Do It Yourself!

build the

PATRICIAN IV SPEAKER ENCLOSURE

Electro-Voice® do-it-yourself project

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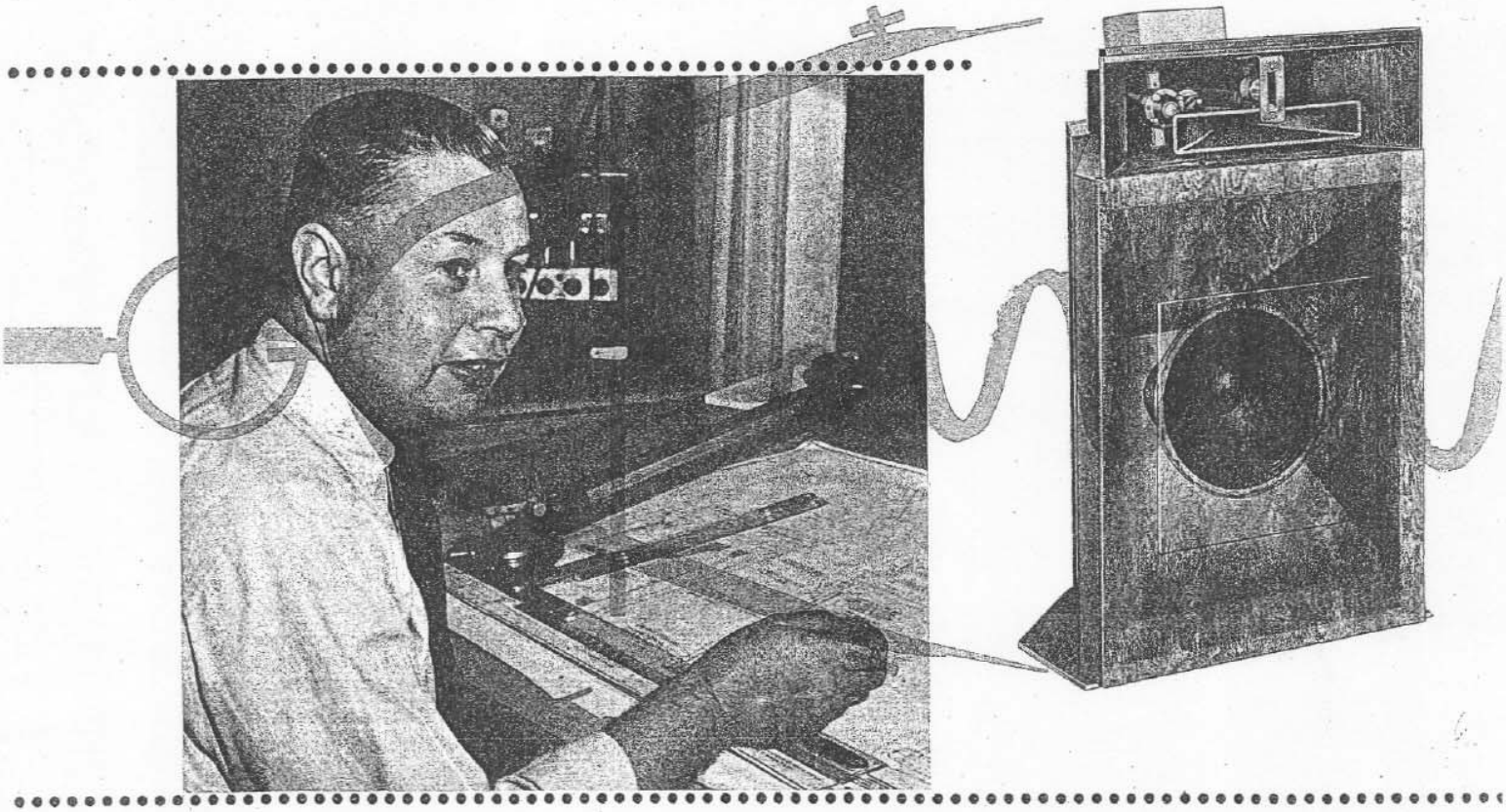


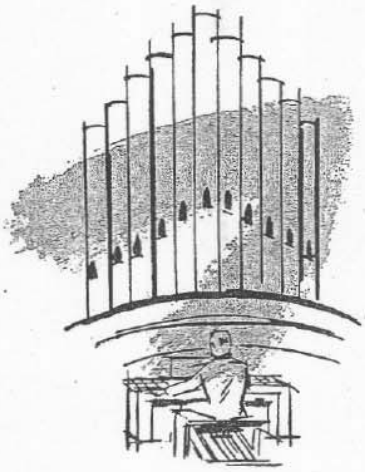
ROY R. CARLSON
designer of the PATRICIAN ENCLOSURE

A few short years ago, Hi-Fidelity started sweeping the world before it. Each extension of range demanded a new speaker. Before long the simple record player had become a Frankenstein monster, dominating the living room. One speaker was ugly enough, but three, or FIVE! "Take that junk down to the basement and keep it there."

"Speakers can be beautiful," reasoned Roy, "and efficient as well". Condensing the complexity, mass and bulk of an efficient sound radiator into a functional piece of furniture was a task engineers avoided with surprising agility. Roy waded in, and four years later the end result was the PATRICIAN, the world's best and most highly condensed reproducer enclosure. Not only did it outperform all others, it had the external appearance of dignity and quality. It was designed to be a reproducer and made no attempt to be anything else, but somehow, now the Frankenstein monster had achieved respectability, and it was INVITED into the parlor.

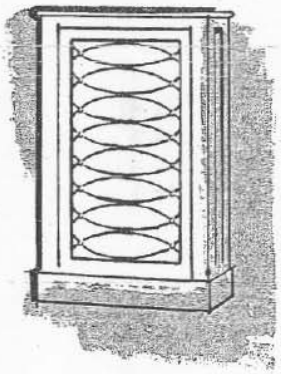
The Patrician is now a part of the American Scene, but Roy kept right on working, drawing plans, designing kits, so now there is no reason why anyone who wants a Patrician cannot have it, if he is willing to make the effort. You can create a Patrician, from raw material, or by assembling pre-fab parts supplied as a package. While the idea is Roy's, the completed instrument is yours, as individual as your signature.

WHAT IS A PATRICIAN?



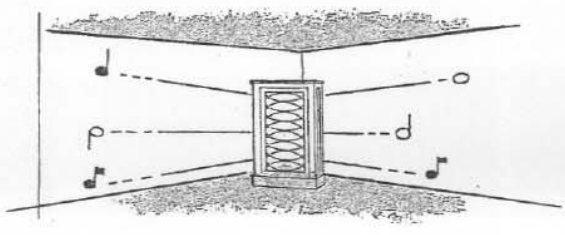
It is a new experience. It cannot be put into words. It is as subtle, as overwhelming, as awe inspiring as a burst of sunlight after a thunderstorm. It is as if the curtain of darkness has suddenly been drawn back and now you see for the first time what was there all along. Only with the Patrician, you don't see it, you hear it. It is the magic gift of the Gods which unlocks the treasure compressed into the grooves of a flat disc of vinylite. It is the Bagdad Carpet which whisks you out of the dreary work-a-day world right into a realm of make-believe. It takes you, and your comfortable armchair, right into the music hall, where you can have a front row seat at the best performances. By reaching out your hand, you can almost touch the artist. The Patrician brings the best of everything directly to you. The Patrician brings out the best of the best in the record, and the most of it. The Patrician is to music what Todd AO is to movies. There is nothing finer.

HOW DOES IT WORK?

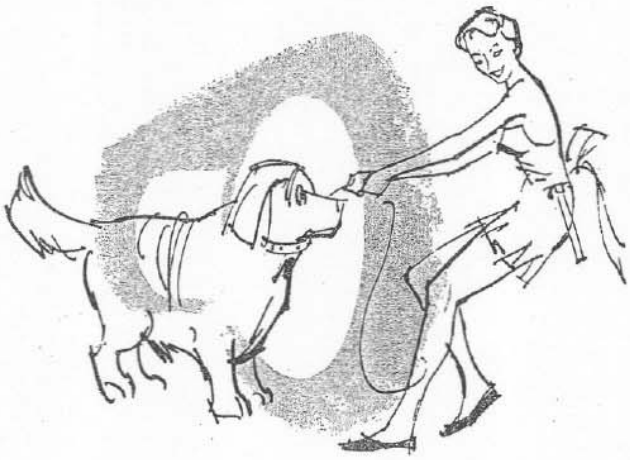


Simple magic is inadequate. Compressed into the restricted dimensions of the Patrician is an electro-acoustical mechanism capable of reproducing the deep notes of an organ and the shrill chirp of a cricket with absolute fidelity, and everything between with equal ability. There is no magic here, just consummate care and a degree of engineering ability almost beyond belief. The engineering genius of Louis Hoodwin is responsible. Slowly and carefully, he designed suitable reproducing units, matched them, balanced them, equalized them, until a total of five speakers worked together as one. Between them, the entire audible spectrum was covered, and the result was so smooth, so unobtrusive, so realistic it was impossible to tell which speaker was delivering which note. Yes, it was difficult to tell whether the speakers were even working. The music filled the room and swelled about the listener. The obvious blare and directional effect of a single speaker was absent. Yes, the entire accepted concept of music appreciation had suddenly been rendered obsolete.

The deep bass resonating cavity There are not many devices capable of creating extremely deep notes. There are still fewer able to reproduce them. This is due to physical limitations. Make a drum or horn big enough and it will produce sounds so low the ear cannot hear them, only feel the air blast. Due to the difficulty of getting these deep notes, they are very desirable in musical compositions and are displayed like diamonds. The fact the average radio or phonograph won't pick them up only increases their intrinsic value. To reproduce a deep note with true fidelity requires a horn of extreme proportions. It won't go in the average living room.



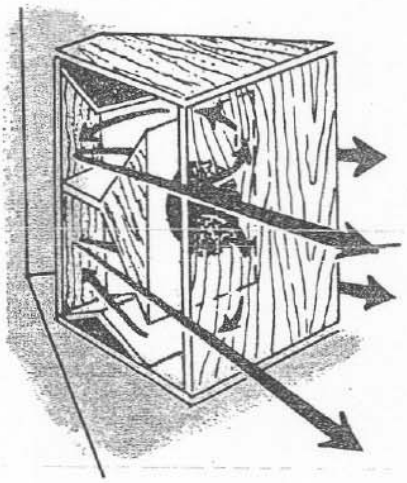
A gentleman named Klipsch hit upon the solution. Use the room as part of the horn. It worked. The horn was folded back on itself to save space, then coupled to the walls of the room. This idea was expanded by Louis Hoodwin and incorporated into the Patrician, with due credit to Klipsch, of course.



18WK WOOFER

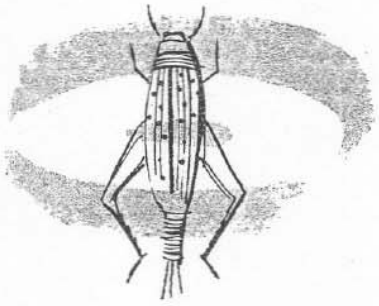
To get bass notes, you start with a speaker which has a growl like a grizzly bear. The cone is 18 inches in diameter. It moves a considerable distance, but with relatively slow speed, pushing a vast column of air ahead of it. This air column is directed into a cavity which is 7 x 14 inches to start, and expands according to the exponiental curve to a pair of ports, size 10 x 48 inches each which are then coupled acoustically to the walls of the room.

Creating this cavity is the major portion of the work entailed in constructing the Patrician. According to outmoded standards, it is bulky; viewed by modern electro-acoustical concepts, it is compact to an amazing degree. Stretched out in the form of an exponential trumpet it would result in a horn 20 x 48 inches throat size and 6 feet long. The woofer handles only bass notes. The others are all filtered out and channeled to the proper speakers.



THE VITAL BACK CONE CAVITY

Every cone has two radiating surfaces, front and back. When one side is pushing, the other is creating a low pressure. The two must be isolated, or no sound in the bass range will be heard. A baffle will delay the back wave a half cycle so it can be piped around to reinforce the front wave, or it can be simply excluded. This is done by sealing off the cavity to the rear of the cone. This results in pure sound, but is obviously less efficient. In the Patrician the back cone cavity is tuned, and to bring the efficiency up to an acceptable level this pressurized column of air creates a spring effect on the diaphragm, snapping it back to normal with a greatly decreased time lag. This delay and return, or dashpot effect, is timed to the precise response which will augment and balance the bass, resulting in that unusual and seldom encountered timbre which identifies a Klipsch system and raises it above the level of all others.



THE VERY-HIGH-FREQUENCY SPECTRUM

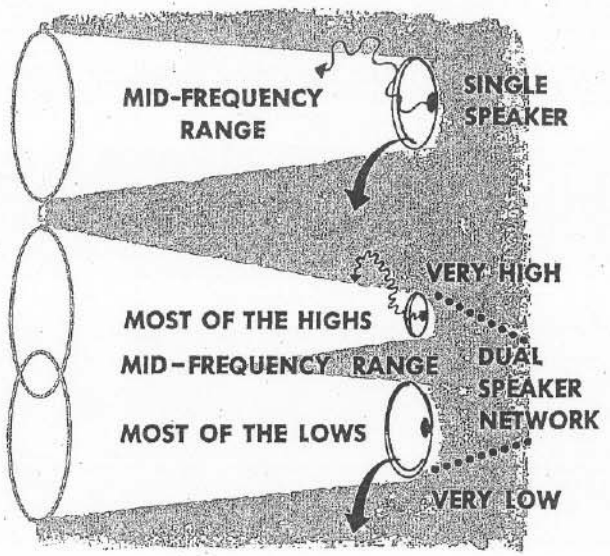
The old style record player, and yes, even the old style records, stopped somewhere around 7,500 cycles, Like the deep bass, this borderline neighborhood of 7,500 to 20,000 cycles is but thinly populated with musical sounds. For years they were ignored because it proved too costly to reproduce them. Now, with Hi-Fi, the world has suddenly become aware there are such sounds waiting to be heard. Like the deep bass, they are not musical by themselves, but a fleeting passage or a haunting echo gives that certain something to an otherwise run of the mill musical selection. Current "extended range" records overdo it, but they will mellow down when popular fancy accepts very high frequency notes as essential. Best, and of most interest to you, is the fact the Patrician not only reproduces these formerly unheard notes, but gives them their proper emphasis. They are heard, but are not conspicuous.

T35 TWEETER

This starts where the usual "treble" leaves off, responding to sounds well above the level of audibility. This brings the hearing threshold to midscale, giving full brilliance to the thin squeaks that are actually "high notes." It does not take much in the way of a horn to project high notes, so the treble is a mere handful. Like the bass, high notes also pass through a filter, which strains out all sounds below the acceptable level. A violin sounds clear, resonant and for the first time, beautiful, but the spoken voice is reduced to a high cackle, very grating on the nerves. A world composed only of high pitched sounds is so unnatural the human ear refuses to accept it. These same sounds, blended in true proportion with others, restore the feeling of natural hearing so long muted out of radio and phonograph music.

MID-FREQUENCY RANGE

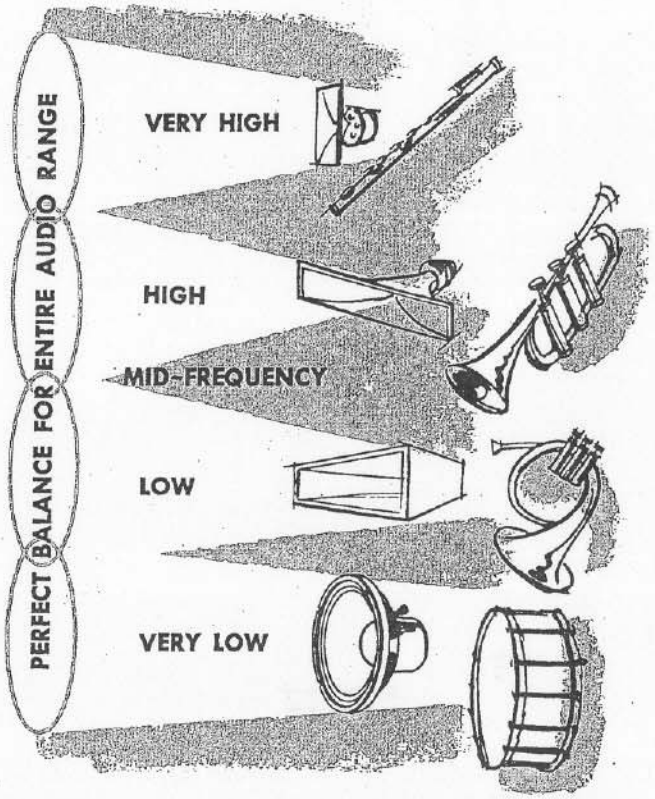
Deprived of both highs and lows, the popular music spectrum as the world has known it through radio and phonograph, is composed entirely of mid-frequency sounds. This embraces the spoken voice and the melody notes of music. Until you hear the extended range of the Patrician, it seems quite satisfactory. Even in the mid-frequency range it is asking a lot to expect one speaker to handle the whole show. A low note will vibrate at 200 cycles a second and a medium high note will pull the cone in and out at 6,500 vibrations a second. How can one cone vibrate well at both speeds at once? It can't. The answer is to break the range down still further and let one speaker handle the low notes and the other the higher ones, with filters to regulate the traffic.



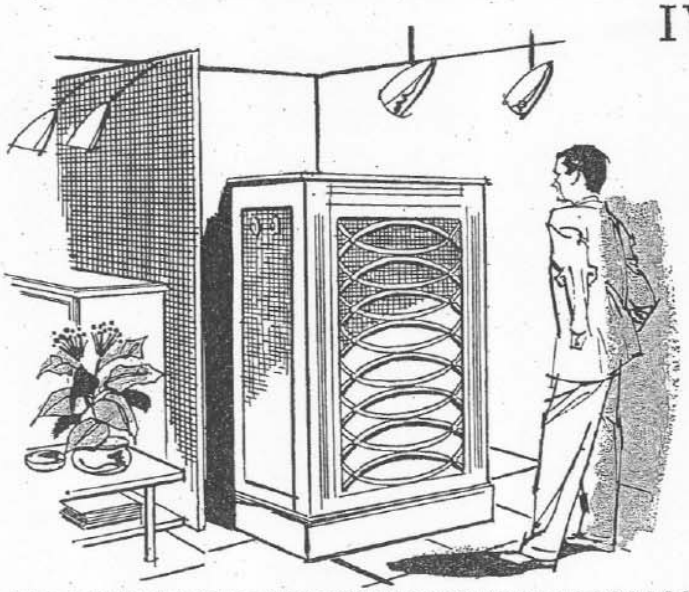
A 6HD and T25A driver and horn assembly does what the usual "tweeter" is expected to do, and does it in a big way. The upper mid-frequency range is where most of the common sounds lie. It does not take a large horn to handle these, so the speaker is nested inside the cavity used to direct the output of the two.

Two 828HF driver units handle the frequencies between deep bass and normal, which completes the mid-frequency range. This is approximately 200 to 600 cycles. Two units are coupled to a single air column to put more "soup" into the bracket which encompasses the heavy end of the musical range as well as the deeper singing and spoken voices.

An X2635 crossover network provides the filters to keep each of the five speakers in its own operating sphere. These include high pass and low pass circuits, properly blended. By using a combination of coils and condensers it is possible to arrive at any predetermined destination as far as electronics and electro-acoustics are concerned.



4 WAYS OF SELECTING YOUR PATRICIAN IV SPEAKER ENCLOSURE



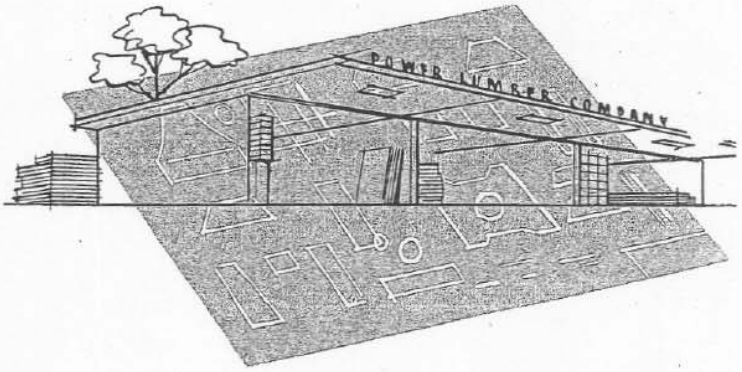
The established American idea of free enterprise and unlimited opportunity is no place more evident than right here. Also untrammeled is the fact that you can get what you want. All people do not want the same thing. One man wants the pleasure of creating something useful, complex and unusual. Another wants to keep himself busy evenings developing his skill at handicrafts. A third cares little about making essential complex interior structures, but is highly skilled at design and decorating. He would like to produce an end result without having to consume time on the fundamentals. A fourth wants results and would much rather pay cash and get them than consume his valuable time in a home workshop.

For each of those four men there is a Patrician. Each can get what he wants most, which for him is personal satisfaction, and each can get it in his own way.

first choice

Build a PATRICIAN from stock material

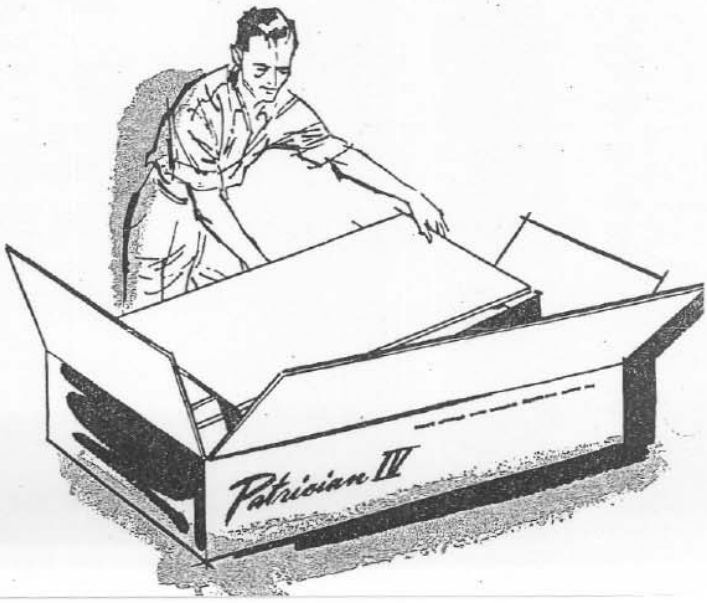
The plans are drawn. They are accurate. By following them implicitly you will achieve the end result, a Patrician. It is up to you to select the raw material, purchase it, cut it to size and assemble the components one by one, following instructions. This takes more than simple tools. You must have either power equipment or a degree of skill and ability which vanished with the old time cabinet maker and is practically extinct today. Building a Patrician with power tools is a matter of following instructions. Building a Patrician with hand tools puts you on the same plane as Chippendale and Duncan Phyffe. If you can do it, you are good.

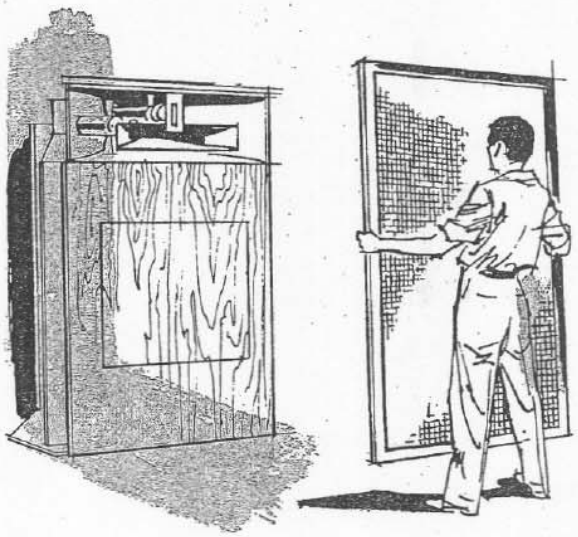


second choice

Build a PATRICIAN by assembling a kit

The same cabinet production line which makes Electro-Voice custom enclosures also makes pre-fab parts and packages them in kit form. These parts are cut on the same power machines, from the same material, and by the same men. The only difference is, the parts are not put together. Each part specified is inspected, packaged in a kit and shipped to you. This eliminates the cutting, machining and the detailing of parts, leaving you free to concentrate on fitting and assembly. Because the Patrician enclosure is heavy and must be airtight, assembly is no quick nail-up job. It takes time and skill. Each part must be carefully positioned, glued and drawn snug with fasteners. While it is drying you work on another section. There is enough hand work to keep you busy for many happy evenings.

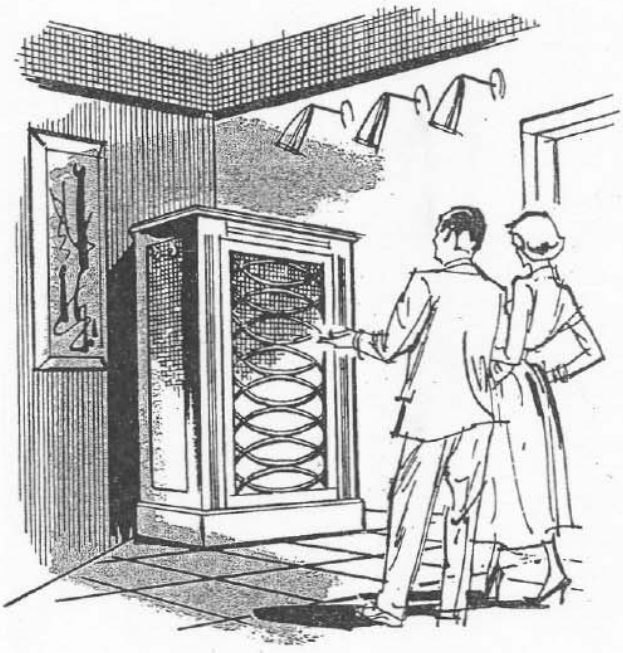




third choice

Buy a PATRICIAN enclosure and build a cabinet around it

This is for the decorator, the custom installer or the man who has a "dream" to make come true. The enclosure is complete, glued and prime painted. All that is left is to install the speaker system and build it into the room, put a cabinet around it, or do what you had in mind. In this way, the purchaser can concentrate on the electrical and audio end as well as finished appearance without having to concern himself with the problem of creating the basic operating structure.



fourth choice

Purchase a PATRICIAN complete, ready to operate

This is doing it the easy way, and in an actuary sense, the cheapest way. All romance and glamor aside, it actually takes less time and energy to earn the money and buy the Patrician than it does to create it. Why? Because the Patrician is made on an assembly line with machines and power tools doing all the hard work. Assembly, securing and gluing is done with jigs and fixtures. There is still plenty of hand work, but it is highly skilled labor. This you pay for. Balance the total against the man hours it would require for you to do the job and you have your answer.

1 2 3 4

THE CHOICE IS YOURS

There is a rugged and strong willed strata of humanity which will not accept this answer. The answer will not be accepted by a man who rebels against buying what he can make, or feels he can make. A Patrician is something you or I can make. You won't save any money by making it, if your time is an asset, but you will have a lot of fun. You will learn first hand why electro-acoustics is a precise science. You will develop your skill and increase your self confidence. You will create something which is yours, and yours only. In conclusion, you will get what you want in the way you want it, and if that includes perspiration, bruised fingers, midnight mazdas and family apprehension—it is all part of the purchase price.

Building a *Patrician II* FROM STOCK MATERIAL

It will not be easy. The bass horn portion is about as complicated as cabinet making projects come. Cutting and fitting the parts takes a high degree of personal skill. It can, however, be done, and it can be done very well by any person willing to follow instructions and make the effort. And these instructions have been made very concise. They have been made that way because a number of high school manual training instructors have requested plans for student projects. The once popular craft of jointing and fitting is almost extinct due to the use of machine tools and the encroaching of other materials on the field once held exclusively by wood. Because many of the younger men have never met a skilled cabinet maker, or had the opportunity to see how the work should be done, each step is explained in detail. Building a Patrician by hand is almost like stepping back to the gay 90s when the art of cabinet making reached an all time peak.

HAND TOOLS

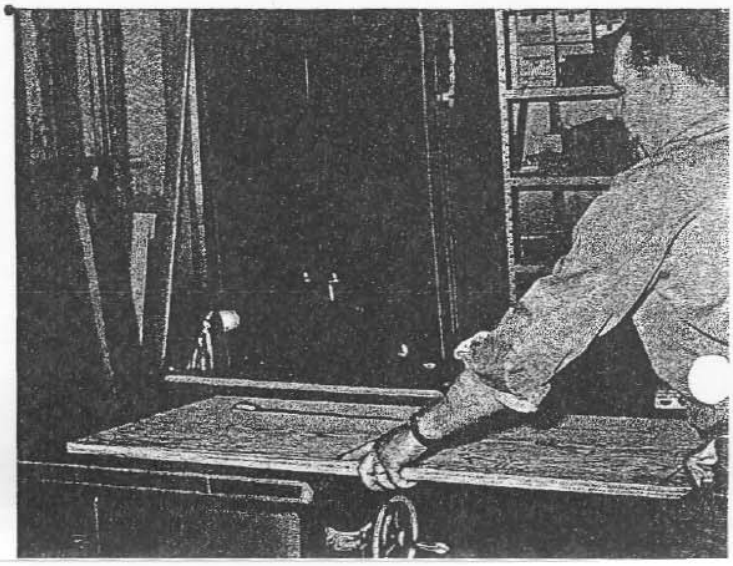
- HAMMER
- SAWS-CROSSCUT, KEYHOLE
- SCREW DRIVER—PHILLIPS
- PLANE
- BEVEL GAGE—PROTRACTOR
- RULER
- PENCIL
- SAW HORSES
- PLASTIC GLUE
- C-CLAMPS
- SANDING BLOCK
- CALKING IRON
- DRILL
- BITS
- COUNTERSINK
- SCREWS—NAILS
- CALKING COMPOUND

TOOLS YOU WILL NEED

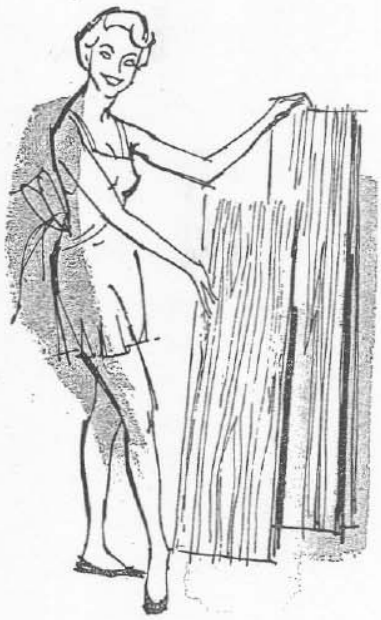
You can't buy many of the better cabinet tools because they have become obsolete and have been off the market for years. You won't need them, because construction has been beamed toward the "streamlined" modern conception of hand tools and popular power equipment. The man who has no tools but wants to get started, can purchase all the equipment needed at the better hardware stores. These tools are listed, and are all you will need. If you were lucky enough to "inherit" some genuine cabinet making equipment, their use will become obvious after reading the instructions, but we will say, sadly but truthfully, the quality of modern tools is vastly superior to that of the good old days. The blades are keener and stay sharp longer, the handles are easier to hold and adjustments are simple.

ELECTRIC POWER TOOLS

Best of all, electric power tools take away most of the hard work and let you concentrate on doing a good job. There is no bottom when you start dipping into the power tool situation, but a sturdy circular saw will do 90 per cent of the work required on the Patrician, and the other 10 percent can be divided among hand tools. There are power tools on the market which will do everything from drive screws to spread glue and bond the joints electronically, but after all—the man who choses to build himself a Patrician expects to do a little perspiring.



SELECTING YOUR LUMBER

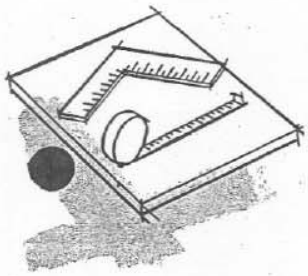


Fir plywood is the best material for building everything from boats to airplanes to furniture to pre-fab homes, when cost, service and availability are concerned. The supply is virtually unlimited. Workability with power tools is fair. Cutting fir plywood with hand tools is one of those things we prefer not to discuss. It can be done, but it takes a severe toll on patience and muscle. The wood is hard, dense and tough. It grabs tools, it splinters. It is not a bit interested in how you feel as a creative individual.

If you intend to build your Patrician without the aid of a sharp and heavily powered circular saw, treat yourself to a supply of soft wood. The added cost will take much of the misery out of your sacro-iliac.

Pine "crating lumber" can be used for the detail parts, and the panel sections cut from sheets of five-ply poplar or basswood. These panels can be purchased in assorted sizes from "cabinet lumber" supply houses and shipped to you by express if you live beyond the limit of city delivery (see yellow pages of phone book for dealer listing).

LAYING OUT THE PARTS



Plywood panels, be they fir or soft wood, come in gigantic sizes. The question is whether you prefer to buy a large sheet and cut it up yourself or have the dealer size it for you. With the large sheet you can make paper templates of the part profiles in Fig. 1, lay them in position and do your cutting to avoid waste. By using small panels the handling is easier, but waste may prove excessive. It is your choice. The choice is further complicated by the availability of equipment.

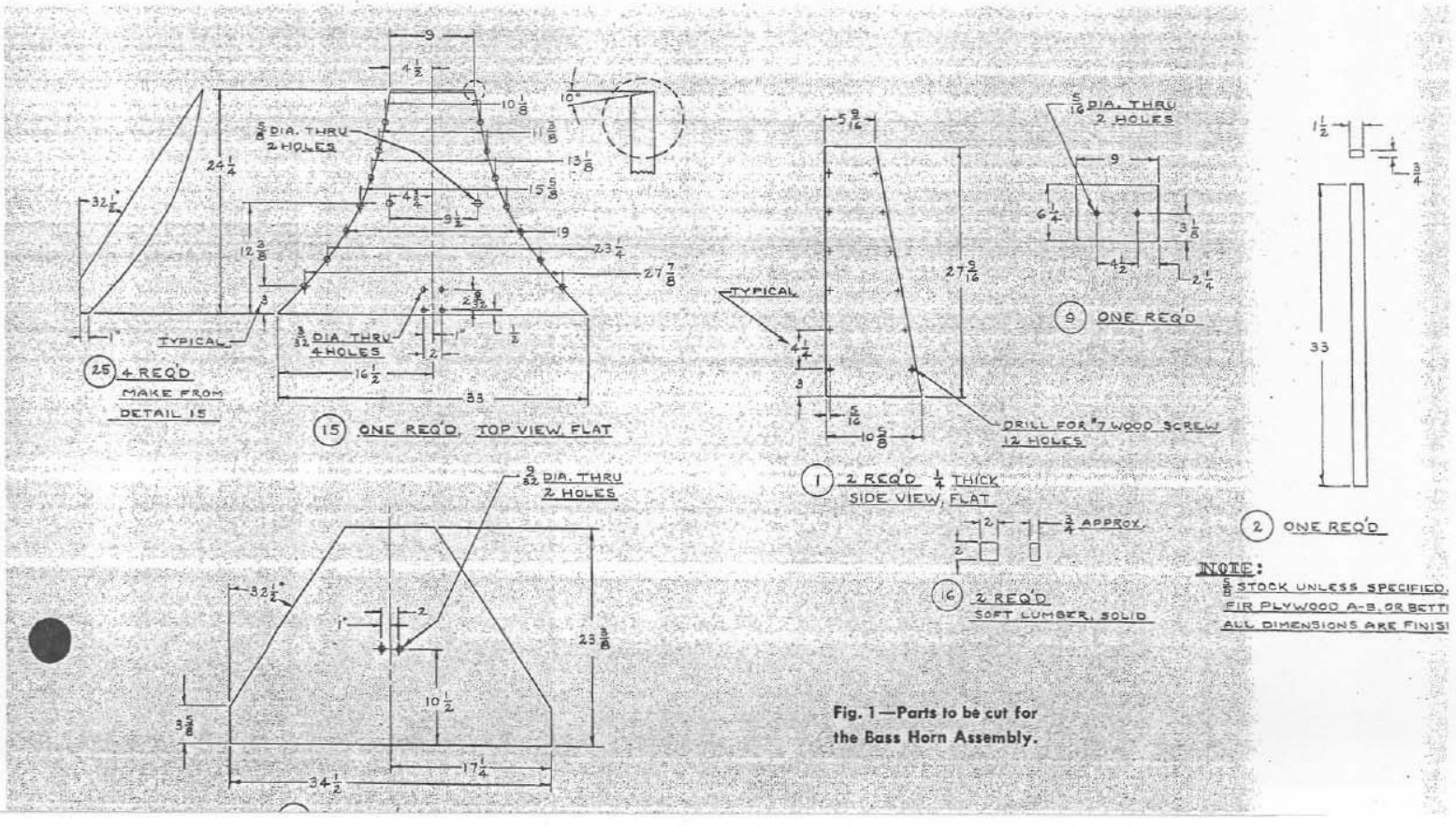


Fig. 1—Parts to be cut for the Bass Horn Assembly.

SMOOTH CUTTING PLYWOOD

Smooth cutting plywood is the answer to the home workmans prayer. It cuts as quickly and neatly as soft pine. Bass and poplar plywood were the accepted standard for furniture making before fir edged them out pricewise about twenty years ago.

These softer woods have a definite advantage in workability which, to an extent, offsets the higher cost. They saw, plane, drill and shape with practically no effort. Fir, on the other hand, does not respond to hand tools with any degree of enthusiasm. It does machine beautifully at high speed. As all factory equipment runs at breakneck velocity, fir has no disadvantages on production runs, and many advantages. The Patrician kit supplied by Electro-Voice is made of fir plywood.

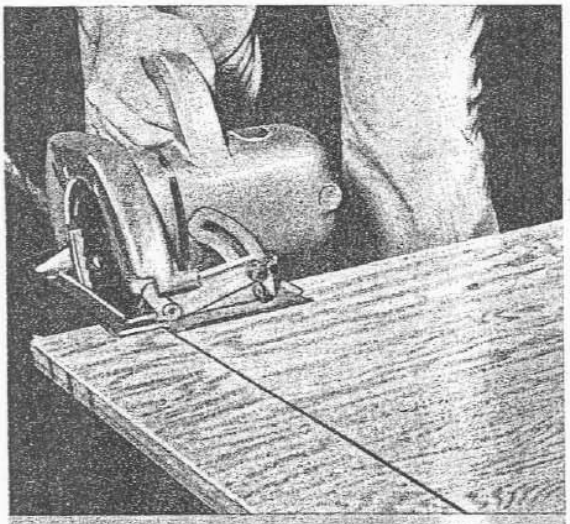


Fig. 2—A Power Saw is a handy and versatile power tool.

POWER SAWING

A power saw, Fig. 2, can be guided along the panel with the ease and accuracy of a dressmaker cutting material. Feeding a large panel into a circular saw may prove difficult. It can be done, but requires judgment and ability and one or more helpers to catch the sections as they cut free from the parent stock.

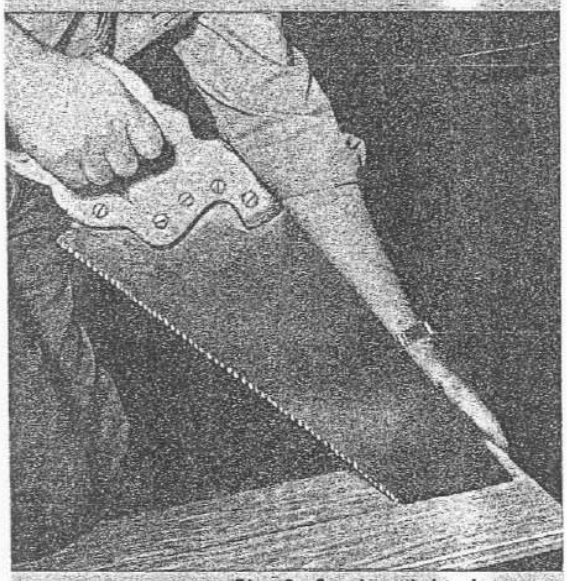


Fig. 3—Sawing right down the middle of the line.

SAWING PLYWOOD

Sawing plywood basically, consists of first laying down a guide line, then sawing right down the middle of it, Fig. 3. We say middle, because the practice of cutting to one side of the line breeds confusion. In the middle of a cut you may forget which side you are supposed to be working on, or how FAR to the side the cut should be. Stay in the middle.

This applies to both power and hand saws. On the larger pieces it may not be convenient to use guides on the power saw and the piece will have to be guided by eye. This is not as hard as it sounds, but you can go off the deep end fast if the situation gets away from you. To get that added margin of safety have the saw just high enough to clear the work. Then if the work grabs, lift up quick and the piece will free itself. Shut off the power and start over again. This procedure is relatively safe when ripping or crosscutting large panels, but *always* use a guide when working to close dimensions and on smaller members.

TRICKS IN HANDSAWING

Handsawing plywood requires a special technique quite different from sizing solid lumber. Draw your guide line with a pencil, then start the saw down the middle of the line, Fig. 4. A ripsaw or a crosscut saw may be used. The preference depends upon the condition of the teeth and the set. Teeth must be freshly sharpened, and set held to close limits. Jagged or excessive set will require subsequent planing to obtain an airtight fit. Use gentle pressure, slow feed and take it easy. You will be sawing a long time, so there is no reason to rush. Watch the reflection in the blade, Fig. 5 and use it to hold the saw on even keel. The mitred joints had best be made by cutting square, then planing down to a protractor indication, Fig. 6.

Whether a panel saws best in a vertical or horizontal position is something only you can determine. If vertical, clamp to a post, Fig. 4 and work down from the top. If horizontal, lay across horses and have someone handy to hold the dangling end, Fig. 3.

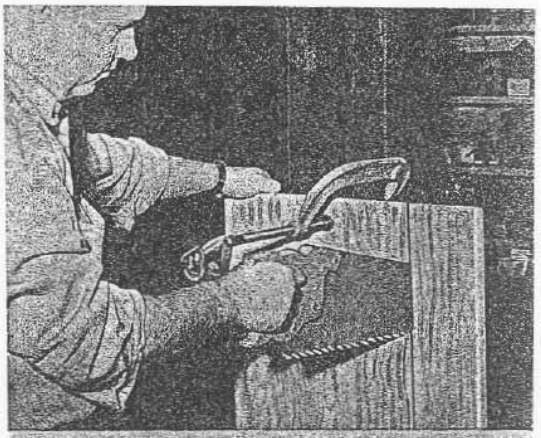


Fig. 4—Vertical sawing with panel clamped to post.

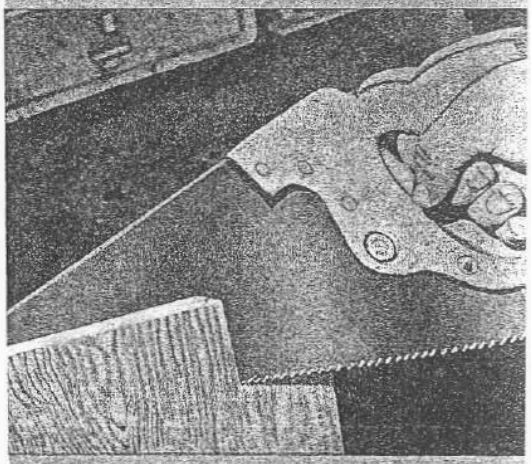


Fig. 5—Use the reflection in blade to hold cut to proper bevel.

SAWING A BEVEL

Planing need be done only when handsawing because the power saw is capable of producing an airtight joint in a single operation. Use a long smoothing plane, and take off a bare minimum of material. When an edge is to be mitred by plane, first square it, then set the bevel protractor and remove stock until you are cutting *almost* across the face, The skirt edge is your guide, and by holding it, the cut will be uniformly consistent.

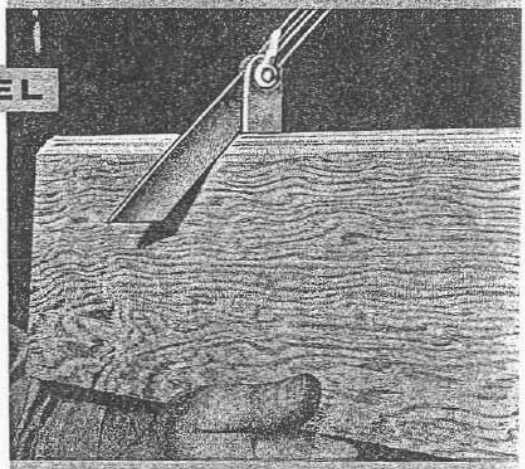
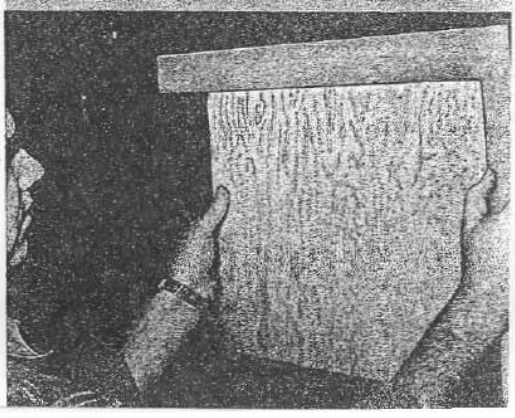


Fig. 6—Check your bevel angle with a protractor set bevel gage.

Fig. 7—Check and check again with your steel square.

Fitting The final check of a dressed edge is whether or not it fits tight against the component member. Cut and try procedure is needed as the work goes along. Mistakes and reworking may result in pieces which are too small. It is much better to discard and make new ones than attempt to patch up the error. Check across the face with a straightedge, Fig. 7 as work progresses, and maintain uniform height on all supposedly identical pieces. Glue and clamping pressure will compensate for minor irregularities, but don't count on it.



ASSEMBLING THE ENCLOSURE

This is where you start if you buy the pre-fab kit, or the next step if you have cut your own parts.

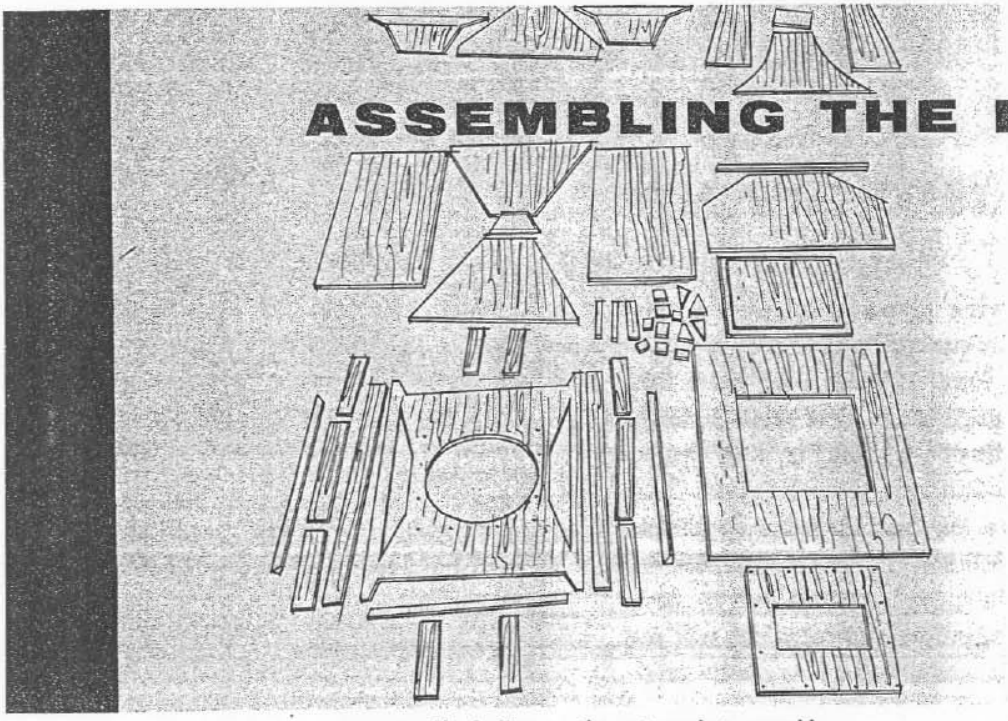


Fig. 8—Here are the parts ready to assemble.

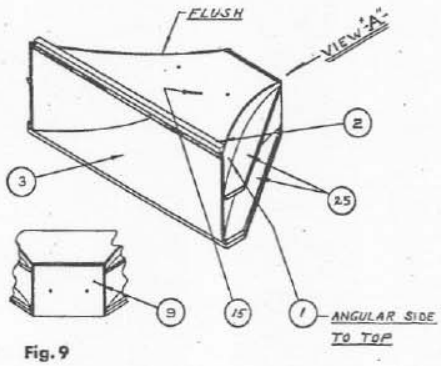


Fig. 9

IDENTIFYING THE PARTS

Identifying the parts is done by laying them all out on the floor, Fig. 8 and either coding each to the plan, if you made them yourself, or recognizing each part by the number, if you purchased the kit. Then the parts go together. There are as many ways of putting a kit together as there are people to do the job, and surprisingly, they all come out correctly in the end, or most do. It is possible, even easy, to "spoil the works", but if you *READ* first, and follow instructions, the kit will go together one piece at a time. Here at Electro-Voice we took a number of kits and a selection of men, and told each to put the kit together as he thought it should go, each man working alone and in the quiet of the evening. We took pictures of the work as it progressed. Each man worked as he saw fit and all followed more or less the same procedure, and the difference in elapsed time could be counted in minutes. We are satisfied the Patrician kit can be assembled by anyone willing to make the effort. Allowing time for glue to set and granting a handicap for time out to study the prints, it should take five evenings to put the kit together. True, there will be men who can do it in one night, but it will be a long, hot night. Make the job fun. Take it easy and enjoy yourself; you will have lots of time to sit back and enjoy the music later on. Joy and the anticipation of more joy to come is really the only reason to embark on a project like this, so as they say in the Navy—shove off!

GETTING STARTED

The 200-cycle horn element, Fig. 9 is the most difficult part of the assembly, and most men felt it advisable to get it together first and out of the way. This is a good place to start, but is purely optional. The horn has to be non-resonant and airtight in the seams. Resonance is suppressed by installing dampers, Fig. 10. These are battens which are screwed and glued in place to stiffen the structure.

To start, take part 1, and drill for the mounting screws, Fig. 11 then wrap it around template 25 and secure. This is done by coating the mating surfaces with a generous application of plastic glue, and driving the screws home one by one. Seat each screw securely before starting the next one. There is no easy way of jigging this operation, so do it freehand and work carefully. It takes plastic glue thirty minutes to set after exposure to air, so there is plenty of time to drive six screws.

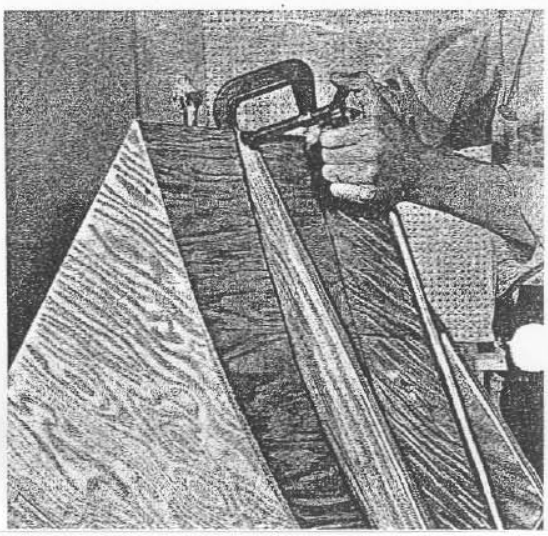
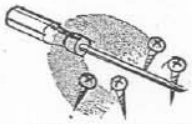


Fig. 10—Stiffening battens being clamped

GLUE

The old idea of hot glue and long setting intervals has vanished like most of the other traditional cabinetmaking procedures. Plastic glue comes ready mixed, is squirted out of a nozzle, is spread with your finger, dries slowly if spread thick, and is very patient in the hands of a bungling amateur. If the job goes together wrong, it can be taken apart at once, the glue scraped off with a putty knife, and the whole procedure started over from the beginning. There are a number of plastic glues, one of which is "Elmer's", available at most hardware stores and supermarkets. If you have a preference, use the glue of your choice and apply it according to directions, but remember, the quick setting types don't give you much leeway on pulling plywood panels into position with wood screws.



SCREWS

There is only one reason for using wood screws. The reason—most people don't own a set of cabinet clamps. The screws PULL the panels into position. The glue HOLDS them there. The screws can be taken out after the glue sets with no decrease in holding ability. Phillips head screws are easier to drive in awkward positions, Fig. 12.

The use of nails to draw panels into position is satisfactory if one is very sure of himself. Nails, however, are not easy to release and a rework job quickly takes on complications. The use of snake-tooth or cement coated nails produces a junction which cannot be taken apart. The heads will pull off these nails before they will release their grip. Ordinary, smooth nails do not hold plywood and had best be avoided. The use of nails to tack awkward panels in position while the screws are started is good practice and is advocated. The nails are pulled out when their mission is completed.

PLYWOOD WRAPPING

Side panel 1 will be under considerable tension by the time it is screwed securely to template 25. By the time it is wrapped around top, 15, there will be considerable twist introduced. Let the twist stay for the moment and install back board 9. This piece may have to be hand fitted as the curves of 1 introduce a flare of several degrees. Tap into place, Fig. 13, and when the mating edges have been planed down sufficiently to create a tight joint, secure with glue and screws. This will take away a good portion of the twist. The horn assembly is now positioned and secured to top panel 3. Line carefully and check angles with a square. Use lots of glue.

The battens 25, upper and 2 are now glued and screwed in place. If they do not appear to fit well at first, press into position and the spring in the plywood will fit the contour. Use clamps, Fig. 10 to secure the ends while the glue sets, as screws will not hold so close to the end.

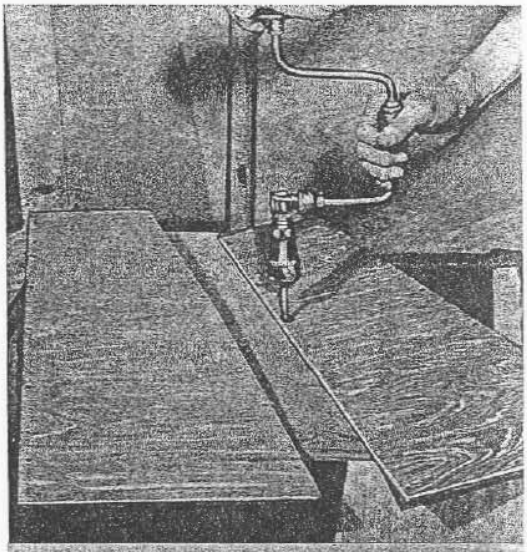


Fig. 11—Countersinking Screw Holes.

Fig. 12—Drawing the Joint Snug.

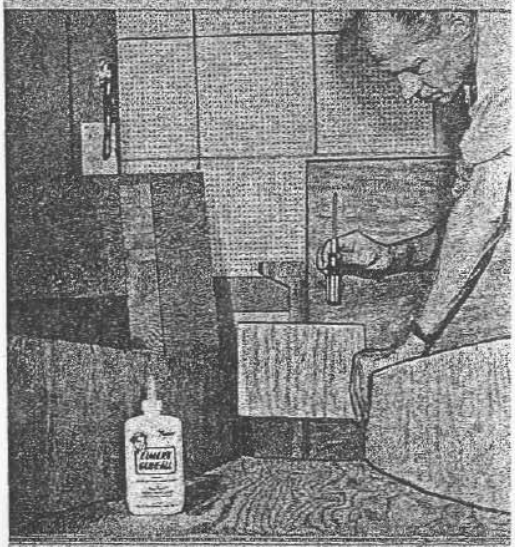


Fig. 13—Positioning Backboard.