

not surprising, yet without the low tones a great deal of the pleasant musical effect is lost.

As already mentioned, the radio-frequency stages usually pass the high frequencies easily, but should be well designed, or reproduction will suffer through their suppression of the lower tones. One particular type of set, placed under test in an American laboratory, did not pass any frequencies below 350 cycles through out R.F. stages. Signals suffer less by having several R.F. stages of medium selectivity rather than one highly selective stage. This is because the "side-bands" are with high selectivity received with less amplitude or volume than the centre of the carrier wave.

There are several factors that can cause high-note loss in the audio amplifier. Two stages of transformer coupling form the popular amplifier, as giving the greatest amplification per stage, but unless the transformers are well designed they will nullify the good reproduction of which the remainder of the circuit may be capable. And the choice of suitable valves is also essential.

Amplification must be unaccompanied by distortion, otherwise it is useless. Some of the well-designed modern transformers are capable of giving fairly even amplification over a range of 40 to 6000 cycles, but the small-sized badly-designed type will not approach anywhere near this performance, and on account of its low primary impedance, will give very poor amplification on the low notes. If the coupling device between audio valves is such that its impedance varies with frequencies, then amplification suffers at some parts of the musical scale, and the same thing happens in the average coupling system, transformer, or resistance, owing to the fact that the amount of amplification falls off proportionately as the strength of signals increases. This latter may not always be a disadvantage, though it reduces the contrasts of light and shade in the music received. Double-impedance coupling gives more uniform response in this respect.

If a transformer capable of amplifying low notes satisfactorily is to transmit high audio frequencies equally well, other conditions must exist, and the most important, perhaps, is the effective capacity across the secondary windings. Small values of capacity across the secondary will seriously reduce the voltage of the higher frequencies, which is reducing volume. Resistance or condensers should never be placed across the secondary of a transformer, as volume will thereby be reduced. Fidelity of reproduction is also reduced by this practice.

One thing should be made clear, and that is that the troubles now being discussed cannot all be entirely eliminated, but only reduced to a negligible minimum. As amplification of low notes is increased, so there is liable to be a corresponding falling-off in the higher frequencies, which is a very common cause of high-note loss.

#### Resistance Coupling.

IN resistance-coupled amplifiers, the amplification depends entirely upon the amplification factor of the valves employed, therefore, only those with a high amplification factor, about 30, should be employed before the power valve. The value of the resistance in the plate circuit must never be less than the actual plate resistance of the valve, and a high voltage must be applied to the plate circuit to overcome

this high resistance, and still leave sufficient voltage for efficient operation. Correct valves for the coupling condenser and grid resistor are also important. Increasing the capacity of the coupling condenser reduces tendency to distortion, and increasing the grid leak value increases amplification, whereas too great increase of either produces tendency to "motor-boat." As already pointed out in this column, high notes are lost or weakened through the higher frequencies being by-passed through stray or unwanted couplings in the circuit which offer much higher impedance to the lower frequencies, and thus preserve their volume.

#### Loss of Deep Notes.

MUCH of the loss of deep notes is caused by want of even amplification, just as in the case of the high notes. To preserve the deep notes in transformer-coupled amplifiers, high primary impedance is necessary in the transformers, especially the last stage. To pass the deepest notes a low ratio, say 3 to 1, is to be preferred to a high as the well-designed low ratio instrument generally has more room to spare for increased primary winding, which gives the higher impedance. Sometimes a high impedance winding following the detector will give a certain amount of trouble in the shape of either whistling or eliminator hum, if a B eliminator is used. The whistling or howling may be present if a B battery is used. Sometimes a resistance of, say, 8000 ohms across the primary will cure this trouble. If a high impedance valve is used as a detector. This measure should not be resorted to if it can be dispensed with, as it slightly reduces volume. The usual by-pass condenser from plate to filament should be provided and different capacities tested, from .0005 upwards. In resistance-coupled circuits, it is imperative to keep the capacity of this by-pass condenser as low as possible.

#### Loudspeakers.

THE loudspeaker has a very great influence upon quality reproduction, particularly with regard to the range of notes that may be properly produced. At the same time it is quite a common occurrence for the loudspeaker to be blamed for glaring shortcomings in the receiver.

Horn speakers are as a rule not strong on the lower notes, but if fed by a good receiver, it is surprising what good reproduction can be obtained from the larger type of horn speaker, and in such a good percentage of the lower frequencies will be heard, along with the middle frequencies, whilst the reproduction of the high sounds will depend to a great extent upon what is passed by the receiver.

Cone speakers are being gradually improved, and some splendid models are now to be obtained. A good cone speaker gives good volume and clarity on the low frequencies without unduly weakening the high. In large sizes the balanced-armature types give increased volume with facility for reproducing the higher frequencies, and in the same class may be placed the double-acting or "push-pull" type, in which there are two pairs of magnets acting in unison on both sides of the armature.

The moving-coil or dynamic speaker is said to give higher quality than either of the above, but this type of

speaker has so far not been imported into New Zealand in any quantity. It costs a little more to run than ordinary types, but where mains are available to supply current for the field magnets, the running cost would be very small. Some of these speakers have permanent magnets, and thus dispense with current for excitation.

#### Large-sized Horns

OF exponential and arthaphonic horns a great deal has been heard of late, and undoubtedly these in large sizes approach very near the present limit in reproduction of the whole musical scale. The chief drawback is their bulk, which really presents a serious problem in the average house. Sizes up to 9 and 12 feet in length are built in folded form and furnish a satisfactory solution, reproducing sufficiently low frequencies. A straight six-foot horn may be conveniently suspended near the ceiling with the unit

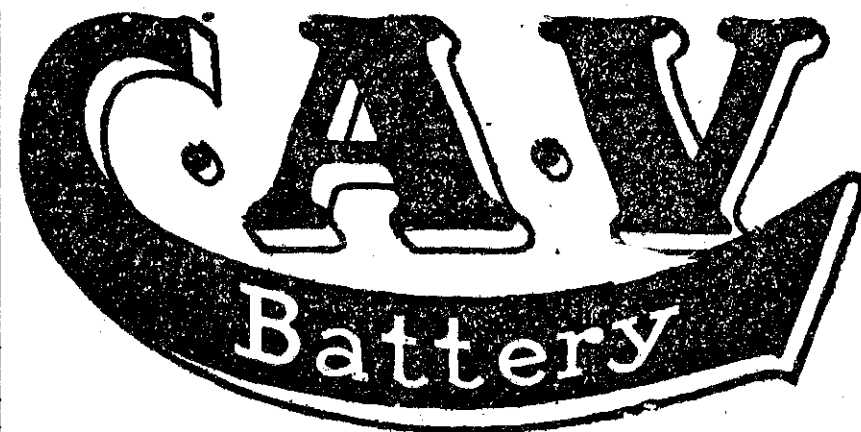
in the corner. This is the most unobtrusive method of using such a horn.

#### The First Linen Diaphragm

A NAPIER constructor writes: "I have made the linen-diaphragm speaker described in the 'Radio Record' and am very pleased with same. Could you inform me where I can get a good unit for it? The one I am using is rather small for the job."

#### Lengthening Cone-Driving Spindles.

WHEN it is found necessary to lengthen the driving spindle of a cone until the best plan is to cut the spindle about half-way. Then roll up a strip of brass or copper foil to make a thin tube to fit over the spindle slip one piece of spindle in each end, solder up, and a good extension is the result. Keep moving parts of cone speakers as light as possible.



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