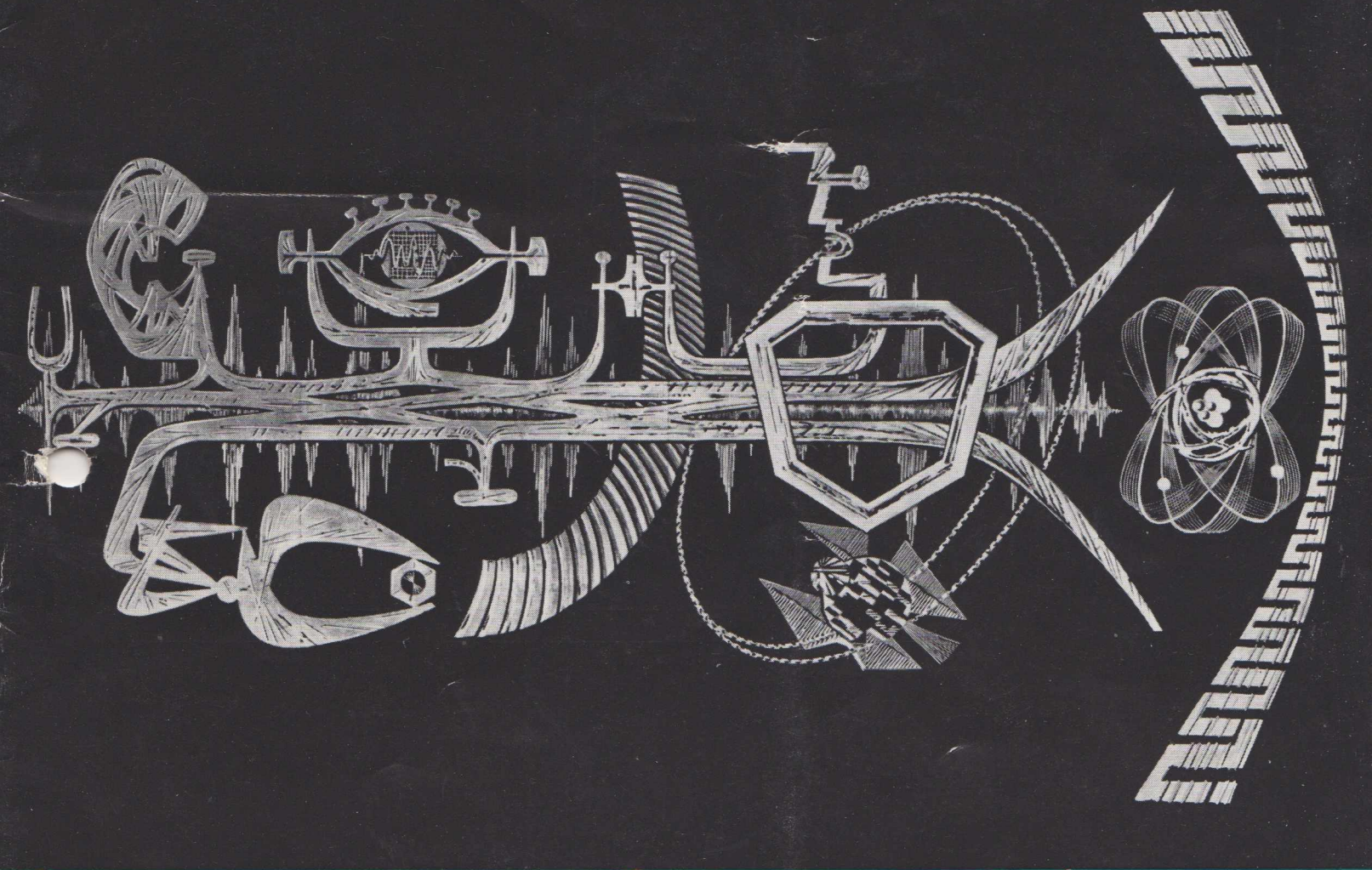
Mullard Outlook

AUSTRALIAN EDITION



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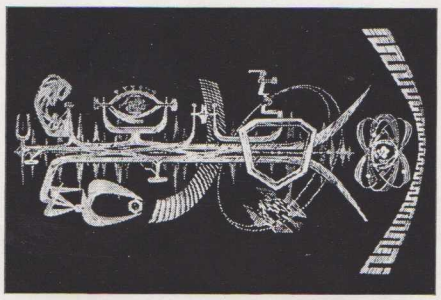

"Creation Sequence" is the title of this 22 feet x 9 feet mural in aluminium by designer John Jedwab in the Mullard Electronics Centre, London. Viewing from the extreme left to right it depicts the birth of a scientific idea and its subsequent development. The Electronics Centre is invariably on the itinerary of Australian engineers visiting the United Kingdom.

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To faithful Old Friends . . . to Cherished new Friends . . . to those whose Friendship we hope to earn . . . it is a Pleasure to Extend Best Wishes of the Season . . . may your New Year be one of Happiness and Prosperity . . .

2nd NATIONAL TV SERVICE CONVENTION

The 2nd National TV Service Convention, Chevron Hotel, Sydney, N.S.W., October 20th-22nd, was sponsored by the Television & Electronic Technicians Institute of Australia (T.E.T.I.A.) and the Television & Electronic Services Association (T.E.S.A.) and was opened by the Hon. Arthur D. Bridges (N.S.W. Minister for Child Welfare and Social Welfare).

The Convention was attended by a large number of delegates and visitors who came from all over the Commonwealth, even the remote corners of N.S.W.

Mullard-Australia General Manager, Mr. M. A. (Maurie) Brown, discusses the Mullard exhibits with two guests. On the extreme right the colour television deflection components are visible — the deflection unit AT1022, the convergence unit AT1023, the blue lateral magnet AT1025 and the EHT transformer AT2044.

As guest speaker at the official luncheon, Sir Samuel Jones, Managing Director of Standard Telephones & Cables Pty. Ltd., complimented the service engineers and technicians on their rapid and thorough assimilation of the techniques involved in introducing television to Australia. He went on to detail the scope of electronics in communications and industry, and said that with the tremendous growth in the application of more sophisticated electronic equipment the need for skilled technicians was far reaching.

Lectures by guest speakers dealt with the management side as well as the technical aspect of television servicing. Mullard-Australia Chief Engineer, Mr. H. S. Watson, chose as the theme of his talk "Modern Trends and Overseas Technical Developments" and touched briefly on colour television, a subject of some interest to the service engineer at present. Indeed, a colour television picture tube and associated deflection components displayed at the Mullard stand created considerable interest among our servicemen friends.

Colour deflection components

The EHT transformer AT2044 is designed for use in conjunction with the colour deflection unit AT1022 and will supply 25kV EHT which is regulated by a triode valve to ensure stabilisation.

The colour deflection yoke is designed with a high degree of precision to satisfy the more stringent linearity requirements of colour television receivers.

The convergence unit AT1023 is positioned immediately behind the deflection unit (AT1022) on the picture tube neck and is used for static as well as dynamic convergence. Centring, and thus colour purity, may be adjusted by moving the magnets on the back of the unit.

The blue lateral convergence unit AT1025 is mounted more towards the base of the picture tube and is used to shift the blue beam only by means of two rod magnets. Dynamic convergence of the blue beam is effected by the electro-magnets mounted on the same unit.

The winner: Mullard entertainment product sales manager, Mr. Keith Robertson, presents the multimeter to Mr. Nick Maina.

Another point of interest at the Mullard stand was a poster sized diagram showing the use of Australian manufactured silicon planar transistors in a hybrid monochrome television receiver.

(Elsewhere in this issue, an article discusses this subject in more detail.—Ed.)

How many Holes?

"How many Holes?" was the theme of an invitation at the Mullard stand to estimate the number of holes in an unformed shadowmask of a Mullard colour television picture tube. After a busy time sorting out the many entries, the Mullard Competition Committee found that the entry of Mr. Nick Maina, Northern Suburbs TV, 98 Belmont Rd., Mosman, N.S.W., came closest to the correct number of holes, and he was presented with a multimeter by Mullard entertainment product sales manager, Mr. Keith Robertson.

Mullard Publications

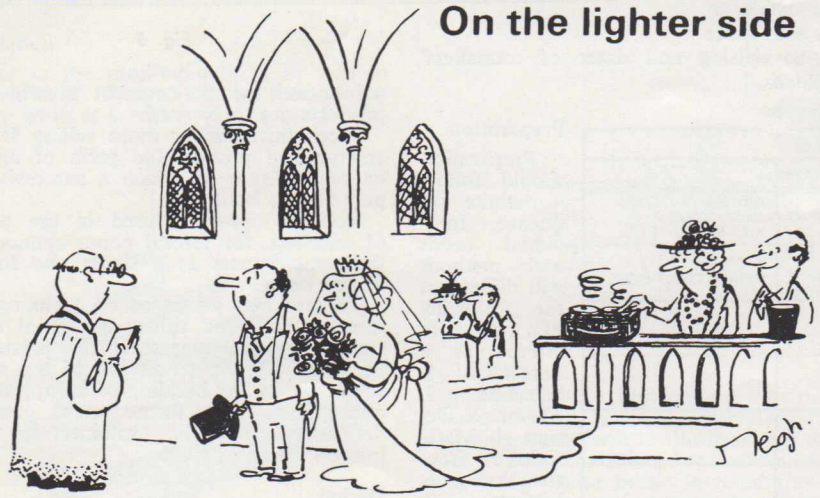
A wide range of Mullard publications was on display at the stand and a large quantity of these was handed out to visitors. One of the most sought-after was the Mullard Transistor Interchangeability List.*

The Mullard Television Picture Tube Interchangeability List, together with a comprehensive tabulation of Australian Television Channels and Repeater/Translator Stations and the little blue book (colour, not contents—Ed.) entitled "The TV Serviceman—Roving Ambassador Extraordinary" also proved popular and stocks had soon to be replenished.

As our General Manager, Mr. M. A. (Maurie) Brown summed-up during the dinner-dance which ended the activities, the Convention was "inspiring and stimulating". ■

*This publication is available from Mullard offices throughout the Commonwealth, priced at $0.25.

On the lighter side



"....AND TO OBEY"

DYNAMIC DISPLAY MEANS EXTRA SALES

PART 2: DISPLAY IN ACTION

A previous article dealt with the theory of display, its function and the principles of good design. Before passing from theory to practice it is advisable to prepare a plan of operations. This makes for good workmanship and speeds up the actual installation. There is nothing more frustrating than a display which "goes wrong" because of inadequate planning, which will always have a detrimental effect on the finished work. On occasions, of course, there may be a call for an impromptu display at short notice. At these times a working knowledge of design principles will serve as a reliable guide to the rapid formation of a well-composed arrangement, for, as I stressed in an earlier article, the elements of good design can be applied to display in all its aspects.

Planning

An adequate budget, based on business turnover, is a 'must' for a progressive display policy. As a general guide, one per cent of the turnover is a reasonable amount to set aside for advertising and display. This allocation should be sub-divided according to the needs of the business. Appropriations might be made for fortnightly or monthly window changes, interior display, fittings, showcards and price tickets, special promotions and appropriate displays for Christmas and other seasons.

The programme should be made out for several months ahead, but must be flexible enough to meet unexpected opportunities and events. I find it convenient to produce the plan in the form of a large wall chart divided into columns for the various headings. Fig. 1 shows a specimen chart with the following headings: 1. Merchandise. 2. Current Advertising. 3. Theme. 4. Properties. 5. Showcards and Price-tickets. 6. Installation date. 7. Duration. 8. Notes.

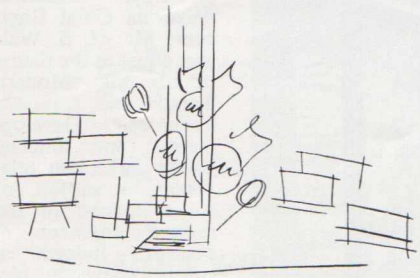


Fig. 2

It is important that events of local and national interest, with which a display link can be made, should be prominently shown in the final column. These might include major sporting events to be televised, pop music festivals (a 'natural' for promoting transistor portables), the Radio Show, trooping the Colour, Ascot, Henley, Wimbledon, etc. The chart should show with equal prominence details of local and direct mail advertising and dates of setmakers' campaigns.

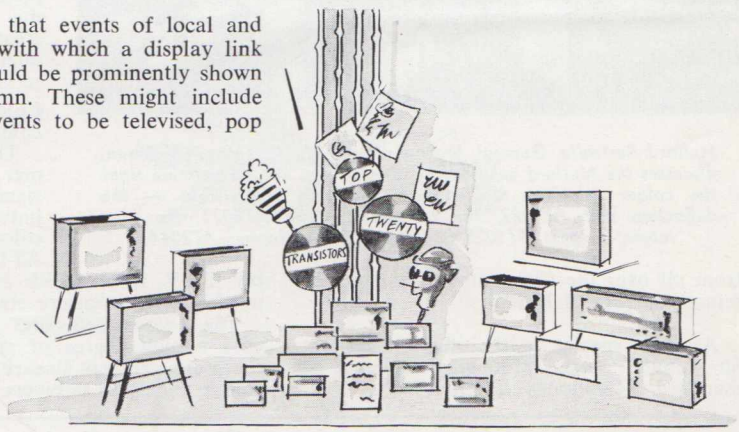


Fig. 3

By H. C. Murrills, F.B.D.S., F.R.S.A.
The author has been a practising display man for thirty years, as well as a well-known writer and lecturer on the subject.
One of his books, **The Practical Display Instructor**, is among the most widely read text books of its kind, with editions in Italian and Japanese as well as English.
He operates courses and classes for the staffs of electricity and gas boards, multiple firms, trade organizations, etc. He is an active member of the British Display Society Education Committee and is a Fellow of the Society. He also acts as an examiner for both the B.D.S. and for the examinations conducted by the City & Guilds of London Institute.

DISPLAY PROGRAMME

MERCHAND	CURRENT ADVERT	THEME	PROPS	CARDS	INSTAL	DURATION	NOTES
TV TRANSISTORS RADIOGRAMS	LOCAL	RADIO SHOW	PHOTO BLOW UPS	BLANKS STUDIO	SEPT 1st	OCT 1st	NAT. ADVERTISING RADIO TIMES NAT. PRESS
SPECIAL RENTAL	—	PRICE	—	13 x 25 BANNERS	OCT 1st	NOV 1st	EVENING DEMONSTRATIONS.

Fig. 1

Preparation

Preparation should follow a definite sequence. Individual needs and methods will differ, but the following stages are offered as a suggestion: 1. Selection. 2. Theme. 3. Design. 4. Materials. 5. Construction. 6. Fittings. 7. Tools. 8. Installation.

Selection of Merchandise

You will be the best judge of the goods to be shown, but I suggest you always strive to include in each group something of outstanding interest. Some items, while not being the best selling lines, are good 'window' merchandise. They attract by their design, by their special features or by their topical value. Other aspects affecting the choice are advertising, seasonal suitability, quality and price. Many other factors may also have to be considered, depending on circumstances.

The Theme

A selling display may be based on a careful selection of merchandise, an intelligent use of colour and lighting, a crisp and well-balanced layout and adequate ticketing. The introduction of a theme or selling story will, however, make a more dynamic appeal.

The theme should develop naturally from the sales features of the products and I usually make a mental analysis of these points and the environment in which the products are to be used.

From this, one or more selling features emerge and provide the germ of an idea or catch-phrase on which a successful display can be built.

Restraint must be used in the process of selection, for several points cannot have the same impact as a **single one forcibly driven home.**

Themes may be based on technical features, quality and value, an appeal to the customer's ego, suggesting the prestige to be gained by the possession of the article, or simply by the building of an appropriate atmosphere. The theme must create a desire and give the customer an active interest in the goods.

Design

The need to illustrate and emphasise the theme will often form the design's founda-

tion. I have three main methods: (a) by preparing scale elevation and plan, (b) by quick sketch, and (c) by allowing the design to 'grow' as I work. The sketch method is the quickest and most satisfactory for the retailer. No drawing ability is needed. Any small scribble that the originator understands will do. The only part of the sketch that needs to be absolutely accurate is the proportion of the window.

Fig. 2 shows the original thumbnail sketch for the more finished illustration (Fig. 3). An indication of the general arrangement and colour scheme, even in a simple form, means that you start work with clear intentions.

Materials and Construction

Once theme and design are defined, the materials to be used must be ordered or constructed. This includes floor and wall treatment, properties (items other than the actual merchandise) showcards and price-tickets. The average retailer will have little or no time for the construction of properties, but there are many ways of keeping this work to a minimum and the matter will be enlarged upon in a subsequent article.

Fittings

In many shops the window display appears to remain unchanged for weeks on end, simply because those responsible have little opportunity to vary the arrangements of the fittings. Unless a variety of fittings, sufficient in number, are available it is impossible to maintain a lively and interesting display. This is another subject which will be treated in a forthcoming article. In the meantime, it is always advisable to thoroughly check and clean fittings before a new display is installed.

Tools

Valuable time can be saved if tools for display work are kept in a divisioned, lightly-constructed box. The basic kit should include: staples and staple gun, light hammer, screwdrivers, scissors, pliers, Stanley knife, small hand saw, ticket pins, Scotch tape, insulating tape, drawing pins, nylon thread, dusters, etc.

The list will vary according to the technique adopted and with the number and variety of displays to be serviced. The staple gun is the most useful and versatile tool in the kit.

Installation

Prior to the installation it is as well to make a 'drill' of checking the window enclosure while it is still empty. If the following points are given attention, the enclosure will remain in good condition: 1. Check window lights, clean and replace lamps. 2. Check ceiling for general cleanliness, remove old screws, staples, wire and threads. 3. Check all backgrounds for cleanliness and possible damage. 4. Check floors—if felt-covered, recovering may be necessary. 5. Check any other points peculiar to the particular window.

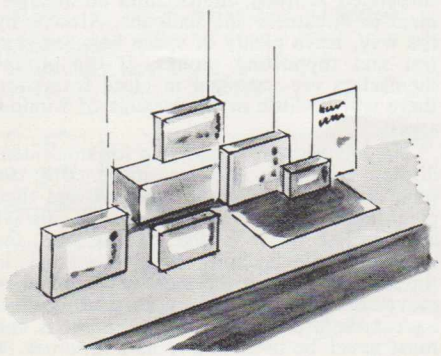


Fig. 4

Fig. 3 is an example of a display for the promotion of transistor sets where the theme has been confined to the window's centre section with supporting groups on either side. The transistor sets are shown in massed technique on a closely grouped arrangement of blocks which concentrates attention on this area. Individual sets must be precisely positioned, parallel to the window glass, but with variety of depth (Fig. 4). The supporting groups, shown at an angle, contrast with the placing of the central unit. As a general guide, groups placed at **three** different angles provide sufficient contrast of direction. A number of inexpensive bamboo poles give height to the unit while providing a background to the lively arrangement of record sleeves and the three records which carry the caption 'Top Twenty Transistors'. A human touch is introduced by the inclusion of two polystyrene heads decorated in the 'young set' idiom.

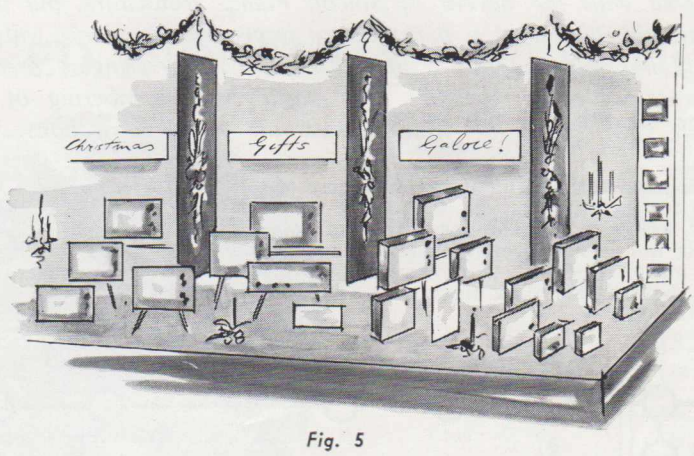


Fig. 5

Illustrations

It is neither practical nor desirable that retailers should attempt the kind of display produced by professionals. The time factor, alone, rules out such an operation.

But there is a middle course between the professional displays and the far from satisfactory displays sometimes seen in retailers' windows. It **is** possible to have the best of both worlds.

In my initial article I referred to the unchanging appearance of the average retailer's window. I believe it is perfectly possible to show a good representative selection of products while at the same time injecting some attractive and dramatic feature which will overcome this serious failure.

Fig. 5 shows an orderly arrangement of Christmas decorations that takes up the minimum of space (window space has an additional value during the Christmas period). The repetitive arrangement of the panels serves to divide the groups of merchandise and leads the vision through the complete display. A similar motif in various sections of the shop interior would maintain the same theme. The panels, made in hardboard, can be fixed to display rods running

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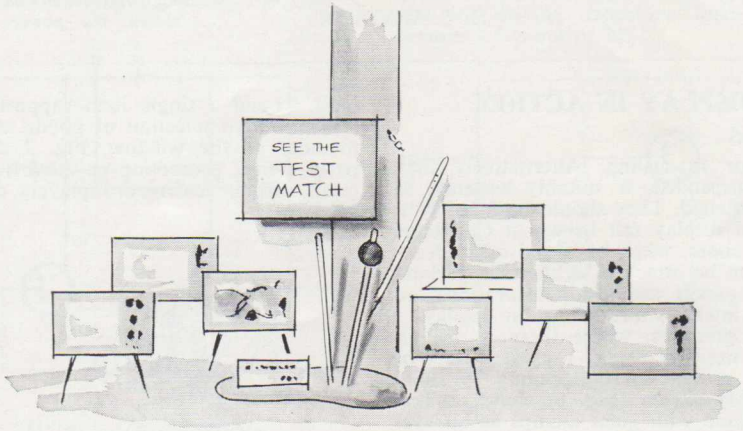

Fig. 6

In each of the illustrations shown here I have tried to design a centrepiece round a definite theme and to illustrate this theme with an attention-demanding feature. At the same time I have borne in mind the limitation of time and finance in producing designs which I hope are practical and attractive.

HYBRID MONOCHROME TELEVISION RECEIVER

Hybridisation of television has exercised the minds of design engineers for some years and though outwardly attractive, it presents many vexing problems. Many of these problems have now been resolved with the advent of Silicon Planar transistors, but it must be stated from the outset that there is little likelihood of a performance improvement over a valve receiver. It can be argued that reliability would improve and this is indeed so, providing stringent precautions are taken to ensure that the circuit is protected against picture tube flashover, remembering of course that those sections of the receiver which can readily be transistorised are not the sections where failures are normally encountered.

Why then transistorise? The answer is largely one of economics, for hybridisation or the degree of it is dictated by relative costs. The new family of Mullard TV Si-planar transistors currently manufactured in Australia now makes it possible to produce a TV receiver of the type shown in the block diagram. It will be noted that valves remain in all the power stages, not only because valves are more economical in these applications but also because the transistor power supply is easy to design, (requiring only 30 mA). In addition, all the power stages may be grouped separately to avoid heat problems and may be readily transistorised at a later date when it becomes economically feasible to do so.

There is, of course, more to the question of valve versus transistor than simply cost consideration. The transistor circuit allows miniaturisation, thus opening the door to a standard chassis for all receivers from 17" to 25". For example, the transistor circuit shown in the block diagram may be constructed on a very small printed board mounted on one side of the picture tube and the power circuits and power supply mounted on a small but convenient chassis on the other side of the tube. ■

H. S. WATSON.

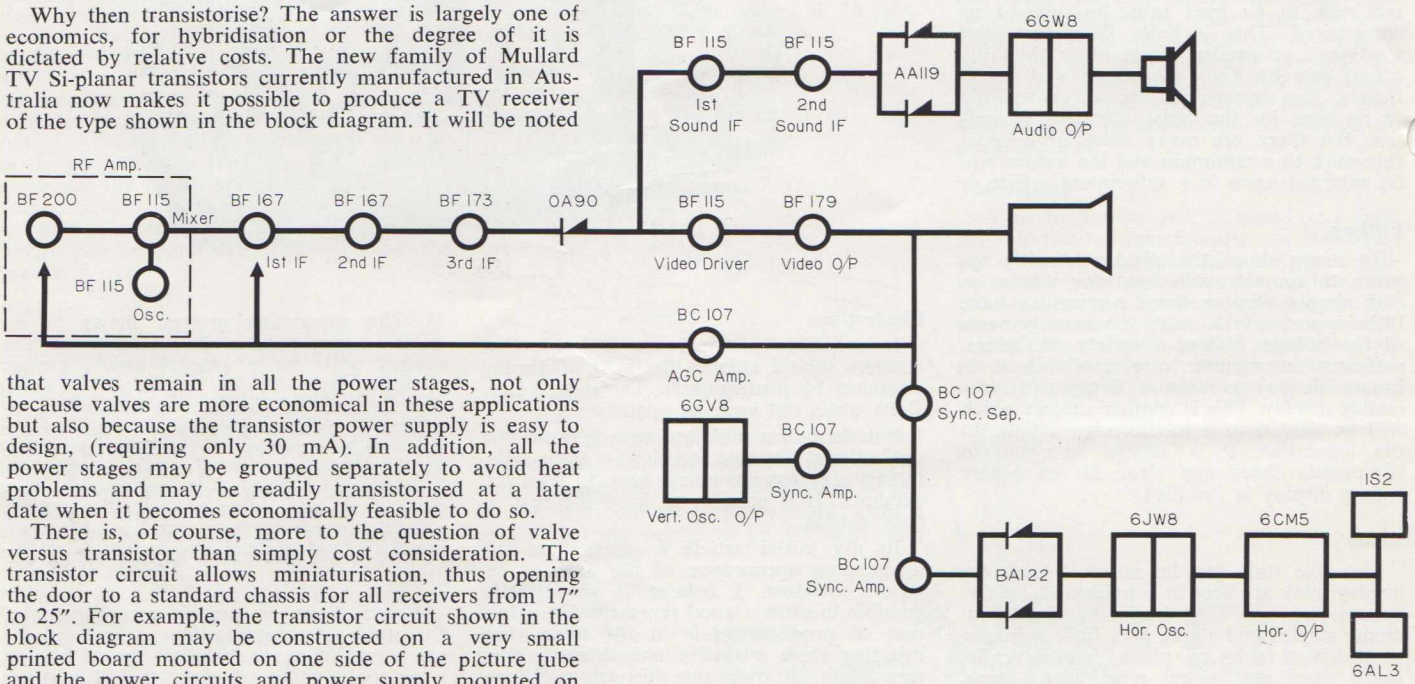

Fig. 1. Block schematic diagram of a typical hybrid monochrome television receiver, using fourteen silicon planar transistors, five diodes and six valves. Although not shown, the power supply would normally use two OA210 silicon diodes.

DISPLAY IN ACTION

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from floor to ceiling. Alternatively they can be suspended, if suitably battened to keep them rigid. They should be faced with bright red display felt to which Christmas ferns, fir cones, witch balls and other decorations can be attached. A metallic garland links the panels and small decorations are placed at intervals throughout the display.

Rental premises, where there is not always the need to display a great variety of products, present an opportunity for bold display. My sketch (Fig. 6) shows a Test Match theme with giant stumps as an eye-catching motif. Greatly enlarged properties attract attention and the flying stumps and bails suggest movement. Stumps can be made cheaply in 1½ in. dowelling and the giant ball, screwed to one of the stumps, is made from a wood ball as stocked by most timber shops. A hardboard base, covered in green felt, is drilled to take two of the stumps. The TV-shaped board is displayed in the vicinity of the operating set.

Occasionally an arresting display can be built around a single item supported by a representative selection of goods in the remainder of the window. Fig. 7 depicts a party theme, promoting an attractive radiogram with a few record players displayed in the same area. The properties are readily obtainable, inexpensive and make no demands on installation time. Atmosphere is provided by the inclusion of colourful scatter cushions, a small coffee table set, drinks and a few record sleeves.

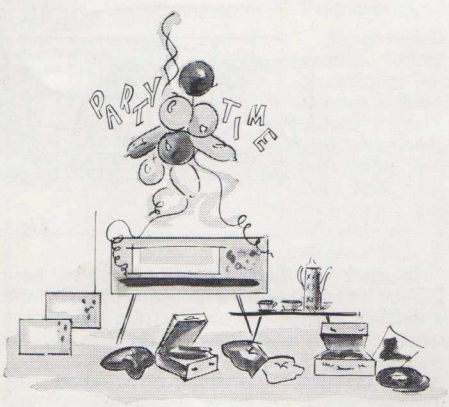


Fig. 7

'Party Time' in bold individual letters is suspended at lively angles amid an arrangement of streamers and balloons. Always, by the way, leave plenty of space between central and supporting groups. If the groups themselves are arranged in close formation there will be little or no wastage of window space.

The inclusion of a turntable for small-item display increases effective space. But use such aids only for a short period and then give them a rest. Movement will always attract, but there is the danger that the specator may become more interested in the movement than the merchandise. When movement is used in any display it must have a close connection with the goods and must never be used simply as a gimmick. ■

This article will be continued in Outlook Vol. 10, No. 1.

INTEGRATED LOGIC CIRCUITS

The new integrated circuits types OMY120 to OMY125, have a narrower temperature range than the parent OMY100 to OMY105 group which was developed for more demanding military requirements. All of the new types will be available in quantity shortly at very competitive prices. Closely matched characteristics allow these circuits to be used as simple 'building blocks' to make up complex computing and counting systems at a lower cost than is possible with similar circuits constructed in accordance with conventional techniques.

COMPETITIVELY PRICED INDUSTRIAL SELECTION

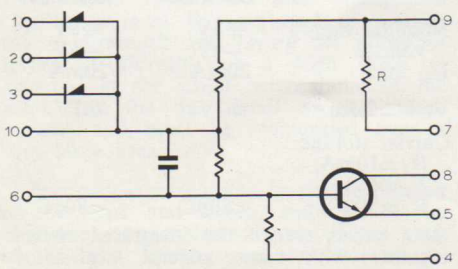
Diode transistor logic has been chosen because this system permits optimum design for a given set of requirements without the need for close tolerances on the individual components—both active and passive—forming the circuit. DTL circuits are highly standardised and widely accepted as a fully proven circuit technique.

There are six Mullard integrated circuits in this series, to which eleven type numbers have been allocated to identify the temperature selection—items OMY100 to OMY105 provide the extensive coverage from −55 to +125°C demanded for military applications, whilst items OMY120 to OMY125 meet the 0 to +75°C general industrial requirements. All circuits are designed to operate from +6V and −6V supplies and have a short-term overload rating of 9V. They are in 10-lead TO-5 encapsulation with a reduced envelope height of only 5.33mm. The cans are isolated.

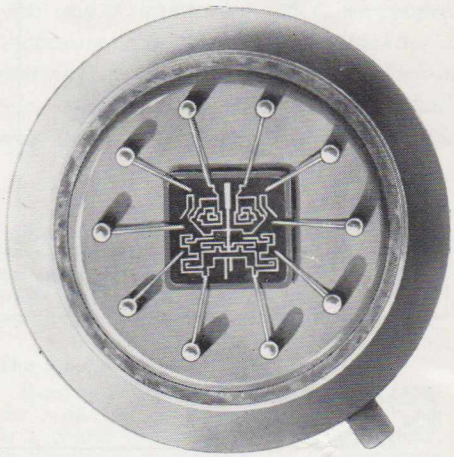
OMY100/OMY120 DTL Nor/Nand Gate

Nor/nand integrated circuits OMY100 and OMY120 are each three-input gates with a fan-out of up to 7. In addition to these inputs, a direct connection is available to the node point and transistor base so that fan-in can be extended if required by the addition of either external diode elements or 5-diode expanders type OMY105 or OMY125. Advanced design gives a high noise margin—typically 950mV—an excellent feature which will in most cases allow these circuits to be used without special screening arrangements.

	OMY100	OMY120
Nominal supply voltage	+6V −6V	+6V −6V
T_{amb} operating	−55 to +125°C	0 to +75°C
Typical propagation delay	23ns	23ns
Signal/noise immunity at 25°C	950mV	950mV
Signal/noise immunity at 125°	400mV	—



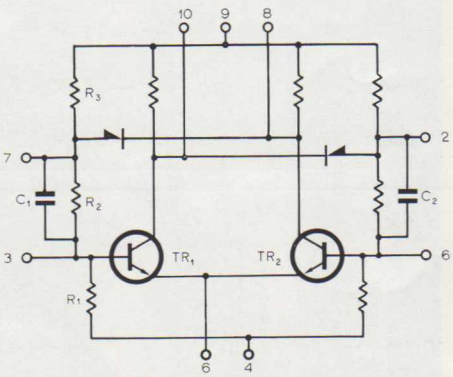
OMY100/OMY120 nor/nand gate.



The OMY series of integrated logic circuits is mounted in a modified TO-5 encapsulation which is only 5.33mm high. A greatly enlarged cross-section is depicted, clearly showing the "chip" and associated connections.

OMY101/OMY121 DTL Bistable

Bistable integrated circuits OMY101 and OMY121 have been designed for use as AC or DC coupled counters or shift registers. Each has a fan-out of up to 6 and is capable of operating at frequencies up to 5Mc/s. When used in an AC flip/flop with steering circuit OMY102 or OMY122, the maximum operating frequency is 2Mc/s

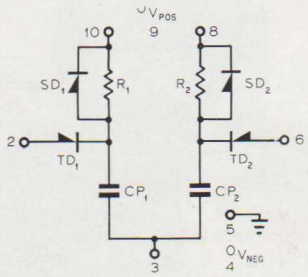


OMY101/OMY121 bistable.

	OMY101	OMY121
Nominal supply voltage	+6V −6V	+6V −6V
T_{amb} operating	−55 to +125°C	0 to +75°C
Noise margin with diode input	400mV min	

OMY102/OMY122 DTL Steering Circuit

The OMY102 and OMY122 are steering circuits designed for use with OMY101 and OMY121 bistables respectively. Their use effectively converts these bistables from two input set/reset circuits to single input counting circuits.

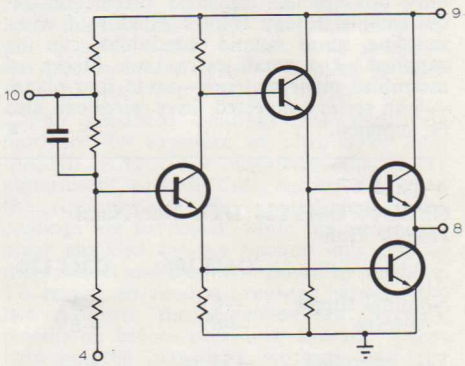


OMY102/OMY122 steering circuit.

	OMY102	OMY122
Nominal supply voltage	+6V −6V	+6V −6V
T_{amb} operating	−55 to +125°C	0 to +75°C
Operating frequency	2Mc/s	2Mc/s

OMY123 Buffer Amplifier

The OMY123 buffer amplifier has a high output current which makes it eminently suitable for high fan-out applications, and for driving capacitive loads. Its use permits a fan-out of 20.



OMY123 buffer amplifier.

Nominal supply voltage	+6V −6V
T_{amb} operating	−55 to +125°C
Typical propagation delay	50ns
Noise margin	400mV

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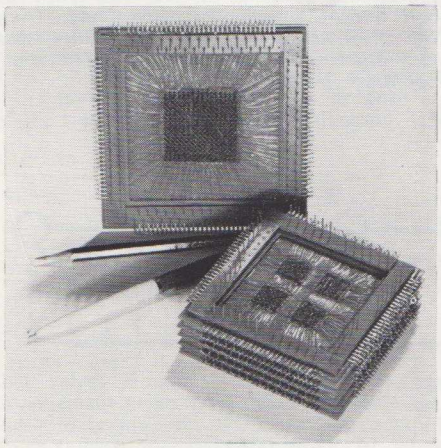
Magnetic Matrices for Low-cost Data Storage

The latest release in the wide range of magnetic matrix assemblies is a series of inexpensive single-plane matrices designed to meet the technical and economic storage requirements of small electronic digital equipment. Used for storage in such equipment, in small calculating machines for example, magnetic matrices offer important advantages over semiconductor stores, not only in cost and space occupied per stored digit, but also in the fact that, once data is in the store, it is not lost even though the equipment is disconnected from the mains supply.

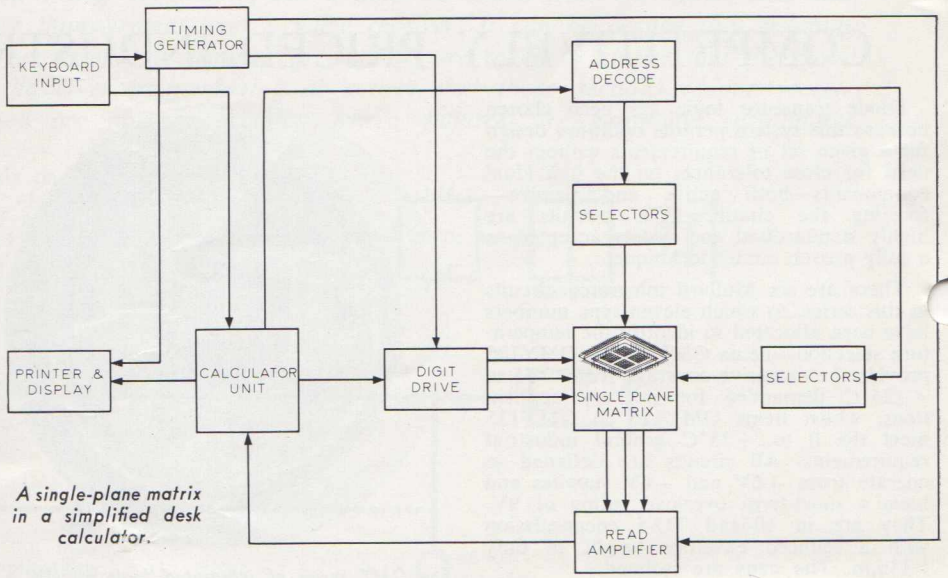
The operational stability of these matrices is assured by the wide temperature range (0 to 70°C) of the lithium nickel ferrite cores used in their construction. This permits operation without current compensation over a wider temperature range than is possible with most other conventional



Type AW3529 single-plane matrix and matrix stack.

cores. Low drive current operation (190mA) is obtained by using 2-turn X, Y and Z windings, to reduce the drive requirements and thus permit relatively simple drive and selection circuits to be used. Wiring is in accordance with the well-known MIT system.

The keen prices at which these planes are offered result from extensive standardisation—frame sizes are limited to four basic dimensions: non-standard frames can only be supplied for mass production requirements. Epoxy frames capable of withstanding more humid conditions can be supplied at a small extra cost. Stacks of assembled plane matrices—up to four planes—with series connected drive wires can also be supplied. ■



A single-plane matrix in a simplified desk calculator.

THE STANDARD RANGE OF SINGLE PLANE MAGNETIC MATRICES

Type No.	*Plane layout (No. of cores)*	*Total No. of bits*	*Outer dimensions*
AW3526	One — 16 × 16	256	82 × 82mm
AW3527	Four — 8 × 8	256	82 × 82mm
AW3529	Four — 12 × 12	576	102 × 102mm
AW3531	Four — 16 × 16	1024	122 × 122mm
AW3532	One — 32 × 32	1024	122 × 122mm

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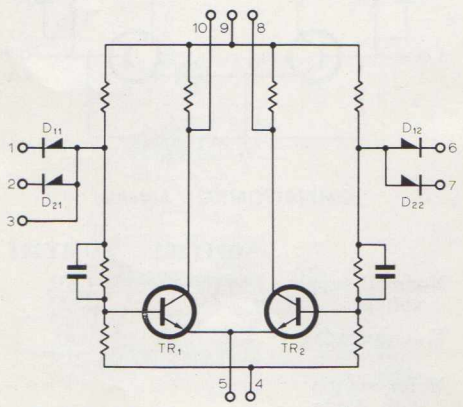
OMY104/OMY124 DTL Nor/Nand Double Gate

	OMY104	OMY124
Nominal supply voltage	+6V −6V	+6V −6V
T_{amb} operating	−55 to +125°C	0 to +75°C
Typical propagation delay	24ns	24ns
Signal/noise immunity at 25°C	950mV	950mV
Signal/noise immunity at 125°C	400mV	—



OMY104/OMY124 nor/nand double gate.

OMY105/OMY125 5-Diode Expander

This expander has been designed for use with OMY100 nand/nor gates to increase the fan-in of these devices.

	OMY105	OMY125
Nominal supply voltage	+6V −6V	+6V −6V
I_{FM} max.	20mA	20mA
$V_F(I_F=2.5mA)$	0.7V	0.7V
Carrier storage (I_F=10mA, V_R=5V, R_R=500Ω)	<80pC	<80pC

Data sheets on all the integrated circuits together with some general explanatory notes will be supplied on request. ■

MULLARD 'ColourScreen' COLOUR TELEVISION PICTURE TUBES

The Shadowmask

Many possible display devices have been proposed for colour television, and a few have reached the stage of laboratory demonstrations. Only one, however, has yet been fully engineered and become commercially available, and that is the shadowmask tube. In this and a subsequent article we propose to discuss Mullard 'ColourScreen' tubes and their manufacture. The elaborate processes of mask making and screen laying will be especially emphasised, since these have no counterparts in the manufacture of black-and-white tubes, and may not therefore be familiar to retailers and service engineers. In this issue we shall concentrate on the production of the shadowmask: in one of the next issues the depositing of the phosphor screen will be discussed.

Colour television pictures are a synthesis of red, green and blue primary-colour images that correspond to the primary-colour content of the original scene. In the shadowmask tube, these three images are reproduced simultaneously by three independent guns and one common deflection system. Integration of the three colour images relies on a display screen composed of a fine mosaic of light-emitting phosphors. Three such phosphors are used, one glowing red when energised, one glowing blue and one glowing green. These are laid down in a closely interwoven pattern of triads of dots which are not discernible at normal viewing distances.

Excitation of the phosphors is by means of three electron beams derived from the three electron guns in the neck of the shadowmask tube. The three colour-drive signals are applied to the guns so that each beam carries one primary-colour signal. The three beams scan the screen in the usual way, except that provision is made to ensure that each colour phosphor is excited by the correct beam. This colour selection is effected by means of the "shadowmask", which is a perforated metal sheet interposed between the phosphor screen and the guns. The phosphor dots are so disposed on the picture-tube faceplate that the "red" electron beam traversing the mask can only impinge on the "red" phosphor; the "blue" beam on the "blue" phosphor; and the "green" beam on the "green" phosphor. In this way the three primary images are produced simultaneously and in such an intimate pattern that from normal viewing distances they appear as a full-colour reproduction of the original.

Much skill and care are needed in the manufacture of the shadowmask tube. Exceptional precision and scrupulous cleanliness must be employed in making the shadowmask and laying the phosphor screen. Uniformity of a high order is essential in the small perforations of the mask and the fine detail of the screen mosaic and must be maintained over a very large area.

Accuracy is paramount in the positioning of the mask and screen, and also in the alignment of the electron guns in the neck of the tube. Inaccuracies can lead to imperfect beam shadowing and consequently, imperfect colour reproduction. Closeness in matching the electrical characteristics of the three electron guns is vital. Disparities either initially or occurring during life can result in unacceptable colour distortion.

The Shadowmask

Readers will probably now be quite familiar with the purpose of the shadowmask in a colour television picture tube. Briefly, its function is to constrain the three electron beams carrying the primary-colour signals to appropriate areas as the beams scan the picture-tube screen. These areas are minute dots of luminescent phosphors that glow red, green or blue when they are energised. If the colour beams strike phosphor dots of the wrong colour luminescence, then the colours of the displayed scene will not correspond with those of the original scene.

In essence, the shadowmask is a thin sheet of metal about the size of the picture-tube faceplate containing an extensive pattern of minute and closely-spaced holes. The method of manufacture is basically one of photo-chemical etching similar to that used in the preparation of lithographic half-tone plates for printing. However, the accuracy required for the size and spacing of the holes in the shadowmask is such that the tolerances imposed during manufacture are many times narrower than those accepted for the production of the lithographic plates. And the standards of cleanliness maintained at the various critical stages of the production of the mask are often comparable only with those encountered, for instance, in the most delicate and intricate stages of the manufacture of semiconductor devices.

Shadowmask sheets after coating with photo-sensitive etchant resist.

Dust and lint-free conditions are essential and special clothing is worn by operators.

Hole pattern printing for etching

Mullard shadowmasks begin as rolls of mild steel, some six-thousandths of an inch thick, from which lengths are cut, chemically cleaned and scrubbed with an abrasive slurry. The slurry produces a fine mesh of scratches over the surfaces which forms a key for a photosensitive etchant-resisting coat. To facilitate etching from both sides of the sheet—and this is essential to achieve the requisite hole profile—the photosensitive resist is applied to both sides of the plate simultaneously.

The sensitised coatings are selectively hardened by exposure to ultra-violet light through screens—or negatives—that carry patterns of opaque dots corresponding to the required holes. The exposed areas of the coatings are hardened, while the unexposed areas shielded by the opaque dots remain unhardened and can be removed by washing. To ensure an accurate register between the two patterns, the negatives are precisely positioned before exposure, and the spaces between the sensitised surfaces and the negatives are evacuated to give intimate contact during exposure. Even slight misalignment of the patterns will give wrongly profiled holes after etching.

Deposition of the photosensitive resist and the formation of the etching patterns require scrupulously clean conditions and special illumination. The holes to be produced in the mask are comparable in size

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ColourScreen Colour Television Picture Tubes—continued

with particles of dust, so that the hole patterns could be ruined by the presence of dust. Furthermore, the sensitivity of the etchant-resist to normal illumination necessitates actinic-free lighting. Consequently, sodium lamps have been installed in dust-proof photographic rooms expressly designed for these stages in the manufacture of the shadowmasks of Mullard colour tubes.

General view of developing area for shadowmask sheets where sensitised sheets are "developed" after exposure to ultra-violet light: the emphasis on dust-free conditions is apparent.

Master negatives of hole patterns

Exposure of the light-sensitive etchant-resist described above is made through two photographic negatives, each of which comprises tens of thousands of accurately-dimensioned and precisely-located minute opaque dots. The acceptability of the completed shadowmask depends greatly on the quality of these negatives, and since they are obviously subject to some wear and tear during normal use, it is imperative that they should be fairly readily reproducible. Two master negatives, from which the secondary negatives for each side of the mask can be obtained photographically, are therefore kept at the Mullard factory. Without doubt, the production of a master negative involves higher standards of accuracy than does any other stage in the manufacture of a colour television tube. On the precision of the master negatives rests the quality of the shadowmask, and consequently of the quality of the phosphor dot patterns on the screen.

On it therefore rests the fidelity and purity of the colour picture in the complete receiver.

The major problem in making these masters is that an accuracy of the order of micrometres (microns) must be maintained over an area of some four to five thousand square centimetres.

Before the master negatives can be photographically produced, a large fine-mesh screen comparable with the photo-lithographic halftone screen is required. This screen comprises two sets of hundreds of closely-spaced parallel lines accurately machine-ruled onto the surface of optically flat plates of glass which are cemented together with the ruled surfaces in intimate contact, the sets of lines being inclined to each other at a precisely determined angle. Although the mesh of this screen is coarser than that of a half-tone screen, the accuracy of the angles and dimensions of the mesh is many times greater than that required for the half-tone screen.

When installed in the camera, the screen functions like the half-tone screen: it breaks up the light falling onto the photographic plate into countless small discrete areas of light. Correct positioning of the camera aperture, the screen and the photographic plate then give the required circular areas of light on the plate. When this is developed a pattern of circular dots is thus obtained on the negative.

The diameter of the dots depends on the light intensity at the plate, and therefore on the intensity of the source. A variation in the light distribution in front of the camera will result in different size dots over the negative. To obtain a suitable dot structure, the light distribution must therefore be precisely controlled, and this is achieved by means of a specially designed Mullard photo-multiplier and light integrator.

The ruled screen is used for both negatives, and the two different patterns are achieved by adjusting the intensity of the light source. The adjustment of the camera is not altered from one negative to the other, so that the essential precision matching between the two sets of dots on the master negative is ensured.

Etching and shaping

Etching of the holes in the shadowmask is performed in a large tank in which the two pattern-imprinted surfaces of the metal sheet are exposed simultaneously to batteries of jets. The etchant is ferric chloride solution, and each sheet is sprayed with it for three to four minutes. It is then turned through 180 degrees and sprayed again for the same period. In this way, possible unevenness in etching at the top and bottom of the sheet is avoided.

The resist is now removed from the mask, the mask is cleaned and dried, and surplus metal around the periphery is removed.

In the completed shadowmask tube, the mask is situated about one centimetre from the inner surface of the glass faceplate. For correct functioning of the tube, the shape of the inner surface and the mask must be the same. Before assembling the mask and faceplate, therefore, the flat perforated mask must be pressed into a spherical form that matches accurately the contours of the inner surface.

To remove directional stresses in the mask that could prove troublesome during pressing, the flat masks are first annealed and then rolled in a roller-leveller comprising two sets of pairs of staggered rollers through which the masks undulate.

A similar process is applied to the sheet metal used for car bodies before pressing: its purpose is to prevent the occurrence of lüder lines—lines of non-uniform stretching—in the pressed metal. Pressure is then applied to the mask by means of a steel piston in such a manner that the hole pattern

A shadowmask sheet is exposed to ultra-violet light.

in the masks is not distorted. The forming surface of the piston is spherical, and its radius of curvature is slightly larger than that of the tube faceplate to allow for elastic recovery in the mask when the pressure is removed.

The formed shadowmask is welded to a

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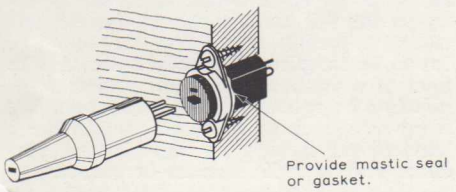
MULLARD MINI SPEAKER UNITS

A DESIGN FOR SMALL LOUDSPEAKER HOUSINGS

The popularity of the Mini Speaker Unit has necessitated yet a further reprint of the leaflet entitled "Mullard Mini Speaker Units"* which contains the combined articles that have appeared in OUTLOOK to date. Also tabulated in this leaflet are suppliers of approved Mini Speaker enclosures.



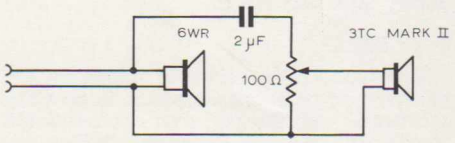
Method of sealing the connector

OUTLOOK Enquiry Service

Enquiries regarding the Mini Speaker Unit are often centred around the air-tight sealing of the enclosure and the materials used.

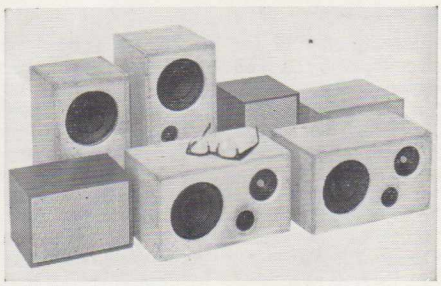
* This leaflet is available on receipt of a self-addressed stamped envelope (no smaller than foolscap size) endorsed "Mini Speakers".

A point which often seems to be overlooked is the sealing of the lead-out loudspeaker wires, which becomes especially important when a plug-in connector and socket are used. Some of these connector sockets are designed in such a way that when they are mounted onto the back cover of the loudspeaker enclosure, air can move to and fro, thus seriously impairing the performance of the unit. A sketch has been prepared to show how the sealing of the connector may be effected.

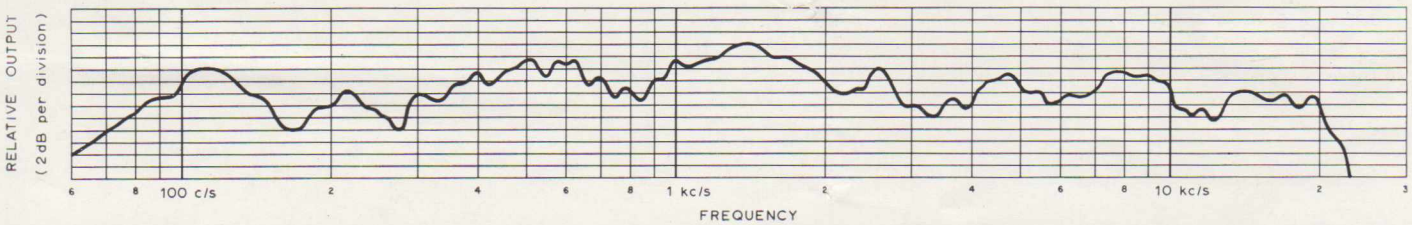


Circuit showing component parts necessary for the attenuation of the high frequency sound radiation.

It is often felt that the high frequency radiation of the Mini Speaker enclosure is too good for some applications. The Mullard Applications Laboratory has designed a circuit which allows the high frequency performance to be controlled without affecting noticeably the impedance of the whole unit. When installing the potentiometer care has again to be taken to effect the air-tight sealing and with most potentiometers the mounting bush is sufficient. ■



Early experimental enclosures from which the Mini Speaker Unit evolved.



The response curve of the Mullard Mini Speaker Unit was measured with the microphone on the tweeter axis 18" away from the front of the enclosure.

ColourScreen Colour Television Picture Tubes—continued

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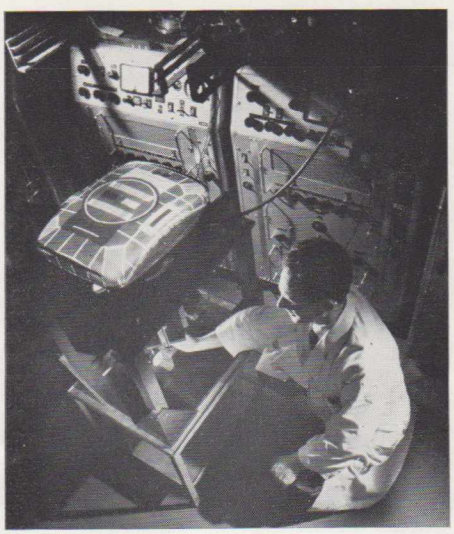
circular support ring to which are also welded three supporting springs. Since a large proportion of the electron current from each gun is intercepted by the mask during operation of the tube (the average transmission of the mask is only 15%) considerable heat will be generated in the mask. Therefore the assembly of formed shadowmask and support ring is blackened to give the surfaces good heat radiating properties.

Assembly of Shadowmask and Tube Faceplate

As will be seen in Part 2 of this article, the shadowmask plays an essential part in the production of the intricate phosphor screen of a shadowmask tube. Unlike the screen of a black-and-white tube, the screen of the colour tube is laid before the glass cone of the tube is added to the faceplate.

Production of the glass faceplate is basically the same as that for the black-and-white tube. The composition of the glass differs, however. Cerium oxide is added to the glass for the colour tube to prevent the occurrence of X-ray browning. This precaution is taken because higher EHT potentials will be used with the colour tube than with black-and-white tubes, and larger beam currents will flow. The glass for the faceplate of the shadowmask is also harder than that for monochrome tubes to prevent any sagging during the longer pumping processes essential with the shadowmask tube.



While an electrical test is being carried out on a television tube the shape of geometry of the tube itself is measured.

During the production of the faceplate, three metal pins are embedded in its rim. Holes in the spring mountings welded to the support ring of the shadow mask fit over these pins when the mask and faceplate are assembled. Since the dimensions and location of the pins and holes are extremely accurate, very precise positioning of the mask on the faceplate is ensured.

Precision mounting is also of vital importance in subsequent screen-laying processes. Up until this point in the production of the Mullard shadowmask tubes, any shadowmask can be used with any faceplate. However, the mask and faceplate become intimately wedded during the depositing of the screen material, and although the assembly is dismantled during the processes, once screen-laying has begun, the one mask can only be used with the one faceplate. The screen-laying operation and the remaining manufacturing stages of Mullard shadowmask colour picture tubes will be described in one of the next issues of OUTLOOK. ■

Impedance Conversion and Chopping = M-O-S TRANSISTORS

Two Mullard high input resistance metal oxide semiconductor n-channel transistors have recently been released under type numbers BFX63 and BSX82. Introduced as development devices just over a year ago [95BFY] and now available in production quantities, m-o-s transistors have been the subject of an extensive programme of applications investigation and research.

Type BFX63

Recommended for impedance conversion circuits, the BFX63 enables such circuits to be designed with, typically, input resistances of at least $10^{11}\Omega$ and output resistances in the region of 1000Ω: the voltage gain is approximately 0.92. More sophisticated impedance conversion circuits, using a second transistor such as the BC108, can be used to increase the circuit input resistance and decrease the output resistance. Design flexibility is assured by the fact that the BFX63 is suitable for operation in both enhancement and depletion modes.

In addition to its use in general purpose impedance amplifiers, the type BFX63 is also suitable for use in impedance converters for piezo-electric transducers and in temporary analogue stores.

Type BSX82

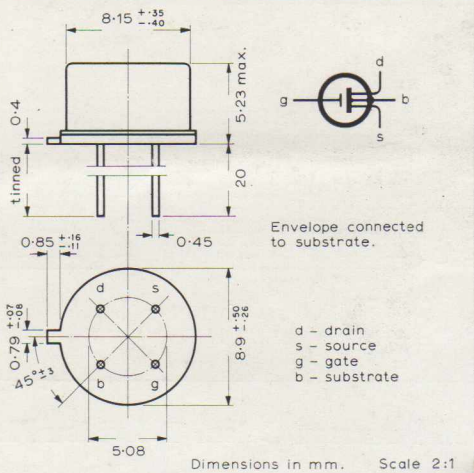
The BSX82 is primarily intended for chopping applications in which it provides substantial advantages over conventional transistors, because, in these applications, the BSX82 exhibits neither offset voltage nor current. It also offers low drain-to-gate capacitance, a feature which gives very small feed-through transients and permits chopping rates of up to some hundreds of kilocycles to be achieved. A second application for this transistor is in multiplexing where it permits periods of the order of 1μs to be sampled. The BSX82 can also be used as a variable resistance, a typical application being found in a.g.c. circuits where it provides such an order of control that a hundredfold increase in input signal produces only a 50% increase in output.

Both m-o-s transistors are in TO-33 encapsulation with the substrate connected to the can. ■

ABRIDGED ADVANCED DATA FOR TYPES BFX63 AND BSX82

Max. V gate to substrate	±15	V
Max. V gate to source	−30	V
Max. I_D	50	mA
Max. power dissipation (T_{amb} = 25°C)	250	mW
Gate to source cut-off voltage (I_D = 20μA, V_{DS} = 20V)	−4.5 to 0	V
Min. gate transconductance (I_D = 5mA, V_{DS} = 20V)	1.3	mA/V
Max. drain source 'ON' resistance (I_D = 10μA, V_{GS} = 5V)	1	kΩ

OUTLINES AND DIMENSIONS



Outlines for types BFX63 and BSX82 are identical.

Mullard Take Integrated Circuit Lead with Range of 2 Nano-Second Logic Circuits – Fastest-ever Computer Circuits

With the announcement of a new series of integrated circuits having a propagation delay time (operating time) of only 2 nanoseconds, Mullard claims to have taken a world lead in high-speed microcircuits.

The new circuits are emitter-emitter coupled logic (E^2CL) types and are for use in the central processors of very fast computers. Faster by a factor of two or three times than other commercially available integrated circuits, they will allow computer speeds and efficiencies to be significantly increased with resulting savings in costs to the computer user.

Designed by the Mullard Central Applications Laboratory, the new circuits are one of the first results of the company's recently announced expansion of microcircuit activity, and by early 1967 production of a range of E^2CL circuits will have started at the company's Southampton factory. The range will be rapidly enlarged to include at least 6 gate circuits, 2 flip-flops and an interface unit.

E^2CL circuits are designed to extract the maximum advantage from the inherent possibilities of integrated circuit technology, including the development of even faster circuits with sub-nanosecond delay times, low cost and close control of all important circuit parameters. Advantage has been taken in the circuit design of the small device-to-device spreads and the low temperature-differential on the silicon chip to give a circuit in which temperature effects are minimal.

In spite of their high operating speeds, the circuits have a low power consumption —60mW for a standard double gate with a 0.7V logic swing from 0 to −0.7V. Their input and output impedances have been designed for use with standard 75-ohm transmission lines, since operation at this low impedance-level improves stability and reduces difficulties caused by signal reflections, and their noise margins are at least 20% at each end of the logic swing.

Several methods of driving transmission lines are possible with E^2CL circuits to meet the requirements of modern central processors. ■

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Mullard Outlook

AUSTRALIAN EDITION

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and

Product Type Number Index

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VOLUME 9, 1966

MULLARD OUTLOOK

TABLE OF CONTENTS — VOLUME 9, 1966

In addition to the main heading of any article, significant product type numbers have been included in square brackets for convenience. Readers should also refer to the Product Type Number Index shown at the end of this tabulation.

MULLARD PRODUCT TYPE NUMBER INDEX

The tabulation below is compiled of Mullard product type numbers, in alphabetical and numerical order, which are frequently referred to and which have appeared in Outlook, Volume 9.