

TEST REPORT

# EDDYSTONE MODEL 680

The Model 680 has its essential controls neatly and conveniently arranged. Note the large turning knob with one of similar size for the wave-change switch.

The selectivity is changed in steps, five in all, and these give bandwidths of 15 kc/s, 7 kc/s, 4.5 kc/s, 2.5 kc/s and a few hundred c/s respectively, for an

## Fifteen-valve Super-heterodyne of Advanced Design

**T**HOUGH intended primarily for the exacting needs of professional communications this set possesses an indefinable quality that cannot fail to appeal to the discriminating amateur who is looking for a really sound general-purpose receiver. Neither in conception, nor in coverage, nor in cost is the set in the least "amateurish" and its specification will bear comparison with that of any other set designed for a similar purpose.

It has 15 valves, all but two of which are the latest miniature all-glass type with B7G bases. The frequency coverage is very wide, but perhaps not quite so extensive as some of the sets in the same class because it does not take in the longer wavelengths, necessary for some kinds of professional communications. The frequency coverage of the Model 680 is 480 kc/s (625 m) to 30 Mc/s (10 m) so that it just takes in the 600-metre band which is used extensively for short and medium distance ship-to-shore traffic.

This frequency band is covered by five switched ranges, their individual coverages being 480 to 1120 kc/s, 1.12 to 2.5 Mc/s, 2.5 to 5.8 Mc/s, 5.5 Mc/s to 13 Mc/s and 13 to 30 Mc/s respectively. Although not apparent there is an overlap between all ranges, as the calibrated portions do not in all cases occupy the full length of the scale.

An unusual feature of this set

is that it has a mechanically operated selectivity system, or as it is sometimes called, bandwidth control. The couplings between primaries and secondaries of the i.f. transformers, and hence the selectivity of the circuits, is varied by change in physical relationship of the coils. The principle is not new; it may actually have predated the more commonly used electrical systems, but it is nevertheless a perfectly sound one, and moreover, is quite satisfactory as applied to this set.

attenuation of 6 db at the boundaries. The narrowest of all is with a quartz crystal filter.

In common with all modern high-performance receivers, the Model 680 is a superheterodyne and it has two r.f. stages before the mixer. Their main purpose is not necessarily to improve the sensitivity but to give adequate second-channel rejection at the higher frequencies. Coils with adjustable dust cores are used on all ranges in this portion of the set. Waveband switching is by means

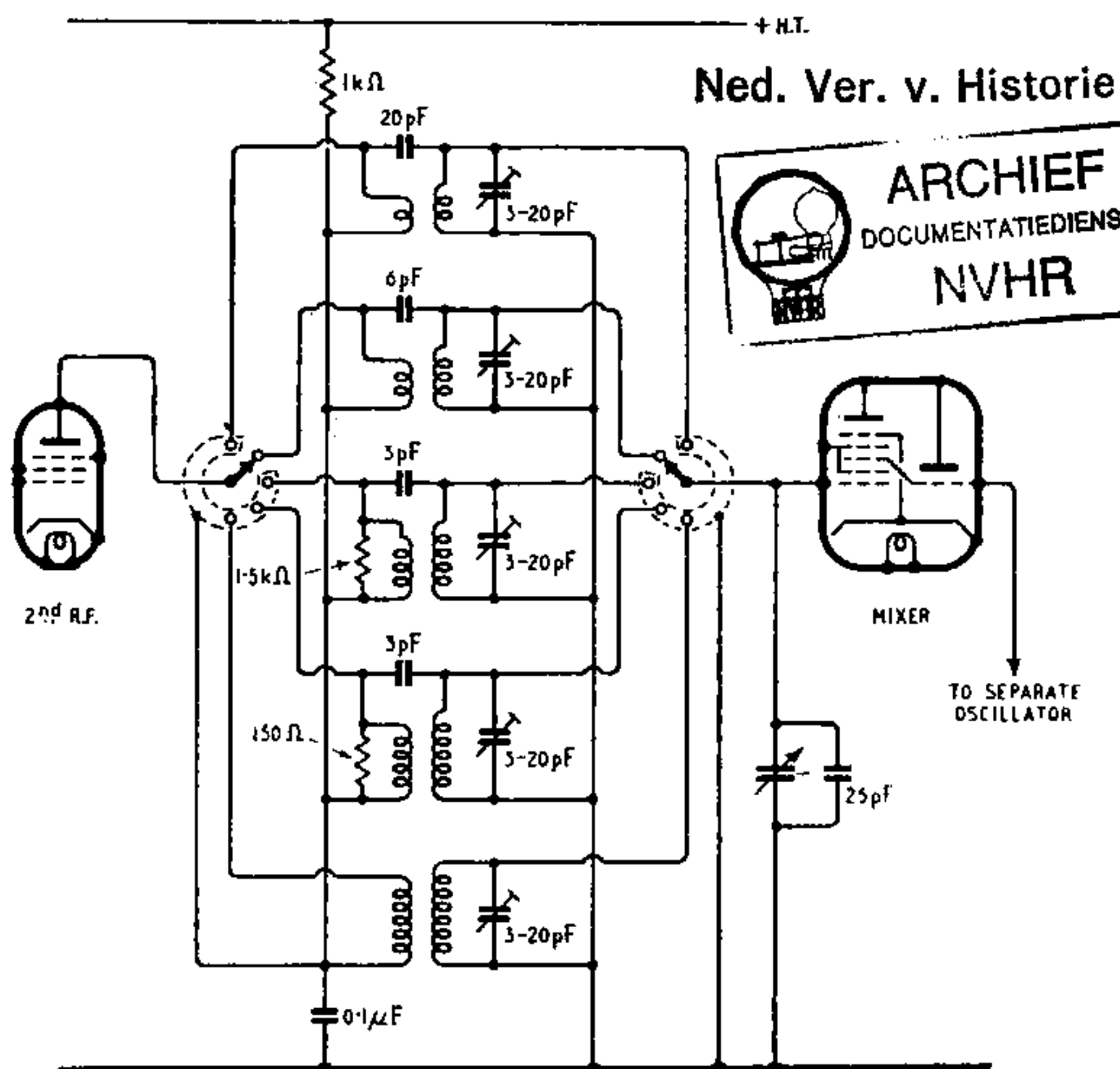


Fig. 1. Typical of the r.f. stages in the Model 680 this interstage coupling is between the second r.f. and mixer valves.

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of ganged wafer switches and the general arrangement of the circuit is shown in Fig. 1, which depicts the inter-stage coupling between the second r.f. stage and the mixer. It is typical of the other r.f. couplings.

A triode-hexode is shown in the mixer position but a separate oscillator valve is actually employed, only the hexode part giving service as the mixer. Its triode section is ignored although the triode grid pin is utilized for oscillator injection. The idle

is the crystal filter, this being the usual form of bridge-connected circuit with the crystal balancing, or, as it is sometimes called, the phasing capacitor, controllable from the front panel. It can thus be used to give high attenuation of an interfering carrier on either side of the desired signal and this is the so-called "single-signal" technique which will be familiar to users of communications sets.

Included in the circuit of Fig. 2 is the first i.f. valve and the signal strength (or "S") meter and its controlling diode. The

The i.f. amplifier has seven tuned circuits in all, three being in the crystal filter, and they are tuned to approximately 450 kc/s by fixed capacitors of 400pF, the final tuning to this frequency being effected by the adjustable dust cores.

Two stages of amplification are employed using 6BA6 valves, which are the latest button base r.f. pentodes with B7G bases. Both are included in the a.g.c. system, which, with the two r.f. valves, makes four controlled stages in all. Exceptionally good control of the audio output is thus obtained; the a.g.c. characteristic shows that for a change in the input signal of about 100 db the audio output does not vary more than 9 db. Considerable delay is allowed before a.g.c. becomes operative and this amounts to about -13 volts. It is derived from the bias resistor of the output stage and is achieved by joining the cathode of the a.g.c. diode to the cathode of the output valves. This diode is the companion to the detector, which of course operates without a delay voltage, and the two form one of the 6AL5 valves used in the receiver.

The detector circuit is more or less orthodox except that the diode load consists of four resistors joined to a switch which is linked with the bandwidth control. By taking the a.f. output from an appropriate tapping on the diode load for each position of the selectivity switch, some compensation is made for variations in the i.f. gain that inevitably accompany changes in bandwidth, no matter what system is employed.

Further compensation for variation in i.f. gain with change in bandwidth is also provided and this takes the form of adjusting the stage gain of the second i.f. valve. It is effected by switching in different bias resistors, the switch being part of the bandwidth control.

Following the detector is a series-connected noise limiter, the diode being the companion to the one controlling the "S" meter. These two form the other 6AL5 valve in the set. Details of the detector circuit, and of the noise limiter, which incidentally can be switched in or out as

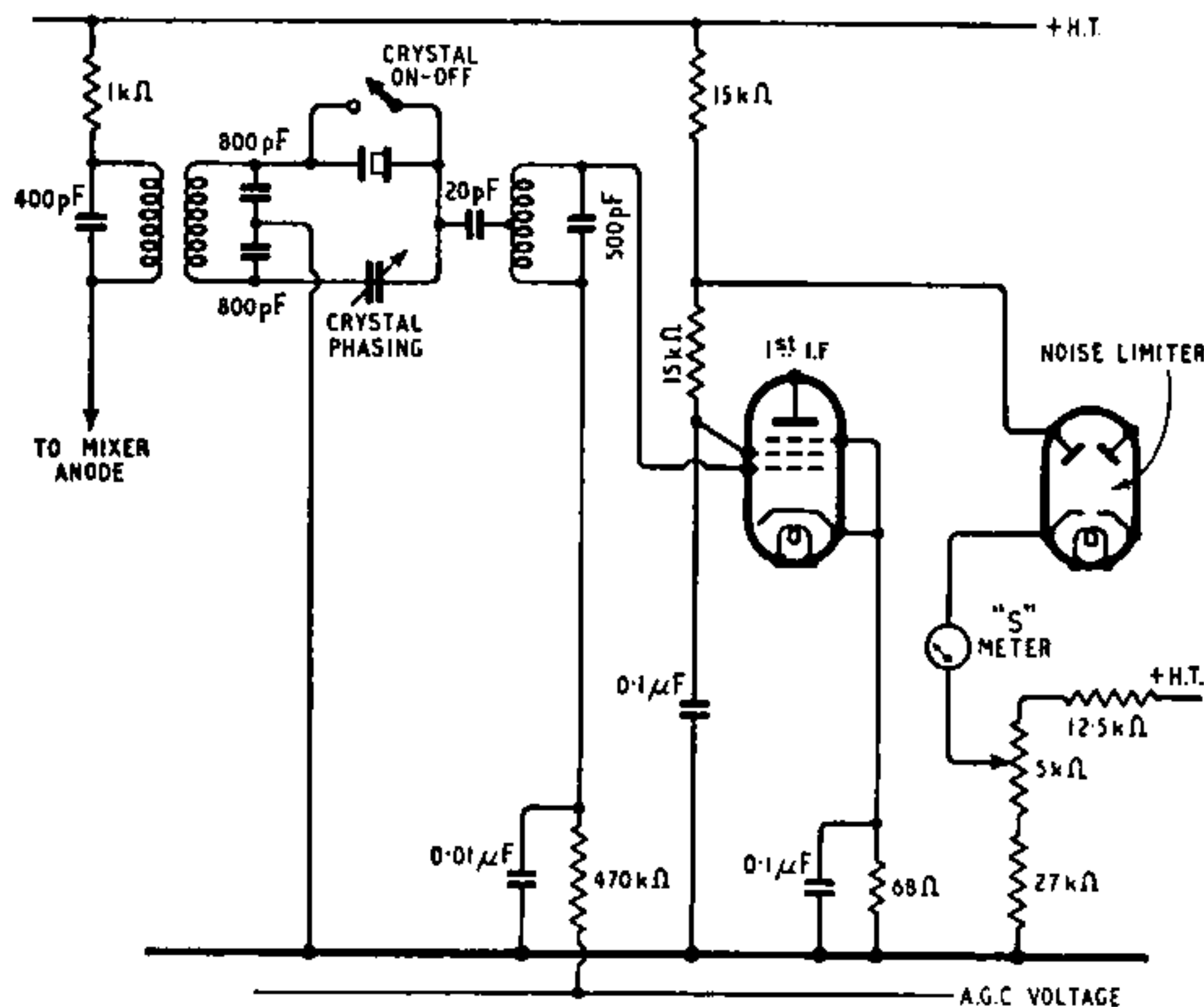


Fig. 2. The crystal filter is included in the first i.f. coupling following the mixer valve. Shown also is the diode and source of voltage controlling the "S" meter.

anode is joined to the cathode. As an alternative to the X81 or 7S7, which are the triode-hexodes favoured, an ordinary hexode mixer, such as the 6BE6 may be used in some receivers. The particular model reviewed here had the X81.

The separate oscillator valve is an 8D3 pentode but triode-connected in an orthodox form of the familiar back-coupled oscillator using shunt-fed anode coils. Fixed tracking capacitors are used on all five ranges and circuit trimming is taken care of by adjustable dust cores and small ceramic pre-set capacitors.

Immediately following the mixer, and as shown in Fig. 2,

meter is actuated by the change in  $G_2$  current under the influence of a.g.c. but responds to the voltage drop in this electrode's series feed resistors. It does not, however, function when receiving c.w. or m.c.w. with the a.g.c. switch in the "off" position.

In order to derive the full benefit from a crystal filter, the filter must be supported by a chain of really good tuned circuits. In the Model 680 all the i.f. transformers, like the signal circuits, have dust cores and the grids of the valves are tapped down the secondary windings in order to relieve the circuits of undue damping. Circuits of quite high "Q" are thus obtained.

required, are included in Fig. 3.

From the noise limiter the audio output passes to a volume control, then to a 6AU6 voltage amplifier and from there, through a phase reversing stage, (another 6AU6) to a pair of 7D9 output valves operated in push-pull. Some negative feedback is applied from the anodes of the two output valves to the anodes of the two penultimate valves. The output transformer has a ratio to suit a loudspeaker of between 2 and 3 ohms impedance.

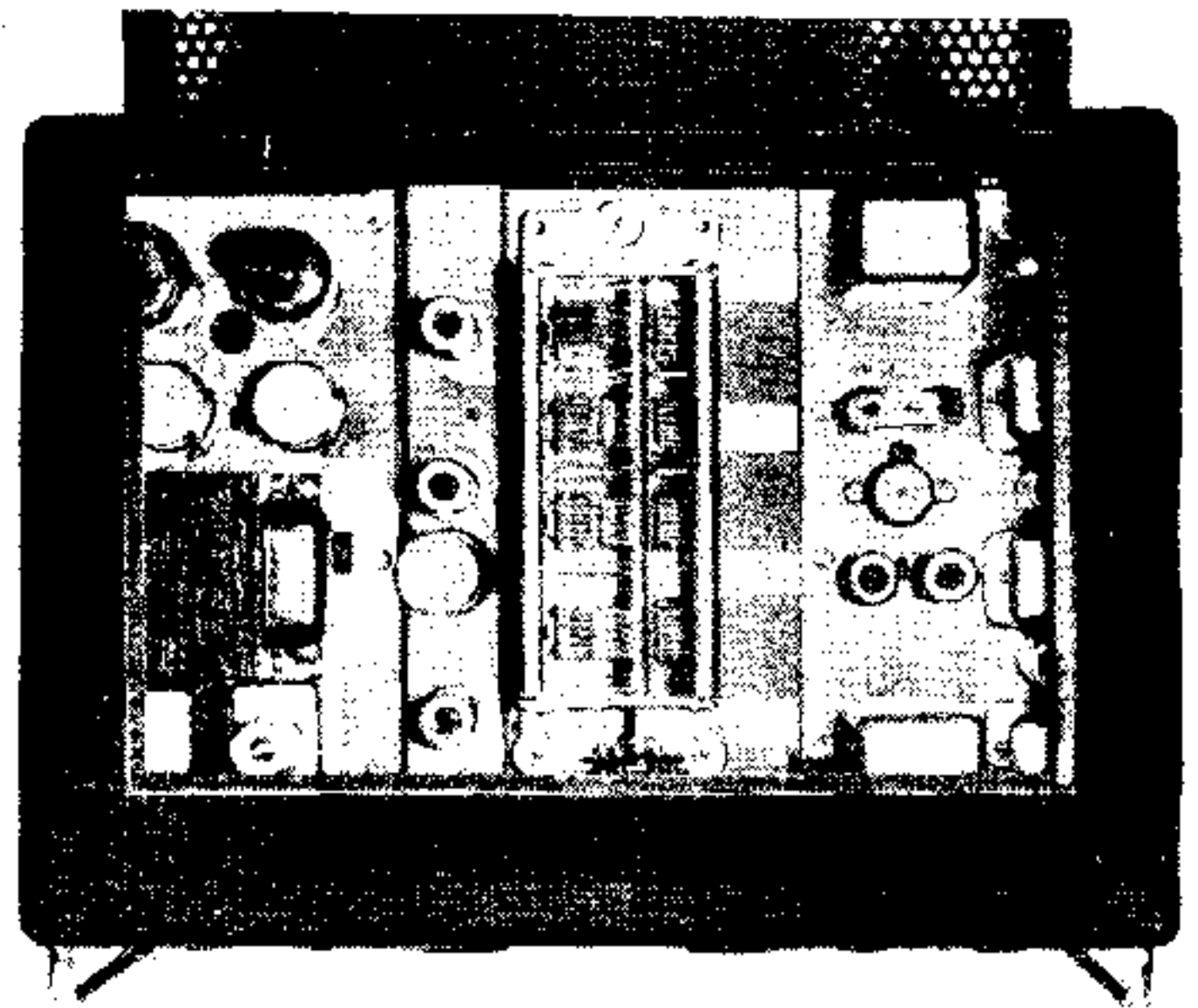
Provision is made for reception with high-resistance headphones, a jack being included in the anode circuit of the first 6AU6 valve and connected so that when the 'phones are plugged in the output and phase reversing stages are isolated.

The b.f.o. valve is a 6BA6 connected as a triode and the circuit is the well-known electron coupled arrangement. This is a particularly stable form of oscillator and so is well suited to a set of this type, which needs a very stable oscillator for heterodyning the signal when the crystal filter is in circuit. Stability is

As the stability of the frequency changer oscillator is every bit as important as that of the b.f.o., the stabilized h.t. is fed also to this valve and to the screen grid of the mixer, but not to its anode

(b) With the lid raised all valves are accessible, so also is the mains transformer for voltage adjustment. To trim the circuits, it is necessary to withdraw the chassis from the cabinet.

Tappings on the mains transformer provide for operation on 110 and 200 to 240 volts a.c. at normal supply frequencies.



which joins to the common h.t. line.

The receiver is self-contained, so far as the provision of all operating voltages is concerned, and it includes a mains transformer, a 5Z4G rectifier, stabilizer, as already mentioned, and adequate smoothing circuits. The

Although the receiver is not in the most expensive class (the price in the United Kingdom is £85) it is none the less a delightful set to handle. The 140 to 1 reduction in the tuning mechanism provides a precision of control that is most essential on the higher frequencies, yet it is not

a tedious control to operate as it embodies a heavy fly-wheel which serves to carry the pointer from one end of a range to the other with but three spins of the tuning knob.

Despite the low gearing, no trace of backlash could be detected, although quite a long chain of gears are used. These are all spring-loaded and of the split-wheel type. Similar gears drive a small subsidiary dial

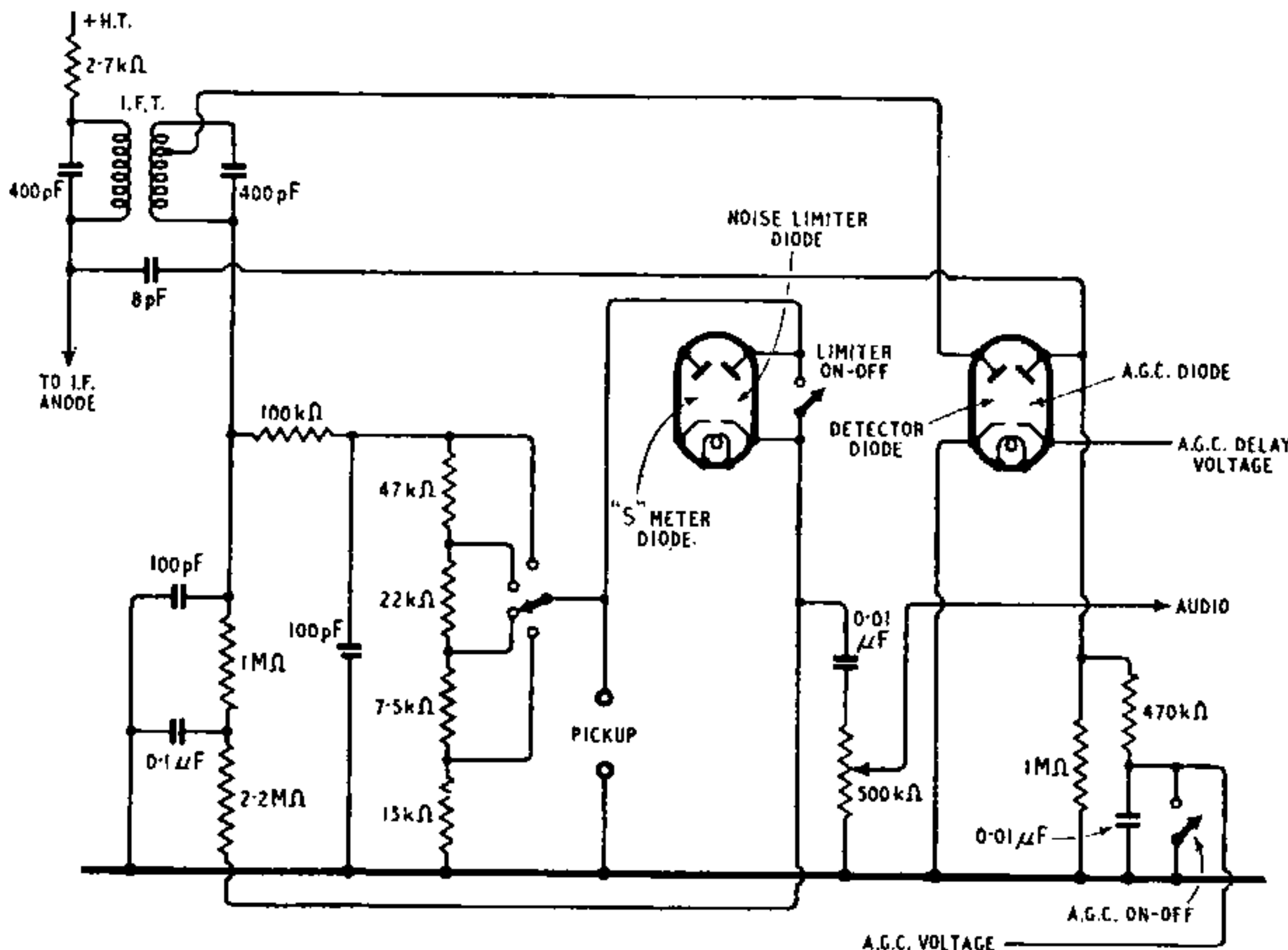


Fig. 3. Detector and noise limiter circuits of the Model 680. Included is the switching of the detector diode load and also the a.g.c. system.

further ensured by stabilizing its anode voltage, the stabilizing medium being a VR150/30 neon tube.

smoothing choke is of generous size and the two associated capacitors are 16 and 40μF respectively, the 16-μF being the reservoir.

which serves the equivalent of band-spreading, at least so far as logging stations is concerned. It is geared eighteen times faster

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than the main pointer and has ten inclined scales, each 1 in long, with a total marking of 100 divisions.

On the highest range, which is the longest or outer scale on the main dial, a scale length of 10 in is available and, with the subsidiary dial 20 in total. But as the subsidiary dial makes nine complete revolutions for the pointer's coverage of the main scale, it provides the equivalent of 90 in. of scale on this range. On the lowest frequency range, which is the inner calibrated scale, the effective length becomes 43 ins. In addition to the frequency calibrated scales there is a small logging scale on the main dial engraved 0-9. Thus to log a station it merely suffices to record the range (e.g., 1-5) the area on the 0-9 scale and the setting on the 0-100 bandspread scale. For example, a station on 9 Mc/s can be recorded as K2397½ as it is in range 2, comes in division 3 on the 0-9 scale and tunes in at 97½ on the bandspread dial.

So many receivers have smallish tuning knobs that it is a welcome change to handle a set with one of generous size. The two principal controls on this set—the tuning and the wavechange switch—are 2 in in diameter and have fluted edges into which the fingers sink comfortably.

**Subsidiary Controls**

Grouped on either side of the large knobs, and in two rows, are the subsidiary controls. On the left the upper pair of small knobs are for r.f. gain and b.f.o. pitch control, while below, are three toggle switches which, reading from left to right, serve the functions of power on-off, send or receive and b.f.o. on or off.

For reception the send-receive switch has to be in the down position and h.t. is then supplied to the valves. In the up, or off, position the h.t. supply is interrupted, but the heater supply to the valves is maintained. In addition, a second pair of contacts on the switch close and they can be used to operate a starting relay in a transmitter, either locally or at a distance. A pair of terminals at the back of the set join to these contacts.

The right-hand group comprise the crystal phasing capacitor and a.f. gain controls in the top row, and below, three switches for (from left to right) noise limiter on-off, a.g.c. on-off and bandwidth selection. Immediately above the crystal phasing capacitor is a flush-type thumb-operated switch for bringing the crystal into use when required.

This disposes of all the controls on the front panel, but there are two more located at the rear of the set. One, which is adjacent to the mains input socket, is an unusual fitting, as it is a small rheostat for adjusting the brightness of the dial light. At the opposite end of the set, and close to the loudspeaker connections, is a screwdriver slotted spindle for "zeroing" the "S" meter. This spindle is normally covered by a screw-on cap. The telephone jack is not very obvious as it is located on the left edge of the front panel, which, in this set, is slightly

dished with short, straight sides which rabbet into the main body of the metal cabinet.

The performance of the set on all wavebands should satisfy the most fastidious, and whether one is searching for a particular station, be it for traffic purposes, for a broadcast programme, or may be for an elusive and rare amateur DX station, the "680" has an uncanny knack of pulling the wanted signal out of the jumble that exists on most well-used bands.

When using the h.f.o. for c.w. reception it is necessary to have the a.f. volume control well advanced and regulate the output by the r.f. gain control. If the a.f. gain is turned too low the heterodyne beat appears to be very weak.

It has previously been mentioned that the output stage is push-pull, but this does not mean that a great deal of audio power is available. The pair of 7D9 miniature pentodes take about 16 mA each only, and for traffic handling, where a little distortion is of no consequence, an audio output of 5 to 6 watts is available. For high-quality broadcast reception this should be reduced to about 2 watts for distortionless reproduction over the widest possible range of audio frequencies.

A few words regarding the cabinet may not be out of place here. As befits a professional type of receiver, it is functional rather than ornamental, although this does not mean it is unpleasing in appearance. The rounded edges of the front and back actually tend to make the set look somewhat smaller than it actually is. The controls are conveniently placed, the dial is large but not overpowering and the louvred front and sides give adequate ventilation for all purposes.

The cabinet and front panel are finished in black crackle enamel with chromium plated carrying handles. All knobs are black. Overall dimensions of the set are: 16½ in wide, 13½ in deep and 8½ in high. The weight is 41 lbs. Access to the inside of the set is given by a flush-fitting hinged lid in the top of the cabinet.

The makers are Stratton and Company, Eddystone Works, Alvechurch Road, West Heath, Birmingham, 31.