B - thickness of string -	.024"-.032"
2 - A	.018"	B	.032"-.040"
3 - A	.018"	B	.040"-.050"
4 - A	.020"	B	.050"-.062"
5 - A	.020"	B	.062"-.074"
6 - A	.022"	B	.074"-.086"

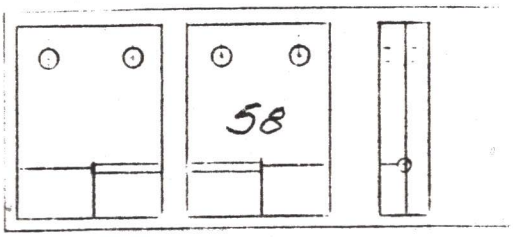


Figure 58

After attaching the winding next to the motor, set the motor to low speed and wind in wide sweeps from the eyelet to point B (see drawing). Then incline the winding a little to the left so that it becomes denser, and as you near 1/2" stop the motor. One half the jigs must be propped up so that the core lays in its place, the string in its, and the windings come out at channel C.

Lay the other half of the jig on the locator, press down with your fingers, and start the motor, lightly forcing the jig towards the motor. Once past the crimped part of the core, 1/2" from the right side, break off the winding. Stop the motor, pull out the end of the winding from the eyelet and manually unwind from A to B (see the drawing) Data.

Place the wound string on the bandura at once and look for item D. For string tension you must draw back 5/16" for the basses and 3/16" to 1/8" for the trebles and remove the extra winding so that, when stretching the string the winding will touch neither the nut nor the bridge post (part #30).

The switching handles with black and red stripes are arranged in this manner: The first bass has two red stripes, this is dole - C; the second is without stripes; the third, two black; the fourth, one red; the fifth, three red; the sixth, three black; the seventh, one black; and the eighth, two red. This order is repeated to the far end. When tuning the bandura all handles with black stripes are in the down

position and are tuned to pitch. The black stripes indicate flats (b) and the red, sharps (#). When you need one flat, lift up the handle with one black stripe, and when you need two sharps then press down the handles with one and with two red stripes.

Semi tones are tuned a half tone lower than the tone for that string which has a common switch. The locking screws for the levers together with their pads are clamped so that, in switching keys, they will not come loose. The bridge posts are placed so that the strings will centre in the hole of the mechanism. Seeking out the exact semi tone switch point of the string is done by shifting the mechanism along the oblong screw holes (part #31).

Commentary

For craftsmen who undertake to manufacture banduras on a mass-production basis. Several people have appealed to me with the idea of starting a craftsman's mass-production series of banduras for sale, not only amongst those of Ukrainian descent, but also amongst others. But after becoming acquainted with my instructions, they become intimidated by the high costs of the loss of time in building such a complex instrument.

By fabricating them at home, the expense in time and money for only the accessories will take almost as much as the cost of the first bandura itself. Then the costs of the second bandura would cancel half those of the first. If one would take a series of banduras of a hundred or two, and the need for good concert banduras is very great indeed, then the time needed, of which most goes into fashioning the bowl and making the mechanism, may be shortened by about 10 or 20 times. And this is only by means of buying a duplicator for about

$1,600 for shaping the bowl in 12 hours, and by ordering a die costing five or six thousand for the manufacture of the switching mechanism. The forms for the bowl, which would have to be made by hand according to my instructions, would require the fabrication of two plastic replicators for about fifteen hundred. Therefore, summing up, we have 1600 + 6000 + 1500 = 9 or 10 thousand, which, when spread over the first series of, say, 100 banduras, works out to only $100 per bandura. The second series will therefore cost $100 less than the first. At present the Chernikiv model sells for $400, while our model sells for $750 and higher. The need, therefore, is there, and if an average is taken we have 400 + 750 = 1150 ÷ 2 = 550 less 100 for the machines = $450. Can we not make the face, glue it up, varnish it and string it for $450?