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HIGH FIDELITY LOUDSPEAKER ENCLOSURES

By
B. B.
BABANI

26 practical designs with **40** Drawings:
Corner Reflex, Bass-Reflex,
Exponential Horn, Folded Horn,
Tuned Port, Klipschorn Labyrinth,
Stereophonic, Tuned Column,
Loaded Port, Multispeaker Panoramic,
Etc.

No.
146

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B. B. BABANI

BERNARDS (Publishers) LTD.
LONDON, W.6

General Editor

WALTER J. MAY

First Published September 1957

*Printed by V. Cooper & Partners Ltd., Flitcroft Street, W.C.2,
for Bernards (Publishers) Ltd., The Grampians, Western Gate, London, W.6*

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High Fidelity Loudspeaker Enclosures

Introduction

With the increased interest in High Fidelity, it is obvious that there is a need for a comprehensive handbook, with practical plans relating to loudspeaker enclosure construction.

Suitable enclosure design for High Fidelity reproduction has always been an art combined with a certain amount of science and loudspeaker manufacturers usually make available one or two suggested enclosure designs. However, there has not been any book available offering such a wide choice as the present volume.

The author would especially like to thank the following U.S.A. Companies for making available their suggested designs enabling him to present a range of models from the simplest and smallest to complicated multi-speaker enclosures, suitable for large halls.

One reason for selecting American Designs is because the major loudspeaker factories and acoustical laboratories in the U.S.A. spend a very much larger proportion of their budget in research in this field than is the case in this country.

Altec. Lansing Corp.	**161, Sixth Avenue, N.Y., 13, U.S.A.**
Electro-Voice, Incorp.	**Buchanan, Michigan, U.S.A.**
General Electric Co.	**Electronics Park, Syrecuse, N.Y.**
Jenson Manufacturing Co.	**6601, South Laramie Ave., Chicago, 38, Illinois, U.S.A.**
Klipsch and Associates	**Hope, Arkansas, U.S.A.**
James B. Lansing Sound Inc.	**2439, Fletcher Dr., Los Angeles, 39, California, U.S.A.**
Racon Electric Co. Inc.	**3746, Boston Road, Bronx 69, N.Y.**
Stromberg-Carlson Co.	**Rochester 3, N.Y., U.S.A.**
University Loudspeakers Inc.	**80, S. Kensico Ave., White Plains, N.Y., U.S.A.**
United Speaker Systems	**34, New Street, Newark 2, N.J., U.S.A.**
Etc.	**Etc.**

Classes of Enclosure

The loudspeaker unit itself is one of the most important links in any High Fidelity chain, but without a suitable enclosure there is no point in installing a high grade unit because without this vital ancillary the loudspeaker is incapable of proper reproduction.

There are many classes of enclosure, of these the most important are the horn, and the direct radiator. Naturally, there are many variations of both of these and plans of an extensive range of both types has been included.

With the horn system, the speaker diaphragm is linked to the air via an impedance structure, i.e., the horn itself. Whereas with direct radiators the speaker diaphragm itself is directly coupled to the air without an intermediate step. Horn enclosures are capable of superb reproduction, but to get a full frequency range, a very large structure is necessary. This makes them much more expensive than the direct radiator, which can itself, prove to be a very effective design. They reproduce at nearly as high an efficiency and with practically as wide a frequency range as the horn enclosure with the advantage of much lower cost and more important still, much more compact and presentable form.

Correctly designed horn radiators produce no transient generation over a very wide frequency range, resulting in much higher acoustical efficiency than is possible with a direct radiator. In other words a comparatively low power is required to feed a horn radiator compared to a direct radiator working at the same acoustical level. However, by careful design direct radiator enclosures can be made free of transient generation. An important feature of the horn radiator is the low distortion factor due to the low power required to load it effectively. Amplifier distortion is likely to be less at a low power level. However, to offset these advantages the horn enclosure demands much more critical construction than the direct radiator and if required to cover the lowest audible frequencies their physical size tends to become unrealistic. The horn reproducer is used mainly in theatres and large auditorium installations, where its large size is of no consequence.

Direct radiator enclosures are available in various form such as the infinite baffle, folded baffle, flat baffle, base reflex or labyrinth. Horn enclosures are also found in various forms such as the straight horn, single and double folded horn, Klipsch horn, multicellular horn, etc. It is possible to utilise combinations of both types of enclosure, such as a direct radiating high-frequency and mid-frequency speaker combined with a rear folded horn radiator operating from the back of the speaker, to make the most of the low frequencies.

This book covers both of these principle types, together with as many variations as possible. No special recommendation can be given for using any special design in preference to another.

Reproduction of sound is very similar to the enjoyment of food, that which suits one listener's ear may not please another persons hearing. However, each of the designs included in this book have been tried either by the author and his friends, or by various research institutes and loudspeaker manufacturers, in every case results have given satisfaction to the majority.

It is pointed out at this juncture that most of the designs described are patented and it must therefore be clearly understood that because a design is shewn in this book it does not imply a licence to manufacture for re-sale. Single hand-made copies of the suggested enclosures should not, in the opinion of the author, contravene any patent granted to the original designer.

Much of enclosure design is based on complicated mathematical formulae. Because the average constructor has no desire to be taught or reminded of advanced mathematics, the technical reasoning why various dimensions are chosen has been omitted as this is better explained in the learned works available in the field of acoustical engineering.

Bass-reflex enclosures are amongst the most popular types used for High Fidelity reproduction. The critical factors of this design are the port or air gap calculation and the overall enclosure dimensions. These measurements are controlled by a number of factors, the most important are the resonant frequency of the loudspeaker and the physical area of its cone. These standard factors result from the original work of Helmholtz, etc., and to save readers extensive calculation, a number of tables have been included showing the port size and length of tunnel dimensions, for a range of loudspeaker sizes with various resonant frequencies. Ideally the proportions of a bass-reflex should be in the ratio of 2:3:4 with respect to depth, width and height, two extensive tables covering this data are included. It is strongly urged that after constructing any bass reflex enclosure it should be carefully tuned to the speaker or speakers fitted. Tuning means making the port larger or smaller to cope with individual loudspeaker variations. This can be easily effected by means of temporary sliding doors on the ports to permit experimental variation of their physical size (see Page 44).

Tables

Table A, gives the required dimensions in the ratio of 2:3:4 that will be needed to construct an enclosure with a volume of any desired number of cubic feet. Table B, is similar to Table "A", except that the required volume is shown in cubic inches.

Table C, D, E and F, are to enable the reader to assess the cubic capacity required for an enclosure depending on the resonant frequency of the speaker to be used. At the same time the actual port area and port depth or tunnel length is shown. These four tables cover 10, 12, 15 and 18″ loudspeakers.

Further information on using these tables is given on Page 33 section headed **Using Tables A—F.**

Many of the designs in this book use more than one speaker, this is because even the most perfect loudspeaker can produce only a limited range of frequencies. High Fidelity reproduction over the useful audible frequency range, i.e., from 30 cps. to 17,500 cps., require a combination of two or more loudspeakers. A bass unit covers the low frequency band, i.e., 30 cps. to 5,000 cps. and a high-frequency tweeter to reproduce 5,000 cps. upwards. Sometimes the audible range is split up between three speakers. In this case a medium size loudspeaker is used in addition to give brilliance to the middle register say from 1,000 to 5,000 cps.

When selecting a loudspeaker, particular attention should be given to the size and weight of the magnet used. A large heavy magnet is necessary for high acoustical efficiency. Readers should not be misled by advertisement claims of very high gauss, unless combined with very heavy magnet weight, i.e., in the case of a 12″ speaker a recommended minimum weight of at least 48 ozs., of magnet is suggested. Checking this point is especially important as many manufacturers simply give the magnetic flux density, but do not state the actual weight of magnet used in the speaker. This is often as low as 4 to 5 ozs. 8″ speakers require a minimum magnet weight of 16 ozs., tweeters of 2″ to 4″ diameters, 4 ozs.

Timber choice is left to the constructor, however, a thickness less than that recommended should not be considered. Experience has proved that high grade bonded ply is one of the best types of material available, because it does not suffer from distortion or warping and is usually well seasoned before delivery to wood merchants. Much experimenting can be carried out to improve the response and to eliminate transients on bass-reflex or direct radiation enclosures with damping materials, such as fibre glass, thick felt, blanketing, etc.

TABLE "A"

DIMENSIONS IN INCHES TO GIVE REQUIRED ENCLOSURE VOLUME IN CUBIC FEET.

					depth		*width*		*height*
1 cu. ft.	=	1728 cu. in.		=	8¼	×	12½	×	16½
2 ,,	=	3456	,,	=	10½	×	15¾	×	21
3 ,,	=	5184	,,	=	12	×	18	×	24
4 ,,	=	6912	,,	=	13¼	×	20	×	26
5 ,,	=	8640	,,	=	14¼	×	21¼	×	28½
6 ,,	=	10368	,,	=	15	×	22½	×	30½
7 ,,	=	12096	,,	=	16	×	23¾	×	32
8 ,,	=	13824	,,	=	16½	×	25	×	33
9 ,,	=	15552	,,	=	17¼	×	26	×	34½
10 ,,	=	17280	,,	=	18	×	26¾	×	35¾
12 ,,	=	20736	,,	=	19	×	28½	×	38
14 ,,	=	24192	,,	=	20	×	30	×	40
16 ,,	=	27648	,,	=	21	×	31½	×	41¾
18 ,,	=	31104	,,	=	21¾	×	32¾	×	43½
20 ,,	=	34560	,,	=	22½	×	34	×	45
25 ,,	=	43200	,,	=	24¼	×	36¼	×	48½
30 ,,	=	51840	,,	=	25¼	×	37¾	×	50½
35 ,,	=	60480	,,	=	27¼	×	40¾	×	54½
40 ,,	=	69120	,,	=	28½	×	42½	×	57
50 ,,	=	86400	,,	=	30½	×	46	×	61
60 ,,	=	103680	,,	=	32½	×	49	×	65
70 ,,	=	120960	,,	=	34¼	×	51½	×	68½
80 ,,	=	138240	,,	=	35¾	×	53¾	×	71½
90 ,,	=	155520	,,	=	37¼	×	55¾	×	74½
100 ,,	=	172800	,,	=	38½	×	58	×	77

TABLE "B"

DIMENSIONS IN INCHES TO GIVE REQUIRED ENCLOSURE VOLUME IN CUBIC INCHES.

Volume			*depth*		*width*		*height*
500 cu. ins.	=		5½	×	8¾	×	11
1,000 ,,	=		7	×	10¼	×	13¾
2,000 ,,	=		8¾	×	13⅛	×	17½
2,500 ,,	=		9½	×	14	×	18¾
3,000 ,,	=		10	×	15	×	20
3,500 ,,	=		10½	×	15¾	×	21
4,000 ,,	=		11	×	16½	×	22
5,000 ,,	=		11⅞	×	17¾	×	23¾
6,000 ,,	=		12½	×	19	×	25
7,000 ,,	=		13¼	×	19⅞	×	26½
8,000 ,,	=		14	×	20¾	×	27¾
9,000 ,,	=		14½	×	21½	×	28⅞

Volume			*depth*		*width*		*height*
10,000 *cu. ins.*	=		15	×	22½	×	29½
12,500 ,,	=		16	×	24	×	32⅛
15,000 ,,	=		17	×	25¾	×	34
17,500 ,,	=		18	×	27	×	36
20,000 ,,	=		18⅞	×	28⅛	×	37½
22,500 ,,	=		19½	×	29½	×	39
25,000 ,,	=		20¼	×	30½	×	40½
27,500 ,,	=		21	×	31¼	×	41¾
30,000 ,,	=		21½	×	32¼	×	43
35,000 ,,	=		22¾	×	34	×	45½
40,000 ,,	=		23¾	×	35½	×	47¼

TABLE "C"

10″ Loudspeaker

Port Area 50 sq. inches

VOLUME OF CABINET IN THOUSANDS OF CU. INCHES.

Duct or Port Tunnel

Length in Inches

Speaker Resonant Frequency	2	2.5	3	3.5	4	5	6	7	8	9	10	15	20	30	40
20													24.0	13.0	8.0
25												20.0	12.5	6.0	2.5
30												11.5	6.5	1.5	
35											13.5	6.0	2.75		
40									13.0	10.5	8.5	3.5	0.75		
45								11.0	8.5	6.5	5.0	1.0			
50						15.5	10.5	7.25	5.5	4.0	3.0				
55						10.75	7.0	4.75	3.25	2.0	1.0				
60					12.0	7.25	4.5	2.75	1.5	0.5					
65					9.0	5.0	2.75	1.25							
70				8.5	6.25	3.25	1.5								
75			10.0	6.5	4.25	1.75									
80		12.0	7.0	4.5	3.0	0.75									
85		9.0	5.0	2.75	1.5										
90		6.5	3.75	1.5	0.5										
95	11.0	4.5	2.0	0.75											
100	7.5	3.0	1.0												

TABLE "D"

12″ Loudspeaker

Port Area 78 sq. inches

Duct or Port Tunnel Length in Inches

VOLUME OF CABINET IN THOUSANDS OF CU. INCHES.

Speaker Resonant Frequency	3	3.5	4	4.5	5	5.5	6	7	8	9	10	15	20	25	30	40
20															24.0	15.0
25														16.0	11.5	6.5
30													12.5	8.0	5.5	1.75
35												13.0	6.5	3.5	1.5	
40											18.0	7.5	3.5	0.75		
45									20.0	14.5	11.5	4.0	0.75			
50								18.0	13.0	9.5	7.0	1.25				
55							17.0	11.25	8.0	5.5	4.0					
60						14.5	11.25	7.25	4.75	3.0	1.75					
65					13.5	9.5	7.25	4.5	2.75	1.25						
70				13.0	9.0	6.5	4.75	2.75	1.0							
75			13.5	8.5	5.5	4.0	3.0	1.0								
80			9.0	5.5	3.5	2.0	1.0									
85		11.0	6.0	3.75	2.0	0.75										
90		7.0	4.0	2.0	0.75											
95	9.0	4.5	2.0	0.75												
100	6.0	2.5	0.5													

VOLUME OF CABINET IN THOUSANDS OF CU. INCHES.

Speaker Resonant Frequency	4.5	5	6	7	8	9	10	15	20	25	30	35	40	50	60	70
20														22.0	15.5	11.0
25											26.0	17.0	14.5	9.0	5.5	3.0
30										19.5	13.0	9.5	6.5	3.0	0.5	
35									17.0	10.0	6.5	3.75	1.75			
40								20.0	9.5	5.0	2.0					
45								11.5	5.0	1.25						
50								7.0	1.75							
55							14.0	3.25								
60						12.0	8.5	0.5								
65					12.0	7.5	5.0									
70				13.0	7.0	4.0	2.0									
75				7.0	3.75	1.75										
80			9.0	3.75	1.25											
85			5.0	1.75												
90		9.0	2.5													
95		5.0	0.75													
100	5.5	2.0														

Duct or Port Tunnel

Length in Inches

TABLE "E"

15″ Loudspeaker

Port Area 133 sq. inches

VOLUME OF CABINET IN THOUSANDS OF CU. INCHES.

Duct or Port Tunnel

Length in Inches

Speaker Resonant Frequency	6	7	8	9	10	15	20	25	30	35	40	50	60	70	80	90
20														22.0	16.0	12.5
25												19.0	12.5	8.5	5.5	3.0
30											15.0	8.0	4.25	1.5		
35								24.0	15.0	9.5	6.0	1.75				
40								12.5	7.0	3.5	2.0					
45							13.0	5.5	2.0							
50						21.0	7.0	2.0								
55						10.0	2.0									
60						5.0										
65						1.5										
70					11.0											
75				11.0	5.0											
80				5.0	1.75											
85			5.0	1.25												
90		7.5	1.0													
95		2.0														
100	6.0															

TABLE "F"

18″ Loudspeaker

Port Area 200 sq. inches

Fig. 1. For the first time a practical spherical tweeter reproducer is shewn. A working model of this assembly was demonstrated at the Hanover Fair in 1956 and aroused considerable interest. Since then, descriptions have appeared in German and French radio publications. Twelve tweeters are used and sound dispersion is completely omni-directional. The original design used 12 T S L Lorenz LPH 65 tweeter units, and it is recommended that these should be used if the remarkable results achieved are to be duplicated.

The finished appearance is rather similar to a sphere of 14″ dia. Mounting can be effected in a number of ways, either on a lamp standard, so that it is placed above the main middle and bass enclosure or alternatively, particularly effective results are achieved if the unit is suspended from the ceiling, as though it were a pendant lamp.

Wood used for the original model was ½″ ply and all 12 pentagons fixed together internally in the form of a sphere by using inexpensive miniature hinges, thus making a most effective unit with a minimum of labour and at low cost.

It is very important that the impedance combination be calculated to suit the impedance offered at the output of the amplifier.

A series-parallel arrangement is necessary, the impedance of the LPH 65 may be taken as 5 ohms.

Fig. 2. Particularly recommended for superior performance where 12″ or 15″ bass speakers are used and is a combination of bass-reflex with all the assets of a horn reproducer combined. Constructional details are clearly shewn, of special interest is the pyramid reflector in the bottom portion of the unit, which provides perfect diffusion.

Fig. 3. Recommended where overall size is an important factor as with the modern living room. It is a true example of the tuned port bass reflex cabinet, and should be built of seasoned timber, minimum thickness ⅞″. Alternatively good quality ply of similar thickness can be used. The base legs can be made to suit individual tastes.

Height from the floor should be approximately 3″. Originally, this enclosure was constructed for use with a 12″ speaker, but with the changes in the port size it is also suitable for speakers of 10″ or 15″ diameter.

Dimension A=13″ × 2″ for 10″ loudspeakers.
„ A=13″ × 3″ for 12″ loudspeakers.
„ A=13″ × 5¼″ for 15″ loudspeakers.
„ B=Cut to suit speaker size.
„ C is obtained by reference to depth of port tables on Page — according to speaker size. This dimension is also dependent on the fundamental resonance of the speaker used and the tables cover this requirement.

Fig. 4. The "Library Enclosure". This is an efficient tuned port bass-reflex enclosure of high quality. It is designed for use with a good quality 8″ loudspeaker, resonance about 75 cycles. From the dimensions of this enclosure it will be seen that it has been specially designed to fit into book shelves without being obtrusive.

It is very simple to construct, but essential that all timber used should have a minimum thickness of ¾″. Relevant dimensions are clearly shown on the diagram. Particular care in fitting should be taken with the back, top, sides and front which should be made as airtight as possible.

Fig. 5. This Miniature Horn Loaded Reflex enclosure is eminently suitable for small installations where space is limited. Genuine High Fidelity is satisfactorily achieved using a loudspeaker of 8″ diameter. Due to the unique horn loading and the tuned port, reproduction from this enclosure will delight the most critical listener. Because of the small physical size, it is stressed that the minimum thickness should be ¾″ for all timber used for this model.

Fig. 6. The 12″ Minihorn. A horn radiating unit which eliminates any tendency to transient generation, it has very extended frequency range and high acoustical efficiency. The major asset is that the minimum quantity of timber is used in construction because two walls of the room are used to form the major sides of the horn itself.

Particular care must be taken when building this enclosure to see that the top is exactly 90° or ¼ circle in order to fit into the room walls. It is suggested, that to obtain optimum results, faces

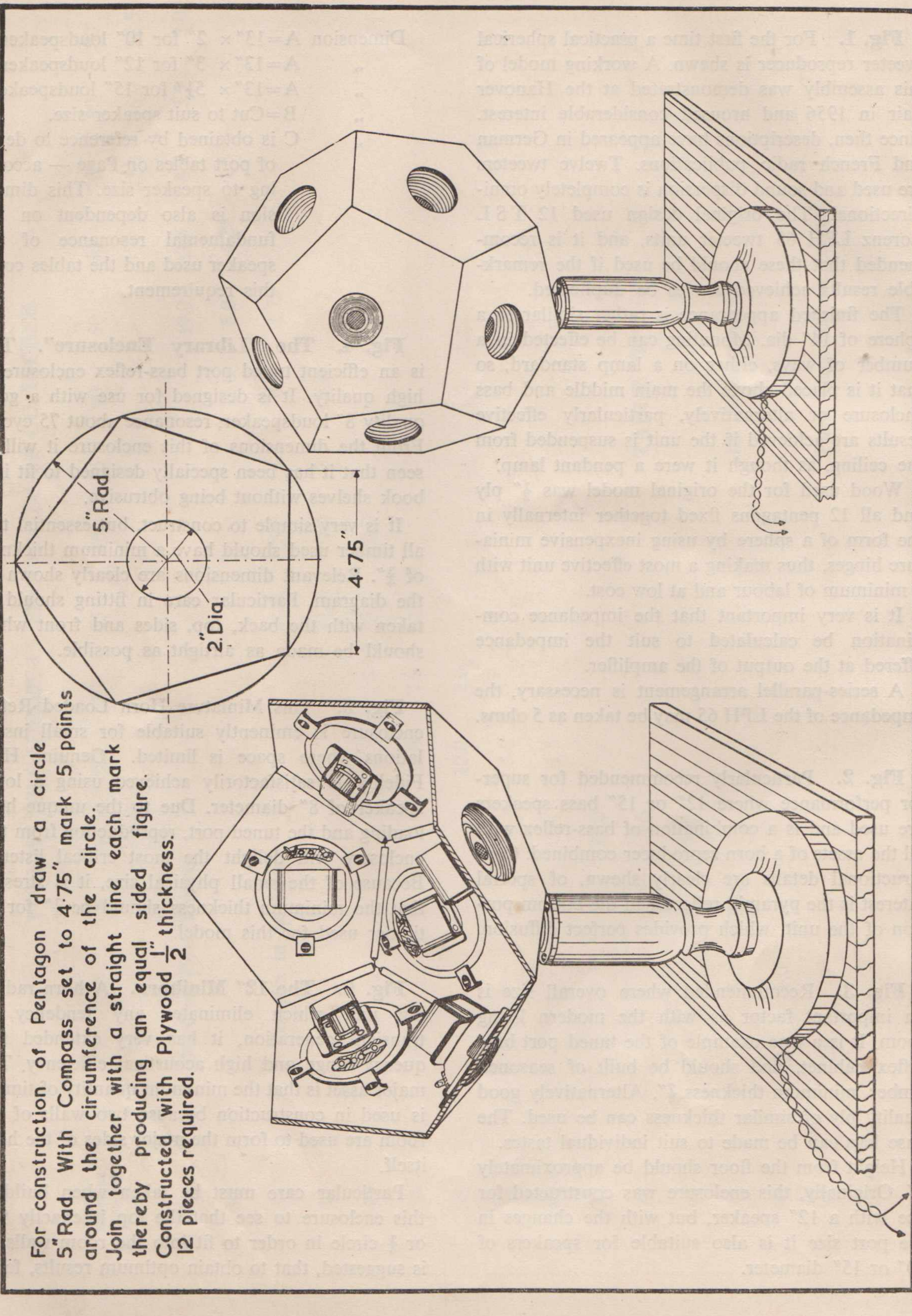

For construction of Pentagon draw a circle 5" Rad. With Compass set to 4·75" mark 5 points around the circumference of the circle. Join together with a straight line each mark thereby producing an equal sided figure Constructed with Plywood $\frac{1}{2}$" thickness. 12 pieces required.
5 Rad
4·75"
2" Dia

Fig. 1

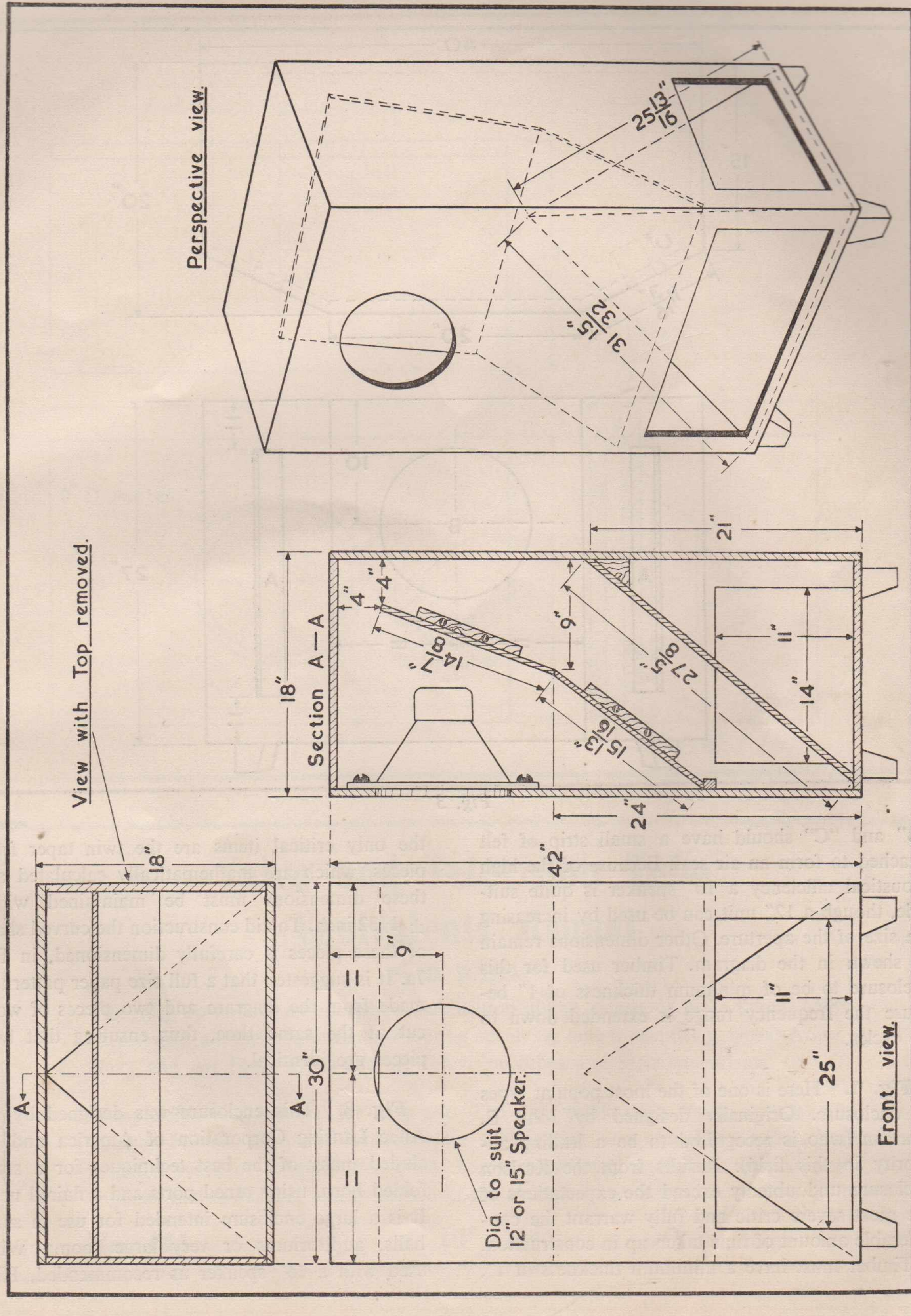

Perspective view.
25 13/16"
31 32/15"
View with Top removed.
Section A—A
18"
4"
4"
14 7/8"
9"
27 5/16"
15 13/16"
24"
21"
11"
14"
42"
18"
9"
30"
A
A
Dia. to suit 12" or 15" Speaker.
11"
25"
Front view.

Fig. 2

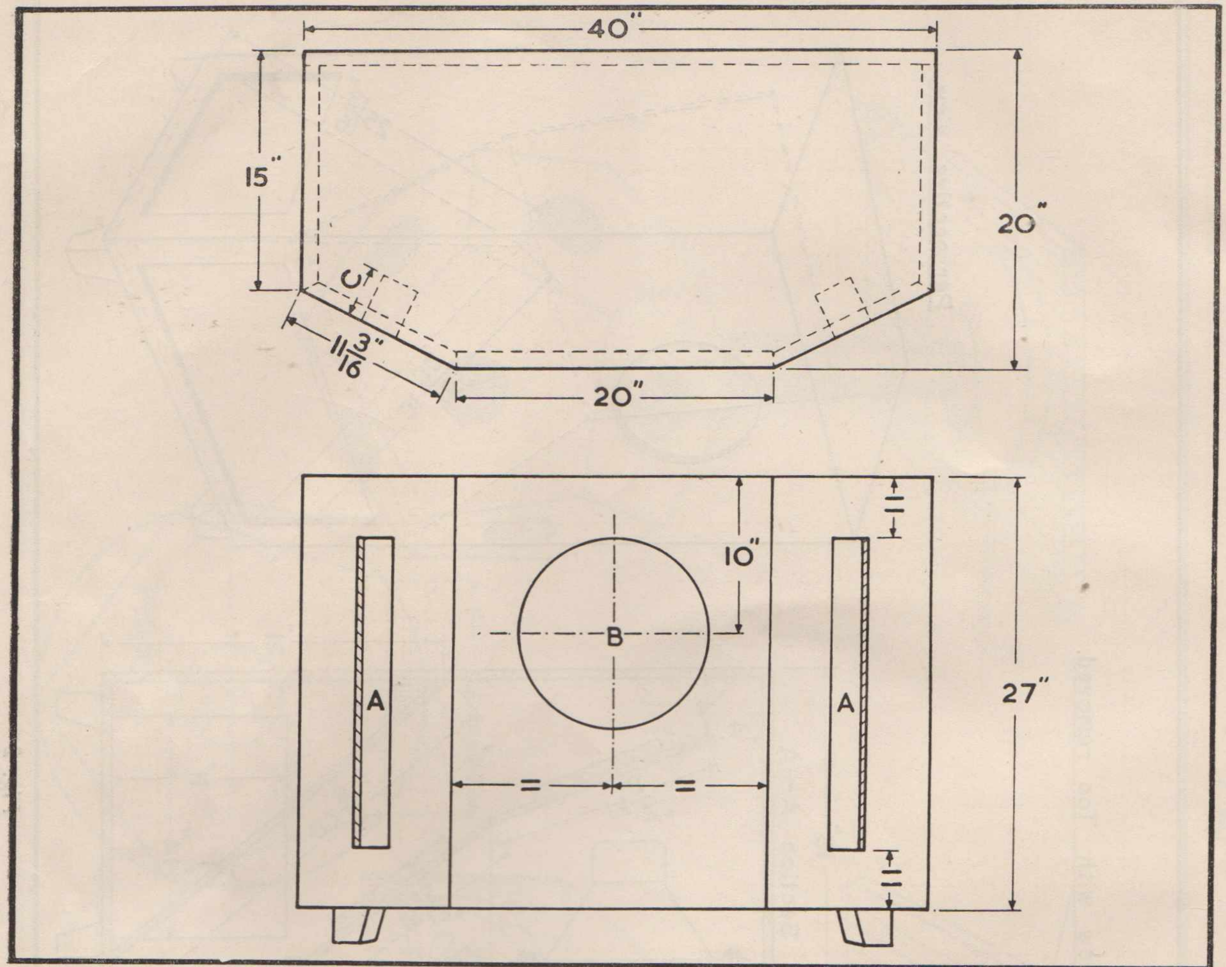


Fig. 3

"B" and "C" should have a small strip of felt attached to form an air seal. Because of the high acoustical efficiency a 10″ speaker is quite suitable, though a 12″ unit can be used by increasing the size of the aperture. Other dimensions remain as shewn in the diagram. Timber used for this enclosure to be of minimum thickness of 1″ because the frequency range is extended down to 30 cycles.

Fig. 7. Here is one of the most popular types of enclosure. Originally designed by John E. Karlson (who is recognised to be a leading authority in this field). Results from the Karlson enclosure undoubtedly exceed the expectations of the most severe critic and fully warrant the considerable amount of time taken up in construction.

Timber must have a minimum thickness of 1″, the only critical items are the twin taper front pieces, which are mathematically calculated and these dimensions must be maintained within ± 1/32 inch. To aid construction the curved shape of these pieces is carefully dimensioned, in Fig. 7a. It is suggested that a full size paper pattern be made from the diagram and two pieces of wood cut at the same time, thus ensuring that both pieces are identical.

Fig. 8. This enclosure was designed by the Altec Lansing Corporation of America and included many of the best techniques for a semi-folded horn, using tuned ports and a flaired neck. It is a large enclosure intended for use in small halls, auditoriums or very large rooms. When used with a 15″ speaker as recommended, High

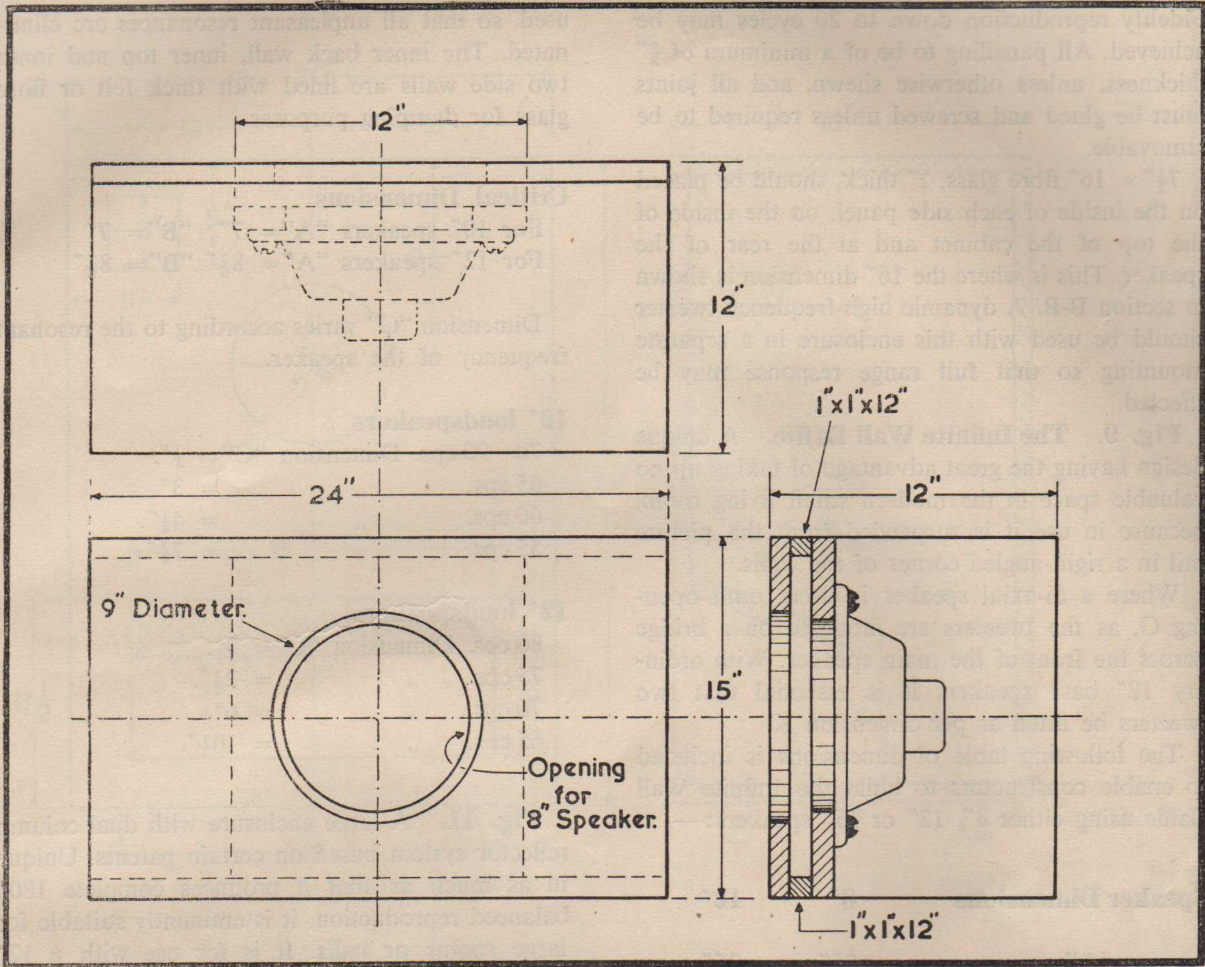


Fig. 4

Fidelity reproduction down to 20 cycles may be achieved. All panelling to be of a minimum of $\frac{5}{8}''$ thickness, unless otherwise shewn, and all joints must be glued and screwed unless required to be removable.

$7\frac{1}{2}'' \times 16''$ fibre glass, 1″ thick, should be placed on the inside of each side panel, on the inside of the top of the cabinet and at the rear of the speaker. This is where the 16″ dimension is shown in section B-B. A dynamic high-frequency tweeter should be used with this enclosure in a separate mounting so that full range response may be effected.

Fig. 9. The Infinite Wall Baffle. A unique design having the great advantage of taking up no valuable space in the modern small living room, because in use it is suspended from the picture rail in a right-angled corner of the walls.

Where a di-axial speaker is used, omit opening G, as the tweeters are mounted on a bridge across the front of the main speaker. With ordinary 12″ bass speakers it is essential that two tweeters be fitted as per dimension K.

The following table of dimensions is included to enable constructors to build the Infinite Wall Baffle using either 8″, 12″ or 15″ speakers: —

Speaker Dimensions	**8″**	**12″**
"A"	25″	35″
"B"	12″	17″
"C"	27″	40″
"D"	$6\frac{1}{4}''$	8.7/16″
"E"	5.13/16″	$8\frac{1}{2}''$
"F"	$7\frac{1}{4}''$	$10\frac{7}{8}''$
"G"	$2\frac{1}{8}''$	$2\frac{1}{8}''$
"H"	$\frac{3}{4}''$	1″
"J"	$1\frac{3}{4}''$	$1\frac{1}{4}''$
"K"	—	6″
"L"	$11\frac{1}{4}''$	$16\frac{1}{4}''$
"M"	8″	$11\frac{1}{2}''$

Fig. 10. A modern bass-reflex enclosure with bottom fitted tuned port. This enclosure takes full advantage of the natural baffling qualities of the room flooring because the tuned port is placed in the base of the enclosure. Because of this, better equalisation and response distribution is obtained.

Timber of not less than 1″ thickness must be used, so that all unpleasant resonances are eliminated. The inner back wall, inner top and inner two side walls are lined with thick felt or fibre glass for damping purposes.

Critical Dimensions

For 10″ speakers "A" = 7″ "B" = 7″
For 12″ speakers "A" = $8\frac{7}{8}''$ "B" = $8\frac{7}{8}''$

Dimension "C" varies according to the resonant frequency of the speaker.

10″ loudspeakers

70—90 cps.	Dimension "C"	= $\frac{1}{4}''$.
65 cps.	,,	= 3″.
60 cps.	,,	= $4\frac{1}{4}''$.
55 cps.	,,	= $7\frac{3}{4}''$.

12″ loudspeakers

80 cps.	Dimension "C"	= $\frac{1}{2}''$.
75 cps.	,,	= $2\frac{1}{2}''$.
70 cps.	,,	= 6″.
65 cps.	,,	= $10\frac{1}{2}''$.

Fig. 11. A large enclosure with dual column reflector system based on certain patents. Unique in as much as that it produces complete 180° balanced reproduction, it is eminently suitable for large rooms or halls. It is for use with a 12″ speaker and variable tuned ports are arranged on the front of the enclosure, these are separately tuned acoustically to suit the pair of loudspeakers used. It is vital that the two units are correctly phased. The top semi-circle reflector is made of two pieces of $\frac{1}{8}''$ thick perspex bent into a cone shape and held by strips of wood. The resulting cavity should be filled with plaster of paris and allowed to set. This is to eliminate any sympathetic vibrations in the most important part of the enclosure, the reflecting unit. Smaller loudspeaker units may be used, if required, reduce these dimensions in the ratio of 5:6 for a 10″ unit and 2:3 for an 8″ loudspeaker.

Fig. 12. Corner fitting long channel horn enclosure utilising any two walls at right-angles to one another as the main enclosure walls. The main advantage of this design is the long path formed for the sound to travel before emerging

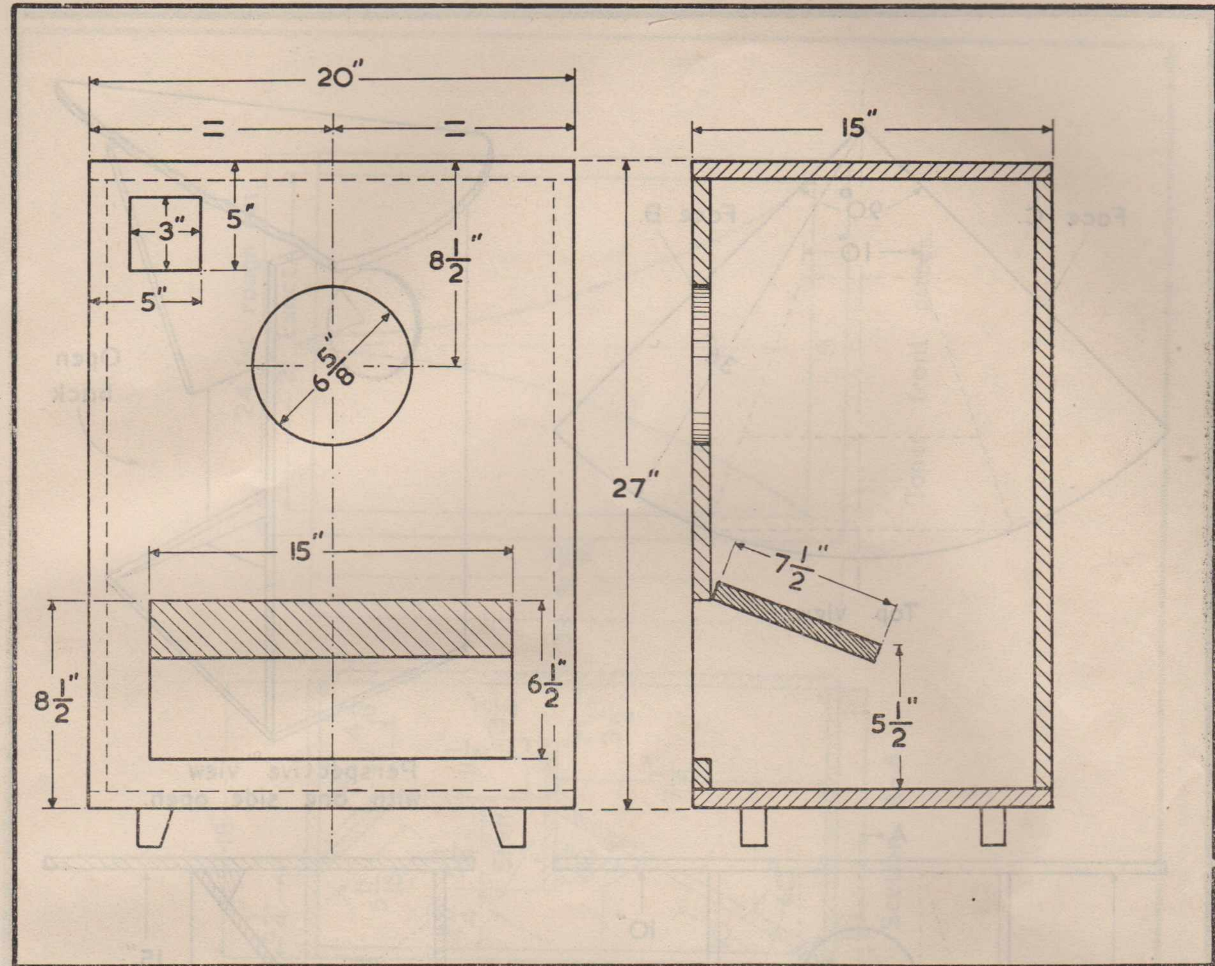


Fig. 5

so that particularly good response is achieved at bass frequencies. Physically, very little room is taken up because of the corner fitting. Timber of not less than 1″ thickness must be used and to avoid any resonant effects it is suggested that fibre glass or thick felt 1″ thickness be tried in various positions at the rear of the enclosure. It is impossible to specify just where to dampen the enclosure because this factor is dependent on the loudspeaker unit selected.

Fig. 13. Long channel enclosure for a 12″ loudspeaker. An attractive model designed with minimum dimensions. Simple to construct and in spite of its small size, capable of providing good quality reproduction over a wide range. It compares very favourably with much more elaborate and expensive enclosures.

Efficient, acoustically, because a comparatively long path is secured for the rear loading of the speaker. Timber for this enclosure can be $\frac{5}{8}$″ thick provided the interior is well strutted to obtain extra rigidity. By using $\frac{3}{4}$″ timber the necessity for strutting can be avoided.

If it is required to use an 8″ speaker, reduce all dimensions on the diagram in the ratio of 2:3. Damping the interior will improve results.

Fig. 14. This is a rear large horn slot loaded corner enclosure intended for use with 12″ or 15″ speakers. It will reproduce with clarity and true fidelity down to the lowest audio frequencies. This design relies on two right-angled walls of the room to form the balanced porting and outer walls

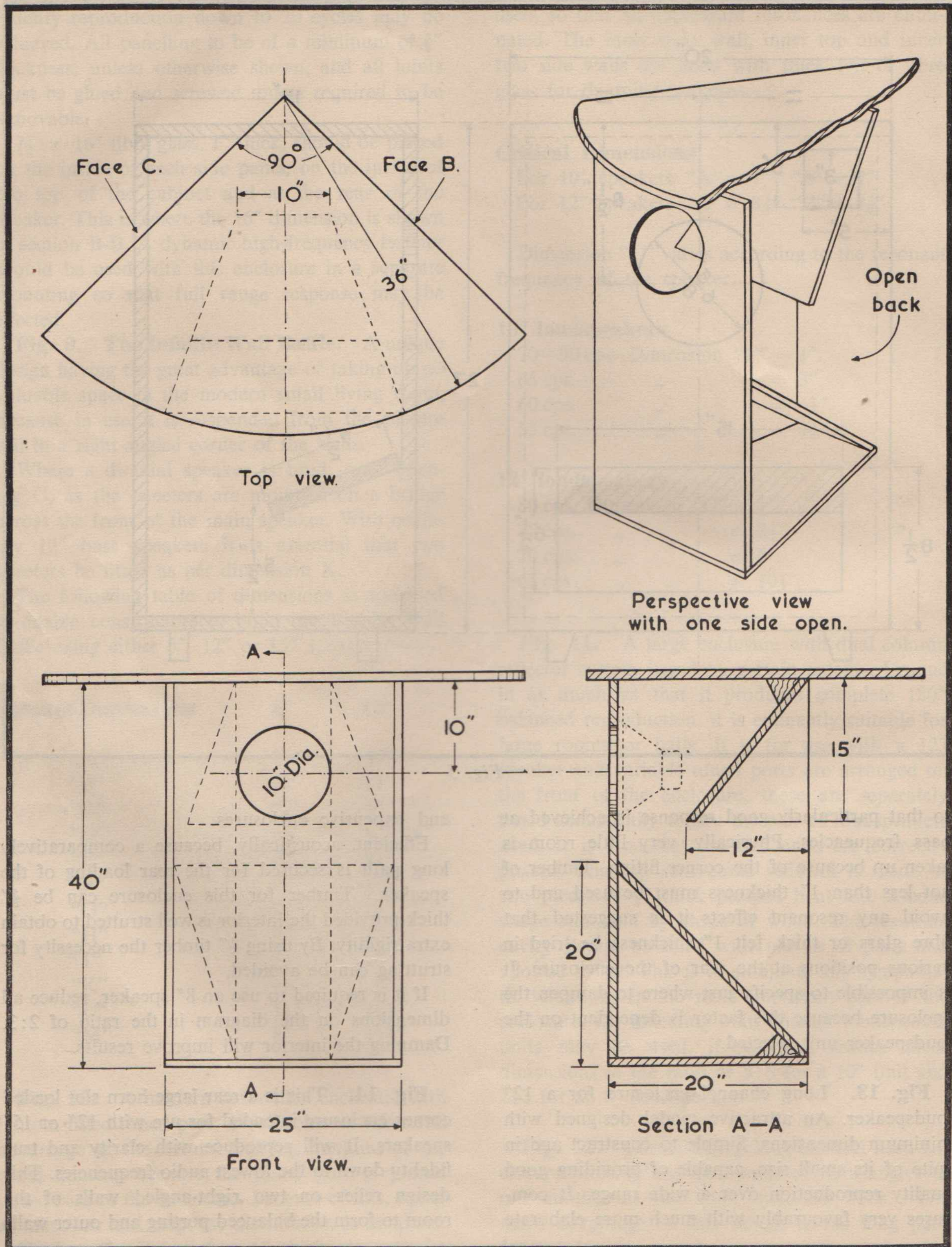

Face C.
90°
Face B.
10"
36"
Top view.
Open
back
Perspective view
with one side open.
A
10"
10" Dia.
40"
A
25"
Front view.
15"
12"
20"
20"
Section A—A

Fig. 6

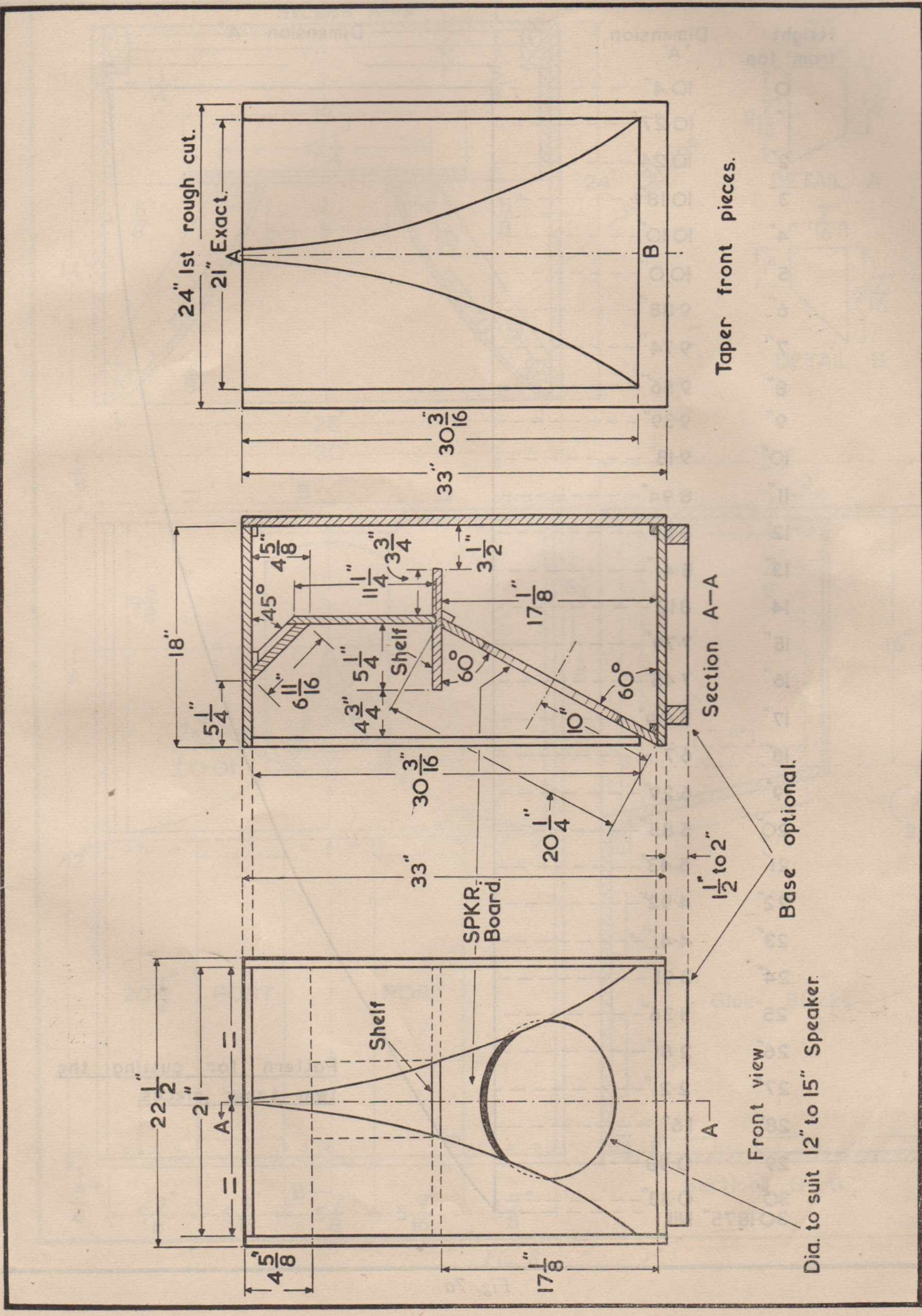
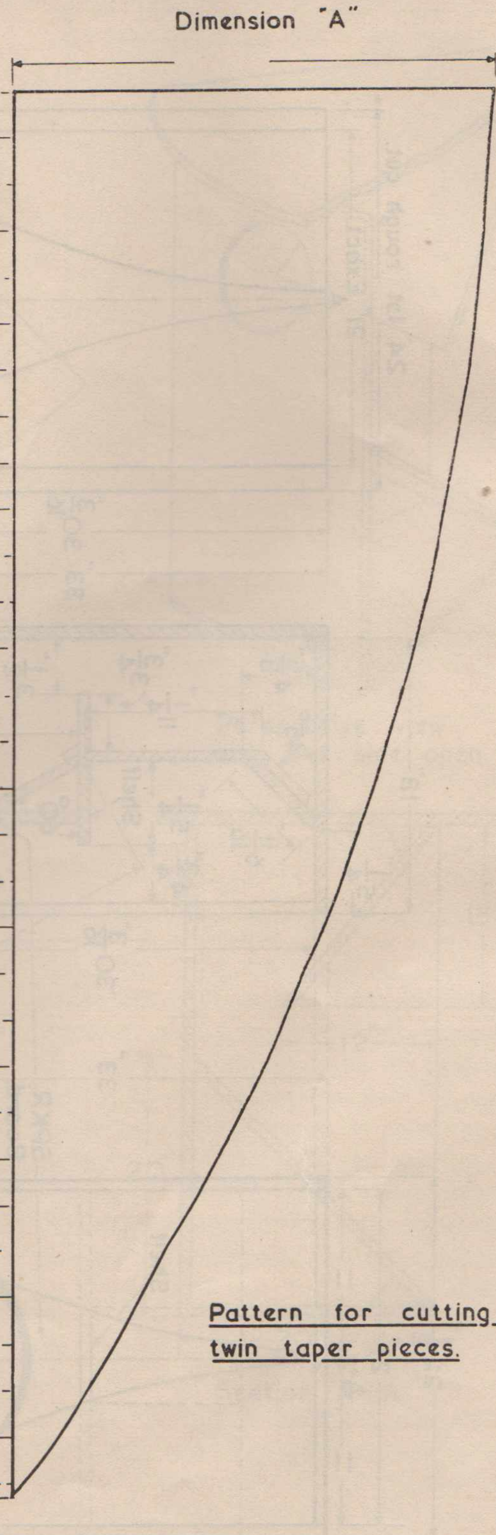

24" 1st rough cut.
21" Exact.
A
B
Taper front pieces.
30 3/16
33"
18"
5 5/8"
3 1/2"
11 1/4"
3 3/4"
17 1/8"
45°
Shelf
5 1/4
6 11/16"
4 3/4"
60°
60°
10"
5 1/4"
Section A–A
30 3/16"
20 1/4"
33"
1 1/2" to 2"
Base optional.
SPKR. Board.
22 1/2"
21"
A
A
Shelf
Front view
Dia. to suit 12" to 15" Speaker.
4 5/8"
17 1/8"

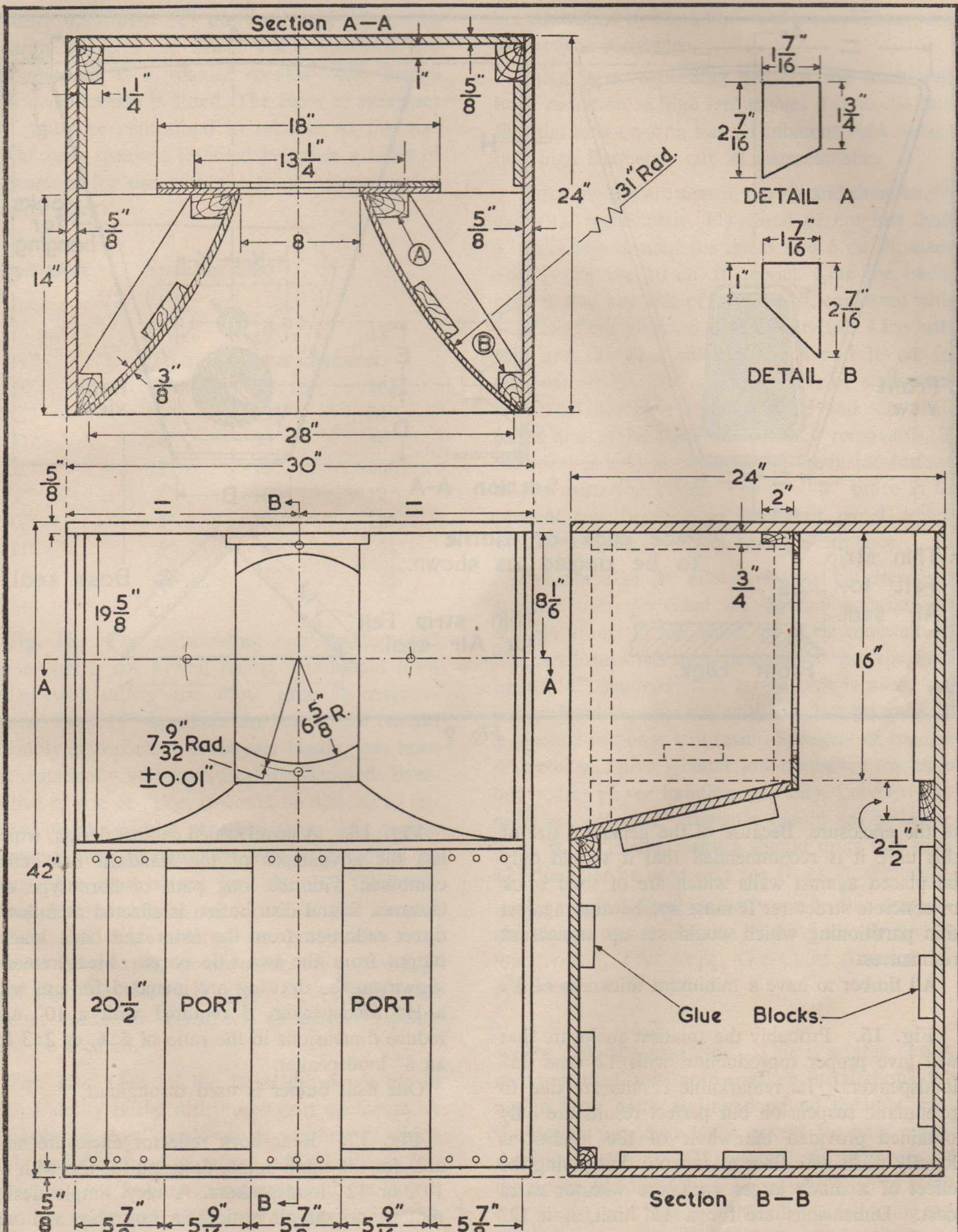
Fig. 7

Height from top.	Dimension. "A"
0	10·4"
1"	10·27"
2"	10·24"
3"	10·18"
4"	10·10"
5"	10·0"
6"	9·88"
7"	9·74"
8"	9·56"
9"	9·39"
10"	9·18"
11"	8·94"
12"	8·69"
13"	8·41"
14"	8·12"
15"	7·79"
16"	7·45"
17"	7·09"
18"	6·7"
19"	6·29"
20"	5·85"
21"	5·43"
22"	4·92"
23"	4·41"
24"	3·91"
25"	3·36"
26"	2·81"
27"	2·21"
28"	1·6"
29"	0·98"
30"	0·33"
30·1875"	Nil.



Pattern for cutting the twin taper pieces.

Fig. 7a



Section A—A
1"
5/8
1 1/4
18"
13 1/4
24"
31" Rad.
5/8
5/8
8
A
14"
B
3/8
28"
30"
DETAIL A
1 7/16
2 7/16
1 3/4
DETAIL B
1 7/16
1"
2 7/16
5/8
B
=
=
24"
2"
19 5/8
8 1/6
3/4
16"
A
A
6 5/8 R.
7 9/32 Rad.
±0·01"
2 1/2
42"
20 1/2
PORT
PORT
Glue
Blocks.
5/8
B
Section B—B
5 7/8
5 9/16
5 7/8
5 9/16
5 7/8

Fig. 8

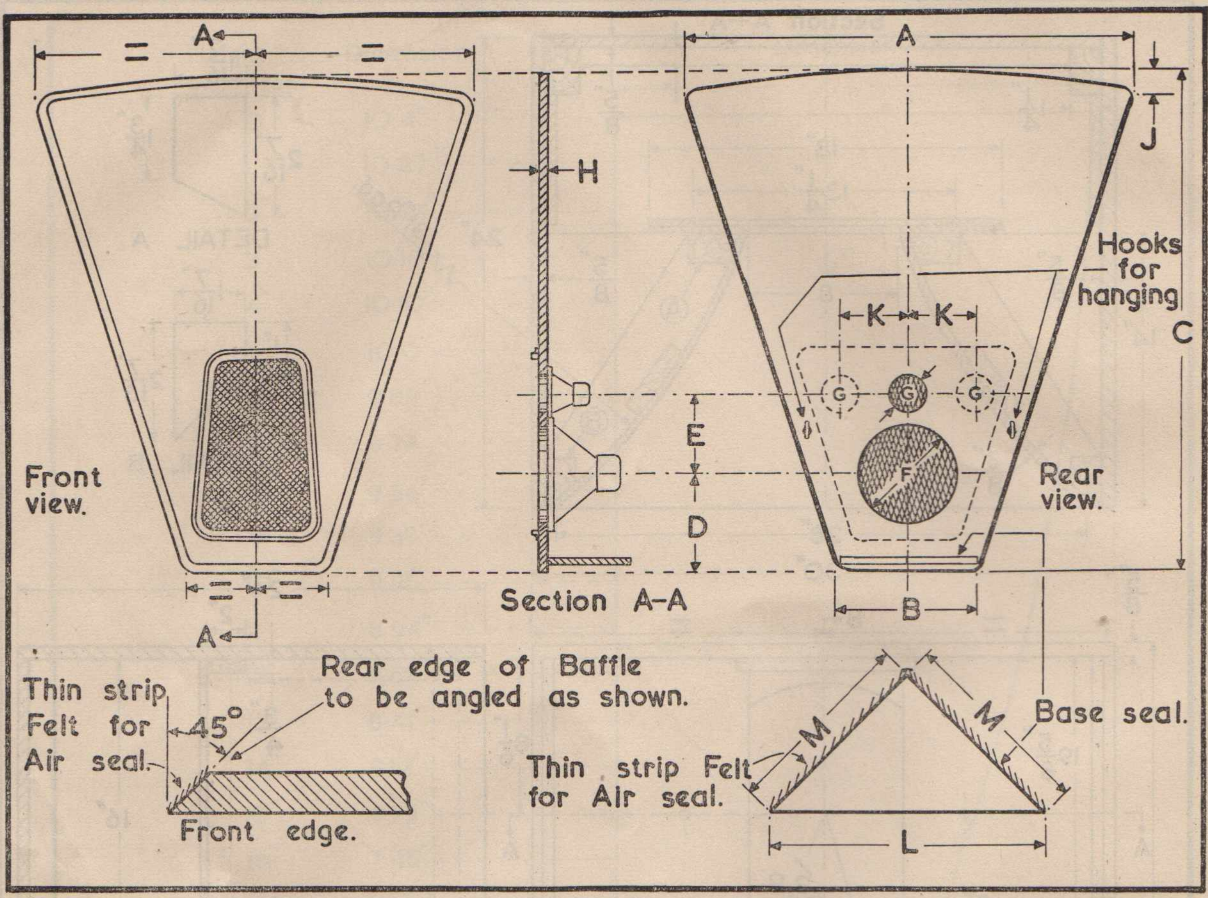


Fig. 9

of the enclosure. Because of the generous size of this unit, it is recommended that it should only be placed against walls which are of solid brick or concrete structure. It must not be used against thin partitioning which would set up unpleasant resonances.

All timber to have a minimum thickness of ¾″.

Fig. 15. Probably the smallest enclosure that will give proper reproduction with 12″ and 15″ loudspeakers. Its remarkable results are due to pneumatic suspension but perfect results are only obtained provided the whole of the interior is loosely filled with fibre glass wool thus giving the effect of a much larger enclosure without extra cost. Dimensions are for a 15″ unit, if a 12″ speaker is to be used, reduce the dimensions in the ratio of 4:5.

Fig. 16. A novel sealed cabinet design, which has the advantages of the standard bass-reflex combined with the long path of horn type enclosures. Sound distribution is effected as follows, direct radiation from the front and back loaded output from the two side ports. Measurements shown on the drawing are intended for use with a 12″ loudspeaker, if required with a 10″ unit reduce dimensions in the ratio of 5:6, or 2:3 for an 8″ loudspeaker.

One inch timber is used throughout.

Fig. 17. Rear horn reflector enclosure suitable for the small home, designed for use with 8″, 10″, or 12″ loudspeakers. A very simple design that is not at all critical in assembly and will provide pleasing results with the minimum outlay in time and expense. Timber used, ¾″ throughout.

Tweeter apertures "A" are used only when two separate tweeters are fitted. These apertures are not required if a diaxial speaker with bridge mounted tweeters is fitted. The faces of apertures "A" must be centralised in relation to the size of the bass speaker. Detailed below is a table of dimensions for use with the three recommended speaker sizes:—

Dimension	**Speaker Size**		
	8″	10″	12″
"A"	To suit tweeter diameter.		
"B"	6¾″	8.7/16″	10⅞″
"C"	18″	22½″	24″
"D"	24″	30″	36″
"E"	12″	15″	16″
"F"	8″	10″	12″
"G"	9″	10½″	12″
"H"	5″	6¼″	7½″
"J"	5″	6¼″	7½″

Fig. 18. For outstanding reproduction and where cost is not a vital factor, this folded horn design will satisfy the most exacting requirements. Two 15″ speakers are used and careful assembly is important as the rear loading has been mathematically and acoustically calculated. Irrespective of size or price, it would be difficult to improve on the results obtained from this design. Adequate interior damping must be provided by using fibre glas of not less than 1″ thickness, firmly secured to the rear wall of the circular sloping exit chute. Unless the prospective constructor is an expert woodworker, the author suggests that this design be given to a professional cabinet maker to construct, as perfect rigidity must be secured.

Fig. 19. One of the latest developments in High Fidelity is the distributed port enclosure. A "Distributed Port" enclosure is a reflex in which back and front radiation are added at low frequencies. Low frequency response and the power handling ability are both improved by using this system. It differs from most reflex enclosures in that the response and impedance characteristics are controlled by the addition of a specific amount of acoustic resistance.

There is no cancelling between the front and back radiation at high frequencies due to the fact that the reflex action has an inherent back radiation high frequency cut off characteristic.

Three models are shewn, ten six and three cu. ft. capacity, respectively. Ply wood of not less than ½″ thickness is used for the 3 and 6 cu. ft. sizes and ⅝″ for the 10 cu. ft. model. Line the back, bottom and one side of the 3 cu. ft. enclosure with 1″ thick fibre glass or good quality felt. Line bottom and two rear sides of the 6 and 10 cu. ft. enclosures with 2″ thick fibre glass or equivalent acoustical damping material. Glue and screw all joints and make the front or back removable, if the speaker is to be mounted on the inside surface of the mounting board. The 1″ × 2″ brace is to prevent reverberation in the front panel which would ruin the low frequency performance.

The shape of the enclosure may be altered to suit the user, provided the internal volume and configuration of the front panel is maintained. This enclosure has been designed to use speakers up to 12″ diameter, if a larger unit is used, the power handling capacity will rise, but poorer low frequency response will result. Speakers of smaller diameter will give a better low frequency response but poorer power handling capacity. Loudspeaker units exceeding 12″ diameter should not be in the 3 cu. ft. enclosure, neither should units less than 12″ diameter be used with the 10 cu. ft. enclosure.

The original development work on this remarkable design was carried out by the Audio Engineering division, T.V. Dept., G.E.C. of America. America.

Fig. 20, 20a and 20b. This is a large design recommended for multi-speaker installations for use in large halls, auditoriums and theatres, etc., the design uses two 12″ speakers for bass reproduction, and three 2½″ tweeters to take care of the upper register. Constructors who wish to build this model, will have no difficulty in following the three drawings provided, which are self explanatory.

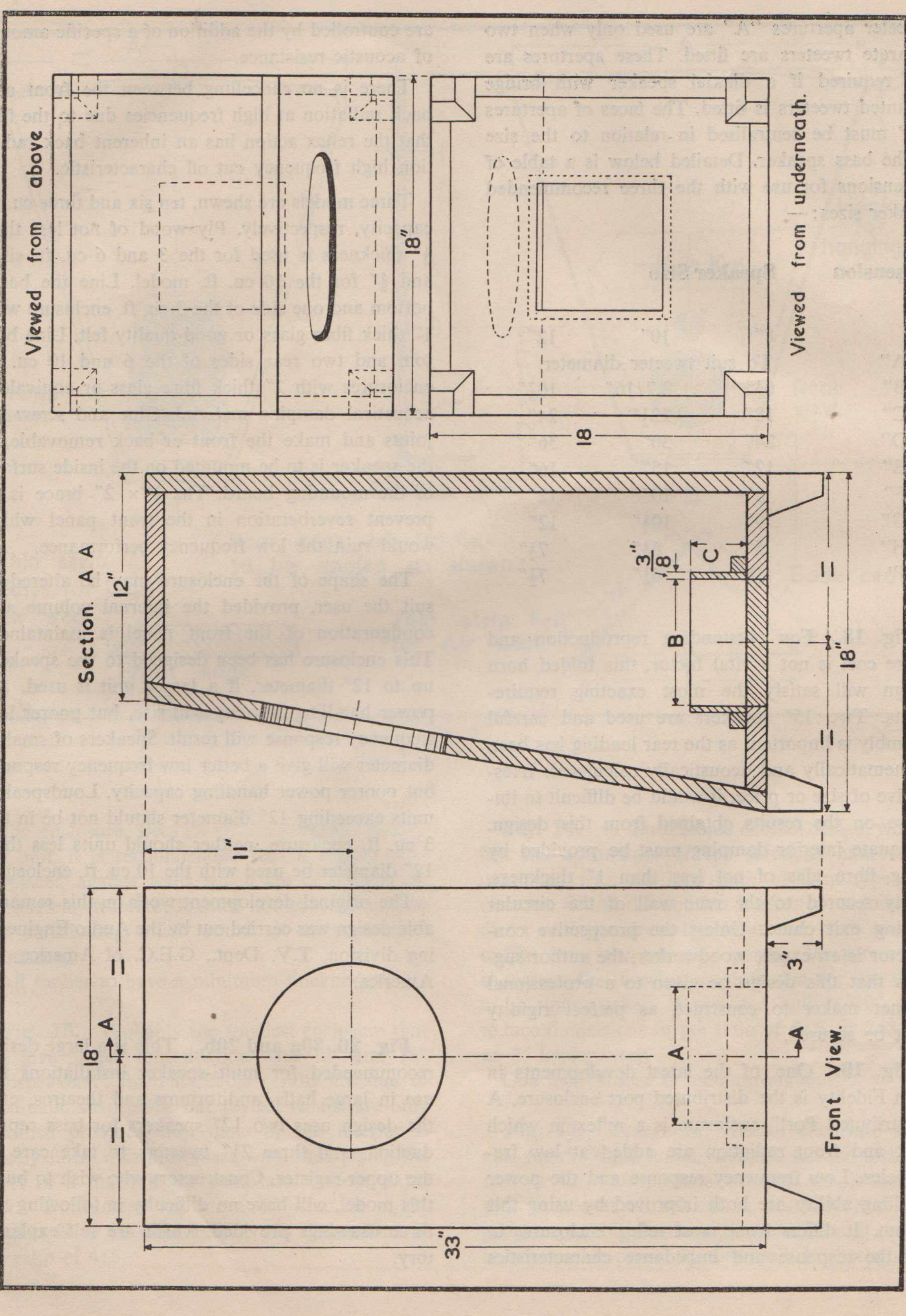

Viewed from above
18"
Viewed from underneath.
18
Section A A
12"
3/8"
C
B
18"
11"
3"
A
A
A
18"
Front View.
33"

Fig. 10

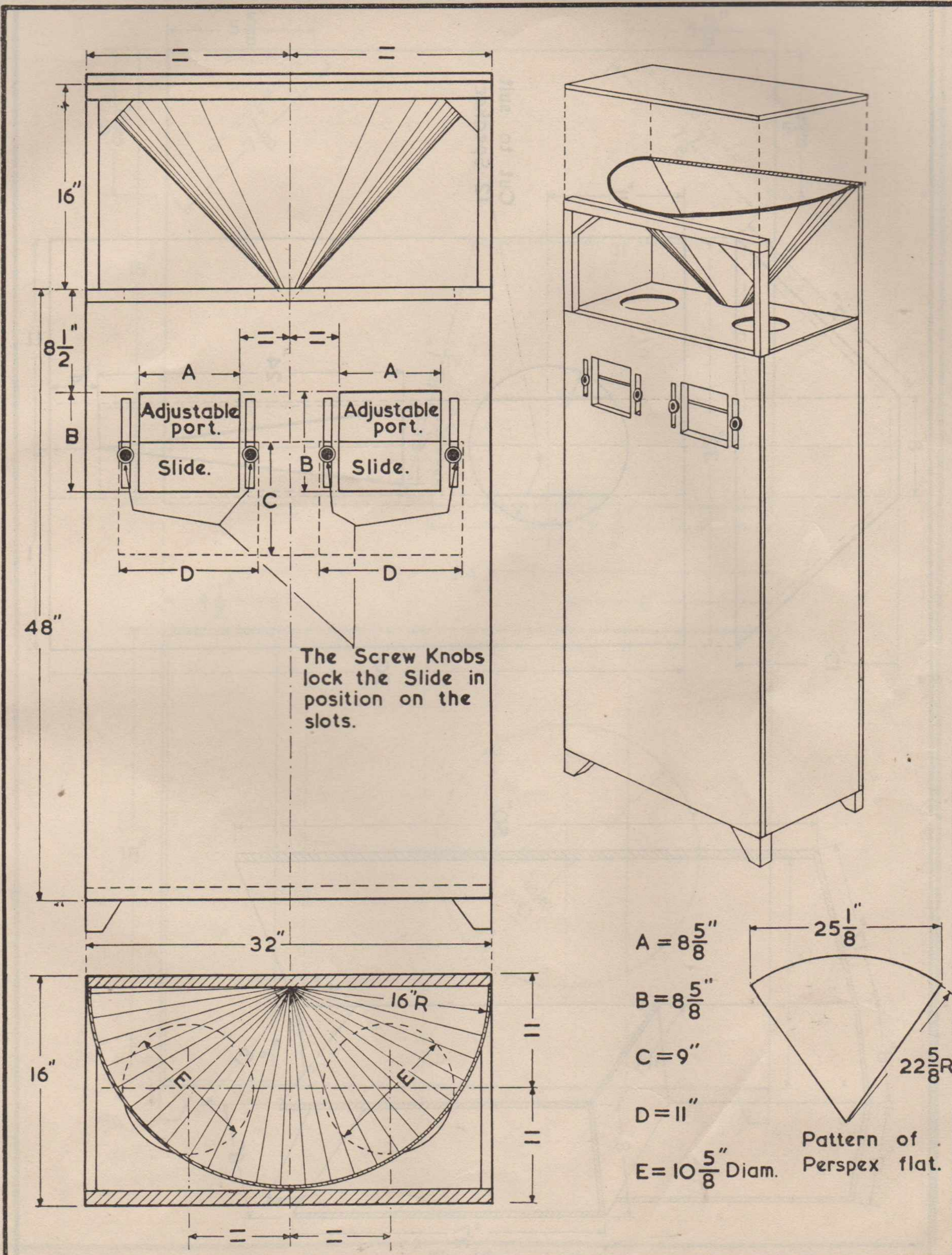

16"
8 1/2"
48"
A
B
C
D
Adjustable port.
Slide.
The Screw Knobs lock the Slide in position on the slots.
32"
16"R
E
16"
A = 8 5/8"
B = 8 5/8"
C = 9"
D = 11"
E = 10 5/8" Diam.
25 1/8"
22 5/8 R
Pattern of Perspex flat.

Fig. 11

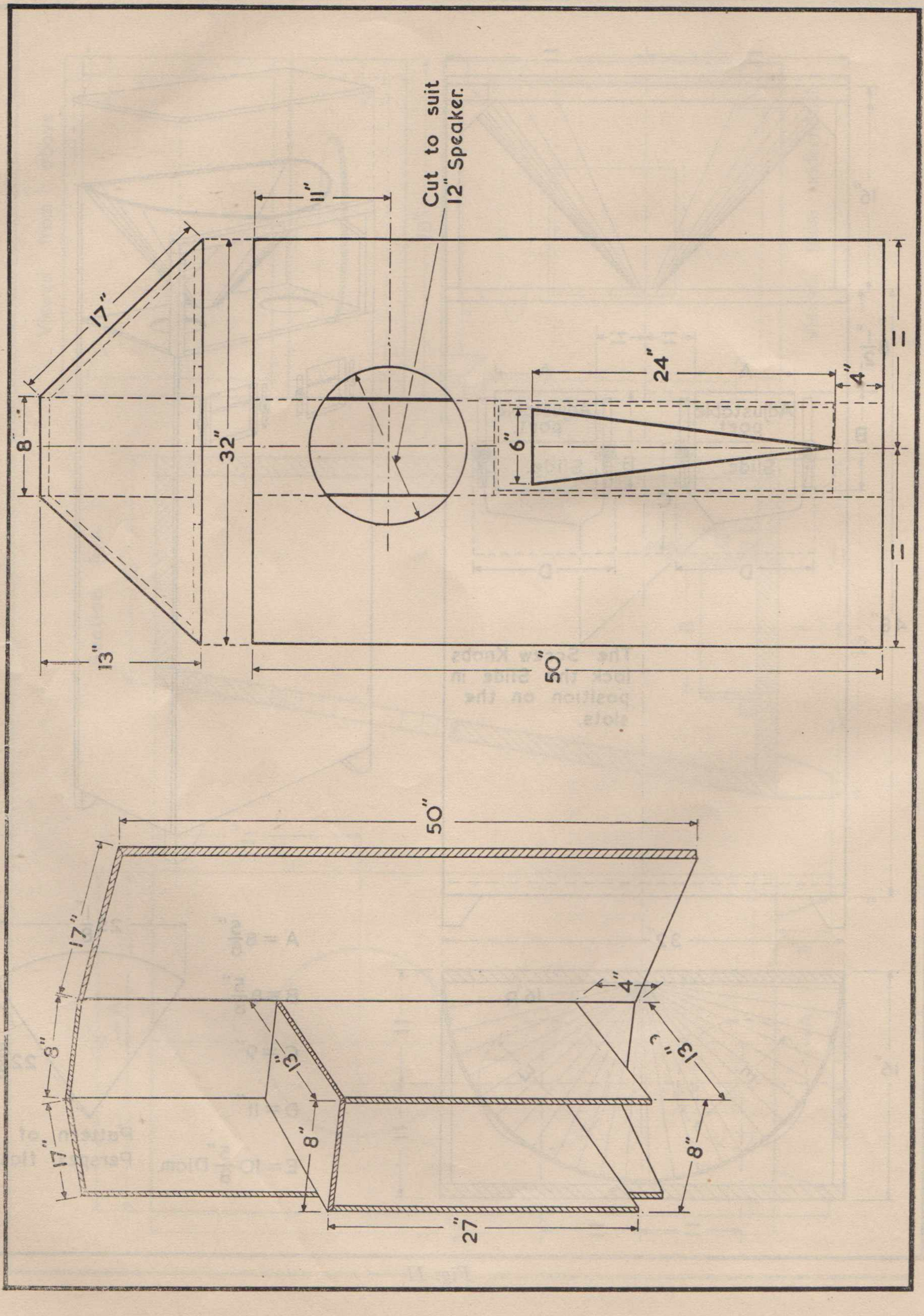


Fig. 12

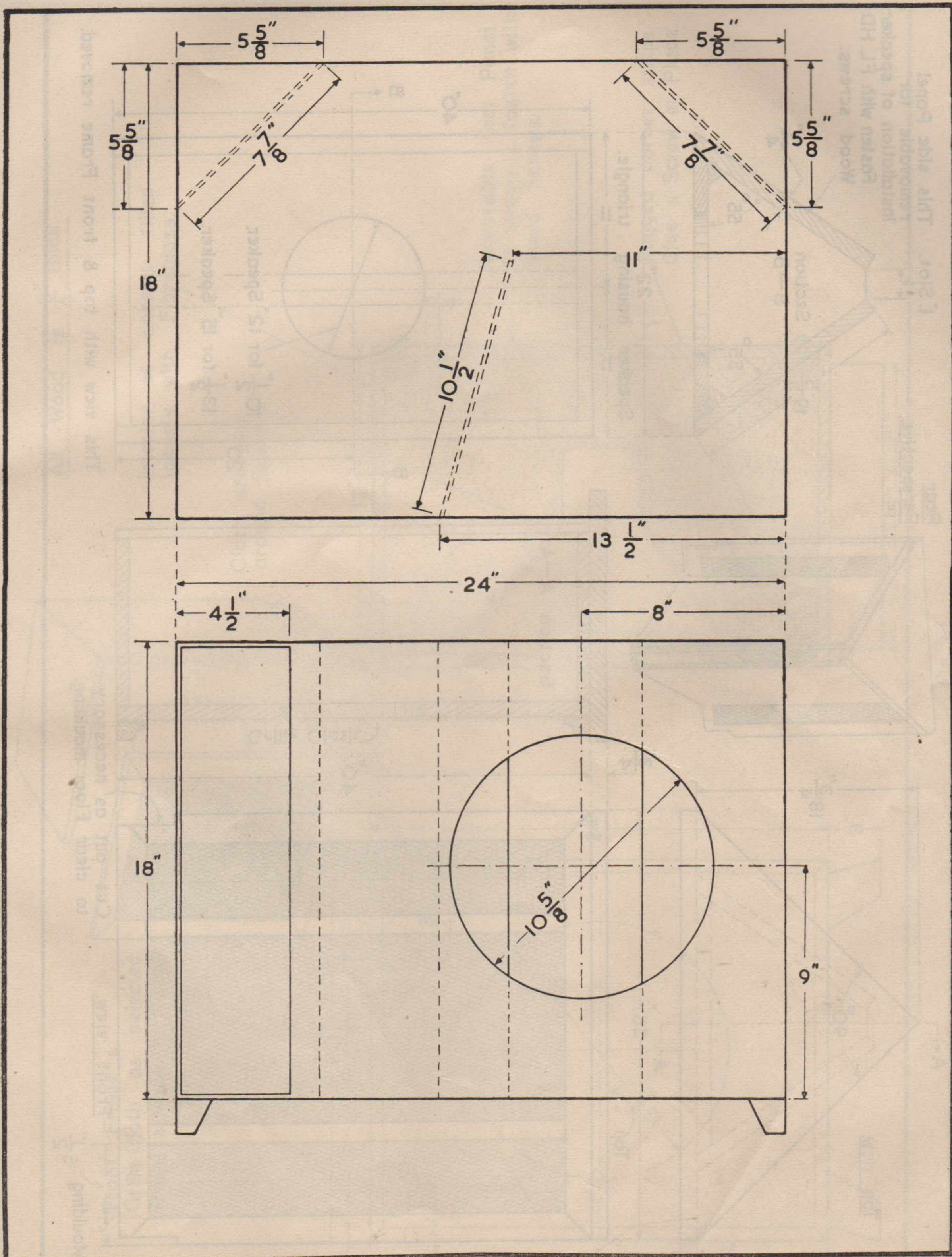
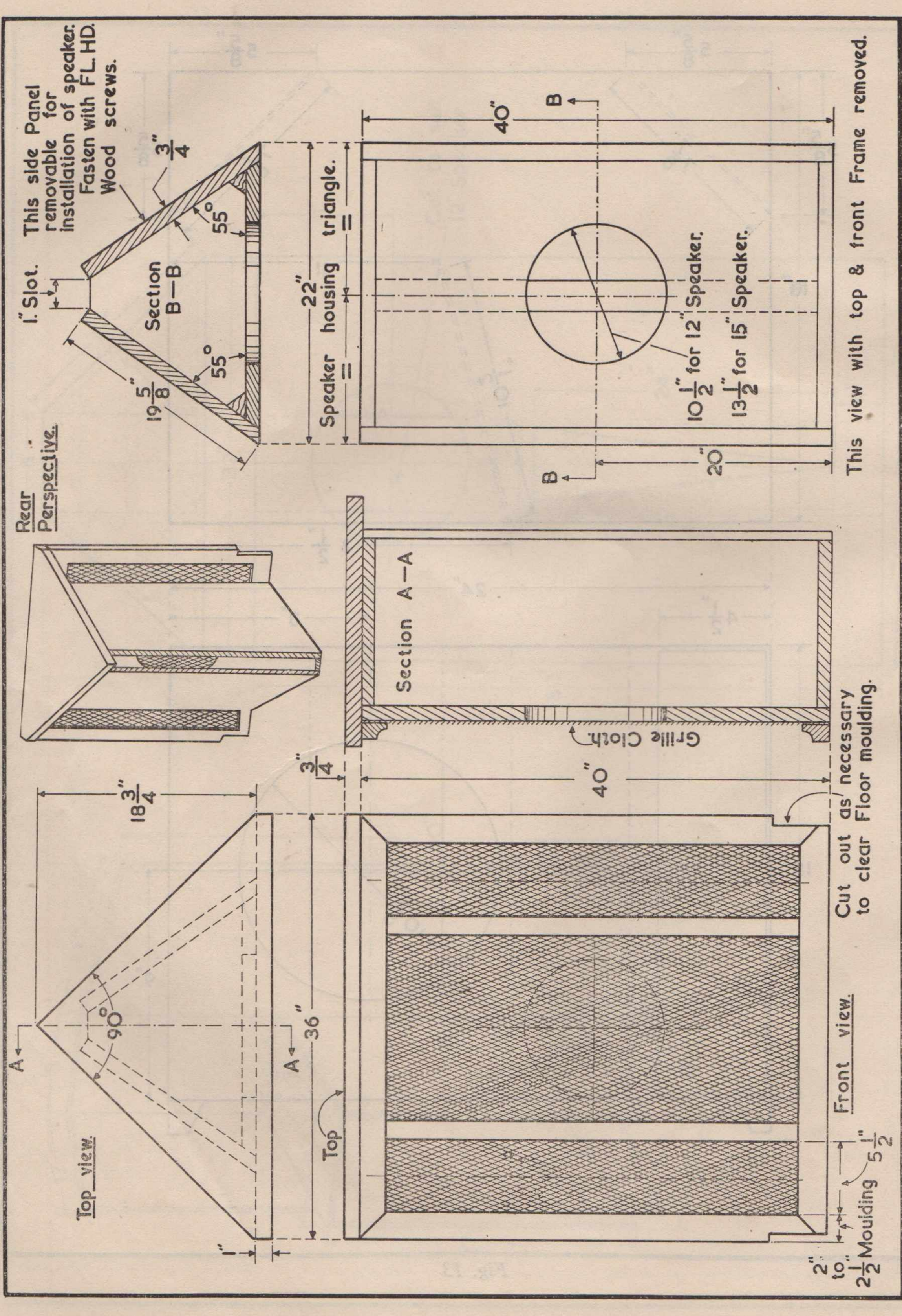


Fig. 13



This side Panel removable for installation of speaker. Fasten with FL. HD. Wood screws.
3/4"
1" Slot.
Section B—B
55°
55°
19 5/8"
22"
Speaker housing triangle.
40"
B
B
10 1/2" for 12" Speaker.
13 1/2" for 15" Speaker.
20"
This view with top & front Frame removed.
Rear Perspective.
Section A—A
Grille Cloth.
3/4"
40"
Cut out as necessary to clear Floor moulding.
18 3/4"
Top view.
90°
A
A
36"
Top
Front view.
1"
5 1/2"
2" to 2 1/2" Moulding

Fig. 14

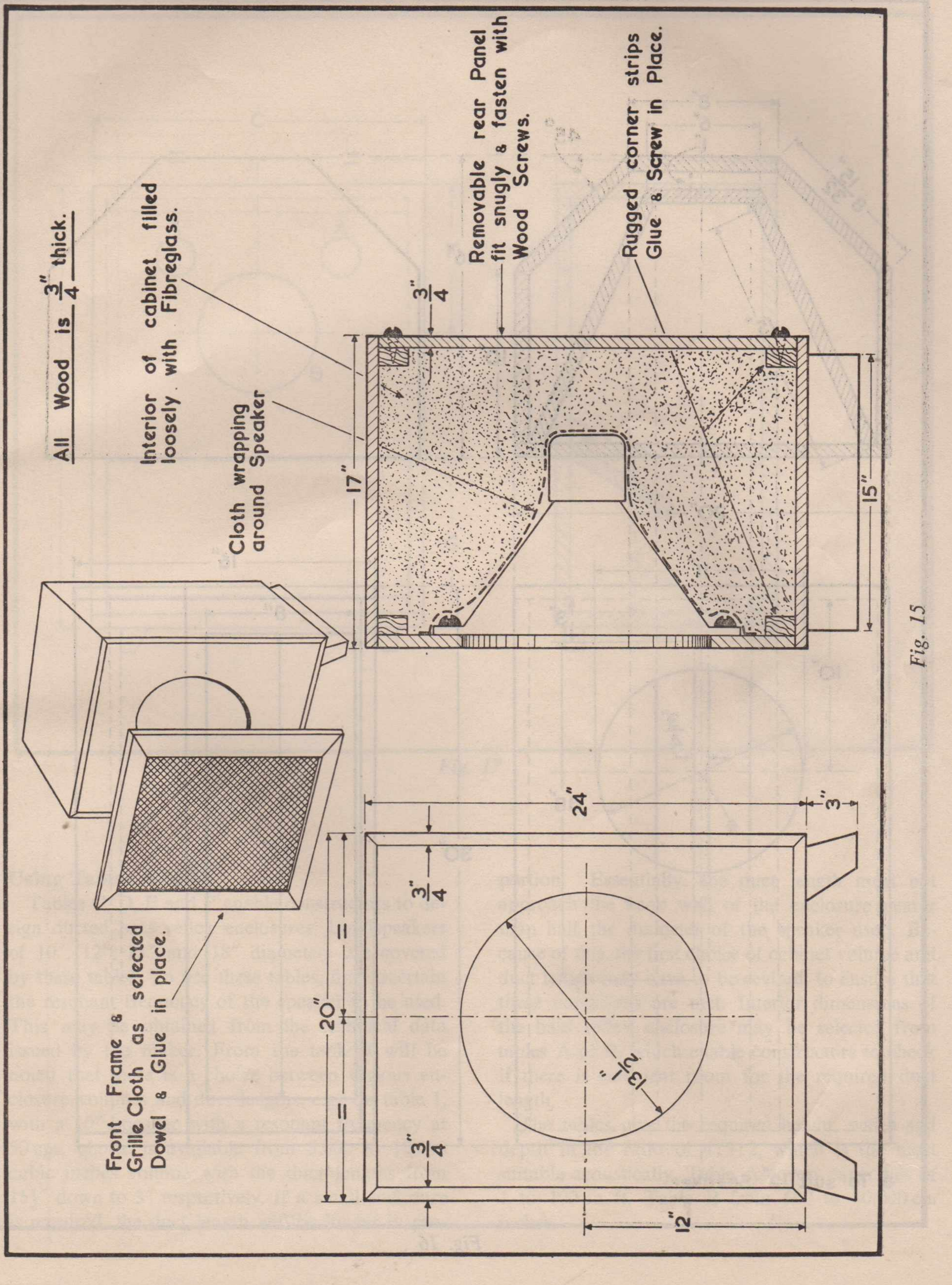

All Wood is 3/4" thick.
Interior of cabinet filled loosely with Fibreglass.
Cloth wrapping around Speaker
Removable rear Panel fit snugly & fasten with Wood Screws.
Rugged corner strips Glue & Screw in Place.
Front Frame & Grille Cloth as selected Dowel & Glue in place.
3/4
17"
15"
24"
3"
20"
13 1/2"
12"
=
=

Fig. 15

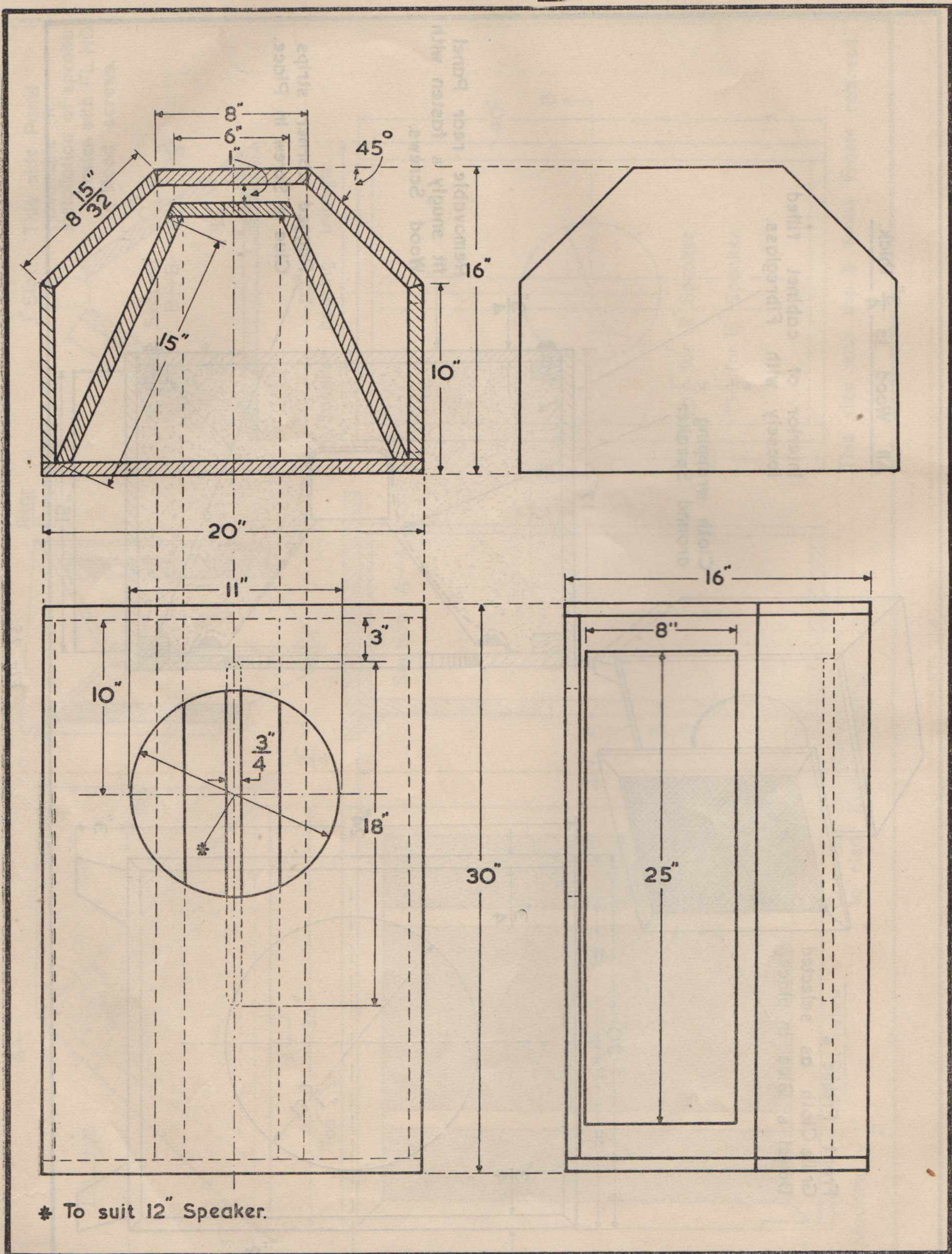


Fig. 16

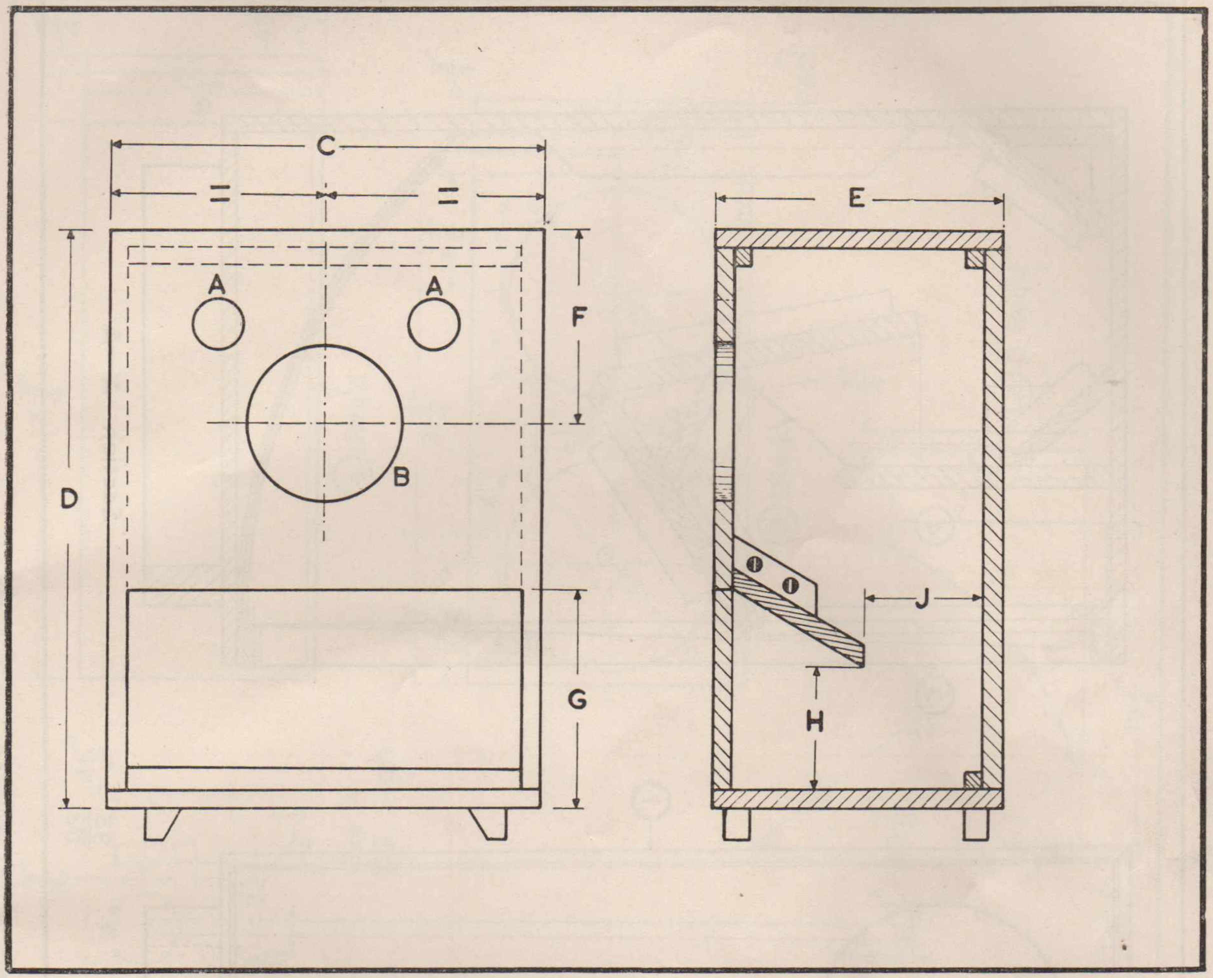


Fig. 17

Using Tables A to F

Tables C, D, E and F enable constructors to design ducted bass reflex enclosures. Loudspeakers of 10″, 12″, 15″ and 18″ diameters are covered by these tables. To use these tables, first ascertain the resonant frequency of the speaker to be used. This may be obtained from the technical data issued by the maker. From the table it will be noted that there is a choice between various enclosure volumes and duct lengths, e.g., on table 1, with a 10″ speaker with a resonant frequency at 50 cps. choice is available from 5,000 to 10,000 cubic inches volume with the duct lengths from 15½″ down to 3″ respectively. If a small enclosure is required, the duct length will be longer in proportion. Essentially, the duct length must not approach the back wall of the enclosure nearer than half the diameter of the speaker used. Because of this, the first choice of cabinet volume and duct length may have to be revised, to ensure that these conditions are met. Interior dimensions of the bass reflex enclosure may be selected from tables A or B, which enable constructors to check if there is sufficient room for the required duct length.

The tables give the required height, width and depth in the ratio of 4:3:2, which is the most suitable acoustically. Table A covers capacities of 1 to 100 cu. ft. Table B from 500 to 40,000 cu. inches.

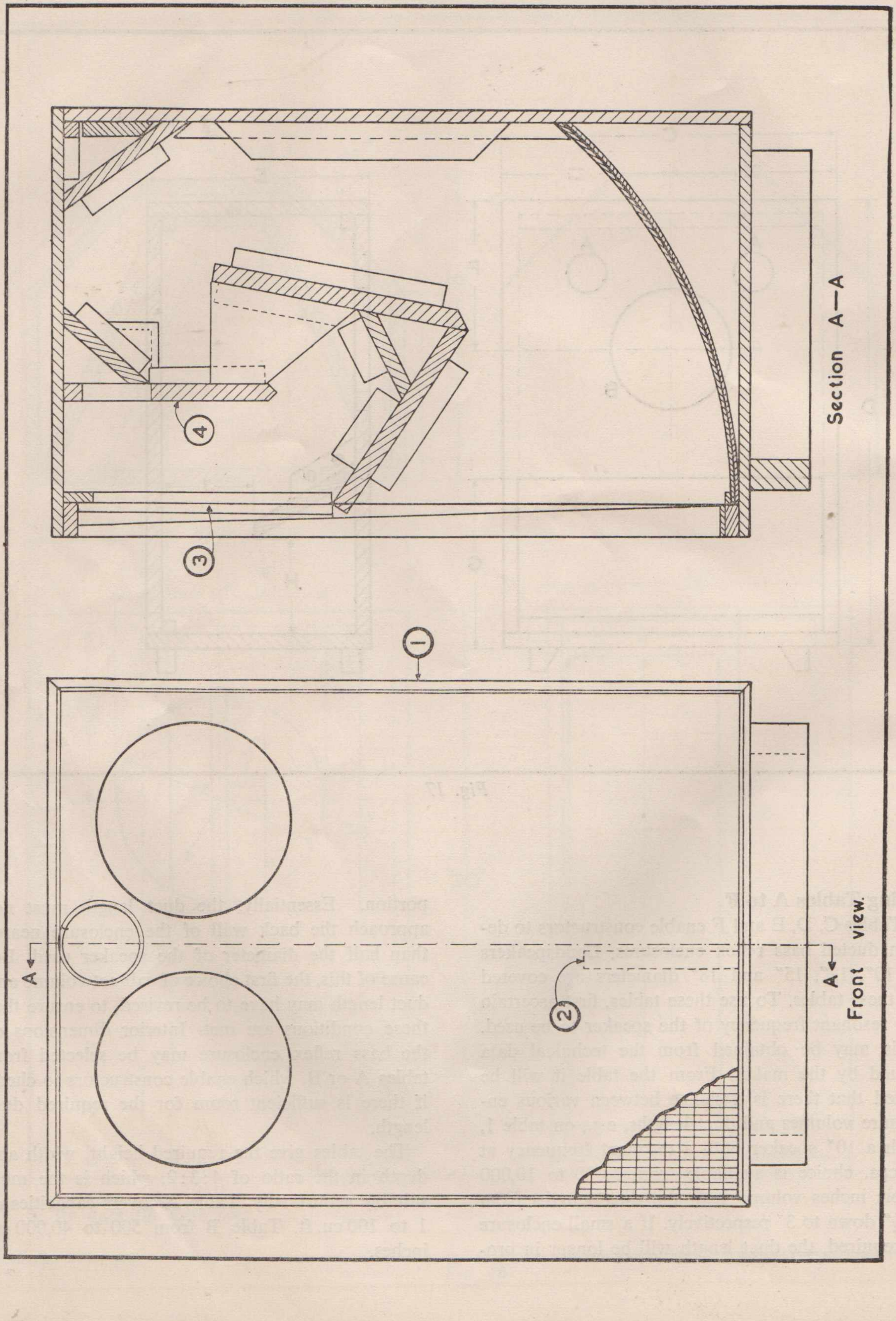


Fig. 18

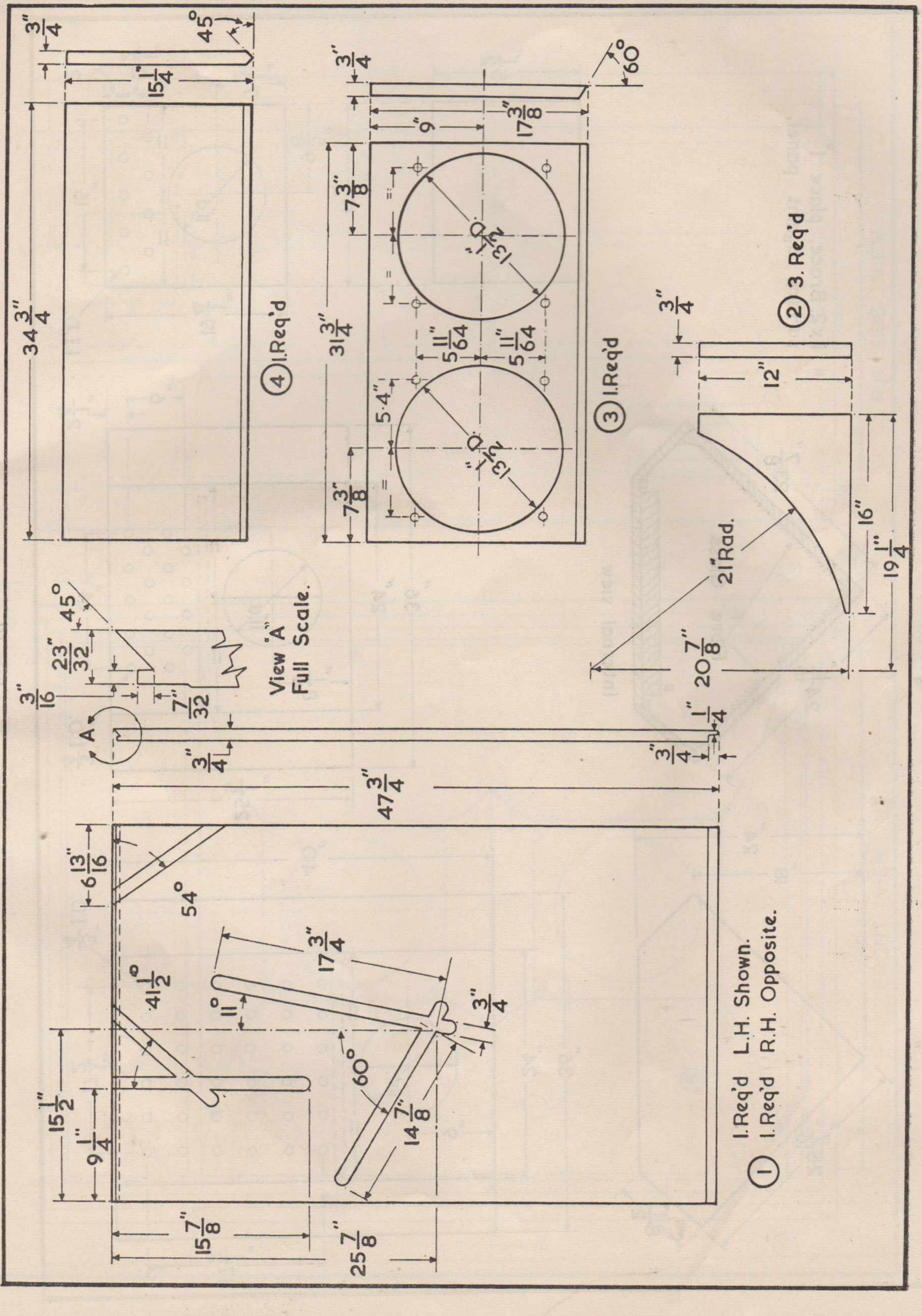
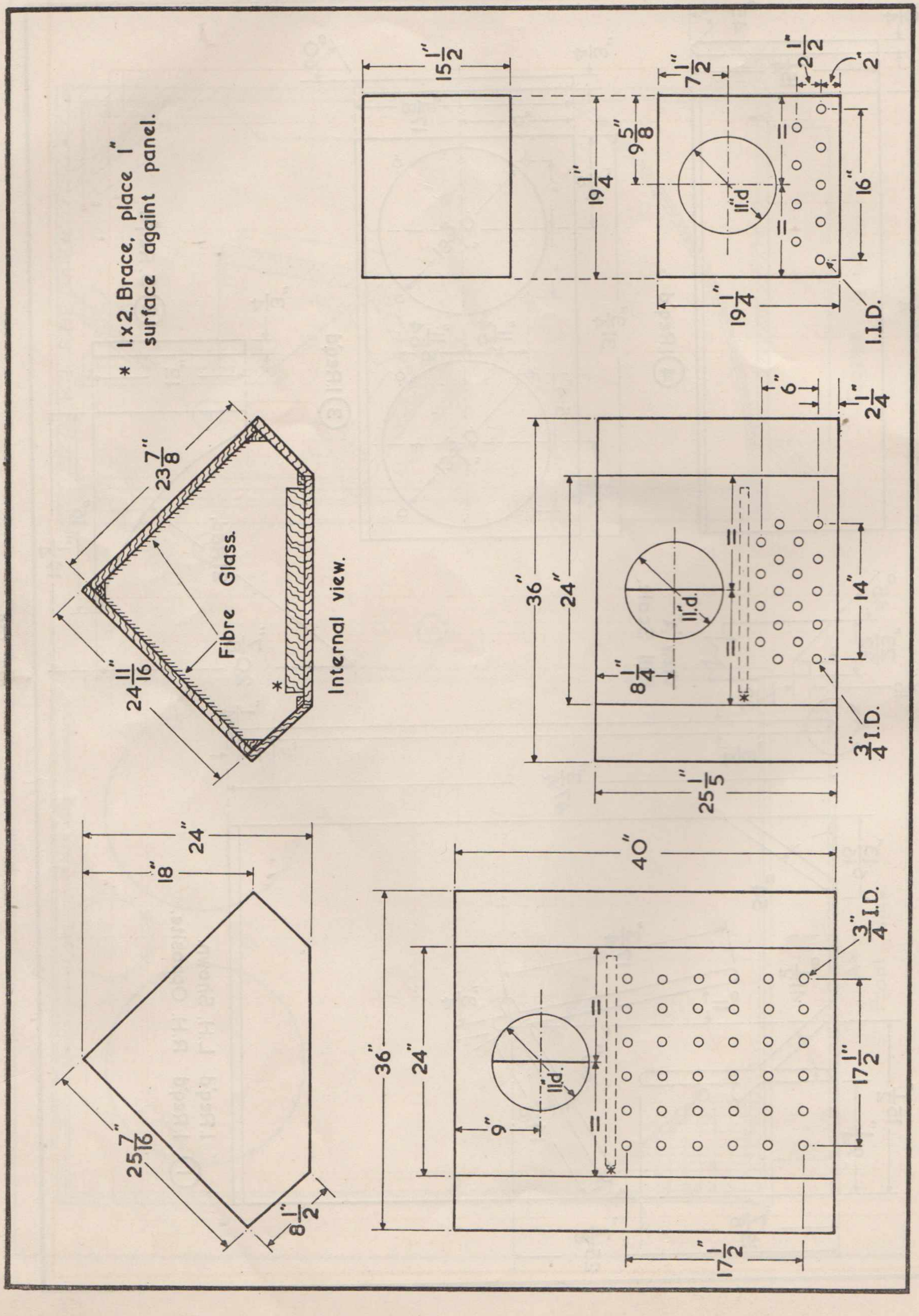

4 1.Req'd
3 1.Req'd
2 3. Req'd
1 1.Req'd L.H. Shown.
1.Req'd R.H. Opposite.
View "A" Full Scale.
A
21" Rad.

Fig. 18a



* 1.x2. Brace, place 1" surface againt panel.
Fibre Glass.
Internal view.
I.I.D.
3/4 I.D.

Fig. 19

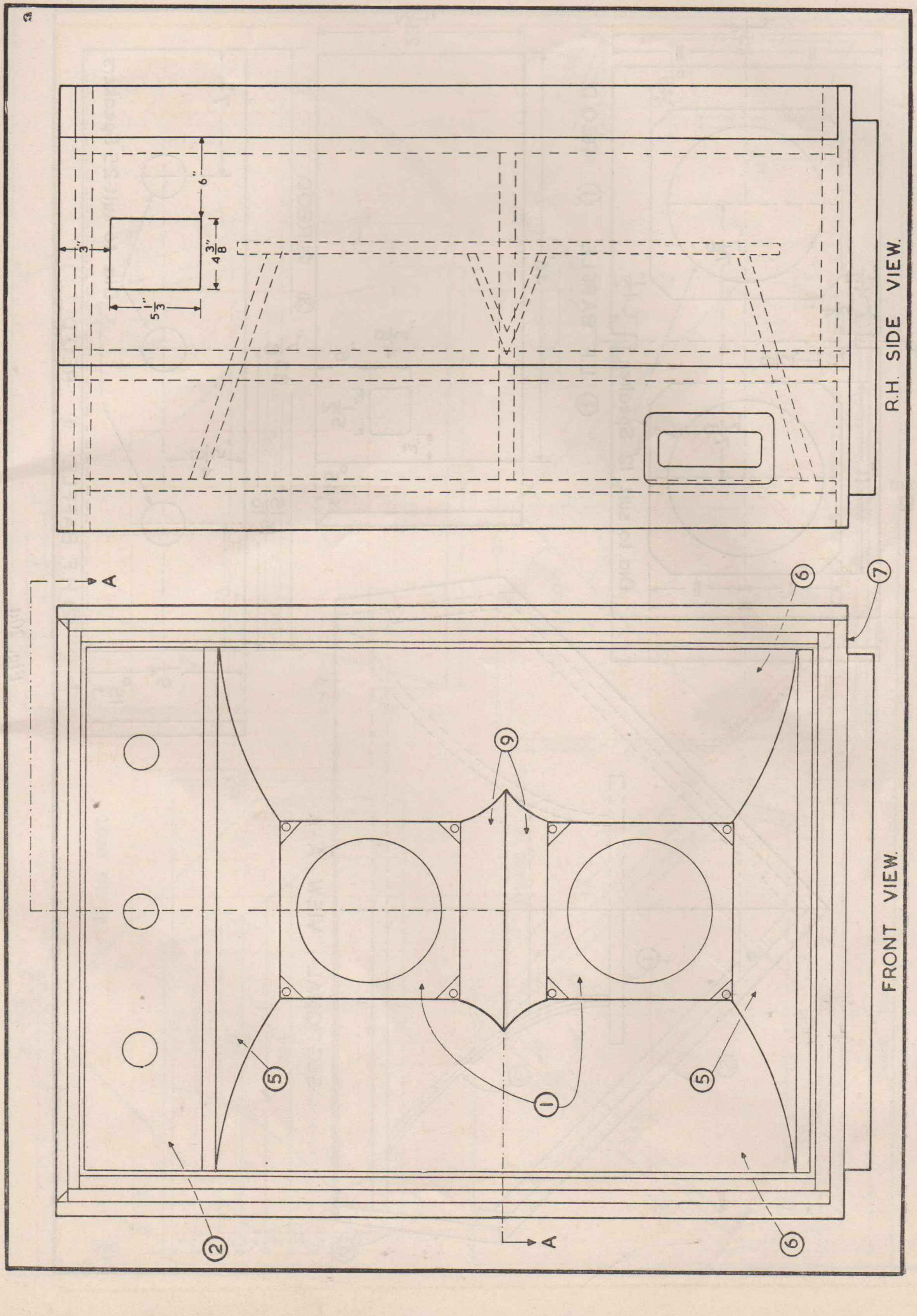


Fig. 20

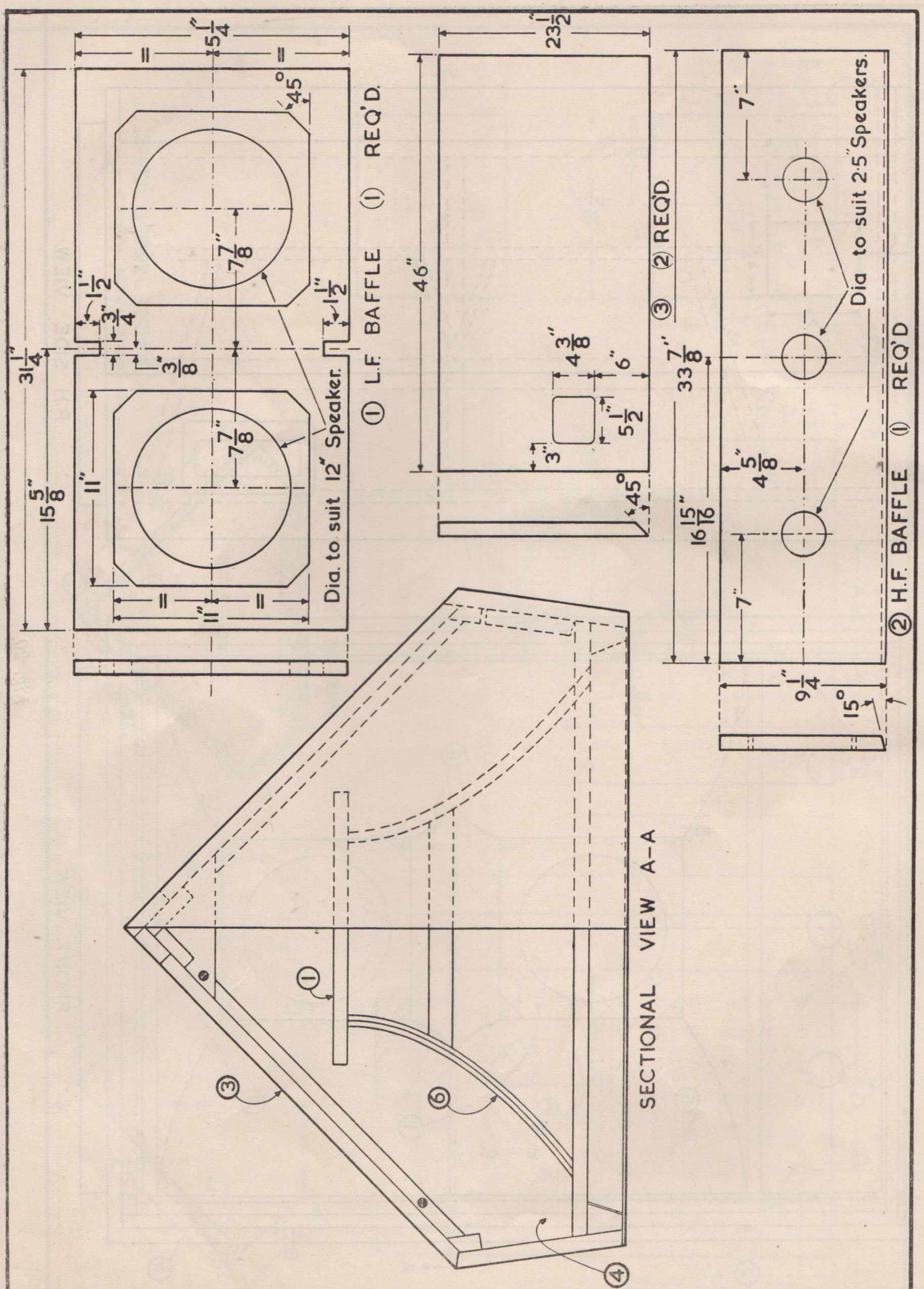

① L.F. BAFFLE (1) REQ'D.
Dia. to suit 12" Speaker.
③ ② REQ'D.
② H.F. BAFFLE (1) REQ'D
Dia to suit 2·5" Speakers.
SECTIONAL VIEW A–A
46"
$23\frac{1}{2}$"
$31\frac{1}{4}$"
$15\frac{5}{8}$"
$5\frac{1}{4}$"
$7\frac{7}{8}$"
$33\frac{7}{8}$"
$16\frac{15}{16}$"
$9\frac{1}{4}$"
$4\frac{5}{8}$"
$4\frac{3}{8}$"
$5\frac{1}{2}$"
11"
7"
6"
3"
45°
15°

Fig. 20a

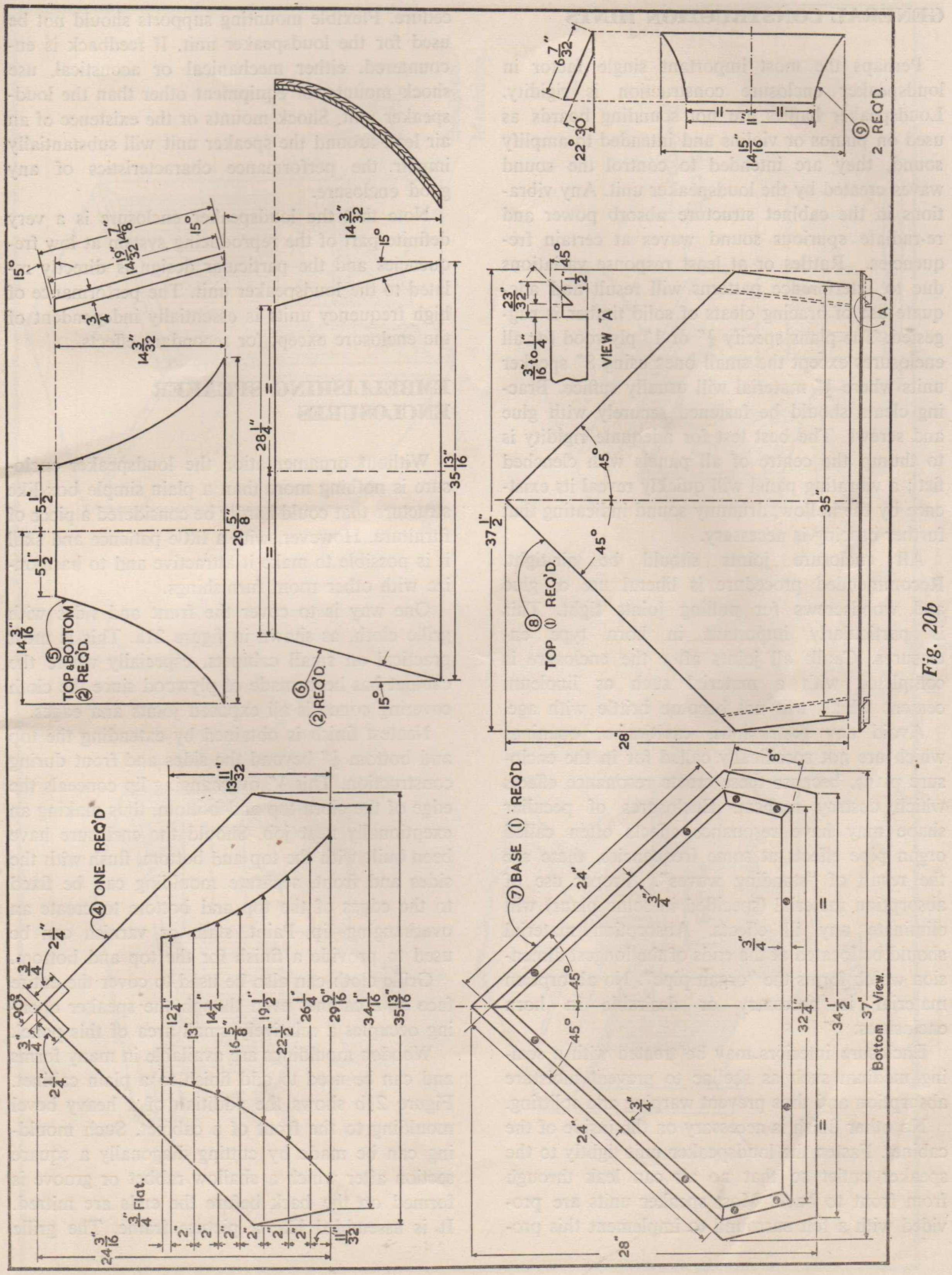

⑨ 2 REQ'D
VIEW 'A'
TOP ① REQ'D ⑧
TOP & BOTTOM ⑤ 2 REQ'D.
⑥ 2 REQ'D
④ ONE REQ'D
⑦ BASE ① REQ'D
Bottom View.
3/4 Flat.

Fig. 20b

GENERAL CONSTRUCTION HINTS

Perhaps the most important single factor in loudspeaker enclosure construction is rigidity. Loudspeaker baffles are not sounding boards as used on pianos or violins and intended to amplify sound, they are intended to control the sound waves created by the loudspeaker unit. Any vibrations in the cabinet structure absorb power and re-radiate spurious sound waves at certain frequencies. Rattles or at least response variations due to interference patterns will result and adequate use of bracing cleats of solid timber is suggested. The plans specify $\frac{3}{4}''$ or 1″ plywood for all enclosures except the small ones using 8″ speaker units where $\frac{1}{2}''$ material will usually suffice. Bracing cleats should be fastened securely with glue and screws. The best test for adequate rigidity is to thump the centre of all panels with clenched fist ; a vibrating panel will quickly reveal its existence by the hollow, drummy sound indicating that further bracing is necessary.

All enclosure joints should be air-tight. Recommended procedure is liberal use of glue and woodscrews for pulling joints tight. This is particularly important in horn type enclosures. Caulk all joints after the enclosure is completed with a material such as linoleum cement which will not become brittle with age.

Avoid any restrictions, cavities or openings which are not specifically called for in the enclosure plans, because these create resonance effects which destroy realism. Enclosures of peculiar shape may have resonance effects often called organ pipe effects at some frequencies, these are the result of "standing waves". Proper use of absorption material (specified in some plans) will eliminate any ill effects. Absorption material should be located at the ends of the longest dimension which forms the "organ pipe". No absorption material is necessary or desirable in horn enclosures.

Enclosure interiors may be treated with a sealing medium such as shellac to prevent moisture absorption and thus prevent warping and splitting.

No other finish is necessary on the inside of the cabinet. Fasten the loudspeaker unit tightly to the speaker outlet so that no air can leak through from front to back. Most speaker units are provided with a felt surround to implement this procedure. Flexible mounting supports should not be used for the loudspeaker unit. If feedback is encountered, either mechanical or acoustical, use shock mounts for equipment other than the loudspeaker unit. Shock mounts or the existence of an air leak around the speaker unit will substantially impair the performance characteristics of any good enclosure.

Note that the loudspeaker enclosure is a very definite part of the reproducing system at low frequencies and the particular design is directly related to the loudspeaker unit. The performance of high frequency units is essentially independent of the enclosure except for secondary effects.

EMBELLISHING SPEAKER ENCLOSURES

Without ornamentation the loudspeaker enclosure is nothing more than a plain simple box-like structure that could hardly be considered a piece of furniture. However, with a little patience and skill it is possible to make it attractive and to harmonize with other room furnishings.

One way is to cover the front and sides with grille cloth, as shown in figure 21a. This is most practical on small cabinets, especially where the cabinet has been made of plywood since the cloth covering conceals all exposed joints and edges.

Neatest finish is obtained by extending the top and bottom $\frac{1}{8}''$ beyond the sides and front during construction. This $\frac{1}{8}''$ overhanging lip conceals the edge of the cloth top and bottom, thus making an exeptionally neat job. Should the enclosure have been built with the top and bottom, flush with the sides and front, separate moulding can be fixed to the edges of the top and bottom to create an overhanging lip. Paint, stain or varnish can be used to provide a finish for the top and bottom.

Grille cloth can also be used to cover the entire face of a cabinet even though the speaker opening occupies a relatively small area of this panel.

Wooden mouldings are available in many forms and can be used to add finish to a plain cabinet. Figure 21b shows the addition of a heavy bevel moulding to the front of a cabinet. Such moulding can be made by cutting diagonally a square section after which a shallow rabbet or groove is formed on the back before the ends are mitred. It is assembled like a picture frame. The grille

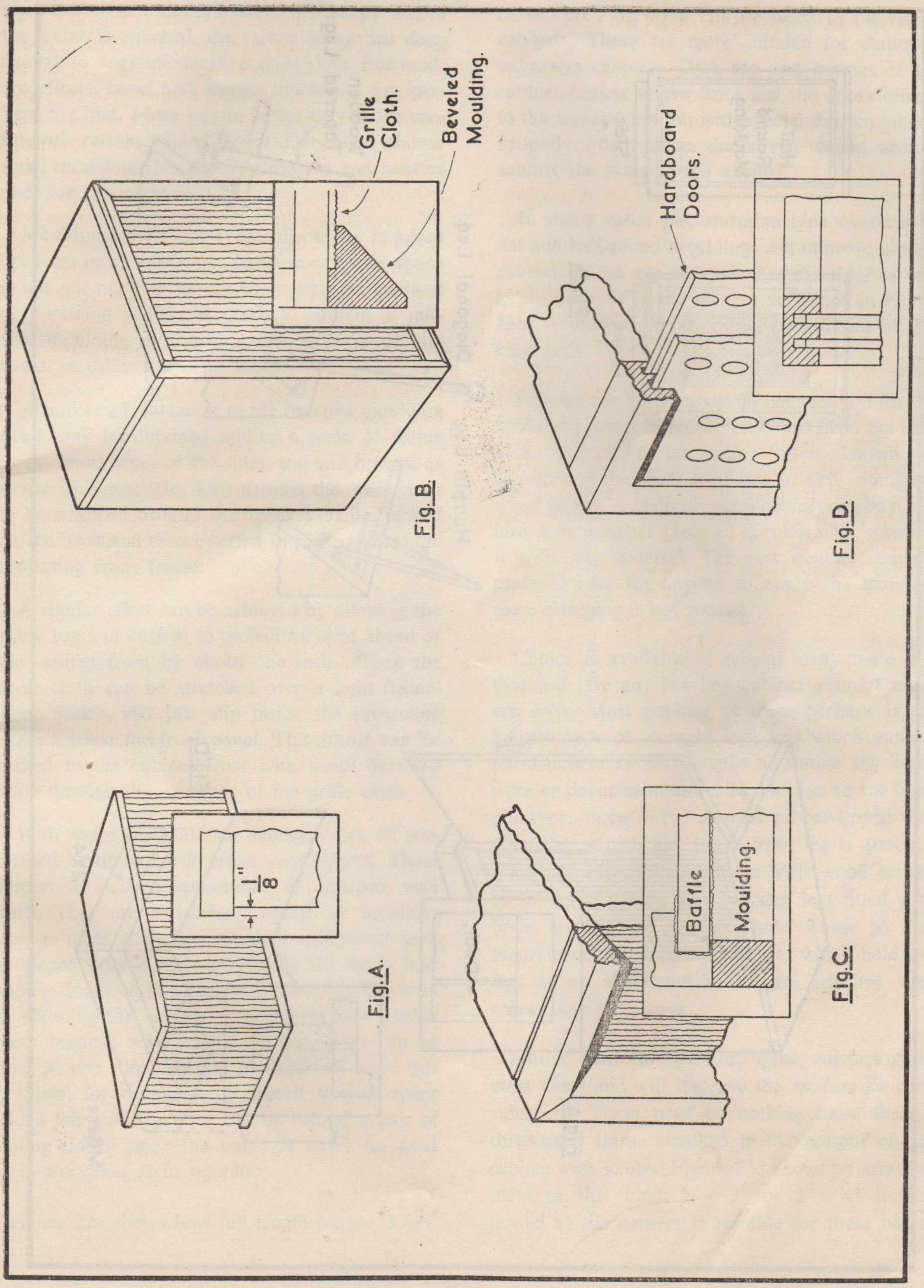

Grille Cloth.
Beveled Moulding.
Fig. B
Hardboard Doors.
Fig. D
1/8"
Fig. A
Baffle
Moulding.
Fig. C

Fig. 21

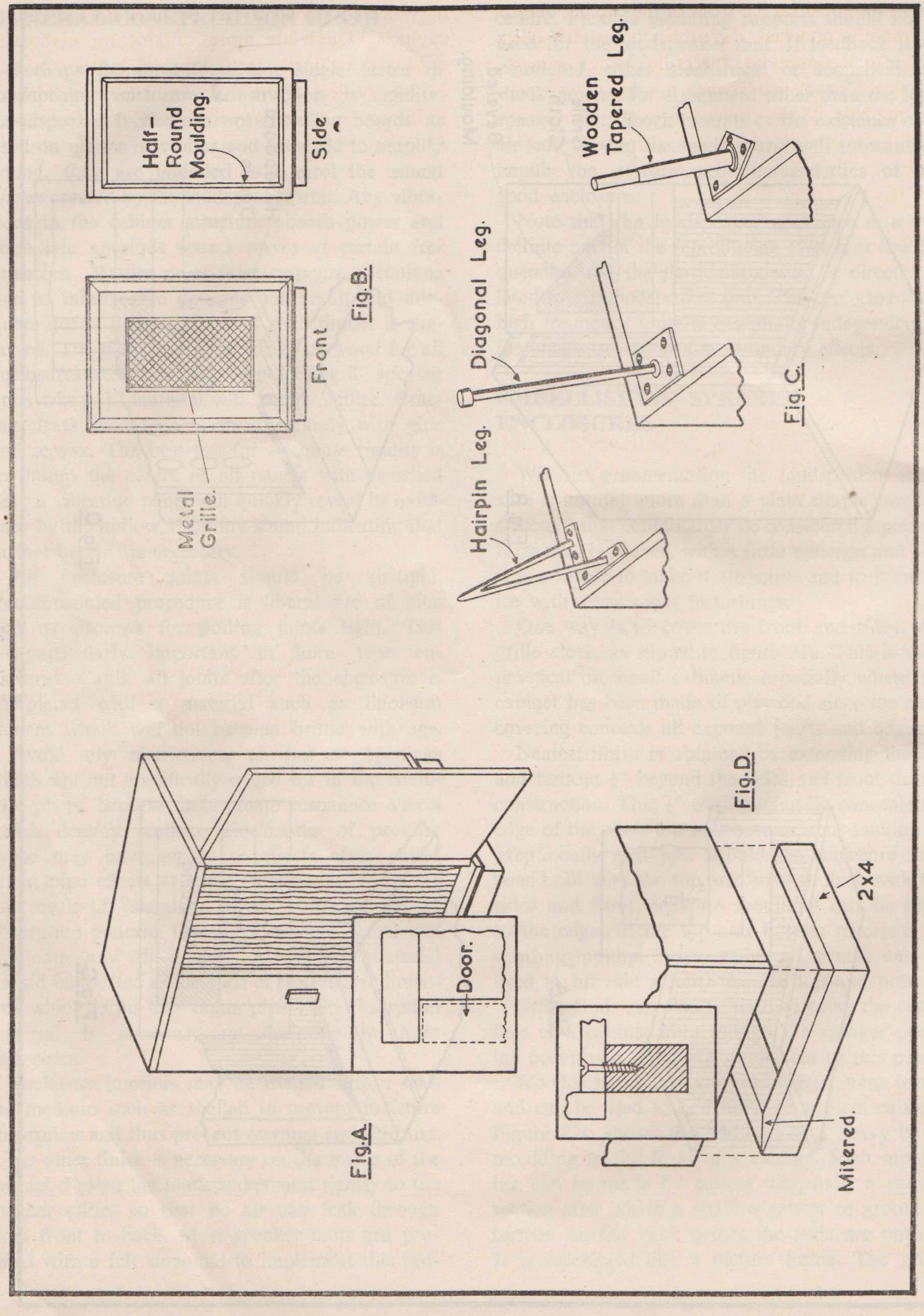


Fig. A.
Door.
Fig. B.
Metal Grille.
Front
Half-Round Moulding.
Side
Fig. C.
Hairpin Leg.
Diagonal Leg.
Wooden Tapered Leg.
Fig. D.
2x4
Mitered.

Fig. 22

cloth is mounted on the front of the cabinet before the frame is attached, the rabbet being just deep enough to accommodate the grille cloth. For modern effects, bevel and square mouldings are perhaps the best. More ornate forms may prove useful with certain cabinet styles. Generally, choose small mouldings for small enclosures and heavier ones for the larger variety.

Mouldings must not encroach on the required openings in an enclosure. In some cases the space is not adequate to permit their use. One method of obtaining additional space to support a suitable moulding is to add a second layer of plywood, in other words, a double top.

A sunken effect similar to the bevelled moulding effect may be obtained adding a plain $\frac{3}{4}''$ frame to the front edges of the sides, top and bottom as shewn in Figure 21c. This permits the grille cloth to be wrapped around the speaker baffle, tacked on the back and then inserted in place against the projecting front frame.

A similar effect can be achieved by allowing the sides, top and bottom to project forward ahead of the cabinet front by about one inch. Then the grille cloth can be stretched over a light framework which will just slip inside the projecting edges against the front panel. This frame can be tacked to the cabinet front with small finishing nails through the openings of the grille cloth.

With some installations, sliding doors of perforated hardboard will prove very helpful. These impart a modern appearance to grouped wall units. They are particularly useful for amplifier storage units and other types of equipment such as record storage cabinets. Figure 21d shows how sliding doors of this kind are installed. Use care in planning the cabinet arrangement when using them because only half of the door area can be open at one time. Careful thought will solve this problem, for example, the record storage space and a television receiver can be behind a pair of sliding doors since the one will never be used when the other is in operation.

Figure 22a shows how full length hinged doors of veneered plywood can be fitted to individual cabinets. These are more suitable for elaborate expensive cabinets. Both top and bottom of the cabinet project at the front and the doors hinged to the top and bottom with special flat pin hinges. Properly fitted, these doors can swing around against the sides of the cabinet.

In many cases picture-frame type overlays of flat and half-round mouldings will improve a plain cabinet. These can be applied to the sides as well as to the front in the manner suggested in Figure 22b. A number of interesting possibilities of this kind exist.

Perhaps the most important contribution for the home workshop in recent years has been the durable, decorative laminates (often known as counter-top material) available in rich, simulated wood grains. A plain plywood cabinet can be made into a reasonable piece of furniture by covering it with this material. The new contact cements make it easy for anyone to apply the laminate since clamping is not necessary.

Choice is available of several ready-made legs that will give any low-boy cabinet a smart modern look. Most popular of these perhaps is the hairpin type of wrought iron legs which can be purchased in various lengths at almost any hardware or department store. In addition to the hairpin type, there is the straight rubber-tipped diagonal leg, which like the hairpin leg is attached solidly to the cabinet bottom with wood screws as shown in Figure 22c. Wooden legs fitted with brass ferrules are also available. These go into separate metal mounting brackets which hold the legs at an angle and which are attached with screws, like the others.

Simple platform bases are quite satisfactory in most cases and will improve the appearance considerably. These need be nothing more than a three-sided frame attached to the bottom of the cabinet with screws. Figure 22d shows an arrangement of this kind, $2'' \times 2''$ or $2'' \times 4''$ timber mitred at the corners is suitable for these bases.

Tuning

So that maximum benefit may be derived from a given bass-reflex enclosure it is necessary to tune it to suit the particular loudspeaker unit employed. Firstly, it is necessary to know the fundamental resonance of the loudspeaker and for this purpose an audio oscillator, amplifier and AC voltmeter are required.

Place the loudspeaker unit on the table cone facing upwards, no baffle of any description is used. Connect speech coil to amplifier through 100 ohm 1 watt resistor, that is, a resistance of 100 ohms is in series with loudspeaker and amplifier see Fig. 23. Across the speech coil a low reading AC voltmeter is wired, 0-5 or 0-10 volts is suitable. Inject a 100 cycle note from the oscillator through the amplifier and adjust level to 1 volt. Now slowly sweep the oscillator frequency downward toward zero frequency. At the resonant frequency of the loudspeaker unit there will be a considerable rise in voltage, this will be observed on the voltmeter and the cone movement will also register a large increase in movement. The resonant frequency can be read off from the oscillator and noted. Mount the loudspeaker in the enclosure and set up the measuring apparatus as before. It will be observed that the large peak has disappeared and in its place two peaks, one on either side of the original, and of much lower amplitude are present.

Tuning can only be considered accurate when the two peaks are of equal amplitude and are equally displaced on either side of the free air resonant frequency originally measured.

By closing off part of the port opening it will be found that it is possible to vary the amplitude of one peak against the other. Port area should be artificially reduced until the conditions of correct tuning are approximated, port size can then be made permanent (see Fig. 24 A and B).

Critical Damping

Obtain a 4.5v. torch battery and some cloth the latter to be of similar texture to that exhibited by cheap hankerchiefs. Connect one side to the battery to the loudspeaker, make provision for easy connection and disconnection for the remaining side. Make and break contact. A sound resembling a "bing and bong" will probably result. Connect a single layer of cloth tightly across the port opening and repeat the test.

Continue adding layers of cloth and repeating the test until both "bing" and "bong" have been reduced to "click" and "click". Make sure that both "bing" and "bong" have gone, one may disappear before the other but do not add more layers of cloth than necessary because over damping will cause inefficiency.

Critical damping properly carried out will ensure that the loudspeaker system is free of undesirable transient generation.

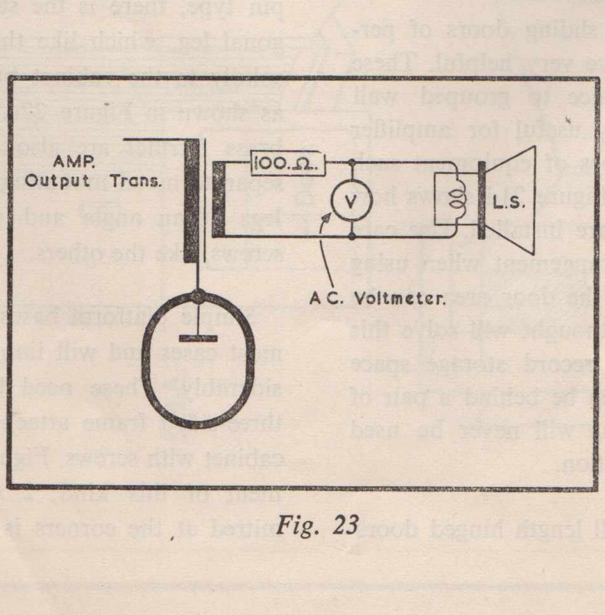


Fig. 23

Crossover Filters

Most readers will appreciate that a single loudspeaker unit cannot satisfactorily cover the entire audio spectrum. Usually two or more speakers are used and the audio spectrum is split up between them by means of an LC network commonly referred to as a crossover filter. Such a filter is normally situated in the speech coil circuit for reasons of convenience and adaptability. It is possible to use an electronic crossover network at the front end of the audio system and two separate amplifiers. This system is superior to the first method but of course, more costly.

Readers interested in this latter system are referred to "Audio" magazine May, 1956, an American publication, this issue contains a description of an ingenious cathode follower electronic crossover unit designed to feed two amplifiers.

There are a number of low impedance networks suitable for inclusion in the loudspeaker circuit perhaps the most popular are the quarter section series and half section parallel. Figs. 25 a and b show circuits and component values for both of these types.

Method of operation is simple to understand, the capacitor reactance increases as frequency is lowered, therefore a capacitor in series with a speech coil will attenuate low frequencies. On the other hand, a parallel capacitor will pass low frequencies but attenuate higher frequencies. The effect of the inductance is the reverse of this. From this it will be apparent that the response of a given system can be adjusted to almost any requirement. Power loss with either circuit of Fig. 25 is not serious, about 1dB for the quarter section and 2dB for the half section.

Both networks of Fig. 25 are designed for 15 ohm loudspeaker units and for a crossover at 2000 cycles. It is a simple matter to change the crossover frequency or to make the units suitable for loudspeaker units of lower impedance. Divide 15 by the voice coil impedance of the loudspeaker unit to be used and multiply all L and C values by the quotient. If it is required to crossover at a different frequency and the crossover point is *lower* than 2000 cycles, divide 2000 by the required frequency and multiply all C and L by the quotient. Should the crossover frequency be above 2000 cycles divide the crossover frequency by 2000 and divide all L and C by the resultant. Conversion to a three speaker system is quite easy. A high frequency dynamic tweeter such as the TSL Lorenz LPH65 is fed via a high-pass filter consisting of a 2 mfd. capacitor across the existing treble unit. In practice the capacitor is wired in series with the tweeter and the combination wired in parallel with the existing treble unit. With such a system it is easy to obtain an overall response from 20 to over 17000 cycles. Capacitors

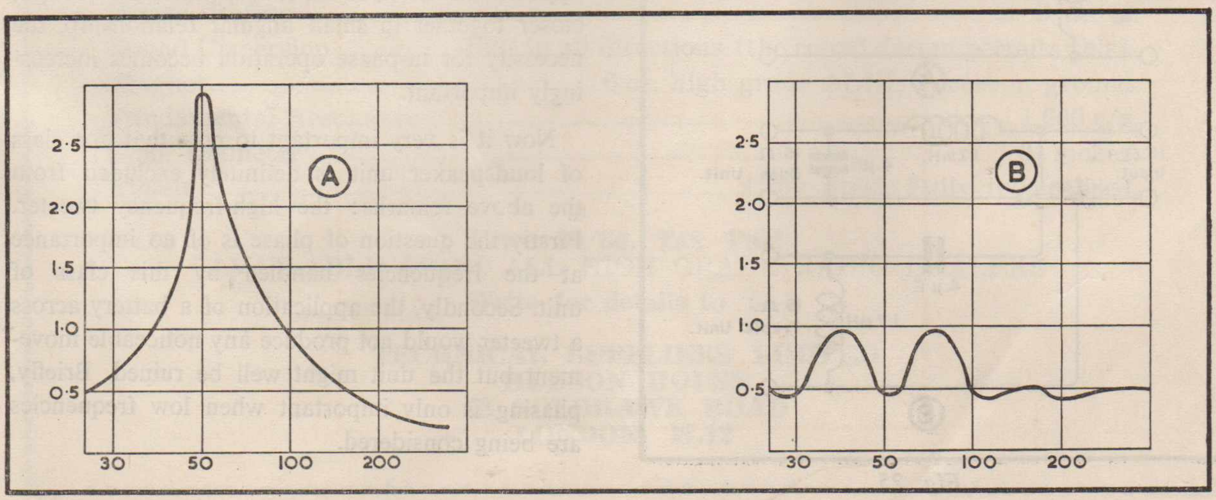


Fig. 24 (A) Free air resonant peak. (B) Response from correctly tuned enclosure.

for crossover units should normally be of paper construction, use of electrolytic components can under certain conditions involve considerable power loss.

Coils or inductors are normally home constructed and air-cored. For the inductance values quoted in Fig. 25 their resistance should not exceed 0.6 ohm. Mr. G. A. Briggs in his excellent book "Sound Reproduction" has given useful instructions for constructing air-cored coils and the original coils for both filters in Fig. 25 were based on Mr. Briggs' recommendations. Coils were wound to the following specification, 18 swg. cotton covered enamelled copper wire, 1" dia. wooden former provided with end cheeks, 32 turns per layer. For a 1.3mH inductor 265 turns are necessary the 1.7mH coil will need 300 turns. If inductances of 2.6mH or 3.4mH are required, turns necessary are 365 for the former and 410 the latter.

It is not claimed that these specifications will provide the exact theoretical inductance required but errors of 10% are not serious with crossover networks and coils wound to the above specification are in use by the author.

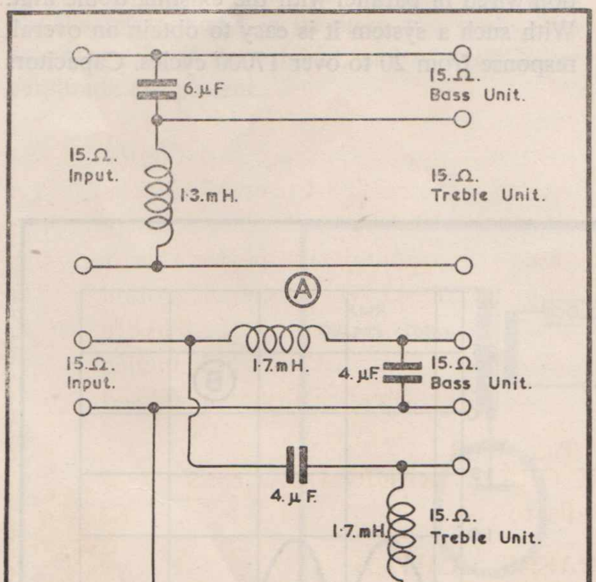


Fig. 25

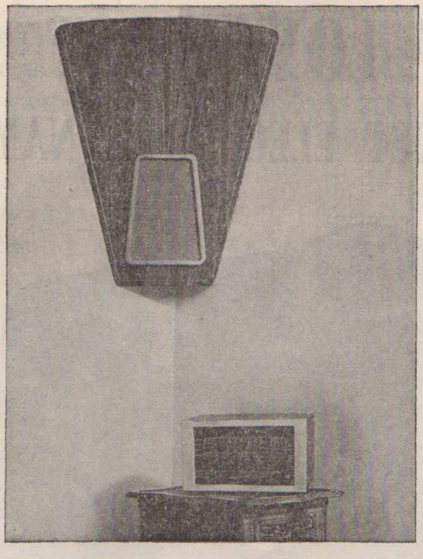
PHASING LOUDSPEAKERS

"Phasing" is concerned with the utilisation of two or more loudspeakers in such a way that the sound from any one loudspeaker does not cancel the sound from other units thus creating a dead area between them. This is an important consideration where loudspeakers face the same direction. Connections to the voice coils, whether series or parallel, must be made in such a manner that at any one instant all diaphragms are moving in the same direction.

If two driver units are connected to a single horn it can be clearly understood that, if out of phase, the resultant pressure where the sound of the two units meet in the horn would be completely cancelled and no sound would result. For parallel operation, the like terminals of each unit must be connected together, but if the loudspeakers are wired in series, two unlike terminals must be used as a junction. In-phase connections can be checked very easily, all that is required is a torch battery. Temporarily, wire up the loudspeakers in the manner to be used for final operation, i.e., series or parallel. Connect the terminals of the torch cell to the resultant two leads, a click will be heard and the cones will move in or out of the gap. Connections to the loudspeakers must be so arranged that all cones move in the same direction.

Phasing is of least importance where two loudspeakers are some distance apart or pointing in opposite direction, as the loudspeakers are brought closer together in small angular relationship, the necessity for in-phase operation becomes increasingly important.

Now it is very important to note that one class of loudspeaker unit is definitely excluded from the above remarks: the high-frequency tweeter. Firstly the question of phase is of no importance at the frequencies handled by this class of unit. Secondly, the application of a battery across a tweeter would not produce any noticeable movement but the unit might well be ruined. Briefly, phasing is only important when low frequencies are being considered.



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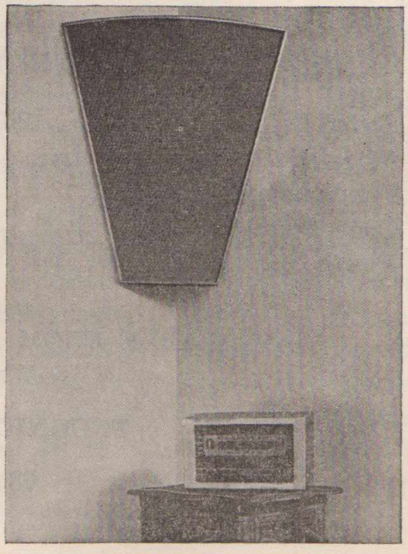
The Concert Soundcorner is hand-made in the highest grade multiple ply bonded wood, which is not subject to warping, and is offered in alternative designs. The "Carlton" finished in the very best furniture grade mirror polished walnut, medium colouring. The "Waldorf", a contemporary gold style frame with the latest tygan plastic finish of neutral shade, enabling it to blend with any furnishing scheme. It is non-dust collecting and washable, thereby preserving its fresh pleasant appearance.

TECHNICAL SPECIFICATION

Dimensions : 27″ high × 24″ wide at top × 11½″ at bottom
Overall depth from Front to Back : 6″
Impedance at 800 cycles : 4.5 ohms
Frequency range : from 35 to above 17,000 cycles
Peak Power loading : up to 15 watts
Normal Power loading : 10 watts

Price £13 16s. 3d. Tax Paid

The Speaker system used in the Concert Soundcorner consists of the famous LPH 65 High Frequency Speaker, for super top note reproduction, combined with the LP 215 Concert Speaker, which takes care of the medium and bass response. The specifications of these two speakers are listed individually in other parts of this catalogue. These two speaker units are matched with a correctly designed High Pass Filter unit which is included as a permanently mounted part of the design at the back of the Soundcorner.



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