JULY 1980

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TELEVISION

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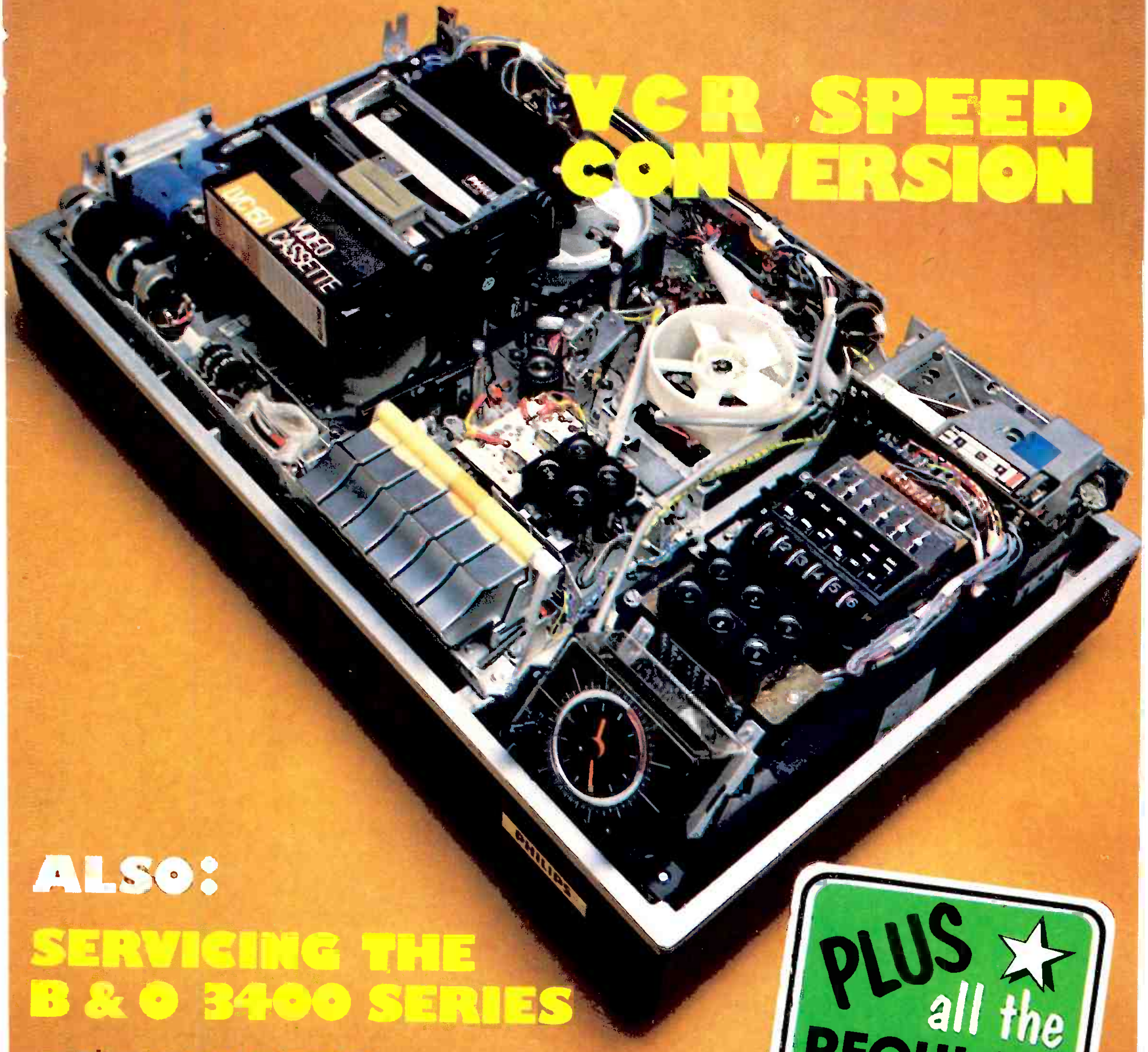

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BA130	0.15
BA154	0.10
BA155	0.20
BA164	0.12
BAX13	0.16
BAX16	0.08
BAY38	0.16
BY206	0.20
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BY126	0.20
BY127	0.15
BY133	0.22
BY164	0.50
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BY238	0.15
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IN4001	0.10
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IN4003	0.12
IN4004	0.12
IN4005	0.12
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BZY88 4V7	0.10
BZY88 5V1	0.10
BZY88 5V6	0.10
BZY88 6V2	0.10
BZY88 6V8	0.10
BZY88 7V5	0.10
BZY88 8V2	0.10
BZY88 9V1	0.10
BZY88 10V	0.10
BZY88 11V	0.10
BZY88 12V	0.10
BZY88 13V	0.10
BZY88 15V	0.10
BZY88 18V	0.10
BZY88 20V	0.10
BZY88 22V	0.10
BZY88 27V	0.10
BZY88 33V	0.10
BZX61 7V5	0.25
BZX61 8V2	0.25
BZX61 9V1	0.25
BZX61 10V	0.25
BZX61 11V	0.25
BZX61 12V	0.25
BZX61 13V	0.25
BZX61 15V	0.25
BZX61 16V	0.25
BZX61 18V	0.25
BZX61 20V	0.25
BZX61 22V	0.25
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BC113	0.15
BC114	0.15
BC115	0.20
BC116	0.20
BC117	0.20
BC118	0.20
BC119	0.50
BC125	0.20
BC126	0.20
BC136	0.20
BC137	0.20
BC138	0.40
BC139	0.40
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BC142	0.40
BC143	0.40
BC147	0.15
BC148	0.10
BC149	0.15
BC153	0.15
BC154	0.15
BC157	0.15
BC158	0.15
BC159	0.15
BC160	0.40
BC161	0.40
BC170	0.15
BC171	0.15
BC172	0.20
BC177	0.20
BC178	0.20
BC179	0.20
BC182L	0.15
BC183L	0.15
BC184L	0.15
BC184LC	0.20
BC186	0.30
BC187	0.30
BC203	0.15
BC204	0.15
BC205	0.15
BC206	0.15
BC207	0.15
BC208	0.15
BC209	0.15
BC212L	0.15
BC213L	0.15
BC214L	0.15
BC225	0.40
BC237	0.15
BC238	0.15
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BC301	0.40
BC303	0.50
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BC328	0.15
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BD134	0.70
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BD538	0.70
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BF154	0.20
BF157	0.70
BF158	0.40
BF160	0.60
BF163	0.60
BF167	0.50
BF173	0.50
BF177	0.50
BF179	0.50
BF180	0.50
BF181	0.60
BF182	0.50
BF183	0.50
BF184	0.50
BF185	0.50
BF194	0.15
BF195	0.15
BF196	0.15
BF197	0.15
BF198	0.15
BF199	0.15
BF200	0.15
BF224	0.15
BF240	0.15
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BF256LC	0.50
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BF271	0.60
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BF337	0.50
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2N2904	0.50
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2N2905	0.50
2N3053	0.50
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2N3710	0.20
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TAA350	0.80
TAA550	0.60
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TAA611	1.75
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TAA661B	2.00
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TBA530Q	2.00
TBA540	2.20
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EF184	1.10
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PL509	3.50
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LLDF 24 Iron Coated Longlife Tip	0.90
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TELEVISION

July 1980

Vol. 30, No. 9
Issue 357

this month

SEE NOTE ON PAGE 473 REGARDING PUBLICATION DELAYS

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All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", King's Reach Tower, Stamford Street, London SE1 9LS. Editorial correspondence should be addressed to "Television", IPC Magazines Ltd., Lavington House, Lavington Street, London SE1 0PF.

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THE UNBEATABLE BRIARWOOD SERVICE

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U.H.F. P/Button D/S **£3.50**. U.H.F. P/Button S/S **£4.00**. Rotary **£3.00** + £1 P&P.

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i.e. Philips, Bush etc. £3.50 + £1 P.&P.
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PCL83	0.25	30C17	0.10	30C15	0.10	EF184	0.10	6/30L2	0.10	PL509	1.00
PCL84	0.10	PCF802	0.10	30C18	0.25	6BW7	0.10	30PL1	0.25	PY500	1.00
PCL85	0.10	PCF805	0.25	PC97	0.20	EH90	0.10	30PL13/4	0.10	GY501	1.00
PCL86	0.10	PCF806	0.10	PC900	0.10	DY802	0.10	30FL1/2	0.25	PL508	0.50
PFL200	0.10	PCF808	0.25	EF80	0.10	PY800/1	0.10	ECC82	0.10	PCF200	0.50
PCF801	0.10	PCF80	0.10	EF85	0.10	PL36	0.25	ECC81	0.10	EY51	0.15

Please note there is 25p Postage and Packing per order.

WE DO NOT SELL RUBBISH AT BRIARWOOD TV

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	IF	LUM	CHROMA	EHT	REG	CON	S/OUTPUT	POWER	L/TB	F/TB
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GEC/Sobell	5.00	5.50	—	—	—	5.00	—	—	—	7.50
Philips	5.00	7.00	—	—	—	5.00	—	—	—	5.00
Decca	5.00	9.00	9.00	—	—	5.00	2.00 (19" only)	6.00	—	5.00
Thorn 2000	5.00	5.00	5.00	6.50	6.50	7.00	—	6.50	10.00	5.00
Pye	7.00	6.00	7.00	—	—	5.00	—	—	—	5.00
Baird	6.50	8.50	7.00	—	—	5.00	—	—	—	5.00

Postage & Packing £1.25

S/STANDARD COLOUR SPARE PANELS

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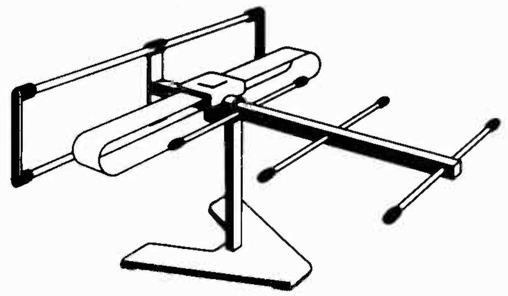

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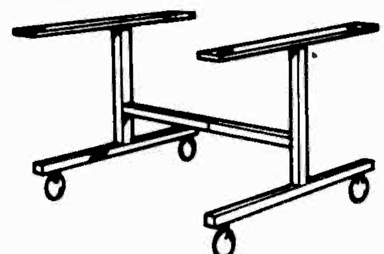

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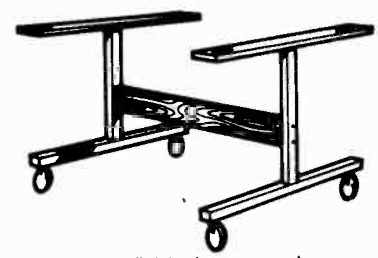

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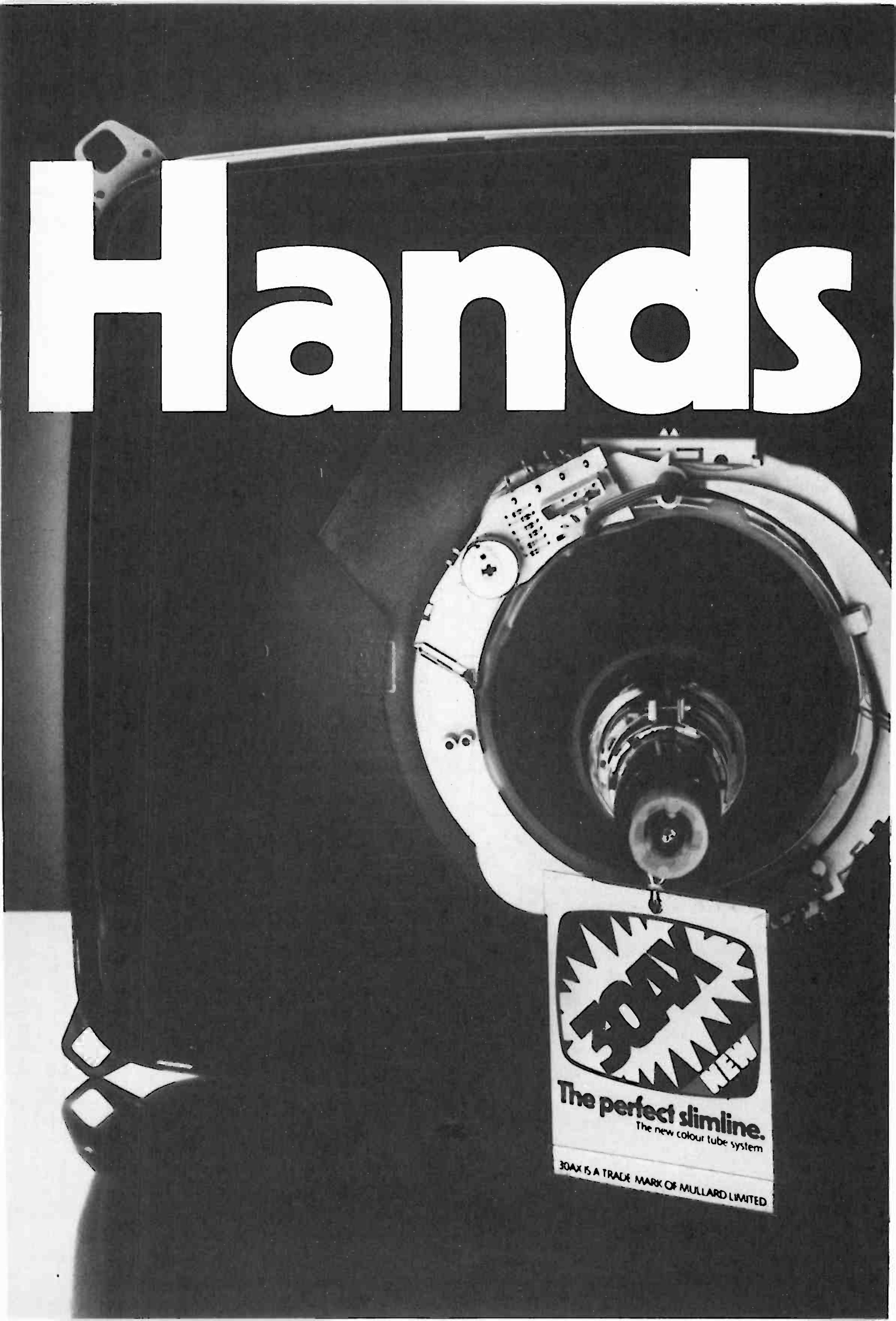
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P.T.O.

OUR REF: JW/J70

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Peter Rogers

Peter Rogers
Marketing Co-Ordinator

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Annual Report

Following the trade shows, it's annual reflection time: where are we, where do we go from here, and what does the future hold?

The only word to describe the overall TV market last year is static. Deliveries of colour TV receivers to the trade were 1·9 million, compared to 1·8 million in the previous year. Within the overall figure however there have been some interesting changes. First of all have been the increased sales of small-screen colour TV sets, which accounted for some 24% of the colour TV market in 1979 and are expected to increase further this year. There's no doubt that the small-screen colour TV set with its bright picture is an attractive proposition, especially for smaller rooms/flats. First point for the dealer therefore is whether he's taken his share of this relatively new market – new since 14 and 16in. colour sets were hardly thick on the ground pre-1978.

The second significant change has been the growth in the number of sets with full remote control. The reason for this is undoubtedly the improved reliability and performance of the latest remote control systems. Gone are the days when a thick cable linked the set with its control unit. Those systems, with their plug/socket and open-circuit lead problems, are best forgotten about. The following generation of ultrasonic control systems suffered from sensitivity and reflection problems. The current generation of infra-red remote control systems is proving far more satisfactory.

We'll assume then that you're adequately stocked with small-screen colour sets at one end of the range and full infra-red remote control, large-screen sets at the other. What else? It's a sad fact that teletext is still not doing very well. Only some 40,000 teletext equipped sets were sold/rented in 1979. The industry hopes that the figure will rise to some 150,000 this year, and this is considered to be a healthy growth rate.

While teletext has been rather a disappointment so far in the market place – maybe people still don't like the rather "unconventional" look of the matrixed lettering, and the black background to the display – there are signs that video, i.e. VCRs, are on the move. Sales of some 110,000 units in 1979 were at the upper end of the range of expectations, and hopeful estimates are being made for 1980. Two factors seem to be helping. First the growing availability of prerecorded cassettes, and probably more important the fact that VCRs are becoming relatively less expensive. Higher domestic inflation and the strong pound have resulted in imported VCRs becoming quite a bargain. Another consequence of these economic facts is that the likelihood of VCRs being produced in the UK in the foreseeable future is remote indeed.

What about the sales/rental mix? Having become aware of the vastly improved reliability of the present generation of colour TV sets, people have opted in increasing numbers for outright purchase. Old habits die hard however, and rental still accounts for over 50% of the market. Suspicion of new products is reflected in the fact that for VCRs the percentage is well up, at 70%.

So what did we see as we trudged around this year's trade shows? Not too much technically on the TV receiver side. Plenty of 30AX chassis, but with modern tube technology the drive requirements are such that a single chassis will drive most tubes, so last years' chassis (there were plenty of new chassis last year you will recall) will generally do for the 30AX. A case in point is the Philips K30 chassis, which differs only very slightly from the KT3 chassis.

Mention of the K30 brings up a sad point. Just how many people in the UK are involved nowadays in TV receiver design? The K, as you will probably know, means that the K30 is a continental design. There is of course no reason for a firm like Philips to have half a dozen design departments in different countries when nowadays only the tuner, the SAWF, the intercarrier tuned circuit and the decoder panel need to be altered from one country to the next. There are still some things for designers to do however – with the growing complexity of tuning systems, teletext interfacing, ever more detailed component specifications and so on.

Finally, what are the prospects for those in servicing? People in the UK love to keep old sets going, but the cost of spares is in many cases making this totally uneconomic. The old hybrid sets are gradually cooking themselves up, while the latest generation of cool, solid-state chassis seldom require attention. So it seems that the servicing trade will contract, a rather chilling thought for some of us. The answer perhaps is to get involved in VCRs, video disc players, TV games and other assorted items.

PRODUCTION PROBLEMS

Publication of the June and the present issue of Television has been delayed as a result of industrial disputes. Production of the next issue will be something of a rush as we endeavour to get back nearer to our normal publishing date. We hope you will understand our problems therefore if any of our usual coverage or features have to be left out of next month's issue.

Long-distance Television

Roger Bunney

APRIL 1980 produced a little of most things for us! Many DXers noted the first indications of the coming Sporadic E season on April 4th, which was fortunately a holiday. This interesting opening produced Russian programmes here at Romsey, from around 0900. The general pattern throughout the country was for RTVE (Spain) to be received first, with RAI (Italy) later on in the morning and through into the mid-afternoon. Various individuals reported reception of signals not generally available. Gareth Price (Lowestoft) for example logged MTV (Hungary) ch. R1 and NRK (Norway) ch. E2 – whereas Arthur Milliken (Wigan) received NRK chs. E2, 3 and 4 but no MTV. Cyril Willis (near Ely) received RUV (Iceland) chs. E3 and 4, which don't seem to have put in an appearance anywhere else. It seems that southerly signals (RTVE and RAI) were best, and this could be a pointer to what to expect once the season itself gets going. Other SpE receptions worth recording were TVP (Poland) ch. R2 on the 10th, by Brian Fitch (Scarborough), and both RAI ch. IA and RTVE ch. E2 on the 11th by Brian Fitch and Arthur Milliken.

There was persistent high pressure over the UK and Western Europe during much of the month, but although the conditions were right for a good tropospheric opening things never really got going. There was nevertheless an improvement for those in more favourable locations, with u.h.f. reception from West and East Germany, the low countries and Sweden. Brian Fitch has obtained a Plemi u.h.f. array, and logged many West German stations at his seaside location. The 15th produced the most dramatic reception – DFF (DDR) ch. E29. Gareth Price also did well, his best day being the 14th which produced the Swedish 1,000kW Kisa transmitter on ch. E49. Gareth mentions that both NRK and RTVE are now using digital clocks on their test patterns.

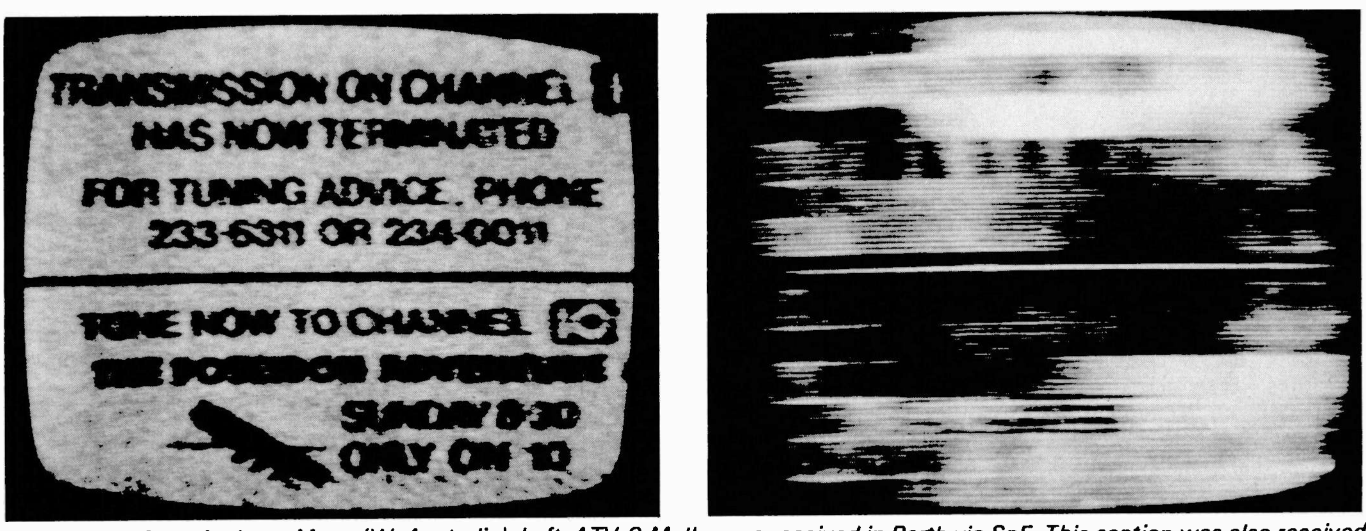
There's been some F2 reception at times, though Australian reports suggest that we in the UK are missing out somewhere! Gareth received the usual Gwelo (Zimbabwe) checkerboard on ch. E2 at midday on March 30th, with characteristic smearing. On April 4th Hugh Cocks (East Sussex) phoned me to report that Gwelo ch. E2 was present via evening TE (Trans Equatorial skip), with sound but no vision. I tuned in my vintage (1939) Hallicrafters S21, but heard absolutely nothing... I subsequently heard Hugh's recording of the signal, and it was quite dramatic to hear the weather forecast for the region. The next day I was rewarded with sight of Gwelo and a second F2 signal on ch. E2 at lunch time. The signals were strong but suffered the usual smeary/ghosty characteristics.

Australian DX

Our Australian friends' letters make envious reading. Robert Copeman received very strong ch. R1 signals from China (Nanking and Lanchow) for nearly four hours on the 13th. His friend Todd Emslie on the other side of Sydney received the same signals. Robert has done very well with F2 v.h.f. reception during the last six months, with BBC ch. B1 video, Vladivostok ch. R1 and now these Chinese signals.

Anthony Mann (near Perth) on the other side of Australia sent us a telegram to say that after some years of constant effort he'd finally been successful in receiving Gwelo ch. E2 (vision actually offset at 48·26MHz) over a distance of some 5,200 miles. Just before Gwelo put in its appearance he monitored strong South African police transmissions at 40MHz. On the same day the Hawaii 50·1MHz beacon was received for over two and a half hours in S. Africa. So April 20th was a red letter day for Anthony: our congratulations! The New Zealand ch. 1 video had been a good signal in W. Australia for several days, via F2.

Robert and Todd have both sent further information on the ethnic TV services due to start at the end of the year.



Two photos from Anthony Mann (W. Australia). Left, ATV-0 Melbourne received in Perth via SpE. This caption was also received in the UK via F2 by Hugh Cocks – though with poorer quality! Right, Sweden ch. E2 received via F2 last winter.

The languages used will be Greek, Italian, Spanish and others, with transmissions in both Sydney and Melbourne (call letters MTV–0 and MTN–0 respectively). The Melbourne transmitter will probably use the old ATV–0 mast, while in Sydney negotiations are in progress for use of the ABC Gore Hill mast (ch. 2).

Unusual Signals

Finally, two interesting receptions in the UK. Jim Cook (Newcastle) has reported reception of programme material, with typical SpE characteristics, at a frequency between chs. B1 and E2. This could be a West German transmission at approximately 47MHz – this signal has been received from time to time along the south coast. As to its origin, this remains a mystery. Its frequency is well below ch. E2, and there's no listing in EBU publications.

Frank Lumen (now in Colorado, USA, previously in Glasgow) kindly sent me a Tandy/Radioshack portable radio covering 58-230MHz, intended for TV/FM/aircraft reception. While tuning over the "low-band TV" section at 2000 on the 26th I heard music plus hum at approximately 68MHz. The intermittent carrier, crackling and hum indicated that this was not a professional broadcasting station, and since the signal was f.m. and not a.m. I suspect an illegal pirate transmission. It's not been heard since!

News Items

China: Suggestions have been put forward for the transmission of three national programmes, including regional programmes, from satellites at 62°, 82° and 92°E, or alternatively national programming from a single craft at 92°. 12GHz is favoured. Commercial radio transmissions have started in Harbin.

Monaco: The TMC (Télé Monte Carlo) ch. E35 Italian language transmissions to Northern Italy are now on the PAL instead of the SECAM standard. Other transmissions continue to use SECAM colour.

West Germany: An expansion of the AFN (American Forces Network) TV service is being planned, with either new studio facilities at Bremerhaven or a radio link back to the main HQ at Frankfurt. The programmes run from 0900-2400 daily, using System M with NTSC colour, at 143 bases. West German viewers use special converters to receive the restricted System M transmissions.

New EBU Listings

The e.r.p. of the West German Haardtkopf ch. E25 transmitter has been increased to 400kW.

The following French transmitters, all providing the TDF-1 service, are now listed: Bourges-Neuvy ch. E23, 800kW; Le Mans E24 25kW; Toulouse/Pic du Midi E27 500kW; Reims E43 25kW; Argenton E46 80kW; Vannes E50 400kW; Chartres E55 250kW; Tours-Chissay E65 200kW. All transmitter powers e.r.p., with horizontal polarisation.

From Our Correspondents . . .

Arthur Milliken raises an interesting problem on which readers' comments would be welcome. He has a Pye teletext Model CT467 which seems to produce bad interference on his DX equipment in Band I when operating with teletext – smearing and vertical striped lines are the symptoms. My first thought was i.f. radiation: I'll be checking to see whether this is a common problem however and what steps can be taken to overcome it.

Geoff Perrin is now established in Oman and has a 500ft.

aerial mast. No aerials yet, but he's already seen Pakistan TV on his Skantic receiver. The local Muscat TV shop displays Pakistan TV on all the showroom receivers!

Jim Maden (South Africa) has written following my comments on Amman ch. E3 and skip distance (F2 or SpE?). He says the shortest SpE signal he's seen was from 251 miles, the longest (double hop) 2,278 miles, while for F2 the shortest distance was 2,590 miles and the longest 6,110 miles. He points out that the distance from ATV-0 (Melbourne) to the UK (South Coast) would be some 10,569 miles. We hope to feature further reports from him shortly.

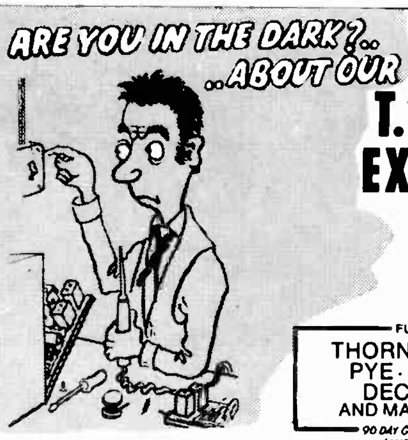
Products

Readers seem to have been spending quite large sums on imported monochrome receivers featuring v.h.f./u.h.f. coverage with switchable 5·5/6MHz sound for systems B/G/I. I've certain reservations about the ability of such receivers for DXing in the crowded Band I spectrum, due to their inherent selectivity problems, but feel it only fair to test one of these sets and report on it. Panasonic have kindly lent me a 5in. dual-standard portable set (Model TR5030), and I look forward to seeing (and hearing) how it performs during the forthcoming SpE season.

Maxview Aerials Ltd. have introduced a new range – they've entered the multiple-director array market with a couple of aerials (8 and 14 element) that are available in group A, B and C/D versions. The appearance of these aerials is similar to the Fuba/Vorta VPX continental X-director arrays, but the dipole is their patented triangular-shaped structure. I'm hoping to be able to try one of these budget-priced systems shortly, and will publish my findings. Multiple director arrays are now available in profusion, with the XG8, JBX8, VPX8 and now the MX8 . . .

An Apology

Several letters (see the *Letters* column in the May issue for example) have been received pointing out that the Arabic script in the Amman ch. E3 off-screen photograph included in my March column was not a text from the Holy Koran but an advertisement for a clothing sale. My apologies for this grave error.



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LOPT	£3.95
Control panel	£2.95
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All other panels are priced as per 697 chassis.
All these prices include VAT.

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GOODBYE OLD FRIEND!

A timetable for the closure of the UK's 405-line TV service has been agreed by the government and the broadcasting authorities. Transmitter closures will start in 1982 and will continue over a period of about four years. At least two years' notice will be given before the close down of particular stations, with wide publicity. The transmitting equipment for the 405-line service is apparently rapidly nearing the end of its useful life: substantial capital investment would be required to extend its life beyond the next few years, and it's considered that such expenditure on a duplicate and obsolescent service cannot be justified. A further relay station building programme to extend the coverage of the u.h.f. service to groups of less than 500 people wherever this proves reasonably practical has been approved by the Home Secretary. The broadcast authorities will try to provide stations for groups of 200 or more people, and it's anticipated that the first of these stations will be built in 1984. A procedure whereby small groups of people who will not be served by further relay stations can obtain a transmitter at their own expense has also been agreed. Such schemes would be licensed by the Home Office, and the broadcast authorities have agreed to assist such groups in planning small transmitting stations and ensuring that they will not cause interference to existing or planned stations.

In these days of rapid technological progress, it's extraordinary to recall that the 405-line system remains basically as specified by EMI back in 1934. Colour was tried on 405 lines, and the results were very good. The move to 625 lines put an end to any idea of that however. The interesting thing now is what will be done with the vacant frequency space?

RANK'S NEW TV CHASSIS

Amongst the TV chassis seen for the first time at the recent trade shows was the new Rank T26A chassis – designed for use with the 30AX tube. The switch-mode power supply and the signals panel are basically as in the previous T22A chassis, but there's a new timebase panel (T156A). The main change here is that a TDA2653 i.c. replaces the complex discrete transistor field timebase, with its class AB output stage, that Rank have used since the introduction of the Z718 chassis in 1975. The TBA950 sync/line generator i.c. has been replaced by the TDA2593. The line output stage, with its BU208A line output transistor, is similar to that used in the T20/T22 chassis, and the same over-voltage trip arrangement is employed. The use of the 30AX tube has led to simplification of the EW raster correction circuit.

IBA RECEIVES DIGITAL VIDEO VIA SATELLITE

The first reception of digital video transmissions via the European OTS experimental satellite, using a small-dish terminal, has been achieved by the IBA Engineering Centre at Crawley Court, Winchester. The digital pictures were transmitted to the satellite via the Post Office's Goonhilly Downs 14GHz terminal, the down link being at 11GHz. The IBA's research terminal has a dish aerial of only three metres diameter. The analogue signal was initially sampled at four times the colour subcarrier frequency (142Mbit/s) and then digitally converted to the equivalent of twice the subcarrier frequency (71Mbit/s). The data rate was further reduced by means of bit-reduction techniques, including the use of differential pulse-code modulation. After adding error-protection and "housekeeping" bits, the final system bit rate was 60Mbit/s. The purpose of the experiments is to establish the relative merits of digital and analogue modulation techniques for international TV programme distribution, and to determine the minimum dish aerial size for a given satellite power required to give reliable reception of good quality pictures using digitial techniques.

RCA'S FLAT-PANEL DISPLAY

RCA are working on a 50in. (diagonal) flat-panel colour TV display device for wall mounting. It consists of forty 1in. wide modules mounted side by side within the device, the technology employed using switched electron beams with a shadowmask and a conventional phosphor screen. In terms of brightness, energy requirements and manufacturing feasibility, RCA consider this concept to be the best approach to a flat-panel colour display for domestic use. There are still problems however, and RCA feel it will be nearer to 1990 before such a device can be produced at a price suitable for the domestic market.

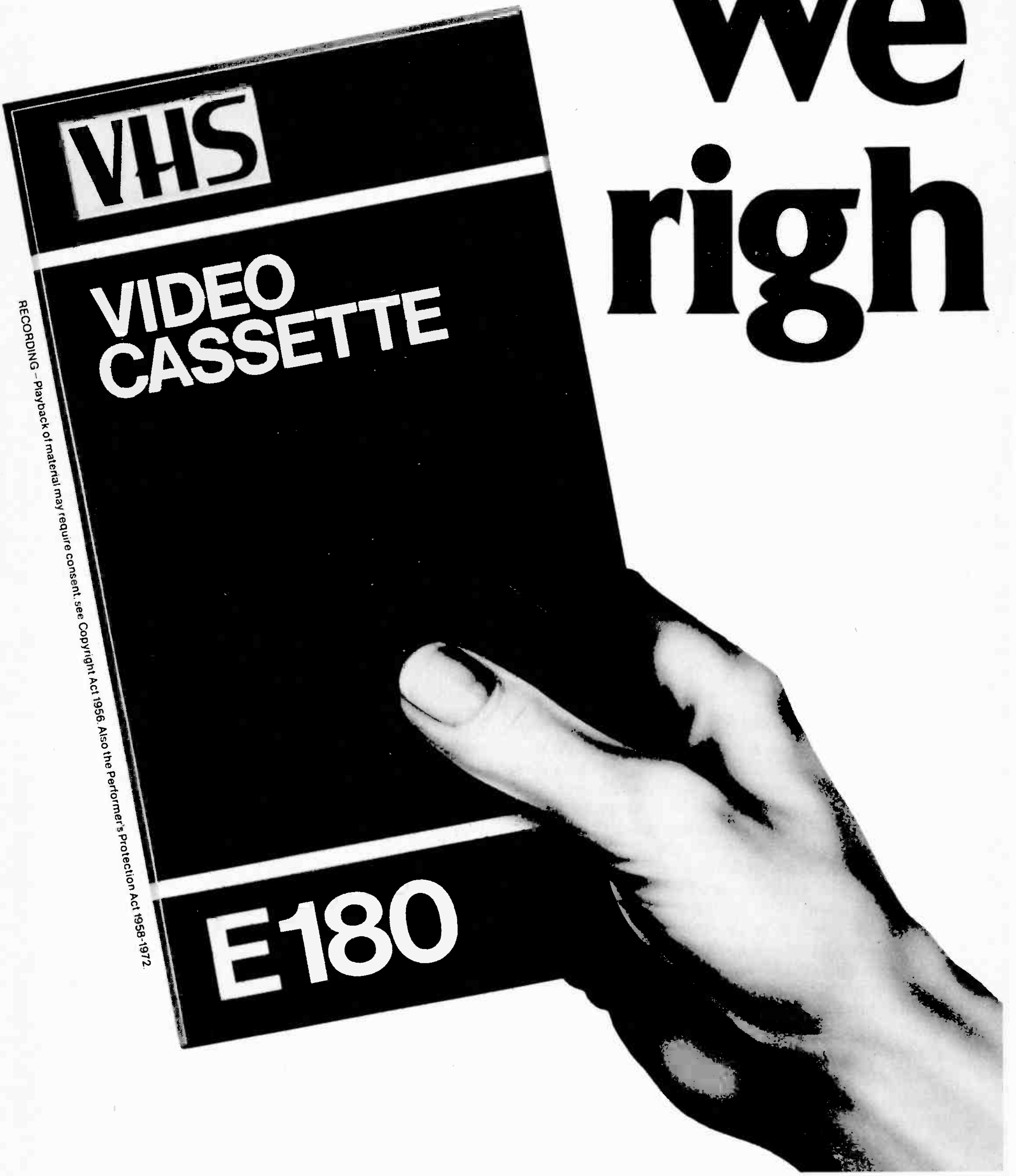
VLP DISCS SHOWN

One of the things we were particularly interested to see in operation at the 1980 trade shows was the Philips VLP video disc system. The pictures were excellent, and the fast forward, fast reverse and frame freeze facilities demonstrated the versatility of the system. Philips intend to launch the system in the UK next year, with a player priced in the range £400-£500 and discs (some 200 titles) at £10-£20. Sony were also demonstrating their version of the optical video disc system. It's interesting to note however that Sony are not solely committed to the optical video disc – they also have a licence from RCA to use the RCA Selectavision capacitive video disc system, and are understood to have developed prototype players and discs of this type.

It appears that Sony see the optical system as being

The Philips VLP video disc player with, in the foreground, one of the discs. The system is to be launched in the UK next year but was on demonstration at the 1980 Philips trade show. The performance was certainly impressive.

We righ



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better suited to commercial/educational applications, with the capacitive system best suited to domestic use.

Toshiba's linear video cassette system was also on show for the first time in the UK, and from all accounts gave good pictures.

VHD DISCS

Meanwhile, fresh moves on the VHD disc front. Thorn-EMI, Matshushita, JVC and US General Electric are discussing the formation of a joint venture to launch the VHD (Video High Density) video disc system in the USA next year.

NEW FROM TELEPART

Several interesting items have been added to the Telepart range (Telepart is a division of Willow Vale Electronics Ltd., Old Hall Works, Arborfield Road, Shinfield, Reading). First is a touch-tuner head conversion for the GEC C2110 series solid-state colour sets. The original touch-tuner head has a tendency to drift and spontaneous channel changes, and is difficult for the user to adjust. The Telepart modification kit does away with the touch tuner and the associated touch-tuner panel at the rear of the receiver, replacing these with a standard push-button tuner head whose output plugs straight into the i.f. panel. Conversion is simple and the new unit costs slightly less than the original. Order code 07-137.

The Telepart "Magic Circle" saves the bother and expense of replacing a complete monochrome portable receiver's line output transformer with encapsulated e.h.t. rectifier when the problem is simply that the diode has gone short-circuit. You simply remove the old e.h.t. lead, solder on the "magic circle", heat shrink the insulated sleeving supplied over the solder connection, connect up to tube and switch on. Order code 09-054.

The epicyclic 7:1 ratio tuning potentiometer for use with varicap tuners – as used in Thorn 1690/1691 portables – is also available from Telepart (order code 20-244). This useful device enables you to tune easily over the whole u.h.f. TV spectrum.

Willow Vale can also supply the CED 5A c.r.t. tester/reactivator.

For details of these and other items phone Reading (0734) 884444.

VIDEO PIRATES MOVE

Concern about video pirates has resulted in a move by the BBC, the IBA and the film industry in the UK to set up a joint body to try to control the pirating of TV programme material. The holders of the copyright in film and TV programme material are anxious about a growing international black market in video tapes. A recent example quoted was the offer of video cassettes of BBC programmes in Tunisia for £15 a time – the vendor was based in Bradford. Video piracy seems likely to spread, since there is at present no legal basis on which a market can be developed – negotiations between the performing unions, the film and television companies have been going on for several years without agreement. A spokesman for BBC Enterprises comments that the only way of combatting piracy is to get legitimate products on to the market.

REPLACEMENT POWER PANEL

DR Electronics have extended their range of replacement panels with the introduction of a new power supply panel for the Rank A823 series of solid-state colour chassis. The

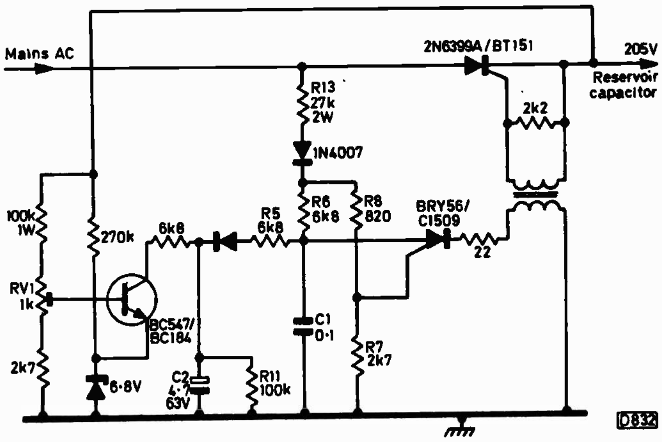


Fig. 1: Circuitry used in the DR Electronics replacement power supply panel for the Rank A823 series chassis.

panel has been designed to overcome the problems of burnt areas on the original panel, and is a direct replacement. The design has some interesting features however (see Fig. 1). To avoid using the troublesome surge limiting thermistor on the original panel, a soft-start arrangement is used. At switch on C2 is discharged, and whilst charging delays the action of the *RC* network R13/R6/C1 to give the soft-start action. Instead of the diac employed for triggering in the original design, a BRY56 silicon-controlled switch is used (as in the Philips 320 monochrome chassis). This is controlled by the a.c. waveform applied to its anode gate via the potential divider R8/R7 and the sawtooth applied to its anode. The trigger pulse is transformer coupled to the cathode gate of the 2N6399A thyristor. The value of R11 is chosen to prevent excessive h.t. – it provides a discharge path for C2. 3A diodes are used in the l.t. bridge rectifier circuit for increased reliability. The panel is available through normal suppliers, e.g. Lloyd Electronics, 63 North Parade, Grantham, Lincs.

THE ULTIMATE VHS MACHINE?

JVC's new, de luxe Model HR7700 VHS VCR seems to offer more facilities and greater flexibility in use than ever before possible with a VCR. Amongst the new features are a motorised front-loading cassette system, full infra-red remote control, feather-light touch operation due to microcomputer assisted full logic tape control, a new direct drive drum motor providing greater stability and higher reliability, a two week, eight programme programmable timer – in fact just about everything. Of particular interest are the ESC (editor start control) system for minimizing picture distortion between separate recordings on the cassette, and the fact that this is the first VHS machine with a visual search facility for quick location of the desired part of the recording in both the forward and reverse directions.

A similar machine, Model 3V23, has been added to the Ferguson range of VCRs.

Deliveries of both machines are due to start in the Autumn.

LATEST ANTIFERENCE PREAMPS

Antiference have introduced three new TV signal preamplifiers. The XtraBoost Model XB1U is an indoor preamplifier intended for the DIY market. It's housed in the same attractive brilliant white high-impact plastic case as the XtraSet, which was launched earlier this year. The bandwidth is 470-860MHz, the gain 10dB and the noise figure less than 4dB. The recommended retail price is £14·40, plus VAT. The other two preamplifiers are high-power masthead types, offering a gain of 15dB (Model

UP2300) or 27dB (model UP3300). They are ultra-wideband amplifiers covering 40-860MHz, and are intended for remote powering via the downlead from the associated PU1240 power unit. Both amplifiers are housed in a new weatherproof moulding which can be mast or surface mounted. Another addition to the Antiference range is the CS1000 combiner/splitter unit. This too covers 40-860MHz, with an insertion loss of 3·5dB at v.h.f. and 4dB at u.h.f., the isolation between outputs being 20dB. It's housed in the same moulding as the masthead preamplifiers, and the design is non-resistive.

VIEWDATA ADAPTOR

Radofin Electronics are to start production in Hong Kong of a Prestel adaptor which is expected to sell for only £200 or so. The adaptor would be suitable for use with most existing monochrome or colour sets, and would be a less expensive approach than buying a TV set with built-in Prestel facilities.

SONY EXPAND IN S. WALES

Sony are to double the investment in their TV plant at Bridgend, S. Wales. A further £10 million is being spent, mainly to start production of 27in. Trinitron tubes. TV receiver production capacity will be increased from 125,000 to 150,000 a year when the expansion is completed in 1982. Sony point out that at present 50% of the components used in the sets produced at their S. Wales plant come from UK sources, and that when the new tube facility is operational the percentage could increase to 90% or higher. The 27in. Trinitron tubes will have a deflection angle of 114°.

Meanwhile in Tokyo Sony have announced the development of a VCR/projection system able to handle Cinemascope films – the aspect ratio of these is 2·66:1. The picture produced by the prototype equipment is 6 × 3ft.

STATION OPENINGS

The following relay stations are now in operation:

Ambergate (Derbyshire) BBC-1 ch. 22, ATV ch. 25, BBC-2 ch. 28, TV4 ch. 32.

Chatham TV4 ch. 54, BBC-1 ch. 58, Thames/London Weekend Television ch. 61, BBC-2 ch. 68.

Fitful Head (Shetland Isles) BBC-1 ch. 39, Grampian Television ch. 42, BBC-2 ch. 45, TV4 ch. 49.

Horton (Ribblesdale) Granada Television ch. 41, BBC-2 ch. 44, TV4 ch. 47, BBC-1 ch. 51.

Rosneath (Strathclyde) TV4 ch. 54, BBC-1 ch. 58, Scottish Television ch. 61, BBC-2 ch. 64.

Scalloway (Shetland Isles) BBC-1 ch. 55, Grampian Television ch. 59, BBC-2 ch. 62, TV4 ch. 65.

WIDEBAND BAND I AERIALS

South West Aerial Systems (10, Old Boundary Road, Shaftesbury, Dorset), with which our DX correspondent Roger Bunney is associated, have introduced a range of six wideband Band I aerials designed to cover the 47-68MHz spectrum. There are one, two, three and four element directional types and two omnidirectional aerials with crossed dipoles.

SERVICE BRIEFS

A correction is required to our note on the Philips/Pye TX monochrome portable chassis in the May issue (*Teletopics*, page 349). The suggested replacement line driver transistor is type BC637, not BC636. Note that three different types of c.r.t. have been fitted in sets using this chassis: this involves a resistor value change in the first anode feed network to ensure adequate brightness control range. With the Philips 12VBJP4 tube, R576 should be 820kΩ; with the 12VCUP4 tube it should be 470kΩ; with the Orion 12VBJP4 tube either value can be used.

Note that the correct position for the flashover protection diodes D4285/D4269/D4253 in the RGB ouput stages of the KT3 chassis is between the collectors and emitters of transistors T4276/T4260/T4244 respectively. In early production the anodes were taken to the c.r.t. side of the associated series 470Ω resistors. In cases of diode failure, check the exact position of the faulty component and if necessary wire the replacement item as in later production. Circuit corrections: resistors R4285/R4269/R4248 on the RGB panel should each be shown connected to the 155V rail instead of in series – and R4248 should be shown as R4253 (1MΩ), i.e. there are two R4248s on the official Philips circuit for the KT3. While we're on about this circuit, C1565 on the earthy side of the e.h.t. circuit should be shown as 150nF instead of 150pF.

C84 (0·22μF) on signals panel T130 in the Rank T22 chassis has been changed from a tantalum to a mylar type. The reason is the impedance a tantalum capacitor introduces at the colour subcarrier frequency (4·43MHz). This can cause lack of colour or colour drop out. In chassis using a TBA950 sync/line generator i.c., i.e. the Z718, T20 and T22, the resistor from pin 14 to chassis should be changed from 11kΩ to 10kΩ if any difficulty is experienced in setting up the hold control for the correct pull-in range.

SOLUS CATALOGUE

A new edition of the Solus product range and price list has been issued (May 1980) and is available from Solus (Electronics) Ltd., Kirkwood Road, Cambridge CB4 1BR. The Solus range is intended to meet the needs of the TV servicing industry.

DIGITAL TV STANDARDS CONFERENCE

The BBC has been host to a conference of some 100 engineers from the European Broadcasting Union, gathered to discuss future technical standards for digital TV signals. The outcome was an initial recommendation to the CCIR that the standard for digital video should be based on coding the luminance and colour-difference components of the video separately rather than as a composite signal. Another recommendation was that samples should have a picture-repetitive structure, with co-siting of the luminance and colour-difference samples. Further work on sampling rates will be required before the standard can be finalised.

The practical potential of one proposal, a system known as "12:4:4", referring to the sampling rates for the luminance (12MHz, i.e. 756 samples per line) and the two transmitted colour-difference signals R – Y and B – Y (4MHz), was demonstrated. Apart from some very critical source material, the 12:4:4 standard was able to preserve the quality of the original RGB signals very well: with a composite coder at the output, it was virtually impossible to detect whether a digital system was in fact in use. Operation with colour separation overlay (CSO, or chroma key) was less successful however. Other demonstrations showed that the 12:4:4 system, with its gross bit rate of 160Mbit/s, was within the capabilities of present day digital signal processing and recording technology.

It's hoped that a firm recommendation for a system will be ready for putting before the CCIR Plenary Session in 1982.

TV Servicing: Beginners Start Here . . .

Part 34

S. Simon

THE last two power supply circuits we looked at (those used in the Philips G8 and the Rank A823 chassis) employed a single thyristor to provide a regulated h.t. supply. The idea is that the thyristor "tops up" the h.t. reservoir capacitor when it's switched on by a trigger pulse applied to its gate. The switch-on time of the thyristor determines the h.t. voltage produced across the reservoir capacitor, so by altering the timing of the trigger pulse as required the h.t. voltage is controlled (see Fig. 1). It's worth noting that the triggering must be done at some point during the falling edge of the positive-going excursion of the mains input waveform. Why? Because if we triggered it on during the rising edge of the mains input waveform the thyristor (which is switched on, then switches itself off when the voltage as its anode falls below that at its cathode) would simply charge the reservoir capacitor to the peak mains input voltage and then switch off, i.e. there would be no control action. What we've been talking about then is a half-wave rectifier which is triggered on at a suitable time to produce the h.t. voltage required by the set.

Why not use a full-wave circuit, with all the advantages of 100Hz operation, i.e. less wear and tear, improved smoothing, etc? We could have two thyristors happily clunking away to provide rectification on either side of the mains input waveform, i.e. on both the positive- and negative-going excursions. If nothing else this would keep the supply people happy: hundreds of sets each working on one half of the mains waveform tends to make the shape of the mains waveform a trifle irregular to say the least, and if there's one thing these chappies like it's a nice, evenly balanced waveform – and you can't blame them for that.

So what could we do about this? Well, we could use a nice, bulky mains transformer with a centre-tapped secondary winding, so that the two halves of the mains input each drive one of a pair of rectifiers. The classic full-wave 100Hz rectifier circuit in fact, but using thyristors to obtain the required voltage control. Transformers have their disadvantages however, and anyway why transform the

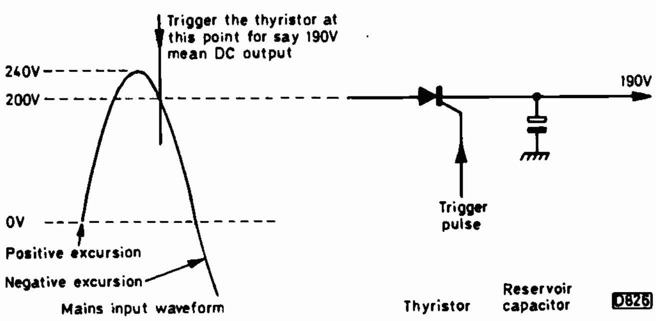


Fig. 1: Basic idea of using a thyristor as a triggered half-wave rectifier. The d.c. output voltage obtained depends on the time at which the thyristor is switched on during the falling edge of the positive excursion of the a.c. mains input waveform. To achieve regulation, the timing of the trigger pulse is varied by the control circuit. If the h.t. voltage falls for example, the thyristor is triggered on at an earlier point to compensate.

input when the output voltage required is much the same? Why not use a bridge rectifier arrangement? We could use a simple bridge, with the a.c. mains supply applied to one side and a 100Hz pulsed d.c. output taken from the other side. This requires just four diodes, and we could follow this with a thyristor to do the regulating. We could indeed, and in fact this has been done, in the Pye 713 colour chassis and the Philips 320 monochrome chassis for example.

But wait a minute. Why not combine the rectifying properties of the thyristor in the bridge itself? Say with two thyristors and two diodes? Fine, but we still need to be able to monitor the full mains voltage itself, so as to be able to compensate for variations in that voltage: i.e. we must rectify the full mains voltage so that the control circuit for our thyristors is able to compensate for mains voltage variations in its h.t. supply regulating action. So if we adopt this course we end up with a minimum of four diodes and two thyristors. Such circuits are used in Autovox colour receivers and in the Philips/Pye G11 chassis. Don't ask us about the former however (ask Comet Warehouses if you have to). It's the latter we're concerned with this time.

The G11 chassis was the successor to the G8 and G9 chassis. Just to get these clear in our mind, the G8 was for use with 90° delta-gun tubes, the G9 for 110° delta-gun tubes, while the G11 came along with the 20AX tube. Now some setmakers have in recent years tended to use combined power supply/line timebase arrangements. Neat, but this does tend to introduce a considerable amount of doubt (confusion?) in the simple mind of the service engineer who is called upon to give a rapid diagnosis of a fault condition (we must look at this from our own selfish point of view). The use of a separate power supply helps diagnosis immensely, since we can rapidly check whether it continues to function when other parts of the set it supplies are disconnected. An overload may shut down the power supply for safety, but disconnecting the faulty circuit will restore the power supply to normal operation. Philips decided to adhere to the separate power supply concept in the G11 chassis, and we thank them for doing so.

Now to take a closer look at it. A feature of the chassis is the use of dual connectors, i.e. all essential supplies are taken not to a single plug and socket (which could develop

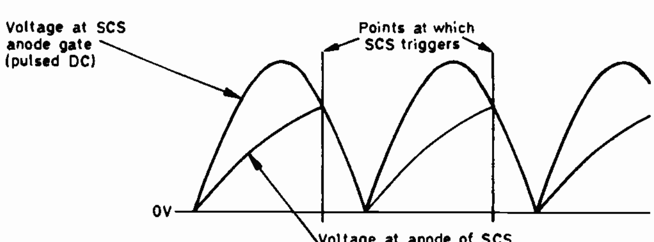


Fig. 2: How the SCS is triggered. To vary the timing of the trigger pulse for the thyristors, the SCS is switched on at a point along the falling edge of the 100Hz waveform applied to its anode gate.

poor contact) but to a pair of connectors. This enhances the long-term reliability of the chassis.

Circuit Description

The mains input goes first to the on/off switch, then to the small "mains input panel", where the fuses, mains filtering components and the degaussing circuit resistors (with single encapsulation) reside. The fuses are a pair of 3·15A anti-surge types (the one on the neutral side is replaced by a resistor in current production versions – see later). These are followed by a pi filter consisting of a pair of 0·33μF capacitors (C1304/6 see Fig. 3) on either side of a choke (L1305). The purpose of this filter is to iron out the spikes (short-duration, high-voltage peaks) that occur on the mains input waveform. The filter is aided by a VDR (R1307) which conducts on any remaining voltage peaks so that they are removed prior to the supply reaching the power supply panel.

The 3.15A fuses will often be found blown and blackened. This is rarely due to a fault in the filter unit in this model. The cause is far more often to be found on the power supply panel, to which we must now turn.

The power supply panel is to be found on the lower right side. At first sight the rectifier circuit with its four diodes and two thyristors looks a trifle odd. It's pretty obvious that diodes D4091-4 form a bridge, but what does it supply? Certainly not the receiver's h.t. line. This is derived from the junction of the two thyristors – note that the expected a.c. voltage reading at the anode of each is 117V a.c., i.e. half mains. This means that the chassis of the set is always at half mains potential. How then is the chassis returned to the mains to complete the circuit? The answer is via the chassis connection to the anodes of diodes D4091/2 in the bridge.

These two diodes complete a bridge circuit with the two thyristors. They are thus double agents. They work with D4093/4 to form the low-current bridge supplying the power supply control circuitry, and with the two thyristors to form the high-current bridge for the receiver's main supply. They thus lead a hard life, and don't like this. So they often register a protest by shorting out. This is in fact the most common reason for the 3·15A fuses on the preceding panel blowing and presenting a blackened appearance. So if you find the fuses blown, the first thing to check is diodes D4091/2. This is the most common fault you'll find on this otherwise very reliable chassis.

We've already noted that once a thyristor is switched on by a trigger pulse it remains on until the voltage at its anode falls below that at its cathode. Two points to note here. First the trigger pulse need be only just that, i.e. a spike – it doesn't need to be maintained. Secondly, the trigger pulse may arrive at the thyristor's gate, but it won't do much unless the anode is at that moment positive with respect to the cathode. This is why we can use a single trigger pulse generating circuit in the G11 chassis. We can apply the pulses to both thyristor gates at once, and only one thyristor will switch on (the one with the positive half cycle at its anode).

Now how is the trigger pulse produced? Rather nicely really. To trigger the big thyristors we employ a small one (SCS4061, type BR101 or BRY56). The sequence of events is roughly as follows. The other side of the bridge (junction D4093/4) supplies (amongst other things) the charging capacitor C4058, via R4044. Since the value of R4044 is fairly high (120kΩ), C4058 charges fairly slowly. As it charges, so the voltage applied to the anode of the SCS rises. Note that the voltage applied to the network R4044/C4058 consists of a 100Hz "pulsed d.c." waveform (see Fig. 2). This same waveform is fed to the SCS's anode gate, via the potential divider R4059/R4060, this time with little delay. The outcome is that at some point during the falling edge of the waveform fed to the SCS's anode gate the anode voltage rises above the anode gate voltage. As a result, the SCS fires, discharging C4058 and at the same time producing a sharp pulse across R4063. This pulse is coupled via C4069 to the Darlington pair amplifier Tr4068/Tr4077, which in turn drives the two thyristors via C4065/C4050.

Regulation is effected by adjusting the timing of the trigger pulses, in the conventional manner. Observe that transistor Tr4045 is connected in parallel with C4058. It thus controls the charging of C4058, since it shares the current flowing via R4044. The more current it passes, the longer C4058 takes to charge and the later in the cycle the SCS conducts to produce the trigger pulse for the thyristors. The conduction of Tr4045 is in turn controlled by feedback to its base from the output of the thyristors – via the potential divider chain R4024/4041/4042/4043. Thus variations on the voltage developed across the h.t. reservoir capacitor C4029 are sensed at the base of Tr4045 and used to adjust the trigger pulse timing. That's the feedback action, which compensates for variations at the output. There's also feed-forward to compensate for variations at the input – observe that the 100Hz signal is applied to the base of Tr4045 via R4053. We've provided therefore for h.t output and mains input variations, and we can adjust R4042 for the h.t. voltgage we require – 170V across C4029.

There are two more control circuits, in Tr4045's emitter circuit. The slow-start circuit Tr4055/C4049 etc. shorts out R4047 and the 7·5V zener diode D4048 when the set is switched on. The result is that Tr4045 conducts more heavily than normal at switch on, thus delaying the trigger pulses so that the h.t. rises slowly (this period lasts for 1-1·5 seconds). The idea is to limit the surge current as C4029 charges after the set is switched on, without having to rely upon series components which dissipate a lot of heat. The other control circuit, consisting of Tr4086 etc., comes into operation when the c.r.t. beam current is excessive. Under these conditions Tr4086 switches on, and this time R4046/R4047/D4048 are short-circuited. Tr4045 conducts heavily and the h.t. falls to a very low level. If the cause of the trouble is temporary, the circuit returns to normal operation. If there's a definite fault, for example a short-circuit RGB output transistor, the circuit will continue to cycle on and off.

Further protection is provided by the inhibit circuit, which ensures that spikes on the mains supply, should they get past the protective measures in the mains input circuit, don't cause false triggering of the thyristors. The inhibit circuit consists of the monostable Tr4013/Tr4014 which produces a "window" pulse that's fed to the base of Tr4072. The window pulse waveform switches Tr4072 on and off. When it's on, the base of Tr4068 is short-circuited to chassis so that trigger pulses can't pass through to the thyristors. Tr4072 is switched off during the falling edge of mains input waveform, i.e. during the period when we want the thyristors to be triggered. The monostable circuit is controlled by feeding the 100Hz signal from the diode bridge via the potential divider R4074/5, then C4010 and D4084, to the base of Tr4014.

Returning to the h.t. side of things, the next thing to notice is the switch (S4067) between the thyristors and the h.t. reservoir capacitor C4029. This switch is normally closed, and can be likened to the thermal cut-out trip we found in the Thorn 3000/3500 chassis. In this case however the switch is used to provide over-voltage protection. Should the h.t. voltage rise to the point at which the glow switch GS4038 strikes, current will flow via R4067. Since the voltage across SG4038 then falls, it simply goes out again. If the excessive voltage persists, R4067 gets hot enough after repeated striking of SG4038 to open the thermal switch S4067. This can be reset only by soldering it back. Use the correct type of solder (60/40 tin/lead alloy) so that the protective function is preserved.

The final bit of circuitry for us to consider on the power supply board is the electronic smoothing circuit – Tr4032/4033 and associated components. This may look at first glance like a series regulator circuit, but isn't exactly. It would hardly be appropriate to have a regulator following the thyristor circuit already used to provide voltage regulation, would it? The active or electronic filter is really a way of achieving h.t. smoothing with the minimum amount of dissipation, thus reducing the heat in the cabinet and improving reliability. The *RC* smoothing network R4030/C4034 provides Tr4033 with a smoothed base bias. This transistor is an emitter-follower, so a nice, smooth d.c. is present at its emitter. This in turn drives Tr4032, another emitter-follower. The result is a smoothed d.c. output, achieved with the minimum series resistance and a small value smoothing electrolytic (C4034, which is only 10μF).

The final bits and pieces consist of the h.t. fuse FS4037 and C4040 which provides decoupling rather than smoothing. A word of warning here. Should FS4037 blow, C4029 will remain charged at about 175V and will hold this charge for a long time. It needs to be treated with due respect therefore when you find FS4037 open-circuit.

Fault Finding

As we've seen, the most common fault is failure of the diodes D4091/2 with the resultant blowing of the 3·15A mains fuses. This does not raise any particular problem. It's the less common faults that are likely to cause head scratching.

Suppose we have the condition that the mains input is intact, but there's no h.t. output from the thyristors. This suggests absence of triggering pulses. If you've an oscilloscope, evidence of their presence or absence will be obvious. We'll proceed along the harder path however and assume that you can't "see" the pulses. Since they are of low frequency, they can at least be heard: this is a point worth bearing in mind if a signal tracer (not injector!) is at hand, but bear in mind the shunting effect that a tracer or a pair of high-impedance headphones will have.

As in most circuits however, careful voltage readings will provide the best means of finding the source of the trouble. Say for example that the base of Tr4068, the first transistor in the Darlington trigger pulse amplifier circuit, is low (it should be about 0·18V). This could mean that Tr4072 is conducting, and we might find therefore that its base voltage is high (0·4V is the figure to expect under normal operating conditions). Should the voltage be 0·7V or more, check along to the monostable circuit where Tr4014 is likely to be switched off (collector voltage high). Under normal working conditions, Tr4013's collector voltage should be 4·7V and Tr4014's 2·1V. If these voltages are incorrect, a thorough check on the components in the stage will have to be carried out. We can give only this general guidance, because the circuit is highly reliable.

Had the voltage at the base of Tr4072 been 0·4V (the normal figure) or less, the trouble could have been collector-emitter leakage in Tr4072 rather than high voltage at its base, since 0·7V is required to switch it on. The monostable

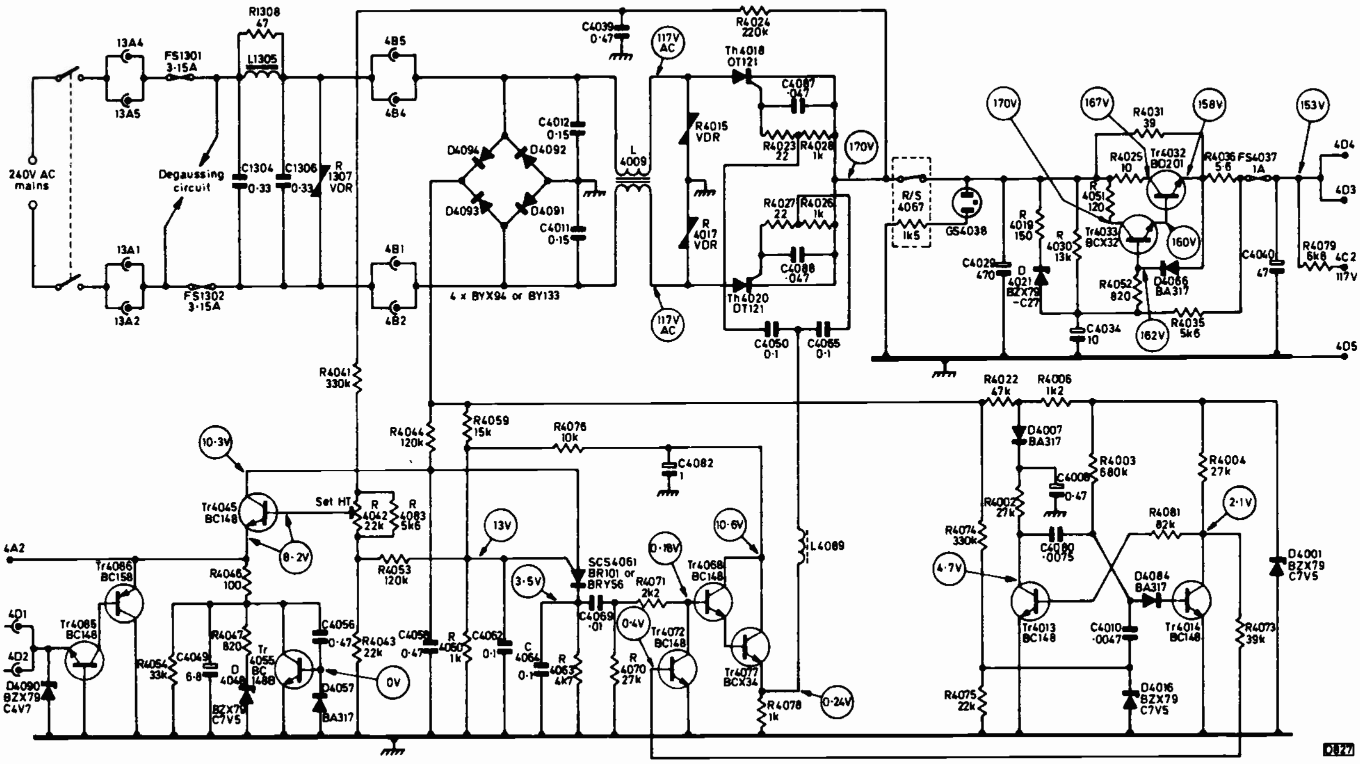


Fig. 3: Circuit of the full-wave thyristor power supply used in the Philips/Pye G11 chassis.

circuit would not be suspect therefore.

Low voltage at the base of Tr4068 is more likely however to be due to absence of trigger pulses. This would mean going back to the SCS to find out how its anode is faring. Complete absence of voltage here could mean that R4044 is open-circuit, which is not unknown. That's not very likely however. Attention is more likely to be required around the control transistor Tr4045, whose collector is connected to the anode of the SCS and to the junction of the charging capacitor C4058 and R4044. Tr4045 should have about 10·3V at its collector, while its base voltage (use a meter range of not less than 25V at this point) and its emitter voltage should be at about 8·2V. If the collector voltage is low, there's likely to be a difference between the base and emitter voltages, and the emitter voltage will probably be low.

If this is the case the slow-start and beam limiter circuits come under suspicion. Things to check are the zener diodes D4048 (7·5V) and D4090 or D6011 (both 4·7V – D6011 is in parallel with D4090, but is mounted on the decoder board, and in later production you'll find D4090 replaced by an 0·0022μF ceramic capacitor). Any of these zener diodes can short. So can either of the two beam limiter transistors Tr4085/6.

The purpose of Tr4085/6 is pretty obvious – they are there to switch on when the beam current is excessive. The purpose of the slow-start transistor Tr4055 may not be so obvious. At switch on C4056 is completely discharged. As soon as Tr4045 starts to conduct, C4049 starts to charge.

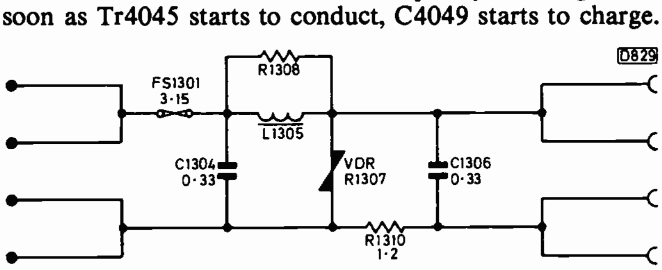


Fig. 4: Recent modification to the mains input circuit used in the Philips/Pye G11 chassis.

The positive potential thus developed appears at the base of Tr4055 via C4056. Tr4055 thus switches on, delaying the charging of C4049 (and thus holding Tr4045 conductive) until C4056 has been charged by Tr4055's base current. This takes a time (C4056 charges very slowly), thus providing the slow-start feature. When the set is switched off, C4056 and C4049 are rapidly discharged. The slow-start action occurs even if the set is switched off and on again quickly therefore.

If a fault is causing Tr4055 to conduct, the emitter of Tr4045 will be at a low voltage and it will also conduct. C4058 will be prevented from reaching the voltage at which the SCS will fire, so there'll be no trigger pulses. No trigger pulses, no h.t.

Another point to watch – in sets fitted with remote control – is connector 4A2. In sets without remote control, this connector is not used. With remote control however it's used to enable the h.t. to be switched off, i.e. the set left in the "stand by" mode. In this condition, 4A2 is connected to chassis via a low-impedance path (transistor Tr519 in the remote receiver unit). This is the same as Tr4085/6 conducting. If a remote control unit is incorporated therefore this must also be cleared of responsibility in the event of no h.t.

This may all sound rather complicated, but a few quick checks with a voltmeter should enable the source of any trouble to be isolated without too much heartache. One fault that does occasionally occur and may prove more difficult is when the large wirewound resistor R4059 makes poor contact with the print. The result of this is h.t. level fluctuations.

Modification

A modification on the latest production sets is to delete one of the mains input fuses (FS1302) and to add a 1·2Ω resistor (R1310) in series with the neutral side of the supply (see Fig. 4). The idea is to provide further protection by reducing the switch-on current surge.

Servicing the Beovision 3400 Series

Part 1 **Eugene Trundle**

THE Beovision 3400 series was the second generation of hybrid colour receivers to be manufactured by the Danish setmaker Bang and Olufsen, and was one of the first wide-angle (110°) colour sets to be marketed in the UK. It used the Mullard/Philips Phase II c.r.t. system (A66-140X), the thick-neck, delta-gun tube being driven by a complex circuit using ten valves, 104 transistors, 89 diodes and one i.c. – the whole lot drawing 360W from the mains supply.

Like its predecessor, the 3400 was very much in the luxury class, with an elegant rosewood or teak cabinet and truly excellent sound and vision performance. Again like the 2600/3200 series, the chassis was engineered for optimum performance virtually regardless of cost, the result being a receiver of considerable complexity with a very large component count.

Unfortunately, this sheer weight of numbers, combined with the relatively high temperature at which the chassis runs, means that the reliability factor is rather disappointing to say the least. This situation is somewhat aggravated by the fact that the deflection and convergence circuits are unconventional in many respects, so that when trouble is experienced a bit of head scratching may be necessary.

Many of the faults that occur do not fall into the stock category. We'll describe the operation of those sections of the chassis where trouble is most likely to be encountered therefore, in addition to outlining the common faults we have come across. Space does not unfortunately permit either a full circuit or a full circuit description – these alone would fill several issues of the magazine!

Circuit Diagrams

Before we start, a few words of explanation on the arrangement of the circuit diagrams in the Bang and Olufsen service manual may be of help. To avoid a forest of lines and the confusion this could cause, B and O use a trunk system in their circuits. The circuit is in four sections, each of which has a "wire trunk" around two or more sides. When a connecting lead enters the trunk, it's given an identification, a direction and a destination. If the identification consists of a double letter, the destination is on the same diagram, and by following the direction of the

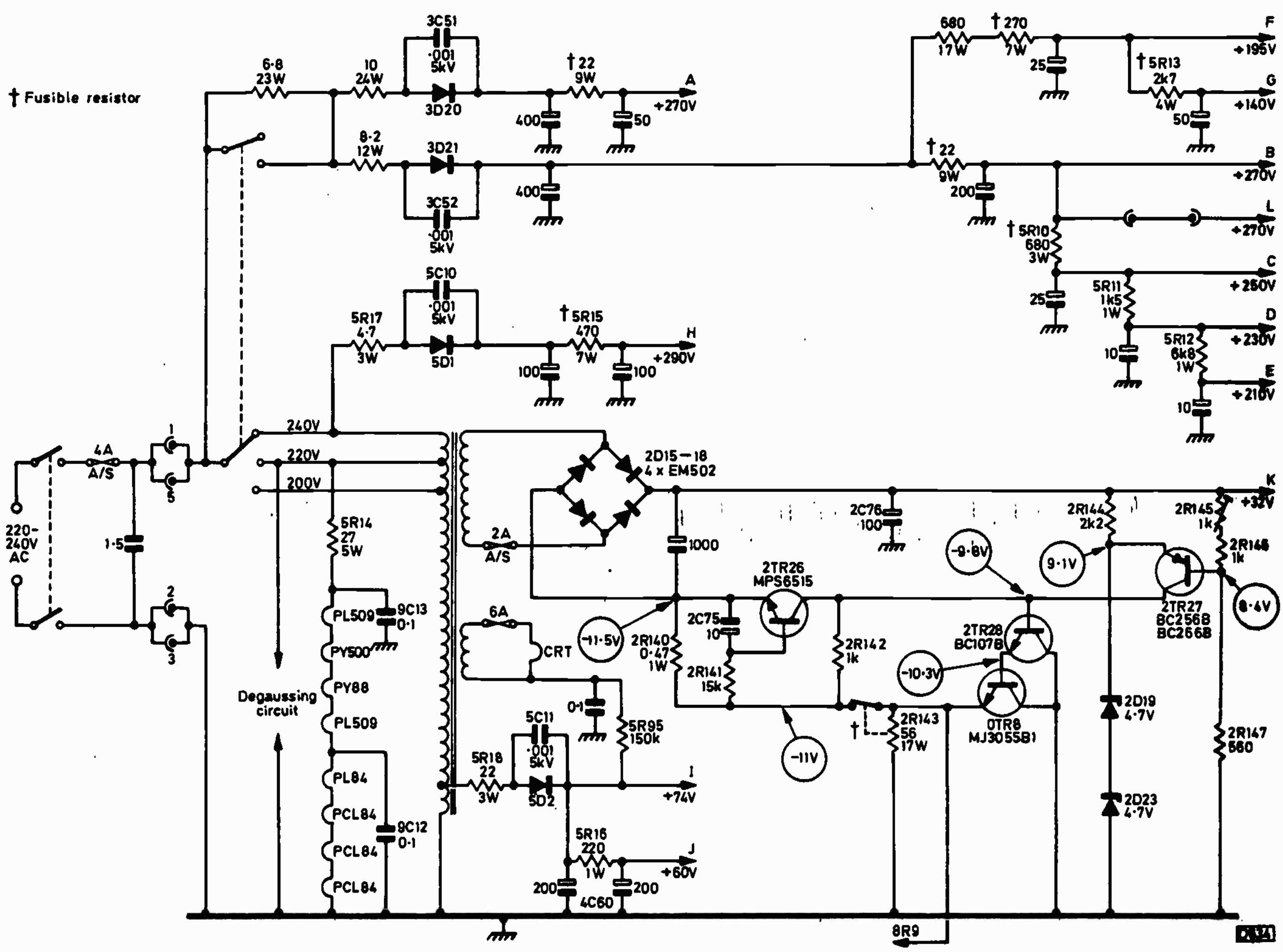


Fig. 1: Power supply circuitry used in the Beovision 3400 series chassis.

arrow you'll find it emerging from the trunk at some point. Sometimes the arrow is double-headed (diamond shaped), the connection being picked up at two points, one in each direction. If the identification consists of a single letter or symbol, a destination will be found nearby, consisting of a capital D followed by a number. This indicates which of the circuit diagrams 1–4 the lead goes to. In such cases follow the trunk in the direction of the arrow to its end. The wanted letter or symbol will be in a queue alongside an arrow marked D2, D3 or whatever. A corresponding arrow will be found on the destination diagram, again with a queue of letters to indicate the routing. Follow the new trunk, and you've arrived.

Where plugs and sockets are involved, they are drawn near the circuitry with which they are concerned, and assigned an identifying Roman numeral and sometimes a colour code. Plugs are indicated by solid dots for pins, while sockets are drawn with hollow rings. A plug or socket may be drawn more than once on a diagram, with different pins being used in each case. Where a D number is printed beside a plug or socket pin, it indicates the diagram from which that lead is routed via the plug and socket concerned.

Heavy black lines on the diagram enclose each printed panel or assembly, components outside these lines being mounted on the chassis metalwork. Each component has a prefix number to indicate the panel or subassembly on which it belongs, those mounted on the chassis being prefixed "0".

Chassis Arrangement

The works are arranged in similar fashion to the 2600/3200 series, with a "front chassis" containing the tuner, customer controls, i.f. stages and low-level post-detector circuitry, while the main chassis carries the power supply, signal output stages and timebases.

Signal Circuits

The front chassis and decoder are virtually identical, but updated, versions of those fitted in the 90° 2600/3200 chassis. These were comprehensively covered in the March and April 1977 issues of *Television*, by Keith Cummins. In the 3400, the troublesome 12V zener diode 4D3 (corresponding to D93 in the 2600) has been uprated to a 12·5W device which is very reliable. The high-voltage stages in the decoder, 4TR4-8, use type BF178 transistors, and the clamp diodes (3D4/5/7/8/9/10) are type BA145 in place of the EB91s of yore.

Unlike the other modifications, this latter one seems a definite step backwards since these diodes, being in the front line flashover-wise, tend to develop leaks and upset the grey-scale. The effect is usually temperature-dependent, the picture becoming more tinted as the set gets thoroughly warm. Test the reverse resistance of the diodes on the highest resistance range of the multimeter. The slightest movement of the pointer is enough to condemn a diode. If the current equivalent to the BA145, the BY206, is used as a replacement, colour imbalance can result due to the slightly different dynamic characteristic. So we prefer to replace all six diodes at once, preferably with six BY206s from the same batch. Note however that not all BY206s will do: use ones from a reputable source, e.g. Mullard. If this fails to hold the c.r.t. grids steady, leakage in the 10nF ceramic disc coupling capacitors will probably be responsible. These are 3C22/29/39.

A more subtle change has been introduced in this area due to the absence of the parallel heater chain. The colour-difference output valves are now type PCL84. This is a trap for the unwary, because ECL84s (as used in the earlier chassis) fitted in error will usually produce some kind of colour, but not for long!

Still on the valve heater theme, the 12HG7 luminance output valve's heater forms part of the dropper from the main 32V line to the 12V stabilizer zener on the front chassis. If there's a signal problem, a glance at the colour temperature of the 12HG7's heater will thus tell much about the 32V and 12V lines. This can be a time-saver.

The set-white switch is as troublesome as on the 3200, and sudden loss of luminance, video streaking or intermittent or permanent static misconvergence are the symptoms. The decoder in the 3400 has the smaller version of the chrominance delay line and, a welcome feature, component numbers printed on the panel. Apart from the odd failure of germanium diodes, reliability here is good.

Before we say goodbye to this part of the set, one or two common faults. Tuning drift and intermittency can in most instances be resolved by cleaning the tuner bandswitches. All sorts of intermittent effects can be caused by poor contact in the three noval plug/socket connections between the front chassis and the rest of the set. The mains filter capacitor and fuse are more prominent on this receiver than its predecessor – beware shocks! Finally many of the services on the front chassis and signal boards are dependent on the operation of the line timebase. It's prudent therefore to make sure that this department is working before delving into a no signal or no colour fault for instance.

The Power Supply

The power supply (see Fig. 1) is conventional for a hybrid receiver, with two main h.t. rectifiers (3D20 and 3D21) feeding eight h.t. supply lines via the usual decoupling filters. Failure of the 6·8Ω 23W surge-limiting resistor may be for internal reasons or because one of the h.t. rectifiers 3D20/21 has shorted. The mains transformer supplies 74V to the field timebase and 60V to the decoder via rectifier 5D2 from a tap on its primary winding. A fourth rectifier 5D1 furnishes a separate 290V rail to power the luminance, R–Y output and some convergence circuitry. All four rectifiers so far mentioned may be replaced by BY127s.

Many of the *RC* filter resistors in the power supply are fusible, and if one of these fails the cause will be excessive loading on its output line. A shorting PL84 sound output valve for example will spring 3R102, and delete the B–Y signal by robbing the B–Y output valve of screen grid voltage (fed via 3R102). Most of the fusible resistors feed more than one section of the receiver, so wherever two or more apparently independent faults occur simultaneously look at the fusible resistors on high.

The mains transformer has two secondaries, 6·3V feeding the c.r.t. heater via a troublesome and strange-looking 6A fuse which often goes open-circuit to give an intermittent no picture symptom, and a 35V winding which supplies the stabilized l.t. rail. The output of the bridge rectifier 2D15-18 is applied to a 1,000μF reservoir capacitor whose positive plate provides the stabilized 32V rail.

LT Regulator Circuit

Stabilization and smoothing on the active-filter principle are achieved by the insertion of 0TR8 (2N3055) between chassis and the negative bridge output. A sample of the 32V line potential is applied, "potted down", to the base of 2TR27, whose emitter is anchored to 9·1V by the zener diodes 2D19/23. The error voltage produced by 2TR27 is then passed to the base of 2TR28, amplified and applied to the series regulator transistor 0TR8. 2TR26 plays a protective role, sampling the current through 2R140. If this current is excessive, 2TR26 conducts, turning down 2TR28 and 0TR8. If the overload is very heavy, 2R143 will spring off. This is rare however.

The circuit is very effective, reducing the ripple voltage on the 32V line to 60mV p–p. The set is very critical with regard to its l.t. voltage, and 2R145 should be set for 32V±2% across 2C76, preferably using a digital voltmeter.

When this department goes haywire, the usual result is hum on the 32V line. This modulates the sound and shows as a drifting bar on the picture. In milder form, only the chroma is affected, with the hum bar showing as a vertically drifting bar of lighter saturation. The effect is usually intermittent, and sometimes occurs only when the set has thoroughly warmed up. 2TR28 (use a BC107B) and 0TR8 are the things to go for. The fault will not always show up on an instrument test, so check them by substitution.

The rectifiers can also be responsible for hum troubles, but this is less common. The reference zener diodes 2D19/23 have been found responsible for voltage drift on the l.t. line. This shows mainly as changes in convergence and height.

Apart from 0TR8, all these components are in the middle of the field timebase panel, below the c.r.t. neck. They're a bit difficult to get at, due to the chassis angle and the tangle of the wires (there's a song there somewhere, isn't there?). Beware of solder blobs and burnt leads.

VCR Speed Conversion

G. Beard

THE playing time of Philips VCRs in the N1500 series is only an hour. This means that they are rather expensive from the tape point of view. The machines themselves can often be obtained at very reasonable prices however, making it worthwhile converting them to the 2½ hour N1700 standard. At the time of writing (January 1980) N1500s are on offer in the range £30–£70. At this sort of price the machine will almost certainly have worn or broken video heads, making it necessary to fit a new head assembly anyway. With any luck you may get some tapes thrown in.

Before starting, it's best to have the full service manual for the machine – unless you have the sort of memory that can recall the sequences in which parts fall, spring and shoot apart. The manual part number for the N1500 is 726 11066 and for the N1501 726 11502.

Initial Steps

First remove the two Phillips-headed screws on the cassette mechanism cover, then remove the four screws at the cassette opening. Next loosen (three turns) the four Phillips-head cover screws at the ends of the unit (see photo 1). Carefully raise the back of the unit, pivoting on the front edge. You will now notice that the recording level meter is attached by a strange spring with a plastic sleeve (see photo 2) on the side nearest the input leads. Manoeuvre this spring out, then lay the meter down carefully and Sellotape it to the chassis front. If you fail to take this step the meter can be broken or bitten in half by the cassette mechanism.

Put the cover, cassette cover and screws to one side. You can now see the full mechanical, electromechanical and electronic horrors you've let yourself in for.

Plug in the mains cable, which I hope you remembered to get with the machine. Connect the aerial input and output to a television receiver, push the eject button, and post a cassette in the slot, depressing it to lock. Now watch the mechanism and push the on button. If you were not looking, push the off button and try again . . .

It's probably not much use trying to play back any tapes, but just to see what sort of picture a worn out head produces switch on the TV set and tune it to the VCR's channel (approximately ch. 37). Check that the VCR buttons are tuned, and press the start button. No picture, or bands of noise, no colour and field slip probably mean that the electronics are all right. Next clean off any dirt or grease on the deck.

Now to do something constructive. You did Sellotape the level meter didn't you? – because it's now that it will fall about a bit. Stand the VCR (see photo 3) on its right-hand end (the clock end), remove the two Phillips-headed screws at the front of the bottom cover, lift up the front edge and ease from the rear clips. Six printed circuit panels are now visible. Five of the boards are on a hinged frame which is released by loosening two screws, one at the top front of the frame and one at the right-hand edge – with the machine stood on its end, that is. Swing the boards out to the extent of the retaining wire – it's best to release this to allow easier access to the mechanism. (See photo 4.)

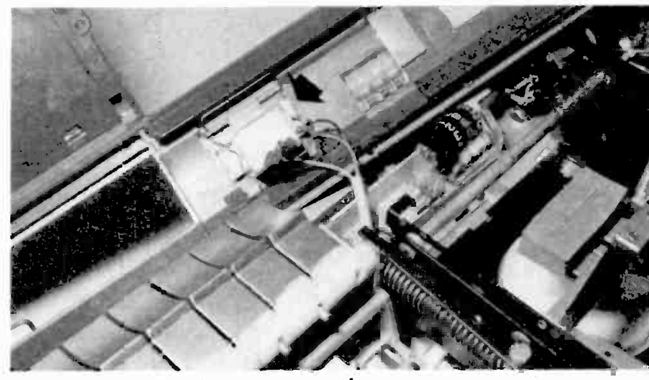
In the middle of the chassis there's a plate (517, see Fig. 1) which is secured by three screws. Remove these and the washers.

Dismantling

Now look at the top of the chassis. Locate the capstan, and remove the rubber washer 154 (199 in the N1501 manual's exploded view – bracketed numbers hereafter refer to the N1501). Gently remove the drive belt 163 (209) from pulley assembly 219 (238) etc. (see photo 5). Note that plate 520 (522) locates over the lug on bracket 170A (217). Pull the flywheel and capstan 162 (208) etc. from bearing 155 (200). Look out for nasty greasy bits and also falling bearing plates etc. The idler wheel assembly 142 (186) is best removed for replacement (if necessary) at this point. Put the flywheel assembly aside for machining (see photo 6). The diameter of the capstan has to be reduced to 0·1312in. (±0·0001) – see Fig. 2. This is a precision job and must be done by a firm with the necessary equipment. We got A.C. Park Precision Ltd., Holland House, Burmester Road, Tooting, London SW17 (telephone 01-947 2942) to do the job.

Next for the video head drum. Remove retaining bracket 114 (166). This is accessible from the top of the chassis (see photo 7) and is held by a single screw and washer. Now go back under to head drum pulley 111 (164). With a 1·5mm.

1: Positions of screws at ends of unit.



2: Recording level meter mounting.

Allen key, loosen the two grub screws 13 (28). Then, from the top, pull the video head drum from its bearing. A close look at the heads themselves will convince most people that the instruction to avoid touching the heads is justified. They are *very* fragile, though simple. Take care of the brake disc assembly, to prevent damage.

The tape drive motor pulley assembly 219 (238) can now be attacked – gently of course (see photo 8). Find that Allen key, loosen grub screw 13 (28), and undo (about $9\frac{1}{2}$ turns) the tape drive motor fixing screws. Slide (ha, ha!) the pulley assembly off. The grub screw has naturally dug a crater in the spindle, so a certain amount of persuasion is necessary.

The pulley (see photo 8 and Fig. 3) must now be turned down to half the diameter it is, i.e. from 1in. to 0·5in., and a groove of the original proportions cut.

Parts Required

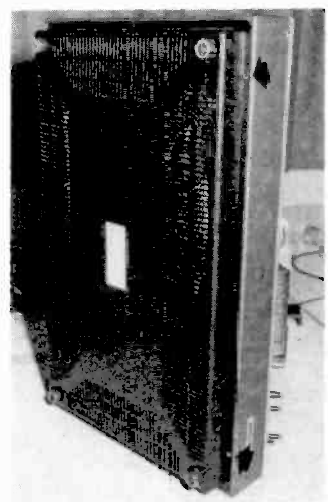
The parts required for conversion are as follows:

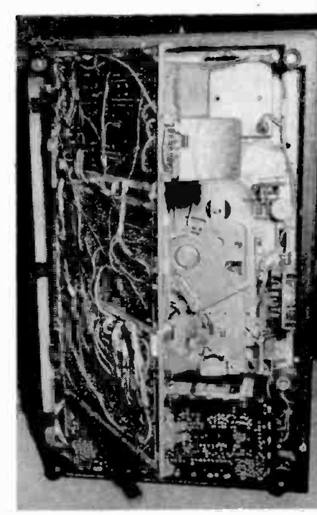
Part	*Part number*
N1700 video head drum	4822–691–20098
	3103–109–00914
N1700 audio and sync head	4822–249–10093
One servo head	4822–249–20025
U721 picture sharpener module	4822–210–20227

An N1700 test cassette is also helpful (see later) – part no. 7103–119–04023.

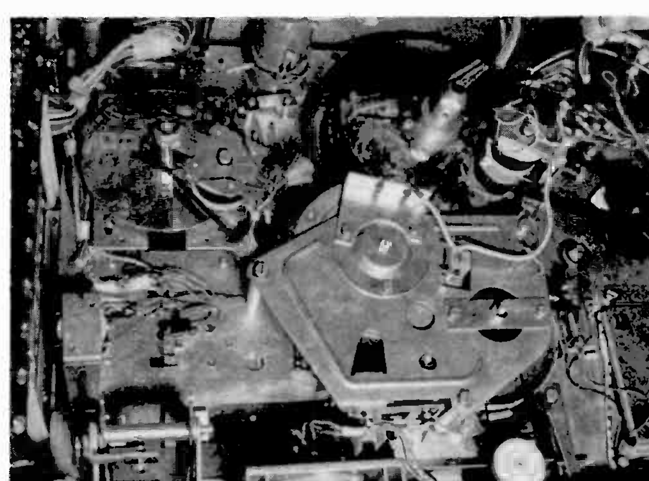
If the idler wheel assembly and pressure roller are worn they should be replaced. Part numbers 4822–528–70242 and 4822–528–70198 respectively. See items 142 and 200 in Fig. 1 (186 and 244 in the N1501).

Let's assume then that you've got all the conversion parts and have done all the other small jobs – such as cleaning, lubricating etc. There is no particular order that has to be followed, but I suggest leaving the video head drum till last – it's too expensive to risk damaging it.





3 (left): Screws at front of bottom cover.
4 (right): Hinged frame swung out.



5: Plate 517, drive belt and pulley assembly.

Sync and Servo Heads

I started with the audio and sync head. Remove pressure roller 200 (244) by easing it off – don't lose the lockwasher 25 (45) or the top and bottom retaining rings 196 (62).

Raise the cassette mechanism, and remove the four screws 6 (16). Ease springs 165 (210) off the pillars, and lift from the chassis.

Remove retaining washer 31 (29) in order to release lever 557 (561). Remove retaining washer 18 (50) from spindle 574 (557). Ease pin on strip 230 (269) from beneath strip 558 (562), and lift the sync head assembly from spindle 574 (557), catching spring 199 (243) and fibre washer 197 (71).

This may seem rather complicated, and there are other ways of removing and replacing the sync head. I did it this way to avoid the realignment problems associated with other methods.

Remove the new sync head from the bracket with which it is supplied – mine had two screws in the base, whereas the old one has only a single screw.

Note carefully the position of the old head relative to its bracket and spindles, and fit the new head – with one screw at its front (nearest face) hole. Lock with epoxy resin, solder leads, reassemble the pressure roller with the top and bottom washers and refit the whole assembly. Refitting retaining washer 31 (29) is easier than removing it!

Refit the cassette trapeze, making sure that LA1 is

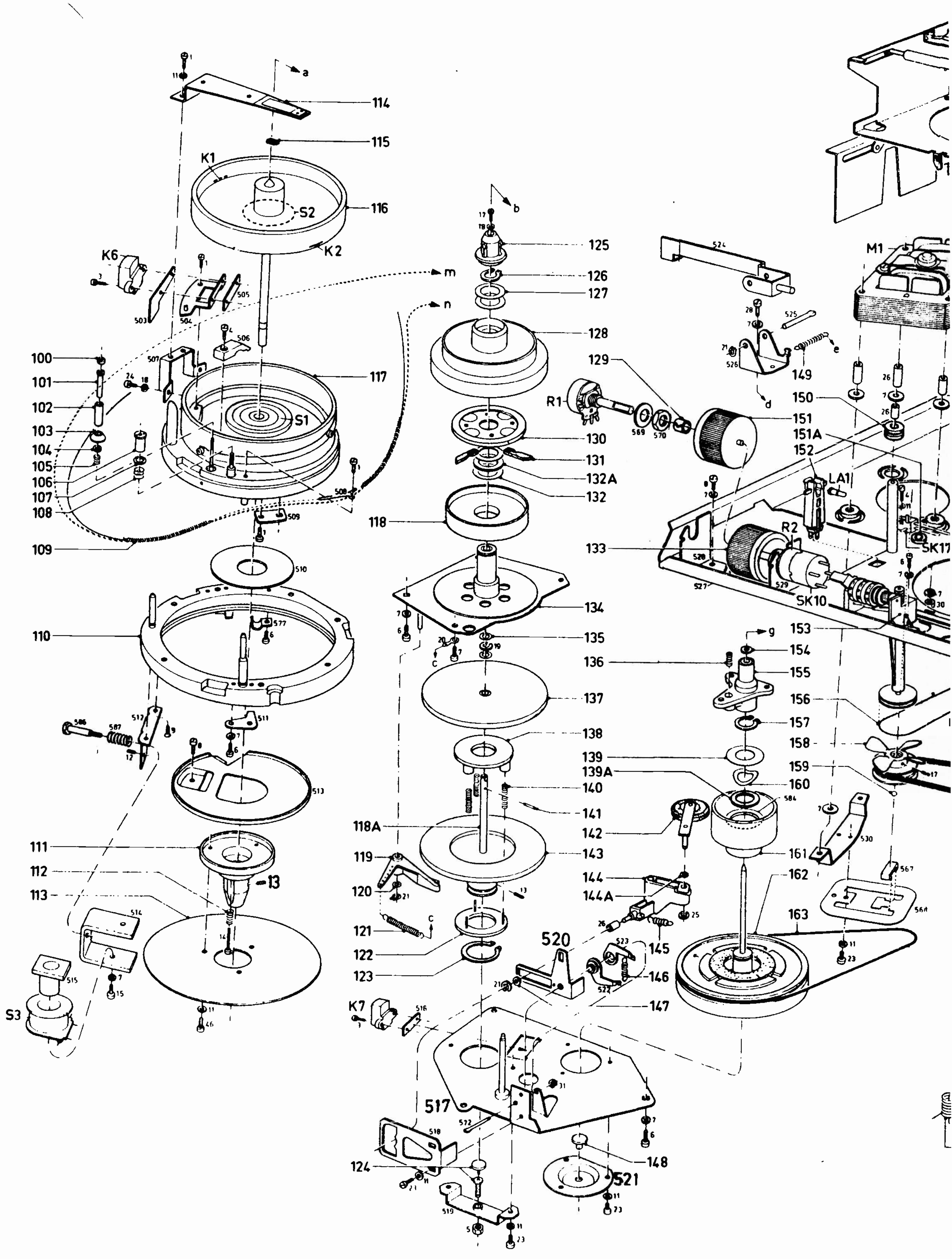
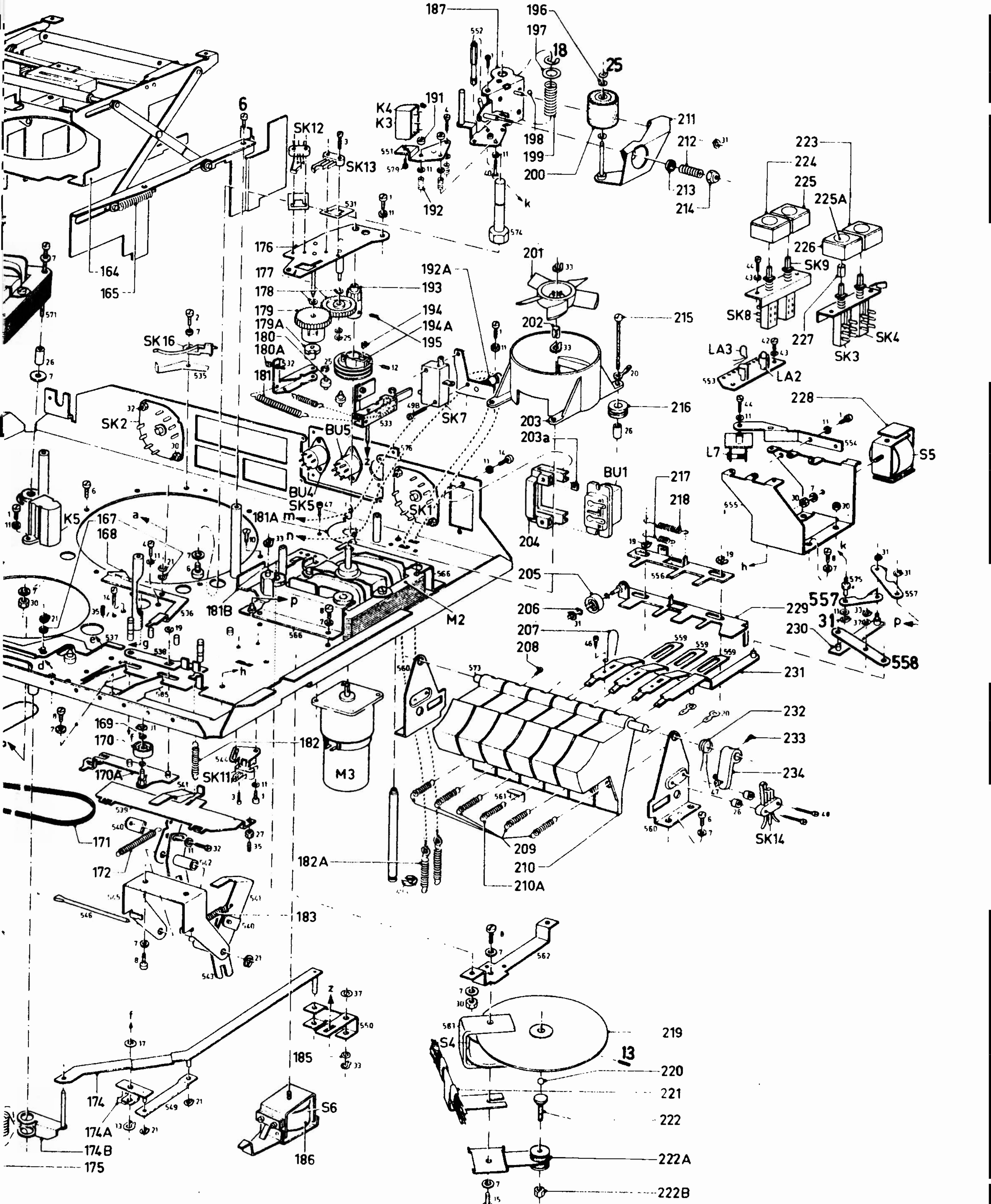


Fig. 1: Exploded view of the Ph



ilips N1500 VCR.

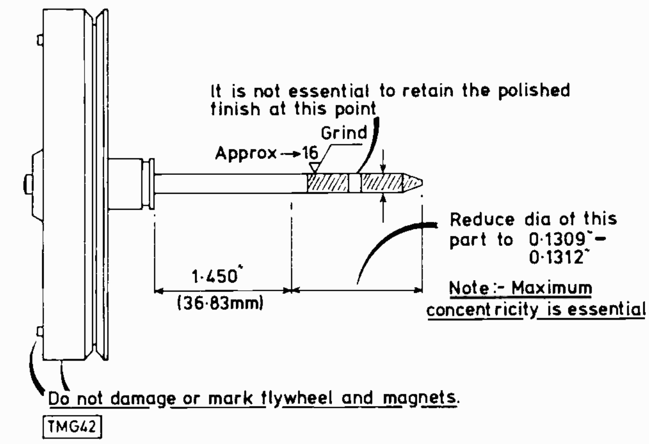


Fig. 2: Capstan reduction details.

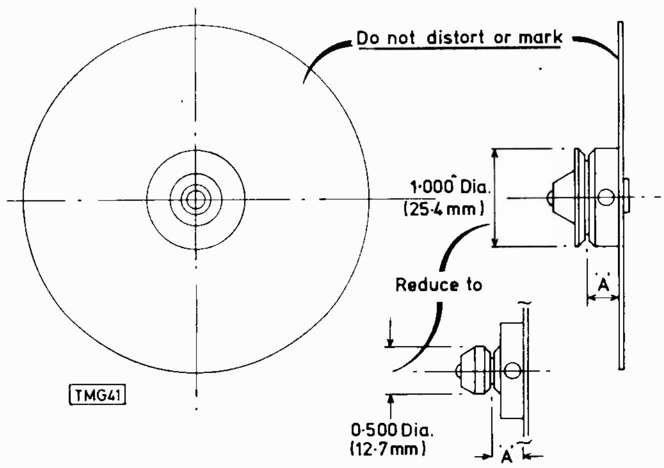


Fig. 3: Pulley reduction.

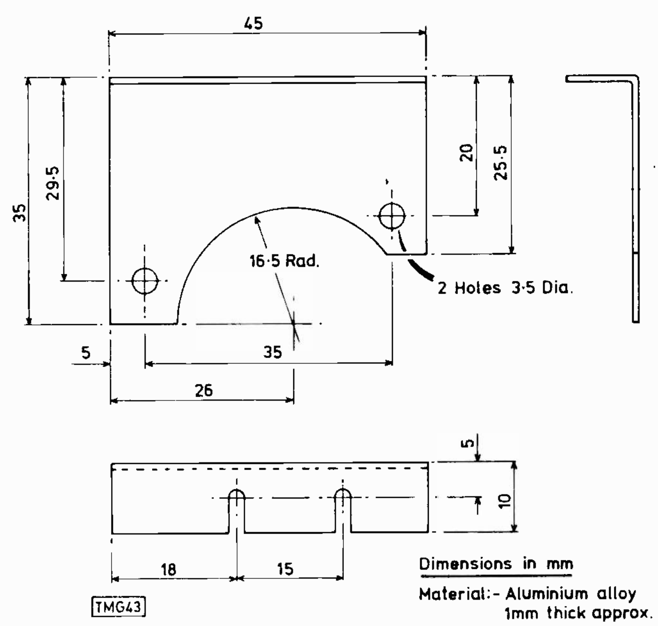


Fig. 4: Servo head bracket. Mounting slots are 2mm wide.

not dislodged – it can cause a short-circuit and blow fuse Z101 (3·15A slow-blow – not fitted in the N1500).

Next to the extra servo head required. Make a bracket (see Fig. 4) and attach the head as shown in photo 9 – in series with the existing head. If care is taken in aligning the new bracket when mounting it on part 521 (520), no further adjustments will be required.

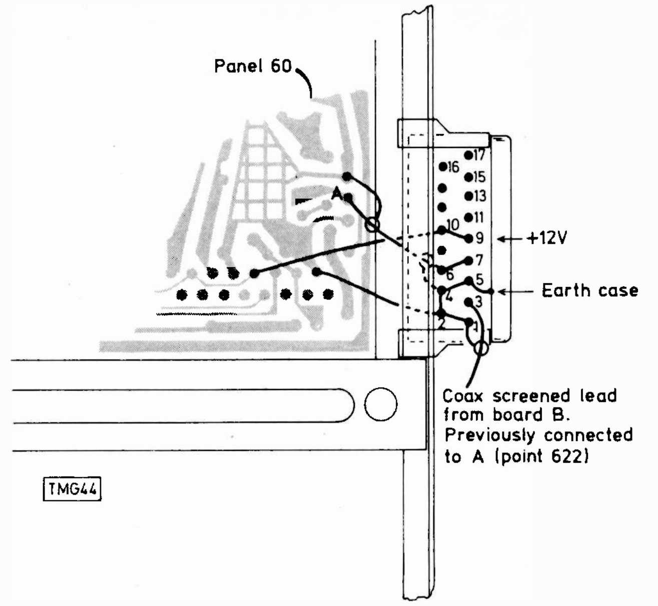


Fig. 5: Connections to the crispener module.

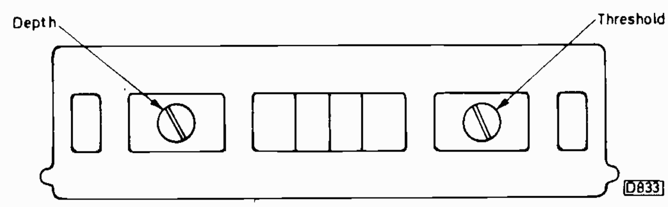


Fig. 6: Crispener adjustments.

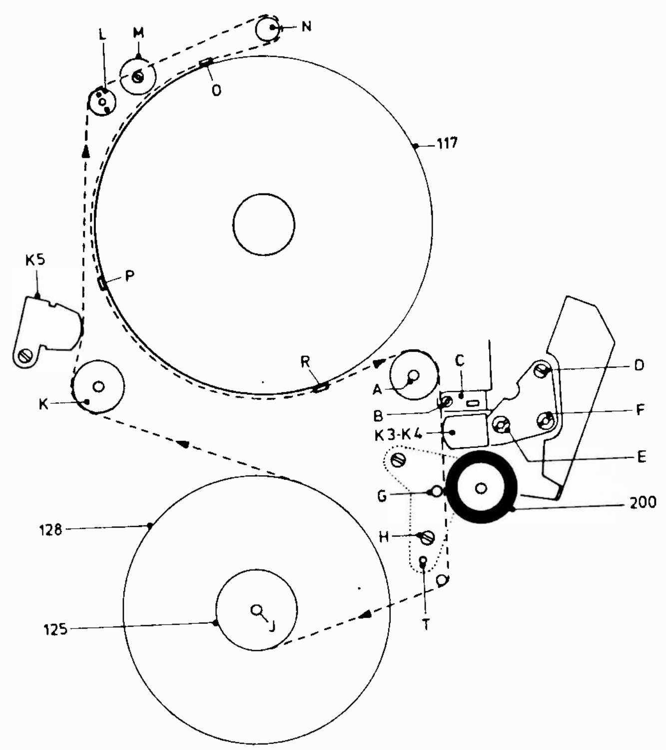
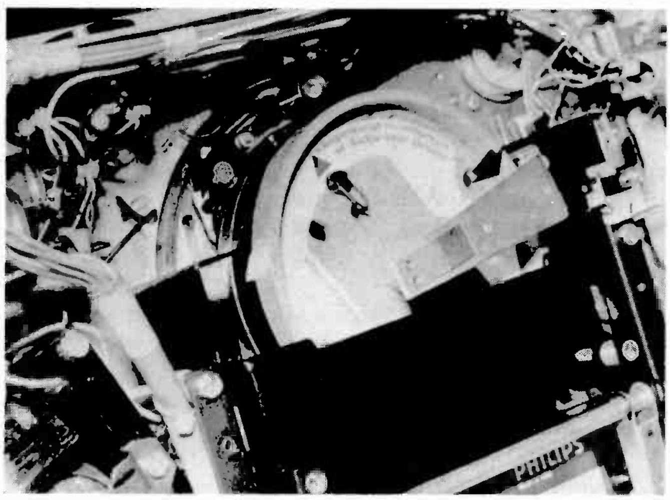


Fig. 7: Tape path. K5 is the erase head, K3-4 the audio/sync head, G the capstan, item 117 the video head drum and 200 the pinch roller.

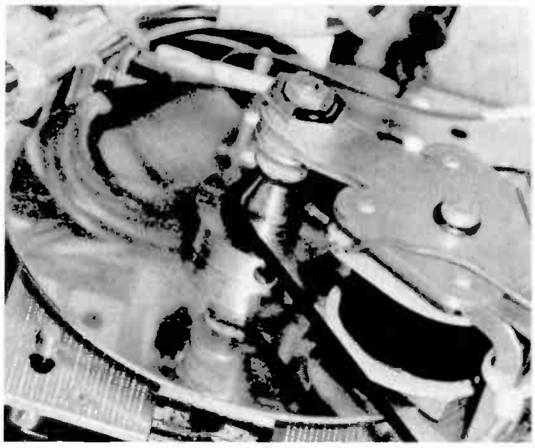
Reassembly

Now fit the capstan carefully into its bearing and plate assembly 517, with the new idler wheel assembly 142 (186) if this had to be replaced. Juggle driving belt 163 (209) into position, replace and securely fix plate 520 (522) on bracket

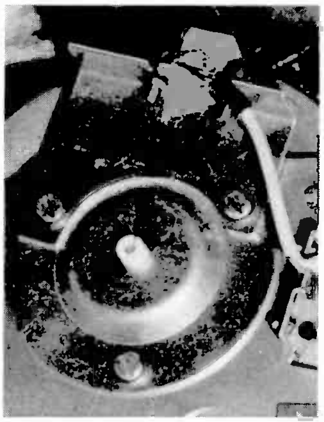
6: Capstan and flywheel assembly.

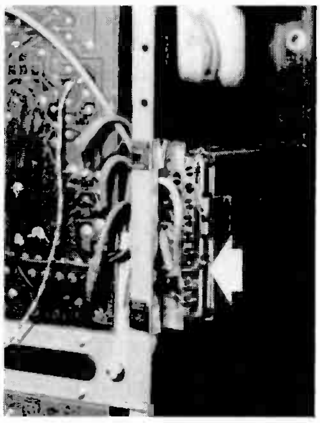


7: Head drum retaining bracket. Note that the machine is shown in the laced-up condition.



8: Pulley after reduction.





9 (left): Extra servo head mounted on its bracket.
10 (right): Crispener module mounted on the hinged frame.

170A (217). Don't forget to replace ring 154 (199) on the capstan, with a small gap from the bearing. Nearly there!

Tape Drive

Refit assembly 219 (238), the tape drive pulley and brake disc, locating it centrally between the jaws of brake coil assembly S4. Make sure that the drive belt is not twisted, and is between the brushes 221 (239).

Adding a Crispener Module

I next fitted the crispener module (it's the one from the N1502), mounting it by means of two tabs clipped to the bottom board frame in front of panel 60 – see photo 10 and Fig. 5. When mounted in this way, the crispening depth and threshold controls are adjustable from the top of the chassis (with the top cover removed). The positions of the two controls are shown in Fig. 6. Adjust the depth first – to just sharpen the picture verticals. The threshold control sets the minimum contrast level change at which crispening occurs, and may not require any adjustment.

Video Head Drum

Finally, fit the new video head drum. The procedure is the reverse of that previously given. Do it carefully! Adjust the tape input guide (see photo 7) about 270° clockwise (this is L in the manual – see Fig. 7 – and when the tape is laced up is the guide nearest the tape head). A 2mm. Allen key is needed for this.

Final Work

If you want to modify the clock to give 2½ hours' timing, refer to the details on page 64 of the October 1978 issue. It's a fairly intricate filing job, but works very well.

Now double check everything. Note that the new servo head can touch parts of the circuit boards when the lower hinged frame is closed: I used a piece of adhesive tape to prevent this. Also ensure that the record/replay switch lugs are located correctly when closing the frame.

I believe in good ventilation, and feel that if the machine is used on a soft surface the air flow may be inadequate. So I extended the height of the feet by 10mm.

Now insert a cassette, check for free running, and try a recording. All was well in my case, but if you intend to swop tapes it's best to adjust the sync head and tape guide in conjunction with a known good recording or test tape 7103–119–04023.

With the N1500 it's worth providing audio h.f. boost by adding an $0{\cdot}1\mu F$ capacitor across R555. We found it best not to do this with the N1501.

Acknowledgement

Various letters and articles that have appeared in the magazine previously have been a great help with this project. I'd also like to thank those who gave guidance on various points over the 'phone.■

One Damn Thing After Another

Les Lawry-Johns

I must confess to feeling very sad occasionally of late. Little seems to buck me up very much, and I seem to make so many daft mistakes. Look at what happened yesterday for example. The phone rang, as phones do.

"Hallo. Hoodo Yoovue" I said, trying to cheer myself up.

"Don't muck about. I know it's you" said a voice I knew fairly well.

Then I remembered. It was Mr. Gay, the funeral director.

"Hallo Mr. Gay. How's business?"

"Not bad. Could do with a good epidemic though. Anyway I called you about our set. Can I bring it round?"

And that's how it came about that a damn great hearse drew up outside the shop and two men clad in black solemnly opened the back and carried in a set with all due ceremony. It needed only an organ and some lilies to complete the picture.

In those brief moments my mind filled with all sorts of ceremonies that could be carried out on TV sets, including cremation. But I never said a word out of place.

The set was a Thorn 8800, and the complaint was that the sound was there all the time but the picture kept going.

A Solicitous Enquiry

Off went the undertakers, promising to return later in the day. They had hardly departed when the inevitable happened. One of the local old girls popped her head in the door.

"Has she gorn then?"

"Has who gorn?" I asked, quite unnecessarily since I knew perfectly well the old ghoul was hoping that someone had passed under or over or whatever people do when they pass on, and since I was in evidence she must have thought that honey bunch was deceased.

"The missus" she said. "I saw the undertakers and I thought they'd come to straighten someone up. My daughter can come in and clean for you if you like."

"There are still a few more years of cleaning left in the missus" I said, "she hasn't shuffled off, but thank you for asking just the same. They didn't come to measure anyone up, only to bring a set in."

The old girl wandered off disappointed, muttering something about people didn't ought to be allowed to make other people think that someone had died when they hadn't.

Now to the Set

So we turned to the Marconiphone (and we won't see that name again on a new set, at least not from Thorn), and switched it on to see what all the fuss was about. There was a loud pop as the mains filter capacitor threw in its hand and the fuse disintegrated.

Having made good that diversion, we tried again. All now seemed well, with a fair picture and sound. This continued for some time, then the picture became a mass of noise and the sound became hissy. It looked like a tuner fault, but as we were not born yesterday we decided to take a look at the lower left side of the signal panel. A slight touch on the i.f. input plug from the tuner confirmed that this was indeed making poor contact, as it so often does on this type of panel (8000 on up to 9600).

Having cleaned the contacts, normal service was resumed for about five minutes. Then the sound failed completely. This time it was the MJE340 sound output transistor which had departed this life. A BD410 was fitted in its place and all now seemed well. So the set was wrapped up to await the undertakers' return.

Return of the Little Old Lady

Some time ago we related how we were made to feel decidedly uncomfortable when we had hysterics in front of the Vatman after a dear old girl suddenly appeared to buy a new Pye CT450 (G11 chassis). Well, she appeared again the other morning. There she stood in the middle of the shop, looking just as hesitant as before.

"Hallo Mrs. Wandless, come to buy another new set?" I enquired cheerfully.

"I didn't want to" she said quietly, "but the one I bought seems to have worn out. The one you sold Mrs. Powe two years ago still seems to be going all right. Why has mine worn out so quickly?"

"It hasn't worn out Mrs. Wandless, it's just a little thing that's stopping it coming on. I'll pop out this afternoon to make sure it's still connected up properly."

"I don't think you'll be able to. The man next door came in and he couldn't make it work."

We let that one pass and arranged a time to call.

So during the afternoon we arrived at her house with some fuses in one pocket and some diodes in the other.

Just to be sure, we checked the 5A plug fuse first and then inserted the plug and switched on. The set burst into life and I looked askance at Mrs. Wandless who was standing in the middle of the room looking lost.

"It didn't take you long to mend it, but I hope you won't have to come all this way every time I want the set on."

"Oh no" I said without conviction. "It'll come on when you do it." So saying I switched the set off and removed the mains plug (which was her habit). "Now you do it and you'll see."

"I don't think it will" she said.

"Try it and see" I encouraged her.

So she did and it didn't.

Swallowing hard, I removed the rear cover and checked around with the meter. Mains o.k. at the fuses on the input panel. H.T. o.k. at the power panel. H.T. at the line output transistor and the line driver, but no drive at the base of the driver. Move over to the timebase panel.

As soon as I touched this panel the set burst into life and no amount of prodding would turn it off. So it seemed that the start-up circuit was at fault. Close inspection revealed a dry-joint on the print to R2010, the 5·6kΩ wirewound start-up resistor. Resoldering this restored normal working each time the set was tried, but it took a little time to persuade Mrs. Wandless that the set would work after I'd gone.

A Handsome Amplifier

A chappie brought in a rather handsome Rotel amplifier the other day. "I wonder if you'll have a look at this. It seems to be dead." I accepted the job thinking it would turn out to be some sort of short that had blown a supply fuse.

When I got round to it, I removed the case and found an envelope inside containing some ten or twelve transistors – outputs, drivers and preamplifiers. All had been neatly removed from the panel and the heatsinks. That was enough. From bitter experience we know all too well that this would be only the tip of the iceberg. Once a job like this is started, it inevitably leads from one minor disaster to another until the repair bill assumes massive proportions the owner will not accept. The fact that he (or someone else) had already been at it showed that economy had probably played a part in the tragedy, and we'd no wish to join the cast. Sorry old chap. It needs to be taken to an expert.

Unit Audio Wouldn't Go

I never really got to grips with the next one. Perhaps you can.

A lady sent her unit audio in because it wouldn't go. There was an additional note that when it did it was too loud, so would it be all right to work it without the loudspeakers connected?

Only the unit had been sent (no speakers), so we put it on the bench and connected our test speakers. Continuing with our boobs we put on a record, got nothing and proceeded to remove the bottom cover in order to find a possible amplifier supply fuse blown – the turntable was working fine.

All the supplies were in order, so we suspected a faulty headphone socket. Plugging the headphones in proved that the unit was working well, and it was only then that we realised there was a headphone button on the front panel. When this was actuated the sound came normally from the speakers, and we were again wasting our time since there was nothing wrong with the unit at all. Remembering the note that it was "too loud" we checked the volume controls and found that these worked perfectly down to zero.

When the lady came in to see if we had repaired the unit we told her that there was nothing wrong except that the headphone button had been depressed. Then it started.

What was the headphone button? Where was it? What was it there for if she didn't have headphones to use, and if she did have them where were they and what did they look like?

I could hear my lotus blossom giggling like a loon as she pretended to rearrange the window display.

The lady then informed me that she had had the unit for five years and the button had never been pressed in before. So why should it have been pressed in now? By accident I suggested, but now she knew what it did she could check on it herself.

Too Loud

Then she wanted to know if she could leave the loudspeakers off since it went too loud.

We explained that all she had to do was to slide the controls to reduce the sound to the required level and, if she wanted the speakers off altogether, to push in the headphone button.

"Which is the headphone button? . . ."

Perhaps she preferred the sound coming from the stylus only. Which brings us to the next funny thing.

Music Centre Problems

A music centre came in with a complaint about the cassette section. This was eventually traced to poor contacts on the edge connectors (intermittent loss of oscillator bias to the record head). Having cleared that headache up we thought we'd better check the radio and the record player sections. The radio was o.k., but when our test record was put on it sounded most peculiar.

Now whatever may be on a test record, if you've played it hundreds of times you know every tiny piece on it and can immediately spot a difference. This particular one was a vocal, and a solo vocal at that. There were two voices however, one preceding the other by exactly one line of the song – as though it had been arranged that way, but I knew it hadn't.

All sorts of possible gimmicks presented themselves to my mind and were promptly dismissed. I then took a look at the stylus and found it twisted so that both the tip and one edge were riding in the grooves at the same time, the sound from the edge not being very inferior to that from the tip.

The customer hadn't mentioned this added facility, but I wondered whether his records had appreciated it. My test record seems not to have noticed, but it doesn't sing a duet now. I'm expecting the owner to ring up and complain that he no longer has a double tracking capability.

Mr. Pinchpenny's Portable

When Mr. Pinchpenny popped his ITT Featherlite portable in, he popped the inevitable question. "How much will it cost?" Since at the last count he was worth about ten million we didn't actually give him an estimate, merely saying that it would probably break him. This provoked no more than a wintry smile, and he left promising to return on the morrow. He gave a quick look at our colour portables on the way out, and visibly shuddered at the price.

The complaint was that the picture would become very grainy on occasions, while on others it would distort and lose hold. The first complaint we attributed to a dry-joint in the varicap tuner (right), the second to faulty bridge rectification (wrong).

The Graininess Came and Went

We found that by giving the tuner an affectionate squeeze the graininess would come and go. We usually take the tuner out and go over the soldered joints around the input stage, also any others that may look a trifle suspect, then refit the tuner for test. If there's any further trouble we fit a new one. In fact the soldering proved effective on this occasion, so Mr. Tightfist was saved a few bob on this score.

Supply Line Trouble

The bridge rectifier proved to consist of four hefty diodes which didn't respond to hair drying or freezing. Evidence of poor smoothing came and went at random however, and was unaffected by shunting each diode in turn with a 1N5408. We then turned our attention to the main smoother, clipping another in its place. The curvy verticals etc. still came and went, but now at about half-hour intervals. Initially it seemed as if the electrolytic had done the trick. But no. We eventually turned our attention to where it should have been turned when doubt first arose – to the series regulator transistor, which in this model is in the negative return from chassis.

We replaced the regulator transistor, using a BD203, and had no further trouble. We'd wasted a lot of time however through not suspecting a regulator fault as a result of doubts about the bridge and the smoother.

We'll doubtless be chatting about bigger boobs next time.

The K70's Field Timebase Circuit

Brian Dempster

AT first sight the field timebase circuit (see Fig. 1) used in the Philips K70 chassis looks strange indeed. An output transformer with no fewer than five windings, a pentode oscillator whose anode is connected to chassis, field output stage stabilisation and, oddest of all, a peculiar sync arrangement which Philips called "automatic field sync". A very similar though even more complex circuit was used in the subsequent K80 chassis. These hybrid colour sets incidentally were imported during the colour boom period of the early 70s, most of them starting out in life on rental through Visionhire branches.

It's fortunate from a servicing point of view that the circuit is pretty reliable, most troubles being simply a matter of defective valves. The circuit is likely to puzzle anyone who has to take a closer look at it however, and unfortunately information on it is hard to obtain (there's no circuit description in the manuals, and Philips UK seem unable to help – presumably all the original information is in Dutch or Swedish). The aim of the present article is to fill this gap.

Phase-controlled Oscillator

The basic idea behind the design is to maintain close phase control of the field oscillator, as well as frequency control, in order to achieve the best possible interlacing. Following conventional practice, the field oscillator's free-running frequency is slow (in this case 46·3Hz). It's brought up to 50Hz in two steps. First, the positive-going output from a phase discriminator is used to raise the frequency to 49·7Hz. Direct field sync pulses are then applied to bring the frequency to 50Hz.

Sync System

We'll consider the sync system first. A separate field sync separator transistor, fed with a negative-going luminance signal at about 6V peak-to-peak, is used. The output from this is integrated to give a roughly parabolic field sync pulse whose amplitude may vary with signal strength. It's fed to a clipper stage therefore (TS456, Fig. 1). This transistor is normally reverse biased via R1243. The most negative-going excursions of the sync pulses cause it to saturate however. In consequence it produces fixed-amplitude, positive-going field sync pulses with a low source impedance.

These sync pulses are integrated by R1249 and C832 and presented to the anode of the phase discriminator diode GR496. The mean voltage at the cathode of this diode is about 12V – the cathode is returned via R1252 to the cathode of the field output pentode. GR496 is reverse biased for most of the time therefore, and the positive-going sync pulses on their own are insufficient to overcome this reverse bias. The waveform at tag 3 of the field output transformer is also fed to the cathode of GR496 however, the flyback pulse at tag 3 being negative-going (see Fig. 2). C834 and R1253 differentiate this waveform, sharpening the flyback pulse and removing the scan component. This negative-going waveform is fed via C833 to GR496's cathode, and is again insufficient on its own to overcome the reverse bias applied to the diode. The combination of the positive-going sync pulse at its anode and the negative-going flyback pulse at its cathode results in GR496 conducting however (see Fig. 3).

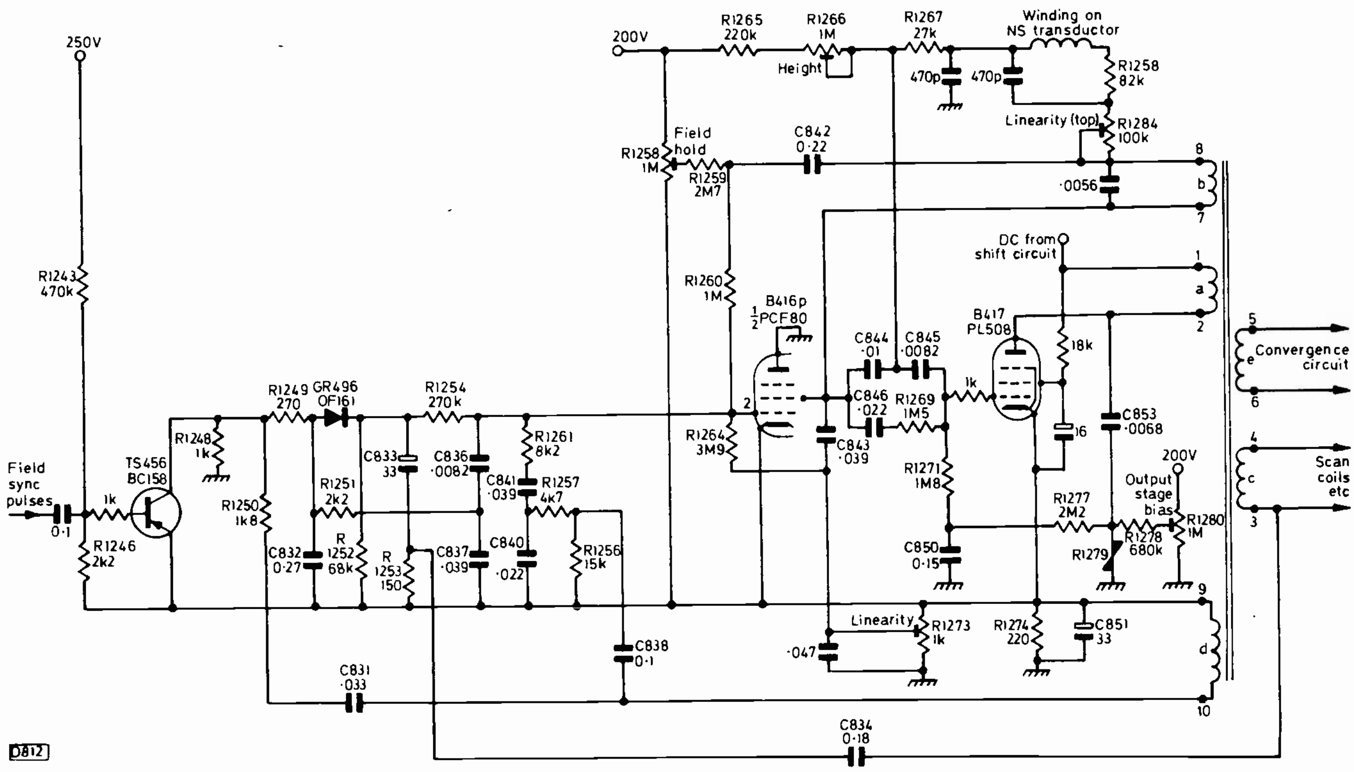


Fig. 1: The complete field timebase circuit used in the Philips K70 chassis.

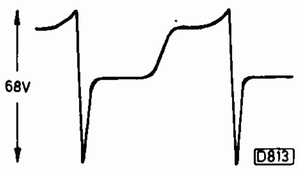


Fig. 2 (left): Waveform at tag 3 of the field output transformer.

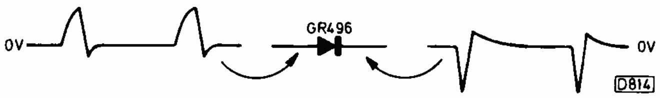


Fig. 3: The waveforms applied to the anode and cathode of the phase detector diode.

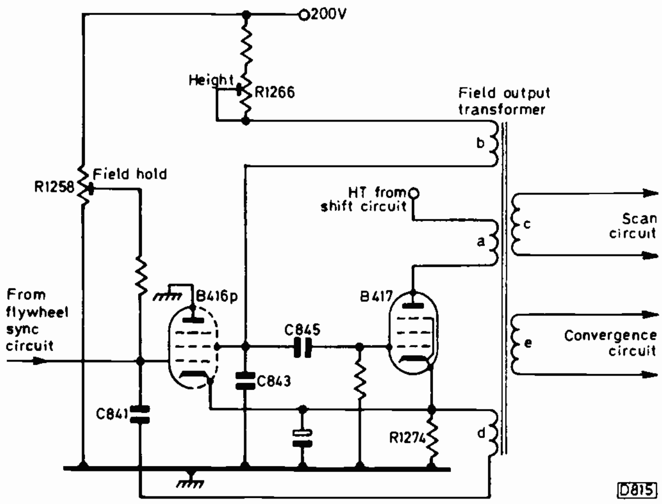


Fig. 4: Simplified circuit to show the action of the field oscillator stage.

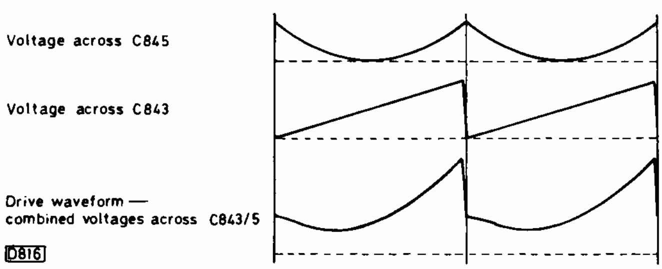


Fig. 5: Producing the drive waveform for the field output valve B417. B for bottle?!

As can be seen, the phase relationship between the field sync pulse and the field flyback pulse determines the anode voltage at the onset of GR496's conduction, and thus the voltage appearing at its cathode. This voltage is integrated by R1254 and C836/7 and applied to the field oscillator (B416p) valve's control grid. B416p's mean control grid voltage depends therefore on the phase of the oscillator relative to the transmitted field sync pulses.

The oscillator's free-running frequency should be set to 46·3Hz with no field sync pulses present, i.e. with the aerial removed. When the sync pulses are applied, the resultant shift in B416p's mean grid voltage raises the frequency to just below 50Hz (in fact to 49·7Hz). Now the field sync pulses are also integrated by R1251 and C837 and fed to the oscillator's control grid via C836. They initiate the flyback, locking the frequency at 50Hz. The phase of the oscillator is still controlled by the conduction of GR496 however, thus maintaining good interlace.

To prevent the oscillator frequency falling abruptly to 46·3Hz should the field sync pulses be momentarily lost – this would cause an unacceptable picture jump – a field waveform from tag 10 of the field output transformer is fed into the circuit after differentiation by C831 and R1250 (to remove the scan part of the waveform). The resultant pulses are reduced in amplitude by the potential divider action of R1250 and R1248, and maintain the conduction of GR496 in the absence of sync pulses. C833, C836 and C837 provide a flywheel effect, maintaining the speed of the oscillator at approximately the correct frequency for a period of time.

Oscillator Circuit

The strange looking field oscillator stage becomes rather less odd when two factors are pointed out. First and rather obviously, the pentode valve (B416p) is being used as a triode. Its anode and suppressor grids play no part in the action, its screen grid being used as the anode. Secondly, the circuit is actually a blocking oscillator, with positive feedback to the grid from winding d on the field output transformer. Winding b is concerned with linearity correction – see later. Fig. 4 shows the arrangement of the circuit in simplified form. The field output transformer should also now look rather less strange.

The charging capacitor C843 charges via winding b, the height control and the associated resistors to produce the basic field scan waveform. This is coupled to the control grid of the field output valve B417 via C845. During this time B416p is held cut off by the negative voltage at its control grid (on the upper plate of C841) and the positive voltage at its cathode (developed across R1274). The output pentode is thus being driven into increased conduction, and a negative-going sawtooth appears at its anode.

The flyback occurs when B416p switches on. The positive-going pulse which then appears at the anode of B417 is coupled back to the grid of B416p via winding d and C841. As a result, B416p saturates, discharging C843 and completing B417's turn off. When B416p saturates, its grid current charges C841 negatively with respect to chassis. Thus B416p switches off, C843 starts to charge again and the foward scan recommences.

The negative charge on C841 leaks away via the field hold control network. Eventually B416p would switch on again. This is the free-running frequency, set by R1258. As we've seen, this is slow and is brought to the correct frequency of 50Hz by the action of the sync circuit. The voltage to which C843 charges determines the height, and is set by the height control R1266.

Reverting to the full circuit, C838 and R1256 differentiate the waveform fed back to the control grid of B416p, R1257 and C840 integrating out any line frequency signal present due to mutual coupling between the line and field deflection coils.

Output Stage

Most of the complications around the output stage are due to the linearity arrangements. First, C843 is returned to chassis via the overall linearity control R1273. This means that the bottom plate of C843 is linked to a proportion of the parabolic waveform at the cathode of the output pentode. The result is that the exponential waveform produced as C843 charges is converted to a sawtooth waveform. This next has added to it the waveforms across C844 and C845. During the flyback, winding b on the field output transformer acts as a generator, charging C844. The rate of charge can be varied by means of the top linearity control R1284. During the forward scan C844 acts as a generator, driving current through C845, C846 and R1269. As this circuit is mainly capacitive, a parabolic waveform is developed across C845. This is added to the sawtooth waveform across C843 to give the final drive waveform (see Fig. 5).

The minimum drive voltage occurs at about a third of the way through the forward field scan. Any change in the d.c. conditions of the output valve could cause non-linearity at this point. Since neither linearity control can correct this, output stage stabilisation of the type usually found in valve line output stages is employed. The operation is exactly the same as with a line output stage. C853 couples the field flyback pulse to the VDR R1279. As a result, it changes to its low-impedance state. When it changes to its high-impedance state at the end of the flyback pulse, C853 has on its bottom plate a negative charge proportional to the flyback pulse amplitude. This voltage is filtered by R1277 and C850 and used to bias the output valve's control grid. R1280 allows the bias conditions to be set up.

Servicing

The setting of R1280 is important since it determines the mean voltage at the cathode of the output valve and, as a glance at the full circuit shows, this is a common point for much of the circuitry. After adjusting the height and linearity controls, R1280 should be set to give the voltage across R1274 (between 11–12·5V) indicated on the chassis – usually written on a small white label on or near the field output transformer. If this setting is incorrect, the result will be troubles such as intermittent field roll.

The method of setting the field hold control is, as you would by now expect, unusual. Remove the field sync pulse input by short-circuiting R1246. Connect an 8·2MΩ resistor between pin 2 of the field oscillator valve B416p and the slider of the field hold control R1258, then adjust R1258 for a stationary picture. Finally, remove the short-circuit and the 8·2MΩ resistor.

As we said at the beginning, the circuitry we've been describing has proved to be quite reliable. A couple of points are worth noting however. The polystyrene capacitor C836 in the auto sync circuit is a suspect component. It can be responsible for field collapse or lack of field sync. Weak sync (both line and field) can be due to a fault farther back in the circuit. Transistor TS451 drives the line and field sync separator transistors. Its collector load resistors R1145 (47kΩ) and R1147 (39kΩ) can increase in value to give this fault.■

Monochrome Portable

Part 3

Luke Theodossiou

IN this final instalment we shall deal with the c.r.t. base board, the front panel controls, the power input arrangements, the tube, connecting up, testing, and fault-finding.

The CRT Base Board

Most monochrome portable chassis designs do not include an adjustable focus control. We felt however that since it doesn't increase the price of the project by more than a few pence it is worth including, particularly since it *does* make a difference, as constructors will find out when setting up the receiver. The focus control and the flashover protection resistors are mounted on a small p.c.b. which includes the c.r.t. base connector. This arrangement makes for a neat and safe connection to the tube. The circuit diagram of the base board is shown in Fig. 4, while Fig. 3 shows the component locations. The focus potential is variable from 0-550V, whilst the first anode potential is derived from the junction of R3 and R5 and is normally 400V. The brightness control wiper (more about this later) is applied to the tube grid via R1, whilst the video signal from the signals board is applied to the cathode via R2. The heater is supplied directly from the 10·8V rail.

User Controls

The user controls comprise the brightness control, volume control, on-off switch, and channel selector. The interconnection diagram (Fig. 1) includes the necessary information for these controls.

The brightness control circuit is basically a potential divider which provides the c.r.t.'s control grid with a voltage of between 30V and 80V. The inclusion of the diode and the 10μF capacitor provides switch-off spot suppression by allowing a negative voltage change to develop across the capacitor. This, when transferred to the grid, cuts off the tube. The small value decoupling capacitor at the wiper of the control prevents line pulses being picked up. These would cause striations on the screen. Note that the e.h.t. takes time to discharge after switching off, so that care is required.

The volume control operates as a potential divider in conjunction with R11 on the signals board, supplying a variable voltage to pin 6 of IC1. This operates the electronic volume control circuit inside the i.c.

The secondary winding of the mains transformer is connected directly to the a.c. input pins of the bridge rectifier BR1 on the timebase board. Battery operation is achieved by applying the input to terminals 1 and 3 of connector D on the timebase board, i.e. directly across the reservoir capacitor C26. If a proprietary socket is used for the mains/battery connection then automatic changeover is effected when the battery connector is inserted. Protection against reversed battery connections can be incorporated if a diode such as a 1N4003 is connected as shown in Fig. 1 across the supply *after* the fuse. If the leads to the battery are reversed the diode conducts and blows the fuse. This precaution is not necessary if a cigar lighter adaptor is used for connecting up to a car battery, but is worthwhile if crocodile clips are used.

Choice of Tube

We have left the choice of tube to the constructor's own preference. The circuit will drive any 110° tube with a 20mm neck. The tube used in our prototype is the Mullard A31-410W. The screen size is unimportant. If one of the newer generation of tubes is used, e.g. the Mullard A31-510W, the focus and first anode voltages will have to be reduced to +130V. This can easily be done by using the video supply rail. These tubes are rather difficult to get however, and are rather more expensive than the usual types one encounters in portable sets. Japanese tubes can also be used without any difficulty. We tried the Toshiba

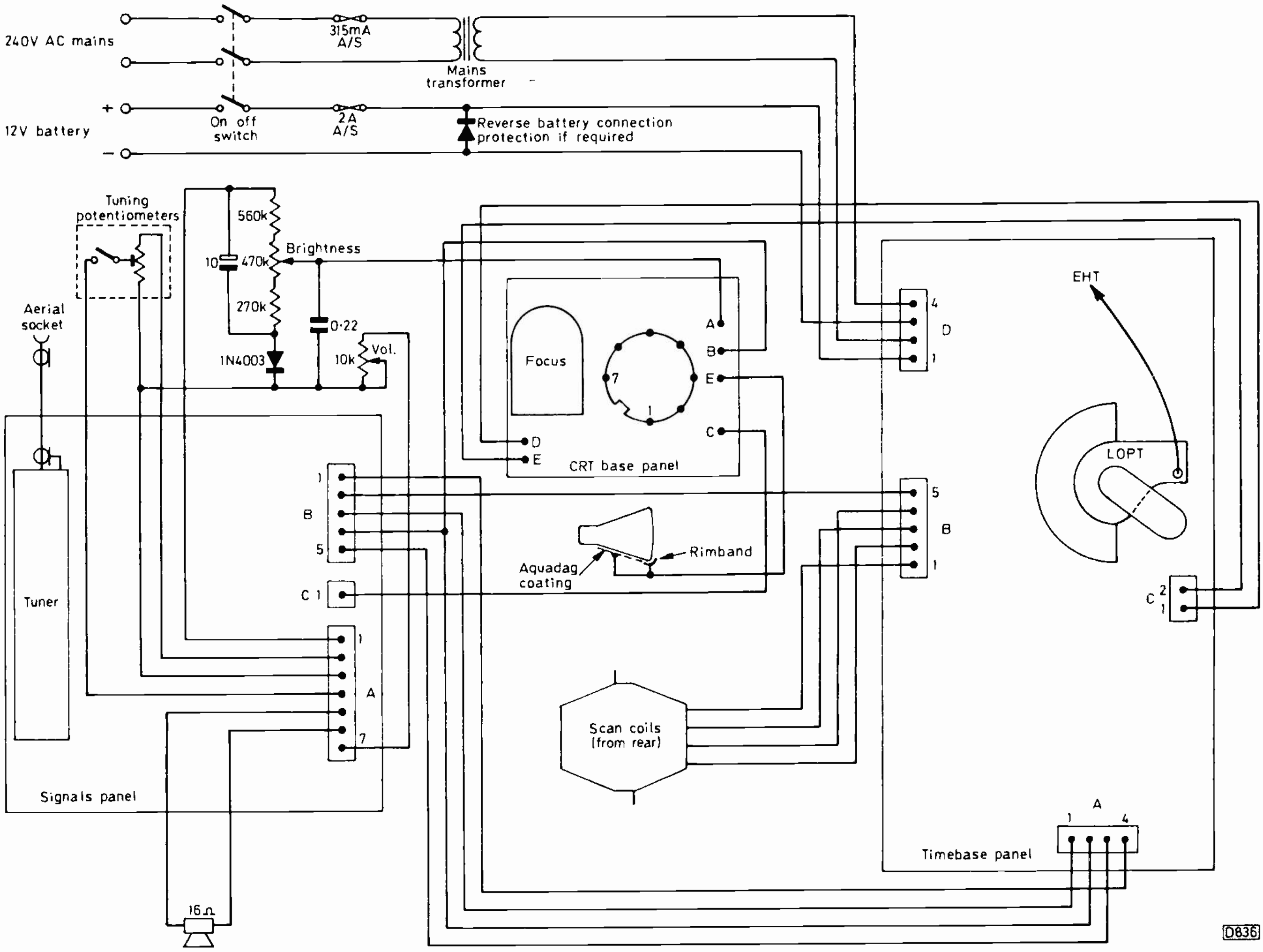


Fig. 1: Interconnection diagram.

★ Components List

C.r.t. base board:

R1 8k2
R2 1k5
R3 100k
R4 22k
R5 270k
VR1 470k
Standard horizontal mounting preset.

Note: All resistors are 0·5W carbon film.

User controls and miscellaneous components:

560k.
270k
470k lin., rotary or slider potentiometer
10μF 250V electrolytic
220nF 250V polyester
1N4003
10k lin. rotary
315mA and 2A anti-surge fuses
3-pole on-off switch*
4 or 6 position tuning head (100k potentiometers)
Scan coils Orega 4081
C.r.t. base board, p.c.b. ref. no. D076
Aerial socket
PCB mounting c.r.t. base socket
Mains transformer: secondary 15V at 3A, e.g. RS 207-267 with secondary windings connected in parallel.
Mains/battery input socket*

*These components are as used on the Bush BM6514AH receiver, and may be obtained from: The Service Dept., Rank Radio International, Watton Road, Ware, Herts SG12 0AE.

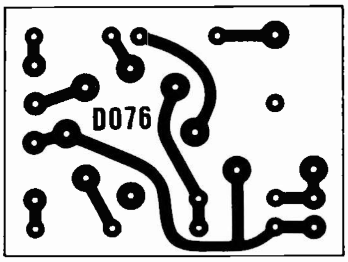


Fig. 2: Track pattern for the c.r.t. base board.

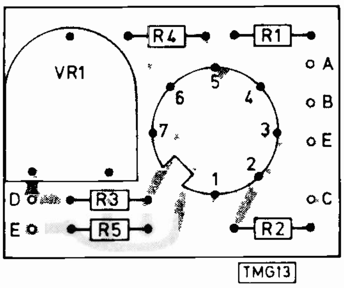


Fig. 3: Component positions on the c.r.t. base board.

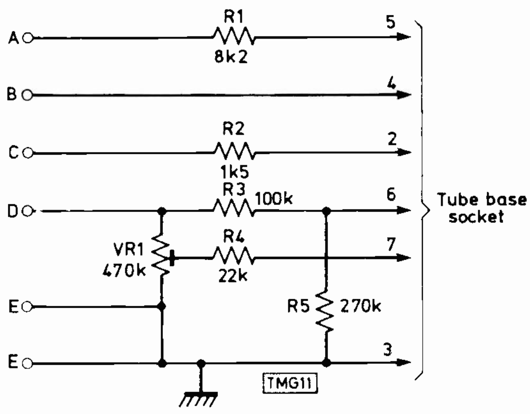
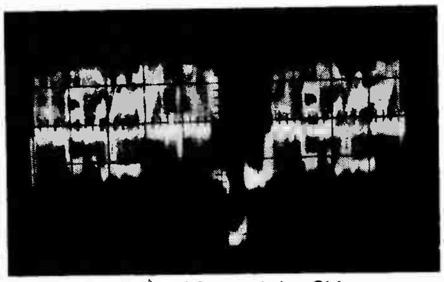
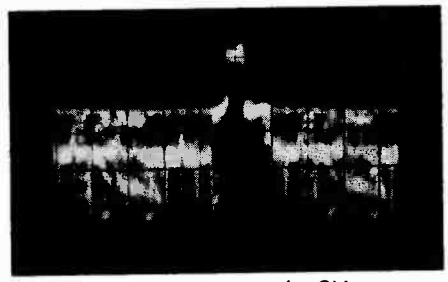


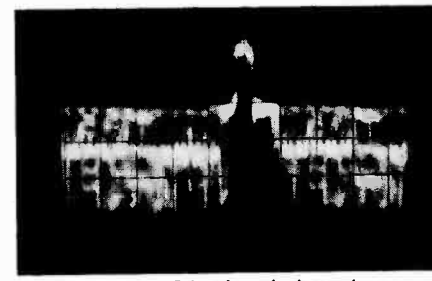
Fig. 4: Circuitry and connections on the c.r.t. base board. The c.r.t. heater is supplied from the main l.t. line which must not exceed 11V.



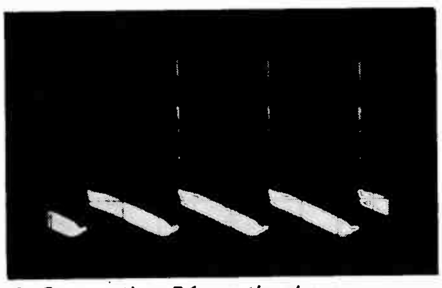
1: Pin 1 of the i.f. module. 3V peak-peak, 10μ sec/division.



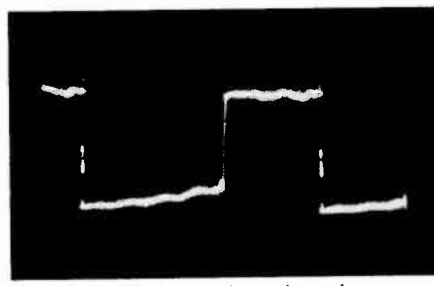
2: Pin 2 of the i.f. module. 3V peak-peak, 10μ sec/division.



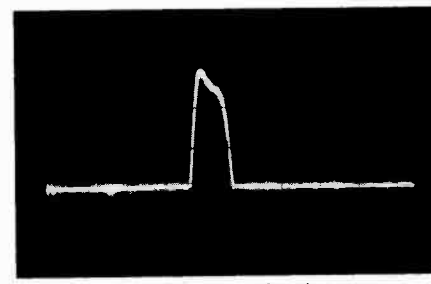
3: Connector C1, signals board (c.r.t. cathode). 55V p-p, 10μ sec/division.



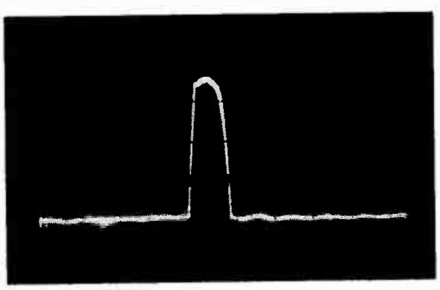
4: Connection B1 on timebase board. 25V p-p, 10msec/ division.



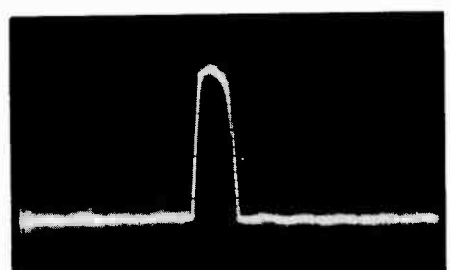
5: Base of Tr1, timebase board. 6V p-p, 10μ sec/division.



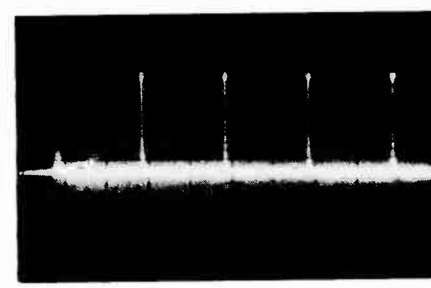
6: Collector of Tr1 on timebase board. 250V p-p, 10μ sec/ division.



7: Line output transformer pin 2. 150V p-p, 10μ sec/division.



8: Line output transformer pin 7. 380V p-p, 10μ sec/division.



9: IC1 pin 8, timebase board. 5V p-p, 10msec/division.

M6529FZP, which proved to be a direct equivalent to the Mullard A31-410W.

Connecting up and Testing

The interconnection diagram (Fig. 1) shows the way the three boards are connected up. There is nothing difficult about this, but a few points are worth mentioning. The timebase board will in fact operate without the signals board being connected up. This is sometimes helpful when first switching on – to avoid total disaster! The oscillograms are helpful in determining that the various sections are functioning correctly. Don't forget to earth the c.r.t. rimband and its Aquadag coating, preferably using a spring to ensure contact at all times. The earth connection *must* be made at the c.r.t. base board and not anywhere else.

The aerial connection is made via a piece of coaxial cable to an aerial socket. An aerial isolator is not necessary but can be used if desired. Ensure that the connections to the mains switch and the mains side of the transformer are well made and insulated.

After thoroughly checking the contruction of the p.c.b.s and the interconnections, switch on and adjust VR4 for +10·5V at the emitter of Tr2. Set all controls half way. Assuming that you have a noisy raster on the screen, tune into a station and adjust L1 on the signals board for best sound, VR1 and VR3 on the timebase board for field and line lock, VR2 for optimum vertical linearity, L1 for best horizontal linearity and the contrast control VR1 on the signals board in conjunction with the brightness control for a good picture. The focus control is finally adjusted for optimum overall performance (particularly noticeable at the corners). The scan coils have to be correctly orientated, then locked using the retaining screw on the back. Rotate the shift magnets both individually and together to centre the raster vertically and horizontally. The pincushion correction magnets on the periphery of the scan coils may be adjusted on a slightly reduced raster for minimum pincushion distortion.

The line scan coils are specified as having a possible variation of ±5% on their resistance and/or inductance values. Although the nominal supply voltage required for a correctly sized picture is 10·5V, this may have to be adjusted slightly to counteract this tolerance. In our prototype, one set of scan coils required 10·5V and another 10·8V. Don't exceed 11V.

The best way of setting up the line and field hold controls correctly is to tune the receiver to an unused channel, wait a few seconds, then switch to a local channel. The optimum position for the controls is when the picture locks in the minimum possible time.

Fault-finding is made easier by checking each stage using the oscillographs shown. Bear in mind however that if a supply rail is missing some or all of these will be absent or incorrect. If excess current is drawn from the supply (for example if the 2A fuse keeps blowing) the probability is that either Tr1 is short-circuit or IC2 is failing to oscillate (in this circuit IC2 switches Tr1 *off*). In the absence of a scope, the base of Tr1 can be shorted to ground to eliminate the second possibility.■

Components for TV

Part 2

Harold Peters

AFTER resistors, which we dealt with in Part 1, the next most numerous components in TV sets are of course capacitors. In what order to deal with the various types? Let's start at the top, i.e. with the largest types, and work down. This brings us then to electrolytics, the largest capacitors to be found in TV sets and also the most troublesome. Ironically however some of the smallest capacitors found in TV sets today are also electrolytics: the working principle remains the same, but improvements in construction and manufacture have made drastic size reduction possible.

ELECTROLYTICS

The basic principle of the electrolytic capacitor is shown in Fig. 9. An oxide layer is electrolytically deposited on an aluminium plate by passing a current to it through a chemical fluid such as a borax solution. The current path is completed by a second aluminium plate, but it's important to note that this plate is not an electrode. The two electrodes are the first plate and the chemical fluid, with the dielectric the oxide layer formed by the electrolytic process.

The action is similar to charging a car battery. The bubbles don't rise to the top however but hang about on the surface of the plate to form an insulator. This will never be a perfect insulator, so there's bound to be some leakage current always present. The greater the polarising voltage, the "bigger the bubbles" or oxide layer. This explains why physical size and working voltage are related. Furthermore the form of the oxide layer can be regulated by the strength and composition of the chemical used as the electrolyte. An electrolytic will break down if its stated voltage is grossly exceeded, but could possibly reform.

Another factor which determines the capacitance is the surface area of the aluminium foil which forms the positive electrode. By etching or roughening the surface of this foil the area exposed to oxidisation is increased, and thus so is the capacitance for a given size of can.

To select an electrolytic for any purpose, choose one just over the capacitance required and nicely above the working voltage. If this is not observed what can happen?

Over Voltage

If the working voltage is exceeded the oxide layer will break down: the capacitor "bubbles" will collapse, leaving a low resistance. If there's no protection the wattage thus dissipated will boil the electrolyte. The capacitor will explode, showering the rest of the set with a rotten smelling conductive chemical paste in a binding agent (like tissue paper). The stuff tastes rotten too! Large capacitors, which can find themselves exposed to this treatment, have a form of expansion vent fitted into the rubber sealing ring. This may blow out like bubble gum, but don't be tempted to prick it.

Under Voltage

An electrolytic run without a polarising voltage, or with very little, will slowly lose its capacitance value. This can take two-three years to occur, and is guaranteed to provide you with fault symptoms which are not in the manual. If the polarising voltage is low, but still effective, the oxide layer may in time modify itself to give increased capacitance at the expense of working voltage. This depends on the way the capacitor is made however.

Reverse Voltage

Reversing the voltage, for example "putting it in the board the wrong way round", should produce the same overheating effect as applying an over voltage, together with the same bang and mess. A slight reverse voltage is permissible however. It should never exceed 2V or 10% on low voltage types. This feature permits electrolytics to be used in such circuits as long-tailed pair discriminators where the error voltage can momentarily swing either side of balance due to sudden changes. For such short bursts of reverse polarisation, the oxide layer remains formed and the value in microfarads stays put. Longer periods of reverse polarisation cause the electrolytic to form up the other way round, that is an oxide layer begins to form on the negative aluminium electrode which normally supplies the current into the chemical paste. If this happens, the reversed electrolytic will have only about 10% of the capacitance value it should have.

Excessive AC

You will probably have guessed from the foregoing that the peak-to-peak a.c. applied to an electrolytic should not exceed the rated d.c. voltage or swing more than 2V negative. This point must be strictly observed where high alternating currents flow – for example in output coupling circuits and power supplies. Reservoir capacitors in power supply circuits suffer most in this respect, due to under design.

You may think that it would be the leakage current that lets the side down in such cases, but in fact it's the series resistance formed by the basic resistance of the chemical paste and the poor lateral resistance of the oxide layer. With the reactance of the component being low to a.c., the high alternating current that flows is dissipated as heat in the series resistance: if the foil temperature exceeds the case temperature by up to 10°C, gases will form within the can.

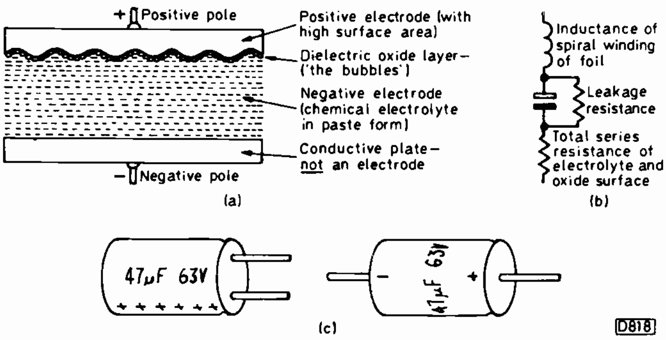


Fig. 9: The electrolytic capacitor. (a) Construction. (b) Equivalent circuit. (c) Leadout arrangements, radial (left) and axial (right).

Tolerances, Forming and Shelf Life

Because of the nature of an electrolytic capacitor, the precise capacitance value is more difficult to control than with other types of capacitor. The figures on the label are usually the minimum value. A generally quoted capacitance tolerance is +50% −10% of that stated.

The oxide layer is formed during manufacture, just as you get an initial charge on a new car battery.

Once properly formed the capacitor usually gives no further trouble, and just as with a car battery the best thing to do from then on is to use it regularly. If you store an electrolytic capacitor for too long the oxide layer may deteriorate. If you think that this has happened, it will pay to apply a steadily increasing d.c. voltage across it for a few moments before recommissioning it.

The same advice applies to equipment containing electrolytics when brought back into service after a long period of idleness. They will always benefit from having the supply applied gradually. Not everybody has a variac, but a 100W lamp in series with the spare TV for the first five minutes of use after it's been stored in the attic should do it the world of good.

The service life of an electrolytic depends on how hot you run the equipment. Keeping capacitors below 40°C can add years to their lives.

Cans

An electrolytic capacitor's can is usually its negative element. This is not always the case however, so replacements should be checked. If the case is isolated it doesn't always pay to trust the insulation too much – use an external sheath if in any doubt.

In multiple blocks – that is cans containing more than one capacitor – some strange symptoms can result if the internal negative connections become severed from the tag or can. Under such conditions a spurious capacitor can form itself between the negative pin and case, its value being of the same order as the now incorrect values appearing at the other terminals of the block.

HF Performance

The equivalent electrolytic capacitor circuit shown in Fig. 9 suggests that an electrolytic will not perform very well at high frequencies. Some are worse than others. A typical series reactance is about 0·5 Ω at 100kHz. In a wideband circuit such as a video coupling network it pays to bypass the electrolytic capacitor with a metallised foil type for medium frequencies or a ceramic capacitor for very high frequencies.

Variants

Most electrolytic capacitors comply with what you have just read. Extra attributes offered by certain makers come from tight control in manufacture, careful material selection, or extra processing.

There are some very small electrolytics, looking like lozenges, in which the electrolyte is a solid chemical such as manganese dioxide. Where space is at a premium, or reverse voltages may be met, these types will be found. They withstand up to 15% of their rated voltage when operated in reverse.

There are also fully reversible electrolytics which appear to contradict everything we've just said. They are purpose made, and for the purpose of understanding them you should regard them as two electrolytics connected back to back inside the same can. It follows that a reversible electrolytic takes up more room than its polarised counterpart.

An extension of the solid chemical type is the tantalum capacitor. In this type tantalum replaces aluminium, and there's a solid electrolyte. For the extra you pay you get real miniaturisation, long life, good frequency characteristics, and stability in hot environments. Typical leakage current is a microamp or less. Because of their small size there's a printing problem, and a special colour code based on the resistor one is frequently employed.

FOIL CAPACITORS

Waxed paper capacitors have gone for good, having been replaced by foil capacitors. These divide into two types, metallised foil and film/foil (see Fig. 10).

Metallised foil types use a plain plastic foil as a base-cum-dielectric, the two plates being formed by depositing a thin coating of metal from opposite edges inwards on each side. When rolled into a block, wires are connected to each edge, giving a very compact capacitor which is encapsulated variously, most frequently with a thick waterproof lacquer.

Film foil types are reserved for more critical applications, and comprise a sandwich of two thin strips of metal foil with a plastic dielectric. The whole is rolled up, wired, and encapsulated in the same way as the metallised foil type. By comparison they are more bulky and costly for the same item.

There was a time when the dielectric foil was always kraft paper, but these days this is confined to special types. The two most common plastic types are polyethylene terephthalate (PETP, i.e. the usual type of polyester used) and polycarbonate. What's the difference?

Polyethylene terephthalate has a positive temperature coefficient, average loss factor, the capacitance decreases with frequency and the insulation resistance begins to fall at 50°C.

Polycarbonate has negligible temperature coefficient, low loss factor, the capacitance remains constant with frequency change and the insulation resistance begins to fall at 100°C.

For most purposes PETP is satisfactory, with polycarbonate the choice for high-voltage applications. Both have a common range of values from 0·1μF to 2·2μF, with working voltages from 100V d.c. to 400V d.c. and tolerances of 10% and 20%.

The pulse capacitors used for line flyback tuning have polypropylene foil, or possibly paper, or a combination of the two. The case will be of flame retardent material and thus have a BEAB safety mark. Values from 0·001μF to 0·01μF are common. Above this value they get a little bulky.

Because of the specialised nature of line output stage harmonic tuning (third harmonic for monochrome to get the voltage – fifth harmonic for colour to get the current) the capacitor values used do not conform to the IEC series but are made to order to suit the output stage.

Elsewhere, if the required accuracy is of the order of 1% a combination of polystyrene dielectric and a metal foil is found. With these materials very accurate values from 50pF to 0·04μF can be produced. They are very stable, have a low loss, and only a small negative temperature coefficient.

One disadvantage of all the above mentioned foil types is the fact that thermoplastics cannot withstand excessive heat. Care must be taken during soldering not to dwell on the joint for longer than is necessary. As the heat travels up

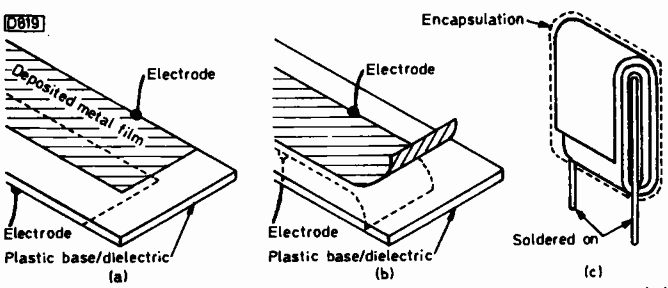


Fig. 10: Constructional differences between metallised foil (a) and film/foil (b) capacitors. (c) Encapsulation.

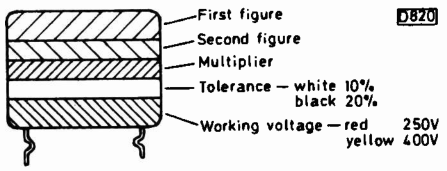


Fig. 11: Colour coding for the Mullard C280/352 series of metallised foil capacitors.

the wire, it can melt the edge connection, distort the dielectric, or push the leadout wire through the foil. After this the leadout could be held in contact with the dielectric by the pressing of the encapsulation. This is the invariable explanation for intermittency or failure after prolonged use, when oxidisation will introduce resistance at the "joint".

Polystyrene types suffer a further fault from the same cause: the capacitance changes value downwards. This has been overcome in the later varieties of these types by fitting wires other than copper – to reduce heat transfer – and by crimping the wires to stand the capacitor off the board (and thus up from the solderbath). Two seconds is as long as any self-respecting plastic foil can suffer solder temperatures.

The Mullard C280/352 is a popular series of metallised PETP foil capacitors. The appearance is attractive in view of the use of standard colour coding (see Fig. 11) on the body instead of printed lettering. The colours follow the resistor code given in Part 1.

CERAMIC CAPACITORS

The need for small physical size, high accuracy and high capacitance has come with the age of the silicon chip. Ceramic capacitors fulfil this requirement and have virtually replaced the silver-mica type of yesteryear. There are two sorts. One provides high *Q*, high accuracy, stability and a linear temperature coefficient. The other provides much higher capacitance values at the expense of *Q*, accuracy and a linear change of capacitance with temperature.

The latter are known as "high K" types, and include a range of really small, high-value items which are not really capacitors at all but consist of a sandwich of semiconductor material which can be regarded as two diodes back to back.

The precision, or "low K", types are chosen for their value accuracy and temperature coefficient, and range from 2pF to 300pF with working voltages from 63V d.c. to 100V d.c. They are made by depositing two metallic surfaces on to an extremely thin ceramic plate – this applies to the lower values. For higher values a sandwich version is used. This can be readily seen by looking at the specification. The temperature coefficient will jump at say 20pF from NP0 to N150, and at 150pF from N150 to N750. At these points the number of layers in the sandwich is progressively increased.

To recap on temperature coefficients, N750 for example means a downward change of capacitance of 750 parts per million per degree centigrade increase of temperature. Thus a 270pF capacitor at 15°C will change as the temperature rises to 25°C to:

$$270 - \frac{270 \times 750 \times 10}{1{,}000{,}000} = 270 - 2 = 268\text{pF}.$$

Such a change doesn't seem very significant, but there are some parts of the set where the temperature exceeds 50°C, and the change here will be of the order of minus 10pF.

This disadvantage can be turned to good effect if the designer has a drift problem. Just as resistive drift can be taken up by the use of a suitable thermistor, so tuning etc. drifts with heat can be effectively neutralised by incorporating a capacitor of known temperature coefficient in the network.

Capacitors with silver used as a deposition should be avoided. Silver has a habit of migrating in use – wandering over the edge to see what is going on at the other plate – and this does not aid stability.

Earlier we mentioned "high K" types. It would be better to talk of "medium K" and "high K" varieties.

The medium K types are constructed in the traditional manner, and extend the capacitance range from where the low K ones leave off. They are available from 300pF to 4,700pF. At 10% tolerance they are less precise, while their temperature coefficients are non-linear and positive. They do maintain the small physical size necessary for modern equipment however. Applications are in coupling and decoupling circuits, but they are often found in tuning circuits if the inductance alongside has plenty of tuning range in hand.

For higher capacitance values, but still within the size limitation, the high K types are available. These extend the range to 0·022μF, the increase in capacitance for the same body size being produced by the novel technique mentioned earlier. Two semiconductor layers are mounted back-to-back so that the one conducts whilst the other forms a high capacitance barrier layer, and vice versa. At up to 0·022μF the working voltage reaches 50V d.c., but if only 6V d.c. is required it's possible to get as much as 0·1μF into the encapsulation.

Some leakage is bound to be measurable with these devices, and it's to be expected that they will show different leakages each way round. Their behaviour is very similar to that of a solid dielectric type of electrolytic, so it will come as no surprise to find that the tolerances – typically −20% +50% – are also similar.

TRIMMERS

The only application in TV sets for capacitive trimmers these days is where fine tuning of a crystal oscillator is needed – for example the colour reference oscillator and teletext clock oscillator. There are three common types, the air-spaced (or "beehive") variety, the ceramic disc type, and the film dielectric type.

The latter are the most versatile, since the number of plates can be varied to suit the requirement. Ranges vary from 1½pF to 5pF for a single vane type and from 5pF to 60pF for a multivane type etc. Certain solvents are death to them, and they abhor a lot of heat since this will melt the plastic dielectric foil. One of the tag connections usually comprises a leaf from each stator vane, so they need to be soldered in with care to avoid intermittence in service.

If you adjust any of these types with a metal trimming tool this becomes part of the rotor and adds to the capacitance. A non-metallic tool is favoured therefore. Try also to avoid the use of locking paint – this can alter the dielectric value as it dries out.

Service Bureau

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NATIONAL PANASONIC TC2201

The picture's colour temperature drifts, necessitating adjustment every few days. There's no particular bias favouring either of the three primary colours – any of them may need to be increased or decreased. The problem seems to be worse with the rear cover left in place – with it removed, only a weekly adjustment is required to remove the colour cast.

We've known the problem to be caused by leakage in the spark gaps embodied in the c.r.t. base connector. Dismantle the socket carefully, then check and clean these. Also make sure that the tracks of the first anode (background) controls are clean and noise-free. Finally suspect diodes D361/2/3 in the flyback blanking network.

WALTHAM W125

The trouble with this set is too much height. Even with the height control at minimum, there's still an overlap of at least 1½in. at the top and the bottom.

The suspect components are the resistors in series with the height control, R332 (1MΩ) on one side and R339 on the other. The latter is specified as 680kΩ/1MΩ/1·5MΩ/2·2MΩ on the circuit, i.e. it can be changed up to 2·2MΩ if necessary to suit the circuit. It's just possible that the height stabilising VDR is defective.

BEOVISION 3400

Slight defocusing and a generally tired look has replaced a picture that was previously first class and needle sharp. The focus control seems to be hidden away, so I haven't attempted adjustment.

It's likely that one of the high-value resistors in series with the focus potentiometer has changed value or that the control's track has become noisy – try rotating it to and fro to clean the track. The control is accessible through a hole in the top right-hand side of the line scan screening cover, and should be adjusted only with a well insulated tool.

TELEFUNKEN 709 CHASSIS

An even, gradual reduction in height was followed by field collapse. I've tried a new PL508 field output valve, and also replaced its cathode components and the high-value resistors in the height circuit, but the problem remains.

The field timebase circuit used in this chassis has some unusual features. As a first step, check whether the fault is in the output stage or the preceding circuitry. This can easily be done by connecting an 0·1μF capacitor between pins 4 (heater) and 1 (control grid) of the PL508. This should produce some sort of raster if the output stage is all right. If so, check transistor T421 and the two diodes Gr421/2. Check for –48V at the junction of R431 and the height control – if this voltage is absent, check its source in the line output stage. The suspect components here are the rectifier diode Gr490 and its reservoir capacitor C491. If the 0·1μF capacitor does not produce some sort of raster, check the 100Ω screen grid feed resistor R444 and the raster correction transductor Tr480. The latter is in series with the field scan coils, and sometimes goes open-circuit.

PHILIPS 300 CHASSIS

The trouble with this monochrome set is lack of line sync – as the line hold control is turned four images appear. The sound is o.k. and there's a full raster.

There are two ECC82 valves in the line generator department, the multivibrator oscillator V2004 and the flywheel sync valve V2003. Try interchanging them. If this cures the trouble, replace the low-emission valve. If it doesn't, check the values of R2144 (27kΩ), R2164 (470kΩ) and R2146 (220kΩ), all of which can change value. Check also the print connections to the hold control and the contrast control, and inspect the print around the valve bases. In a stubborn case, check the multivibrator cross-coupling capacitors C2060 (56pF) and C2061 (100pF), and the PFL200 video/sync valve and associated components.

THORN 8000 CHASSIS

On several of these sets we've had what appears to be severe ringing in the i.f. strip. Is there a known "stock fault" that causes this?

The only common cause of this effect we know about is slight misalignment of the quadrature coil L108 associated with the MC1330PQ vision detector i.c. (IC1). We suggest you try very slight adjustment of this coil on test card.

GRUNDIG 1500/3010

The problem with this set is picture quality. It appears streaky/scratchy, and the brightness control has to be well up. Previously the picture tended to become smeary after the set had been on for a quarter of an hour or so.

There are some miniature chokes in the i.f. strip that often gives rise to these symptoms – three of them, associated with the vision detector diode Di335. They are delicate and difficult to check and replace, a replacement i.f. strip often being a better solution to the problem.

BEOVISION 2600 (Type 3619)

There is excessive brightness on this set, the brightness control having little effect. Operating the service switch to collapse the field scan gives full control of the brightness however.

The first step to take is to check the 12HG7 luminance output valve by substitution. If the valve turns out to be o.k., it's likely that the 12V zener diode (circuit reference number 93) on the i.f. board is faulty. If necessary, check the –225V supply to the brightness circuit. This comes from diode 554 in the line output stage.

PHILIPS 320 CHASSIS

There's a constant hissing noise in the background. Also, with no signal there are two vertical black lines about an inch in from either side. These change to white when there's a signal. The voltages around the intercarrier sound i.c. are

correct, and adjusting the a.g.c. crossover control doesn't improve matters.

With the set switched off, connect a 100µF, 63V electrolytic from TP5 (base of the lower BD131 audio output transistor) to chassis. If this stops the hiss, the TBA750Q intercarrier sound i.c. is suspect. If the hiss persists, change the two audio output transistors. For the lines we suggest you check C2424 (15µF) and D2417 which smooth/stabilise the supply to the line oscillator i.c., and C2242 (16µF) which decouples the h.t. supply to the video output transistor. An oscilloscope would be a great help in tracking this fault down.

RANK Z718 CHASSIS

There's neither sound nor raster on this set. 5R6 on the line output panel was found to be burnt out, but replacing this and the two line output transistors has failed to resolve the problem. The two h.t. lines from the power supply are present, but are high at about 315V. Do you suspect the line output transformer?

The line output transformer would not be the first thing we'd condemn. We suggest you start by checking the line driver transistor 5VT1, which receives its supply from 5R6 when the set is running. If 5VT1 is short-circuit, check 5C1 and 5R1 which damp the primary winding of the driver transformer. Replace fuse 5FS1 in the start-up supply to the line driver stage. Then check the start-up capacitors – 4C18 in the line oscillator and 5C3 in the line driver stage. These can be bypassed by a 5·6kΩ resistor rated at 5W as a check and to sustain the line drive during any further fault-finding that may be required. If the line output stage is being overloaded, the protection circuit will operate, removing the drive at the base of the driver transistor.

ITT VC200 CHASSIS

It sometimes takes as long as a quarter of an hour for the sound and raster to appear after the set has been switched on – at other times the sound and raster come on normally. When there's a delay, switching on and off a couple of times will usually, but not always, get the set working. The trouble seems to be due to the line oscillator failing to start, since the line output valve gets red hot.

It's quite a common problem on this chassis. If a new PCF802 line oscillator valve doesn't eliminate the trouble, any of the four capacitors in the oscillator stage could be responsible – C124/5/6/7. Check them by substitution.

RANK Z718 CHASSIS (Model BC6111)

There is an intermittent tuning fault on this touch-tuned set. It usually occurs when the set has been on for twenty minutes or so. The set then detunes itself to a greater or lesser extent, the severity ranging from loss of colour with poor sound to complete detuning. The fault is worse on BBC-2 than on the other channels. The tuning voltage has been checked and remains constant up to the tuner sub-panel, but a slight variation in voltage can be detected along the feed line to the tuning voltage input pin of the tuner (pin 2).

The symptoms outlined suggest that the tuner itself is faulty. Varying internal leakage on the varicap tuning line is often the cause of this sort of trouble.

THORN 3500 CHASSIS

There's a problem with the chopper power supply panel. A replacement panel has been tried and the set then works o.k. The original power panel also works, but emits a high-pitched whistle from the chopper choke. There are also faint horizontal lines of the screen, about ¾in. apart. The 30V and 60V lines are present and correct.

Replacing two capacitors in the power supply should cure this trouble, the h.t. smoothing capacitor C619 (use a 220µF type) and C631 (0·01µF) in the chopper driver stage.

TELETON TA12

The picture on this mains/battery portable has started gyrating wildly. The field and line hold controls will not stabilise it. The sound and brightness are o.k. however.

Check the supply to the sync separator transistor TR207. It should have 22V at its emitter, with somewhat higher voltages at its base and collector. The collector supply is derived from the line output stage (90V rail), which must be in order since the rest of the circuitry seems to be working correctly. The supply comes via R229, which is decoupled to the 22V rail by the 1µF 50V electrolytic C232. We feel that this capacitor is likely to be the cause of the trouble.

THORN 1500 CHASSIS

The fault on this set is an extreme cogwheel effect. It can be almost cured by very delicate adjustment of the line hold control, but the hold is then so delicate that the picture frequently breaks up into lines. The top of the picture is always wavy.

The cogwheel effect on this chassis is usually due to C51 (1µF electrolytic) in the flywheel sync filter circuit going partially open-circuit. A sideways quiver at the top can be caused by the d.c. amplifier transistor VT10. Other components that may have to be checked are the discriminator diodes and C102 (12µF) which smooths the supply to the line generator. If the effect is more one of tearing, replace the charging capacitor C53 (180pF) in the blocking oscillator circuit. This tends to become leaky.

KÖRTING HYBRID CTV

Two dark bands, about 1½-2in. wide, are present in the background. They usually move slowly upwards and over, occasionally downwards. I've changed the valves in case of heater-cathode leakage, and the main h.t. smoothing electrolytic C603.

Hum bars on this chassis are usually due to problems in the l.t. regulator section. The most likely culprit is the series regulator transistor itself, T651 (AD142), which should be checked by substitution. The other semiconductor devices in this department can also cause the problem though. These are T653 (BC173B), T652 (BC148B) and the 12V zener diode D651. A more remote possibility is the BY164 bridge rectifier or its reservoir capacitor C650 (2,500µF). When the repair has been completed, make sure you adjust R654 for 24V at TP52.

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TELEVISION JULY 1980

PYE 731 CHASSIS

The trouble is that the mains fuse keeps blowing. Lift the h.t. fuse and the mains fuse holds, so the trouble would appear to be in the line timebase. I've tried just about everything though – the tripler (disconnected), the EW modulator diodes, the first anode supply reservoir capacitor, the line output and driver transistors and the line output transformer.

You seem to have checked the most likely suspects. There are one or two capacitors that could be responsible for the trouble if leaky however – the flyback tuning capacitor C549, the h.t. smoother C550 and the capacitors in the EW modulator circuit. If these are o.k., lift the h.t. fuse and measure the current flowing, then progressively disconnect various legs of the circuit in turn. The scan coils could be faulty for example (disconnect SK584). The focus potentiometer frequently goes low, taking the tripler and the line output transformer with it.

TEST CASE

211

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.

The telephone request was to attend a Pye set with the no sound or raster symptom. The field engineer called and sure enough the set was giving no results at all. It was a solid-state set (Pye 741 chassis), and our engineer had little experience of these (we'd become rather disillusioned after renting out many hundreds of the earlier hybrid sets). The power supply seemed to be quite dead, for no apparent reason, so the set was brought into the workshop for attention.

The job was assigned to a new recruit. He too was without experience of these Pye sets, but had a business like approach to any set given him. Into the power supply department he went, armed with meter, scope and an air of purpose. The 741 (also 731, 735, 737 and 725) chassis employs a reasonably conventional thyristor regulated power supply, of the half-wave variety. The usual charging circuit fires a diac which in turn triggers the thyristor. Soft-start and over-voltage circuits complete the general arrangement. The thyristor tops up its reservoir capacitor C880 (600μF) via a 3·3 Ω surge limiter, which forms part of a large power resistor assembly. The other two sections of this are the h.t. filter resistor and the anti-breathing resistor in the feed to the line output stage.

As time dragged on, our man's face grew longer. He'd long since discovered that there was no voltage at the cathode of the thyristor, nor anywhere along the power resistor unit. The full mains voltage was reaching the anode of the thyristor however, and after extensive checks no fault could be found in the triggering circuit. Pulses were present at the diac and at the gate of the thyristor, but the thyristor simply wouldn't fire! Nor would two more from the stores.

The frustrated engineer was soon put out of his misery when he explained the symptoms to a member of our staff who'd crossed swords with these Pye sets before. Only one component had to be replaced to restore life to the Pye, and to our flagging bench engineer. Any idea which?

ANSWER TO TEST CASE 210
– page 452 last month –

A case of old wine in new bottles! It will be recalled that the floating, white interference lines were not present on the old Thorn monochrome set, nor on the rather newer Sony loan set. The new Decca sets suffered badly however.

The vital clue was given by the elimination of the effect when a coaxial attenuator was fitted. The signal from the aerial passes through the power unit box (for the masthead amplifier) on its way to the TV set. The masthead amplifier is powered via the coaxial downlead from the aerial, so the power unit box incorporates components to provide d.c. isolation between the unit and the TV set. Just two components, a choke through which the d.c. is fed to the inner conductor of the coaxial downlead, and a d.c. blocking capacitor between the inner conductor and the output to the receiver (see Fig. 1). As a result of this, the coaxial cable's inner core is electrically isolated and floating unless earthed by the isolating network used in the set's aerial socket.

It seems that the impedance from this point to chassis in the Decca set is sufficiently high to enable the inner core to pick up mains hum, giving rise to the strange effect noted on the picture. This effect is no doubt aided by the half-live chassis arrangement used on this model. The coaxial attenuator contains matching resistors which effectively short this hum signal to the cable's outer conductor (the braiding). The senior technician in fact fitted a 1k Ω ½W resistor across the signal output connections in the power unit box. This value was high enough to kill the hum effect whilst having no attenuating effect on the signal.

The shocking BBC-1 reception and imbalance between signal strengths on different channels is a common legacy from the early days of single-channel (BBC-2) u.h.f. reception. Many of the aerials produced in those days were cut (tuned) to the frequency of the BBC-2 channel required, i.e. they have a peaked response with poor bandwidth. We advised the customer to change to a modern group C/D aerial, retaining the existing masthead amplifier – and 1 kΩ resistor!

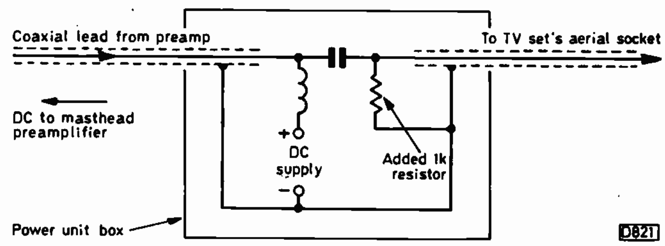

Fig. 1: Masthead preamplifier powering arrangement.

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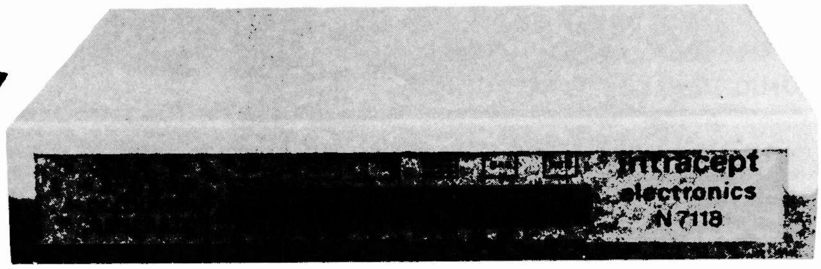

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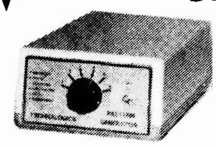

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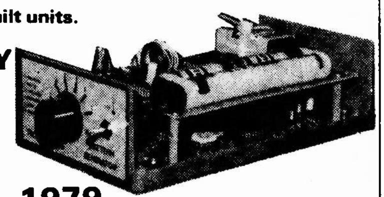

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200 + 200 + 75 + 25mfd	CVC5	£1.70
200 + 200 + 150 + 50mfd	2047	£1.70
200 + 200 + 100 + 32mfd	169	£2.20
300 + 300 + 150 + 100 + 50mfd	2040	£2.60
1000mfd 63v.	3500	50p
2200mfd 63v. (PC)	G9	80p.
1250mfd 50v.	691	45p.
4700mfd 25v. (PC)	1590	60p.
2500 + 2500mfd 30v. (PC)	A823	90p.

PLASTIC FILM CAPACITORS

Mains Filter Capacitors 250v. AC working

0.047mfd	26p.	0.22mfd	42p.
0.1mfd	36p.	0.33mfd	48p.
1.0mfd (Three wire type)	45p.		

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0.047mfd	22p.	0.22mfd	42p.
0.1mfd	28p.	0.47mfd	54p.

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4700pF	28p.
5200pF	35p.
11,000pF	48p.

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0.91mfd G11	44p.

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PLEASE ADD 30P. PER ORDER TO COVER POSTAGE AND PACKING. ADD VAT AT 15%

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Tenrec Electronic Engineers Ltd
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MONO TV'S from £10

COLOUR TV'S from £50

Hitachi colour in stock. All sets working and guaranteed.

PYE CT 205 etc. Solid State CDA panels **(NEW) £23**

*A31–410, 12" Mono Tube New. Special Price for Current "Television" Feature; **£19.** P&P–£2.

PYE 713 I.F. panels with S.A.W. **£11.39.**

Plenty of used colour panels working. S.A.E. for list. 50p p. & p.

Trade enquiries welcome

(All prices include VAT)

(T.I.)

REBUILT CATHODE RAY TUBES IN

SOUTH WALES

NEWPORT CARDIFF NEATH

C.R.T. SERVICES

274 Chepstow Road, Newport, Gwent.
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CARDIFF
Dependable TV, 9 Crwys Rd.
Tel. Cardiff 44006

NEATH
Sureview, 89 Windsor Rd.
Tel. Neath 567676

CURRENT PRICE LIST

A44-271X, A47-342X/343X	£30	470ERB22, 470FTB22	£40
A49-120X, A51-110X	£30	A51-161	£40
A56-120X, A56-140X	£33	A56-500X, 560HB22	£43
A63-120X, A66-120X	£36	A66-500X	£46
A66-140X, A67-120X/150X	£36	Add 15% VAT to all prices.	

Prices are based on a type for type exchange tube suitable for reprocessing.

TWO YEAR GUARANTEE ON ALL TUBES

BUSH 2211/14/15 AU 863
GEC 2110/SOLID STATE
DECCA 22/30 SERIES
FERGUSON 3713
PYE 18" 200-713 SERIES
KB 703/704
MITSIBUSHI CT 200B/202B
HITACHI CMP 190/20
THORN 8000

SPECIAL OFFER!

PYE 205 VARICAP (Sold as checked complete, good cabinet, tested tube)

	22"	26"
Singles	£28.00	£24.00
5's	£26.00	£22.00
20's	£24.00	£20.00
100's	£18.00	£18.00

Working Sets add £12 Delivery add £8 each
ALL PRICES PLUS VAT

SPECIAL OFFER!

COMPLETE COLOUR SETS (but minus tube)
Many Chassis Working
All Models and Sizes
First Come! First Served!
Quantity Discounts Deliveries Arranged
We are taking orders now
BATCHES OF 12 FOR £115 inc. VAT

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Hamilton
Tel: (0698) 282141

LONDON
395 397 Albany Road
Off Walworth Road
LONDON SE5
Tel: (01) 703 4040

LONDON
Cedar House
Nobel Road
Eley Estate
Edmonton
LONDON N18
Tel: (01) 807 4090

WEST
Unit 4a
Bulwark Industrial
Estate, Chepstow
Nr. Bristol
Tel: Chepstow
(02912) 6652

MIDLAND
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Street
Birmingham 5
Tel: (021) 622 1023

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HIGH TEMPERATURE PUMPED COLOUR TUBES

Orders accepted by phone, same day delivery. Manchester area £3.50. Mail Order anywhere by request, fitting while you wait £15 extra.

18"	A47 – 342×343×	**£30.00**
19"	A49 – 120×/192×	**£30.00**
20"	A51 – 220×/110×	**£30.00**
22"	A56 – 120×/123×	**£32.00**
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These tubes replace many Toshiba types.
Callers welcome, please phone first.
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Reg Office:
43 Clarke Cres, Little Hulton,
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While stocks last – 3 hour convertion kits for Philips 1500 Video's **£99** inc. P. & P.

QUALITY TV's ALWAYS AVAILABLE

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QUANTITIES OR SINGLES

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BERRYVISION 510 (set only).
EMO
THORN 3000/3500 Series, 8000/8500/8800/9000 Series.
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PHILIPS G8 G9
RBM A802/823 AV (Ultrasonic) BC6100.
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GRUNDIG 5010/6010 GB 5011/6011 GB.
PYE 691, 697, 713, 723, 731
SONY 1800UB
TRADE REPAIRS ON ALL SONY COLOUR T.V.'s
VERY COMPETITIVE PRICES.
3 MONTHS WARRANTY ON PANELS FROM DATE OF OUR INVOICE.
DISCOUNT FOR BULK PANEL ORDERS.
CATALOGUE AVAILABLE ON REQUEST.

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HIGH QUALITY COLOUR AND MONO-CHROME REPLACEMENT TUBES AT COMPETITIVE PRICES.

- ★ Complete New Gun fitted to every Tube.
- ★ Two year Guarantee
- ★ Every Tube Electrically Tested.
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- ★ Supplier to Major Rental Companies.

18″, 19″	£25
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25″, 26″	£29

All prices quoted assume the return of your old glass rebuildable condition. Old CRT cash/cheque with order. Please add VAT at 15%.

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Tel. 01-247 3097

BIRMINGHAM AND DISTRICT DEALERS/ENGINEERS

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HIGH VACUUM QUALITY REBUILT TELEVISION PICTURE TUBES

COMPETITIVE PRICES

CONTRACT TERMS AVAILABLE

2 YEAR GUARANTEE

E.G.

17" 18" 19"	**£29.50 + VAT £4.43**
20"	**£32.50 + VAT £4.86**
22"	**£34.00 + VAT £5.10**
25"	**£37.00 + VAT £5.55**
26"	**£40.00 + VAT £6.00**

PIL Tubes our speciality.
All Prices For Tubes available on a Sound "Glass for Glass" basis otherwise **£20** surcharge

Built up to a standard not down to a price.

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NEW TUBES AT CUT PRICES

EUROPEAN TYPE Nos.

	Price £	VAT £ 15%
A28-14W	18.95	2.84
A31-19W/20W	19.95	2.99
A31-120W/300W	17.95	2.69
A31-410W/510W	17.95	2.69
A34-100W	18.50	2.77
A38-160W	17.50	2.63
A44-120W	18.75	2.81
A50-120W	17.95	2.69
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A61-120W	18.95	2.84

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9AGP4	19.50	2.92
190AB4/C4	17.50	2.62
230ADB4	28.50	4.28
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240AB4A	17.95	2.69
CT507 equiv	18.95	2.84
CT512	27.50	4.12
310DGB4/DMB4	23.00	3.45
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310EYB4	18.75	2.81
310FDB4	19.95	2.99
310FXB4	17.50	2.62
310GNB4A	23.50	3.52
310HCB4	23.50	3.52
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340AYB4	25.25	3.79
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Some Rebuilt Japanese & European Types Available at £14.00 + VAT £1.75

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12VARP22	62.50	9.37
330AB22	67.50	10.12
470FUB22B	97.50	14.63
A44-271X	65.00	9.75
A47-342X	69.50	10.42
A47-343X	69.50	10.42
A49-191X	59.50	8.92
A51-161X	59.00	8.85
A51-220X	64.00	9.60
A56-120X	58.50	8.77
A63-120X	69.50	10.42
A66-120X	65.00	9.75
A66-140X/410X	70.50	10.57
A67-120X	65.00	9.75
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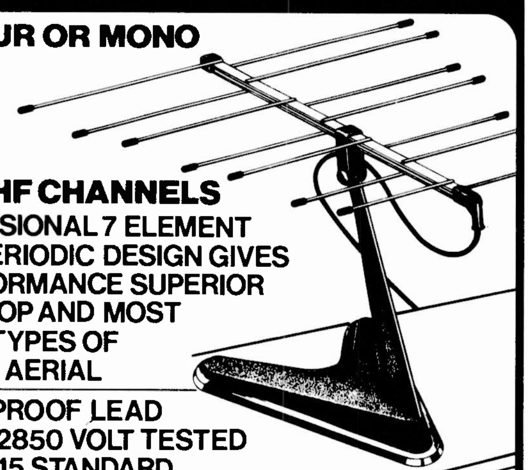

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LONG CABLE TO FIND BEST POSITION ON OR NEAR SET.

FOR HORIZONTAL OR VERTICAL POLARISATION

CAN BE WALL MOUNTED

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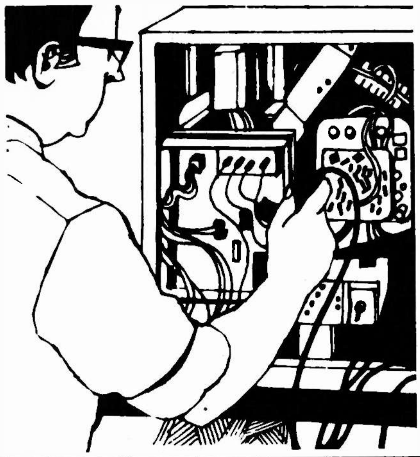

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Southern Valve Co.,
2nd Floor, 8 Potters Road, New Barnet, Herts.
Tel: 01-440 8641 for current prices & availability, all popular valves stocked. **NO CALLERS**, SAE Lists. Cash with order. Same Day Postal Despatch. (Lunch 12.30-2p.m.)

Valves, Tubes, Aerials etc by LEADING-MAKERS. Send SAE Lists or Phone for current prices. Counter or MAIL ORDER. NO COD. Speedy Despatch assured. No order under £1.
Philip Bearman, 6 Potters Road, New Barnet, Herts.
Tel: 01-449 1934/5 (1934 Recording Machine).
Please phone for opening hours.

DXTV. Band I sound and vision notch filters £17.90 inc post. Band I/II Mosfet aerial preamplifier (tuneable). Ideal in local overload areas, £28 inc post. SAE data. H. Cocks, Cripps Corner, Staplecross, Robertsbridge, Sussex. Tel: 058083-317.

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ANY 1–20p, 5–80p, 10–£1.25, 50–£5.50

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COLOUR VALVES 65p EACH

PY500/A, PL508, PL509, PL519.

Postage & Packing 30p, no VAT

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DX-TV AERIALS and Equipment. At Discount Prices. Send 40p in stamps for Catalogue. Aerial Contractors (Southern), 28 Caulfield Road, Shoeburyness, Essex.

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THORN 3000/3500 & 9000 TRIPLERS
High Quality Silicon Replacement Units
T3500 only **£3.95** inc. P.P. Add 59p V.A.T.
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ALL COLOUR TUBES HOT PUMPED AT 385c AND REBANDED TO BRITISH STANDARD. 415 1972 CLAUSE 18-2.

19" and 22" TUBES APPROVED. OTHER TYPES PENDING.

BRITAINS LARGEST INDEPENDENT REBUILDER FOR 21 YEARS.

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Rebuilt with new electron gun, to British Standard. High temperature pumping.

Here is what you pay.		VAT
17-18-19 inch	£29	4.35
20 inch	£30	4.50
22 inch	£31	4.65
25 inch	£34	5.10
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Guarantee 2 years.
Exchange basis.

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A38/160W **ONLY £13.50**
(Perfect for TELEVISION mono portable)
Guaranteed 12 months. Quantity discounts for trade and export.

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Over 1000 Colour and Mono TVs for disposal
Many working ★ All complete
Good cabinets ★ All screen sizes
Large or small quantities sold.
Regular supplies available.
Deliveries arranged if necessary.
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Faircrest Engineering Ltd., manufacture a comprehensive range of equipment for processing all types of picture tubes, colour and mono. Standard or custom built units for established or new businesses. We export world-wide and have an excellent spares service backed by a strong technical team.

Full training courses are individually tailored to customers requirements.

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FAIRCREST ENGINEERING LTD.

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WORKERS & NON-WORKERS,
TESTING FACILITIES AVAILABLE,
QUANTITY DISCOUNTS.

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(0302) 49583–68416
EX EQUIPMENT TUBES & PANELS

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19" £29.50, 20" £29.50, 22", 25", 26" £30. One year guarantee. **Colour TVs from £55 wk.**

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- BATTERY POWERED
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BUILT READY FOR USE
£17.45 plus 30p p and p

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Colour Tubes....................from **£25**
20 AX all sizes....................from **£25**
Toshiba P.I.L. All Sizes....................from **£20**
Top quality Regun 90°. All sizes.................... **£28**

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HIGH TEMPERATURE PUMPING
COLOUR (2 year Guarantee)

90° up to 19"	**£31**
90° 20" – 22"	**£33**
90° 25" – 26"	**£36**
110° and PIL	**£38**

MONO (including thin necks) from **£12.**

All prices + VAT
Delivery UK Mainland £6.
4 year Optional Guarantee
Agents in West London, Croydon, Anglia.
Send or phone for full list and terms.

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"SEE-VU" Works, Strangford Road, Seaham, Co. Durham. Tel. (0783) 812142.

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Hot Pumped and Rebanded.

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The North Easts' Largest Rebuilder
Established 1957.
Competitive with Reliability.
Mono Tubes also available.
Two **Year Guarantee – Four Year Available.**

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For Good Quality Colour and Mono T.V.'s Ex-Rental, Part Exchanges, Re-possessions, etc.
COLOUR T.V.'s from £11 inc. V.A.T.
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Why not Call or Phone now to Londons Established Wholesaler

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Tel: 01-200 7337.

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2 year warranty
MULLARD A31/510 12" **£17**
Replaces A31/120
A31/410
VEGA A50/120WR 20" **£12.00**
VEGA A61/120WR 24" **£13.50**
12 months warranty

REBUILT COLOUR TUBES
2 year warranty
Glass for Glass exchange ex stock
17" 18" 19" 20" **£28**
22" **£30**
25" 26" **£34** 26" 110° **£36**
CARRIAGE COSTS PER TUBE
All Mono £3 50 including 15% VAT
Colour £4 50

All tube prices **subject to 15% VAT**
MULLARD COLOUREX TUBES—ALL SIZES IN STOCK—S.A.E for prices

NEW VALVES

Valve prices include 15% VAT

Type	Price	Type	Price	Type	Price	Type	Price
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30FL2	£1.39	EF183	87p	PCC88	£1.04	PL81A	58p
DY802	81p	EF184	87p	PCC89	82p	PL84	81p
DY86/7	71p	EH90	98p	PCC189	82p	PL95	£1.15
ECC81	74p	EL34	£1.87	PCC805	57p	PL504	£1.36
ECC82	70p	EL81	£1.14	PCF80	83p	PL508	£1.72
ECC83	74p	EL84	74p	PCF86	£1.15	PL509	£2.66
ECC84	86p	EL90	88p	PCF200	£1.63	PL519	£3.20
ECC85	79p	EL509	£2.65	PCF800	£1.15	PL802	£2.15
ECC88	£1.03	EY86/7	79p	PCF801	£1.15	PY33	44p
ECF80	92p	EY500A	£1.63	PCF802	83p	PY81	70p
ECF82	92p	EZ80/1	66p	PCF805	£1.87	PY83	70p
ECH81	74p	GY501	£1.43	PCF806	93p	PY88	83p
ECH84	£1.12	GZ34	£1.79	PCF808	£1.87	PY500A	£1.63
ECL80	86p	KT66	£3.69	PCH200	£1.23	PY800/1	70p
ECL82	88p	PC86	93p	PCL82	75p	UCF80	91p
ECL86	£1.00	PC88	93p	PCL83	£2.30	UCH81	86p
ECF86	£1.04	PC92	93p	PCL84	83p	UCL82	£1.01
EF80	62p	PC97	83p	PCL85/805	87p	UCL83	£1.18
EF85	73p	PC900	90p	PCL86	87p	UL84	£1.18
EF86	86p	PCC84	45p	PD500	£3.36	U26	£1.00
EF89	86p	PCC85	62p	PFL200	£1.30	U191	58p
				PL36	98p	6F23	98p

ALL VALVES ARE NEW – BOXED – AND GUARANTEED
P&P CHARGES 20p for 1 valve – 10p for each additional valve (Maximum £1) – 2p extra for each large value – Post free for orders over £20.

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Prices **include** 15% VAT — **P&P 50p per parcel**

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THORN 1500/1580	£2.67	GEC 1028	
THORN 1500 5 stick	£3.30	2028 1040	£5.72
THORN 1600	£3.17	ITT/KB CVC5/7/8/9	£6.08
THORN 3000/3500	£6.98	ITT/KB CVC20/25/30	£6.98
THORN 1400	£3.61	KORTING (similar to Siemens TVK1)	
THORN 8000	£2.67		£6.98
THORN 8500/8800	£5.53	PHILIPS 3113 550/1/3	£6.08
THORN 9000	£7.25	PHILIPS G8	£6.98
DECCA CTU 19/25	£5.07	PHILIPS G9	£6.28
DECCA CS1730/3		PYE 691/3	£5.07
CS1830/5	£3.17	PYE 731/25	£7.10
DECCA 1910 Bradford		RANK BM A823/Z179	£6.34
2213	£6.22	RANK BM A823A/V	£6.98
DECCA 30	£6.08	REDIFUSION Mk 1	£6.34
DECCA 80	£6.59	B R C. 2000	£7.97
DECCA 100	£6.34	"UNIVERSAL TRIPLER"	£5.69
GEC 2110 before Jan. '77	£7.25		

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No. 1 in

- ★ Used colour T.V.'s
- ★ Competitive prices
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- ★ Fully equipped premises.
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