

TECHNICAL BULLETIN

Jensen

in the interest of BETTER SOUND REPRODUCTION

THE REPRODUCER OF THE FUTURE

This bulletin describes the unusual four channel ultra-fidelity system demonstrated at the two 1952 Audio Fairs and gives constructional information for the unique Transflex Bass Reflex Transmission Line Unit and associated 45 cycle crossover network

In conjunction with one of the JENSEN continuous research studies it became desirable to re-evaluate the contribution to listening of the very low frequency portion of the audio spectrum. Therefore it became necessary to assemble an experimental reproducing system to cover the entire range of human hearing with uniform efficiency throughout this extreme range. Since the advent of the JENSEN RP-302 H-F Unit, systems utilizing this basic element could easily be assembled which fell short of these stringent requirements only in the very region of particular interest—the frequency range adjacent to the lower limits of audibility.

It is commonly recognized that horn structures can be used to meet this need. However, it is also well known that the mouth dimensions must be of the order of one-third wavelength at the lowest frequency to be reproduced. At 25 cycles, for example, the wavelength is about 45 feet indicating a required mouth size of about 225 square feet! Furthermore, the performance of such horns becomes more closely related to the room characteristics at decreasing frequencies. Even though such a horn could easily be demonstrated in a large auditorium the properties in smaller rooms would be modified, to say the least.

A simpler structure or at any rate a more compact device of far better space factor was desirable for

this system. The JENSEN Transflex Bass Reflex Transmission Line Unit developed by JENSEN engineers to meet this need departs from the straightforward character of the remainder of the system and is a unique arrangement quite compact in terms of the wavelengths involved. This Transflex Unit represents the newest JENSEN contribution and is perhaps the outstanding feature of the "Reproducer of the Future".

The complete reproducer system was demonstrated at the Audio Fair in Chicago in the Spring of 1952 and again at the Audio Fair in New York City in the Fall of 1952. It has generated a great deal of interest and because of the many inquiries received requesting details we have responded with this bulletin describing the JENSEN "Reproducer of the Future".

GENERAL DESCRIPTION

The "Reproducer of the Future" shown in Figure 1 consists of four electrical channels and four separate loudspeaker units to reproduce these channels. Figure 2 is a block diagram of the system with its four reproducing units and three electrical crossover networks. It can be noted that the entire spectrum is first divided at 45 cycles and the range below 45 cycles is reproduced by the Transflex Unit. The frequency range above 45 cycles is then divided again at 600 cycles and the

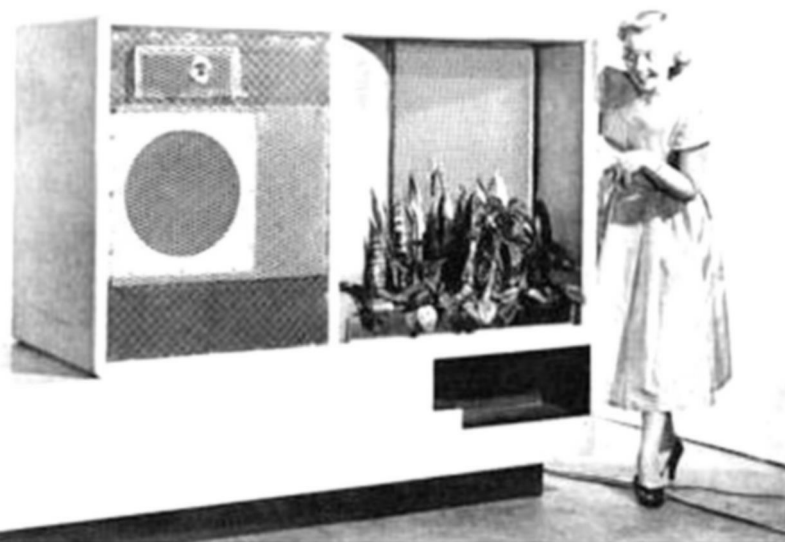


Fig. 1. The JENSEN Reproducer of the Future.

range between 45 and 600 cycles is reproduced by a special 15" low frequency (l-f) unit installed in a large back-loading folded horn. This latter horn structure is that described in JENSEN Technical Bulletin No. 1, "A Back-Loading Folded Horn for 15" Loudspeakers"¹; the loudspeaker unit is the JENSEN Model P15-LL. The frequency range above 600 cycles then is further divided at 4000 cycles. The range between 600 and 4000 cycles is reproduced by a medium sized compression type unit with cast horn; this is the JENSEN Model RP-201 H-F Unit. The frequency range above 4000 cycles is reproduced by the JENSEN Model RP-302 Ultra H-F Unit. All of the loudspeaker elements in this system are commercially available² as also are the two higher frequency crossover networks, Models A-61 (600 cycles) and A-402 (4000 cycles). Only the 45 cycle crossover network, the Transflex Unit and the folded horn are non-commercial items. Therefore, it is a relatively simple matter for anyone to assemble a "Reproducer of the Future" if certain workshop facilities are available.

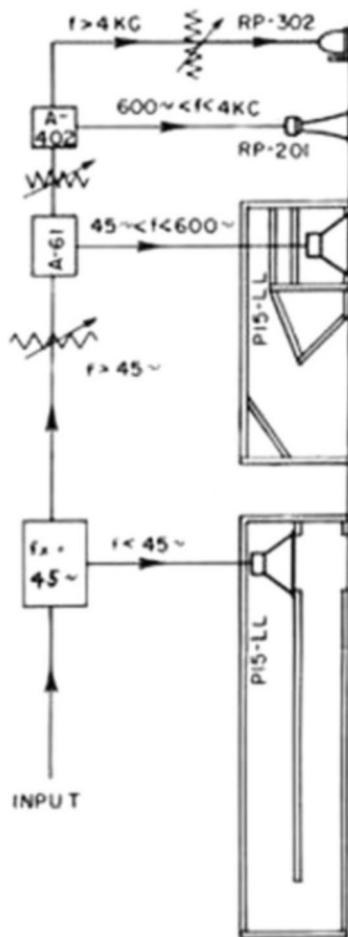
1. Available without charge from your dealer or direct from us.
2. See JENSEN High Fidelity Brochure No. 1020.

PHYSICAL ARRANGEMENT

Figure 3 shows three arrangements suggesting the several ways the various elements can be assembled. Where the folded horn is vertically oriented as in arrangements A and C, the two Type RP Units can be assembled in the space immediately below the l-f speaker baffle. A removable panel gives access to this space. For arrangement B the two RP Units are placed on top of the folded horn (lying on its side). This is necessary because the RP-201 horn mouth must be horizontal to give the correct coverage angle. It is not necessary to enclose or baffle these two Type RP Units for maximum efficiency; however, they can be enclosed if desirable for other reasons. Alternatively these two units can be suspended from the top (side) of the folded horn inside the horn mouth. In this case the RP-201 H-F Unit should be placed as near the l-f speaker unit as possible.

In the demonstrations of this system the RP-201 H-F Unit was mounted within the confines of the folded horn which, in turn, was placed on its side. The front face openings were all covered with "expanded metal" grille screens and the RP-302 Ultra H-F Unit was attached to the screen covering the RP-201 horn mouth. Due to its complexity this arrangement is not practical and is therefore not recommended.

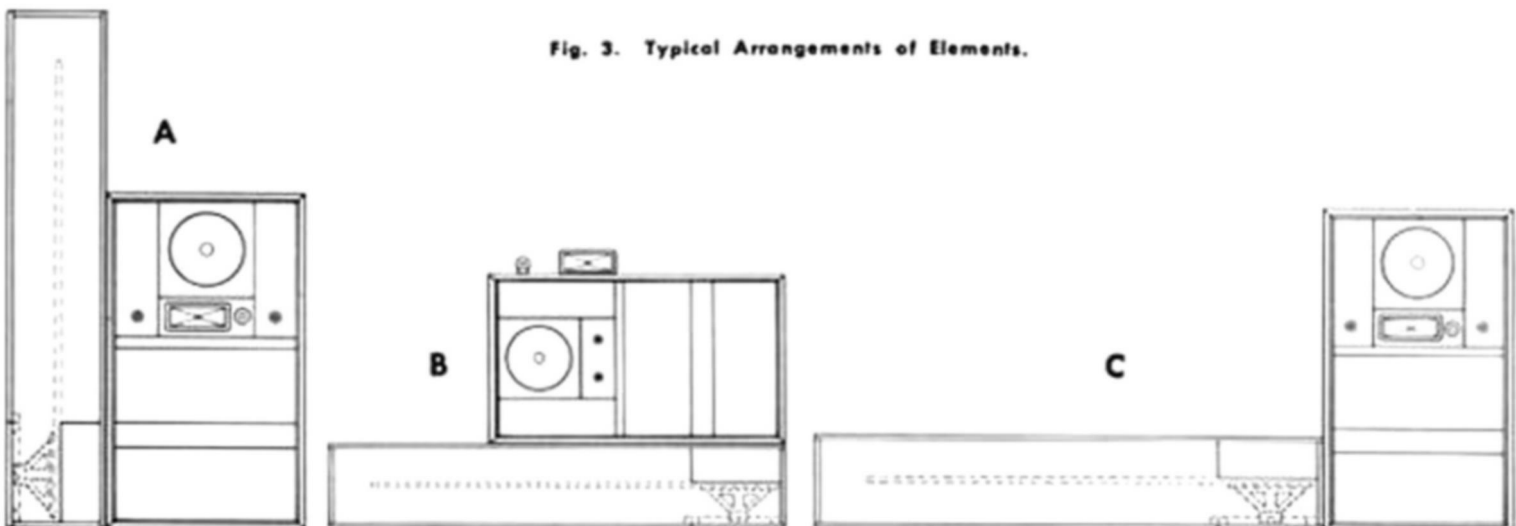
Fig. 2
Block Circuit Diagram
of System
Constant resistance networks
divide the spectrum at 45
cycles, 600 cycles and 4000
cycles for the four loudspeaker
units.



It should be pointed out that the JENSEN G-610 Triaxial 3-channel loudspeaker system can be used instead of the P15-LL, RP-201, RP-302 and associated A-61 and A-402 Crossover Networks. This unitary assembly has its own 3-way crossover network and the assembly is obviously quite a bit simpler. Resulting performance will in no way be degraded with this unit since the reproducing elements are essentially the same.

The long tube-like structure is the Transflex Bass Reflex Transmission Line Unit which will be described in detail in the next section. Two types — essentially identical in performance — are described. The particular type and the assembly arrangement will depend on the space available. The large size of this system will probably limit its use to experimental installations and deluxe reproducing systems which can be built into a wall.

Fig. 3. Typical Arrangements of Elements.



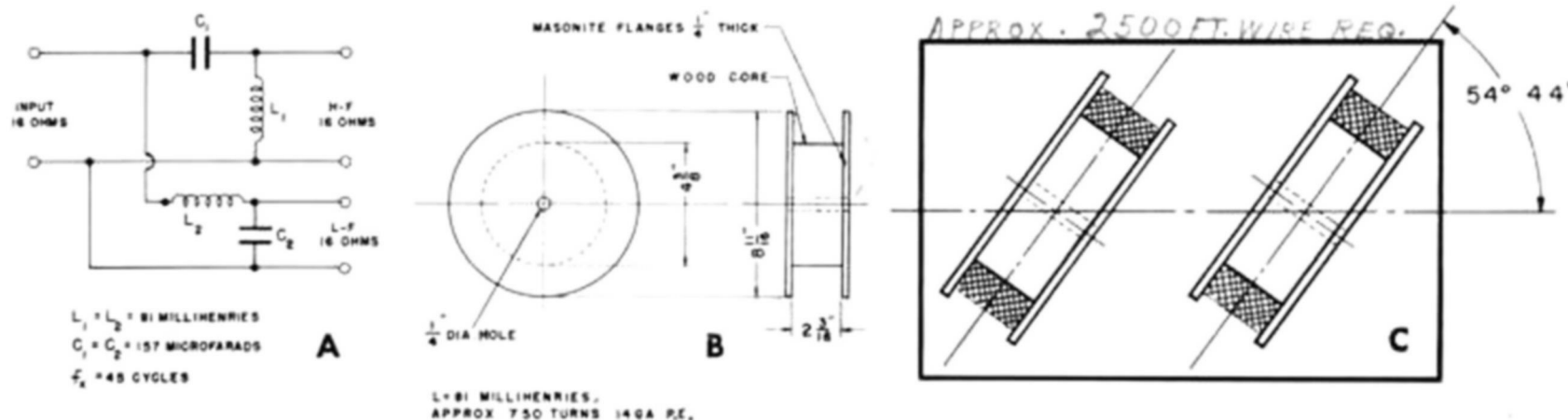


Fig. 6. The 45 Cycle Crossover Network:
 A. Circuit, B. Inductor Design, C. Inductor Orientation.

It is important to note that the Transflex Unit reproduces a band of only a little over one octave (below 45 cycles). The use of transmission line units over greater bandwidths is not recommended because extremely variable output will result due to (organ pipe) resonant and anti-resonant modes of vibration.

It can be seen that the total length of the transmission line is one-half wavelength at approximately 40 cycles. The air in the line is easily set into vibration by the push-pull driving arrangement for all frequencies in this vicinity. The vibrating air is coupled to the outside air by means of the port opening; the loudspeaker diaphragm contributes very little because of its relatively small amplitude.

It must be recognized that the efficiency of the Transflex is not nearly as great as that of a horn designed for the same frequency range but its relatively small size justifies its existence. The balance of the system (above 45 cycles) must be attenuated in this system by about 6 db for correct balance.

THE 45 CYCLE CROSSOVER NETWORK

As shown in the block circuit diagram, the first frequency division occurs at 45 cycles. This crossover network is not commercially available but can easily be constructed by the experimenter from the data below. Figure 6A shows the circuit of this constant resistance type network.

The two capacitors of 157 microfarads each can be assembled by a parallel connection of any number of smaller capacitors since the total capacitance for such a connection is the sum of the individual capacitances. For example, 78 capacitors of 2 microfarads each and 1 capacitor of 1 microfarad all connected in parallel will give the desired value. All individual capacitors should have a voltage rating of not less than 50 volts. Paper wax impregnated capacitors should be used; electrolytics are not recommended for this use.

The 81 millihenry inductors can be constructed from the data shown in Figure 6B. The thoroughly dry wood core and masonite flanges should be treated with shellac and dried completely before assembly and

winding. Mechanical stresses during winding are considerable and adequate fastening is important. Brass screws should be used because iron will affect the inductance of the finished coil. The winding consists of 750 turns of 14 ga. plain enamel copper wire.

The loss due to the resistance of these coils is rather high but occurs only in the l-f portion of the circuit. Ideally, larger wire would be indicated but such wire is not readily available and the winding process becomes difficult.

The finished coil can be given a coat of "coil dope" to exclude moisture. If desired, a series of small holes can be drilled around the edges of the flanges and a lacing cord used on the finished coil to prevent spreading of the flanges.

Figure 6C shows the suggested orientation of the inductors to minimize undesired mutual coupling between the inductors. Preferably, the coils should be well removed from any metal to prevent a change in their inductance values. A wooden box base is ideal and the capacitors can be assembled inside this box. Solder lug terminal strips provide excellent means for assembling and mounting these capacitors.

JENSEN Technical Monograph No. 3, "Frequency Range and Power Considerations in Music Reproduction", discusses the question of frequency range at the two ends of the spectrum in some detail. You can obtain this monograph from your dealer or directly from us (price: 25c). Despite the fact that statistically the last octave at the lower end of the frequency spectrum is of questionable value, it should be pointed out that for selected instruments these statistics do not apply. Large components of signal appear in the frequency range below 45 cycles for the bass drum and for the pedal notes of large pipe organs and electronic organs. For this reason many will not compromise performance and will want to construct the "Reproducer of the Future".

Write for your copy of JENSEN High Fidelity Brochure No. 1020 describing the above commercial units; it also includes practical suggestions on the choice of loudspeakers and many valuable suggestions on their proper use.