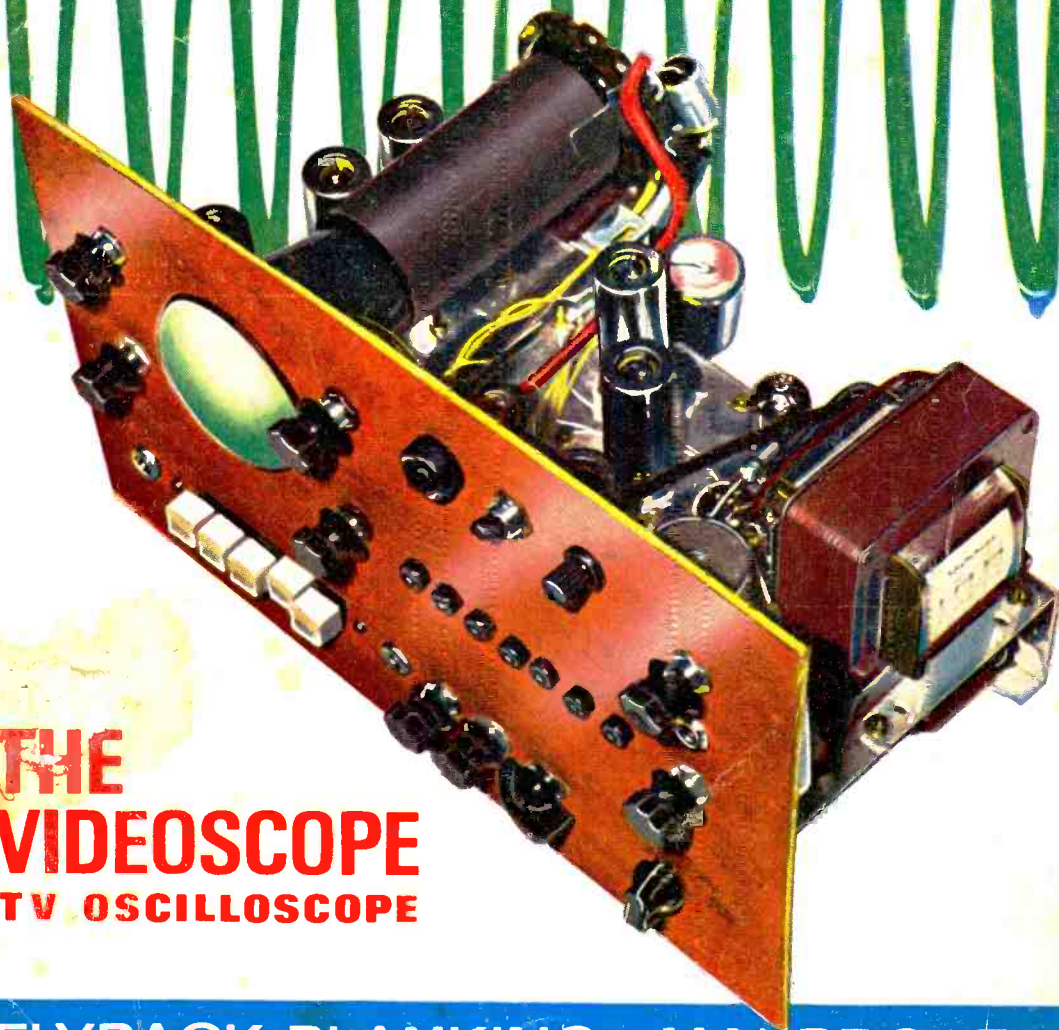


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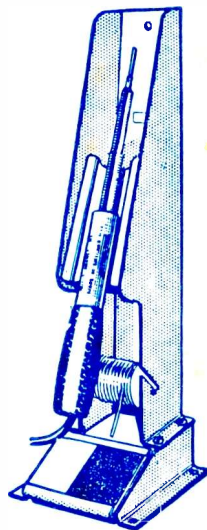
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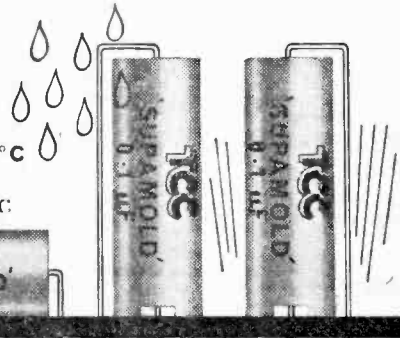
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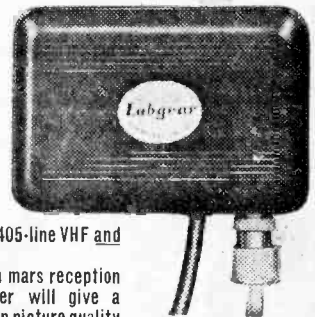
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# Practical Television

AND TELEVISION TIMES

VOL. 15, No. 169, OCTOBER, 1964

Editorial and Advertisement  
Offices:

**PRACTICAL TELEVISION**

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The Editor will be pleased to consider articles of a practical nature suitable for publication in "Practical Television". Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for the manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed to The Editor, "Practical Television", George Newnes Ltd., Tower House, Southampton Street, London, W.C.2.

Owing to the rapid progress in the design of radio and television apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

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## A Hundred, Not Out

WE are always passing landmarks, anniversaries, Red Letter Days and what have you, either National, local or personal. Reaction to such events varies from individual to individual, from uninhibited jubilation, through mild indifference to pure dejection. A common event like a birthday, for instance, could invoke what the film people used to call "the gamut of the emotions".

This elaborate preamble is simply a pretext to announce another *Practical Television* landmark. The regular, and highly popular, series "Servicing Television Receivers" is, in fact, now ten years old, and with this issue sets off briskly into its eleventh year.

We feel this calls for congratulations to the author of this epic series on his store of knowledge, unflagging enthusiasm and highly consistent contributions. Over the past decade, Les. Lawry-Johns has given us a wealth of practical information which, we know, has been avidly read by thousands of readers. Amateurs and professionals alike are among his followers and we hope will remain so for a long time to come.

Individual articles in this series have, of course, passed the century mark and this, in itself, is another landmark. It has been suggested that the next cause for celebration will be the author's own personal century. Alas, we fear this will not be for a year or two for we believe (it is a closely guarded secret) he is yet only a sprightly 90 or so.

But, they say, age is relatively unimportant; it's what you feel that matters. The same might apply to Servicing. To the professional it is a job of work, undertaken with various degrees of enthusiasm, with a pay packet at the end of the week. To the amateur, it might mean an absorbing problem, a tedious chore or sheer misery and frustration.

But although amateurs and professional vary in ability and keenness, there can be little doubt on one point—a sticky servicing problem at once highlights the ability or otherwise of the potential repair man. It will ruthlessly expose any limitations in technique and theoretical knowledge, for while obvious faults are usually pretty obvious, and stock faults are a matter of common sense and a good memory, the real "sticky dog" demands clear, logical thinking based on fundamental theory. It provides a reliable demarcation line.

It has been said (though we have never found by whom!) that successful servicing requires 90% practical know-how and 10% theory. This is meant to suggest the importance of practical knowledge but, if the ratio is assumed to be correct, then we say that the 10% is valuable far beyond the implied face value.

Jobs which require theoretical reasoning are those which are so time consuming and nerve racking to those whose grasp of basics are inadequate or who are unable to take theory a stage beyond the textbook and consider likely causes and effects.

The moral (if it can be so called) is probably that when faced with a stubborn servicing problem one does not have to be an Einstein, or even a Lawry-Johns. But it helps!

Our next issue dated November will be published on October 22nd.

# TELETOPICS

## PRODUCTION STARTS ON KLYSTRONS FOR U.H.F.

JUST seven months ago work began at the Paignton, Devon, plant of Standard Telephones and Cables' Valve Division to set up a new production unit for the manufacture of u.h.f. television klystrons. Already the unit is producing its first valves, the type 4KM100LH. Initial production at Paignton will be concentrated on the types 4KM100LH, 4KM100LA and 4KM100LF

klystrons, although manufacture of additional types having different power outputs will follow.

These new valves will feature prominently in the transmitting equipment providing the new 625-line TV services as they are introduced by the two broadcasting authorities. The 4KM-100LH is a magnetically focused power amplifier with four integral

cavities and a frequency coverage of 700 to 890Mc/s. In picture transmission this valve will provide a minimum of 25kW of peak synchronizing power with a power gain of 30dB and a 1dB bandwidth of 8Mc/s.

STC are manufacturing this range of klystrons under an agreement with Eitel McCullough Incorporated.

## NEW RED PHOSPHORS FOR COLOUR C.R.T.

THE intrinsic brilliance of the new Sylvania Electric Products colour television c.r.t.—the "Color Bright 85" — represents an improvement of 40% over the performance of previous types.

This improvement was achieved through the development of a new red phosphor involving the rare-earth chemical element Europium, and by developing a new technique of depositing the phosphors on the screen.

The improved process is being used by Sylvania in the manufacture of both their conventional 70° colour tube and their new 90° rectangular version, which will be available in 1965.

A secondary result of the improved red phosphor is that the full intrinsic brilliance of the green and blue phosphors (which had to be damped somewhat in earlier tubes) can now be exploited as well. This will make colour television viewing under daylight conditions feasible and will probably contribute considerably to general public interest when colour television is ultimately launched in this country.

## "Shared Site" Relay Station

BUILDING contracts for a new "shared site" television relay station have been announced by the BBC.

The station which will be built at Robrow, about two miles West of Scarborough, will have a 200ft mast which will eventually carry both ITA and BBC aerials. An ITA relay station will also be built at the same site.

The BBC station should be completed early in 1965 when it will radiate BBC-1 programmes and the three v.h.f. radio programmes. This will provide the Scarborough and Filey areas with improved reception of these services which have previously been prone to interference from transmissions from the Continent.

When the ITA transmissions begin, they will serve roughly the same region as those from the new BBC station.

## TRIPLE CHECK

Image-orthicon television camera tubes made at the Hayes factory of EMI Electronics Ltd. receive a total of approximately three hours testing in the equipment shown on the left, prior to despatch to customers.

The tests are carried out in three stages: first immediately after manufacture, second after a month and finally on despatch.

The specialised equipment used for the tests simulates all the operating conditions the tube is likely to experience by duplicating all the electrical, optical and mechanical parameters relevant to its future performance in a television camera.



## C.C.TV TRAINS PERSONNEL

CLOSED-CIRCUIT television equipment in the Shell Centre, London, has been put to a number of unusual uses since its installation including familiarizing public relations and other staff with speaking in front of TV cameras to provide for the eventuality of either the BBC or ITA requiring an authoritative speaker on any subject concerning the Shell International Petroleum Company

### BBC-2 Publicity Campaign

BY the installation of temporary equipment at the Sutton Coldfield station of the BBC (see Tele-topics, August) the third television programme will commence in the Birmingham area during November, nine months ahead of schedule.

The service area of this temporary transmitter represents, it is estimated, a potential two million viewers for the new programme.

A large campaign to publicise BBC-2 in Birmingham and its environs has already been mounted by the Corporation and the television retail trade and industry.

Limited. The Company's film unit too has found the equipment a valuable aid in checking the details of film sets before shooting commences and the quality of the film after its completion. Foreign language courses is yet another field in which c.c. TV is being used in the Centre.

The Shell Company has, in fact, found so many applications for a closed-circuit TV system that a special studio in the Centre has recently been installed with cameras and associated equipment supplied by EMI Electronics Ltd.

In the studio itself are two cameras for "live" programmes, while another in the control room televises titles and captions. A fourth camera forms part of a telecine arrangement.

## INTERNATIONAL TV SHOW

NOW that the TV and Radio Show is over for another year, some advance information of the French International Radio and Television Show to be held in Paris in 1965 has already been given by the organisers, the Fédération Nationale des Industries Electroniques (Electronic Industries Association of France) who will be working in co-operation with the ORTF (the French radio and television broadcasting office) to provide an exhibition to surpass its predecessor which was held in 1963.

The dates for this important exposition are 9th to 19th September, 1965. Domestic radio and television receivers, tape recorders and record players will again provide the majority of displays at the show which will be spread through three halls of the Parc des Expositions, Porte de Versailles where the exhibition is to be held. Two other halls will be used to stage radio and television programmes organised by the ORTF.

## Inexpensive Video Tape Recorders

AT the International Conference on Magnetic Recording held at the IEE in London recently, Peto Scott Electrical Instruments Ltd., demonstrated a simplified video tape recorder which has been developed by Philips Electrical Limited.

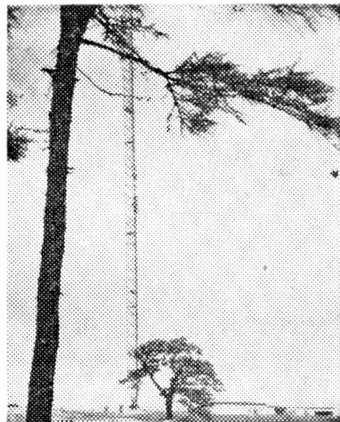
Although this new recorder uses the conventional helical scan technique, it operates with only one video record/replay head, which is made of Ferroxcube—a substance which has the longest life of any known recording head material.

In operation, the 1in. tape is scanned by the single rotating video head at a rate of 23m/sec. while the tape moves at 7½in./sec. The rotating head is thence coupled to the preamplifier by a rotating transformer.

Designed to operate on the C.C.I.R. television standard, this video tape recorder can provide a maximum playing time of 45 minutes using 8in. reels containing 1,800ft. of L.P. tape.

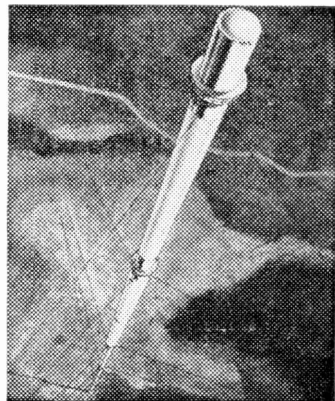
Various versions of the recorder will be introduced gradually at prices ranging from a little less than £1,000.

## PRESENT-FUTURE

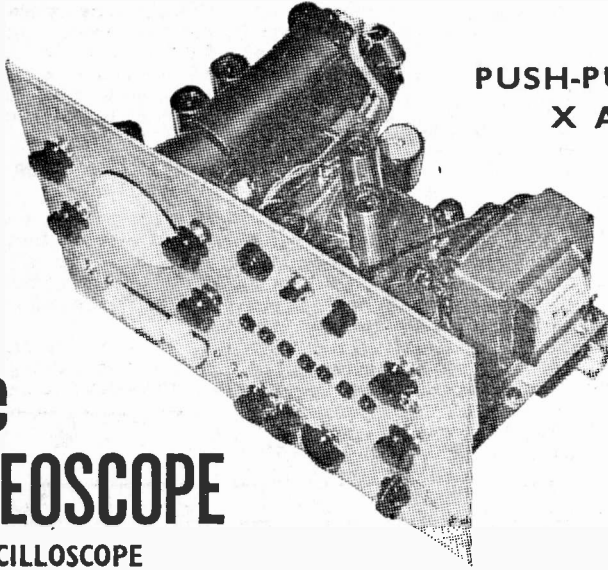


The conventional transmitting mast shown above is that of the ITA's Moel-y-Parc station in North Wales. This isolated station has been operating continuously for more than twelve months now, ever since Marconi engineers had the formidable task of installing its equipment during the hazardous winter of 1962/3.

Looking more to the future, the artist's impression below is of a new type of cylindrical steel mast now being erected by British Insulated Callender's Construction Co. Ltd. for EMI Electronics Ltd., at Emley Moor, Winter Hill and Belmont television stations to carry both u.h.f. and v.h.f. aeriels. Strictly for the birds, this view clearly shows the top-most sections of the mast where the aeriels will be housed behind translucent glass-fibre cylinders.



## FLYBACK BLANKING



## PUSH-PULL X AND Y-AMPLIFIERS

## H.V. PROBE

# The VIDEOSCOPE

## TV OSCILLOSCOPE

BY MARTIN L. MICHAELIS

**T**HE Videoscope is built around the surplus VCR139A c.r.t. obtainable for about 15s. Whilst these tubes are often of somewhat poorer quality than commercial types, the cheap price more than compensates for this.\* Considerable experimenting to obtain a circuit highly tolerant of c.r.t. shortcomings, has led to a satisfactory prototype.

At the low e.h.t. voltages cheaply obtainable from slightly modified conventional h.t. supplies, the VCR139A suffers from astigmatism and deflection-defocussing to an extent greatly exceeding the tolerances of even the most broad-minded reader, unless push-pull deflection is used throughout, on both X and Y plates.

Some tube specimens were found better than others, but even then push-pull deflection is still necessary to obtain the necessary peak-to-peak deflection amplitude of nearly 200V. Single-valve deflection would require rather large h.t. voltage to generate this output, with consequent problems and expense in components—particularly electrolytics.

To avoid the expense, weight and space of numerous iron-cored smoothing chokes, yet maintain excellent h.t. feed decoupling of the various portions of the instrument, smoothing resistors of rather large values compared to the currents drawn are used, thus already necessitating a relatively large h.t. input from the rectifier (350V).

*\*[We hope, at a later date, to present an article showing how a commercial c.r.t. may be used with this oscilloscope.—Editor.]*

It is vitally important *not* to substitute the EZ80 valve-rectifier, V8, with a metal rectifier, as the heater warm-up time of the rectifier gives the essential delay in application of voltage to the electrolytics until all valves have warmed up.

With a metal rectifier there would be an immediate surge to about 500V on the h.t. line when switching-on, which would remain until the valves have warmed-up, a time sufficient to destroy the electrolytics.

### CONSTITUENT PARTS OF CIRCUITS

The Videoscope is composed of four parts. The first is a high-gain Y-amplifier, with capacitive and inductive compensation in a form which can easily be managed by the normal constructor. This gives full amplification not only over all audio frequencies of the hi-fi scale, but also through the entire long and medium wavebands of radio frequencies and some way beyond.

The amplifier is, of course, not tuned to any of these frequencies—it passes and amplifies all of them linearly; it is, in other words, a true video amplifier with the necessary push-pull output for symmetrical deflection on the c.r.t.

The effective sensitivity at the input terminal is so high that direct pick-up of local medium-wave broadcast stations, without any leads or aerial connected whatsoever, can lead to full screen-size display of the modulated carrier(s) on the c.r.t. in areas of high signal strength, making the most





## COMPONENTS LIST

### Resistors:

R1	1M $\Omega$ $\frac{1}{2}$ W	R47	100k $\Omega$ 1W
R2	820k $\Omega$ $\frac{1}{2}$ W	R48	100k $\Omega$ $\frac{1}{2}$ W
R3	180k $\Omega$ $\frac{1}{2}$ W	R49	47k $\Omega$ 1W
R4	1M $\Omega$ $\frac{1}{2}$ W	R50	68k $\Omega$ $\frac{1}{2}$ W
R5	38k $\Omega$ $\frac{1}{2}$ W	R51	1M $\Omega$ $\frac{1}{2}$ W
R6	1M $\Omega$ $\frac{1}{2}$ W	R52	150k $\Omega$ $\frac{1}{2}$ W
R7	10k $\Omega$ $\frac{1}{2}$ W	R53	2.2M $\Omega$ $\frac{1}{2}$ W
R8	1M $\Omega$ $\frac{1}{2}$ W	R54	10k $\Omega$ 1W
R9	4.7k $\Omega$ $\frac{1}{2}$ W	R55	33k $\Omega$ $\frac{1}{2}$ W
R10	470 $\Omega$ $\frac{1}{2}$ W	R56	470k $\Omega$ $\frac{1}{2}$ W
R11	1M $\Omega$ $\frac{1}{2}$ W	R57	470 $\Omega$ $\frac{1}{2}$ W
R12	270 $\Omega$ $\frac{1}{2}$ W	R58	10k $\Omega$ 2W
R13	470 $\Omega$ $\frac{1}{2}$ W	R59	68k $\Omega$ $\frac{1}{2}$ W
R14	10k $\Omega$ 2W	R60	68k $\Omega$ $\frac{1}{2}$ W
R15	4.7k $\Omega$ $\frac{1}{2}$ W	R61	10k $\Omega$ 2W
R16	10k $\Omega$ 2W	R62	5k $\Omega$ 5W w.w.
R17	1M $\Omega$ $\frac{1}{2}$ W	R63	22k $\Omega$ 1W
R18	470 $\Omega$ $\frac{1}{2}$ W	R64	100 $\Omega$ $\frac{1}{2}$ W
R19	10k $\Omega$ 2W	R65	100 $\Omega$ $\frac{1}{2}$ W
R20	22k $\Omega$ 1W	R66	470 $\Omega$ $\frac{1}{2}$ W
R21	68k $\Omega$ $\frac{1}{2}$ W	R67	47 $\Omega$ $\frac{1}{2}$ W
R22	68k $\Omega$ $\frac{1}{2}$ W	R68	470k $\Omega$ $\frac{1}{2}$ W
R23	10k $\Omega$ 2W	R69	27k $\Omega$ $\frac{1}{2}$ W
R24	100 $\Omega$ $\frac{1}{2}$ W	R70	4.7k $\Omega$ $\frac{1}{2}$ W
R25	100 $\Omega$ $\frac{1}{2}$ W	R71	5.6M $\Omega$ 1W
R26	470 $\Omega$ $\frac{1}{2}$ W	R72	22k $\Omega$ 1W
R27	270 $\Omega$ $\frac{1}{2}$ W	R73	270k $\Omega$ 1W
R28	270 $\Omega$ $\frac{1}{2}$ W	R74	270k $\Omega$ 1W
R29	1M $\Omega$ $\frac{1}{2}$ W	R75	560k $\Omega$ 1W
R30	5k $\Omega$ 5W w.w.	R76	47k $\Omega$ 1W
R31	2.2M $\Omega$ $\frac{1}{2}$ W	R77	2.2M $\Omega$ $\frac{1}{2}$ W
R32	2.2M $\Omega$ $\frac{1}{2}$ W	R78	2.2M $\Omega$ $\frac{1}{2}$ W
R33	10k $\Omega$ $\frac{1}{2}$ W	R79	2.2M $\Omega$ $\frac{1}{2}$ W
R34	150k $\Omega$ $\frac{1}{2}$ W	R80	2.2M $\Omega$ $\frac{1}{2}$ W
R35	150k $\Omega$ $\frac{1}{2}$ W	R81	1M $\Omega$ $\frac{1}{2}$ W
R36	270k $\Omega$ $\frac{1}{2}$ W	R82	100k $\Omega$ 1W
R37	270k $\Omega$ $\frac{1}{2}$ W	R83	33k $\Omega$ 1W
R38	470k $\Omega$ $\frac{1}{2}$ W	R84	470k $\Omega$ 1W
R39	220k $\Omega$ $\frac{1}{2}$ W	R85	47k $\Omega$ 1W
R40	220k $\Omega$ $\frac{1}{2}$ W	R86	33k $\Omega$ 1W
R41	47k $\Omega$ 1W	R87	10k $\Omega$ $\frac{1}{2}$ W
R42	100k $\Omega$ 1W	R88	4.7k $\Omega$ $\frac{1}{2}$ W
R43	2.7k $\Omega$ $\frac{1}{2}$ W	R89	3.3k $\Omega$ $\frac{1}{2}$ W
R44	150k $\Omega$ 1W	R90	1k $\Omega$ $\frac{1}{2}$ W
R45	470 $\Omega$ $\frac{1}{2}$ W	R91	1k $\Omega$ $\frac{1}{2}$ W
R46	3.3k $\Omega$ $\frac{1}{2}$ W		

All  $\pm 10\%$  carbon unless otherwise stated

### Potentiometers:

VR1	2k $\Omega$ 2W lin.	VR5	250k $\Omega$ lin.
VR2	250k $\Omega$ lin.	VR6	250k $\Omega$ lin.
VR3	2M $\Omega$ lin.	VR7	100k $\Omega$ lin.
VR4	250k $\Omega$ log.	VR8	25k $\Omega$ lin.

All carbon track types

### Capacitors:

C1	47pF cm	C29	8 $\mu$ F e50/t
C2	220pF cm	C30	8 $\mu$ F e350/t
C3	750pF cm	C31	0.1 $\mu$ F pt
C4	1500pF cm	C32	33* 100pF cm
C5	0.25 $\mu$ F pt	C34	35* 1000pF cm
C6	2200pF pt	C36	37* 0.01 $\mu$ F pt
C7	2700pF pt	C38	39* 0.1 $\mu$ F pt
C8	50 $\mu$ F e350/t	C40	0.1 $\mu$ F pt
C9	32 $\mu$ F e350/t	C41	0.1 $\mu$ F pt
C10	50 $\mu$ F e450/550/c	C42	0.1 $\mu$ F pt
C11	2700pF pt	C43	16 $\mu$ F e350/t

C12	0.15 $\mu$ F pt	C44	2700pF pt
C13	0.1 $\mu$ F pt	C45	0.15 $\mu$ F pt
C14	0.1 $\mu$ F pt	C46	8 $\mu$ F e350/t
C15	0.15 $\mu$ F pt	C47	0.01 $\mu$ F pt
C16	0.01 $\mu$ F pt	C48	25 $\mu$ F e350/t
C17	50 $\mu$ F e350/t	C49	50 $\mu$ F e450/550/c
C18	2700pF pt	C50	0.5 $\mu$ F mp
C19	0.02 $\mu$ F pt	C51	0.5 $\mu$ F mp
C20	0.02 $\mu$ F pt	C52	8 $\mu$ F e350/t
C21	0.02 $\mu$ F pt	C53	8 $\mu$ F e350/t
C22	8 $\mu$ F e350/t	C54	0.1 $\mu$ F pt
C23	8 $\mu$ F e350/t	C55	0.1 $\mu$ F pt
C24	2700pF pt	C56	0.1 $\mu$ F pt
C25	0.1 $\mu$ F pt	C57	8 $\mu$ F e350/t
C26	2700pF pt	C58	8 $\mu$ F e350/t
C27	8 $\mu$ F e350/t	C59	8 $\mu$ F e350/t
C28	2700pF pt	C60	2700pF pt

\* Matched pairs: selected 1:10:100:1000.

Code: pt=paper tubular 500V; mp=metallised paper can 500-750V; cm=ceramic or mica 500V; e50=electrolytic 50V; e350=electrolytic 350V; e450/550=electrolytic 450-550V; /t=tubular; /c=can.

### Valves:

V1	EF80	V5	EF86
V2	EF80	V6	EF80
V3	EF80	V7	EF80
V4	EF80	V8	EZ80
V9	VCR139A		

### Diodes:

DI, 2, 3,	
4, 5, 8	S36 fast silicon (Brush Crystal Co., Southampton)
D6, 7	E250 C50 flat selenium rectifiers

### Switches:

S1	3-pole 5-way (two wafers each 2-pole 5-way, leaving one pole blank).
S2	5-key push button aggregate (piano key unit) each key 2-pole 2-way. See text.
S3	2-pole 4-way wafer.
S4	Double-pole on/off toggle.

### Sockets:

SK1, 2, 3	Coaxial sockets
SK4	3-pin mains socket
SK5, 6, 7, 8	
9, 10, 11	Insulated wander sockets

### Miscellaneous:

TC1, 2, 3,	
4, 5	3-15pF "postage stamp" trimmers
F1	1A slow fuse
LPI	Red, panel-mounting pilot lamp
T1	Mains transformer. Secondaries 350/250/0/250/350V 80mA; 6.3V 3A; 4V 2A
LI, 2, 3	See text
	Mounting assembly for V9 (base, bracket, screening can from Service Trading Co., Gt. Newport St., London). Panel-mounting unit for F1. 6in. x 12in. x 2in. aluminium chassis with base plate. Ten small pointer knobs. Coaxial, mains and wander plugs. Eight Noval valveholders, seven skirted with screening cans. Wood and material for cabinet. Tag strips, mains lead, wire sleeving, etc., etc.

The method of gain-control thus adopted, consists of a bridge-bank balanced attenuator built around a five-pushbutton aggregate (a row of five d.p.d.t. toggle switches is usable as a substitute), to select five basic sensitivities. A negative-feedback cathode-potentiometer in the input stage, gives continuous fine-control in about (6:1)-ratio, to cover the gaps between the five basic steps.

The only drawback of this combined arrangement, otherwise excellent, is that operation of the cathode potentiometer VR1 necessarily generates a spurious transient signal whilst tuning, so that

correct for, and including the characteristics of the probe. One will only in very exceptional circumstances operate without the probe, so that its inclusion in the calibration avoids constant mental arithmetic when working with the unit.

Inclusive of the probe in this way, the *Videoscope* is calibrated for a continuous coverage from 333mV/cm to 400V/cm at the Y-amplifier input. Without the probe, i.e. for direct input at the coaxial socket, the sensitivity is 15 times greater but the frequency and phase correction is lost above audio frequencies in general.

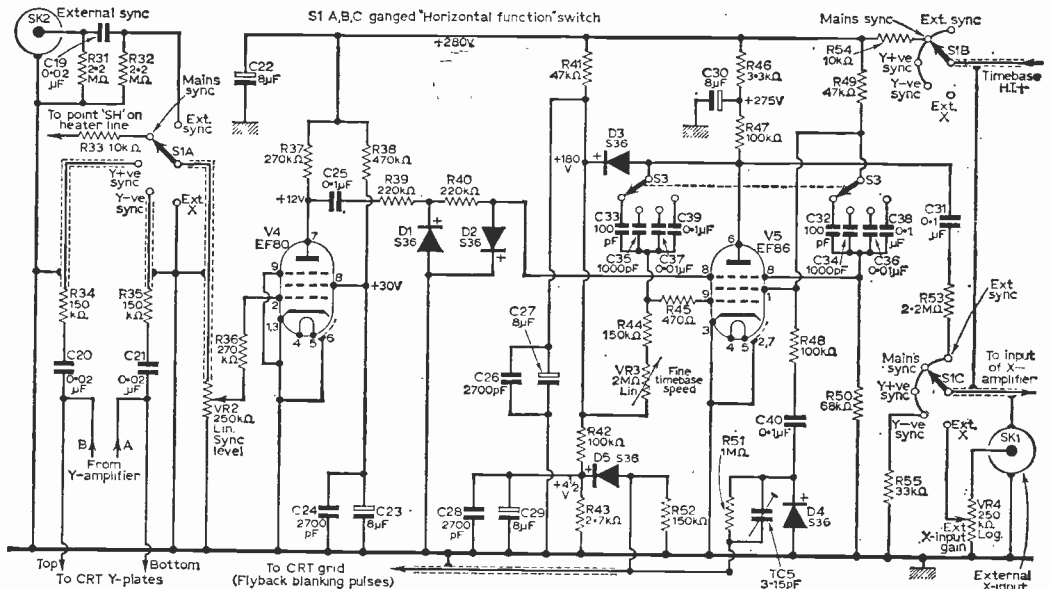


Fig. 2—Timebase and sync circuits. Four speed ranges and fine control are used (covering speeds from 2µsec/cm to 20msec/cm) and a diode shaping circuit obtains flyback-blanking pulses for the c.r.t. grid from the screen grid of V5.

operation must be gentle to avoid brief flutter of the trace off the screen. But this is considered tolerable after practical operation with the prototype; further balancing arrangements to overcome it were considered an unnecessary complication.

**SIGNAL CABLE**

It is necessary to feed the signal to be 'scoped from its point of origin to the Y-input socket of the *Videoscope*, and a yard or two of coaxial cable is required for this. The total stray capacity of this cable together with the input circuitry will lie around 200pF, i.e. it is too large to impose across the circuitry being tested.

It is thus essential to use a correction-probe head at the front end of the coaxial cable. This consists simply of a parallel combination of high valve resistors and small ceramic capacitors, forming a balanced-bridge bleeder, raising the input resistance and lowering the input capacity. The proportionate loss of overall gain is the price paid for this, but is tolerable on account of the very high initial gain of the amplifiers.

It is of great advantage to make the volts/centimetre calibrations on the Y-gain controls

Together with the probe to be described, a waveform of maximum peak-to-peak amplitude of 1.2kV can be accepted and displayed, and a d.c. voltage of 1.5kV can be blocked on all ranges. This enables measurements to be made with safety for waveforms tied up with the boost voltage feeds of TV receivers.

D.C. voltage measurements are made by repeatedly jabbing the prod of the probe against the point to be tested, with the timebase running at the slowest speed provided (20msec/cm). Owing to the excellent bass response of the Y-amplifier, a series of square pulses will then be observed, their height giving the d.c. voltage value (same calibrations as for a.c.) and their direction the polarity.

D.C. voltages as low as 10mV can be measured with reasonable accuracy (direct input without probe), and up to 1.5kV (with probe) at the other extreme, with source loading characteristics of valve-voltmeters, i.e. much less than with multi-meters.

**THE TIMEBASE CIRCUITS**

The timebase is a stable and reliable circuit. Experiments were made using other types of time-



is an approximate squarewave, positive halfwaves thereof roughly coinciding with the forward stroke and negative halfwaves with the flyback of the anode waveform. This waveform is applied, in principle, to the c.r.t. grid, with its positive level clamped with a diode to the slider of the brilliance-control. This assures that the set brilliance voltage is held during all strokes, and the c.r.t. is cut-off at the grid during flyback. Now it is a fact that the negative-going stroke of the screen wave, at the end of the timebase forward stroke, is generally sharp, giving immediate extinction of the c.r.t. trace at the very start of the flyback, even at high speeds. But the positive-going stroke to bright-up the c.r.t. trace at the start of a new timebase-run is generally much slower, taking an appreciable time to reach its final level. At high speeds this can lead to late bright-up, causing the first portion of the trace to remain dark, and thus be lost.

Apart from consideration of stray capacities, the precise characteristics of the pentode chosen for V5 play an important role, and in general valves with a good screen-to-anode gain are best.

It is also of advantage to choose a valve of low mutual conductance at the control grid, as this leads to larger values of required timebase capacitors at the higher frequencies (speeds), swamping the undesirable effects of stray capacities. This is the ultimate reason why an EF86 has been selected for V5, whereas all other positions are occupied by EF80's giving higher signal-gains at low anode values.

#### FLYBACK BLANKING

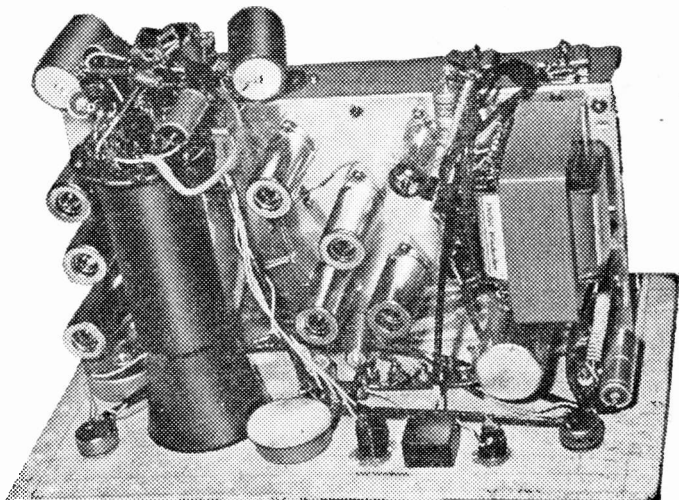
R48 (Fig. 2) is a series resistor to reduce screen loading of V5 by the blanking circuit. C40 blocks the screen-voltage d.c. component, and together with D4 clamps the waveform entirely positive-going with respect to chassis. R51 and R52 constitute a voltage-divider, to reduce the high amplitude to the lower amplitude required at the c.r.t. grid.

TC5 is the bridge-balancing capacity to offset the effects of the considerable capacity of the screened cable to the c.r.t. grid. A low-capacity type should be used for this cable for best results. D5 is a limited diode, selecting only the lower, 4-5V of the attenuated waveform, thus rejecting the more rounded top, to offset the bright-up delays already mentioned. Finally, D8 clamps the remaining 4-5V amplitude squarewave entirely negative-going with respect to the brilliance control slider.

TC5 can be adjusted empirically for optimum trace brilliance uniformity at high speeds on the finished oscilloscope, or, more exactly, with a second oscilloscope observing the negative square pulses at the junction of R51 and R52. TC5 is thereby first screwed to maximum capacity, and then reduced until the sharp spike (negative) at the start of each pulse just vanishes, leaving a clean square half-cycle.

Provided a good low-capacity cable has been used for the c.r.t. grid lead, unnecessary lengths and stray capacities in the associated circuitry right from V5 screen grid avoided, and TC5 has been properly adjusted, blanking precision is virtually perfect on three ranges, and only slight loss at the start of the trace is apparent on the fastest range over the final fastest 20% of its coverage.

If the screened cable is of really low capacity, the performance of the fastest range at the fastest end, regarding blanking can be further improved by judicious increase of R52.



*A view of the completed chassis.*

#### TIMEBASE SPEED RANGES

The timebase speed controls are calibrated in time/cm. values, not in frequencies. This is far more useful and unambiguous than the antiquated form of frequency-calibration, because it allows quantitative time and frequency readings on 'scoped signals without falsification or ambiguity due to the unknown duration percentage of the flyback.

If a signal waveform is locked with the sync control, and the length of one cycle noted against the centimetre-grid scribed on the perspex window in front of the c.r.t., then this length multiplied by the time per centimetre read off the speed-controls calibration gives the time for one period of the waveform being 'scoped, whose reciprocal is the frequency thereof, in an unambiguous fashion.

The fine speed control is calibrated in time/cm. units from 2 to 20; the coarse control (S3) gives four decimal steps, so that the "units" are milliseconds, hundreds of microseconds, tens of microseconds or microseconds respectively. This corresponds to a continuous coverage from about 5c/s to about 50kc/s' timebase frequencies on the older nomenclature.

CONTINUED NEXT MONTH



# SERVICING TELEVISION RECEIVERS

No. 106: FERGUSON 546T, 506T and 508T,  
HMV 1890, MARCONI VT164

By L. Lawry-Johns

**M**ANY B.R.C. receivers have basically the same chassis and these notes may be used in servicing a large range, provided it is realised that circuit components may differ in value to those given and that many modifications were made during production.

### Typical Variations

For example a 506T under repair may be found to have an extra couple of presets at the rear of the timebase board and V7A and V9 may be found working as a multivibrator without a blocking transformer (T4) being anywhere in sight.

The hold controls may be found at the rear (as in the HMV 1893) and other Schedule A models or at the side (Schedule C).

With these differences in mind it may be possible to present an article which is useful without being confusing.

All models use 110° tubes with AW43-88 in the 17 inch and AW53-88 in the 21 inch versions.

The transportable models have a quick release cabinet but some adjustments may be made from the rear through apertures and the protective dome over the end of the tube may also be removed to provide access to the picture shift adjustment.

### Removal of Cabinet

The cabinet of these models is removed as follows. Pull off the channel selector, first removing the centre insert, using a coin rather than a screwdriver. Remove the two screws holding the control panel and remove this. Lay receiver face down on a soft surface, remove the two screws at the rear and ease off the cabinet shell.

On most other models it is only necessary to remove the rear cover in order to carry out the majority of servicing. There is a panel under the cabinet which permits access to the underside of the

timebase board and the upper i.f. board is hinged at the rear to allow working on both sides.

### Removal of Chassis

To remove the chassis, disconnect loudspeaker leads from the sockets at the side of the cabinet, pull off channel selector knob having removed (unscrew) centre insert, remove single screw from panel and remove panel and fine tuner knob. Remove the two chassis screws from the rear and withdraw complete assembly. The tuner and control panel is hinged and may be swung open when the two screws near the mains input are removed.

Some models have a recessed screw in the channel selector which is covered by a brass trim. This must be sprung out with a fine screwdriver in order to gain access to the screw. Also there may be internal spring latches at the top of the panel.

Twenty-one inch models have three screws instead of two securing the chassis to the cabinet, the third being at the top centre.

### Common Faults

The most common fault is the inability to select a Band III channel positively. Most Fireball tuners suffer from this defect sooner or later. It is normally only necessary to clean the silver plated studs of the coil disc with Electrolube or similar contact improving cleaner. Never use C.T.C. or similar products without afterwards applying a lubricating film.

The disc is removed as follows. Unspring the bottom front of the cover and lift backward and up off the top latches. Remove the nut and washer from the centre of the coil disc. The disc can then be removed and cleaned, taking care not to damage the rather fragile coils. The contact springs may be lightly cleaned but never attempt to increase the bow of these contacts.

Replace the disc, gently rotating to feel the

grooves engage before replacing the washer and nut. Replace cover, top first.

NOTE: There is only one coil core adjustment and that is the oscillator, marked L7 on Fig. 1. This adjustment is made with a fine trimming tool with the channel selected and the fine tuner midway for maximum sound.

The screws at the front should not be adjusted, neither should the two iron dust cores on top of the tuner.

**Rectifier**

The PY32 valve has a limited life and should be replaced by the more recent PY33. Alternatively a silicon diode can be wired across the valve base in series with a 25Ω wire wound resistor from pin 3 or

by arcing between anode and cathode of the PY32. Where the heater of the PY32 lights bright before the fuse fails, the PY81 (V8) efficiency diode should be checked by replacement.

**Small Picture**

Check h.t. voltage and replace PY32 if the voltage is low. If the voltage remains low check the 100μF section of C105—C106—C108 which may be open circuited.

If the h.t. voltage is near normal or is a little high, check the line time base valves PY81 and PL81. In this case the width would be more affected than the height but as the height control is supplied from the boost line some lack of frame or field scan is usually noticeable.

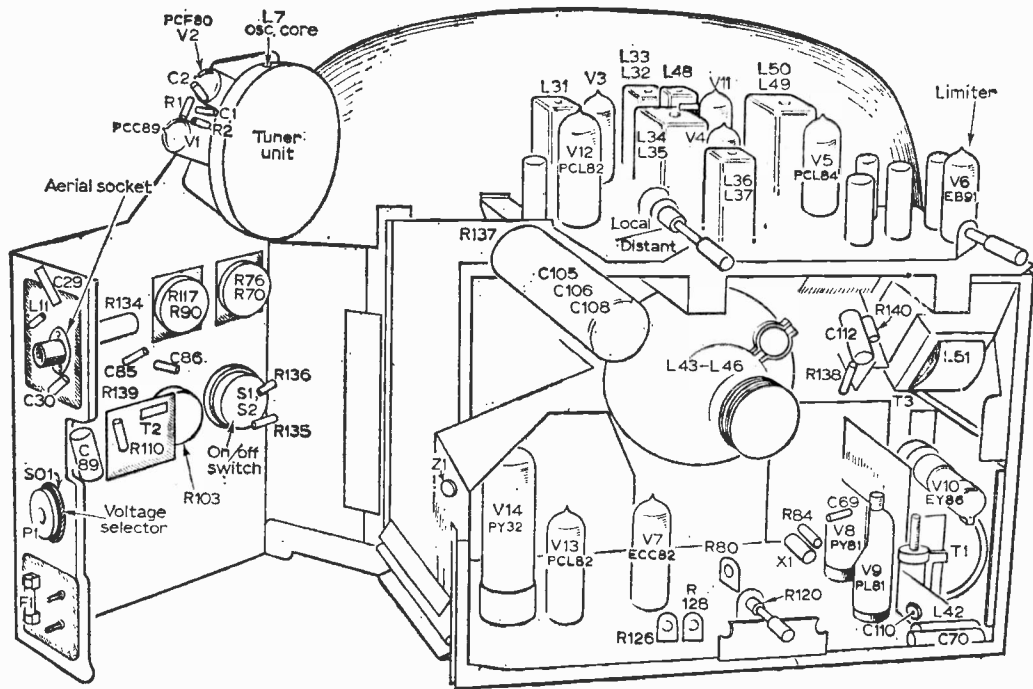


Fig. 1—Receiver viewed from rear with left side unit shown swung open.

5 to pin 8 leaving the PY32 in position to complete the heater chain.

The body of the diode is the h.t. side and connects to pin 8. The centre insulated wire is the a.c. input and connects via the resistor to pin 3 or 5. Pins 4 and 6 are not used and may be employed for the junction of the diode and the resistor i.e. resistor pin 3 to pin 6, diode pin 6 to pin 8.

A failing rectifier gives rise to a long delay between switch on and the appearance of the picture, which usually starts small when it does slowly form. The sound may appear long before the picture but will be fairly weak until the h.t. rises sufficiently to produce a picture.

A blue glow may be seen in the PY32 during the warm-up period. The 1.25A fuse is often blown

The h.t. voltage should be about 185V and the boost line about 600V if the circuits are functioning normally. If the PL81 is found to be weak and normal width is restored when a new valve is fitted no further action is normally required, but lack of line drive due to a weak ECC82 can cause premature failure.

If the line hold is near the end of its travel this is likely to be the case but the 750kΩ R73 should also be checked.

**Line Stabilising**

R80 is a 1MΩ preset which sets the potential across Z1 (VVIII). Once correctly set the circuit is self adjusting and normally R80 should not be dis-

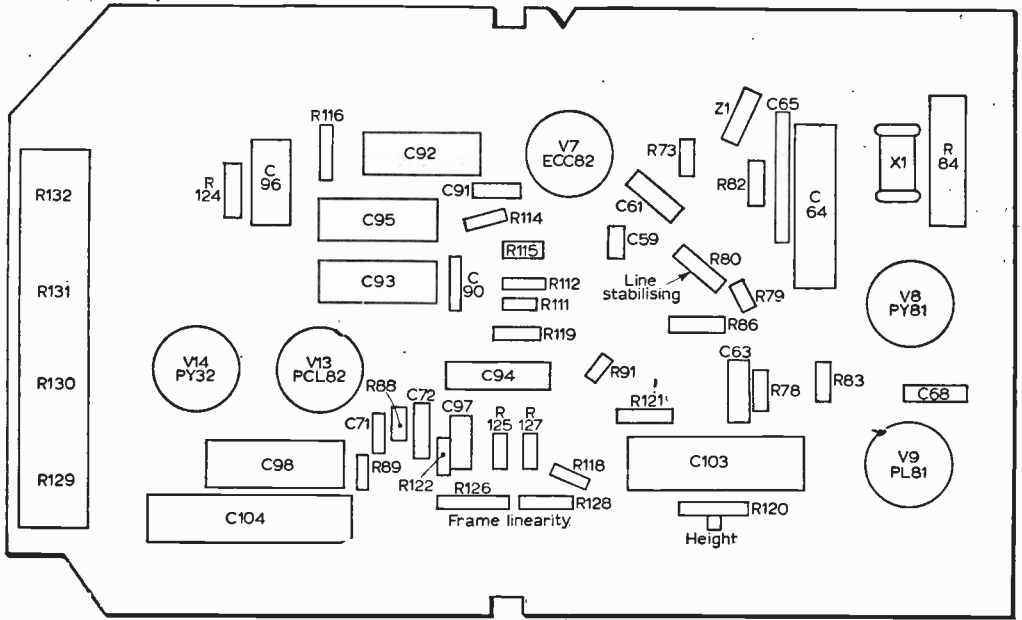


Fig. 2—The timebase panel of the Ferguson 506T sch.C.

turbed. If it has already been tampered with rotate it fully clockwise and adjust width to slightly over-scan.

Connect meter from point 27 (boost line) which is located near R80 and adjust R80 anti-clockwise until the meter has recorded a 30V drop in boost

voltage (say from 670V to 640V).

Arcing can occur across the end contacts of R80 which, of course, necessitates its replacement and correct adjustment as outlined above.

**TO BE CONTINUED**

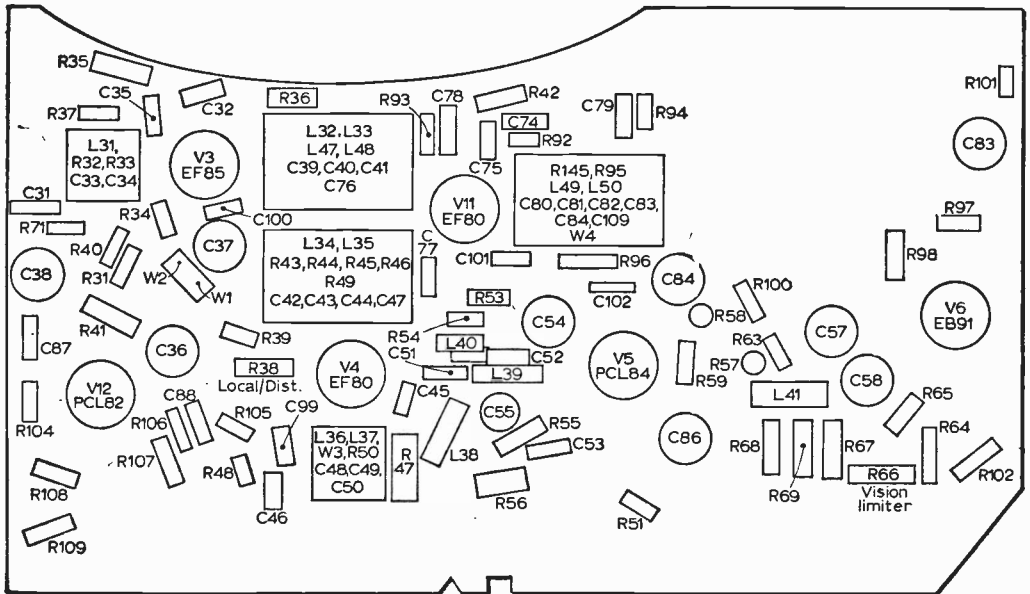


Fig. 3—The i.f. panel.



# DX-TV

by Charles Rafarel

**L**AST month I spoke of the excellent opening for Sporadic E reception during May and June and commented on the "lull" during July. In mid-August this "lull" is still with us but there will most probably be a further opening in late August and September.

This has happened before, so the prize of DX-TV success is "eternal vigilance". Keep a check on conditions each day and then you will find that you are suddenly rewarded!

One depressing aspect this year is the almost generally poor tropospheric propagation conditions, but in the cool autumn evenings after a hot, sunny day reception by this method should improve.

For beginners in particular I am now going to return to the vexed question of reception of the sound channel that accompanies the Continental picture that I hope you are now receiving. The spacing between the sound and vision frequencies varies according to the system that is employed and therefore we cannot use a receiver with "fixed" sound-to-vision spacing if we wish to have simultaneous sound and vision on the various systems. One solution is a separate old receiver for use on the sound channel. Let us now pursue this a little further.

Ideally we should have the choice of either f.m. or a.m. sound available, but our old set will be a.m. only. However, an a.m. set can produce passable quality sound from a f.m. signal, particularly if the set is slightly mistuned.

Even if you do have an f.m. receiver it cannot be guaranteed that you will always receive good-quality f.m./TV sound. Most of the time you will probably find that with the characteristic selective fading of a Sporadic E signal a good deal of distortion is introduced, and in my own experience f.m. and a.m. receivers on a sound channel in practice there is very little to choose the use of either for f.m. sound reception. So why not try that a.m. set on f.m. sound?

## Mystery Signals

Once again we have a report of a mystery signal and welcome any comments from readers regarding its origin. It is a test card similar in design to that of N.R.K. Norway but with no inscription or letters on it. This card has been seen on ChE2.

## NEWS ITEMS

(1) It is reported that D.D.R. East Germany is now using a new type of test card. Details will

be given as soon as possible.

(2) It has also been reported that the Nicosia (Cyprus) test card has been seen on ChE2 and that it is similar to the current test card of Poland except that it has no inscription or lettering on it. This is all very trying and confusing as it appears that Budapest is also using this type of card on the R1 channel adjacent to E2, but watch out for a card of this type on E2 and make sure that it is not "overlap" from Budapest, because it could well be Nicosia!

## READERS' REPORTS

We are very pleased to note that our readers continue to have considerable success with their DX reception.

R. Roper, of Torpoint, Cornwall, has received good signals from T.V.E. Spain on ChE4 Bilbao/Guadalcanal and also R.A.I. Italy on ChE4 Monte Penice/Monte Faito.

P. Wright, of Andover, has received Ostrava (Czechoslovakia) on ChR1, identified from the test card.

P. Watts, of Grimsby, has had R.T.F. France on ChF2 with fast fading, indicating that the signal was received via Sporadic E propagation and was most likely therefore to be Limoges-les-Cars. He also received two weak "floaters" with it which are probably Caen Mt Pincon and Troyes-les-Riceys.

M. Ward, of Cheadle, Cheshire, has had the U.S.S.R. test card on ChR1, but once again we cannot be precise regarding the exact location of the transmitter as the Russian card rarely carries the station name. The most likely choice is Minsk or Leningrad.

He has also received West Germany (Kreuzberg-Rhon) with a sports programme on cycling, also R.A.I. Italy on Chs1a and 1b, Sweden on E3 and E4, Poland on R2 and R.T.F. France Carcassonne on ChF4.

L. Allsopp, of Cardiff, has again been very active and has turned in a good log, including the following: Sweden, Horby or Vannas, on ChE2, West Germany (Bayrischer Rundfunk, Grönten) on ChE2, Austria (fauerling St. Polten) on ChE2a, Poland (Bvdgoszcz) on ChR1, confirmed by the word "dziennik", which means "news" in Polish. Also received R.T.F. France on ChF2 (Caen Mt. Pincon) and U.S.S.R. (Moscow) on ChR1 (identified by "Mockba") opening caption.

This last entry brings us to one of the most difficult of all identification problems, the one concerning Russian stations. The U.S.S.R. stations all use test card type 0249, which only very rarely carries a station name. I have, however, seen Mockba and Leningrad (in Russian characters) on this card and this would seem to be positive proof of origin.

—continued on page 30



## ICONOS MEETS MR. EDISON

*Flashbacks to the nineties*

**T**HERE are so many thoughts—and second thoughts—about new technical developments being used in the fields of entertainment, that it is often worth considering the values of some of the earliest ideas, abandoned because of limitations of the materials, tools and techniques available in those times. Recently I was browsing over the contributions made over the years by Marconi, de Forest, Edison, H. J. Round, Bloomlein, Robert Paul, Lumiere, Swan, Casler, and others, considering the parts played by all of them in the initial practical development of the incandescent electric lamp, the gramophone, wireless, telegraph, motion picture and radio valve, and the origin of the valve—the “Edison Effect”, when I must have dropped off to sleep until a knock at the door led me to admit the ghostly presence of an elderly gentleman. His face was familiar—why, of course—it was Thomas A. Edison!

**ICONOS:** Welcome, Mr. Edison. This is an honour!

**MR. EDISON:** Howdy, Boy! Speak up! I'm a bit Mut and Jeff!

**ICONOS:** What did you say, sir?

**MR. EDISON:** Deaf, boy, deaf! Don't you know your own language Anyway, I'm glad to meet someone on this side of the pond that hasn't swallowed all that stuff about other people inventing my inventions!

**ICONOS:** I know that you invented a lot of things for show business, Mr. Edison—and you were a bit of a showman yourself, sir!

**MR. EDISON:** Well, I played my part. I applied for 141 patents during 1882—some of them for improvements to my carbon filament electric lamp, which started

to be used in theatres instead of gas lighting. New York Stock Exchange had electric bulbs, too, but their life was limited by the particles of carbon deposited on the inside of the bulb.

**ICONOS:** The Edison effect?

**MR. EDISON:** That's what they called it. And I noticed there was always a clear streak inside the glass which was, in effect, a shadow of the leg of the filament connected to the positive side of the d.c. circuit supplying the lamp. I experimented with an extra electrode, positively charged, which attracted atoms carrying the carbon from the negative side of the filament.

**ICONOS:** It sounds as though you invented the vacuum tube diode in 1882!

**MR. EDISON:** Well—I didn't get very far with it. Sir William Preece, Ambrose Fleming and J. J. Thomson made progress with it in England. I was busy with theatre lighting, the phonograph, electric power stations, the motion picture, multiplex telegraphy, electrostatic induction telegraphy . . .

**ICONOS:** Extraordinary! So many of these things seemed to have played their parts in the development of the cinema, radio and television.

**MR. EDISON:** And the gramophone — which I called the phonograph.

**ICONOS:** And what about the motion picture, sir?

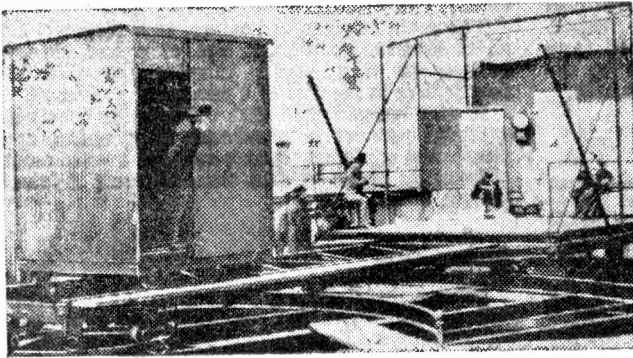
**MR. EDISON:** I missed the boat by sticking to the peep-hole machine. I had played about with film projection but hadn't faith in it in theatres.

**ICONOS:** So Paul in England and Lumiere in France got ahead, sir?

**MR. EDISON:** Yep! They did. I was busy with developments in storage batteries, electric traction, iron ore processing, artificial diamonds, the tungstate of calcium screen for my own development of the Roentgen's X-ray tube . . .

**ICONOS:** A kind of cathode ray tube?

**MR. EDISON:** Not quite. It worked and was demonstrated at the New York Electrical Exposition in 1896. But



*Cinematography, for which Thomas Edison did so much, has advanced a long way since the photograph on the left was taken on the roof of a building in New York City. The camera and operator of this early open-air studio, were accommodated in the hut to the left. The whole rotated on an iron turntable so that the stage could always face the sun.*

(By courtesy, "The Scientific American".)

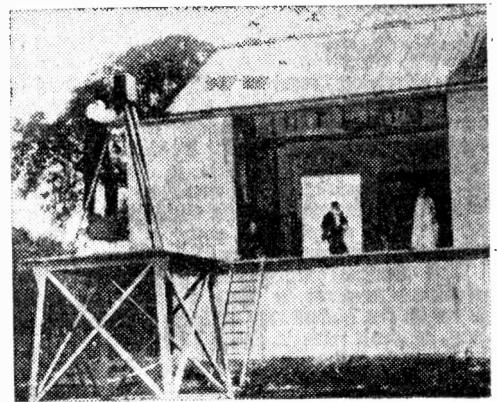
*Below, the first motion-picture studio, built by Robert Paul to frustrate the American attempt to corner the world's film trade.*

**MR. EDISON:** Well, I thought it would be a good idea to harness an animated photographic device to the phonograph, so I brought out the Kinetoscope peep-hole device. Somehow or another we synchronised moving pictures with the sound from a cylinder record—showing boxing matches, opera singers, dancers and "What the Butler Saw".

**ICONOS:** Did that old butler get a good TAM rating?

**MR. EDISON:** Yessir! We had the first Nickelodeon shows on Broadway in 1894 with six Kinetoscopes—and queues of people wanting to put nickel coins in the boxes. My first films were photographed on 35mm film passing horizontally across the camera lens, giving a 70mm picture.

**ICONOS:** What a coincidence! The 70mm film has only just come out in the cinemas and some systems, such as Vistavision and Technirama, use 35mm film photographed and transported horizontally across the camera lens to increase the picture area and improve definition. Then there's Todd-AO . . .



I did make more progress with the motion picture, leaving out the sound side for the time being and running the film on 35mm film, vertically instead of horizontally.

**ICONOS:** On the present-day standard gauge, Mr. Edison?

—continued on page 37

a series for the intending professional serviceman

# The business of SERVICE

PART 2

by John D. Benson

CONTINUED FROM PAGE 560 OF THE SEPTEMBER ISSUE

**I**N the first article of this series we discussed the types of premises and the basic fittings required for setting up a service department. The minimum labour force was considered from various angles as these were deemed to be the keystones on which a successful business is built.

## EQUIPMENT

It is now necessary to examine in full the various types of equipment which experience has taught are absolutely essential if labour is to be employed efficiently and with the minimum waste of time, which is the most costly adjunct to servicing.

The list of requirements—and here we are considering only bare necessities—may seem a fearsome one, but on careful reflection it will be seen that the requirements suggested are in no way exaggerated.

## Repair Ratio

A television receiver will be examined first because from the study of figures relating to servicing it has been shown that the ratio of television repairs to radio is about 3—1. The underlying reason for this is the fact that a television receiver is subjected to more working hours than the average radio and, coupled with this, the electrical demands on many of the components used in its construction are fairly heavy.

The working temperature within the average television receiver is also a major contributory factor to the higher rate of failure. This will, however, be dealt with in detail later.

## Basic Units

Basically, a television receiver consists of a vision and sound receiver, a timebase, a power supply and a c.r.t. provided with scanning and focussing equipment, together with a suitable e.h.t. supply.

All of these units are linked together and housed in a cabinet which may be of plastic or wood or a combination of both. These various units are constructed of metal and insulating materials and are bolted, rivetted or soldered together.

It is obvious then that to deal with equipment so constructed, it is necessary to employ not only

electrical measuring instruments but the tools common to mechanical engineering also.

The radio receiver, radiogram, tape recorder, are all of similar construction but, of course, do not contain so many units carrying out different functions as in the case of a television receiver.

It may be said then that the average television or radio receiver is a mixture of electrical and mechanical equipment which calls for a wide range of tools in order to deal with all their different aspects.

## Setting Up

The purchase of workshop equipment is a costly item and as we are first considering the initial outlay with limited capital, the various ways of making the best use of this will be investigated.

If capital were unlimited, then the course would be comparatively simple and the businessman, in consultation with his service engineer, if he is not sufficiently technical, would simply draw up a list of equipment required and proceed to order it.

Cases such as this are the exception rather than the rule and in practice the prospective businessman has to think twice about every pound he spends. It is therefore imperative that every avenue of buying must be explored so that capital is used to its best advantage.

## Quality Counts

There are several courses that can be taken when buying equipment and each one will be examined and then the buyer can select that which is most suited to his requirements.

Whichever method is adopted there is one common factor which governs the purchases: the equipment bought, whether electrical or mechanical, must be first-class—the purchase of inferior quality instruments or tools is the first step towards failure.

It is quite true that the experienced serviceman can work on a shoe-string, so to speak, but this is only in the case of emergency conditions and is not at all conducive to building up a profitable business.

The first method of buying we shall consider, is by studying advertisements which deal with reconditioned or surplus equipment. A detailed study of the various instruments offered will often reveal

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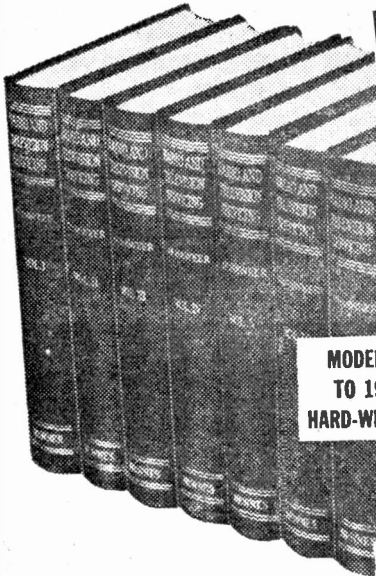
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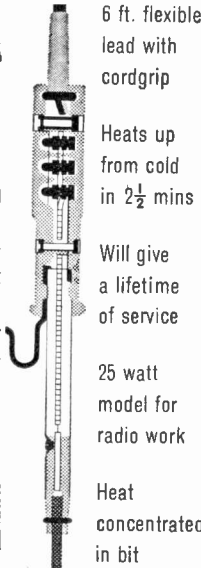
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1S5	3/6	6F13	4/8	12AE6	8/6	35Z4G	4/6	DY87	8/6	ECL83	9/6	EM4	17/9	MU12/14/48	PLM60	15/9	U40	15/6	UA4	15/2	OC29	25/6	
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2X2	3/-	6K7G	1/3	12AT6	4/6	50C5	6/6	E88CC	10/-	EP22	6/6	EM71	13/6	N37	25/8	FX4	9/-	U191	9/6	UM80	8/8	OC36	21/8
3A4	3/9	6K8G	3/3	12AU6	5/9	50L6GT	6/3	E180F	1/6	EP36	3/3	EM80	6/6	N78	26/-	PY31	8/6	U261	9/-	UM6	9/-	OC41	8/-
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3B4	4/6	6L6G	6/6	12BE6	4/9	90A6	6/6	EA42	7/8	EP40	8/9	EM85	7/8	P61	2/6	PY81	4/9	U601	16/3	UY41	4/6	OC66	25/-
3V4	5/3	6L7GT	4/6	12BH7	6/-	90AV	6/7	EB34	1/-	EP41	6/8	EM87	7/6	P81	6/6	PY82	4/9	U620	6/8	UY85	5/-	OC70	6/6
5B4GY	8/6	6L18	10/-	12K5	10/-	90C1	16/-	EB41	4/9	EP42	4/9	EN31	1/6	PC86	10/8	PY82	4/9	U620	6/8	UY85	5/-	OC70	6/6
5D4G	4/6	6LD20	5/8	19A95	7/3	90C2	4/6	EB91	2/3	EP50	2/8	EP51	5/6	PC88	14/2	PY83	5/9	UABC90	5/-	VP4	14/6	OC77	3/6
5V4G	7/6	6P28	4/-	19H1	6/-	90CV	4/2	EB33	8/8	EP80	3/8	EP81	7/3	PC95	11/8	PY88	7/9	UB42	7/-	VY105	5/6	OC72	5/6
6A07	4/3	6Q7G	4/3	20D1	10/-	150B2	16/6	EB34	8/6	EP83	8/8	EP83	8/8	PC97	7/8	PY80	6/6	UB41	10/8	VR150	4/9	OC73	16/-
5Z3	7/-	6R7G	5/3	20F2	11/6	150B2	16/6	EB34	12/6	EP83	4/9	EZ41	6/-	PC98	6/8	PY901	6/8	UB41	6/8	W107	10/8	OC74	8/-
5Z4G	7/-	6S17	4/3	20L1	12/6	866A	12/6	EBF80	5/6	EP86	6/-	EP86	6/-	PC95	6/8	PY901	6/8	UB41	6/8	W729	17/6	OC75	8/-
6A8	5/9	6S8T	4/-	20P1	12/6	8763	7/6	EBF83	7/3	EP89	5/-	EP89	5/-	PC98	10/8	R10	26/8	UBF80	5/9	X41	15/-	OC76	8/6
6A07	3/-	6U4GT	8/6	20P3	12/-	7475	2/9	EBF89	6/3	EP91	3/-	EP91	3/-	PC98	10/8	R17	17/6	UBF89	6/8	X66	7/3	OC77	12/-
6A07	5/9	6V6G	3/9	20P4	13/6	AGSPEN	4/8	EB121	9/6	EP92	2/6	EZ40	5/3	PC189	10/8	R18	9/6	UBL21	9/8	X78	20/6	OC78	8/-
6A05	5/9	6X4	3/9	20P5	17/3	V241	6/8	EC34	12/6	EP93	4/9	EZ41	6/-	PCF80	3/8	R19	8/6	UCB2	3/8	X79	27/-	OC81	4/-
6AT6	3/9	6X3	4/6	25L6	4/9	A241	6/6	EC70	4/9	EP97	11/8	EZ98	3/9	PCF82	6/8	SP41	9/-	UCB4	8/8	X83	5/6	OC82	4/-
6AU6	5/3	6Y30L2	8/3	25Z4G	6/6	B36	4/9	EC92	6/6	EP98	10/-	EZ81	4/-	PCF84	8/8	SP61	2/-	UCB5	8/6	Z66	7/8	OC83	8/-
6AV6	5/6	7B6	12/6	25Z6	6/-	CL33	11/8	EC31	7/3	EP183	7/-	GZ33	17/6	PCF86	7/8	SU25	27/2	UCF80	8/9	Transistors	and diodes	OC84	8/-
6BA8	4/6	7B7	7/-	27R5	23/3	CY31	5/9	EC040	7/-	EP184	7/-	GZ34	10/6	PCF80	10/8	T41	9/-	UCH21	8/3	AF102	27/6	OC170	8/8
6B28	4/9	7C3	3/9	30C15	9/-	DAF96	5/9	ECU81	3/6	EP804	20/5	GZ37	14/8	PCF86	17/8	TR233	6/9	UCH42	7/-	AF114	11/-	IC171	8/8
6B66G	13/6	7C6	6/9	30C18	10/6	DD14	10/6	EC82	4/6	EP89	7/-	HABC80	9/8	PC82	6/8	TR233	6/9	UCH31	6/8	AF115	10/6	OC71	17/6
6B66	5/3	7E7	5/9	30F3	8/9	DE66	15/-	EC83	4/6	EK32	5/9	RN309	25/-	ECL83	7/9	U10	9/-	UCB2	7/9	AF116	10/6	MAT100	7/9
6B66	5/6	7R7	12/6	30FL1	9/3	DF96	5/9	EC84	5/6	EL33	6/9	HVR2	8/8	PCL84	7/8	U12/14	7/6	UCL83	6/6	AF117	10/6	MAT100	7/9
6BQ7A	8/6	7S7	14/8	30L15	9/3	DF97	10/-	ECU85	5/9	EL34	8/9	HVR2A	8/9	PLA5	7/6	U16	15/-	UF41	8/6	AF118	5/6	MAT101	8/6
6BE7	8/3	7Y4	5/-	30P4	12/3	DI101	25/-	ECU88	8/9	EL36	8/9	KT33C	4/-	PCL86	5/6	U18/20	8/6	UF42	4/8	OA70	5/-	MAT120	7/9
6BR8	8/-	9BW6	6/9	30P12	7/6	DI107/18/11	EX-91	3/-	EL41	7/8	KT96	29/1	PEN45	7/-	U22	5/9	UF80	6/8	OA73	7/8	MAT121	8/6	
6RW6	6/9	10C1	8/9	30P19	12/3	DK92	6/9	ECU189	11/6	EL42	7/8	KT41	7/8	PEN45DD									
6BW7	5/-	10C2	12/3	30P14	8/6	DK96	6/3	ECU80	6/-	EL81	8/3	KT44	5/-										

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genuine bargains which offer a large saving against standard prices. The buyer who uses this method will be well advised to deal only with old-established firms, or on a deposit, against approval system.

If the businessman-to-be has not had experience in these matters, then as suggested, the experience of his service engineer or perhaps a friend, experienced in these lines, should be consulted before making final decisions.

The second plan is, having decided on the range of instruments and tools which are necessary to make a start, using the catalogue of an established wholesale firm to choose from, and then contacting the firm or its representative and arranging a hire purchase agreement for the complete selection of equipment. This method has many advantages if wisely used, the goods so purchased can be made to pay for themselves out of income whilst building up the business.

In this way a greater range of instruments can be acquired to start up with, especially when capital is limited, but again, caution is called for in order that income is not overloaded with heavy outgoings in the early days of establishing contact with the public.

## What to Buy

The different ways in which workshop equipment can be acquired has now been considered—there remains the quite complex problem of deciding what to buy.

As has been stated, television and radio receivers etc., are a mixture of electrical and mechanical components which therefore require a wide range of instruments and tools for their repair. This range can be further divided into measuring and indicating instruments for dealing with the electrical side of the work and tools for mechanical work only.

In the first instance, we shall deal with the electrical side and its requirements. The basic instruments used in working on television or radio are required to measure a.c., d.c. and r.f.

In the cases of a.c. and d.c. there is a most comprehensive range of instruments to choose from by well-known makers, the most extensively used being of course, the multi-range meter.

With this type of instrument it is possible to measure a.c. and d.c. voltage and current and resistance over a wide range. Some are also calibrated for measuring a limited range of capacitance. This type of instrument forms the main foundation of the service engineer's equipment.

In buying, however, there are a number of points to be considered in choosing one: first, robust construction. These instruments have to withstand a lot of handling and are therefore of little use if of flimsy design and material. If one of the well-known makes is chosen, this point is adequately taken care of.

## Sensitivity

The second point of importance is the sensitivity of the instrument. This determines the drain put on the circuit to be measured. If cheap instruments are used, then it is more than likely that the instrument will be insensitive and will consequently put a

heavy load on the circuit under measurement and therefore give erroneous results. An instrument of some 20,000ΩV sensitivity which combines robustness is recommended.

With the multi-range meter we have, so to speak, all our eggs in one basket and because of this the experienced serviceman knows that they must be treated with respect and thoughtfulness, for a mistake, such as reading voltage whilst the instrument is still switched to amps. may result in serious damage.

Many instruments are fitted with automatic overload devices to obviate such occurrences but the good service engineer checks the range first before use.

It is very often necessary to take more than one measurement at one time. It is therefore essential that besides the basic multi-range instrument, several individual instruments will also be required.

These are generally milliammeters and can be purchased for very reasonable prices. They should be mounted in suitable cases so that the dial is easily read when used on a bench.

For resistance measurements the multi-range meter is already adapted by the use of internal batteries, and most good quality instruments will cover a range of resistance readings from a few ohms, in some cases a fraction of an ohm, to 5—10 Megohms. The experienced serviceman will also know that the ohmmeter can be used effectively in assessing electrolytic capacitors.

Experience has shown that the a.c. ranges of a multi-range test meter require constant checking, against a known standard; the rectifiers used in the instruments appear to be prone to fairly rapid changes; a satisfactory answer to this problem has never been found, hence the need for a standard to check against.

The most robust instrument for this is the moving iron meter. They can be purchased at a very reasonable price and one should be installed in such a position near the benches that multi-range instruments can be easily checked against. The a.c. meter can be permanently wired to the mains so that a reading is always available.

The accurate reading of a.c. voltages is essential, especially for television receivers, as a receiver adjusted to the wrong mains tapping can lead to serious trouble and a disappointed customer.

## E.H.T. Testing

Television receivers generate very high voltages and there are many occasions when it is necessary to check the voltages present on a c.r. tube.

There are a number of methods used for measuring e.h.t., but one of the most reliable and accurate methods is by the electrostatic meter. This type of instrument imposes little or no load on the e.h.t. circuits and therefore gives accurate readings.

Instruments reading up to 5kV can be bought cheaply and when used in conjunction with a simple potential divider will give accurate readings of all the e.h.t. voltages in television receivers.

## The Megger

In workshops where domestic appliances are also

to be serviced, a very necessary instrument is a Megger for the measurement of insulation, which is so important when the articles are to be used, probably daily, by the householders. The 500V model is to be preferred as the safety factor is then raised and doubts dispelled.

No business can afford accidents to members of the public through faulty insulation. It is well to study the Board of Trade rules concerning this very important factor.

## Valve Tester

While considering measuring instruments, the valve-tester must not be overlooked. A good valve tester is a worthy instrument, but in the early days of starting up a new business it can be dispensed with and the suspected valve substituted by a known one.

This applies especially to television where very high frequencies are encountered and unless the valve tester is an exceedingly good one, the tests will not give an accurate picture of the true state of the valve under test.

The valve tester will, however, be considered as an adjunct for the expanding business.

Having considered the instruments required for the measurement of voltages, current, resistance and capacitance, bearing in mind that these are minimum requirements, we pass on to instruments which are used for the production and measurement of radio frequencies.

## Signal Generators

The signal generator is a very necessary part of the service engineer's equipment and an accurate source of test signals is absolutely essential.

The choice of signal generator is a wide one, with a corresponding range of prices, but such is the advance in the manufacture of these instruments that a very efficient instrument can be purchased at a very moderate price.

The principal points to watch when making a choice are that the v.h.f. ranges operate on fundamentals and not on harmonics and that the instrument is equipped with a reliable attenuator and has ample output on all ranges.

Another characteristic to watch for is the stability of output. This is important when changing from one frequency to another, which is often done when aligning a receiver.

All these features can be found in the very comprehensive literature which is available from the manufacturers of these instruments.

With the selection of a suitable signal generator we have now covered the basic requirements for coping with the electronic faults which occur in television and radio equipment.

Instruments which were once considered luxuries are, in some cases, nowadays becoming more or less essential. First in this category is the oscilloscope. Although it is not essential in aligning TV receivers, if one has the spot frequency instructions for a set from the maker's service manual, it is often very helpful and is, moreover, virtually indispensable when tackling certain fault conditions—notably in the timebase and a.g.c. circuitry. It is

also valuable in radio repair work, notably f.m. receivers.

Allied to the oscilloscope is the wobulator and here again, this instrument may not be in such frequent use as other test gear but in some instances it is the only means of carrying out tests and procedures at maximum efficiency. It is possible to obtain a combined wobulator and display device—useful where space is limited.

Other items can be added once the basic range of equipment is installed. Among such pieces of test gear can be numbered such things as bridges for resistance, capacitance and inductance measurements.

Finally, but not necessarily in order of importance, anyone seriously entering into servicing on a full scale business footing must arm himself with a transistor tester!

The total cost of a well equipped workshop can be formidable. But the reader contemplating such a move will no doubt already have a certain amount of the necessary instruments. And being what he is, some of the less exacting bits and pieces can be built up himself—or by his apprentice, under supervision. Commercial kits offer both the opportunity to build up a workshop comparatively inexpensively and at the same time give any juniors some practical constructional experience.

## Aerials

If the premises are located within the service area for TV and v.h.f. radio, inexpensive indoor equipment can be used, but if the business is situated in a fringe area, then the aerial installations must take a more elaborate form and be mounted outside the premises on the most convenient high point.

Outlet sockets should be located adjacent to the benches, but not on them, as under certain circumstances unwanted couplings can occur. The connections from the sockets to the benches can be made by coaxial leads which can be stored away when not in use. With the erection of suitable aerials, where required, the workshops can now be considered ready from an electrical point of view.

## Benches

The next consideration is the compiling of a tool kit suitable for tackling the many varied mechanical jobs which are part and parcel of servicing work. The well designed workshop will have a bench reserved for metal work in order to lessen the risk of drillings and filings penetrating into receivers and producing undesirable effects.

For starting up this bench, it should be equipped with a good vice, a miniature anvil to do rivetting on, an electric hand-drill with a good supply of drills. A hand grinder can be added, but is not an absolute necessity to start with.

A set of taps and dies covering the BA range of nuts and bolts used in electrical work is a necessity but need not be elaborate. A light hammer, hacksaw and a small selection of metal and wood chisels, plus a heavy duty soldering iron will provide ample equipment for the "mechanical" bench.

The service engineer's bench should be provided



with an adequate supply of spanners (BA), pliers, cutters and a kit of trimming tools. The soldering iron found most successful for television and radio work is the quick heating type which used 16 s.w.g. tinned copper wire as a "bit". It has the advantage of producing very localised heat and can be laid down without the fear of burning surfaces.

A completely separate kit of tools should be kept in a tool box or bag for outside work—it saves much valuable time when called to emergency breakdowns. A box containing a selection of *known* valves should also be kept for outside calls and a similar stock should be provided for workshop use. The experienced service engineer will be well acquainted with the types which are most troublesome. A multi-range test meter in a good protective case and a selection of resistors and capacitors completes the outside job kit.

There are various schools of thought on what jobs should be dealt with in the field and what jobs should be taken from the customer's house to the workshop. But if the set is old and the fault more than, say, a defective valve, it is usually advisable to take it in for a complete examination and overhaul. The soot and dust which accumulates in a receiver in twelve months can often be considerable; it is best removed by the use of a vacuum cleaner which can be permanently located underneath the bench and fitted with extension hoses.

Cleaning should be done after the nature of the fault has been assessed as the act of cleaning may disturb valuable clues to the breakdown.

## Literature

Perhaps the most valuable part of a workshop equipment is its library of service data. These data can be obtained from manufacturers, or built up from the service sheets supplied by trade journals. For efficiency they should be listed and recorded in a substantial book, for they form the life's blood of successful service. The apprentice can be delegated to return all service literature which has been in use to its appropriate file as his first job in the morning. The importance of adequate service data cannot be too strongly stressed.

## CONTACT WITH CUSTOMERS

### The Customer

We must now consider the complex business of handling customers. A service engineer has direct contact with the public, so he and his apprentice should be presentable and good mannered. Since they have to enter people's homes it is of equal importance that the greatest care is taken and anything that is disturbed whilst working is left as it was found.

The whole future success of the business depends on the relationship between service engineer and customer. The writer always tries to avoid carrying out work in the customer's home—the underlying reason for this being that it is difficult to work under scrutiny and the ease with which some repairs can be affected, leads to erroneous ideas being formed when the account is presented.

The exception to this is when the receiver is under rental terms—it is then necessary to carry out

all repairs with maximum speed to reduce maintenance charges to a minimum.

Speed, consistent with reliability, is the key to building up a successful business and at all times the customer should be informed of the expected length of time which a repair will take. If for any reason this cannot be adhered to (e.g., a component may be out of stock and take some time to replace) then the customer should be fitted up with a temporary receiver. It is only by studying these points that a reputation for reliability can be built up.

## Collection and Delivery

The collection and delivery of receivers presents problems. Some businesses have certain days allotted for collection and delivery. This is not advocated since quick service is the essence of success and no customer likes to be kept waiting several days for attention.

The situation gives rise to a seeming paradox, since the service engineer must be kept employed at his bench. The solution to the problem is to arrange for collections to be made during the earlier part of the morning when most people are at home, thus leaving the greater part of the day for bench work. In the same way, finished work can be dovetailed between collections. This system has worked well in practice.

The collection and delivery of receivers is costly and must be paid for—some businesses show this charge as a separate item, but on the whole, inclusion in the labour charge has been found the best way, with the exception of cases where an unusually long journey is necessary, then a mileage charge can be shown as a separate item.

The presentation of accounts presents its own problems, one school of thought advocates presentation of the account when the repaired receiver is returned. This method does not engender confidence. It has been found over many years experience that an account sent out the day following completion of work is most satisfactory.

All businesses have their percentage of slow payers and servicing is no exception. With experience, allowance can be made in assessing overhead charges.


## Aerial Erection

The subject of aerials has been briefly mentioned. This is a side of servicing which should be left to the specialists—only a large business can support a team of aerial riggers. For small and medium sized firms the best policy regarding the installation of TV and v.h.f. aerials is to employ a firm of aerial erectors—the service engineer is much more profitably employed at his bench than climbing up roofs.

If a serviceman has time to erect aerials, then he is not being fully employed.

In this article the problems facing those who are starting up a Service Business have been briefly discussed. In the next article, the system used for assessing faults will be examined and also the extra equipment that can be used to increase the overall efficiency of a growing service department.

NEW



DECAL

VALVES FOR

TV

GORDON J. KING

SINCE the early days of the four-pin battery triode valve there has been a progressive increase in the number of electrodes contained within a single envelope.

In addition to multi-electrode valves like the tetrode, the pentode and so on, the trend has been towards composite valves with two or more distinct sections housed within the one envelope such as the double-triode, the triode-pentode, the diode-pentode, the double and treble diode, triode and like combinations.

#### New Composite Valves

Up until just recently the existing seven, eight and nine pin bases have been able to cater reasonably well for all these electrodes and composite valve arrangements. However, with the advent of the dual-standard TV receiver the need for a rather specialised type of composite valve has been revealed.

That is, a valve with two independent and

shielded sections so as to allow the two sections to operate in entirely different parts of the set without interaction.

Moreover, the need for a double-pentode has arisen which, of course, could not be accommodated on a nine-pin base, for—assuming the suppressor grid (grid 3) in each pentode section to be connected internally to cathode—we have cathode, grid 1 and grid 2 and anode twice and with the two heater connections a need for ten connections.

#### The B10B

Hence the birth of the decal (meaning ten) valve. This is sometimes called the B10B-base valve. It may be wondered why the B9A base was not retained and a top cap fitted to take care of the extra connection.

The reason is that top caps do not lend themselves to printed circuit board techniques and, as such boards represent the backbone of all current television receivers, it is essential that all the connections are brought out at the base.

The envelope dimensions of the decal valve are identical to those of the nine-pin noval valve. The pitch circle diameter of the B9A range of valves has been retained and the tenth pin has been accommodated by reducing the spacing between the pins slightly.

The location of the decal valve in its holder is virtually unaffected and the large space between pins 1 and 10 allows a connection to be "printed" through it so as to provide continuity to the centre of the valve base on the board in accordance with

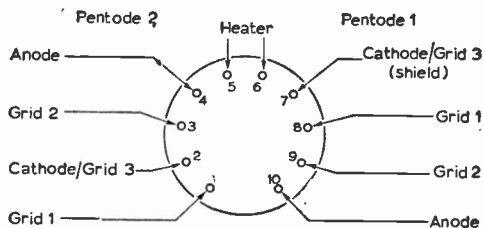


Fig. 1—The base and pin connections of the PFL200 double-pentode.

normal B9A practice. The base of the PFL200 double-pentode is shown in Fig. 1.

Other valves in the European decal series include a triode-pentode PCF200 and a PCF201, the former having a high- $\mu$  triode and the latter a low- $\mu$  triode, and a triode-heptode PCH200 which is designed for noise cancelling sync separator stages in 625-line receivers.

The two chief valves, however, from our aspect

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Performance of Decal Receiving Tubes with Particular Reference to Interference, Electronic Applications, Vol. 23, No. 4.

are the European PCF200 triode-pentode and the PFL200 double-pentode and it is with these that this article is mainly concerned. Let us look first at the PCF200.

**Triode-Pentode Applications**

The pentode section of the PFL200 valve is highly suitable for either a sound intercarrier amplifier or a video i.f. amplifier, while the triode section can be used for a number of functions to give such overall combinations as (i) intercarrier amplifier plus intercarrier limiter, (ii) video i.f. amplifier plus noise detector, (iii) video i.f. amplifier plus a.g.c. amplifier, (iv) video i.f. amplifier plus sync separator, (v) video i.f. amplifier plus pulse amplifier and (vi) video i.f. amplifier plus video limiter.

about 30 times below that of the vision signal.

On arrival at the vision detector the two signals beat together and, resulting from the non-linearity of any detector, a signal equal to the difference between the two frequencies is produced. This is called the "intercarrier" signal. The British difference-frequency is 6Mc/s.

This signal then is applied to the control grid of the pentode section in Fig. 2 and appears in amplified form across the double-tuned bandpass filter in the anode circuit.

From this filter the signal is applied to the grid of the triode section of the valve, the anode of which is loaded by the ratio detector coil and it is from this that the ratio detector diodes themselves are fed. Any f.m. detector, of course, would be suitable for driving from this circuit, but this

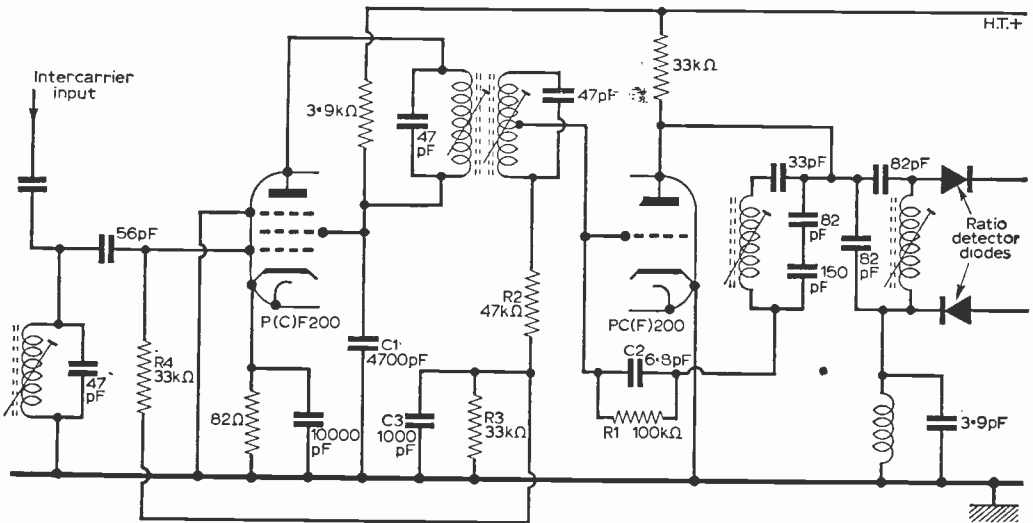


Fig. 2—Circuit diagram of intercarrier amplifier and limiter using the new triode-pentode PCF200.

Note that the first application in each of the above cases is related to the pentode section of the valve.

Efficient internal shielding holds down the cross-capacitance between the two sections to a very low level compared with earlier examples, such as the PCF80 and the PCF86, and thus keeps the inter-sectional coupling to a level sufficiently small to permit the two sections to be arranged as cascaded amplifiers without the risk of instability. The pinning of the valve is also arranged so as to assist in this respect.

A circuit of an intercarrier amplifier (employing the pentode or "C section") plus an intercarrier limiter (employing the triode or "F section") is shown in Fig. 2. Here we have an example of the valve working as a pair of cascaded amplifiers.

**Intercarrier Technique**

It will be recalled that on 625 lines both the sound and vision signals are passed through the i.f. amplifier stages, with the sound signal level being

article is not concerned with the f.m. detector stage.

**Stability Factors**

Tendency for positive feedback to occur in the pentode section is reduced by the use of the decoupling capacitor C1 (on the screen grid circuit of the pentode). This is common to both the screen and anode circuits.

Feedback in the triode section is more of a problem and to maintain a safe stability margin this stage should be neutralised. In the circuit of Fig. 2 this is accomplished by feeding back an out-of-phase voltage from the anode to the grid of the triode via C2. The shunt resistor R1 is included to correct the phase of the feedback voltage.

**Amplitude Limiting**

It will be seen that the grid circuit of the triode is returned to chassis through resistors R2 and R3. These, in conjunction with C3, endow the stage

with amplitude limiting due to grid current. That is, the stronger the signal amplitude the more the gain of the stage is pulled back, the effect of which is to slice off the tops of the waveform and make the amplifier insensitive to changes of signal amplitude.

This is a desirable attribute of intercarrier stages (as in f.m. receivers) to assist in the suppression of impulsive interference, which amplitude modulates the carrier.

In intercarrier stages, limiting of this kind also makes it easier to hold intercarrier buzz (break-through of the vision signal into the sound channel) at a very low level.

In effect, when the applied signal is strong enough to cause the flow of grid current the grid circuit of the triode acts as an amplitude detector. The detected a.m. then appears across R2/R3 and because the junction of these resistors is connected to the grid resistor (R4) of the pentode some of the detected a.m. is fed back to the pentode grid. This gives an a.g.c. effect at the pentode to avoid overloading when the applied signal is very strong.

Intercarrier stages often feature two separate pentodes, such as EF80's, but the use of the new triode-pentode valve one valve can be deleted without loss of overall gain and without detracting from the amplitude limiting properties of the circuit.

Dual-standard receivers use series connected tuned circuits in the sound channel to carry both the 6Mc/s intercarrier signal on 625 lines and the 38.15Mc/s a.m. sound signal on 405 lines as past articles in these pages have shown.

It is likely, therefore, that the PCF200 will eventually find its way into such receivers as well as being of considerable use in the intercarrier section of 625-line-only sets.

**Double-Pentode Applications**

Now let us look at a circuit using the PFL200. This valve is designed essentially for the "L" section to operate as a high-gain video amplifier. This section has a remarkably high slope (mutual conductance) of 21mA/V at 30mA, arising from its frame grid construction.

The "F" section of the valve is a medium-slope pentode which is highly suitable for use as a sync separator or a.g.c. amplifier. The valve is now finding its way into dual-standard sets designed for the British market.

One big advantage of a high-slope pentode which is able to handle high peak anode currents without distress is that it can be employed in a so-called "high-level" contrast control circuit.

High-level contrast implies that the process of contrast control is arranged to happen in a circuit where the video signal is at a high level, this being in the anode circuit of the video amplifier valve.

Normally, manual control of the contrast is achieved by varying the gain of the vision i.f. stages so that the video drive applied to the video amplifier valve is varied. With high-level contrast control the drive to the video amplifier valve is maintained at a constant level by the a.g.c. system and a potentiometer is connected in the anode circuit of the valve to adjust the video signal level as applied to the cathode of the picture tube.

This technique unfortunately adds extra capacitance across the video anode load and to compensate this (to avoid impairment of the high-frequency performance of the amplifier) the anode load resistor needs to be reduced in value.

This action increases the video amplifier anode current and reduces the extent of the video signal swing across the load resistor. Thus an ordinary type of video amplifier valve is not particularly suitable for this method of contrast control.

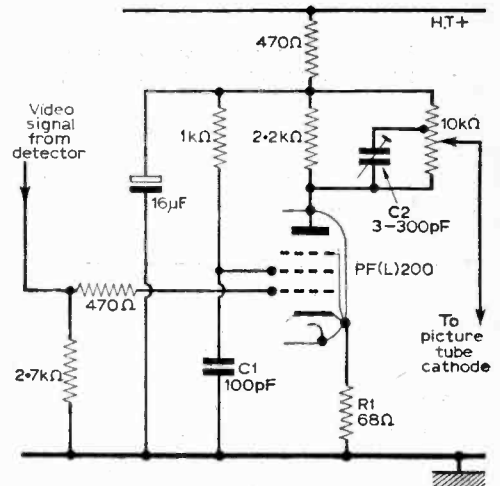


Fig. 3—The "L" section of the PFL200 arranged as a video amplifier valve with high-level contrast control.

However, the high slope and the high peak anode current performance of the "L" section of the PFL200 overcomes the limitations of the earlier valves. Indeed this section can provide sufficient current to produce a composite video signal of 100V peak-to-peak across an anode load as small as 2,000Ω!

—continued on page 39

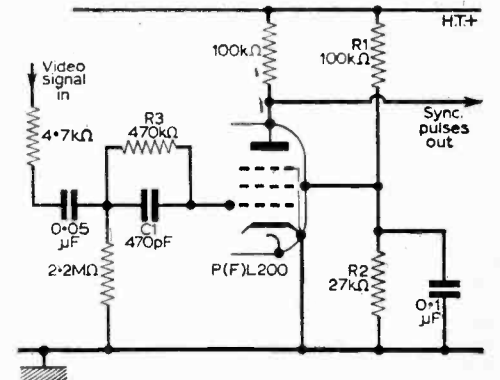


Fig. 4—The "F" section of the PFL200 in sync separator mode.

# eliminating the switch-off spot

BY J. D. BENSON

**A** BRIGHT switch-off spot can cause areas of discolouration on a c.r.t. and thereby ruin its reproducing qualities. Many experimenters have experienced this trouble and have probably been unable to overcome it.

There are a number of ways of tackling this problem where it occurs but all of them are not quite within the scope of the average experimenter.

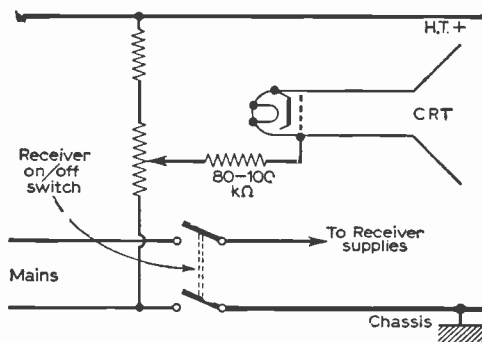


Fig. 1—One circuit arrangement to eliminate the switch-off spot.

There are, however, at least two ways which can safely be applied by the home constructor. First let us examine briefly what is the cause of the presence of the spot.

On switch-off the h.t. voltage decays rapidly, but in most cases the e.h.t. supply decays much more slowly, leaving the final anode of the c.r.t. at high potential. The cathode of the c.r.t. cools very slowly and is therefore emitting electrons. These two facts, together with the very rapid decay of h.t. to the grid, cause beam current to flow and so produces a spot. The spot is kept sharply focused by reason of the permanent magnet focusing unit which is used in many receivers.

The solution to our problem then is to maintain the grid positive with respect to the cathode, using the beam current to discharge the tube. This can be done very simply by returning the earth end of the brightness control to the *neutral* side of the mains, which will deliver a large a.c. voltage to the grid via the brightness control, which will discharge the e.h.t. This method is remarkably simple but there are one or two points which must be

observed. First check that there is a series resistor between the centre contact of the brightness control and the grid of the c.r.t. If not one must be fitted in order to limit the grid current at switch-off. The value is not critical but should be between 80-100kΩ. Secondly, as one side of the brightness is permanently connected to the incoming mains it is necessary to check and make quite certain that the connection has been made to the neutral side of the mains. It is worth noting that this method is only effective when the on/off switch of the receiver is used. Removal of the mains plug defeats the object of the modification. The circuit for this alteration is shown in Fig. 1.

The second method for blacking out the spot is by use of a v.d.r. (voltage dependent resistance). These components were developed by Messrs. Mullard Limited. The characteristics of these devices is such that any decrease of voltage to the circuit in which they are used causes an increase in the value of their resistance. There are numerous applications for these devices but our particular interest is in their application in a circuit for reducing the switch-off spots. The type recommended for this circuit is VDR/E299DC/P338 and it is fitted between the earthed end of the brilliance control and chassis. The circuit is shown in Fig. 2.

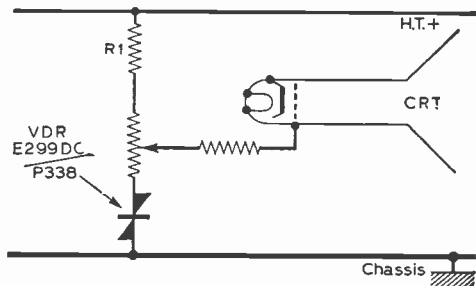


Fig. 2—Including a v.d.r. (voltage dependent resistance) between the brilliance control and chassis effectively reduces the switch-off spot.

At switch-off the reduction of h.t. results in an increase of resistance in the v.d.r., which in turn results in the voltage to the grid being maintained positive, which discharges the e.h.t. If, when the v.d.r. is fitted, there is not enough control of brilliance, R1 should be replaced with a higher value, when control will be restored. ■

FROM PAGE 549 OF THE SEPTEMBER ISSUE

# CHANGING CATHODE RAY TUBES

## PART 7: THE RADIO AND ALLIED GROUP

By H. Peters

**T**HE group dealt with in this article covers Sobell, McMichael and G.E.C. receivers. A common chassis has been featured by this group for about the last two years, and the Sobell-McMichael merger existed even before the previous series of these articles was penned over four years ago.

The Radio and Allied chassis has always been made freely accessible for servicing, and for most purposes all that is necessary is to take off the cardboard back and work away. Replacement of the c.r. tube is slightly more difficult, involving as it does the removal of the chassis, the tuner unit, and control panels, which are often mounted separately in the more elegant cabinets of the group.

Furthermore, no precise instructions for c.r.t. replacement are given in the manuals, and so this article will differ from previous ones in the series by giving, in detail, a "standard procedure" for changing the tube, followed by a series of notes instead of a table of chassis removal instructions.

### Basic method of C.R.T. Replacement

First unbox the chassis as outlined in the second part of the article, then discharge the c.h.t. connection to chassis more than once before removing the anode cavity connection and c.r.t. base connection.

*Before removal* it is advisable to note the position of the "shorted turn" linearity sleeve which is fitted between the scancoils and tube neck on some sets. Also mark the top front of the scan coils with a dot of paint or crayon and measure the distance from the front edge of the clamping band to a perpendicular dropped from the centre of the tube face. These notes will ensure correct reassembly with minimum effort.

Next slacken the scan coil clamping ring and slide the coils back over the tube neck. If the wires tighten before the scancoils can be removed this operation should be deferred until the tube is half-way out and an assistant is available. Unclamp

the tube around the bowl and ease out gently forward.

If it is a 21in. or 23in. tube you will find that it is very front heavy and, unless you know you can change one on your own, an assistant should be standing by, both of you sporting protective goggles, comic though you may look.

Before reassembling the chassis the inside

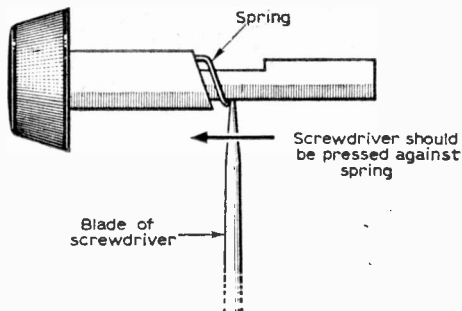


Fig. 1—Most control knobs on receivers in this group may be released by pressing a self-tightening spring with a screwdriver blade.

cabinet should be carefully cleaned to reduce the chance of particles of dust settling on the tube face immediately after reassembling. The new tube should be fitted with the same amount protruding forward of the clamping band as had the old one.

The scan coils should be pressed home as far forward as possible and not tightened down until the "tilt" has been adjusted and the linearity sleeve set for optimum linearity. Picture positioning can then be accomplished by rotating the two rings at the back of the scan coils by means of the lugs provided.

In some cases these rings are somewhat inaccessible and a screwdriver is needed. In these

cases it is usual to find a small hole on the lug into which the screwdriver blade will catch.

**Chassis Removal**

The following notes will enable the chassis to be removed so that the tube change can be carried out. For convenience they have been grouped according to chassis types and this arrangement also provides a list of equivalents useful when trying to obtain a circuit diagram.

**General Warning**

In many of the receivers covered by this article the main chassis panels are clipped to the metal frame on a sub-assembly or hinge. This fact

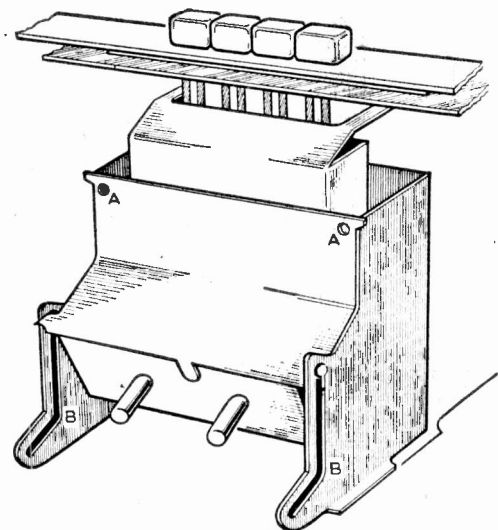


Fig. 2a (above)—By removing the two screws at 'A' and allowing the tuner to slide down the slots 'B', the push-button unit may be flipped over as in Fig. 2b (right).

should be borne in mind when seeking hand-holds by which to extricate the entire metal chassis and frame as it is disconcerting for parts of the chassis to part company whilst being removed.

**SOBELL TPS710, T192, T293  
McMICHAEL MP10**

Disconnect mains and aerial, remove back, channel selector and fine tuner knobs, unclip side panel, release chassis by rotating three fasteners one quarter turn, lift out to extent of leads and remove the two support cords, c.r.t. base, e.h.t. and scan coil connections, and take chassis right out.

Remove perspex front cover on portables and then lay set face down and remove two screws from underneath and two from the top (or the handle) and lift the cabinet off the c.r.t. assembly.

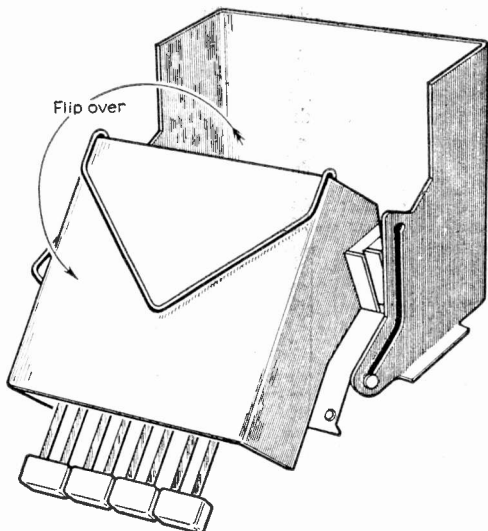
**SOBELL T193, TPS781, T217,  
McMICHAEL MP28, MP27, M75T, P. SC34,  
M99HFC**

Unplug, remove back (and handle on portable), switch to channel 9, remove channel selector and fine tuner knobs (see Fig. 1). Unclip control escutcheon and release chassis from cabinet by removing four screws securing the top brackets and two below the cabinet.

**SOBELL T25, SC35, T280, SC371  
McMICHAEL M723T, M94HFC, M761T,  
M77HFC**

T280, M761(T). Remove the two 4B.A. nuts holding each control panel bracket to cabinet and release main edge controls. Remove two 4B.A. self-tapping screws at top of tuner bracket and lower tuner swivel spring clips out to remove top escutcheon. This reveals two chassis screws, which are removed.

Also remove two at the bottom of the cabinet



and withdraw chassis. Unsolder loudspeaker and light resistor leads if necessary.

T25, M723T. As above but there is no need to take the control escutcheon off to gain access to the chassis fixing screws.

SC371. Remove the four front control knobs, four 4B.A. self-tapping screws at top and two at bottom of chassis, which can then be withdrawn.

M77HFC, M94HFC, SC35. As for SC371 but also remove the four 4B.A. nuts holding the tuner and controls to the cabinet.

**McMICHAEL M794T      SOBELL T194**

Remove back, channel selector and fine tuner knobs (see Fig. 1). Remove the control escutcheon (two clips and two screws) and release chassis from cabinet by removing the four screws holding the top brackets and two below the cabinet.

**SOBELL ST196, ST291**  
**G.E.C. BT455, BT456**

Remove the two bolts below the cabinet and the two nuts at the top rear of the chassis. Pull off the channel selector and fine tuner knobs and unclip the side control panel, which is passed back inside the cabinet through its hole. On 23in. models the tuner is attached to the wall of the cabinet and should be released by removing three 4B.A. nuts.

The chassis can then be withdrawn from the cabinet to the extent of the speaker leads.

**SOBELL ST196DS, ST290DS,**  
**ST291DS, ST197DS, ST297DS**  
**G.E.C. BT454DS, BT455DS,**  
**BT456DS**  
**McMICHAEL MT764DS**

Proceed as for the Sobell ST196 above but also disconnect the system switch link rod. If a u.h.f. tuner is fitted remove its knob and the four nuts holding the u.h.f. mounting bracket so that the tuner can be withdrawn.

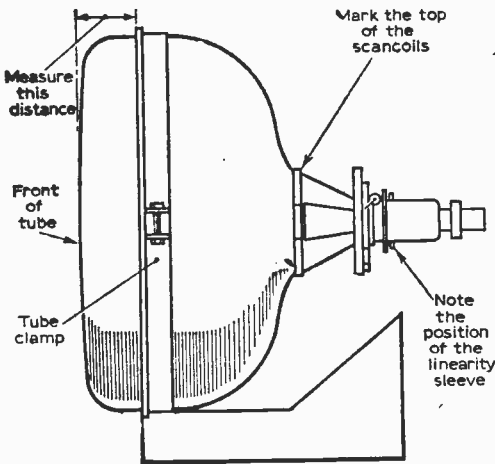


Fig. 3—Critical points to note before removing the tube from its chassis.

**SOBELL ST195\*, ST282, ST283, ST284, ST285,**  
**ST286**  
**G.E.C. BT448, BT449, BT450, BT451, BT452\***  
**McMICHAEL MT762\*, MT763\*, MT765\*,**  
**and P40s\***

The chassis is held by two bolts beneath the cabinet and two nuts at the top rear of the chassis. Before these are disconnected it is necessary on sets

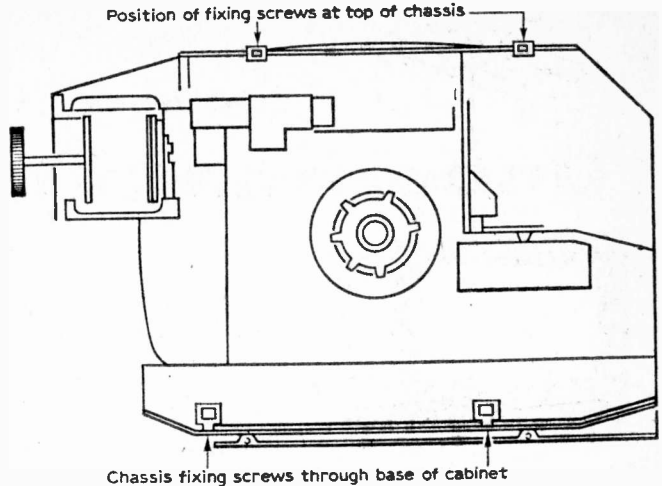


Fig. 4—Most chassis are fixed to the cabinet by two or four screws.

marked (\*) to remove channel selector and fine tuner knobs and unscrew the two PK screws securing the top escutcheon. Remove system switch knob if fitted and release the loudspeaker (one knurled nut).

On the remainder (i.e. those not marked \*), before the chassis bolts are removed it is necessary to take out system switch knob and five press-button covers. Release loudspeaker (two nuts). Unclip extension spindle and light dependent resistor if fitted. Release the v.h.f. tuner where fixed to the cabinet and the control mounting plate (two fasteners).

Part 8 next month

## DX-TV

—continued from page 15

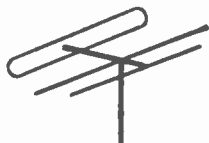
Following the card, when a programme opens there is often an opening caption carrying a place name, i.e. Moscow, Leningrad, Kiev, etc., and this would again seem to indicate the station of origin, although it might well be only an indication that the station actually received is taking a relay from the town mentioned.

It is practically impossible to get any information from the Russian TV services on this point but it is believed that a place name appearing on an opening caption after the test card is in fact an indication of a regional programme from the area named.

East European Interservice captions are much more tricky and when seen in various East European languages the opening caption that follows only indicates the station from which the relay is being taken.

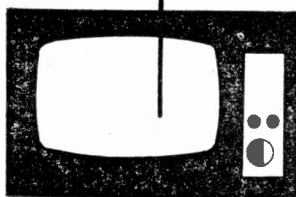
For those who view French television the initial letters R.T.F. are now no longer being used and the opening caption now carries the letters "O.R.T.F." (Organisation Radio and Television Française) and the revolving motif has now given way to the fixed letters O.R.T.F.





A MONTHLY COMMENTARY

# Underneath the Dipole



BY ICONOS

**V**IEWERS in the major areas whose ITV studio centres are in London, Birmingham and Manchester have wide areas to cover in providing local news as an addition to the Independent Television News and in many ways have the same character as national news. Other regions are much smaller and their local news, like local newspapers, includes items which are of minor importance but great local interest — whether they are sporting events, laying of foundation stones or “beating the bounds”. Even the “parish pumps” have local interest. Without visual aids some of these local items might be dull and consequently great use is made of 16mm film, with or without synchronised sound, or still pictures. This had led to the build-up of quite complicated news departments with correspondents and cameramen in various parts of their regions and high-speed processing. Just how high speed this can be may be judged by the film shots of a large furniture store fire near the Plymouth studio, filmed at 5.30 p.m., which was edited and commented on in time to appear on Westward News at 6.05 p.m., with a fine panning shot of clouds of smoke (as a background to the title), leading down to scenes of firemen pouring their hoses on the flames. “Hotting up” the developing machines enabled the film to be developed, fixed, washed and dried in a matter of

minutes—and the negative of the edited newsreel was reversed into positive on the telecine machine for transmission.

## National TV News

Negative is used not only by regional stations but by the Independent Television News and the BBC for topical events, prints being made of all items of international interest for export abroad, an arrangement which is reciprocated by important TV networks abroad such as C.B.S. and N.B.C. in New York. Provincial TV stations in Britain often send to London, by air, train or car, news film items of national interest, and if the local “story” is a big one and there isn’t time for this transport to be used they transmit the picture to London via return coaxial lines and microwave links, if available, for it to be recorded at I.T.N. or BBC on video tape. At one time these items were integrated “live” and direct into the London national newsreels by switching, but these taping facilities are now used to give the London TV news editors greater flexibility in setting up the format of the news programmes. To an onlooker in the studios the rehearsals on telecine with commentators (and sometimes effects and music) give an impression of complete chaos but, only a few minutes later, the actual transmission seen by viewers has a smoothness and professional polish worthy of a national newspaper. All varieties of visual aids are used, with mixtures of 35 and 16mm film, negative or positive, titles, charts, stills and separate commentary sound tracks as well as direct live presentations by a newscaster who is aided by a teleprompter device. This accounts for the rather fixed expression on the newscaster’s face on occasions—especially when last-minute news

is passed on to him which he can’t memorise and might not be on his “script”. Television news and newsreel production is full of movement behind the scenes—never a dull moment. Continental TV news on different standards will be available shortly by the use of the BBC’s new computer line standard converter, available also to I.T.N., and this gives an immense improvement in quality as compared with the older Eurovision monitor-cum-camera line standard converter. Technical facilities are always being improved and it won’t be long before even faster processing machines will be used which will develop the news film in a few seconds or, if the American Thermoplastic system is adopted, processing won’t be necessary. You obtain a positive straight away by an entirely new system free from chemical treatment.

## Japan

How far have the Japanese progressed with television equipment and production techniques? Have they progressed as quickly as they have with photographic processes and cameras, both colour and black and white? Granada TV sent a group of production and technical personnel to study the current techniques but also those which are still in research and development stages. Great advances appear to have been made with midget TV cameras and control equipment, which is not surprising when one realises the speedy improvements that have been made in Japan with transistors and camera tubes. I have just seen in England one of the first of the Japanese 16mm film cameras with striped magnetic sound, especially suitable for TV newsreels and magazines, and was impressed with the appearance and craftsmanship. The main

aimed to be for compactness in design not only for mobile equipment but for studio equipment for video tape, image orthicon cameras and lighting equipment. TV studio lighting, by the way, is similar to the type used in most of the recently fitted TV studios in England—with lamp housings supported on easily movable telescopic fittings. I must say that this type of overhead lighting keeps the studio stages clear of impedimenta for camera movements instead of cluttering up the space with floor-stand lighting. However, there is a tendency to put shadows under the actors' eyes unless "basher" lamps are fixed to the TV cameras, softening the shadows and improving portraiture.

### **The Best-dressed Man**

Top ten assessments are not limited to pop songs and TAM-ratings. The Clothing Manufacturers' Association has prepared a list of Britain's ten best-dressed men for 1964 and this includes Richard Baker, the BBC announcer. Viewers will support the decision of the selection committee, who also included in their list other well-known personalities from show business who are certainly not unknown on TV. I refer in particular to Bruce Forsyth, of Palladium show fame; Brian Epstein, of Beatles' management; and David Webster, general administrator of Covent Garden Opera House. All of them, together with six others in this year's best-dressed men list, have been awarded silver plaques, each of which is etched with a drawing of Beau Brummel, the most immaculately dressed man in history. I am not sure whether Richard Baker's award was gained solely from his appearance on television, in which he is usually behind a desk and is rarely seen in full length, including trousers. But it may be remembered that many years ago Jimmy Sale and Horace Sheldon, the conductors of the orchestras at the London Pavilion and the Palladium music-halls respectively, received similar praise for their immaculate appearance before the audiences as they turned around and smiled confidently before tapping their batons and starting the overture. Unlike Sir Malcolm Sargent, on

his rostrum at the Albert Hall, the lower parts of their suits were concealed by the railed curtains of the orchestra pit. A delayed rush from a golf course occasionally did not give them sufficient time to dress completely in the appropriate manner, but the curtains safely screened the golfing plus-fours. Still the Clothing Manufacturers' awards also took into account aplomb, appeal and appearance. On the whole the male TV announcers are much more effective than the female ones in their performance, apart from the difficult subject of dress. Glamorous dresses are inappropriate for lady announcers and so are non-glamorous ones. This is what worries them. If only they could adopt a "uniform" equivalent to the male announcer's dinner jacket or the quiet and well-cut lounge suit, not too dark and not too patterned, they'd be far happier. And so would viewers, who note their occasional worried expressions.

### **Beat Groups**

There seems to be no fall in the popularity of groups of young men who organise beat groups in all parts of the country. Assisted by electronic devices of all kinds they amplify and reverberate in dance halls. Some of them make private recordings in professional studios and even succeed in reaching the screen of television sets. Watching the enormous international success of the Beatles, they have ambitions to follow in their footsteps. Competitions between the groups have been organised in several regional ITV stations apart from the BBC and the major ITV companies. The participation of personalities in the "pop" world in some of these programmes always seems to ensure success and the names of Brian Epstein and the leading recording company managers as judges have reached star-value proportions. Watching some of these competitions is rather exhausting for those who find the beat monotonous, but it is surprising how good some of the top prize winners are. Their main appeal to the judges depends upon their personalities and presence, very often before their technical performances, and great importance is attached to special

gimmicks, appearance and the choice of musical numbers. While the Beatles may continue with their special hair style which is their trade mark a fair number of pop groups copy similar haircuts (or lack of them), while others adopt their own so-called special kinds of beatnik wardrobe. The judges look more kindly upon a new approach from this angle and the result is a growing number of fancy-dress presentations with haircuts of short-back-and-sides. The main faults in performance are the high-pressure shouting into microphones, wrong notes on electric guitars, lack of training on simple dance movements and absence of the relaxed and confident presentation by the leader and his group. Some of them do get past all these snags and the people in the pop business (including judges on these TV competitions) realise that it will survive for a long time with a variety of presentation supported by strong personalities.

### **Automation in Telecine**

Automation is being introduced gradually into cinemas. Already a large number of cinemas have remote control systems which enable projectionists to run the projectors while seated at a control panel in the audience. Remote control of focus, lamp adjustment, sound volume and change-overs can be made from this seat, while an additional automatic system can be brought into action for changing over from one projector to another. This system, known as Projectomatic, is of especial interest to stations using a large proportion of programmes on telecine machines. This will apply especially, I think, to Pay-TV stations which can in this manner change over from one projector to another without manual control. Reels of films have to be manually loaded, of course, but these can feed 3,000ft or more of film before the end of such a reel automatically changes over to the next ready-loaded 3,000ft. Each 3,000ft of 35mm film lasts about 32 minutes at 25 frames per second. 16mm film runs at only 37½ft per minute and some TV stations abroad use huge reels of this gauge which supply sufficient film for a whole evening's programme.

BY H. W. HELLYER

# STOCK FAULTS

PREVALENT TROUBLES IN COMMERCIAL RECEIVERS

## PART 6 THE A.G.C. CIRCUITS

CONTINUED FROM PAGE 539 OF THE SEPTEMBER ISSUE

FOR some peculiar reason faults in the a.g.c. systems of television receivers cause trepidation even among the hardened gentry of the servicing community. Although the principles of automatic gain control may be understood there are so many different ways of achieving what is almost the same end that the bewildered enthusiast may well be forgiven for thinking that manufacturers design these tangled circuits just to be different.

Whatever the differences there are two principal ways of achieving automatic gain control: the "mean level" and the "keyed", or "gated", system. The former is fairly simple and more widely used. (It should be understood that these notes refer to 405-line receivers, the rather more complicated circuits of the convertible or switchable set having been discussed in previous articles. No doubt, as regular troubles develop into "stock faults" with these newer receivers, the subject will crop up again.)

### Mean Level A.G.C.

This depends, as its name implies, on the mean, or average, level of the picture content. The simplest and most popular method of sampling this control is by taking off a voltage from the grid of a pentode sync separator.

The amplitude of the sync pulses is proportional to signal strength. Positive-going pulses drive the pentode into grid current, charging up the time constant capacitor to a value which holds the grid negative beyond the anode cut-off voltage. The voltage drop across the grid leak, or a portion of it, is used as a control, with a compensating positive voltage applied from a variable potentiometer across the h.t. line, which becomes the contrast control.

A diode across the negative line ensures that the voltage being fed back, whatever the signal conditions, will not be such as to cause earlier stages to overload. Typical of this simple type of circuit is Fig. 30, the sync separator stage of the Alba 321, 324, etc.

In this circuit a pentode valve is used, the grid being held at a low voltage (normally 10V with average signal), the grid being fed from the video

anode via a series circuit, R1/C1.

From the grid, across the grid leak R2, the negative voltage is taken off, filtered and applied to the anode of the clamping diode, whose conducting voltage is regulated by the contrast control, in series, via high-value resistors, from the h.t. The control voltage is taken from this anode of the diode.

Common faults which cause a.g.c. failure, severe overloading and (usually) a video burnout are: failure of the EB91, leaving the grids of the two controlled vision i.f. stages "floating"; the 2.2MΩ screen grid resistor R3 of the sync separator going "high", reducing the negative voltage at the grid, and a leak in either of the two 0.1μF filter capacitors.

This type of circuit has one severe drawback:

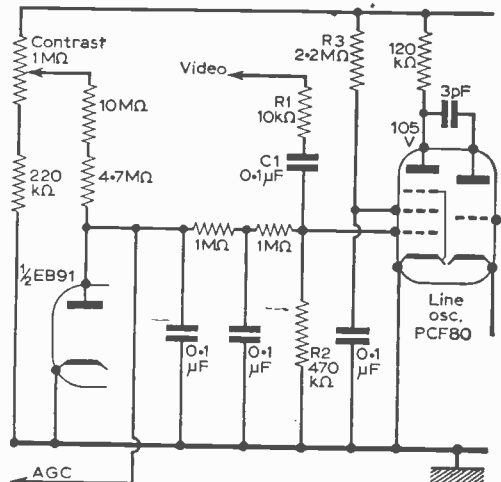


Fig. 30—Typical mean-level a.g.c. circuit, as used on Alba 321, 324, etc. Bias voltage derived from sync separator grid, filtered, clamped by diode, with contrast control setting the level of conduction.

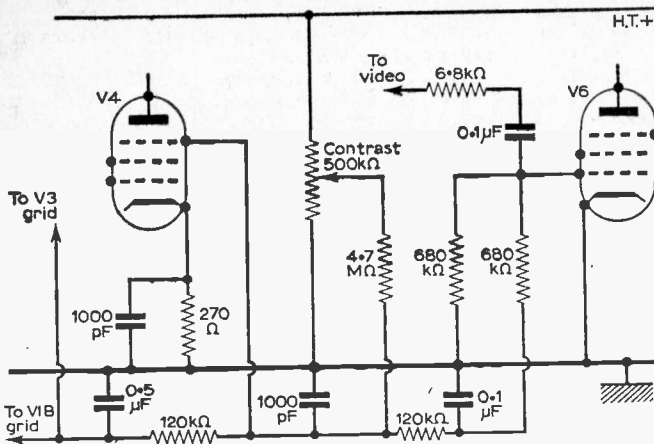


Fig. 31—Mean-level a.g.c., Regentone Ten-17. Suppressor of vision i.f. valve used as clamp. Delay action obtained by circuit constants and valve characteristics.

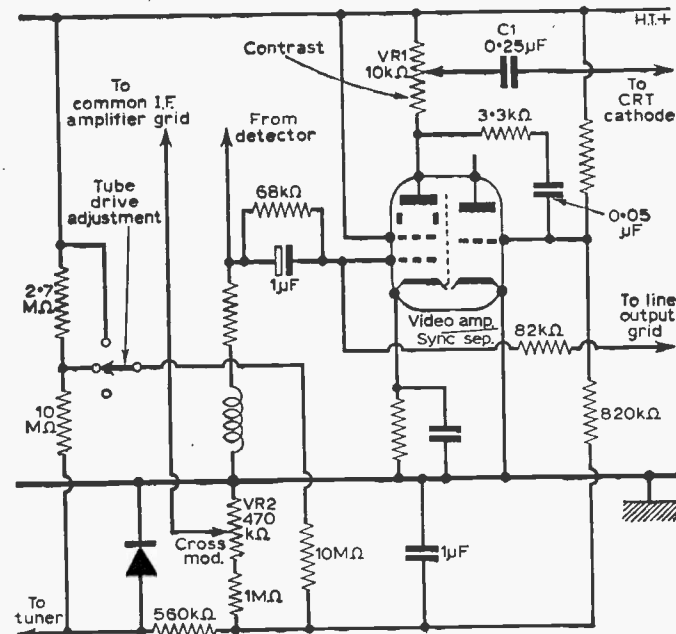


Fig. 32—Ultra and Pilot type of circuitry, requiring special setting-up procedure. See text.

the d.c. component of the picture signal is reduced considerably, causing a lack of gain on bright pictures and an increase of gain on dark pictures. In its simplest form it has the effect of producing a bright raster when there is no picture information being transmitted—just when one would expect the screen to be blank.

### Delay Circuit

In the circuit of Fig. 30 we saw that a clamping

diode had to be provided to prevent the a.g.c. line going positive in the absence of a signal. There are variations of this method which include a "delay" circuit, such as illustrated in Fig. 31, which is the relevant part of the Regentone Ten-17 circuit.

Here the control voltage is again derived from the grid of the pentode sync separator, with the contrast control supplying a variable, balancing positive voltage. But instead of a simple diode the suppressor grid of the second vision i.f. amplifier is used.

When the suppressor is positive with respect to the cathode, conduction takes place. In the absence of a signal, when the contrast control would tend to make the a.g.c. line positive, V4 suppressor conducts, holding the a.g.c. to the cathode potential, which is then about 3V positive to chassis.

Thus the contrast control has a definite action on picture strength and overloading is prevented. Apparent low gain, with no variation of contrast points to the inaction of the circuit and can be caused by burning of the carbon track of the contrast control, requiring replacement of the dual volume / contrast / on-off switch potentiometer.

### Separate A.G.C. Line

To get the best out of the r.f. circuits as regards the possible gain and the signal-to-noise ratio a separate a.g.c. line is often taken to the "front end". There are many variations of this circuit, usually involving quite different filter circuits, additional diode clamps, which are generally small crystal components, and perhaps a separate delay circuit from the main a.g.c. point.

One symptom that is often noted is the apparent failure of a.g.c. as the contrast is at its highest point. Depending on signal level, advancement of the contrast control causes the picture to strengthen, reach a peak, then fall off as the control is advanced to maximum. Almost invariably this is the clue to a loss of emission of the r.f. valve and replacement should be the first test.

A factor that sometimes causes puzzlement is the addition of the sound a.g.c. to the vision line. This has been done by several makers to give a certain measure of control when the sound alone is being transmitted and should not be confused with the method, as employed in some Sobell receivers of earlier vintage, of deriving the auxiliary a.g.c. delay from an anode feed resistor in the sound i.f. stages.

One fault that does occur because of this circuitry is a "sync buzz" on sound when the filtering fails.

An interesting variation of the "sound-and-vision" combination is seen in some Ultra circuits such as the 17-70, VP17-72 and later models (also Pilot PT450, 452 and 650 models) where the screen grid of the common i.f. amplifier is taken to the common h.t. feed resistor of the sound i.f. amplifier, this resistor being heavily decoupled. There are other interesting points about this circuit as can be seen from Fig. 32.

Contrast variation is obtained after the video amplifier—actually by tapping off the signal at the anode from a 10k $\Omega$  potentiometer, which becomes the contrast control (VR1), and applying it to the c.r.t. cathode via a large (0.25 $\mu$ F) capacitor C1.

A preset arrangement called, rather misleadingly, "tube drive", allows accurate setting of the a.g.c. backing off voltage and consists of a link which should be connected to give correct drive. Linking across to h.t. provides maximum drive and the symptom of overdrive is an apparent limiting action.

Disconnecting the link gives improvement in highlight detail, especially when the set is new. Low gain can result from the 10M $\Omega$  link to the adjustment network going "high".

Another feature is the noise control—or "cross modulation control" (VR2). This gives fine control of the a.g.c. and should be adjusted for minimum noise consistent with no cross-modulation.

To check adjustment set the control to zero, apply a strong signal to the set and note the noise on the screen, then slide the control along until this noise just disappears. This should correctly be somewhere near mid-travel. On later marks this control was increased to 680k $\Omega$ .

**A.G.C. Preset**

Other methods of varying the contrast mean setting or applying a delay will be found. In Fig. 33 the a.g.c. circuit of the Kolster-Brandes RV20 is shown. This is applicable to several other K-B models such as the *Queen de Luxe* and *Kolstar* ranges.

The special feature is the a.g.c. preset control, which is part of the grid load of the line output valve. This feeds back a voltage to the a.g.c. line to delay the bias applied to the tuner until after the i.f. gain has been reduced.

It should be adjusted on a strong signal for minimum intermodulation and checked on a weak signal for minimum noise.

In this circuit the split grid load of the sync separator provides separate a.g.c. lines for i.f. and tuner unit and ragged edges on verticals can be caused by either or both R1, R2 going "high". If this fault is accompanied by an increase in overall

brightness the 0.05 $\mu$ F capacitor C1 should be suspected. Excessive brightness with weak contrast may indicate a leak in C2.

Line cogging, although not truly an a.g.c. fault but which is accentuated by this circuitry, can occur when the 0.1 $\mu$ F sync coupling capacitor C3 develops a leakage.

**Keyed or Gated A.G.C.**

As stated previously, the bias voltage should be proportional to the transmitted (and received) signal level. A suitable reference level is the 30% modulation level, which is constant.

This is found at the "black level" period of the waveform which only occurs at the porches to the line sync pulses or during the frame blanking period at the commencement of a raster. Fig. 34 shows a portion of the signal waveform and shows also the very small period during which these conditions obtain.

In practice a valve has to be used to switch the a.g.c. circuit to the video detector output. Normally this valve is keyed, or gated, to conduct

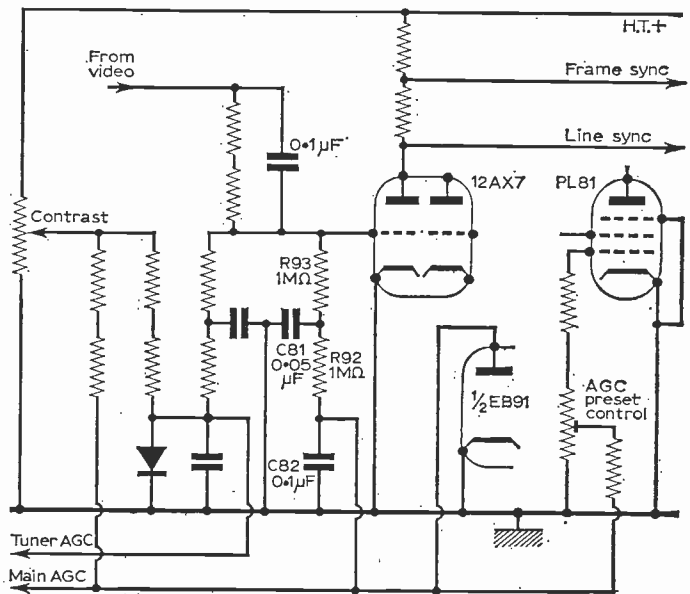


Fig. 33—Mean-level a.g.c. with split feed. (Kolster-Brandes.) Note a.g.c. preset control.

shortly after flyback occurs. This, in turn, drives the grid of another valve positive, the latter being biased to cut-off.

The net result is that the second valve conducts only during the few microseconds of the back porch period.

**A.P.C.**

Mention of gated a.g.c. would hardly be appropriate without reference to the Pye system, for it was the Pye automatic picture control used on the V4 model which brought the system to this

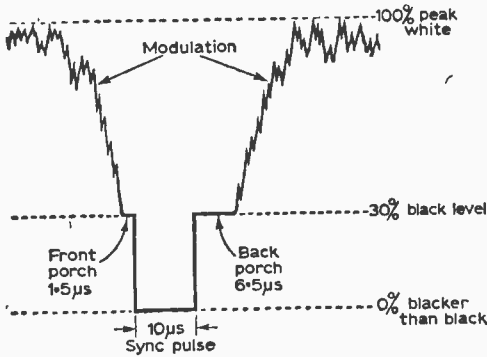


Fig. 34—Portion of waveform at end of one line and beginning of next, showing line sync pulse, with front and back porches. Modulation level varies, but black level remains constant and is sampled during back porch period.

country. Fig. 35 shows the rudiments of the system and is used to demonstrate the method of gated a.g.c.

From the video amplifier the signal is coupled directly to a cathode follower valve V1. Output from the cathode is applied to the cathode ray tube, the sync separator circuit and to a pulse sampling valve V2. The cathode of V2 is connected to the cathode of the a.p.c. amplifier V3 and via a coupling capacitor to the secondary of a transformer which is, in turn, connected across the line output transformer winding.

A gating pulse is thus fed to V2 cathode delayed by the time constants of the circuit just after the line sync pulse has been completed; in other words, during the back porch period.

At this moment V1 cathode has returned to black level but the beginning of the modulation of the line has not commenced. V2 conducts when the pulse arrives, acting momentarily as a closed switch, joining the cathodes of V1 and V3.

The negative pulse at the V3 cathode thus produced causes the diode V4 to conduct, charging C4, which passes the filtered d.c. voltage, as bias, to the first i.f. control grid.

### Safety Circuit

A safety circuit consisting of a crystal diode between video amplifier grid and line output cathode prevents overloading during the warm-up period. R5 is used as a contrast control, setting the bias and thus the gain of V3.

If the signal level increases, V1 passes less current, the signal being negative going at the cathode, resulting in an increased cathode pulse at V3 and thus increased a.p.c. bias.

A fault in the a.p.c. system will be revealed if the contrast control is ineffective. Fault tracing in this circuit is more easily carried out with the aid of an oscilloscope, but voltage and resistance tests should quickly pinpoint the root of any trouble.

It should be remembered that the circuit depends on the keying or gating pulse and failure of the coupling transformer will render the circuit inoperative.

Failure of the line output transformer winding that supplies the pulse will, of course, result also in failure of the flywheel synchronising and loss of line lock.

This is only one individual method of dealing with the problem. There are almost as many variations as there are manufacturers and, as this is not intended to be an article on a.g.c. systems, it is not intended to describe them in detail. But the foregoing should give some idea of the principle and help us understand why some of the stock faults to be mentioned have their particular results.

### External Causes

It should be remembered, however, that in common with mean-level circuits the symptoms of an over-contrasted or excessively grainy picture

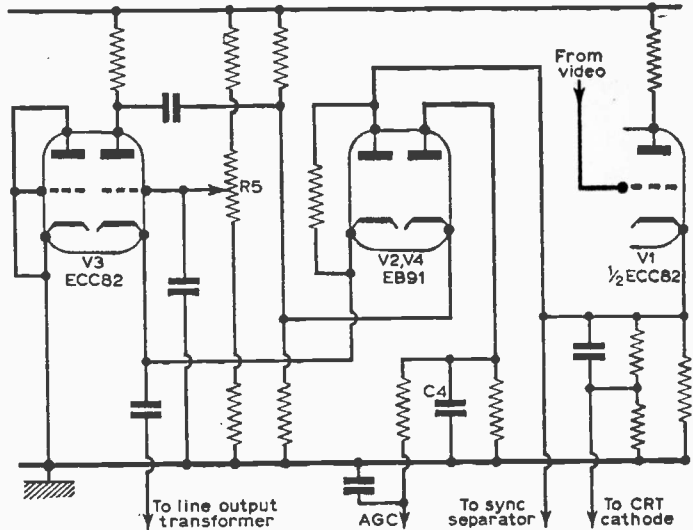


Fig. 35—Early gated a.g.c. circuit (Pye V4). See text for details.

may well indicate a low a.g.c. voltage caused by external faults, i.e. failure in the controlled valve itself.

Examples are the Pye V510F, where incorrect readings on the a.p.c. amplifier valve and even on the peak detector and video valve may simply indicate that the first vision amplifier is passing grid current; and the Philips L155U, which may have quite peculiar symptoms, including a slight positive voltage on the a.g.c. line, for the same reason.

Leaks to chassis of the decoupling capacitors that filter the a.g.c. line can give rise to similar symptoms. This is not usual where ceramic components are used but occasionally one comes across paper dielectric capacitors with quite alarming leaks. A typical fault is the  $1\mu\text{F}$  paper capacitor of the Ultra 1775, which also acts as part of the delay circuit.

Worthy of note is the Alba 909 a.g.c. circuit, illustrated in Fig. 36. Symptoms: a gradual increase in gain, necessitating the viewer hopping up and down to adjust contrast and brightness controls. Cause: a leak developing in the line gating pulse coupling capacitor as the receiver heats up. The misleading factor is that this fault tends to appear intermittently and to disappear when the "eggshell" cabinet is removed.

Another fault which can cause this set to operate rather as if a poor mean level circuit had been used, i.e. whites too featureless, blacks too grey, with no moderation of tones in mid-range, changing as the picture content varies, can be caused by a failure of the  $100\mu\text{F}$  electrolytic decoupling the contrast control.

**General Tests\***

From the foregoing it can be seen that a number of general faults occur and general tests can be applied. Measurement of the a.g.c. line with a high-resistance voltmeter gives a clue to fault conditions.

Note the difference between individual branches such as a.g.c. feed to i.f. valves and tuner unit. Isolate sections to test and do not omit to check the controlled valves and their circuits. Where a subsidiary "holding voltage" is applied, suspect the high resistance from the controlled grid to the h.t. line—a common cause of failure when such a component goes "high"—usually in the inaccessible depths of the tuner unit.

Above all, don't be scared of the a.g.c. fault; it is seldom so baffling as it looks.

PART 7 FOLLOWS NEXT MONTH

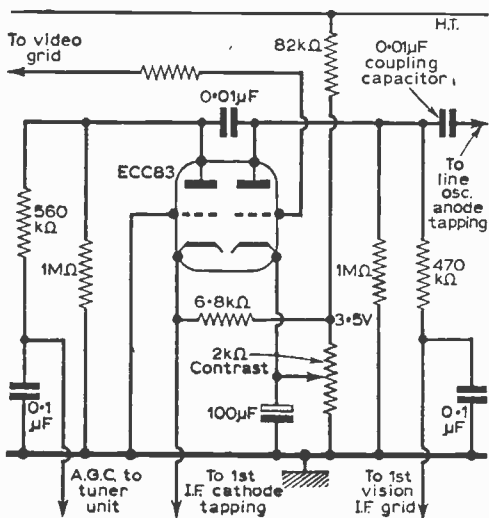


Fig. 36—"Economic" gating circuit used as a.g.c. control for Alba 909.

# ICONOS MEETS MR. EDISON

—continued from page 17

**MR. EDISON:** That's what they call it now—but it is still the Edison gauge. The Edison gauge—as used now in the cinema and on telecine machines at the television stations.

**ICONOS:** Well, quite a lot of Edison effects have been seen in the last 80 years.

**MR. EDISON:** I've been watching them! Amazing improvements!

**ICONOS:** And what progress do you see in the future, sir?

**MR. EDISON:** I don't look into crystals, boy, though I used to scratch 'em before I died! That was when radio came in. Be specific!

**ICONOS:** Well—further progress with motion pictures and television, for instance.

**MR. EDISON:** Ah, yes! I see big advances in zoom lenses, with motion picture miniature built-in TV cameras

surrounding them and feeding monitors as remote viewfinders.

**ICONOS:** And in television?

**MR. EDISON:** The same zoom lenses surrounded by the circuitry of the TV camera instead of being added on to it. Elementary, my dear Iconos!

**ICONOS:** We've seen some of your old films on television.

**MR. EDISON:** Yes—Edison gauge persists and motion pictures and television are the product of the phenomenon of persistence of vision, an illusion of pictures in motion. In one-sixteenth of a second each one fades away . . .

The figure of Edison faded with his last words and I awoke, wondering if the amazing Mr. Edison had anything to do with transistors, nuclear developments, computers and washing machines. You never know, you know!



# LETTERS TO THE EDITOR

## TV CONVERTER

**SIR.**—I am using the 70cm TV converter and aerial design published in *PRACTICAL TELEVISION* some time ago and I am very pleased with the results. However, try as I might I could not make the oscillator work—no matter what I did with it—when following G3LJ/T's suggested circuit arrangement for the grids of the 6J6 and short of removing the h.t. or l.t., I could not stop the oscillator from working. Now, don't ask me what the difference is, but by using a 22k $\Omega$  resistance from each grid the fault is cured.

I sincerely hope that you will continue your series of amateur TV articles as they have certainly aroused some interest in the Fylde area, and I am sure that they will become ever increasingly popular.

May I also beg a fraction of your "Letters" page to request that some reader could furnish me, at reasonable cost, with the articles on "A Closed Circuit Colour TV System", mentioned by Mr. Davidson last month.—A. JAKES (185 Bispham Road, Blackpool).

## CASTLES IN SPAIN

**SIR.**—With reference to your leader in the September issue, I agree that so far as the amateur constructor is concerned there is not a great deal to interest him in the many exhibitions now being organised. Of course, many of us trudge around the Radio Show and similar exhibitions but the salesmen are more interested in what the sets look like than what makes them tick. This is natural as the exhibitions are mainly for ordinary members of the public.

The RSGB exhibition (whatever they call it, it is still known as the "RSGB Exhibition" among enthusiasts!) offers us something—particularly the examples of home constructed equipment, which alone makes a visit worth while. But the displays of components seem to be rather severely limited to one or two companies.

I suppose it is a case of Castles in Spain, wishing for a larger show devoted to the interests of the home constructor. In the old days, many component makers relied to a large extent on their sales to the amateur. Nowadays the home constructor is "small fry" compared with the huge orders possible from Government departments and equipment manufacturers.

On the other hand an enormous business has been built up on the sale of kits and it seems to me

---

**SPECIAL NOTE:** Will readers please note that we are unable to supply Service Sheets or Circuits of ex-Government apparatus, or of proprietary makes of commercial receivers. We regret that we are also unable to publish letters from readers seeking a source of supply of such apparatus.

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The Editor does not necessarily agree with the opinion expressed by his correspondents.

---

that some of the larger retail shops who cater for this market and also have a very large overall mail order business in components could, to the profit both of themselves and to potential visitors, support exhibitions like that the RSGB to a very much greater extent than they do.—G. FRY (Lincoln).

## UNUSUAL PHENOMENON

**SIR.**—I think some other readers may be interested in the following phenomenon which I came across while experimenting with an Ekco T161 receiver fitted with a turret tuner.

With coils for channel 2 in position, the normal receiving dipole connected into one of the coaxial input sockets and a signal generator r.f. output connected into the other coaxial input socket, medium wave signals were received loud and clear with the signal generator set at about 48Mc/s. The whole medium wave band was scanned using different outputs from the signal generator—using Range 6 on the Nombrex type model 27—and fine tuning was obtainable by using the fine tuner on the turret assembly.

Stations such as the Third Programme, Radio Caroline, Luxembourg, Home Service and many foreign stations were received with a good degree of selectivity.

This is an obvious case of the "superhet" principle in practice where two different signals grouped together have provided a third signal in the medium wave band and this signal has been analysed and reproduced by the receiver circuit. Experimentation is being continued on reception of other wave bands, but as yet only medium wave stations are obtainable.—B. ROE (Wallasey, Cheshire).

## YOUR PROBLEMS SOLVED

**SIR.**—The most valuable part of your highly esteemed journal, in my opinion, is the "Problems Solved" section. By profession I am a television service engineer, and I have come across many hints in the replies which are outside the normal service drill, and I have found these most useful.

I always buy two copies of *PRACTICAL TELEVISION* so that I can cut out the "Problems Solved" and paste them in a book under various makes for future reference.

A far better arrangement, in my opinion would be for these "Problems Solved" to be published annually in book form.—B. SMITH (Ilford, Essex).



## TRADE NEWS • TRADE NEWS TRADE NEWS • TRADE NEWS TRADE NEWS • TRADE NEWS TRADE NEWS • TRADE NEWS

R.C. Bridge

THE K.L.B. M.300 is a component bridge with four capacitance ranges from 10pF to 1000 $\mu$ F and four resistance ranges from 0.5 $\Omega$  to 100M $\Omega$ .

This instrument embodies facilities for capacitor leakage tests with an adjustable test voltage between 0 and 500V d.c. Ratio tests can also be carried out in the ranges of 0.05—1 and 20—1, between any two capacitors, inductances or resistors. The price of this instrument is fixed at £23 2s. 11d.



The Paco model Z80 signal tracer

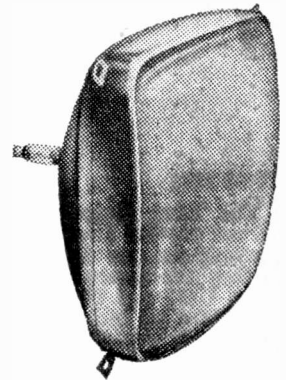
ALSO from K.L.B. comes the Paco Z80 r.f./a.f. signal tracer. Its extremely high gain, coupled with coarse and fine attenuators, make it suitable for detecting minute signals from the aerial circuit or large signals from the output stages. This instrument has facilities for noise testing and speaker substitution and can also be used as a wattmeter. The price of the Z80 is £23 17s. 6d.,

complete with input probe, or it may be purchased in kit form for £22 4s. *K.L.B. Electric Limited, 335 Whitehorse Road, Croydon, Surrey.*

### New Mazda and Brimar TV Tubes

RELEASED by Thorn-A.E.I. Radio Valves and Tubes Limited are two new TV tubes. They both feature a new safe "monopanel" construction and require no separate implosion screen. The type numbers are: 19in., CME1905, and 23in., CME2305, and their electrical characteristics are the same as the CME1903 (AW47-91) and the CME2303 (AW59-91).

Both of these tubes will be added to the "Gold Star" and "Plus" ranges of TV picture tubes manufactured by this company. *Thorn-A.E.I. Radio Valves and Tubes Limited, 155 Charing Cross Road, London, W.C.2*



The new c.r.t. from Thorn-A.E.I.

### Aerial Prices Cut

BELLING-LEE announce price reductions in their Band IV and V aerials. Some examples of the new reductions are: Band IV, U3/4A/W9, 25s.; Band IV, U10/4B, 42s.; Band V, U20/5A, 55s.; Band V, U410/5A, 239s. *Belling-Lee Limited, Great Cambridge Road, Enfield, Middlesex.*

## THE NEW DECAL VALVES

—continued from page 26

### High-level Contrast

In Fig. 3 is shown the circuit of a high-level contrast control system on the "L" section of the valve. This is capable of giving a signal current swing of 50mA (e.g. 100V peak-to-peak across 2,000 $\Omega$ ).

High-frequency compensation is provided by the cathode resistor R1, which also biases the valve. Further compensation is given by C1 on the screen grid circuit, while compensation over the range of the contrast control is provided by the trimmer C2.

Fig. 4 depicts the "F" section of the valve arranged as a sync separator stage. The valve is given a short grid base by operating the screen grid at about 40V, as obtained from the potential-divider R1/R2.

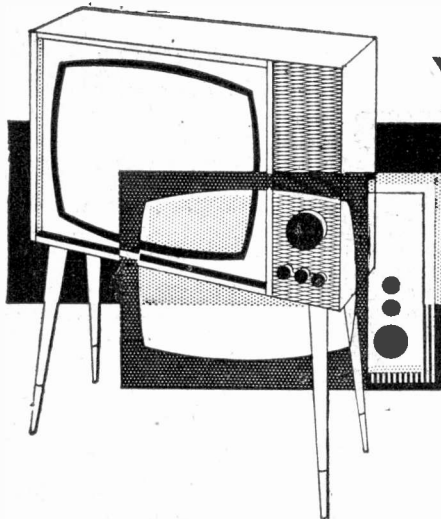
Good pulse shape is maintained by the circuit taking a relatively high anode current at low anode

voltage, thereby allowing the anode circuit to be designed with a relatively low impedance.

The R3/C1 parallel combination in the control grid circuit serves to discriminate against hum and low-frequency disturbances which may be present on the video input signal.

It is hoped that this article will reveal to the experimenter and television enthusiast the potential of the new range of valves as well as giving the service engineer a preview of the things to come in commercial receivers.

It must be clearly stressed, however, that at the time of writing the new decal valves are not generally available in the U.K. The PFL200, however, is currently marketed by Mullard and is readily available, but the range of 10-pin triode-pentode valves represents recent European developments which are not, so far as we know, scheduled for use in British standard receivers. Nevertheless, once the decal technique has been proved in circuits of suitable design for our dual standards, they may all eventually appear in receivers in this country. ■



# Your Problems Solved

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 44 must be attached to all Queries, and a stamped and addressed envelope must be enclosed.

## EKCO T293

The Line Output Transformer on this set burned out and I replaced same. The set worked perfectly for two days then the picture went off leaving the screen blank. I have checked the 30P4, U191 and U26. The new l.o.t. was tested in another set and found to be in working order. The boost capacitor (0.05 $\mu$ F), linearity coil and the scan coils were also checked and found to be all right. There is only  $\frac{1}{4}$ in. spark at the U26 anode and the h.t. voltage is 200V as stated in the service manual.

Disconnecting the e.h.t. lead from the tube and Metrosil does not increase the e.h.t.—H. R. Thornton (Trimdon Station, Co. Durham).

Check the 500 milliamps fuse, the line linearity choke (which may have slipped down to chassis) and the 0.5 $\mu$ F boost capacitor beneath the chassis.

## COSSOR 927

The screen is dead with no raster, save for a narrow ( $\frac{1}{8}$ in.) band of illumination across the centre of the screen. E.H.T. is present and the valve heaters are all in good order. The sound is not affected.—M. Rasburn (Ormskirk, Lancashire).

We suggest you check the two timebase valves. These are the 6AB8's nearest to the main smoothing condenser on the upper deck.

## PYE VT4

This set is impossible to focus. Maximum brightness is at the centre of the brilliance control track, above which the picture blows up. Thinking this was low e.h.t. I replaced the e.h.t. rectifier, but this made no difference. It is also impossible to lock the picture which keeps jumping or sometimes rolling.—R. Bordiss (Hollow Lane, Exeter).

For the focusing trouble, check the ion trap magnet, the PL81 and its 3.3k $\Omega$  screen grid resistor.

Critical frame hold suggests a faulty WX6 interlace diode. A pair of these are fitted below the chassis near the ECC82 frame oscillator.

## PHILCO 1020

The sound is perfect but the screen has a  $\frac{1}{4}$ in. black horizontal band across it, with the picture cramped above and below this line.—C. Lee (Ipswich, Suffolk).

You should check valves ECC82 and PL84. Check the hold control and 470k $\Omega$  series resistor, and the capacitors in this part of the circuit. C65, C67, C68 etc.

## R.G.D. DEEP 17A

Would you please tell me the correct valves for the sync. separator, sync. oscillator and frame output combination.—R. Cull (Worcester).

There are two valves in the centre of the chassis under the tube. That on the left is the PCL82 frame output—part oscillator. That on the right is the ECL80 sync separator—part frame oscillator, and the PCL82 on the front right is the audio output.

## INVICTA 136

Owing to accident, the envelope of the PL81 cracked. Now on replacing this valve, the grid feed resistor 2.7k $\Omega$  had dropped to 500 $\Omega$  but did not heat up. The only parts overheating were PL81, PY81 and the thermistor which is in series with these two valve heaters. On changing the 2.7k $\Omega$  wirewound resistor, the PL81 valve runs a little cooler but with a green-blue glow, and the feed resistor and thermistor again get hot.—J. Smith (Minehead, Somerset).

If the screen resistor is now of the correct value (2.7k $\Omega$ ) and the PL81 is still overheating, check the ECL80 line oscillator and the 0.01 $\mu$ F capacitor from pin 6 to the PL81 pin 21k $\Omega$  resistor. If the PL81 and PY81 no longer overheat, check the 0.05 $\mu$ F boost line capacitor.

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1R3	4/8	7H7	8/8	DK92	8/-	EF91	8/8	PC83	9/-	UC80	5/8
1S5	3/8	7B7	14/8	DK91	4/8	EF92	2/8	PC84	7/8	UCF2	8/8
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3A3	6/8	12AT6	4/8	DK96	6/8	EL38	11/8	PEN4D	1	UC84	7/8
3Z4	4/10	12AT7	8/8	DL33	7/8	EL41	7/8	PC86	10/8	UC80	6/-
5R4	4/8	12A16	5/-	DL33	6/8	EL44	4/8	PEN4A	6/8	UC89	6/8
5V4	5/8	12A17	4/8	DL92	4/8	EM34	7/11	PEN4L7	6/8	UC92	5/8
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6Y3GT	5/-	12K7GT	4/8	DL96	6/-	EM81	7/8	PL36	8/8	UC85	6/8
6Z4G	7/-	12K8GT	8/8	EAB90	8/8	EM84	6/8	PL31	7/-	UCF80	8/8
8AL3	8/-	12Q7GT	4/8	EAP42	8/-	EM87	7/-	PL92	6/8	UC82	7/8
8AQ3	6/-	19H00	6/8	EB41	4/-	EY51	6/-	PL93	5/-	UC81	6/8
8AT6	3/8	20P5	12/8	EB91	5/-	EY85	5/8	PL94	5/8	UC82	6/8
8BA6	6/-	20P5	14/8	EB93	5/-	EZ40	5/8	PN4	9/-	UC83	8/8
8BE8	8/8	20LGT	4/8	EB94	7/8	EZ41	7/8	PN20	7/8	UCF4	7/8
8BG0	12/8	25AC10	1	EBF90	6/-	EZ60	4/-	PY22	6/8	UCF2	4/8
8BH6	5/-	30L15	9/8	EBF99	6/-	EZ81	4/8	PY33	9/8	UCF89	10/8
8BJ6	5/8	30PL1	8/-	ECC40	7/8	FW4/500	8/8	PY80	5/8	UC41	7/-
8F60	3/8	30PL13	9/-	ECC81	3/8	KT32	5/-	PY81	5/8	UC44	15/-
8F13	4/-	80PL14	12/8	EC982	4/8	KT61	7/8	PY82	5/-	UC46	8/8
8F14	6/-	35A5	14/-	ECC85	7/8	KT63	3/8	PY83	7/8	UC84	6/8
8JG0	3/8	32LGT	6/8	EC984	6/8	KT66	12/8	PY88	7/8	UC7	6/8
8K70	1/8	85Z4GT	11/8	EC985	6/8	KT66	12/8	PY88	7/8	UC7	6/8
8K7GT	4/-	52KU	13/8	ECF80	6/8	MU14	5/-	TD4	7/8	UC21	7/8
8K8G	4/8	58KU	8/8	ECF82	8/8	MV8/PEN8	TH21C	9/8	UC41	4/8	
8K8GT	7/8	ACV912	6/8	ECF86	10/8	N18	18/8	TH233	9/8	UC85	5/-
8P28	9/8	AZ31	6/8	EC985	8/-	N18	4/10	UC2	4/8	VP4B	12/8
6Q70	4/8	B38	4/8	ECH42	8/8	PN95	6/8	UC5	8/8	VP41	4/8
6Q7GT	7/8	CL33	9/8	ECH81	6/-	PC97	7/8	UC6	8/8	VP4	3/8
6R7GT	9/8	CY1	12/8	ECCL80	8/8	PCC84	5/8	UC7	8/8	VP7	2/8
68L7GT	5/8	DAC32	8/8	ECL82	7/-	PC96	6/8	UC8	5/-	VP29	16/8
68N7GT	3/8	DAF91	8/8	ECL86	9/-	PCC88	8/8	UC2	4/8	X104	19/8
6V90	3/8	DAF96	6/-	EF39	3/8	PCC90	9/8	UC73	3/8	X109	17/8
6V6GT	6/8	DCC90	8/8	EF41	6/8	PCF80	6/8	UC191	8/8	Y03	4/8
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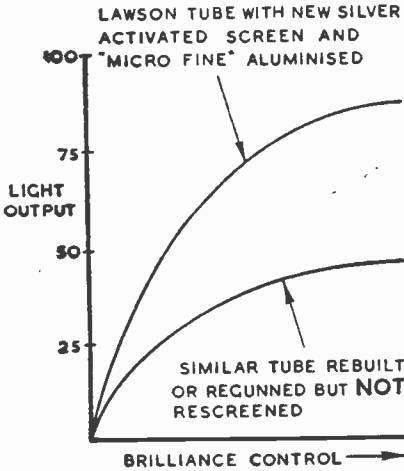
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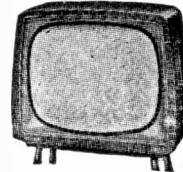
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**EKCO TC196**

The mains transformer T5 has burned out on this set. Please could you tell me what type to ask for when ordering a new one, and from where this component is available.—D. Jones (Neath, Glamorgan).

The mains transformer for this set is a "special" and one could be obtained from the maker's service organisation: Radio and Television Services, P.O. Box 11, Cambridge, via your local dealer.

**PYE CONTINENTAL SP17**

During the last two months I have had to replace a PCL82 four times. The sound is perfect but there is no picture and there is a broad horizontal beam on the screen.—B. Casteleau (London, S.W.13).

The symptoms you describe suggest a leaky coupling capacitor between triode anode and pentode grid, or else a faulty blocking oscillator section. We regret we cannot be more specific, as several different frame timebase circuits may be encountered in the SP17.

**COSSOR 933**

Immediately this set is switched on, the fuse blows. Could you please tell me where to look for the trouble.—W. Shore (Yarm, Yorkshire).

A 0.1 $\mu$ F 250V a.c. working capacitor is fitted across the mains on the set side of the fuses. Check this capacitor, which is fitted behind the voltage selector panel.

**G.E.C. BT2745**

The picture is a scramble mass of blacks and whites. The sound is almost obliterated by a loud hum which increases with the volume. When the aerial is disconnected the hum stops and the normal even raster appears. I have changed both the tuner valves, but this has made no difference.—R. Smith (Chelmsford, Essex).

The fault would appear to be due to a defective 0.001 $\mu$ F decoupling capacitor associated with the right side Z77 (i.f. plate). Check the capacitor from pin 7 to chassis and the other 0.001 $\mu$ F by bridging each in turn with a known reliable component.

**STELLA ST8514U**

The tuner unit was found to be inoperative and after it was repaired, ITV could only be received with a thin line down the screen (about 2in. from the left), and BBC could only be received with a mottled effect of little black lines. This fault could not be tuned out by the fine tuner.—B Howard (Failsworth, Lancashire).

Check the 6.8k $\Omega$  1W resistor to pin 1 of the PCF80 and realign the oscillator coil core from the front with the knobs removed to expose the hole to the right of the spindle.

**FERGUSON 996T**

This set has no picture or raster. The sound is normal and e.h.t. is present. The PL81 and PY81 have been replaced and the video amplifier EF80

is not passing current.—G. Harfield (Hounslow, Middlesex).

We would suggest you try the effect of wiring a 330 $\Omega$  resistor from pin 1 and 3 to chassis of the video amplifier shunted by a 0.001 $\mu$ F capacitor. This is to prove whether the FS 1187A metal rectifier in the cathode circuit is at fault.

**G.E.C. BT452**

The picture on this set is quite normal, but the sound crackles and has a loud hum which increases when camera changes are made. The sound decreases to the point of inaudibility but the hum level remains the same.—O. Greenwood (Neath, Glamorgan).

First note whether the fine tuner has to be at one end of its travel to obtain what sound there is. If this is so, insert a suitable trimming tool through the hole near the channel selector, and with the fine tuner set midway, adjust for maximum sound. Check the sound valves EF80 and PCL84 and sub h.t. line 100 $\mu$ F electrolytic capacitor if necessary.

**FERGUSON 506T**

When this set is switched on, the picture is normal, but after a minute or so the sides of the picture start to close in until there is a gap of 1 $\frac{1}{2}$ in. at each side of the picture and an inch at the bottom.—E. Smith (Doncaster, Yorkshire).

We would advise you to change the h.t. rectifier valve PY32. A PY33 is, in actual fact, the correct replacement.

**PYE V4**

A picture can only be obtained by turning the brightness control to a point at which the screen begins to lose brightness. Sometimes a perfect picture can be obtained by returning the control to normal, but at other times the raster does not appear and there is a change in tone of the line whistle.—A. Wharton (Liverpool, 11).

The symptoms suggest an intermittent grid-cathode short in the c.r.t. You may be able to clear this by gently tapping the tube base.

**MURPHY V240**

When this set is switched on there is no picture or raster, but the sound is normal. The 20P4 was found to be leaky and low, so was replaced. There is a line timebase whistle when the l.t.b. control is at one end. I cannot take the can off under 20P4 and U329 unit—the "works" do not seem to leave the can.—H. Bristow (High Wycombe, Buckinghamshire).

The line output transformer on the V240 is, as you suggest, a sealed unit containing the U25. Your trouble is more likely to be a faulty boost capacitor 0.25 $\mu$ F or a faulty screen dropper resistor 2.7k $\Omega$ . If this latter has failed, check also the pre-set "current control".

**PHILIPS 1446U**

On this receiver there is no raster and nothing can be seen when the set is turned off. There is a strong even line whistle and the e.h.t. circuit appears to be in order—a new EY51 was fitted but had no effect. The tube base voltages

are correct, the sound is perfect and the PY81 and PL81 have been checked by substitution. Is it possible that the fault lies in a low emission c.r.t.?—P. Chart (Horsham, Sussex).

A faulty tube could be responsible for lack of illumination assuming that the e.h.t. voltage is present on the final anode. However, check the ion trap magnet on the tube neck and if this is loose, readjust carefully by rotating and moving along the neck for the maximum illumination.

#### FERRANTI 14T6

On switching on, the sound comes on quite normally, but there is no picture. I can find no e.h.t. present and valves PY81 and PL81 glow red hot.—H. Etherington (Ferryhill, Co. Durham).

A short in the line output transformer could most certainly result in the troubles mentioned, and this would be revealed by checking the insulation resistance between the cathode of the PY81 (top cap) and/or the anode of the PL81 (top cap) and chassis. The reading should be well in excess of 5,000Ω.

Also check the valves for heater/cathode insulation and the boost reservoir capacitor connected between the l.o.t. tap and h.t. positive.

#### COSSOR 934A

Everything is normal for about 2-3 hours viewing, then, on top of the turret tuner there seems to be a sudden shorting to chassis, then the fuses blow.

Could this fault lay with the rectifier valve or near the turret tuner?—G. Fryer (Newcastle, Staffordshire).

The usual cause of the symptoms you describe, is an insulation breakdown between primary and secondary of the i.f. transformer in the top of the tuner. This fault can sometimes destroy the h.t. rectifiers, which usually need to be replaced in pairs.

#### BAIRD 484

All the valves seem to be lighting up except the EY86. I checked this valve, the PL36 and PY800, and they all seem to be in good order.—J. Grory (Glasgow, E.4).

We would suggest that you check the a.c. supply to the rectifier (from the dropper) and the d.c. output of the rectifier. You will probably find the surge limiting resistor section of the dropper is o.c.

## TEST CASE -23

Each month we provide an interesting case of television servicing to exercise your ingenuity. These are not trick questions, but are based on actual practical faults.

? A recently installed receiver was operating satisfactorily apart from two effects which the viewer thought represented faults in the receiver. One was that to the right of large, bright captions occurred black streaking. The effect was greatest when the captions carried a large white content. The other was that although the brightness and contrast controls were set for the best contrast ratio (black/white ratio) on Test Card C, on a picture it was sometimes necessary to re-adjust both the brightness and the contrast controls to avoid the bottom half of a picture, when there was bright sky in the top half, disappearing completely into black.

The service engineer carefully examined the set and reported that there was nothing at all wrong with it and that the effects mentioned were normal. Was the engineer correct in this assumption and if so why?

See next month's PRACTICAL TELEVISION for the solution to this Test Case and for another problem.

### SOLUTION TO TEST CASE 22

(Page 572, last month)

Since the frame lock held solidly when the line hold weakened, the sync separator stage was working reasonably well. The valves were also in

order, as also were the associated components, as subsequent testing proved.

Closer examination revealed that when the line lock weakened the picture definition tended to deteriorate. This gave a clue and tests were made in the video amplifier stage. It was seen that the cathode capacitor of the video amplifier valve was near a large wattage resistor which tended to warm up as the set was running. Bending the leadout wires of the capacitor so that the component was removed from the influence of the hot resistor, gradually restored the definition and line lock.

Later tests on the component showed that its value altered as its temperature rose. This over-compensated the video amplifier sufficiently to distort both the vision signal and the line sync pulses. The frame was unaffected because the frame pulse filter had the effect of correcting possible frame pulse distortion before the pulses were applied to the frame oscillator.

This fault shows that poor line sync may have its origin other than in the line oscillator and sync circuits.

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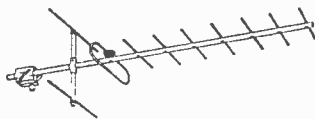
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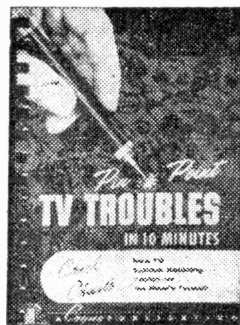
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