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Teletronics

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Official Journal of The Television and Electronic Technicians' Institute of Australia

Report on the 5th National T.V. Service Convention

The P.A.L. Colour T.V. Receiver

Understanding the Transistor T.V. Receiver

Details of the New Journal "Video-Tronics" and how to become a subscriber

Teletronics

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BY THE

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Official Journal of the Television and Electronic Technicians' Institute of Australia.

Contents

*This Paper replaces Instalment 3 of the Teletronics Colour T.V. Course. It is our intention to continue this course in "Video-Tronics"

There is no Data Supplement with this issue

From the Editor's Desk

Teletronics Change

This issue of Teletronics will be the last issue of Teletronics in its present format.

Commencing in February, 1973, a new bi-monthly magazine will be published. It will be called "Video-Tronics", and will incorporate Teletronics, the Official Journal of the Television and Electronic Technicians' Institute of Australia, and Video, the Official Organ of the Television and Electronic Services Association of Australasia.

The new magazine will be larger than Teletronics or Video and will contain both technical and management articles. All the features in Teletronics such as information regarding new receivers, semi-conductor and colour T.V. articles will be retained but, in addition, readers will be able to read articles on management. Previously these have been published exclusively in Video and are very essential to the successful businessman. Let us face it! The majority of our readers are businessmen in the T.V. service business, either as owners, partners or service managers.

The Editor and Manager of both Teletronics and Video, Mr. George Mitchell, will become the Editor and Manager of the new journal, 'Video-Tronics'.

The overall policy will be the same, except that single copies will not be for sale in the bookshops: 'Video-Tronics' will be availabale by subscription only and will be mailed to approved subscribers and to members of T.E.T.I.A. and T.E.S.A. It will be the Official Journal of both these organisations.

The amalgamation of these two magazines serving the television service industry is a step forward in uniting the industry and has been brought about by the changing times.

The National Councils of both the sponsoring organisations have decided that the industry can be better served and present a better image, by having one strong, well-produced and widely circulated journal.

The subscription rate for the new journal will be $6.00 per annum. Subscribers to either Video or Teletronics will automatically be transferred to the mailing list of "Video-Tronics" and will receive each issue of the new journal until the expiration of their current subscription.

Members of T.E.T.I.A. and T.E.S.A. will also receive their copies, as previously.

Would any subscriber to 'Teletronics' who does not wish his subscription to be transferred to 'Video-Tronics' please advise The Teletronics Magazine Publishing Co. Pty. Ltd., 88 Chalmers Street, Lakemba, N.S.W. 2195, on or before 20th December, 1972, and a pro rata refund of subscription will be made. **No adjustments will be considered after that date,** as it is intended that the books of the company will be closed off at 31st December, 1972.

Note: The above is not applicable to members of T.E.T.I.A. or T.E.S.A.

The new journal, 'Video-Tronics', will be published by The Video Publishing Co., of 88 Chalmers Street, Lakemba, 2195, and non-subscribers are invited to send their subscriptions of $6.00 per annum to that address now to make sure that they receive Vol. 1, No. 1, the February/March issue of 'Video-Tronics'.

It's New Zealand in 1973

Mr. FRED. RITCHIE President, N.Z. T.E.S.A., at the close of the 1972 Convention issues a warm invitation to join him and and his fellow Kiwis, in October, 1973

At the close of the Colour Conference in Melbourne Mr. Fred Ritchie, President of T.E.S.A. N.Z., issued a firm invitation to all to join in the First Australasian Colour T.V. Seminar to be held in Auckland, N.Z., from 13th to 16th October, 1973, about the time that Colour T.V. transmissions commence in New Zealand.

Several tours have been arranged following the Seminar. An attractive brochure, giving full details of cost of attending the Seminar and the tours afterwards is available on request from:

THE N.Z. SEMINAR COMMITTEE
C/- 88 CHALMERS STREET
LAKEMBA, N.S.W.—2195

N.Z. readers kindly contact:

THE N.Z. SEMINAR COMMITTEE
C/- P.O. BOX 2099
AUCKLAND, N.Z.

Our hosts at the 1972 Convention

Mr. BASIL LOFTHOUSE Qld. and Federal President, T.E.T.I.A.

Mr. LAURIE EDWARD Victorian President, T.E.T.I.A.

Report on the 5th National TV Service Convention

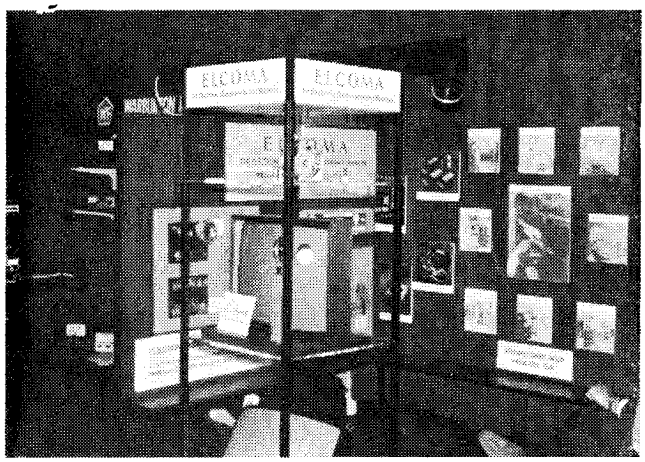
OFFICIAL OPENING

A.B.C.B. Chairman, Mr. Myles Wright, officially opening The 5th National T.V. Service Convention. Mr. Wright urged T.E.T.I.A. and T.E.S.A. to establish a unified organisation that would set ethical standards for manufacturers, servicemen, and retailers before the introduction of Colour Television in 1975. Seated, from left: Norm. Sachse (T.E.T.I.A., S.A.), Basil Lofthouse (T.E.T.I.A. Federal President, Qld.), John Harper (T.E.S.A., Qld.), Ced. Gurd (T.E.S.A. National President, N.S.W.), George Mitchell (T.E.T.I.A., N.S.W.), George Hale (T.E.S.A., Vic.), Laurie Edward (T.E.T.I.A., Vic.).

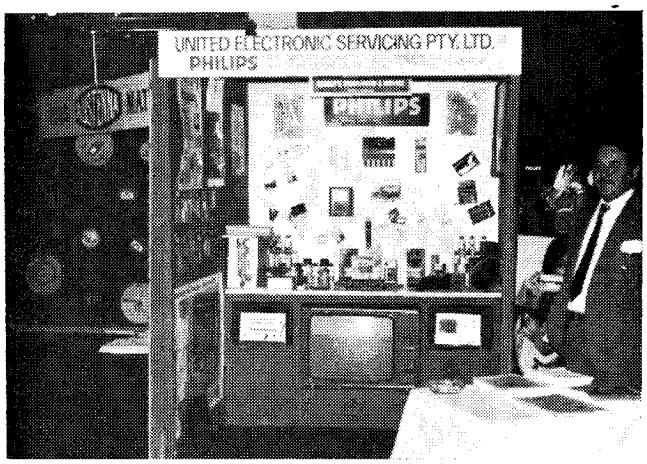
The "Colour Conference", as the Convention was called, was an undoubted success, from the time it opened to the skirl of bagpipes by Her Majesty's Brigade of Gurkhas Pipe Band, as they led the official party to the dais until the close of the final function, a "Homestead Hootenanny" held at the historic woolshed of "Emu Bottom" station, some twenty miles from Melbourne.

The attendance at all sessions was very good; the number of full registrations was a record. There were delegates from all States of the Commonwealth and from New Zealand. A party of ten Kiwis, headed by the N.Z. T.E.S.A. President, Mr. Fred Ritchie, attended. From N.S.W. some 36 delegates travelled by train from Sydney on a special Group Travel arrangement organised by the N.S.W. Divisions of T.E.T.I.A. and T.E.S.A., and other delegates arrived by car, planes and trains.

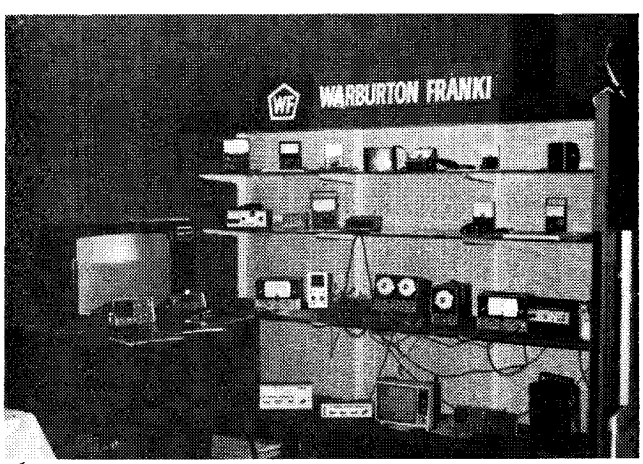
The technical and business sessions were excellent, but the Commercial Exhibition, which has always been



ELCOMA DISPLAY



U.E.S. DISPLAYED THE LATEST SERVICE EQUIPMENT



WARBURTON FRANKI INDUSTRIES DISPLAYED SANWA METERS AND LEADER TEST EQUIPMENT

a feature of our conventions, was very poorly supported by manufacturers and component suppliers; less than half the space allocated for the exhibition was sold to exhibitors, and one missed the stream of non-registered people coming to view the exhibition. The lack of interest in the commercial side reflects the present state of the industry.

The convention's business and technical sessions covered a period of 2½ days and 2 evenings and were of a high standard. It would be impossible to report in detail the subjects covered, except to give a brief resume of the programme and to print some extracts from papers and talks in this issue and in later issues of the new journal 'Video-Tronics'.

The "Colour Conference" Programme

The list of speakers and their subjects were as follows:

Opening Ceremony — Address by Myles Wright, Chairman Australian Broadcasting Control Board.

Key Note Address — Ken Black, Secretary, TESA Victoria.

'Franchising a Service Operation'—Howard Bellin, Managing Director, International Franchising Pty. Ltd.

'Costing and Running a Colour Service Business'—H. M. (Max) Pieremont, Manager of Management Services, United Electronic Servicing Pty. Ltd.

Official Luncheon—Guest speaker Mr. John Poulton (senior vice-president of the Electrical Mfrs. Association).

'Colour TV Receiver Reliability in Field and Factory'—John Ellis, Production Engineer, Radio Corporation.

'Financing Colour TV Sales and Rental' — Clive Hollands, Australian Finance Conference.

'Training and Apprenticeship'—Panel Session.

'The Colour Television Receiver — Frank Brown, Training Officer, Philips Clayton Works.

Installation and Adjustments.

The Thin-Necked RCA Tube and Precision Static Toroid Yoke — Wilf Zowatsky, Thorn Electrical Industries.

'Colour Distribution and Antenna Systems — Henry Drillich, Managing Director Austenna Pty. Ltd.

'No Reply? You've just lost some business'—Peter Schiftan, Sales Manager, Voca Business Machines.

Radio Control for a Service Business—John Dearn, National Sales Manager TMC.

'You and Your Customer'—A panel discussion with consumer and industry representatives.

'Test Equipment for Colour TV'—Ian Angus, Head of Communication Industries Division, R.M.I.T.

(Colour video tape of opening of 1972 Olympic Games.)

Colour Demonstration film from ATV—Channel O.

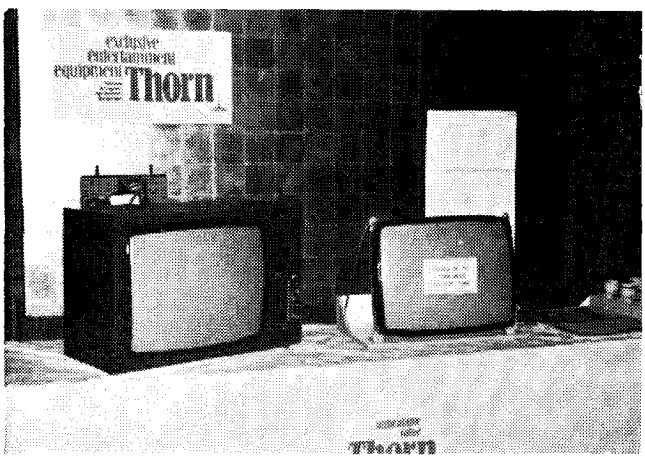
'The PAL Colour TV System'—Frank Brown, Training Officer, Philips Clayton Works.

How the PAL System works—Colour demonstration with microwave colour link from ATV Channel O Studios.

'Renting and Leasing Vehicles'—Noel Howard, Australian Finance Conference.

'The Trinitron Colour Picture Tube'—Presented by Jacoby Kempthorne representing Sony Corporation.

SONY HAD A WIDE RANGE OF COLOUR EQUIPMENT ON DISPLAY



THORN INDUSTRIES DISPLAYED THE LATEST ENGLISH COLOUR T.V. RECEIVER AND NARROW-NECKED TUBE.

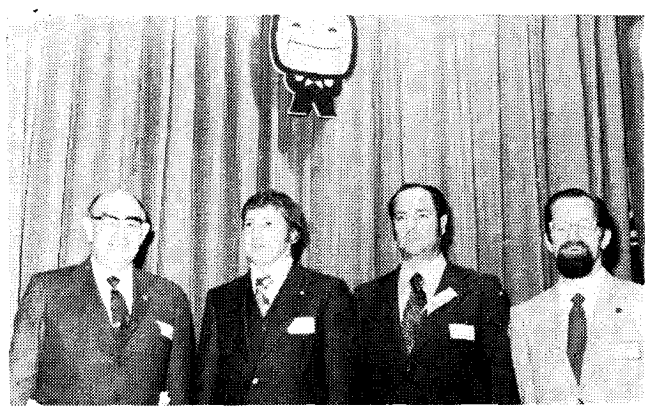
COMPETITION

A competition to name the 'Colour Conference' logie was conducted in conjunction with the convention and 63 entries were received.

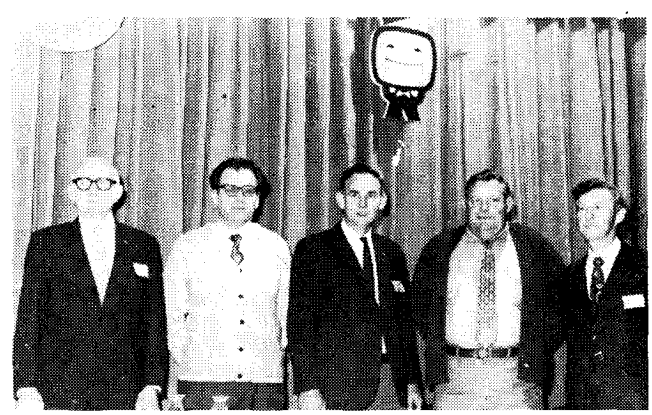
The judges had a hard time deciding that 'Professor P.A.L.' was the most appropriate name. The winning entry was submitted by Mr. Eric Pyatt, of the West Australian Division of T.E.T.I.A.

A few of the other names submitted were: Fred, Colour Sam, Professor, Out of Phase, Des. E. Bell, Con Vergence, Pal Joey, Rudy, Hue, Technicians Pal, Telewinkle and Dino.

Mr. MAX PIEREMONT, U.E.S. PTY. LTD.
told the delegates that the labour content in repairing a colour receiver is five times that of a monochrome



T.E.T.I.A. PRESIDENTS: GEORGE MITCHELL (N.S.W.), ERIC PYATT (W.A.), BASIL LOFTHOUSE (QLD. AND FEDERAL PRESIDENT), AND LAURIE EDWARD (VICTORIA)



T.E.S.A. EXECUTIVES: CED. GURD (N.S.W.), GEORGE HALE (Vic.), JIM CRAW (Tas.), JOHN HARPER (Qld.), and FRED RITCHIE (N.Z.)

The Opening Address

By Mr. Myles F. E. Wright
Chairman, Australian Broadcasting Control Board, Melbourne,
At the Fifth National TV Service Convention, Chevron Hotel, Melbourne, Monday, 9th October, 1972.

I must thank you for inviting me to open your Fifth National TV Service Convention under the title of 'Colour Conference'. I have, of course, to regard any such conference as important, since the question of colour television has occupied so much of the time of my Board over the last five years or so.

Let me first tell you just what the position is today —from the Board's point of view—regarding the planning for colour's official arrival on March 1, 1975. First, as you would know, we revised the basic system standards for the operation of the Australian television service immediately we decided upon the PAL system. In this operation, we had the assistance — the very great assistance—of an Industry Committee which set up working parties, drawn from all sections of the industry. Those system standards were issued in 1970, and the Industry Committee and its associated working parties are now working with the Board on the preparation of detailed operating standards for studio and transmitter equipment, programme relays, and receivers. We are quite confident that we have selected for Australia the best colour system available, and that tse standards we are developing, in association with the industry, will ensure that Australians will see the best quality television picture in the world.

This is a good opportunity to answer, once again, some of the inaccurate and provacative statements which have been circulating about colour television reception. In spite of the fact that we have answered the points over and over again, it seems impossible for the truth to catch up with the rumours. Let me say firmly that with the system selected for this country, if black and white reception is satisfactory—then colour reception will be satisfactory. If ghosting is present in black and white, it will, in most cases, actually be less objectionable in colour. It is true, of course, as you would all know very well, that as the years have passed, many aerial installations are in need of attention—but they're in need of attention now, not because of colour, but because of old age. The Board is currently, with the co-operation of the Post Office, distributing a card with some simple questions and answers about colour television, to every television licence-holder. I hope this will help to clear up a lot of misapprehension on the subject of colour reception.

I want, if I may, to return to this matter, but first let me try to answer some questions about colour that are probably exercising your minds. They are exercising our minds too—and most of the answers as you'll learn in a minute, are pretty tentative so far.

First, how widespread will colour transmissions be on March 1, 1975? In the case of the National service, there is of course a divided responsibility—the Post Office is responsible for the transmittors, and the Australian Broadcasting Commission for the studio equipment—all under my Board's Standards. As I am to understand by the Australian Post Office's planning it is intended that all capital city A.B.C. transmitters should be capable of transmitting in colour on March 1. Correspondingly, the A.B.C. itself plans that all its capital city studios should be capable of transmitting in colour on that day. Conversion of the remaining A.B.C. stations is of course more of a problem for the Post Office than for the Australian Broadcasting Commission—because basically they're all on relay from capital city studios the problems are conversion of the transmitters, and upgrading of the programme links. This will be a State-by-State works programme, and the timetable is planned for the whole operation to be completed in three years at the maximum. No doubt the Post Office will have more details of that timetable, as it affects individual areas, as time goes by. As far as commercial services are concerned, it is my understanding that almost every station in Australia, except for some of the smallest, most distant areas, plans to be capable of some colour transmission on March 1, 1975. I don't know that they all plan to have colour studios in operation, but of course by far the greater part of any country commercial station's programme is on film or tape, and for that, they plan to be ready right from the start.

So, we have the picture that a very large number of Australians are going to be within reach of colour signals right on the day—certainly everyone who is now served by one or more commercial stations, except for the very new and very small stations in Mount Isa, Kalgoorlie, and so on. But of course, it's one thing to have a signal available—the next big question is, how many people will buy sets?

I don't think anyone really knows—and overseas experience doesn't help us much. In all the countries of which we have any detailed statistics, colour television didn't arrive with a bang—it just sneaked in. In the United States, for instance, though colour was around from the mid-fifties, or a little later, there was only a very minimal amount of colour programming until about 1964—even then, it was later still that set sales took off, and even today, though saturation is now progressing fast, only just over 50% penetration of the whole country has been reached. In Britain and Japan, similarly, the amount of colour programming was very small at the start, and set sales were also very quiet.

In both the United States and Japan, it appears that the breakthrough point occurred at about 15% penetration—in other words, once 15% of homes have bought colour sets, the business really seems to take off. I don't recall the exact American figures, but in Japan it took from the start of colour—in September, 1961—until the end of 1969 to reach 16.6% penetration—and two years later the figure was approaching 40%.

Australia will probably be different from these other countries because I should think that nearly 100% of all programmes will be in colour right from the start—in capital cities at least, and that is where the sales are. There is also the fact that, since we are turning to

colour later than the English speaking countries, which supply our imported programmes, we can expect some pent-up demand to exist, especially in a comparatively prosperous community like ours. This pent-up demand, I expect, will come strongly from those who have seen colour, supported by all those who have read about it. Against those two points, of course, we have the question of cost. If our estimate of around $700 for a colour set is correct, it will be a big purchase item. At that price, a 25% saturation of the community—that is, when just one-quarter of homes have a colour set—this will represent an expenditure by the public of more than 630 million dollars.

The Board itself has done some surveying in this matter. Several of our opinion surveys have included a question on whether or not the family would plan to buy a colour television set—if the price is in the six to eight hundred dollar range—within the first three years. Answers have suggested that about 30% would do so, but of course one has to treat this with a good deal of caution. It's one thing to say airily that you'll certainly buy a set, but something else entirely to put up the $700.

The best we have been able to do, so far, is guess that, after the first three years of colour, penetration will almost certainly exceed 10%—which would mean a somewhat faster saturation than has happened anywhere else—and is unlikely to exceed 25%, which would probably be getting close to the industry's capacity. (In making that last remark I am assuming that sets will be locally manufactured—but of course that is only an assumption. I wouldn't want it to be thought that I have any information on that point.)

One factor that will obviously have some influence on the sales of sets, particularly at the start, will be the arrangements for test transmission.

One kind of test transmission is already taking place —these are tests, in cases where the operators are sufficiently prepared, to evaluate the transmitters and equipment generally. They are quite specifically not directed at the general public—for very good reasons. First, because they are indeed **tests**—tests of transmitters and so on—it is quite possible that frequently the quality will not be the best possible; secondly, it would obviously be unwise to direct colour programmes to the public before the receiver standards are finalised, and there by possibly encourage someone to spend good money on a non-standard set, and, finally, I think you'll agree that it's in everyone's interest to accept the recommendation of the manufacturers that colour television be introduced in an orderly marketing manner —or at least as orderly as possible. Just when colour transmissions for home receivers and aerials, and of course for promoting sales, will start I don't know. We have asked the industry working party which is considering receivers for a recommendation, but it's not one of the most urgent matters at this stage, when we're more than 2 years away from C Day. Obviously, there will have to be adequate hours of transmission in colour so that sets may be demonstrated and satisfactorily installed, and obviously I would think, there'll need to be consultation in country areas between station managements, retailers, and manufacturers, so that the start of colour tests from the local station will more or less coincide with the arrival of colour sets on

Thomas Newsletter

WHAT PRICE COLOUR?

The anti-protectionists, advertising agency groups and T.V. station interests have been actively campaigning against any increase in the tariff on imported T.V. sets, claiming it would increase prices and consequently depress sales of colour receivers.
Local set makers on the other hand can forsee a flood of imports from Taiwan, Japan and South Korea once colour sales commence unless the tariff rate is altered.
Large scale imports must effect local set makers as well as component suppliers with the result that the entire electronics industry would eventually suffer a severe decline as has happened in the United States.
Australian set makers could compete effectively against imports if they enjoyed the advantages offered to set makers in Taiwan such as a five year exemption from company tax, exemption from payroll tax and receipt duty, a 50% cut in municipal rates and long term, low interest loans for plant and equipment coupled with a wage rate of about $8.00 per week for most employees.
It is most unlikely that any definte policy statement will be forthcoming from the present Government before the elections, so confusion will continue to reign in the industry.

PAL VERSUS SECAM

Italian set makers who have long favoured the PAL system must have learnt with some dismay that their Government may introduce the SECAM system to Italy. The French have apparently offered to give them equal access to SECAM countries such as Egypt, Lebanon and Tunisia and also claim that Japanese sets would flood the Italian market if the PAL system is adopted.

SOUTH KOREA — COLOUR SET PRODUCER

Five Japanese set makers (Sharp, Hitachi, Toshiba, Sanyo and Crown) are planning to join with local Korean companies to assemble colour sets for **export.** Very low labour costs and long term loans at low interest from the Japanese Government ($40 million) will allow these companies to dominate many export markets.

the retailers' shelves. You will realise that if commercial managements stick to their present intention of turning to colour right on the official date, the commercial stations will be televising in colour well before the Australian Broadcasting Commission in some country areas. I should say that, at the moment, my Board has no fixed attitude on this question of test transmissions. Our hope is that some time next year we will be able to make some sensible rules out of the information that the various sections of the industry will give us. Obviously, these rules must relate, in some way, to the due date which the Government has set for official colour transmissions to begin, and they must have some regard for the problems of station operators and retailers. Most important of all, however, they must be designed so that the viewer gets the best possible deal.

And this last point of course involves you and your organisations very closely. You are the vital link between the viewer and television—it is upon your competence and integrity that he relies—and relies absolutely. Which brings us back to the aerial and installation problems I mentioned earlier.

I have a statistic I want you to think about. As you know, the Post Office radio branch investigates, on the Board's behalf (and at the Board's expense), all complaints from the public about television reception. There were more than 13,000 last year. A great many, of course, relate to man-made interference, but a startling 35% of complaints are due to faults in the viewers' equipment—and more than half of these, in turn, were due to faulty aerial systems. Now, of course I'm not blaming these on you and your members. As we all know, aerial installations corrode, or wear, or are rendered obsolete by new buildings which create new reception problems. I mention the figure to show you how vitally important your work is. And it will become more important with the arrival of colour. Good honest selling of course is important here—a customer who has spent $700 for a new colour set is going to be pretty unhappy if he doesn't find out until he's paid his money that he's also up for the cost of a new aerial.

Which brings me to a point I have been making whenever I have the opportunity to anyone I can find in any side of the industry. We all remember the chaotic trading, the fly-by-night salesmen—the servicemen who couldn't—and all the other get-rich-quick characters who found the introduction of black and white television indeed gave them a licence to print money. Their activities gave your industry a bad name, caused all sorts of difficulties for stations, my Board, the Post Office and so on—and worst of all, they cheated hundreds, perhaps thousands, of citizens out of their hard-earned money.

What I would like to see, before colour comes, is something a great deal wider than your organisation—a grouping which would involve all the servicemen, all the manufacturers, all the dealers, and all the television stations themselves. Since trading conditions are generally State, not Federal, matters, you will realise that as far as I personally am concerned I can only preach in this connection, not make any rules. But I cannot think it beyond the wit of the groups I have mentioned to come together and set some minimum standards which every television selling or servicing organisation should observe. My suggestion would be that all the traders who complied with these standards would be authorised to display the official badge of the organisation, which would give some assurance to the buyer, or to the viewer seeking service, that he was dealing with a reputable tradesman—and, importantly, that he would have somewhere to go with his complaints. The quid pro quo to encourage participation would be that television stations would from time to time display the badge, and advise their viewers to deal only with those entitled to use is. The advantage to the television stations would be that they would be relieved of the complaints which, in the early days, flooded them—because the inefficient serviceman, or the snide salesman, in the early days of black and white, found the best way out of an embarrassing situation was to blame the station transmission. I know that since 1957 Consumer Protection organisations have been much improved in most States, but they inevitably operate after the event. As a strong believer in self-regulation wherever it is possible, I do urge the whole industry to take some action of the kind I've suggested in the interests of the public and of the industry itself.

May I appeal to you today not to do what a number of others have done when I've expressed my belief in the necessity for some action by the industry in this matter. Don't just look wise, and nod, and say "Good Idea—but of course all the others would never come at it". There's hundreds of millions of dollars of the public's money involved, and I think everyone in the industry has a responsibility he cannot lightly forsake. If I may, I commend to your group, which has already demonstrated its concern with standards, the proposition that you should give some practical leadership to your industry in this vital matter.

I know of course you can't do it on your own, but someone has to make a start; and those of you who remember the introduction of black and white television must surely share my concern. Concern, however, is not enough. Your industry is big enough, and able enough, to regulate itself—and certainly it is better to regulate yourselves than to have regulations imposed upon you.

I urge you—as emphatically and earnestly as I can—to give some thought to this over the few days of your Colour Conference. If you do, and if you can achieve some result, I will be glad indeed that you gave me this opportunity to declare the Fifth National TV Service Convention—"COLOUR CONFERENCE '72"—officially open. I wish you all success, and fruitful discussions.

Mazda colour books

Due to the unexpected rush by readers to obtain these books, our stocks are now exhausted.

We do not expect new supplies to arrive from the United Kingdom for several weeks.

If you wish to reserve one, we will accept back orders and supply when the new stocks arrive.

The price is $9.75 (posted). Interstate cheques, kindly add extra 6 cents for stamp duty, to The Video Publishing Co., 88 Chalmers Street, Lakemba, 2195.

The P.A.L. Colour TV Receiver

A Paper Delivered by Mr. Frank Brown

(Training Officer Philips Clayton Works)
at the 5th National TV Service Convention

Discussion of this receiver will neglect all sections of the present monochrome receiver system, except such as are different for important reasons, when used in a colour reception system.

Tuner

Very similar in all respects except that the input matching to the antennae system lead-in must be within narrow limits to prevent ghosting by standing waves at the receiver end. Fine tuning will need to be contracted in frequency coverage for each band to make tuning easier without losing colour. Oscillator stability must be good but fortunately this is reasonably good with solid state circuitry.

Vision I.F.

Better design is necessary to maintain amplitude and phase constant over the full video band. Re-alignment in the field must therefore necessarily be accurate to manufacturers' specifications otherwise colour errors can be introduced, and colour drift encouraged.

Sound Channel

A separate detector will be used and the take-off point shifted forward into the I.F. system to make cross-modulation as low as possible. Trap circuits will be used on 30.5, 5.5 and 4.43 MHz through subsequent circuits.

Video Detector

The pick off, or separation point, between luminance and chroma signals. That is 4.43 MHz sideband signals will be separated from the brightness component which is normal video as we now know it and is generally referred to as luminance or "Y" signal. A luminance delay line of 0.6 microseconds is in this channel to delay the brightness signal that amount. This ensures that when joined up again at the final amplifiers the colour information will match exactly to the corresponding brightness information at any one time. The reason! Colour (or chroma) signals are slowed down by the narrow band channels they must pass through. These are only 1.8 MHz wide.

Horizontal Output

This will be separated entirely from the production of E.H.T. and therefore the circuitry will be simplified considerably.

E.H.T. Unit

Driven from the horizontal oscillator but may be solid state throughout. Some manufacturers may still produce hybrid units. Voltage doubling or tripling will be used to reduce the secondary voltage and rectifier ratings.

Owing to the wide current variations required with three guns varying between off and maximum which could mean zero to 1 m/A at 25KV (0 to 25W) the regulation of this unit must be very good.

Shunt regulator valves which operate across the E.H.T. are not desirable, even although widely used overseas. They raise the X-ray intensity to questionable levels.

Introduction of regulation of the power supply to the switching transistor so that more power is fed into the unit with E.H.T. load increase is very effective. Transistors are used as series regulators with over-regulation characteristics.

Chrominance Circuits

These sections are related entirely to the decoding of the chrominance or colour signals transmitted as 4.43 MHz video sidebands, and are under the control of the colour burst signal. This colour burst, which immediately follows the sync pulse, is the only time that the

Mr. FRANK BROWN
(Philips Clayton Works) was the chief lecturer on the technical side of colour T.V.

4.43 MHz carrier is transmitted, and is used solely as a phase and frequency reference for the chrominance circuit timing. The carrier is suppressed from the actual chrominance signals, hence only sidebands are received and a carrier must be supplied by the receiver itself before demodulation can take place. The supply of this carrier is the function of the reference oscillator or regenerator (q.v.).

Band Pass and Chrominance Amplifiers

These are tuned video amplifiers centred on 4.43 MHz and having a bandwidth of +0.5 and —1.3 MHz which is the allocated spectrum for chrominance signals.

Chrominance Synchronising

The timing of these circuits must be kept accurately

synchronised with the transmitter therefore the 4.43 MHz colour burst is the sole reference for colour reproduction. However, as this occurs once every line period and we need to switch it into circuit at the correct time following each sync pulse, use is made of pulses from the line output unit to do any line period switching. As this is separately synchronised by the well known A.F.C. circuits we can therefore maintain correct and complete control by use of the two functions.

Burst Gate Amplifier

Is switched on only over the duration of the colour burst, by a line pulse. The output therefore is 10 cycles of 4.43 MHz carrier occurring every line pulse. This signal is applied to the

Phase Detector

which is very similar to the A.F.C. diode circuits. It is used to compare the incoming 4.43 MHz carrier with the 4.43 MHz produced by the receiver oscillator, which is generally called the re-generator or reference oscillator. Any variations between the two immediately produces a D.C. potential the polarity of which depends on the direction of variation of the two signals. This D.C. is applied to the correcting circuits of the

Regenerator Oscillator

to bring it back to frequency and phase.

This is a crystal oscillator, the correcting circuit is a variable capacitance diode and the function of the unit is to provide a 4.43 MHz signal to the synchronous demodulators to take the place of the missing carrier suppressed from the chrominance signals. Two outputs are taken from here, one direct to the R-Y, and the other via a 90° phase shifting network to the B-Y demodulators. This therefore complies with the phase relationship of the two carriers originally used in the transmitter for the R-Y, B-Y channels which are separately amplitude modulated then mixed and used to modulate the vision carrier.

Colour Killer

A transistor switch, operated from the rectified colour burst signal taken from the burst gate amplifier or phase detector. As this is controlled by the presence or absence of the colour burst signal it is used to act as a switch for the chrominance channels.

When monochrome is being received there is no colour burst transmitted, the switch does not close and therefore the chrominance channel is dead. When colour is transmitted, there is a colour burst signal, the switch operates and completes the circuit through the chrominance decoding system. Used to prevent unnecessary noise appearing on the tube during monochrome reception and also set to cut the colour if the signal conditions are too bad.

P.A.L. Delay Line and Separator

A 64 μsec glass delay line with associated transformer (separator) circuit, which is the heart of the P.A.L. system. The function is to average out the received signal by adding adjacent lines. Owing to the reversal of phase of the R-Y (V) signal on each alternate line, this averaging also has the result of cancelling out any phase errors which occur in the signal and which would result in a change of colour. The signals emanating from this unit are separated into R-Y and B-Y components with the alternate phase reversal still operating on the R-Y (V). To restore these conditions to their original phasing the R-Y (V) signal is fed to a

Bi-stable and Sub-carrier switch

which is operated by the line pulse. This is used to control the phasing of a signal derived from a phase splitting transistor, so that one of two similar signals of opposite polarity phasing can be selected. This switching may be done either on the R-Y chrominance signal being fed to the appropriate demodulator, or on the regenerator oscillator signal fed to the same demodulator. The end result is the same, in that one of the signals applied to the demodulator is alternately reversed in polarity to cancel the incoming signal reversals and the video signal obtained is in the true direction.

The P.A.L. (Phase Alternation Line) effect is thus in existence only between the transmitter encoder and the receiver decoder and is used solely for assistance in cancelling out phase errors in conjunction with the delay line.

To ensure correct phasing of this switch, an Ident. signal derived from the Phase detector and due to the swinging colour burst, is used in conjunction with the operating line pulse. The switch only operates in a direction to suit the polarity of the incoming signal line.

Synchronous demodulators

There are two of these, one for the R-Y (V) channel and one for the B-Y (U) channel. These demodulators are either of the 4 diode ring type, or 2 diode type and are supplied with sideband chrominance signals and regenerator oscillator signal. The fundamental circuits are identical, the difference is in the signals supplied which are:—

(a) R-Y demodulator. R-Y (V) signals from the delay line which are alternately reversing in phase on adjacent lines, and Regenerator oscillator 4.43 MHz signal via the sub-carrier switch which is reversing the polarity of this signal in synchronism with the chroma signals above.

The output will be Chrominance video output equal in polarity with the original R-Y input.

(b) B-Y demodulators. B-Y (U) signals from the delay line which are not being reversed, and Regenerator oscillator 4.43 MHz signal via the 90° phase shift which advances this signal by 90° to match the timing of the transmitted B-Y signal.

This system of two identical frequencies, separately modulated is termed Q.A.M. or Quadrature Amplitude Modulation.

At this point in the receiver we therefore have R-Y and B-Y video signals but as the amplitudes of these were separately adjusted at the transmitter to prevent over-modulation, the relative amplitudes must be restored. This amounts to a reduction of the R-Y (V) signal to 0.56 of the amplitude at this point. The two signals are then applied to the

First Matrix

which is generally a straightforward resistive network arranged to take 0.51 of the R-Y (V) and 0.19 of the B-Y (U) signal. These two proportions must only be taken out after the above adjustment of relative proportions and the mixture of the two will produce a -G-Y signal. By inversion we obtain G-Y.

Final Matrix

Arranged as a resistive network to mix together the

Y luminence signal from the luminance amplifier and delay line with each of the chrominance signals. As these signals are in the form R-Y, B-Y, and G-Y, by adding Y to each we obtain R. B and G to apply to the final chrominance amplifiers. This therefore gives us outputs R.B. and G which are in exactly the same form and relative amplitudes as the original camera signals.

Convergence Unit

This section is associated purely with the initial setting up of the receiver and affects monochrome as well as colour reception if not correctly done. Due to the presence of the shadow-mask, and the necessity of obtaining complete register of the 3 beams over the whole screen means must be provided for individually adjusting each beam at all positions over the screen. For adjustment directly in the centre, either movable magnets or electromagnets adjacent to each gun are adjusted. This is Static Convergence.

Over the remainder of the screen Dynamic Convergence is used, which consists of adjustment of selected signal waveforms applied to 3 sets of convergence coils situated adjacent to each gun (1 set for each gun). The signals used are vertical sawtooth, vertical parabola, horizontal sawtooth, horizontal parabola and combination of each. This is individual to each gun and is totally separate to the normal deflection coil system which of course affects all beams equally.

Degaussing

As the receiver is very susceptible to external magnetic fields, including the earth's field, great care is necessary to reduce these fields to zero or minimum. An iron shield is fitted around the bulb of the tube to facilitate this and degaussing coils are fitted beneath this shield. These coils are switched on every time the receiver is switched to the mains and a special V.D.R. and P.T.C. resistor circuit is used to gradually reduce the A.C. field produced, to zero. This will degauss any metal within the immediate surround of the tube bulb but will not affect objects outside this area. In the factory, before purity magnets or loud speakers are fitted the whole receiver will pass through a coil the field of which will decrease in effect gradually as the receiver is moved through, and will thoroughly degauss the whole chassis and fittings.

In the field, objects near the receiver can influence the tube if they are magnetised and these must be deguassed with a hand held coil connected to the 230V mains. This is rotated around the object continuously whilst gradually moving away and must not be switched off whilst closoer than 5 feet away. Electric appliances such as vacuum cleaners, polishers, hair dryers, etc., must not be used or switched off while they are within 5 feet of the receiver, even if the receiver is not switched on. The presence of any magnetic fields causes slight permanent distortions of one or more beams with the result that the purity setting is upset. This results in patches of colour appearing in one or more places on the screen. This is termed lack of purity and indicates the necessity for degaussing.

If it is necessary to degauss the tube itself due to the shadow mask itself becoming magnetised, do not let the hand held coil approach nearer than 2" or 3" as it is quite possible to permanently spoil the tube by buckling the shadowmask.

A.W.A. and Thorn Form Joint Company

Australia's largest maker of electronic equipment, Amalgamated Wireless (Australasia) Ltd., is linking up with a major British company to meet the challenge of colour television.

A.W.A. is to form a joint company with the giant Thorn Electrical Industries to manufacture and market colour television sets in Australia.

Thorn is the largest maker of both colour and monochrome television sets in Britain and its expertise in the colour television field will be of enormous help to the joint company.

The new Australian company, to be known as AWA-Thorn Consumer Products Pty. Ltd., will also make and sell monochrome television sets, radios and stereophonic sound equipment.

It will have its headquarters in Sydney and will use the facilities of both Thorn and AWA.

Both companies have a fair slice of the Australian market for monochrome television receivers. At the moment AWA has about 18 per cent of the television receivers market and Thorn 14 per cent.

This means that together the two companies will account for about 32 per cent of the total market for monochrome television sets.

This will put the combined group in front of the present leader, Philips with around 25 per cent of the market. AWA is the only Australian-controlled company making television receivers in Australia.

Other companies' shares of the Australian television market are EMI 19 per cent, Pye 13 per cent, GE 6 per cent and National 5 per cent.

Because the AWA-Thorn venture will account for about 32 per cent of the monochrome market it does not necessarily follow that it will also have the same portion of the colour television market.

What will determine how the companies will fare when colour television starts on March 1, 1975, will be the price at which sets can be offered to the public.

Sir Lionel Hooke, who will head the new company, told the "Herald" recently that "we must get the cost of colour television sets down and the best way of doing this is by volume production".

Sir Lionel would not be drawn on how much he thought a colour television set would cost when the time comes for transmission in 1975. "If you can tell what wages are going to be in 1975 then I'll tell you how much a set will cost", he said. However, the popular figure in the industry is around the $700 mark.

But much will depend on the level of tariff on the imports of colour television receivers into Australia.

The obvious advantages of the AWA-Thorn merger will not be lost on its competitors and this may be the first in several such mergers.

At the moment there is a battle royal going on between the local manufacturers who want high tariff protection and the commercial television stations who want sets cheap enough for everybody to buy.

The Government is undecided over what level of tariff should be levied on colour television sets. The level of this tariff will mean a lot to the local television industry.

Continued on page 15

Tech Aids

These aids or tips are from various sources — some were taken from the service tips sent in for our Study Tour competition, others contributed and others just obtained by the editor.

The journal accepts no responsibility for the correctness of the information given, where possible the tip is checked for accuracy.

No correspondence will be entered into regarding the right or wrong of any "aid" published.

The aids published will all be on receivers built in or on regular sale in Australia.

The circuit references will be those used in the manufacturers' manuals issued at the time the receivers were released on the Australian market. If you haven't a circuit, our circuit copy service is available.

The aids are on old and late model receivers: no attempt is made to collate them into years and models.

Remember, if you have a tip that will help your fellow technician—send it in; if it is published it could earn you a few dollars providing the tip is original.

In the event of identical tips being sent in. the first one received will be the one published.

GE PORTABLE CHASSIS T9V2C
Series Valves Poses A Problem

Among my service activities during the last few weeks I came across a TV fault which, I think, may be of some interest to other TV technicians.

The set in question was a 9" portable made by General Electric, chassis T9V2C.

The owner of the set complained that the set lost its picture and sound, but the screen remained alight. In such a case the first logical step was to substitute, one by one, all valves in the picture chain. Since all valves in this set were connected in series, it was necessary to switch off the set every time a valve was to be substituted.

According to the manufacturer's diagrams the connections of valve filaments were arranged as shown in figure 1.

After substitution of I.F. valves, without any success, I proceeded to the tuner.

While removing valve V2 I forgot to switch off the set, and I was very much surprised to see that all other valves and the picture tube remained alight. I checked the manufacturer's diagram once more but couldn't find any explanation why it was possible for all these valves to be alight with one valve being removed from the series connection.

Fig. 1

I tried a new valve V2 (6HG8) but there was no change at all. I also removed the new valve V2 from the tuner while the set was on with the intention to see what would happen. The set behaved exactly as before—all other valves and the picture tube stayed alight. I assumed that the old valve V2 was in working order and I plugged it back into position. There were no other symptoms which could explain this puzzling behaviour of the valves.

In order to solve this mystery I decided to pull out the tuner from the cabinet and to carry out a closer investigation of the filament connection. I found that the actual filament connection of the tuner valves was different to that shown on the maker's diagram. Valve V2 had a balancing resistor 100 ω connected as shown in Fig. 2. This resistor is not shown on the manufacturer's diagram.

The resistor displayed unmistakable overheating symptoms and had a crack. Its value was only about 1½ ω instead of 100 ω. This was a bit unusual because

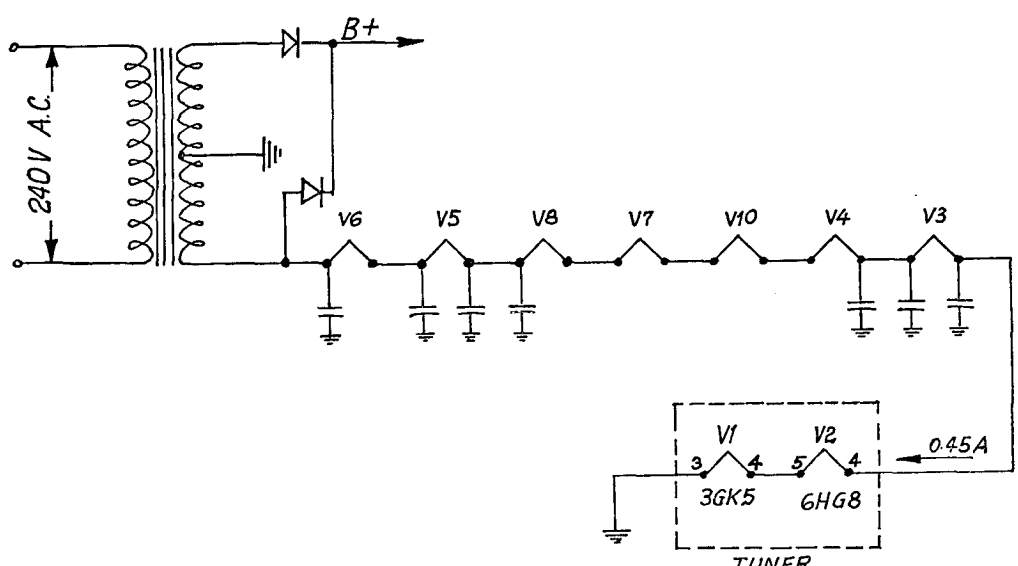


FIG. 1.

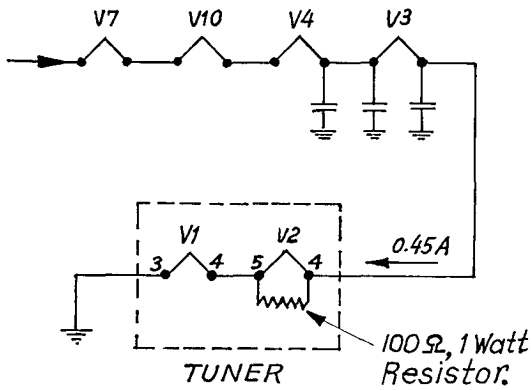


FIG. 2.

in general the overheated resistors rather go open circuit than short.

Now it was obvious to me that the filament current by-passed valve 2 through this shorted resistor throwing the tuner out of function. My next logical move **FIG. 2**
was to replace the damaged resistor with a new one and see what was going to happen. When this was done and the set switched on, I was surprised to see that the new resistor started to smoke. It appeared to me that the filament current still refuses to flow through the valve V2. Why? I quickly removed 6HG8 once more from the tuner and checked the filament continuity. It was open circuit. After fitting of a new 100 ω 1 watt resistor and a new 6HG8 valve, the set started to function normally. Now it was clear why the new valve 6HG8 refused to work.

From the Ohm's law we can find that the filament current (0.45 amps.) by-passing open circuit filament of the valve V2 generated heat in 100 ω resistor equivalent to $(0.45)^2$ x 100 20 watt energy.

No wonder that the resistor suitable only for two watts started to smoke.

ASTOR BSK
Symptom: Picture dark at top.
Cause: CV89—.01mfd, CV90—.01mfd. Replace both.

ASTOR BSK
Symptom: Vertical jitter.
Cause: RV121—1.5K, CV101—.022mfd, CV92—100 mfd, RV109—560 ohms, CV100—.01mfd.

ASTOR BSK
Symptom: Vertical frequency drift.
Cause: RV116—560K, RV115—2.7meg.

ASTOR BSK
Symptom: Poor sync. (mostly vertical but some line pull), poor control of a.g.c. but no apparent corruption of Video frequencies.
Cause: Low reverse resistance of video diode. Similar symptoms can be caused by faulty CV103—.25 mfd.

ASTOR BSK
Symptom: Poor horizontal and vertical sync.
Cause: RV136—560 ohms.

ASTOR BSK
Symptom: Poor vertical sync.
Cause: RV141—22meg, RV143—22meg. Voltage on pin 1 of V18 should be 25-30V for normal signal and about 2V for no signal.

ASTOR BSK
Symptom: Poor horizontal sync.
Cause: RV142—1.2meg, CV112—.1 mfd, CV113—.001 mfd, CV114—.001mfd.

ASTOR SERIES 1
Symptom: Horizontal frequency drift.
Cause: R128—47K, R132—680K, R133—4.7K, R134—22K.

Note.—In one of these receivers, the customer complained of a long history of calls for horizontal instability. I discovered that another technician had fitted a Telecomponents Line Oscillator pattern number 7800 described by the maker as "universal" for receivers using a 6BL8 line oscillator. This is a reasonably accurate statement except that it may sometimes be necessary to make minor modifications. This coil had a very critical adjustment of about a quarter of a turn of the slug. A 47K resistor across the coil increased the stable section to over two turns of the slug. Slight variations in the values of other components (e.g., the 6BL83) no longer affected stability.

ASTOR SERIES 3
Symptom: Horizontal and vertical sync.
Cause: C56—.0022mfd, C58—.022mfd.

ASTOR SERIES 10A
Symptom: No sound, weak sound, distorted sound.
Cause: Work on the audio output section of these receivers has convinced me that the sure way of preventing recalls is to replace TS58, TS59, TS60 and RV10. A chain reaction occurs in this part of the circuit which may originate in RV10 ("bias set") which seems to become intermittently O/C. It is cheaper in the long run to replace all four components.

ASTOR SERIES II
Symptoms: Brief burst of sound when first switching on and then white out.
Cause: Faulty AGC transistor TS59 (originally and AT321) but this at TS58 had been changed to BC's 107's by another technician. We replaced TS59 with another BC107 and the set operated for several days then the same fault occurred. This time the customer had observed several flash overs in the EHT box.

Cure: We did away with the 1S2 and replaced it with a Swe Check Stick Rectifier Kit. The 1S2 socket was remounted about one inch lower because the stick is longer than a 1S2 and would not otherwise clear the top of the EHT box. Also because the

Continued on page 24

The Philips VLP System

45 Min. Colour Programmes on Your TV Set

A Philips development team has succeeded in creating a new system by which colour programmes lasting thirty to forty-five minutes can be recorded on a disc resembling a phonogram record of normal LP size.

For the play-back of these video long-playing (VLP) records, a player has been developed that is equipped with an optical pick-up system and can be connected directly to a TV set.

Just as the magnetic tape recorder for recording voice and music and the phonogram record and its replaying equipment demonstrated that there were two distinct fields for home entertainment where music is concerned, Philips, with the introduction of its new video long playing (VLP) record, believes that it has found the partner for its recently announced video cassette recorder (VCR).

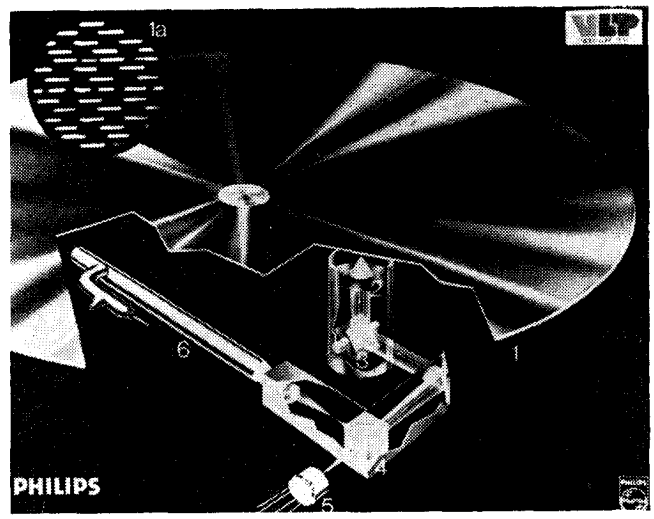
The Philips VLP system in use

The video cassette recorder permits the home user to record programmes in colour or in black and white and play them back through a normal television receiver in either colour or in black and white.

The VCR has many special features allowing a programme to be recorded whilst another programme is being viewed, or for a programme to be recorded automatically at a pre-determined time without anyone being present.

Magnetic tape in a specially designed cassette is used to store the information which can be replayed.

The Philips new VLP system which has just been announced but will not be available to the public for at least two to three years, supplements the video cassette.



Schematic representation of the new Philips VLP system. 1. Video long-playing record. Detail (1a shows the pattern of pits (pits appear white). 2. Spring-suspended lens with automatic focussing of the light beam. 3. Hinged mirror for following the track. 4. Beam-splitting prism. 5. Photodiode (detector). 6. Light source.

The VLP system is extremely flexible in use (providing, for instance, stills, slow-motion, or even reverse-motion pictures from the recorded scenes). This opens up new possibilities in the diffusion of information in picture and sound.

The consequences of the Philips VLP system for such widely varying purposes as education, information retrieval and, of course, entertainment, will undoubtedly be far-reaching.

The Philips VLP system consists of an LP record on which the video information is impressed and a reproducing device that optically scans the record whilst it is being played at a speed of 25 rps. The electrical output from the play-back unit is fed directly to the terminals of a television receiver.

The pick-up of the signal is done by a helium-neon laser beam which means there is no mechanical contact between the record and the playback unit.

Therefore, neither the recording nor the playback system can wear out.

A-m stereo may get trial run

If the Federal Communications Commission gives the go-ahead, a New York metropolitan area radio station will test transmission of a-m stereo sound. By adding a special modulator to be supplied by Electrospace Corp., Westbury, N.Y., station WWDJ will be able to broadcast any stereo recordings in a format compatible with present a-m receivers.

Though a-m stereo is an old idea, it's never been tried. That's why any expansion of this approach to other broadcasters will probably need FCC permission. Present rules do not ban a-m stereo; however, neither do they recognise it.

According to Arnold M. Wolf, president of Electrospace, a broadcaster with a complete fm stereo studio and an a-m studio can equip his a-m side for stereo for about $20,000. And a listener would need two radios, one tuned slightly above the frequency and one slightly below. However, Wolf foresees a new market for a-m radios, should the stereo idea take hold. Such a radio would have two i-f strips and two audio channels.

AW.A. AND THORN FORM JOINT COMPANY

Continued from page 11

The present tariff on imported monochrome television sets is 12½ per cent on the picture tube and 45 per cent plus $50 on the rest of the set. It is believed that the local electronics industry has asked for a tariff of 45 per cent plus $125 on imported colour television sets.

The level of tariff to be levied on colour television sets will also have some bearing on the shape and size of local manufacturing industry. If the tariff is high there will be more incentive for overseas companies to set up production here.

The directors of the new company, AWA-Thorn Consumer Products will be Sir Lionel Hooke (chairman), Mr. D. A. Luttrell, Mr. J. A. L. Hooke, Mr. S. B. Bingham, and Mr. J. E. Bailey as joint managing directors.

The Qantas 747B a better way to fly.

Qantas gives you the big, smooth, quiet and beautiful 747B. This is the plane with the biggest First Class Lounge in the skies. The one with movies and stereo*, with wide, wide aisles and wide custombuilt seats. The Qantas 747B has 15 washrooms. Separate Shaver Bars. And it's a quieter plane from nose to tail. Even the main galley is below, so you're really away from any noise.
You can fly the Qantas 747B between Australia, Singapore, Europe and London, and between Australia and San Francisco.

QANTAS 747B
The service is as big as the plane.

*IATA regulations require us to charge U.S. $2.50 for the use of headsets.

LBI.1302

List of Valves the T.V. Service Technician Should Carry

Compiled by P. Schanzer

Nothing can be more annoying than to travel far out for a service call and discover that you have not got the valve you need.

I carry two suitcases, one with tools and the most common valves sufficient for repairing 70% of all T.V. sets, and another one with the rarer types which I might leave in the car.

The valves are ordered alphabetically and whenever I use one I put the empty box back in its right spot with the top open, so that I cannot overlook to replace it on my return.

Unfortunately, as far as I know, there are no lists published by anybody which tell which valves a T.V. technician should carry, to repair all makes of old and new T.V. sets he may encounter.

I therefore decided to correlate my own list with lists of other technicians and old circuit diagrams, etc., for publication in Video and Teletronics.

This list, though probably not complete, should be sufficient to repair 99% of all T.V. sets encountered.

The most common valves are marked with an asterisk—

*1B3 (DY30); 1BC2; 1BK2; *1S2 (DY86); *1X2; 3GK5; 4DT6; 4EH7; 4EJ7; 4GK5; *5AS4; 5GS7; 5U4; 6AB8 (ECL80); 6AC7; 6AD8 (EBF81); 6AE8; *6AH4; *6AJ8 (ECH 81); 6AK5; 6AK8 (EABC80); *6AL3 (EY88); *6AL5 (EAA91); 6AM5; 6AM6 (EF91); *6AM8; 6AN4; *6AN7 (ECH 80); 6AQ5 (EL90); 6AQ8 (ECC85) *6AS8; 6AT6; *6AU4; *6AU6; *6AV6; *6AW8; *6AX4;*6BA6; 6BA8; *6BC8; 6BD7 (EBC80); *6BE6; *6BF5; *6BH8; 6BJ5 (N78); 6BJ8; 6BK7; *6BL8 (ECF80); *6BM8 (ECL82); *6BN4; *6BQ5 (EL84); *6BQ6 (6CU6); 6BR5 (EM80); *6BU8 (6HS8); *6BV7; 6BW6; 6BW7; *6BX6 (EF80); *6BY7 (EF85); *6BZ6; *6BC6; *6CD6; 6CF6; *6CG7; *6CG8; *6CJ6 (EL81); *6CK6 (EL83); *6CM5 (EL36); *6CM7; 6CQ6 (EF92); *6CQ8; *6CS6; *6CU5; *6CW5 (EL86); *6CW7 (ECC84); *6CZ5; 6DA6 (EF89); *6DB5; *DC8 (EBF89); *6DQ6; 6DT6; *6DX8 (ECL84); *6EA8; *6EB8; *6EH7 (EF183); *6EJ7 (EF184); *6EM5; *6EM7; *6ES8 (EF97); 6ET6 (EF98); *EU8; *6FC7 (EC89); 6FQ5; 6FY5 (EC97); *6GK5; *6GV7; *6GV8 (ECL85); *6GW8 (ECL86); *6H6; 6HG5 (6AQ5); *6HG8 (ECF86); *6HS8 (6BU8); *6J6 (ECC91); *6JW8 (ECF802); 6KV8; 6LX8; *6M5 (EL80); *N3 (EY82); 6N8 (EBF80); *6S2 (EY86); *6S4; *6SN7; *6U8; *6U9; *6V9 (ECH200); 6W6; *6X2 (EY51); *6X9; *6Y9; *7AN7 (PCC84); 7DJ8 (PCC88); 7CS7; 8A8; *8LT8; *9A8 (PCF80); *9AK8; *9AQ8; 9BJ11; *9U8 (PCF82); 10DX8; *11AR11; *11BM8; *11BQ11; 11MS11; 12AK10; *12AT7 (ECC81); *12HU7 (ECC82); *12AX7 (ECC83); *12BH7; 12BT3; *12BY7 (EL180); 14BL11; 14BR11; 14GW8; *15A6 (PL83); *15BD11; *15CW5 (PL84); *15DQ8 (PCL84); *16A5 (PL82); *16A8 (PCL82); 16GK8; *17BF11; *17JZ8; *17Z3 (PY81); 18GV8; 19Y3; *21A6 (PL81); 21HB5; *23Z9; *25E5 (PL36); 28HK7; *33GY7; 38HE7; DY51; ECF82; EF39; *EF50 EF83; EL95; PM84; PY83.

Continued on page 22

Understanding the Transistor Television Receiver

Part II

The Horizontal Output Stage

Introduction:

The horizontal or line output stage has been rated as the most important one in the valve T.V. receiver because of its influence on the performance of many other sections. It supplies deflection currents to the coils, high voltage pulses to the E.H.T. rectifier, boost, voltage for kinescope focus and vertical oscillator, an A.F.C. keying pulse, and in some instances horizontal retrace blanking pulses.

The horizontal output stage is equally important in the transistor T.V. receiver, and while it is doing most of the jobs already mentioned, there are some significant differences. It supplies deflection currents to the coils (as before) and high voltage pulses to the E.H.T. rectifier (as before), but since boosted B+ is *not* developed, it cannot be used for the vertical oscillator or picture tube. However, since the picture tube must have 400v. or so for the focus electrode, this must be developed in some way, and a separate supply using flyback pulses is added to the line output transformer.

A.F.C. reference pulses, A.G.C. keying pulses and retrace blanking are obtained in the usual way from the output transformer.

The last function is that of supplying the collector of the video amplifier with 100v. This stage drives the cathode of the picture tube with up to 60v. of video signal so that a supply in excess of this figure, about 100v., is required. This is obtained by rectifying pulses obtained from a separate winding on the output transformer. The D.C. current is about 10-15 mA.

The functions are illustrated in Figure 1.

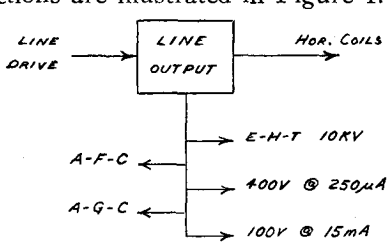


Figure 1

A PNP germanium power transistor type AU103 is used in the output stage. It is enclosed in the large diamond-shaped TO3 case with the collector insulated from chassis, and covered with a rubber cap. Its rating are V_{CBO} 155v. and Ic av./peak 10A. Switch off time is less than 1.7 μS.

In this output stage the current rises to about IA, so that the output transistor is well within ratings. It's quite a surprise to find that, in operation, the case feels only slightly warm.

The output stage is pulsed on and off by a rectangular waveform from the driver transformer T3. (Notice that there is no drive control). The collector current changes are then coupled to the deflection coils through the line output transformer T4. (This may not be evident at first sight, but it will be explained later in this article).

Sudden changes in the sawtooth current waveform are present in the primary of T4, and these are stepped up in the secondary. Positive pulses are developed between terminals 5-7 and rectified by diode D14. It charges C99 to +390v. This voltage is then used for FOCUS and BRILLIANCE control in the electron gun.

Pulses are also developed between terminals 7-12 and rectified by D13 to produce +150v. This voltage is used as collector supply to TR17, the video output transistor.

The E.H.T. supply is fairly standard. Filament power is picked up by a simple insulated loop, in the same way as in valve receivers.

The E.H.T. high voltage winding is a separate encapsulated winding placed on the transformer core and while it looks familiar, it is much smaller than that used in valve sets. The high voltage pulses developed by this winding are applied to the E.H.T. rectifier anode and produce 10Kv. Did you notice that one end of this winding is grounded? This may seem strange, but a little thought will show that the supply will operate quite satisfactorily in this way.

General Description:

The complete circuit diagram of the Kriesler Mod. 49-1 horizontal output stage is shown in Fig. 2.

Checking for E.H.T. Supply:

In valve receivers it is common practice to use the calibrated spark gap method. A good healthy E.H.T. supply is indicated by an arc of about ½". But is the same test feasible in transistor receivers? Of some receivers you will hear that if you short the E.H.T. supply you will blow the output transistor. But it this true of *all* receivers? It depends on the ratings of the output transistor. If it is on the small side and normally runs fairly hot, then a short on the E.H.T. line could obviously invite breakdown. On the other hand, if the transistor is well within its ratings, then there is little risk. Of course, if there is any doubt at all, use an E.H.T. voltmeter. Some power transistors, particularly imported ones, can cost $10 or more.

Developing the Scanning Current:

In the previous article it was shown that the line oscillator was a sine wave type, with the transistor conducting for short periods in each cycle—essentially a switching action. This waveform passed to the base of the driver stage, which also behaves as a switch. The driver delivers a rectangular wave to the base of the output transistor which also behaves as a switch.

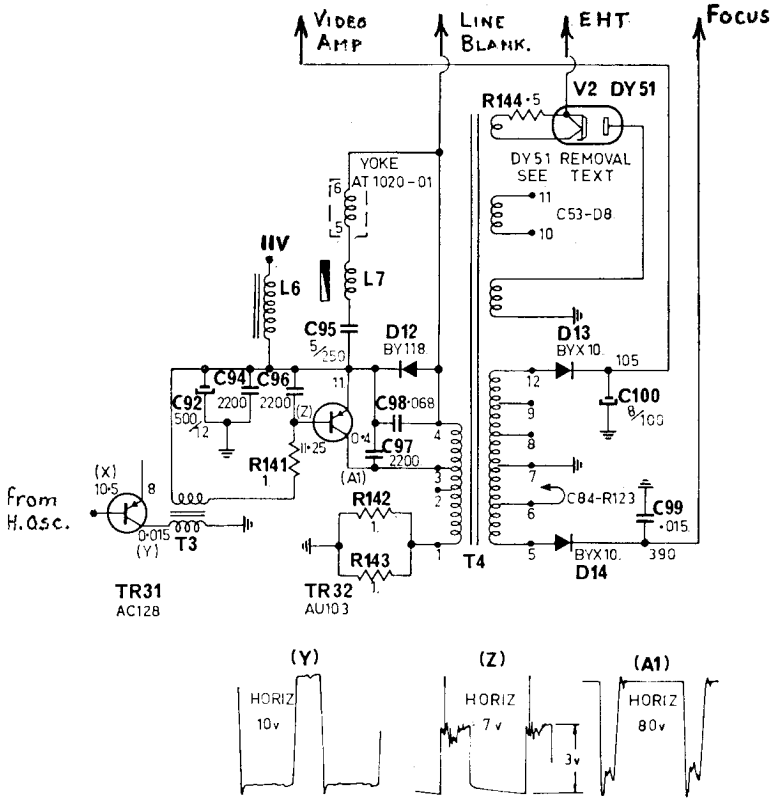


Figure 2

(If you count diodes as switches, you could say that all of the line circuitry, except for TR29, from the base of TR28 through to the E.H.T. rectifier, is a great series of switches!)

Base Drive:

The base circuitry can be extracted and drawn as shown in Fig. 3 (a).

Since the transistor is "upside down," the circuit has been re-drawn the "right way up" in Fig. 3 (b).

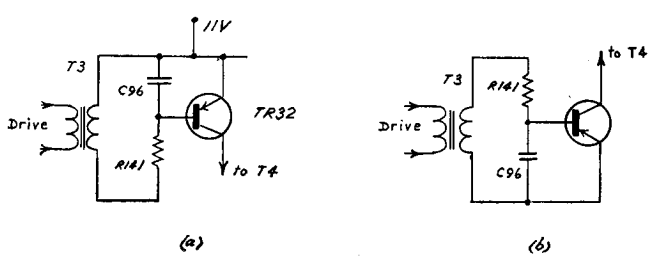


Figure 3

No D.C. base bias is supplied to the line output transistor so that with no signal, it is OFF. Now the drive waveform is rectangular in shape, consisting of short positive pulses and long negative ones.

The long duration negative signal to the base will turn the transistor on the trace while the short positive pulses will turn the transistor off for retrace.

Notice that the D.C. base voltage is slightly positive with respect to the emitter (11.25v. to 11v.) and thus the transister appears to be reverse biased. But this is brought about by base-emitter diode action when the signal is present. Where there is no signal, base voltage would equal emitter voltage.

Fundamental Line Scanning Theory

Basic Circuit:

As already indicated the line output transistor is driven on and off by base drive. It acts as a switch, controlling current through the deflection coils, and is illustrated in Fig. 4.

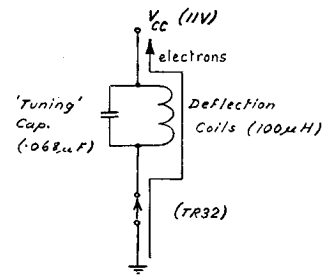


Figure 4

When the switch is closed, a constant voltage is applied and a sawtooth waveform of current starts to build up in the coils (see Fig 5). This produces a maximum of positive field, deflecting the beam to the right-hand edge of the screen. We can say the deflection coils are "charged" with magnetic field.

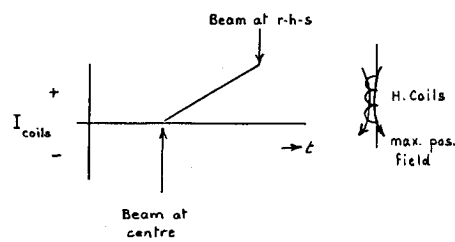


Figure 5

Now the switch is opened (see Fig. 6).

Current continues to flow in the same direction. The field will start to collapse. (The field cannot reverse until it has fallen to zero; similarly the current cannot reverse until both it the field have reached zero.)

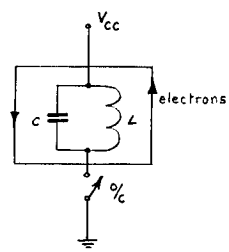


Figure 6

But the nature of the circuit has changed from simply an inductor and capacitor in parallel across the supply to a capacitor and inductor in series, with the inductor "charged" and free to oscillate. Hence in Fig. 6 (a) electrons continue to flow "upwards" in the coils following an anti-clockwise direction to the capacitor, but obeying the laws of oscillations in a tuned

circuit. The flow will continue and will result in zero current in the coils and maximum voltage across the capacity (see Fig. 7). By this action the beam is brought back to the centre of the screen.

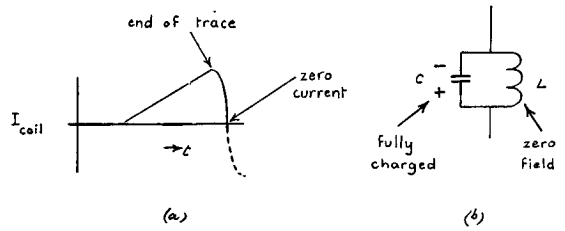


Figure 7

Now the capacitor starts to discharge through the coils (flywheel effect), but this time the current is clockwise. This is a negative current and will produce a negative field which will deflect the beam towards the left-hand side.

When current and field reach their maximum values, retrace will be terminated and the beam will be at the left-hand edge of the screen (see Fig. 8).

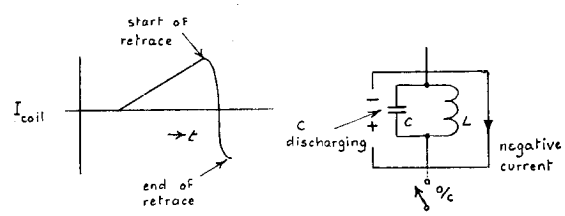


Figure 8

The switch is now closed. Again a constant voltage is applied, but this time the current flow is negative, and it decreases steadily to zero. The beam is therefore deflected steadily during the first half of trace and returned to the centre.

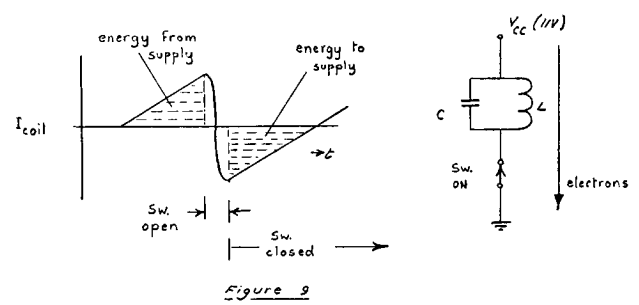


Figure 9

Notice that during this latter action, which is actually the first half of trace, electrons are *leaving* the power supply. If you think of the last filter capacitor on the supply rail, then, if electrons are taken out of it, it will be further charged. Hence the energy originally taken out of this capacitor to provide the field to deflect the beam to the right-hand side of the screen is returned to it after retrace when the beam reaches the centre of the screen again.

The above may seem unnecessarily complicated but the basic action of any line output stage is one of giving out energy and then recovering the energy. In the valve receiver it is the boost capacitor which acts this way. In the transistor receiver it is the supply capacitor which does the job.

Inserting the Transistor:

Figures 4 and 9 are re-drawn together in Fig. 10, but the switch has been replaced by the output transistor.

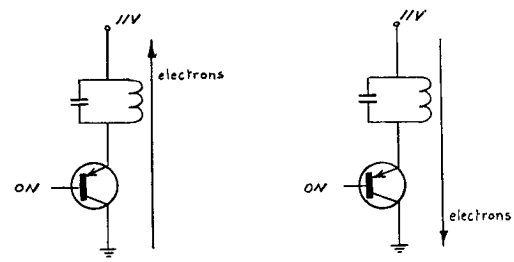


Figure 10

Notice that the transistor is conducting in two directions—"upwards" for the right-hand side of trace, "downwards" for the left-hand side.

This idea of transistors conducting in two directions may be a surprise but it is quite in order, and in the line output stage means an efficiency (or damper) diode may not be necessary.

Let us look back at valve sets again. You will remember that the line output valve produced most of the trace while the damper diode produced the remainder. This is illustrated in Fig. 11.

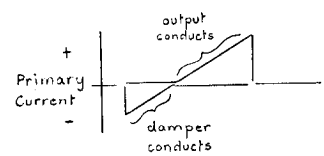


Figure 11

The current is made up a positive part, due to line output and which is larger, and a negative part due to the damper, The A.C. waveform in the secondary would be a continuous smooth waveform.

Fig. 12(a) shows the line output stage conducting its positive current while Fig 12(b) shows the damper diode conducting its negative current.

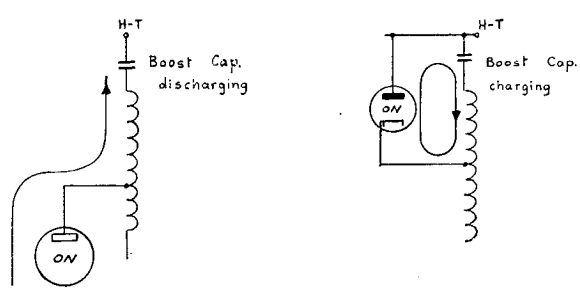


Figure 12

Now, if the line output valve had been able to conduct in both directions, a damper diode would *not* have been necessary.

What then, you might ask, is diode D12 in the Kriesler T.V. set if it's not a damper diode? And what happens if it becomes an open circuit? It is not a damper diode in the usual sense of the word. Remove it from the circuit and you would hardly realize it was gone. Brightness drops a little, the width hardly changes and there is a slight ripple in the lines near the left-hand edge. But it doesn't stop the line output stage as happens in the valve set.

You will find a diode which looks like a damper in all transistor T.V. receivers. It may be there to damp out residual oscillations after retrace, or it may be there as a parallel conducting path switched in to assist the transistor in its reverse conduction mode.

S—Correction for Wide-angle Tubes:

The discussion so far has been based on the generation of a linear sawtooth, waveform of current, illustrated in Fig. 13 (a), but with wide-angled picture tubes, the current waveform is modified as shown in Fig. 13 (b).

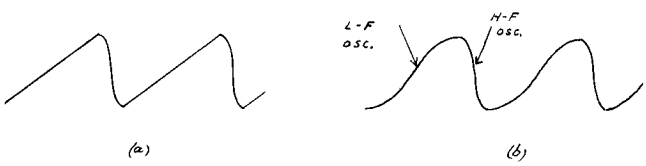
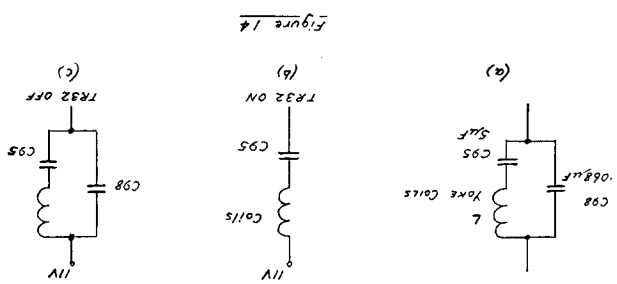


Figure 13

This waveform really consists of a low frequency sine wave for trace and a high frequency wave for retrace. A capacitor placed in series with the coils is chosen to resonate at about 10Khz. The circuit is illustrated in Fig. 14 (a).



When the switch (or transistor) is on, the oscillatory circuit has a 5 μF tuning capacitor; when the switch is open, the two capacitors are in series and have a total value approximately equal to .068 μF. Thus the circuit alternates between a low frequency oscillatory circuit and a high frequency one.

Re-drawing the Line Output Stage:

The popular usage of PNP germanium output transistors on positive supply lines means that servicemen can expect to see the output transistor drawn "upside down" with the emitter towards the supply rail. This was done in Fig. 2 and to make the circuit more readily understandable, it has been re-drawn in Fig. 15 for a negative supply instead of a positive one. Compare the two.

Servicing Pointers:

The general form of the line deflection circuitry is similar to that of the valve receiver, but the line output stage does have some significant differences. When

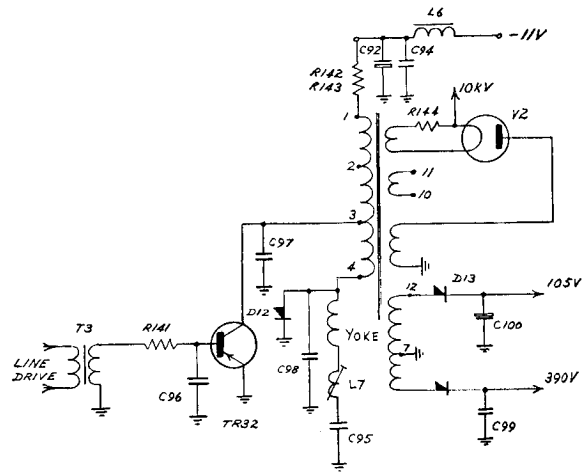


Figure 15

it comes to servicing, the line output stage has a very important difference, and this is the effect of failure of line drive. An example is the best illustration.

Suppose R135 (100K) becomes an open-circuit. TR30 will have no forward bias and will not oscillate. The collector voltage rises to 8.3v. There will be no drive to the base of TR31 and it cuts off. No pulses will be developed across T3 and there will be no drive to the output transistor TR32 which will also cut off. No E.H.T. is developed, and there is therefore no raster.

Thus, in contrast to the conditions in valve receivers when line drive rails and valves conduct at maximum, lack of line drive in transistor receivers simply results in the transistors remaining cut-off.

F.M. in 1976

Statement by Sir Alan Hulme, K.B.E., Postmaster-General

This report results from an inquiry which was conducted at my direction by the Australian Broadcasting Control Board into the possibility of Frequency Modulation Broadcasting in Australia. The inquiry attracted a great deal of interest, and the Board heard 70 witnesses and considered some 150 written submissions. In addition, the Board itself undertook, through its Technical Services Division, an exhaustive examination of the technical problems involved, which are unique to this country.

The result is a comprehensive report which the Government accepts as a blueprint for the introduction of Frequency Modulation Broadcasting in Australia.

Briefly, the Board recommends that Frequency Modulation Broadcasting be introduced in this country in the U.H.F. Band, where there is sufficient space for the service to be utilised to its full potential. The Board notes that this decision means that a great deal of fundamental planning will have to be done to prepare adequate technical standards, and the Government has asked the Board to put this work in hand immediately.

The Government has accepted in principal the Board's recommendation that Frequency Modulation Broadcasting should provide a second regional service for the Australian Broadcasting Commission, planned as far as possible to cover the entire population. The introduction of this service will overcome a serious deprivation which has been suffered by country listeners, who have available to them a less comprehensive service from the National Broadcasting organisation—the A.B.C.—than do city people. This lack has always been of concern to both the Government and the Australian Broadcasting Commission, and I am very pleased to announce that it will now be overcome.

Opportunity will also be taken to provide an FM station, devoted mainly to the broadcast of fine music, to be operated by the Australian Broadcasting Commission in the capital cities.

The Board has also recommended, and the Government has agreed in principle, that provision should be made for commercial FM services throughout the country. The Board has put forward proposals designed both to ensure that these services will be economically viable, and also to encourage new managements and new ideas. These proposals will require careful consideration.

The Board has also recommended the establishment of a new kind of broadcasting station—to be known, it is suggested, as Public Broadcasting Stations. These stations, it is proposed, would be conducted on a non-profit basis, to cater for educational, professional, musical, religious, and other like interests. The Board has proposed that the transmitters for these stations should preferably be operated by the Government, with time apportioned between interested groups by a representative committee of management. The Board has not attempted to spell out the method of operating these stations in detail at this stage. The Government accepts the fact that there is a demand in the community for the services of such stations, and will look to the Board to put forward detailed proposals in due course.

The preliminary technical work to establish an FM service in the U.H.F. Band will take approximately three years, and this will start immediately. Contemporaneously with the technical investigations, the Board will develop, in association with my Department and the Australian Broadcasting Commission, coverage plans for the National service, and will also prepare proposals for commercial stations and for the Public Broadcasting Stations.

As soon as the technical standards have been promulgated, it is hoped that the Government will be able to invite applications for licences for both Commercial and Public stations—and the first of the necessary public inquiries should be held in 1976. With regard to the National service, it is proposed that it should be developed as the work of converting the Australian Broadcasting Commission's television stations to colour is completed.

Finally, I should emphasise that the introduction of FM will not be permitted to hinder such further development of the present medium frequency services as may be possible. As I have often stated, the possibilities in this band are very limited, but there is no doubt that the existing AM stations will be the principle source of radio service for many years, and they should be developed to the maximum possible. However Frequency Modulation Broadcasting represents a significant advance in broadcasting techniques, and, when it is developed, as it will be, in the U.H.F. Band where sufficient space is available for many stations, it will offer a broadcasting service which the Government is confident, will serve this country's needs for entertainment, information, and education, for very many years.

Comment

Thirty years behind some overseas countries, Australia will be able to enjoy the benefits of FM broadcasting in about six years time. How long thereafter will it be before we can hear good music broadcast on FM radio in two-channel stereo form—which the West Germans, for example, have been enjoying for the past six years?—Editor.

Continued from page 17

There are also some very expensive valves particularly on the Admiral T.V. that can be replaced by much cheaper ones. For instance, the 6CD6 costing $7.12 can be replaced by either 6DQ6 or 6BQ6 costing only $2.89—a considerable saving, well worth the small change, on socket and grid cap. Also the 6DB5 ($6.76) can be replaced by a 6EM5 ($1.85) after connecting pin 2 to pin 7. 6BC8 (4.86) can be replaced by 6BQ7 ($2.09). There must be many more such cases.

Technicians are invited to let us know of any extension to the above list.

List of Astor models & chassis types used

(Continued from Sept.-Oct. issue)

Model	Description	Chassis Series
TBO 21	17" Solid State Portable	10A
TBO 22	21" Transportable	11
TBO 23	23" Granada 3-in-1	8A
TBO 23	23" Granada 3-in-1	11A
TBO 24	23" Granada Wide Lowboy	8
TBO 24	23" Granada Wide Lowboy	11
TBO 25	23" Granada Console	8
TBO 26	25" 3-in-1	8A
TBO 26	25" 3-in-1	11A
TBO 27	25" Bedford Wide Lowboy	8
TBO 27	25" Bedford Wide Lowboy	11
TBO 28	25" Derwent Wide Lowboy	8
TBO 28	25" Derwent Wide Lowboy	11
TBO 29	25" Trident 3-in-1	9C
TBO 30	12" Solid State Portable	10B
TBO 31	19" Royal Lowboy	8
TBO 32	23" Royal Lowboy	8
TBO 32	23" Royal Lowboy	11
TBO 33	23" Royal Lowboy	8
TBO 34	25" Royal Lowboy	8
TBO 34	25" Royal Lowboy	11
TBO 35	25" Royal Lowboy	8
TBO 35	25" Royal Lowboy	11
TBO 36	25" Royal 3-in-1	8
TBO 36	25" Royal 3-in-1	11
TBO 37	25" Royal 3-in-1	8A
TBO 37	25" Royal 3-in-1	11A
TBO 38	25" Langdon Lowboy	9B
TBO 39	25" Landon Wide Lowboy	9B
TBO 40	25" Langdon Console	9B
TBO 41	25" Langdon 3-in-1	9C
TBO 42	21" Royal Lowboy	8
TBO 43	19" Royal Lowboy	8
TBO 44	25" Royal Wide Lowboy	8
TBO 45	25" Airliner Lowboy	8
TBO 45	25" Airliner Lowboy	11
TBO 46	25" Barclay Wide Lowboy	8
TDO 47	Not Produced	
TDO 48	25" Lowboy	11
TDO 49	23" Durham Wide Lowboy	11
TDO 50	23" Durham Lowboy	11
TDO 51	25" Dorset Wide Lowboy	11
TDO 52	25" Dorset Lowbov	11
TDO 53	23" Dorset Wide Lowboy	11
TDO 54	23" Dorset Lowboy	11
TDO 55	23" Dorset Lowboy	11
TDO 56	25" Dorset 3-in-1	8
TDO 56	25" Dorset 3-in-1	11
TDO 57	21" Lowboy	11
TDO 58	25" Lowboy	11
TDO 59	25" Monte Carlo Lowboy	11
TDO 60	21" Table Model	11
TDO 61	25" (Myer's Special) Lowboy	11
TDO 62	23" (W.A. Motels) Lowboy	11
TDO 63	24" Sherwood Wide Lowboy	11
TDO 64	25" Dorset (Fringe) Wide Lowboy	9D
TDO 65	23" (Coin Operated) Lowboy	11B
TDO 66	23" (Patersons) Lowboy	11
TDO 67	25" Kalgoorlie Lowboy	11
TDO 68	25" (N.S.W. Stores) Lowboy	11
TDO 69	Not Produced	
TEO 70	24" Riviera Wide Lowboy	11
TEO 71	24" Romsey Wide Lowboy	11
TEO 72	24" Lowboy	
TEO 73	25" (Patersons) Lowboy	11
TEO 74	24" Guilford Wide Lowboy	11
TEO 75	24" (M.S.S.) Wide Lowboy	11
TEO 76	24" Stamford Table Model	11
TEO 77	24" Stamford Wide Table Model	11
TEO 78	24" Stamford Consolette	

Continued on page 24

TEO 79	23" Lowboy	11
TEO 80	25" Lowboy	
TEO 81	25" Wide Lowboy	11
TEO 82	23" (Patersons) Lowboy	11
TEO 83	24" (Patersons) Lowboy	11
TEO 84	25" (Patersons) Lowboy	11
TEO 85	12" Solid State Portable	10B
TEO 86	12" Solid State Portable	10C
TEO 87	17" Solid State Portable	10D
TEO 88	20" Motel Table Model	11
TEO 89	17" Solid State Portable	10D
TEO 90	23" Lowboy	11
TEO 91	24" Wide Lowboy	11
TEO 92	24" Lowboy	11
TEO 93		
TEO 94		
TEO 95	25" Wide Lowboy	11A
TEO 96		
TEO 97	24" (M.S.S.) Lowboy	11
TEO 98	25" Lowboy	11

Continued from page 13

layout in this box is bad in that the leads to the 1S2 enter the base of the socket through a tunnel whose open end faces the end of the EHT transformer clamping bolt, with just enough clearance to prevent arcing. However corona discharge takes place between socket and bolt which eventually carbonises the socket and then a rise in voltage causes flash over. This generates a pulse which is fed through the AGC winding leads to TS58 and TS59. TS58 is protected somewhat by R131a 330K resistor but TS59 gets it through AT321 diode. With the remounted socket there is ample clearance from the EHT bolt as well as the stick rectifier socket insulation so no further trouble should be expected.

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