

A large easy-to-build loudspeaker system

# Playmaster 3-70L

## loudspeaker system

Five years after the highly successful Playmaster 3-75L loudspeaker system was published, we now present the new Playmaster 3-70L loudspeaker system. While it was developed from the old system, the new system has new drivers, a slimmer, more attractive enclosure with added plinth, and an easily removable grille cloth frame.

by NEVILLE WILLIAMS and LEO SIMPSON

While the actual figures are difficult to quantify, there seems little doubt that many thousands of Playmaster 3-75L loudspeaker systems have been constructed since the article was originally published in May 1977. Part of this popularity must undoubtedly be attributed to the heavy promotion of the system over the years by Dick Smith Electronics, but even so, the basic system has worked very well and has provided a great deal of satisfaction to many thousands of our readers.

Recently, we were approached by Dick Smith Electronics to re-present the system in updated form. The principle reason for this was that the original source of the loudspeakers had now ceased production and Dick Smith Electronics wanted to continue selling his popular system albeit with new loudspeakers. At the same time, DSE planned to re-style the enclosure and use an easily removable grille cloth frame instead of the acoustic foam panel used on the previous model.

When we agreed in principle, DSE arranged for the supply of three new loudspeakers and the new enclosure. We duly assembled these together and after some hassles involved in making sure that the systems were really airtight, we were pleasantly surprised with the similarity between the original system and the new prototypes.

While the brief outline above really does not give any idea of the time and effort involved by all parties in the production of this new loudspeaker system, the end result represents outstandingly good value for money. Whether you buy it in kit form or fully assembled, we are

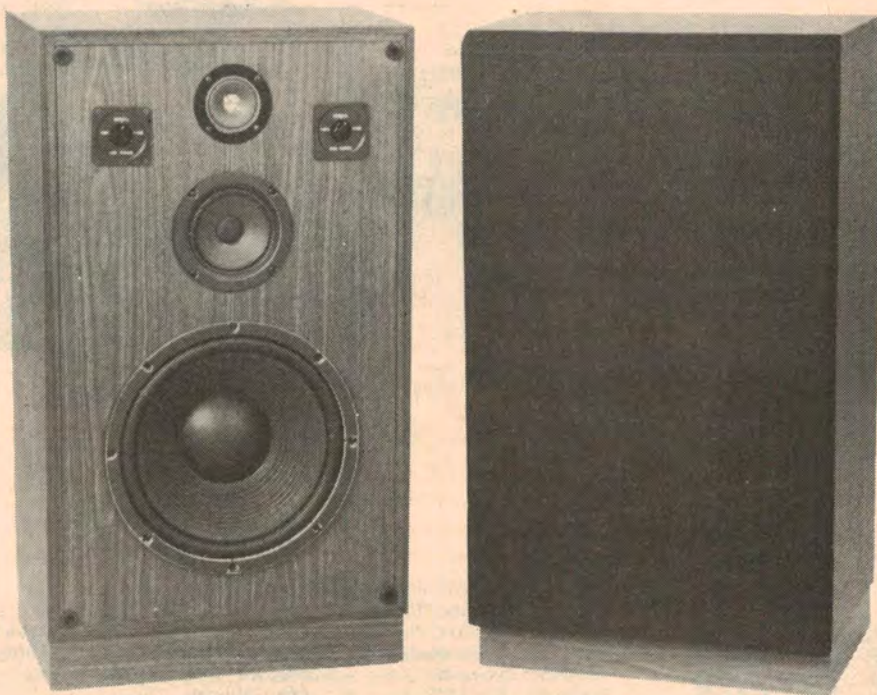
sure you will be pleased with sound quality. At the same time, the new Playmaster 3-70L has reasonable efficiency and generous power handling capacity so that it can give a good account of itself on virtually any type of music.

Let us now discuss the details of the new Playmaster 3-70L before going on to the construction procedure.

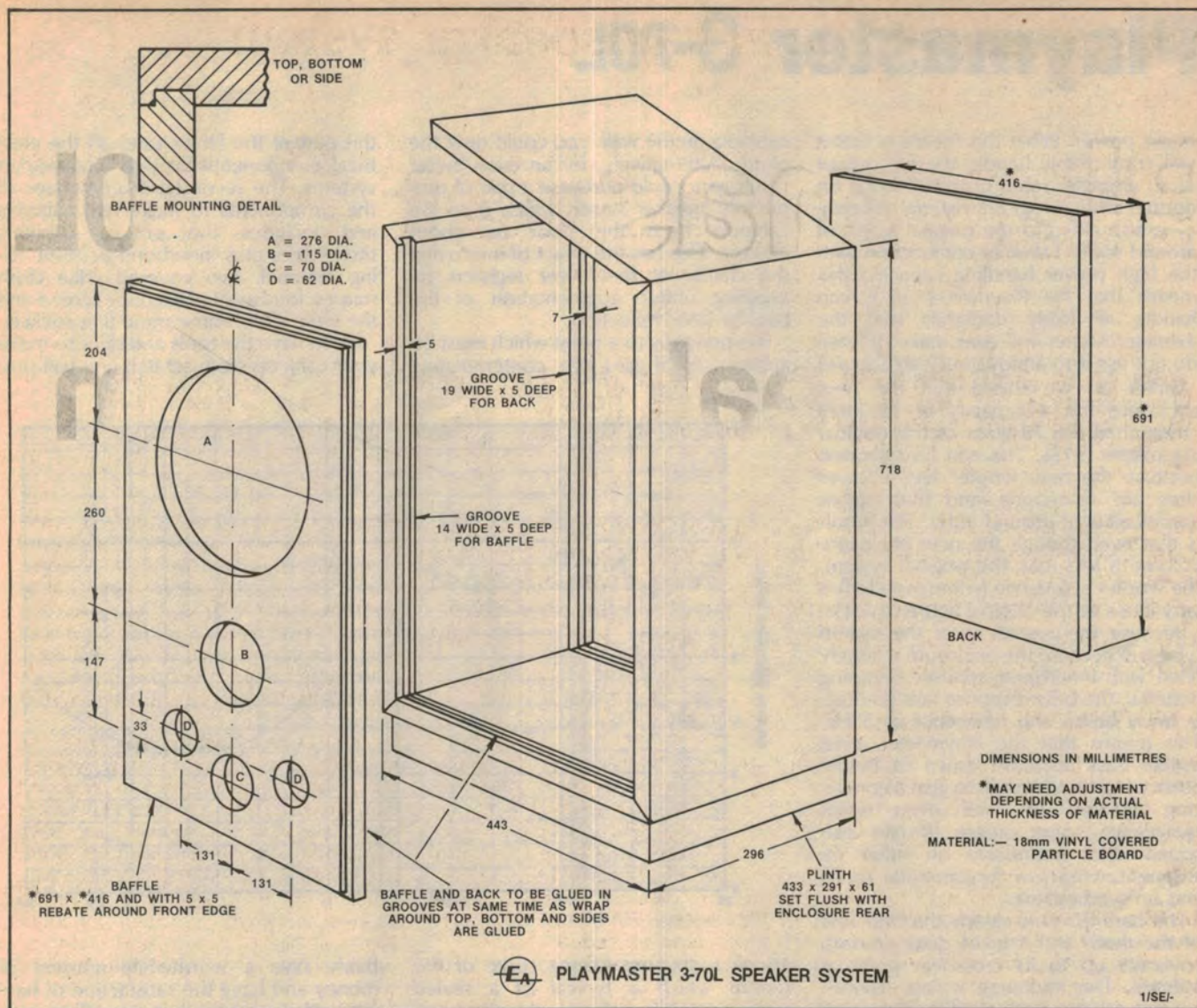
As might be guessed from the 3-70L

designation, the Playmaster is a three-way system with a nominal enclosure volume of 70 litres. The system is sealed rather than vented, which enables it to perform better with a woofer which is really larger than ideal for a vented enclosure of the same size. We will have a lot more to say about the importance of sealing the enclosure later in this article.

The most important loudspeaker in the enclosure is the bass driver or woofer. This is a more impressive looking unit than that used in the original Playmaster enclosure and it appears to have marginally better performance to boot. It has a nominal diameter of 300mm with a heavy ribbed curvilinear cone driven by a voice coil with a diameter of about 50mm. It has a large treated cloth roll surround giving a cone resonance of



Two views of the new Playmaster 3-70L loudspeaker system, with and without grille cloth frame.



about 30Hz which rises to around 55Hz when installed in the enclosure. The loudspeaker chassis is of pressed steel fitted with a reasonably large ceramic magnet.

The midrange driver is a cone-type unit with closed-back construction to render it unaffected by back pressure from the bass driver. It has a nominal diameter of 140mm and an effective cone diameter of about 90mm, after allowing for the cloth roll surround.

The high frequency driver or tweeter is also a cone-type unit with closed back construction. It has a curvilinear paper cone with an effective diameter of 55mm. An aluminium dust cap not only improves the appearance but aids in maintaining the high frequency response.

Both the tweeter and midrange unit have level controls. These are not just simple potentiometers but are constant-impedance pads which maintain the accuracy of the crossover points no matter what their setting. Each level control has a range from a nominal +2dB above reference to completely off, so that if

Here are dimensional details of the Playmaster 3-70L enclosure, as it comes in kit form, ready for "wrap-around" assembly. Note that that it is drawn in the upside-down position in which it should be put together. A handyman carpenter building an enclosure from uncut sheets should work to the external dimensions, using internal cleats as necessary. The baffle and back panel dimensions would need to be modified to become a slide-in fit.

desired, it is possible to effectively remove both tweeter and midrange from circuit.

Crossover frequencies are 1500Hz from woofer to midrange and 5kHz from midrange to tweeter. The crossover network is housed in a small plastic box which has push-on connectors for ease of assembly. The network is modest in complexity, giving nominal attenuation slopes of 6dB/octave after the crossover point, without allowing for the rise in driver impedance due to the voice coil inductance, in each case.

Inductors in the crossover network are small iron-cored units while the capacitors are bipolar electrolytic types, signified by the positive signs at both electrodes. This is shown on the complete circuit diagram of the 3-70L system.

The impedance curve of the completed system is quite normal for a sealed system with a modest peak corresponding to the woofer resonance at 56Hz. From there, the impedance rises and falls in predictable fashion over the whole audio range. Nowhere does the impedance (modulus) fall below six ohms, which is a point in its favour as it is not likely to cause any problems with the driving amplifier.

We did experiment with equalising networks which had the effect of improving the attenuation slopes of the crossover network and flattening the overall impedance curve but the net effect was so small as to be not worth the effort.

Power handling capacity of the complete system remains the same as for the original Playmaster 3-75L — 80 watts

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music power. What this means is that it will comfortably handle the full output of an amplifier rated up to 80 watts on normal music program material. Efficiency is also close to the original figure of around 95dB. Taken in conjunction with the high power handling capacity, this means that the Playmaster 3-70L can handle all likely demands that the average listener will ever make. (Please do not use it to annoy your neighbours!)

Earlier on we stated that the new enclosure has a capacity of 70 litres rather than the 75 litres of the original Playmaster 3-75L. This can be tolerated because the new woofer has a lower "free air" resonance (and thus higher compliance) at around 30Hz. The result is that even though the new enclosure volume is less than the original system, the woofer resonance (when installed) is very close to the original figure of 55Hz.

Because the system is of the sealed type and because the enclosure is largely filled with Innerbond acoustic damping material, the bass response falls gradually away below the resonance at 55Hz. This means that the Playmaster gives usable bass response down to below 40Hz which is adequate to give a convincing account of itself even when reproducing pipe organs. It can also sound most impressive on other instruments with low fundamental tones and on synthesizers.

The bass driver is clearly the best unit of the three and it gives quite smooth coverage up to its crossover point at 1500Hz. The midrange is less smooth but it is of reasonable quality, particularly when its price is taken into account. The same can be said of the tweeter.

All up, the total price for a pair of Playmaster 3-70L loudspeaker systems, will be around \$380 in kit form, which represents very good value for money. We understand that Dick Smith Electronics will advertise the enclosure kits at \$199 a pair, to which must be added to cost of the speaker kit, at \$175, making a total of \$374. Further details are given later.

Our close microphone tests with sinewave signals indicate that the on-axis frequency response can be expected to be within about  $\pm 6$ dB from 40Hz to 18kHz, with usable bass response down to 35Hz.

As noted earlier, the styling of the system has been changed to take advantage of the availability of a Japanese manufactured plastic grille cloth frame which has necessitated a taller and narrower enclosure. The height has been further emphasised by the addition of a 60mm plinth which acts as a kickboard to prevent damage to the grille cloth and its frame by large hobnail boots and aggressive vacuum cleaner nozzles.

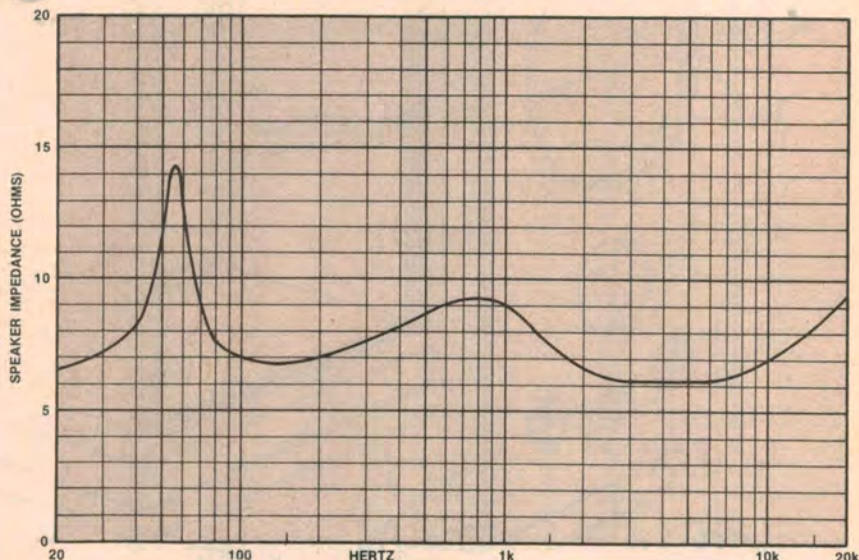
If you elect to install the loudspeaker

cabinets on the wall, you could omit the plinth. Alternatively, for an even better result, you could purchase a pair of proprietary speaker stands which raise the cabinets from the floor by about 200mm. This has the effect of improving the clarity of the lower registers by avoiding undue augmentation of the bass by floor reflection.

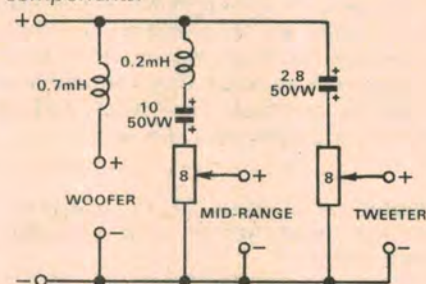
This brings us to a point which must be appreciated if you are contemplating

this part of the kit includes all the electrical components for two loudspeaker systems. The second part comprises all the components to make two cabinets and includes the pre-cut cabinets themselves plus Innerbond acoustic filling material, two covered grille cloth frames, loudspeaker securing screws and the grille cloth frame mounting sockets.

If you have the tools and skills to make your cabinets from scratch you will pro-



Above is the impedance curve of the system which is typical of a sealed enclosure while below is the complete circuit showing the crossover components.



building or buying these systems. First, because they are relatively bulky, they do require a fair amount of floor space. For best results they should not be placed in corners (nor should any high fidelity loudspeaker) or placed directly against the walls if sitting on the floor. Second, if you are to achieve the low bass response of which they are capable, the systems should not be placed in a small room.

You may buy the kit in two parts. The first includes six loudspeaker drivers, two crossover networks, four level controls, two rear terminal panels and two readymade harnesses. In other words,

bably save a worthwhile amount of money and have the satisfaction of having made your own, but you will have to do quite a lot more work.

If you do elect to do it yourself, you can vary the cabinet dimensions provided that the internal volume does not vary from the specified figure of 70 litres by more than about 5% either way. However we understand that Dick Smith Electronics will be making the grille cloth frame available as a separate item, so if you wish to use this the cabinet dimensions should be the same as specified in the accompanying diagram.

## CABINET ASSEMBLY

We understand that the pre-cut cabinet kits will be sold in stereo pairs to minimise packing costs. Each cabinet kit essentially comes in three parts. The sides, top and base are cut from one length of vinyl veneered particle board. Ninety-degree grooves are milled where the corner joints will be, leaving the four sections held together only by the vinyl veneer.

An additional groove is milled near each edge of the sides to take the baffle and rear panel. When adhesive is run into the grooves and the sides folded around the baffle and rear panel, a rigid

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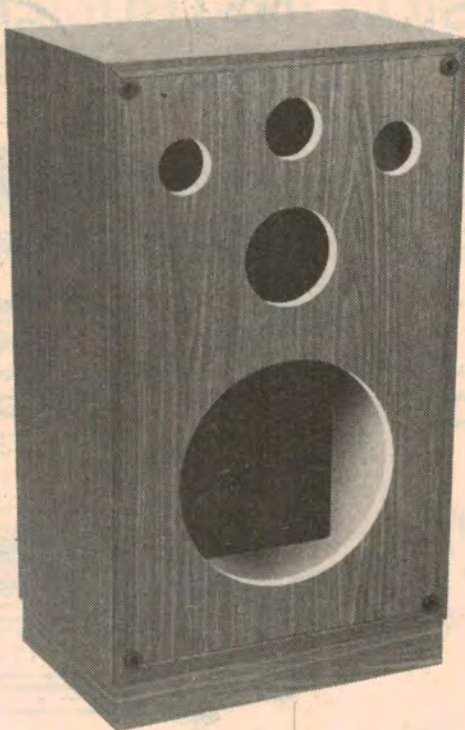
and potentially airtight enclosure is formed.

As we have noted in the past, the vinyl veneer does make an effective hinge which allows the panels to be folded but it should not be idly bent back and forth in a casual demonstration of how it all goes together. While we have not heard of anyone accidentally breaking the "hinge" sections, you would not want to be the first, would you? It could be a trifle embarrassing and inconvenient.

Before starting, make sure that you have available a large tube or plastic bottle of PVA glue such as Selleys Aquadhere. You will need about 100ml of adhesive for the two enclosures. You will also need a roll of masking or packing tape and tools such as a Phillips screwdriver and a hand or electric drill with drill bits to suit the screws supplied. And you can add some clean rags to that list for wiping excess glue from the joints.

Clear a space on the floor and put down newspapers to keep the area clean. Open the cabinet timbers full length upon the floor and tentatively stand the baffle and the back panel in their respective grooves in what will ultimately be the top of the enclosure. When the panels are folded around the baffle and back panel, the join where the two outer ends meet will ultimately be at the bottom and out of sight.

Remember also that the veneered face of the baffle is the front, as is the veneered edge of the fold-up cabinet.

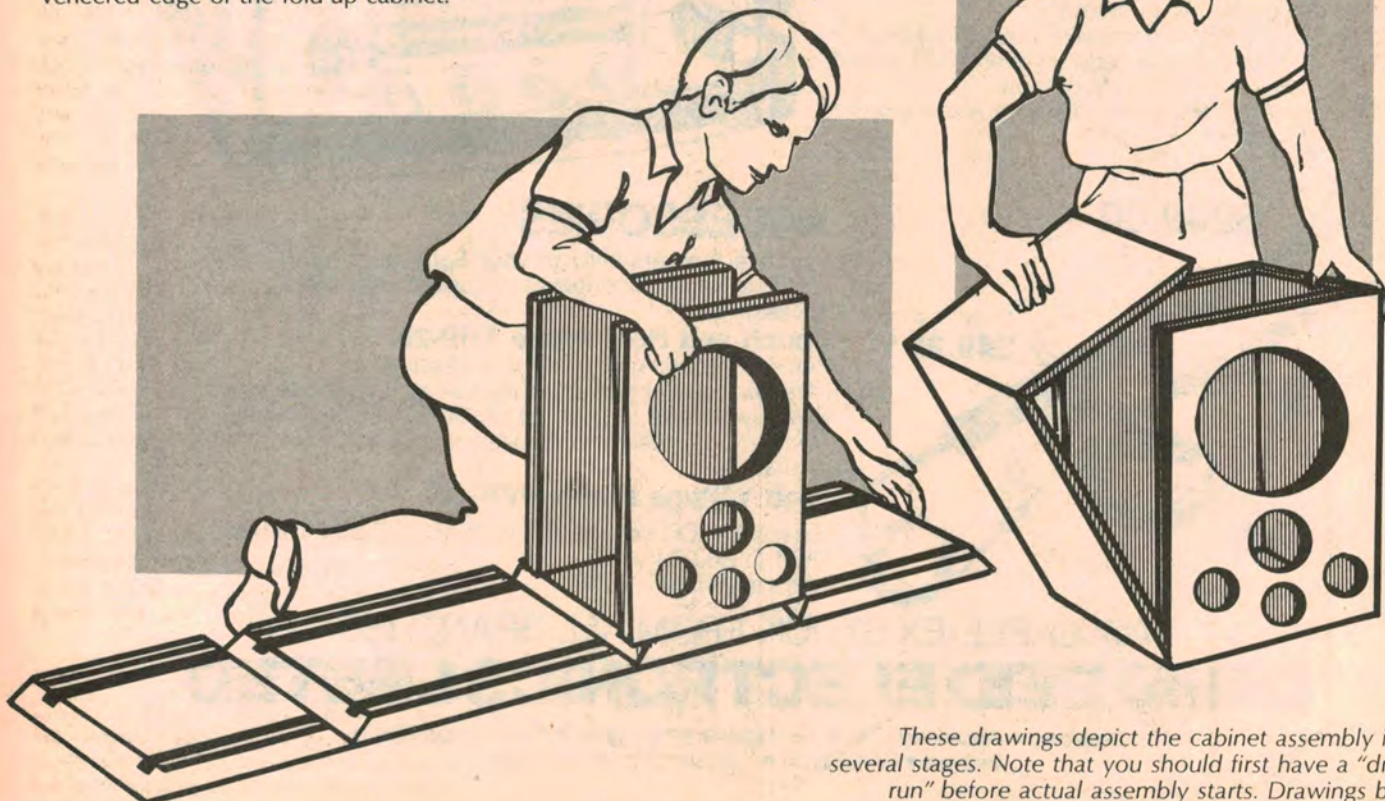


Having worked out how it all fits together, put the baffle and back panels aside and apply adhesive to all the 45° surfaces of the V-grooves and to all surfaces of the grooves which take the baffle and back panels. Do not apply excessive adhesive but apply enough so that, when spread with your finger, it will wet all the mating surfaces thoroughly and evenly. Just for good measure, run a thin, extra line of adhesive in the bottom of each V and in the bottom of the rectangular grooves.

Now fit the baffle into position, tweeter end down and veneered face to the front, without pushing it too hard into the groove. Now, while you hold the baffle vertical with one hand, place the back panel into the other groove in a similar manner and hold it vertical with your forearm. So while your left hand and forearm hold the panels vertical your right hand can fold up the sides.

The next part is a little tricky and perhaps would be easier if you had a helper, but you can manage by yourself if necessary. Fold up the short side sec-

*When you have finished the assembly steps described on these pages, your enclosures should look like this.*



*These drawings depict the cabinet assembly in several stages. Note that you should first have a "dry run" before actual assembly starts. Drawings by courtesy of Dick Smith Electronics.*

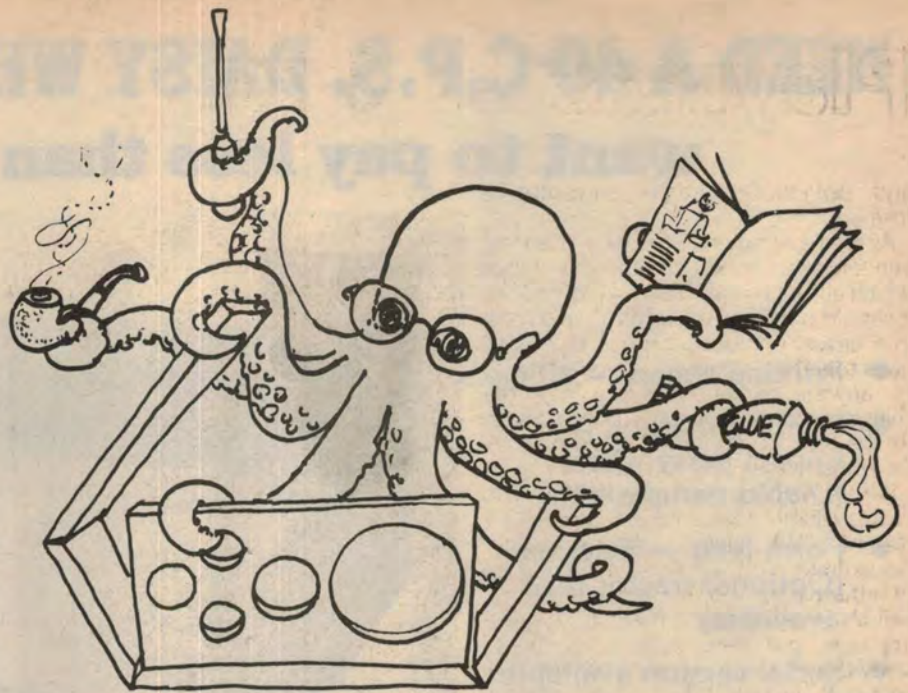
tion so that the baffle and rear panel lock into their respective grooves. Then fold up the other side and top section, allowing the baffle and rear panels to slip naturally into place without straining the "hinges". Bump the panels into place with the ball of the hand, bringing the two free edges tightly together. Finally, hold them in this position by using as many strips of masking tape as seem necessary. Note that when this is all achieved, the veneered face of the baffle and the veneered edges of the cabinet should all face to the front. If that is not the case, pull it all apart quickly before the glue dries and start again!

Use a moistened cloth and wipe away any excess glue which may be visible on the outside of the enclosure. Put the enclosure aside for several hours or overnight to allow the joints to set hard.

The second enclosure can be assembled in the same way.

As a final touch, prop the two enclosures so that they are resting on the mitred joint which is held closed with the tape. Run a line of glue inside the joint, bridging the side and bottom. (You will have to do this via the woofer hole in the baffle.) Allow this to dry for several hours, after which you can remove the masking tape.

The plinth is a similar wraparound



*Now where did I put the . . . back panel!*

assembly which is glued together and then glued to the base of the enclosure.

#### ASSEMBLING THE HARDWARE

The next task is to assemble all the hardware into the cabinets and while this may seem a straightforward and easy task it should not be rushed. The most important facet is ensuring that the

finished enclosures are completely sealed.

Each joint and each hole in the enclosure which is intended for mounting a loudspeaker driver, level control or terminal panel is a potential air leak which must be sealed.

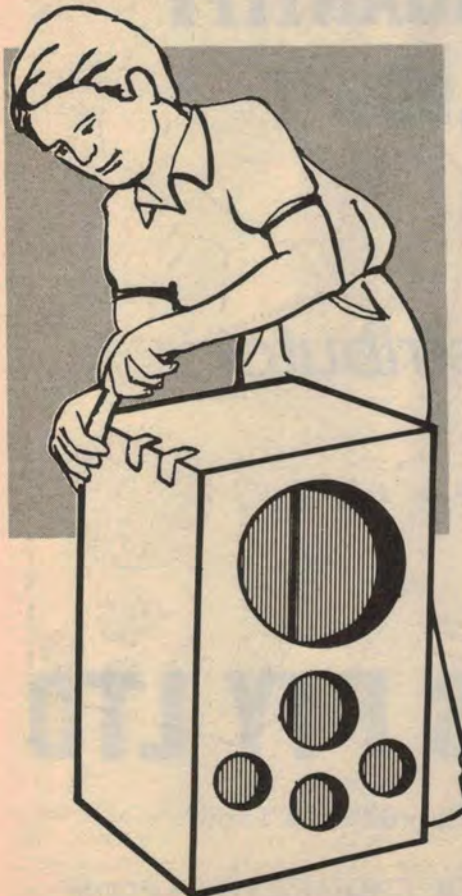
We cannot over-emphasise the importance of sealing and its effect on the final sound quality. We had a graphic demonstration of this with the final prototype enclosure. Having approved a prototype which was built into the old-style enclosure, we were amazed at the difference in sound quality when we compared it with the final prototype which had been quickly assembled. The latter was weak and boomy in the bass and showed marked colouration in the midrange. In fact, the whole balance seemed to be not quite right.

A little investigation soon showed that while the enclosure itself seemed to be airtight, it was leaking like the proverbial sieve around the level controls, the rear terminal panel, the midrange and even through the pilot holes which take the female sockets for the grille cloth frame attachments! Some of these leaks were hissing audibly while the others were just adding their own insidious colouration to the overall sound.

As soon as we carefully fitted gaskets for all the hardware and sealed all the leaks, the sound quality was markedly improved and right up to expectations. So take note of sealing. It is the single most important aspect of the entire project.

#### DRILLING HOLES

All the holes for the screws to mount the hardware must be drilled by the constructor. Now do not just lay the cabinet on its back, drop the speakers into place and drill right through the mounting



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holes. If you do, you stand a good chance of scratching the speaker frames with the drill chuck as the drill breaks through the particle board. Worse, you could even put a hole in one of the cones as you blithely wave the drill about.

No, handle the speakers as if they were precious jewels, fragile and easily damaged. After all, if you take care with this project you stand to receive a great deal of enjoyment from these speakers for a long time to come.

Lay the cabinet on its back and place all speakers and level controls into their appropriate positions with the mounting holes equally spaced around the vertical centre lines. Then mark the positions of all these mounting holes in pencil, remove the speakers and level controls, and drill the holes. Similarly, drill the holes for the rear terminal panel and the crossover network which should be mounted inside the enclosure on the base panel.

Make sure that you drill the holes slightly smaller than the core of the thread of the self-tapping screws, to make sure that the screws do not pull out of the holes.

## SEALING THE ENCLOSURE

As each loudspeaker and level control is installed you must make sure that it is sealed around the periphery. Experience has shown that there is only one really foolproof way of doing this and that is to make up gaskets using a foam-backed adhesive tape such as Engels No 5C draught excluder which is available in five metre packs from most hardware stores. This quantity will be sufficient for two enclosures.

We understand that this foam backed tape from Engels will be included with the cabinet kits.

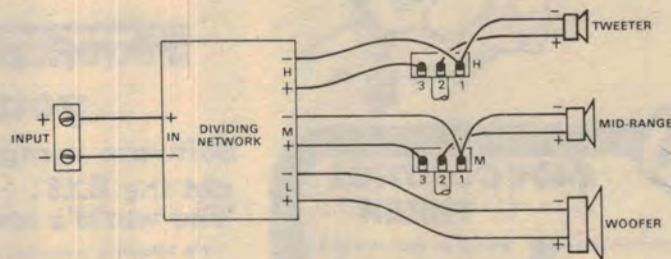
Gaskets made up using this foam-backed adhesive tape have the advantage that they will seal again if the speakers ever have to be removed.

Install the rear terminal panel first, with its gasket and then mount the crossover network inside the enclosure. Then connect the wires of the prepared harness between terminal panel and crossover network. Next, install the tweeter, midrange driver and level controls, making sure to attach the connections before screwing each one into place.

Next, foll up and push the Innerbond material into the enclosure via the woofer hole in the baffle. Make sure it occupies the volume evenly, without dislodging any connections. Finally, fit the gasket for the woofer, attach the connections and screw it into place.

Use both hands when driving the speaker screws home. One hand should guide the blade to ensure that it does

*EA staff member Colin Dawson shows the right degree of care when handling the loudspeakers. This step shows the speakers being positioned before marking the mounting holes for drilling.*



*A prepared harness with push-on connectors is provided for the system wiring.*

not slip off the screw head and possibly damage the speaker cone.

## TESTING FOR LEAKS

The simplest way of testing for leaks is to connect the loudspeaker system to an amplifier and drive it at a low frequency, of around 50Hz, at a volume which is reasonably loud but which is not obviously overdriving the woofer. If you do overdrive the woofer its cloth surround will begin to buzz audibly – a sure sign that you are overdoing things.

With 50Hz signal applied, moisten your palm, cup your hand and pass it over all the likely places where leaks could oc-

cur. Go over the back panel as well as all over the corners. Leaks can occur through the female sockets for the grille cloth frame attachments if the pilot holes have not been plugged.

An alternative to the moist palm method is to use a lighted candle but this does present the risk of burn marks on the enclosure.

When your toil is completed, place your speakers in their final positions, give the cabinets a wipe over with a moist cloth, fit the grille cloth frame and put on your favourite record. We know you will enjoy it.