

The Screen Grid Valve

How Immense Amplifications Can be Obtained



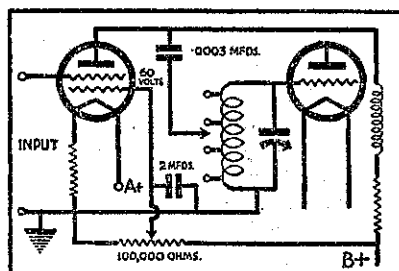
VERY few developments in radio were greeted with such enthusiasm as that of the screen-grid valve, for it was thought that it would solve all troubles which beset the ambitious set designer. Probably for that reason the screen-grid valve incurred more criticism than it deserved. In the short period during which this valve has been available it has improved tremendously.

In a nutshell, it has simplified and enormously increased the amplifying power of the radio frequency amplifier. In the early days of broadcasting attempts were made to amplify the high frequency using the ordinary three electrode valve with the result that uncontrollable self-oscillation became apparent before there was a perceptible increase in signal strength. For this reason r.f. amplification of short-wave is almost impossible.

This uncontrollable oscillation was due to the internal capacity of the valve and methods were sought by which it could be balanced out. The most familiar one of these is the Haziedean neutrodyne circuit, which feeds some of the h.f. energy into another portion of the circuit to balance out that existing between the other parts. This was fairly successful, but the valve capacity is by no means a pure capacity, and cannot be balanced out by a neutralising condenser except at one specific wave-length. As it was impossible to keep reneutralising the set for every wave-length, certain compromises and losses had to be incurred. The screen-grid valve appeared just at a stage when radio had come to a stop owing to this difficulty of balancing out unwanted h.f.

THE screen-grid valve is like an ordinary triode; but between the grid and the plate another grid was placed, and this connected with earth. This did away with stray capacity within the valve. It was found, however, that voltages could be applied to this and the amplification of the valve was

enormously increased. Since the screen is of fine texture the anode or plate will be able to take current from it only and not to produce any extra current itself, but should the screen voltage rise above that of the plate, the screen will rob it of the secondary electrons which will always be found around an electrode which is being bombarded in a manner such as is the plate. It had been found that best results can be obtained only by keeping the plate or anode voltage at least twice that of the screen



voltage, otherwise there is a danger of self-oscillation.

Stage Gain.

THE first commercial screen grid valve had an inter-electrode capacity of .05/1 mfd., this being sufficiently large to prevent any stage gain greater than that of a well-designed neutralised triode, but now the residual capacities are down to the remarkably low values of .003 and .002 mfd.

With the latest types of valves it is possible to obtain a stage gain of over 200 with quite modest components, provided the external screening of the coils and components generally is carried out with meticulous care. Considerably greater amplification is possible per stage and ganging is made perfectly simple with the use of this valve. It does away with the need for regeneration which is not only a dangerous plaything in the hands of amateurs but also necessitates the use of multiple dials

With the direct current screen-grid valve the control grid should be biased negatively by no more than .9 volts, but the a.c. valves require at least 1.5 volts. With the battery valves, the most convenient method of obtaining the .9 is to insert a resistance in the filament return in order to raise its potential above that of the grid.

This method of obtaining bias is applied to the a.c. screen grid valve, but the resistance is placed in series with the cathode. The plate voltage of a screen grid valve is not at all critical, but the screen voltage on the other hand is rather critical and incidentally controls the plate current far more than the plate potential.

The impedance amplification, and therefore the mutual conductance of a screen grid valve is so profoundly modified by the screen-grid voltage that it is impossible to quote these constants unless the exact operating conditions are known. Stage gain depends in the case of tuned-grid tuned-anode coupling upon the relation between the internal and external impedance. Also there will be only one screen grid voltage giving maximum amplification. In the case of poor coils the valves have to supply more power to compensate for the loss of the tuned circuit. Generally the higher the impedance of the valve the more curved are its characteristics.

Cross Modulation.

DUE to these non-linear characteristics it is possible as a result of the curvature referred to for the signal voltage of an unwanted station to be rectified and for low-frequency impulses to modulate the carriers of the unwanted station, so that the two sta-

tions are heard together, although the selectivity of the tuned circuit is ample to separate the stations in the ordinary way. To overcome this the use of a pre-selector or band pass input circuit is resorted to—in fact, many varieties of input filters have been used. Another method entails the use of an h.f. volume control, which may take the form of a potentiometer in the aerial circuit ganged to a second volume control arranged to adjust the voltage of the screening grid of the first h.f. valve.

On no account should the volume of a loud signal be reduced by altering the screen bias volts unless the signal input is decreased at the same time.

Generally the better the coil the worse the cross modulation is likely to be. Experimenters will find that tapping the anode into the succeeding coil will have the effect of throwing the anode screen capacity on to a portion only of the tuned circuit, and this will reduce cross modulation to a very large extent.

When working with a large bias modulation hum is often heard in the shape of mains valves, but probably the most effective way to overcome the difficulty is by the use of the new multimu valves, a description of which was recently published.

The latest screen grid valves employ metal coverings to eliminate separate shielding of the valve. This shield is connected internally to the cathode in A.C. valves and to one of the filament pins (suitably marked) in battery valves. The earth shield so formed avoids the necessity of using a separate cylindrical valve screen and assists in minimising hum and stray coupling.

A Successful Constructor

Youthful Radio Enthusiast

WESLEY CHISHOLM is probably one of the most successful young radio constructors in the Dominion, and the indications are that if he continues at his present rate of progress he will one day be a competent radio technician. Although fifteen years old, he has won eight prizes, including a five-valve receiving set in four years. Many readers will recall that it was Wesley Chisholm who carried off the two junior class prizes at the Wellington Radio Exhibition in 1929. Since that time he has won a prize at the technical school and a first and second at the Y.M.C.A. hobbies exhibition. His latest success is at the Salvation Army Exhibition held a month ago, where he secured first place with his short wave set and first for a crystal set. The judge remarked that the work was the very highest possible, and said that he had seen the work of experts below the standard reached by the exhibitor. "He has a great future," remarked the judge.

Queen Alexandra's Own Band

Concert Relayed by 2YA

THE second honorary members' concert of the 1931 season will be relayed by 2YA from the Grand Opera House, Wanganui, on Tuesday evening, August 25. The concert will be one of outstanding merit. The Queen Alexandra's Own Band are in great form and will be heard to great advantage under the direction of Mr. Ernest Webb, who is the youngest A grade band conductor of the Dominion.

This combination has won fame for Wanganui in the contest field, and has brought to the City of Wanganui more than once the Dominion championship Shield, an achievement that no other Wanganui band has yet accomplished.

Their contest work during the past 20 years stands out with great credit to the members of the band, and the present form of the band argues well for its future success.

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