Aligning Without Instruments

METHODS OF ACHIEVING GOOD RESULTS

By G. Cole

WHILE the experimenter may be in possession of a multi-range testmeter or some means of measuring voltage, current and resistance, he often finds himself faced with an alignment task which normally calls for a signal generator in addition to the basic instruments.

It is not suggested that a signal generator is not necessary to perform such an operation successfully and with the utmost speed, but where time is not an important factor and when simple current and voltage tests reveal conclusively that lack of signals is caused by misalignment of the receiver's tuned circuits, there is a method whereby the alignment can be restored to a reasonable standard of accuracy without the assistance of instruments of any kind. A basic understanding of the principles involved and a good deal of patience being the essential requirements.

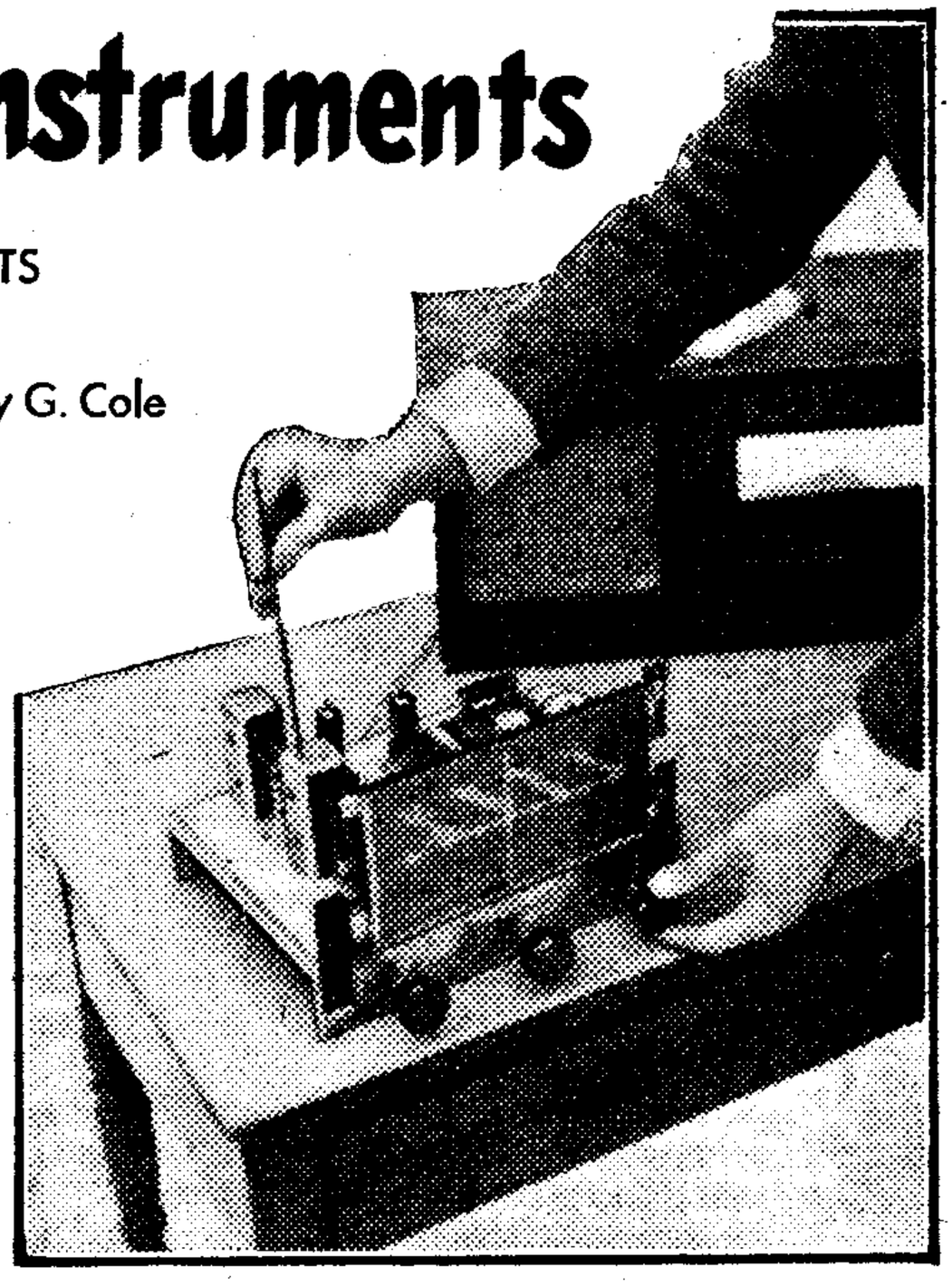
Weak Signal

The skeleton circuit in Fig. 1 is representative of the frequency changer and I.F. stages of a typical three-band receiver. If such a set is completely out of alignment there is little hope of picking up a signal on any band over the full range of the tuning capacitor. However, by removing the aerial from the aerial socket and connecting it direct to the control grid (usually the top cap) of the frequency changer valve, it is often possible to receive a signal from the local transmitter (medium- or long-wave) somewhere within the range of the tuning capacitor. The signal will obviously be well removed from the correct tuning point.

Once a signal of sort can be received the battle is half won. If the set is working well within the service area of a powerful transmitter, it is likely that a weak signal will be obtained somewhere on the dial even with the aerial connected normally to the aerial socket, but this will also depend on the aerial and earth system, and in some cases it may save time to rig up a temporary aerial as a means of injecting into the misaligned receiver the strongest signal possible. A good earth also helps.

Let us suppose that weak reception of the L.W. Light Programme is possible at the end of the dial with the aerial connected to the control grid of V1 (see Fig. 1). The next move is to bring the I.F. transformers into some form of alignment. This is done by adjusting the cores in L13, L12, L6 and L5, in that order, for the loudest signal.

The signal should now be very much improved since the transformer windings are all tuned to the same frequency, even if this is removed from the correct intermediate-frequency. The design of I.F. transformers is usually such that the correct intermediate-frequency is obtained with the tuning cores fairly well balanced in the coil formers or with the trimmer capacitors adjusted between the very loose and very tight positions. It will probably be found that this is far from the case after the cores or trimmers have been adjusted on the weak signal.



A non-metallic trimming tool is used for alignment

The next move, then, is to establish an I.F. tuning point which is closer to the correct intermediate-frequency. The core in the secondary of the second I.F. transformer or the trimmer capacitor across this winding (L13 in Fig. 1) should be adjusted a turn or so towards the point of balance. This will weaken the received signal, but the strength should be restored by following up on the tuning of the set itself and coils L12, L6 and L5, in that order.

L13 should then be adjusted even more towards core or trimmer balance, as described above, and the remaining I.F. coils adjusted to suit, bearing in mind that as the intermediate-frequency is shifted so it will be necessary to re-tune the receiver to hold the signal originally selected. During this operation it will almost certainly be found that the receiver will tune the signal closer to the point that it should be received on the dial. The L.W. Light Programme is a good signal to work with since this is known to be at 200 kc/s, or 1,500 metres.

Long-wave Alignment

After the I.F. transformers have been finally adjusted for maximum signal at reasonable balance of the cores or trimmers, it can be assumed that the intermediate-frequency is pretty well within its correct tolerance. It is then necessary to concentrate on the oscillator and aerial tuned circuits.

When the I.F. transformers have been aligned

the signal will be much louder, and if the aerial has been connected to the control grid of the frequency changer valve it can be removed and connected to the aerial socket, resulting in a temporororary loss of volume. This will be recovered as the aerial and oscillator circuits are brought into correct alignment. However, if the signal disappears on connecting it to the aerial socket, the aerial should be returned to the signal grid until the oscillator circuits have been aligned.

In some receivers a separate oscillator trimmer is available for each band and, in certain cases, a fixed padder is used and alignment at the low-frequency end of the band is achieved by the adjustment of dust-iron cores in the oscillator coils. With such receivers it is best first to adjust the L.W. trimmer in the direction which necessitates turning the tuning towards the correct point on the dial in order to hold the signal. In other words, the trimmer should be adjusted one turn, or less, and the signal re-tuned on the dial in the normal way. This should be continued until the signal is tuned at the correct point on the dial, that is, say, 1,500 metres for the Light Programme.

It may be found, however, that the correct tuning point cannot be established because the L.W. trimmer is at the end of its range. When this is the case, the trimmer should be adjusted to a "medium" setting, the signal re-tuned on the dial and adjustment made, in the same way as described for the trimmer, to the L.W. dust-iron core or padding capacitor. This will give the correct settings at, say, 1,500 metres, but is insufficient to ensure that the receiver tracks correctly over the band.

On L.W. this is unimportant owing to the small number of stations, but reasonable correction is possible by adjusting the L.W. oscillator dust-iron core or L.W. padder for maximum response of, say, Kalundborg with the receiver tuned to this station on the dial, and the L.W. oscillator trimmer for maximum response of Paris with the pointer correspondingly set. These two stations fall either side of the Light Programme, so when correct padder and trimmer adjustment has been attained on them the tuning will also be correct on the Light Programme.

Should it be found impossible to secure correct L.W. oscillator alignment as described, it may well be that the I.F. is too far removed from the correct frequency, in which case it will be necessary to readjust the I.F. transformers, in step, in the direction which swings the tuning of the selected station towards its name or wavelength as marked on the tuning scale.

Medium-wave Alignment

The same procedure is adopted for aligning the M.W. oscillator circuits. It is best first to establish the Home Programme on, say, 330 metres, and use this as a basis. Tracking of the M.W. band can be accomplished at the high-frequency end on Radio Luxembourg and at the low-frequency end on Athlone or any other stations in proximity which can be identified, bearing in mind that the padder or dust-iron core is adjusted at the low-frequency end of the band and the trimmer at the high-frequency end.

With certain receivers, such as that shown in Fig. 1, oscillator alignment is achieved on M.W. simply by adjusting trimmer C12, and on L.W. by adjusting padder C18. The signals to which these adjustments are made should fall approximately in the centre of the bands, the L.W. Light Programme and the M.W. Home Programme being suitable.

Short-wave Alignment

It is necessary to adjust the S.W. circuits to conclude the alignment exercise. This is usually a simple matter since fixed padding is invariably featured on "standard" receivers. The S.W. band is usually full of signals and as quite a large frequency range is covered by the oscillator trimmer itself (C14 in Fig. 1) it may be necessary to listen to one or two signals over a period of time to establish their identity and frequency. However, when the frequency of any station has been discovered, usually by announcement, the S.W. oscillator trimmer should be carefully adjusted until the station is tuned at the correct point on the dial.

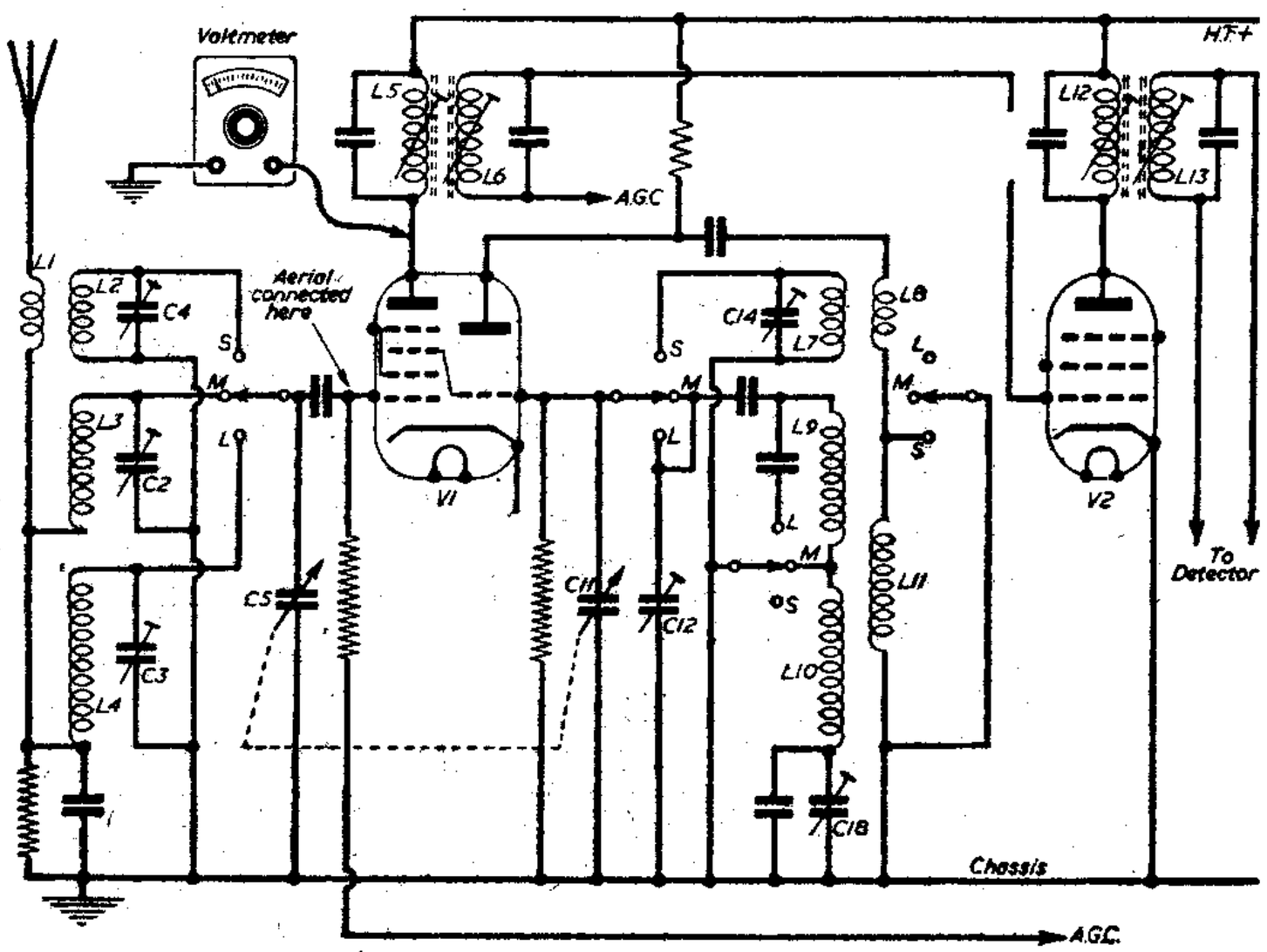


Fig. 1.—Skeleton circuit of the frequency-changer and L.F. stages of a typical three-band receiver.

Aerial Circuit Alignment

So far we have been dealing with the I.F. and oscillator sections, and if these have been adjusted correctly the set should be fairly lively, even though the aerial circuits may be off-tune. In any case, the aerial may still be connected to the control grid of the frequency changer valve. This can now be connected to the aerial socket. There is little

(*Continued on page* 220)

ALIGNING WITHOUT INSTRUMENTS

(*Continued from page 208*)

doubt that signals will be heard this time and switching first to the L.W. band and tuning in the Light Programme, the L.W. aerial trimmer should be adjusted for maximum volume.

The receiver should then be tuned to the Home Programme and the M.W. aerial trimmer adjusted likewise. Finally, the S.W. aerial trimmer should be adjusted for maximum volume of a station towards the high-frequency end of the S.W. band, that is with the tuning gang towards minimum capacitance.

If the aerial coils feature adjustable dust-iron cores or if padding capacitors are included in the design, optimum tracking of the aerial circuits can be accomplished by adjusting the core or padder for maximum volume of a station at the low-frequency end of the band, and the trimmer for maximum volume of a station at the high-frequency end of the band. Exactly the same applies if the receiver incorporates a stage of R.F. amplification. Trimmers C3, C2 and C4 in the circuit in Fig. 1 correspond to the L.W., M.W. and S.W. aerial circuits respectively.

No Signals

If, when the alignment procedure is begun, a signal cannot be obtained to align the I.F. transformers even when the aerial is connected direct to the control grid of the frequency changer, a suitable signal can be generated in the receiver itself simply by connecting a voltmeter between the receiver chassis and the anode of the mixer section of the frequency changer valve (see Fig. 1). The probe should not be firmly connected to the anode, however, but should be scraped against the anode tag on the valveholder. This action produces transient signals in the I.F. stages, and if the volume control is turned fully up and an ear is held close to the loudspeaker corresponding crackling noises will be heard.

The idea is to continue producing such noises while adjusting the I.F. trimmers, adjustment being made for the loudest crackling. At this point the I.F. circuits will be in reasonable alignment and so permit the passage of signals with the aerial connected to the frequency changer signal grid. From this stage the alignment process should be continued as outlined earlier.