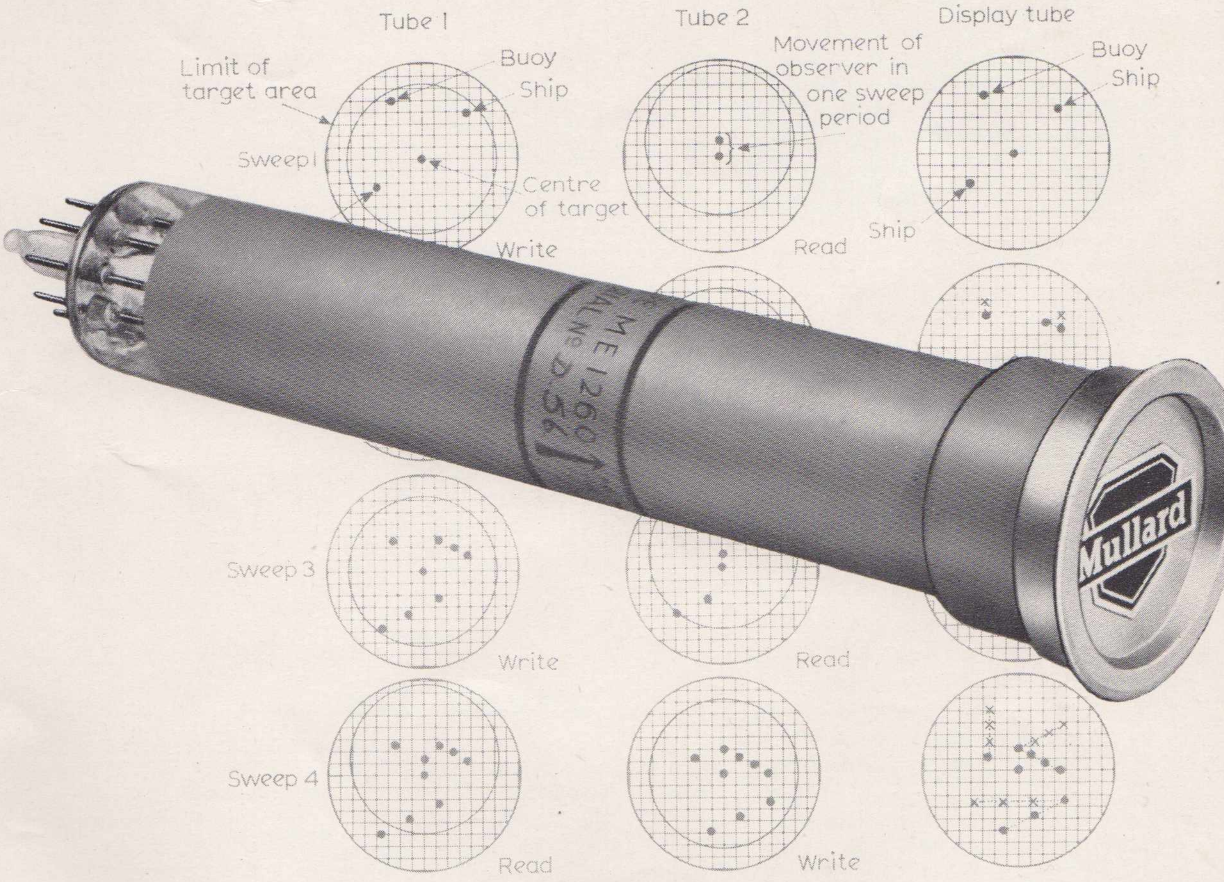
Mullard Outlook

AUSTRALIAN EDITION



VOL. 5, No. 1,
JANUARY-FEBRUARY, 1962

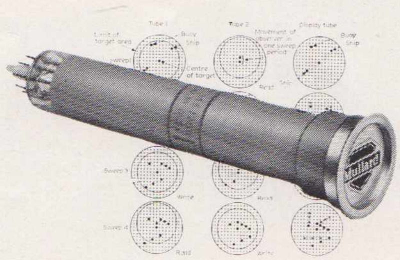
MULLARD-AUSTRALIA PTY. LTD.

VOL. 5 — No. 1 JAN.-FEB., 1962

Editorial Office:
35-43 Clarence Street, Sydney.
Telephone: 29 2006

Editor:
JOERN BORK

CONTENTS



ME1260 INFORMATION STORAGE TUBE

The "Tenicon" is a small, low voltage, single gun tube designed for storing high resolution, half-tone information. It has a target of 22.5 mm diameter, and may be read out almost completely by a single scan. The tube is suitable for television applications which require the storage of information or the compression of the video bandwidth by scanning at reduced speeds. For more detailed information see page 10.

MULLARD-AUSTRALIA PTY. LTD.

35-43 CLARENCE STREET, SYDNEY
Phone: 29 2006

123-129 VICTORIA PDE., COLLINGWOOD, N.5
VICTORIA
Phone: 41 6644

Associated with
MULLARD LTD., LONDON

THE WINDS OF CHANGE

It is perhaps appropriate at the commencement of this fifth year of publication that we dwell on Mullard Outlook and its contribution to this Industry, during a somewhat turbulent period and the ever-increasing influence of semiconductors. At a time in the sales promotion of TV receivers when there seems to be a splitting of hairs, for example, the difference between "new" and "brand new" and, for some, "cash" and "spot cash", at least where the parameters of valves and semiconductors are concerned, the units are finite. It has been gratifying to us to find that the demand for Outlook has been, to a degree, infinite and, in order to best fulfil its particular purpose, we make no apology that, for personal copies we are now obliged to make a small charge.

In conclusion, I quote from the editorial—Volume 1, Number 1, January 1958:—

> "The Mullard Outlook is dedicated to those of our fellow men whose livelihood and interest is in the electronic field and its scope directed to the salesman, the retailer, the service mechanic, the development engineer, the research worker and the hobbyist and it is my earnest trust that through the years this journal will be the happy medium linking our efforts to all whom we have the privilege and pleasure of offering our services."

M.A.B.

VIEWPOINT WITH MULLARD

THE OTHER FELLOW'S BUSINESS

How true the old saying "You can always run the other fellow's business better than your own"—or at least you think you can! Good for one's ego but sanctimonious and patronising acrimony soon becomes tiresome and a full-blooded and sensible theme suffers by the repetition and harping of the do-gooders.

Paradoxical Approach:

In these columns the temptation is always great to dabble in the sales potential of other goods such as small appliances and to debate the merits of the essentials of television sales and services—indeed sales and service on all consumer products.

In this and everything else, many of us overlook that John Citizen, "the public" and any other selective or discriminating consumer group are none other than ourselves, our relatives and friends. We may have learned to provide them in styling with what we feel they want, rather than what we consider they should have and the rest is delegated to merchandising, the magic of sales promotion, creative selling and the attendant theoretical approaches as counselled by the experts — knowing the product, the selling moment, closing the sale, etcetera.

The Critics:

On the sidelines the critics, already with one of everything (appliances in the home) claim that the manufacturers and retailers are promoting the sale of goods to folk who don't want them but finish up buying them, with money they don't have. However, this thoughtful fellow John Citizen, in general has managed quite well in the past and has seldom over-extended himself financially and in fact, has been keen to take a punt on things from time to time, as evidenced by his great following of trotting, horse and dog racing events. Furthermore, he is now conditioned to saving on everything and bargaining on most and for some expendable items such as detergents the manufacturers obligingly show the amount saved by having it printed on the bottle or carton at the time of manufacture!

Informed Advice:

Despite these somewhat blatant insincerities, we believe John Citizen is still groping and will contrive to seek out and respect informed and sound advice and this we are sure is the key to sound consumer product selling—your expert appraisal of the situation. For all "they"—these friends and relatives of ours—need, is a lead with confidence abounding. Know your product, sell it and just as important, service it.

TV Receiver Sales Prospects:

Recent issues of Outlook have mentioned quantities in the broader sense and with particular regard to television receivers, the influence of obsolescence and the bleeding of trade-ins out of the system.

With television, we strongly believe the urge to sell obsolescence will and must continue augmented with features and gimmicks to aid the sale. There are many thousands of 70° and 90° receivers and the householders are accustomed to the space they occupy. It is self-evident that inspired selling could take advantage of this by offering a compact 110° receiver.

Remote Tuning:

We feel the potential purchaser who has never owned a television receiver has little appreciation of the virtue of remote tuning, while conversely the greater the TV addiction the greater the possibility of selling these happy addicts completely new receivers with this facility as the reason. Much the same as selling a pop-up toaster to someone who has never owned the other kind and there are a lot of the other kind still around.

Sydney Six TV Channels:

With a fourth legitimate Sydney station planned and the two Wollongong stations capable of putting a useful signal into almost the whole of the Sydney metropolitan area, as indeed is illustrated by the performance of WIN4, there will be added incentive for the purchase of a 13 channel receiver and some strength to obsolescence selling where similar situations exist in other areas.

Sound Radio:

Various claims are made as to the listener potential of this medium, but nevertheless a great number of AM receivers will be sold in Australia in the foreseeable future. At present the rate is approximately 450,000 a year and by 1970 will perhaps be 700,000. For the manufacturer and the retailer it would be spectacular if we had FM stereo broadcasting, nevertheless there are 100,000 new homes being built each year in Australia—100,000 new homes that require small appliances and, no less, TV, radio and radiograms. After the many years of auto radio, penetration is still relatively small, and an interesting question to ask oneself is when did someone last suggest that you have a radio fitted to your vehicle—or do you set an example and have one already?

Tape Recorders:

Tape recorders, both business and otherwise, we may take together for in many cases each can lead to the sale of the other and whilst straight tape recorders may be purchased just "for the hell of it", a business tape recorder can be a most helpful neces-

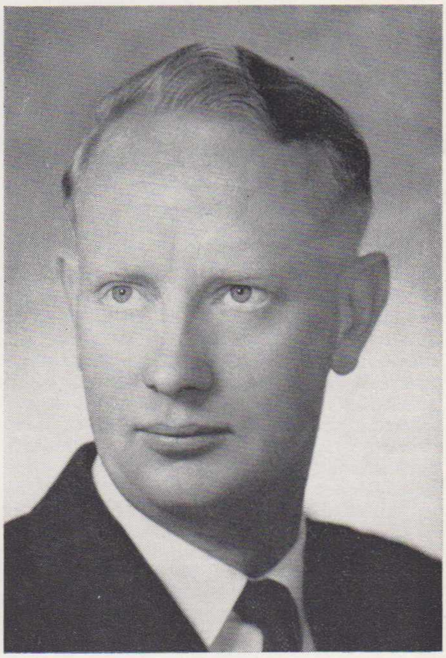
(Continued on page 9)

WIN Channel 4

In Outlook, Vol. 4, No. 4, Page 39, we questioned just where the service area of Wollongong would finish and were hesitant to make any prediction. It is now evident that our hesitancy had some foundation, because WIN4 puts a usable signal into most of the Sydney metropolitan area. Alert retailers and service companies can capitalise on this by providing the additional channels in receivers that are not already equipped. A conservative estimate of the Sydney metropolitan sets in this category, with due allowance to the viewers not wishing to have the alteration, is 350,000. If the alteration charge was £3 to £4 there is over £1,000,000 of business offering.

Alternatively, the fact that for Sydney WIN Channel 4 is available, but unable to be used is a selling factor to support obsolescence.

MULLARD-AUSTRALIA PERSONALITIES



MR. R. JEFFERY

Mr. R. Jeffery is the resident Mullard member in Queensland with home base under the roof of the Mullard distributor, C. A. Pearce & Co. Pty. Ltd., 33 Bowen Street, Brisbane.

The Valve, Electron Tube and Semiconductor Service Centre in Bowen Street is rapidly becoming known as a focal point for technical information on valves and semiconductors generally, closely related to the Technical Service Department of our Head Office in Sydney.

In addition to directly supervising the service function, Mr. Jeffery will be glad to assist you with any technical queries you may have including those pertinent to the application of industrial and professional valve types.

Mr. Jeffery has a basic interest in land, sea and air telecommunications and for many years was engaged in the installation and maintenance of civil aircraft radio equipment. He was recently granted corporate membership of the Institution of Radio Engineers, Australia, having passed the requisite examination held in October last year.

A Queenslander, and naturally a keen fisherman, his other hobbies are photography and the taming of a new garden.

MODERN RADIO COMMUNICATIONS

THE INFLUENCE OF SINGLE SIDEBAND

"It is essential to bear in mind that the two terms, automation and communications, are so closely interlinked that automation can only function perfectly when the communications both up and down are a reality." The Author, Mr. Alfred M. Cooper, writing in "Management Digest" for August/September, 1959, was endeavouring to emphasise the importance of communications in an automated industry.

Communication is important in any business undertaking and a definition of "communications" would include all of the means necessary to transfer people or things from any one point to another. This would also encompass the means taken to transfer information and implies ultimate understanding or a "meeting of minds" with respect to the information transferred.

The essential requirements of a communications system call for accuracy and speed commensurate with the importance of the information to be communicated, and today the need for both accuracy and speed has never been greater. Communication in transport is already into the jet age and only recently an astronaut crossed Australia in 9 minutes—the shape of things to come. An orbiting satellite or manned capsule may travel at a speed of the order of 5 miles per second; however, radio waves travel at a velocity of approximately 186,000 miles per second, vastly superior, and likely to remain so until man conquers the realm of the fourth dimension. Here then is real speed, which when coupled with a high degree of accuracy, provides an almost ideal system of transferring information from one point to another. This is radio communication, used in many modes, each one having particular advantages over the others, according to the type of information to be transferred and the speed required. Several of these modes are covered in greater detail in the following paragraphs.

Modes of Communication

Long distance communication circuits may be established in several ways, the method chosen depending upon the type of country and the distance to be spanned, whether intermediate junctions are required, and of course, capital outlay and cost of maintenance. The chief methods used are:—

(1) Multi-channel line system (carrier telephone);
(2) Multi-channel VHF/UHF systems;
(3) High frequency radio links.

High frequency radio links have the following advantages:—

(1) The capital cost is relatively low;
(2) The system can be made quite flexible, transmitters and receivers being switched to different circuits according to traffic loading;
(3) Installation is relatively speedy;
(4) A large number of radio links can be terminated in central transmitting and receiving sites so that the provision of effective maintenance facilities is simplified.

The main disadvantages are lack of secrecy, susceptibility to jamming, and the influence of abnormal propagation effects.

High frequency communication systems may be divided broadly into two groups—telegraphy and telephony, each system requiring its own specialised equipment. Several types of emission are listed below:—

Amplitude Modulation

Type B. (Damped wave train) now obsolete, previously used by spark transmitters and the earliest form of radio communication.
Type A1. Keyed continuous wave (telegraphy).
Type A2. MCW modulated continuous wave (keyed).
Type A3. Telephony (double sideband full carrier).
Type A3a. Telephony (single sideband, reduced carrier).
Type A3b. Telephony (two independent sidebands, reduced carrier).
Type A4. Facsimile.
Type A5. Television.
Type A9. Composite transmission and cases not covered by the above.
Type A9c. Composite transmissions (reduced carrier).

In the past, most radio telegraphic communication systems have used on-off keying, "carrier on" indicating "a mark" and "carrier off" indicating "a space". The effect of this is to present the receiver with an intermittent signal, which, if integrated over a period of time, is in the "space" condition longer than the "mark" condition; and this results in a low value of average power. If the keying is reversed so that a "mark" signal is represented by "carrier off" and the "space" by "carrier on", an increase in average power results; it has been found in practice that reversed on-off keying shows an advantage over the more conventional method. This method of machine telegraphy has now been replaced by the FSK system in most installations.

For point-to-point telephony circuits, single sideband (SSB) operation is replacing double sideband (DSB) for many reasons. In the case of a double sideband transmission with 100% modulation, half the power is concentrated in the carrier and a quarter of the power in each sideband. As the carrier can be replaced by a local oscillator in the receiver, and only one sideband needs to be transmitted to convey intelligence, it is obvious that the system is wasteful, both in power and in frequency spectrum. A single sideband system is one in which only one sideband is transmitted, the carrier being reduced to a level well below the peak sideband power. An independent sideband transmission is one in which separate intelligence is radiated on each sideband, the carrier being reduced as above.

The gain of a single sideband over a double sideband system may be summed up as follows:—

(1) The carrier is reduced to small proportions, and practically the whole of the radiated power is concentrated in the sideband, thus for a given signal-to-noise ratio at the receiver the transmitter power may be reduced. The more usual way of expressing the improvement is to consider the signal-to-noise ratio at the receiver for a given transmitter power. Under ideal propagation conditions the signal-to-noise ratio at a distant receiver will be the same for an AM transmitter having a carrier power of 100W with two sidebands of 25W each (a total transmitter output power of 150W) when compared with a SSB transmitter having an output of 50W in the one sideband. This assumes, of course, that the SSB signal is received on a SSB receiver with a passband half that of the AM receiver;
(2) By the provision of a steady local or reconditioned carrier, overmodulation is eliminated when the carrier level is reduced by selective fading. This results in a reduction in distortion which cannot be expressed in dB but provides a very important contribution towards the intelligibility of a telephone conversation.

It may sometimes be found advantageous to use a single sideband receiver for exalted carrier reception of a double sideband transmission, for although a decrease in signal-to-noise ratio will result due to the loss of one sideband, this may be offset by the reduction of distortion due to selective fading and also by the possibility of choosing the sideband which is less affected by interference. This is a form of communication that has some of the advantages of single sideband plus low cost and simplicity. It does, however, consume twice as much spectrum space as a single sideband signal.

Frequency Modulation

Type F1. Telegraphy, without the use of modulating audio frequency (frequency shift keying).
Type F2. Frequency modulation (telegraphy).
Type F3. Frequency modulation (telephony).
Type F4. Facsimile.
Type F5. Television.
Type F9. Composite transmissions and cases not covered by the above.

FM is a process of modulation whereby the carrier varies in frequency (rather than amplitude) at a rate determined by the modulation frequency. In effect, the carrier moves up from its normal resting frequency during one-half cycle of modulation and below its normal resting frequency during the other half cycle. The distance (frequency-wise) the carrier moves, is determined by the amplitude of the modulation voltage. The total deviation of a commercial FM station (88-108 Mc/s) is limited to ± 75 kc/s.

Most new teleprinter installations use frequency-shift keying (FSK): that is, the "mark" and "space" conditions are indicated by different carrier frequencies. With this method the transmitter is radiating continuously so that the receiver is presented with an unbroken signal. The advantages of frequency-shift keying over on-off operation may be summarised as follows:—

(1) Transmitter keying is relatively simple especially at higher power levels;

(2) For a given keying speed the transmitted spectrum is small;

(3) An unbroken signal is presented to the receiver although the effect of this may be offset to a certain extent by selective fading. A low value of shift is useful in this respect;

(4) Reduction in random keying due to atmospherics owing to a frequency-sensitive, rather than an amplitude-sensitive system;

(5) The adjustment of the receiver gain controls is less critical.

Pulse Modulation

Type P1. Pulse (telegraphy without modulating audio frequency).

Type P2d. Pulse (telegraphy, amplitude modulated).

Type P2e. Pulse (telegraphy, width modulated).

Type P2f. Pulse (telegraphy, phase or position modulated).

Type P3d. Pulse (telephony, amplitude modulated).

Type P3e. Pulse (telephony, width modulated).

Type P3f. Pulse (telephony, phase or position modulated).

Type P9. Composite transmissions and cases not covered by the above.

The classic example of pulse modulation is of course a radar transmitter. The intelligence is the timing of a pulse chain. The amount of time it takes for the echo pulse to return from an object is directly related to the distance of the object from the transmitter/receiver.

SSB Transmitting and Receiving Techniques

Single sideband is not a recent innovation; it was used after the first world war in conjunction with carrier telephone systems and has continued in use to the present day. Admittedly, both sidebands may be used, each sideband being divided into several segments by means of filters, thus enabling a single sideband to carry many conversations on each side of the suppressed carrier frequency. A typical system might include ten simultaneous voice channels on each side of the carrier for a total of 20 circuits, all carrying different information. Some systems place teletype or teleprinter circuits on one side of the suppressed carrier and voice channels on the other side.

Significance of Sidebands

The carrier and sideband frequencies have a real existence, as is evidenced by the fact that the various frequency components of a modulated wave can be separated from each other by suitable filter circuits. The sideband frequencies can be considered as being generated as a result of varying the amplitude of the wave with modulation. They are present only when the amplitude is being varied, and their magnitude and frequency are determined by the character of the modulation. When the modulating voltage is superimposed on the anode supply voltage to the modulated valve, the anode then alternately becomes more and less positive. As it becomes more positive the minimum anode potential tends to increase, causing the peak amplitude of the pulse of anode current to become larger whilst, at the same time, the angle of flow increases because of the greater anode voltage. The output is accordingly increased. Similarly when the modulating voltage causes the anode potential to be less than the anode supply voltage, the minimum anode voltage tends to become less, thus reducing the peak amplitude of the anode current pulses, which together with the smaller angle of flow, reduces the power output. This changing phase results in the generation of upper and lower sidebands in accordance with the modulating frequency, being removed from the carrier in the upper or lower direction, according to the characteristics of the modulating signal. The carrier frequency, on the other hand, is independent of the modulation, being the same even when no modulation is present.

The intelligence transmitted by the modulated wave is carried by the sideband components and not by the carrier, that is, the intelligence is conveyed by the variations in the amplitude of the wave and not by the average amplitude. It is therefore desirable to put as much power into the sideband frequencies as is possible, which is equivalent to saying that the wave amplitude should be varied through the widest possible range. When the amplitude is carried to zero during the modulation cycle, the modulation is at a maximum, or 100%, and the sidebands contain the maximum amount of power. With sine-wave modulation this maximum sideband power (both sidebands) is one-half of the carrier power. With degrees of modulation less than 100% the sidebands will contain correspondingly less power.

It is apparent that the transmission of intelligence requires the use of a band of frequencies rather than a single frequency. In speech there are important frequency components as high as 3,000 c/s, so that speech modulated upon a wave will produce sideband components extending as far as 3,000 c/s on each side of the carrier frequency. A radio-telephone station therefore may utilize a frequency band 6,000 c/s wide in transmitting voice signals. If this entire band is not transmitted equally well through space and by the circuits through which the modulated wave currents must pass, then the sideband frequency components that are discriminated against will not be reproduced in the receiving equipment with correct amplitude.

The efficiency of normal AM systems can be increased considerably by restricting the modulating frequencies to between 300 and 3,000 c/s at the same time using a form of volume compression or speech clipping to increase the average power in the sidebands. Clipping or compression may be carried out at low level in the speech amplifier stages of the modulator and additional negative peak clipping, designed to prevent the carrier frequency being cut-off on negative peaks of modulation, may be incorporated together with an appropriate filter in the high power stage. This allows a modulation increase in the positive direction to a greater extent than in the negative, and once again increases the average power in the sidebands. This cannot, however, be compared to the efficiency obtainable with single sideband, where all of the modulating power may be contained in one sideband. In our modern age radio communications require faster, more reliable and more accurate systems and this, coupled with a reduction of the spectrum space used, is achieved by the use of single sideband reduced carrier systems. Where communication services require the propagation characteristics obtainable only in the high frequency range, single sideband is essential. Where single sideband HF systems are used for radio bearer links, the power in each sideband segment will be proportional to the number of channels positioned on the sideband.

In the paragraphs to follow, a single sideband suppressed carrier system will be considered with a modulating frequency extending from 300 c/s to 3,000 c/s, which is quite sufficient to convey intelligence in voice communication. If we consider a 100W transmitter modulated 100% with 50W of AF, there will be a total radiated power of 150W, 25W of which exist in each sideband and, although only one of these sidebands is necessary to convey intelligence, both sidebands contribute to the audio output from the detector, hence only 1/3rd of the total power is being usefully employed. If that same power of 150W be transmitted in one sideband (the other sideband and carrier having been suppressed) then there is an effective power gain of three times and consequently a greater increase in the efficiency of the transmitter, as it becomes equivalent to an AM transmitter having a carrier of 300W modulated with 150W, a total of 450W.

Advantages of SSB

The advantages of single sideband over AM under conditions of selective fading referred to earlier, provides perhaps one of the most important reasons for the use of SSB. The deterioration of an AM signal under poor propagation conditions and selective fading causes severe distortion and results in a much weaker received signal. At times this can even make the received signal unintelligible. The most serious result of selective fading, and indeed the most common, occurs when the carrier level is attenuated more than the sidebands and in such cases the carrier voltage at the receiver is much less than the sum of the two sideband voltages. The RF envelope therefore does not retain its original shape and distortion on demodulation is extremely severe. This distortion results because a carrier voltage at least as strong as the sum of the two sideband voltages is required to properly demodulate the signal. Selective fading can also result in a shift between the relative phase of the carrier and sidebands and, when the carrier is shifted by 90° from its original position relative to the sidebands, the original AM signal is converted to a phase-

(*Continued on page 8*)

SURVEY OF MULLA

TYPE No.		MAIN APPLICATIONS OR USE	TYPICAL PEAK RESPONSE	SENSITIVITY Conditions	Value min	Value av.	Value max	
BPY10	Silicon Photovoltaic area 2·82mm^2	Multi-track punched card and punched tape readout systems	0·8 to 0·9μm	Measured at 200 lm/ft^2 (current through a 2kΩ load)	—	20	—	μA
OAP12	Germanium Photodiode area 1·0mm^2	Film sound track scanning, relay triggering, light measurement and photoelectric comparison	1·55μm	Measured with a lamp of colour temperature 2500°K with $-V_d = 10V$	0·5	—	—	μA/lm
OCP71	Germanium Phototransistor area 7mm^2	General industrial switching applications Film sound track scanning	1·55μm	Measured at $V_c = -2V$ uniform illumination of 75 lm/ft^2 falling on sensitive surface	1·5	—	4	mA
Photoconductive Cells								
ORP11	Cadmium sulphide area 1·25cm^2	Smoke and oil flame failure detection, direct relay operation	0·67μm	*Measured at 10V d.c. with 5·0 lm/ft^2	3·0	6	14	mA
ORP12	Cadmium sulphide area 57mm^2	Automatic contrast and brightness control of television equipments	0·67μm	*Light resistance at 93 lm/ft^2	75	—	300	Ω
				Dark resistance	—	—	10	MΩ
ORP30	Cadmium sulphide area 4·5cm^2	Smoke and oil flame failure detection, direct relay operation	0·67μm	Measured at 10V d.c. with 5·0 lm/ft^2	12	30	48	mA
ORP50	Cadmium sulphide area 1·1cm^2	Oil flame failure detection	0·67μm	*Measured at 20V with an illumination of 5·0 lm/ft^2	3·5	10	17	mA
ORP60	Cadmium sulphide area of top of bulb dia. 5·2mm max	Oil flame failure detection, automatic contrast and brightness control of television equipments	0·67μm	*Measured at 30V d.c. with 5·0 lm/ft^2	200	500	800	μA
ORP61	Cadmium sulphide area 0·25mm^2	Oil flame failure detection	0·67μm	*Measured at 30V d.c. with 5·0 lm/ft^2	200	500	800	μA
ORP90	Cadmium sulphide area 2·9cm^2	Smoke and oil flame failure detection, direct relay operation	0·67μm	*Measured at 10V d.c. with 5·0 lm/ft^2	3	10	16	mA
ORP93	Cadmium sulphide area 2·4cm^2	Oil flame failure detection, street lighting control, direct relay operation	0·67μm	*Measured at 10V d.c. with 5·0 lm/ft^2	3	6	14	mA
61SV	Lead sulphide area 0·36cm^2	Pyrometry, gas flame failure detection	2·5μm	*Measured at 200V d.c. with chopped light 0·05 lm falling on cell area	—	3	—	mA(pk)/lm
62SV	Lead sulphide area 0·36cm^2	Near infra-red spectrometry	2·5μm	*Measured at 200V d.c. with chopped light 0·05 lm falling on cell area	—	3	—	mA(pk)/lm
ORP10	Indium antimonide area 3·0mm^2	Intermediate infra-red spectrometry, particularly gas analysis	6·0 to 6·5μm	Measured with 50mA d.c. passing through cell and with 2μW of radiation falling on sensitive cell area at 20°C	—	75	—	Ω
ORP13	Indium antimonide area 3·0mm^2 cooled by liquid nitrogen	Intermediate infra-red applications, spectrometry	4·5 to 5·4μm	Measured with 7·6μW/cm^2 of radiation of wavelength 4·0μm falling on the sensitive area	10	—	60	kΩ
				The following characteristic is for an open circuit cell with radiation interrupted at 800c/s	—	15	—	mV/μW
Photoemissive Cells								
20CG	Caesium on oxidised silver projected area 5·3cm^2 gas filled	Film sound track scanning, oil flame failure detection	0·8μm	*Measured at $V_a = 90V$ with whole cathode area illuminated and $R_L = 1M\Omega$	—	150	—	μA/lm
20CV	Caesium on oxidised silver projected area 6·7cm^2 vacuum type	Oil flame failure detection, register, positioning, tension control for printing	0·8μm	*Measured at $V_a = 100V$ with whole cathode area illuminated and $R_L = 1M\Omega$	—	25	—	μA/lm
53CG	Caesium on oxidised silver projected area 1·1cm^2 gas filled	Film sound track scanning, oil flame failure detection	0·8μm	*Measured at $V_a = 85V$ with whole cathode area illuminated and $R_L = 1M\Omega$	—	100	—	μA/lm
53CV	Caesium on oxidised silver projected area 1·1cm^2 vacuum type	Oil flame failure detection, register, positioning, tension control for printing	0·8μm	*Measured at $V_a = 50V$ with whole cathode area illuminated and $R_L = 1M\Omega$	—	20	—	μA/lm

Mullard

ARD PHOTODEVICES

TYPE No.		MAIN APPLICATIONS OR USE	TYPICAL PEAK RESPONSE	SENSITIVITY Conditions	Value min	Value av.	Value max	
58CG	Caesium on oxidised silver projected area 1·1cm² gas filled	Film sound track scanning, oil flame failure detection	0·8µm	*Measured at $V_a = 85V$ with whole cathode area illuminated and $R_L = 1M\Omega$	—	100	—	µA/lm
58CV	Caesium on oxidised silver projected area 1·1cm² vacuum type	Oil flame failure detection, register, positioning, tension control for printing	0·8µm	*Measured at $V_a = 100V$ with whole cathode area illuminated and $R_L = 1M\Omega$	—	20	—	µA/lm
90CG	Caesium on oxidised silver projected area 3·1cm² gas filled	Oil flame failure detection, film sound track scanning	0·8µm	*Measured at $V_a = 90V$ with whole cathode area illuminated and $R_L = 1M\Omega$	—	125	—	µA/lm
90CV	Caesium on oxidised silver projected area 3·0cm² vacuum type	Oil flame failure detection, register, positioning control for printing	0·8µm	*Measured at $V_a = 100V$ with whole cathode area illuminated and $R_L = 1M\Omega$	—	20	—	µA/lm
90AG	Caesium antimony projected area 4·0cm² gas filled	Sound reproducing system where a dye image sound track is used in conjunction with an incandescent light source	0·41µm	*Measured at $V_a = 85V$ with whole cathode area illuminated and $R_L = 1M\Omega$	—	130	—	µA/lm
90AV	Caesium antimony projected area 4·0cm² vacuum type	Colorimetry, density measuring meters	0·41µm	*Measured at $V_a = 100V$ with whole cathode area illuminated and $R_L = 1M\Omega$	—	45	—	µA/lm
92AG	Caesium antimony projected area 2·1cm² gas filled	Film sound track scanning	0·41µm	*Measured at $V_a = 85V$ with whole cathode area illuminated and $R_L = 1M\Omega$	—	130	—	µA/lm
92AV	Caesium antimony projected area 2·1cm² vacuum type	Colorimetry, densitometry	0·41µm	*Measured at $V_a = 85V$ with whole cathode area illuminated and $R_L = 1M\Omega$	—	45	—	µA/lm
Photomultipliers								
51UVP	Caesium antimony projected area 8cm²	Ultra-violet spectrometry	0·40±0·03µm	**Measured at $V_{a-k1(b)} = 1{\cdot}8kV$	60	500	—	A/lm
52AVP	Caesium antimony projected area 3cm²	Bore-hole prospecting	0·42±0·03µm	**Measured at $V_{a-k1(b)} = 1{\cdot}8kV$	15	30	—	A/lm
53AVP	Caesium antimony projected area 15·2cm²	Gamma spectrometry	0·42±0·03µm	**Measured at $V_{a-k1(b)} = 1{\cdot}8kV$	60	500	—	A/lm
53UVP	Caesium antimony projected area 15.2cm²	Gas scintillation	0·40±0·03µm	**Measured at $V_{a-k1(b)} = 1{\cdot}8kV$	60	500	—	A/lm
54AVP	Caesium antimony projected area 97cm²	Aerial prospecting	0·42±0·03µm	**Measured at $V_{a-k1(b)} = 1{\cdot}8kV$	100	—	—	A/lm
56AVP	Caesium antimony projected area 8cm²	Fast scintillation counting, coincidence measurement	0·42±0·03µm	**Measured at $V_{a-k1(b)} = 2{\cdot}0kV$	—	5000	—	A/lm
56UVP	Caesium antimony projected area 8cm²	High energy particle counting using gas scintillation	0·40±0·03µm	**Measured at $V_{a-k1(b)} = 2{\cdot}0kV$	—	5000	—	A/lm
57AVP	Caesium antimony projected area 315cm²	Applications where an extremely large cathode area is required	0·42±0·03µm	**Measured at $V_{a-k1(b)} = 1{\cdot}8kV$	60	250	—	A/lm
58AVP	Caesium antimony projected area 95cm²	Fast scintillation counting, coincidence measurement	0·42±0·03µm	**Measured at $V_{a-k1(b)} = 3{\cdot}0kV$	—	5000	—	A/lm
150AVP	Caesium antimony projected area 8cm²	Laboratory research and prospecting on the ground	0·42±0·03µm	**Measured at $V_{a-k1(b)} = 1{\cdot}8kV$	60	300	—	A/lm
150CVP	Caesium on oxidised silver projected area 8cm²	Near infra-red spectrometry	0·80±0·1µm	**Measured at $V_{a-k1(b)} = 1{\cdot}8kV$	20	100	—	A/lm
153AVP	Caesium antimony projected area 15·2cm²	High resolution gamma spectroscopy	0·42±0·03µm	**Measured at $V_{a-k1(b)} = 1{\cdot}8kV$	60	500	—	A/lm

*Illuminated by a lamp of colour temperature 2700°K

**Illuminated by a lamp of colour temperature 2870°K

Note R_L is a series resistance

The majority of these photosensitive devices are already in use in Australia and are available from Mullard-Australia Pty. Ltd. and Distributors throughout the Commonwealth.

MODERN RADIO COMMUNICATIONS

(*Continued from page* 5)

modulated signal with the result that a conventional AM detector will not produce an intelligible signal, indeed any carrier phase shift from its original phase relationship to the sidebands, will produce a consequential loss of intelligibility in the audio signal.

A SSB signal is not subject to deterioration due to selective fading, since only one sideband is transmitted and the received signal level therefore does not depend upon the resultant amplitude of two sideband signals as it does in AM. Since there is no carrier, distortion cannot result from loss of carrier power or phase shift. Selective fading within the one sideband of the SSB system merely changes the amplitude and frequency response of the signal and very rarely produces enough distortion to cause the received signal to be unintelligible. (See Fig. 1 which compares the relative advantage of SSB over AM with limited propagation conditions.)

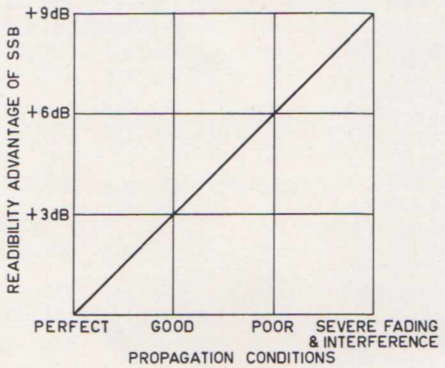


Fig. 1. Comparison of AM and SSB systems having same sideband power.

Further increases in transmitter efficiency may be obtained by considering the duty cycle, that is, the time over which the output valve is dissipating power versus the time over which it is virtually at rest. With an AB1 linear output amplifier it is possible to have a power supply of say 1,000V with a resting anode current of 20mA which rises on speech peaks to somewhere in the vicinity of 200-250mA. In the unmodulated condition the power amplifier is dissipating only 20W and on speech peaks the operating conditions become somewhat tantamount to pulse operation ratings, with a resultant improvement in DC efficiency.

A single sideband signal consisting of a suppressed carrier of say 8 Mc/s and an audio tone of say 3,000 c/s is transmitted on a frequency of 8,003 kc/s, and is said to be an upper sideband signal. If, however, the upper sideband was suppressed and the signal was being transmitted on the lower sideband, the frequency would be 7,997 kc/s. Where sideband switching is incorporated in a system, it is therefore possible by pre-arrangement, to transfer from one sideband to another, enabling in many cases normal reception where interference is present on only one sideband. To receive a single sideband signal it is necessary to insert at the receiver a locally generated carrier whose frequency should be very close to the original carrier frequency, dependent of course, upon the actual signal level. This may be accomplished by transmitting sufficient carrier to operate an AFC circuit which maintains correct receiver tuning, or by using equipment with a high degree of stability, so that, once set, the receiver remains in tune for long periods without further need for adjustment. With present day techniques it is not unusual to achieve in high-class commercial equipment stabilities of 1 c/s at 10 Mc/s in fixed station equipment and 10 c/s at 10 Mc/s in mobile equipment and the need for AFC and pilot carriers is thus eliminated. In fact the modern approach suggests the use of high degrees of carrier suppression in order to reduce heterodyne interference from strong stations on adjacent channels. Where AFC is in use such a station on an adjacent channel may be capable of capturing the receiver and tuning it to that station. One other advantage to be achieved with high degrees of carrier and unwanted sideband suppression is the greater freedom from unwanted distortion products in linear amplifiers due to harmonics of sideband components beating with harmonics of the carrier and producing beat notes which appear on the transmitted signal.

Generators for SSB

There are several methods of generating single sideband signals, which however may be classified into two main groups, filter systems and phasing systems. In both methods one of the most important steps is the reduction of the carrier which may be effected by the use of a balanced modulator which is capable of providing considerable carrier suppression. A balanced modulator may be considered an electronic switch wherein the carrier frequency is switched on and off at the rate of the modulating signal. Either valves or semiconductor diodes may be used for this purpose and a simple balanced modulator circuit is shown in Fig. 2. This would at first appear to be a push-pull amplifier with some form of modulation applied to the centre tap of the grid inductor. It may be thought of as such except that the effects are slightly different from those normally encountered. The notations F_m and F_c denote two frequencies that are fed into the balanced modulator stage, F_c being the carrier frequency and F_m the modulating frequency. It may be readily seen that F_c is in phase at the two grids of the balanced modulator and will therefore cancel in the output circuit. F_m on the other hand is applied to the two grids in push-pull and, for all practical purposes, will not appear in the output circuit, as this is broadly tuned to the carrier frequency F_c. The output of the balanced modulator will therefore consist of the sum and difference frequencies $F_c + F_m$ and $F_c - F_m$ which are, in effect, the upper and lower sidebands.

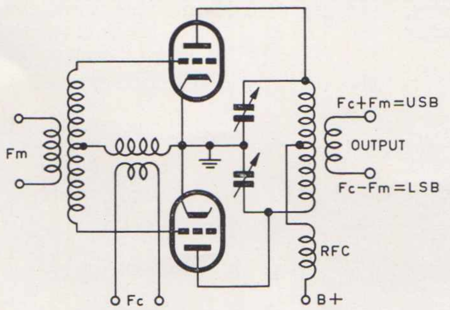


Fig. 2. Basic balanced modulator using push-pull triodes.

Phasing System

In the phasing method, Fig. 3, aiding and opposing voltages are used to balance out the unwanted sideband rather than rejecting it as in the filter system. The voltages must also be of the proper phase, amplitude and frequency. As phase and amplitude requirements are met by employing phase-shift-networks and associated amplitude balance controls, establishing the correct frequency in this case is therefore automatic. Referring to Fig. 3, it may be seen that the output of the speech amplifier is shifted 90° by an audio phase-shift-network. The output of the carrier generator is also shifted 90°. The phase shifted audio and RF signals are combined in the balanced modulator, resulting in two double sideband suppressed carrier signals, 180° apart. When these are combined in a tuned circuit, the voltages in one sideband will add and the voltages in the other sideband will be in opposition, resulting in a single sideband suppressed carrier signal being presented to the following stage. These operations may be performed at the desired signal frequency or at some more convenient frequency and heterodyned to the desired final frequency. The phasing method presents difficulties in its ability to maintain the exact 90° phase shift over the entire desired audio frequency range and hence there may be some unwanted signals outside the desired bands unless a suitable low-pass filter is employed to restrict the audio frequency response prior to modulation. As a result the filter method appears to be more popular in commercial installations, whilst the phasing technique is used where cost is a factor, such as in amateur service.

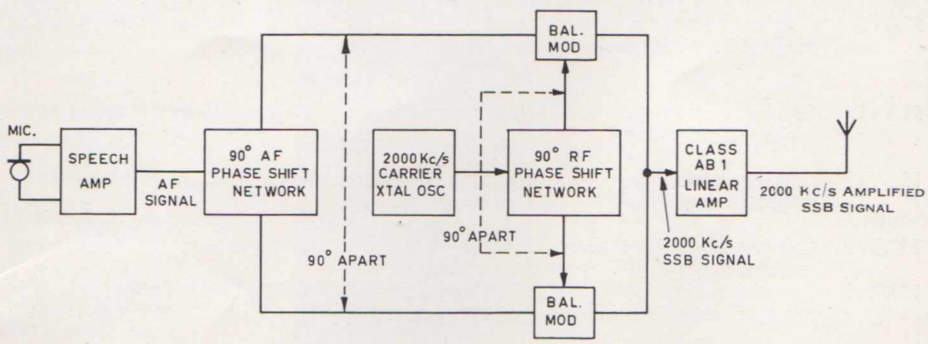


Fig. 3. Block diagram basic phasing exciter. (USB or LSB may be selected by changing the phase of the AF by plus or minus 180°.)

To be continued in Outlook Vol. 5, No. 2

THE 6HG8/ECF86—A NEW FREQUENCY CHANGER

FOR VHF UP TO 220 Mc/s

The latest addition to the range of frame grid valves is the 6HG8, a combined triode and frame grid RF pentode intended for use as a VHF frequency changer. The addition of the 6HG8 to the frame grid range of television valves enables engineers to design a receiver equipped with frame grid valves from the aerial input to the vision detector.

The complete range of RF and IF frame grid valves for entertainment applications is tabulated below:—

6ES8—Variable μ, low noise VHF frame grid double triode for use as a cascode amplifier.

6HG8—Combined triode and frame grid RF pentode for use as a frequency changer for VHF up to 220 Mc/s.

6EH7—Frame grid variable μ, RF pentode for use as an automatic gain-controlled IF amplifier.

6EJ7—Frame grid sharp cut-off pentode for use as an IF amplifier.

The mutual conductance of the 6HG8 pentode section is 12mA/V compared with 6.2mA/V for the 6BL8. The conversion gain obtainable in this section, when used as a mixer, is therefore approximately doubled.

The short I_a — V_{g1} characteristic enables the oscillator injection voltage to be reduced to approximately 1.7 V_{p-p} as against 2.4 to 3 V_{p-p} when using the 6BL8. This results in a reduction of unwanted oscillator radiation for a given application. The lower injection voltage simplifies the task of maintaining an optimum level of local oscillator amplitude, even under adverse conditions as may be the case when using a voltage dependent silicon capacitor such as the Mullard BA102. The improvement in high frequency performance of the 6HG8 when compared to the 6BL8 pentode section is shown in Fig. 1. This graph shows the increase in effective grid cathode capacitance at high frequencies due to the effect of cathode lead inductance. At 200 Mc/s the effective grid cathode capacitance of the 6HG8 pentode is only 10% greater than its low frequency value, whereas for the 6BL8 pentode the increase is about 25%. Above this frequency the effective grid cathode capacitance of the 6BL8 rises to a condition of resonance more rapidly than that of the 6HG8.

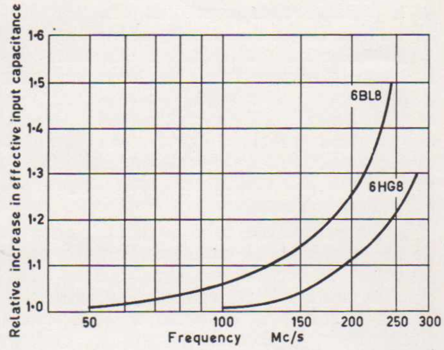


Fig. 1—Increase of effective grid cathode capacitance with frequency.

Screen Regeneration

The input impedance of the 6HG8 pentode section operating as a mixer is nominally 3kΩ at optimum oscillator drive voltage at 200 Mc/s. This value of input impedance has been determined by a certain amount of screen regeneration which is incorporated in the valve by means of an extended screen grid lead connection. The length of this connection is tightly controlled to reduce variations of valve input impedance to an absolute minimum. The inductive component of the screen grid lead connection produces a negative damping effect in the grid-cathode circuit by virtue of the Miller effect; therefore the total input conductance of the pentode due to the effects of cathode lead and screen lead inductance is given by:

$$\omega^2(L_k.c_{g-k}.g_{m(eff)} — L_{g2}.c_{g1g2}.g_{m(eff)\,g1g2})$$

where $g_{m(eff)}$ and $g_{m(eff)g1g2}$ are the pentode slope and control grid to screen grid slope respectively.

To maintain low cathode lead inductance, the pentode cathode is brought out to two pins on the valve base, one on each side of the grid pin, thus reducing changes of input capacitance with changes in frequency. The cathode of the triode section is internally connected to the pentode cathode, therefore the pin connections are somewhat different to those of the 6BL8. The pinning in a high slope converter of this type also reduces the risk of instability due to anode-grid feedback.

6HG8 ABRIDGED DATA

HEATER

I_h	380	mA
V_h	6.3	V

CAPACITANCES

(measured without an external shield)

c_{ap-at}	125	mpF
c_{ap-gt}	30	mpF
c_{g1-at}	<10	mpF
c_{g1-gt}	<10	mpF
Pentode section		
c_{a-g1}	12	mpF
c_{g1-g2}	1.7	pF
c_{in}	5.8	pF
c_{out}	3.5	pF
Triode section		
c_{g-k+h}	2.4	pF
c_{a-k+h}	1.1	pF
c_{a-g}	2.0	pF

CHARACTERISTICS

Pentode section		
V_a	170	V
V_{g2}	150	V
I_a	10	mA
I_{g2}	3.3	mA
g_m	12	mA/V
r_a	>350	kΩ
μ_{g1-g2}	70	
V_{g1}	—1.2	V
R_{eq}	1.0	kΩ
Triode section		
V_a	100	V
I_a	14	mA
g_m	5.5	mA/V
μ	17	
V_g	—3.0	V

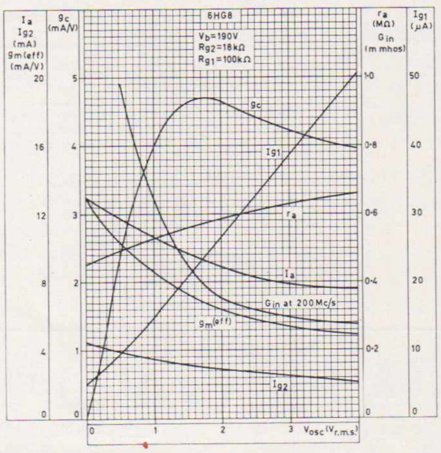
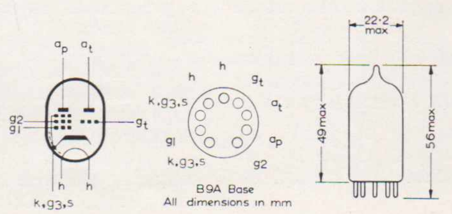


Fig. 2—6HG8 performance curves for use as frequency changer.



Typical VHF Tuner Performance Figures Attainable with 6ES8 and 6HG8

Replacement of the RF cascode 6CW7 with the frame grid valve 6ES8 has resulted in an increase in voltage gain together with a considerable improvement in noise figure.

If, in a typical tuner, the 6BL8 frequency changer is now replaced with the frame grid 6HG8, a further increase in gain of approximately 6dB can be attained, thus contributing to even greater front end efficiency.

THE OTHER FELLOW'S BUSINESS

(*Continued from page 3*)

sity—sell both and get the repeat business of additional tapes. The tape recorder sales potential and merchandising is delicate and specialised and this subject will be covered in some detail in the next issue of Outlook.

Little New:

Whilst we are limited in this country to AM medium frequency sound broadcasting and 625 line black and white TV, it will take real selling and inspired "new set" presentation to encourage the expansion of obsolescence. This then is the challenge to both manufacturer and retailer as much as the sensible disposal of the resultant trade-ins.

ME1260 INFORMATION STORAGE TUBE

Improvements in data handling and processing techniques have resulted in a need for a simple information storage tube without visual presentation, which will store, process or convert information from one standard to another.

To meet this requirement, Mullard have introduced the ME1260 "TENICON"*, which is a low voltage, single gun information storage tube with a capacitive discharge readout process. It is capable of storing high resolution half-tone information, which may be read out immediately or retained for an interval of time. The stored information can be extracted in a different order or at a different rate from that in which it was originally stored.

APPLICATIONS

The full range of applications in which the Tenicon high resolution storage tube would offer improved performance has not yet been established but several uses for this tube are being investigated and developed. These are as follows:—

1. As a delay unit in a telerecording film equipment, whereby a television field occurring during the film pull-down time is stored in the Tenicon. During the next field, the stored field is read out and recorded on the film together with the occurring field.
2. As a change of rate device, in a system where it is required to transmit information at a slower rate than it is received. The incoming information is stored as it is received and is later read out at the required rate.
3. The Tenicon, in common with other half-tone storage tubes, may be used to integrate recurrent information as a means of enhancing the signal-to-noise ratio of the received information.
4. As a means of cancelling permanent echoes in a moving target radar display to improve the observation of moving objects.
5. To produce true motion on a p.p.i. radar display.

To simplify the operation of the Tenicon, the tube has been designed to operate with a standard Vidicon head amplifier and with similar focusing and scanning components to those used with a Vidicon camera tube.

The operation of the Tenicon is very similar to that of a Vidicon camera tube, the electron gun and readout principle being identical. The storage layer or target, consists of a continuous layer of insulating material, on which information is stored as a positive charge pattern which is built up on the target surface by secondary emission. A metallic coating on the surface of the target, remote from the electron beam, is the output electrode. Positioned in front of, and close to, the target surface, is a fine metal mesh which collects secondary electrons in the writing operation and also ensures that the electron beam approaches the target normally.

The action of the tube requires the surface of the target to be stabilised initially at the potential of the cathode (defined as zero). This is achieved by uniformly scanning the target surface with a beam of low velocity electrons, such that the secondary emission coefficient of the target is less than unity.

The secondary current will therefore be less than the primary current, electrons will be gained by the target and its potential will become less positive. This process continues until the potential of the target has fallen to that of the cathode.

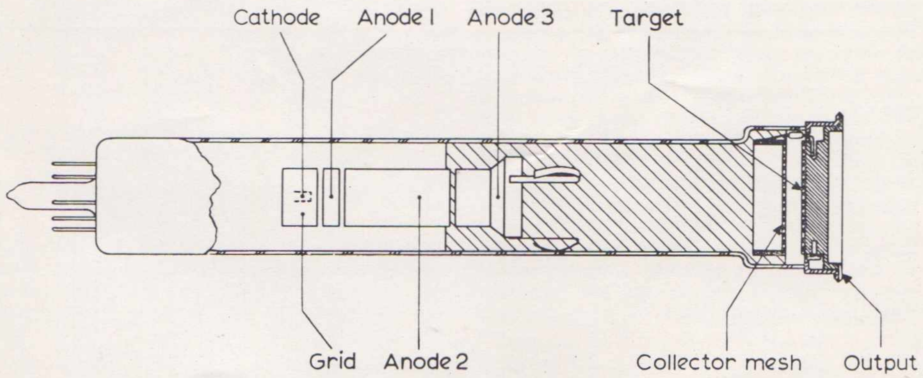
No further electrons can land on the target, and it is said to be "cathode potential stabilised". The target is now at the "black level" and to establish writing conditions the cathode potential is reduced by approximately 100V. Simultaneously, the grid and second and third anode voltages are reduced to retain the beam in focus at the target during the writing process and to keep the beam cut off until the commencement of writing.

Information is written on to the target by applying to the grid a positive signal which modulates the electron beam as it scans the target surface. The primary electron energy is sufficient to make the secondary emission coefficient of the target greater than unity. As the electron beam scans the target, the areas on which the beam impinges are charged positively by an amount which is determined by the instantaneous beam current. The maximum change in potential of a small area of the target is inherently limited to a few volts.

The reading process is identical to that of a Vidicon camera tube. The cathode potential is restored to zero and the grid, second and third anode voltages are restored to the value required to produce a well-focused beam at the target. The unmodulated beam is scanned over the target surface, landing with an energy of only a few volts, at which secondary emission is negligibly small. Those parts of the target which have been shifted in potential during the writing process are discharged, restoring them to zero volts and producing a capacitive signal current in the output lead.

Providing sufficient beam current is used in the reading scan, the discharge will be almost complete, leaving the target ready for a further signal to be written. The residual signal after one readout is less than 20%.

*The name *TENICON* has been derived from the Latin *Tenere*—to hold or retain —and the Greek *Ikon*—an image.



17 INCH STUDIO MONITOR TUBE

The AW43-48 is a new Mullard 17 inch television picture tube intended for use in precision television studio picture monitors.

The tube uses electrostatic focusing and magnetic deflection, the scanning angle being 70°.

Under typical operating conditions a first anode voltage of 300V and a final anode voltage of 16kV are required. The cut-off voltage (V_g) is from –30 to –70V.

The AW43-48 will resolve a minimum of 650 lines based on a picture height of 273 mm and measured at a brightness of 50ft-lamberts with the focus voltage adjusted for optimum spot size.

Apart from requiring a final anode voltage of 16kV, the AW43-48 is electrically identical in its characteristics to the 14 inch type, AW36-48 and has been introduced to meet the demand for a 17 inch precision monitor tube.

1000 Mc/s TRANSISTOR

Exhibited at the Physical Society's Exhibition in London, January 15th - 19th, 1961

Following investigations by Mullard Research Laboratories, the Company's well-established alloy-diffused technique of manufacturing junction transistors has been used successfully to produce experimental devices that work satisfactorily in the region of 1000 Mc/s.

Experimental types have been produced with an f_t above 1000 Mc/s and a base resistance around 20 ohms. These transistors have been used in experimental amplifiers which have gains of approximately 10dB and noise figures of 6 to 8dB at frequencies around 1000 Mc/s.

These new experimental types were demonstrated in such an amplifier fed with an input equivalent to a modulated UHF transmitted signal. The output was demodulated and suitably displayed.

THE PROTECTION OF RF TRANSISTORS

AGAINST ATMOSPHERIC DISCHARGE IN AERIALS

The aerial input stage of transistor receivers and amplifiers may fail due to a breakdown of the base-emitter junction resulting from high-voltage pulses being induced in the aerial during a thunderstorm and, in the case of car radio aerials, due to static charge.

The effect will take place when the amplifier earth is separated from the real earth by a physical or stray capacitance of perhaps several thousand picofarads. When this capacitor discharges via the aerial, the resultant pulse applied to the base of the RF transistor will be in opposite polarity to the charge potential. This condition is illustrated in Fig. 1.

In the case of a car radio, the aerial invariably charges negatively to a voltage

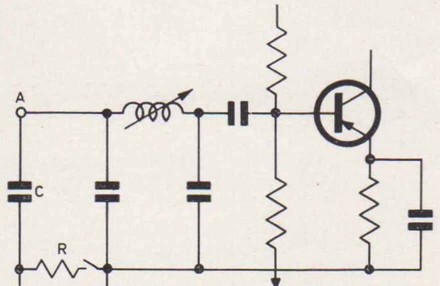


FIG 2

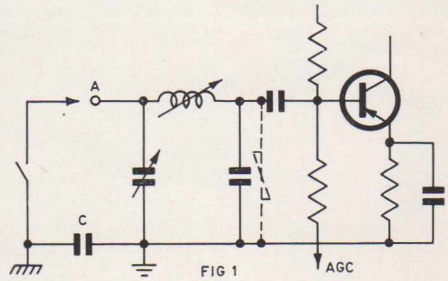


FIG 1

of 1 to 2 kV, which on discharge would destroy the base-emitter junction of the transistor. The base-emitter potential can be maintained at a safe value by applying a low voltage VDR such as an E299DD/P216 across the base input circuit. This VDR measured at 1 Mc/s appears as a capacitor in the range of 100 to 200 pF in parallel with a resistance of 5kΩ to 10kΩ. It is therefore possible to connect the VDR across the transistor input circuit without affecting the receiver performance. Alternatively, a resistor of approximately 2 kΩ would offer a considerable degree of protection. At VHF a diode would be more suitable than a VDR.

An aerial may be charged to a high potential due to atmospheric conditions and discharged through a leakage path in the amplifier circuit. Perhaps a more appropriate equivalent circuit is that of Fig. 2, where C represents the "antenna-to-ground capacitance" and R represents the "discharge path between the real and artificial ground". If the aerial capacitance C is charged to some positive potential, this potential will not affect the amplifier input unless R is of some finite value, such as an ionisation path between artificial and real earth. As C is discharged through R a pulse of opposite polarity will then be applied to the base of the transistor.

In addition, with VHF masthead amplifiers a charge may appear between the 75Ω coaxial line and the aerial circuit which may be bonded to ground. If this occurs the induced charge will appear across the supply and, depending upon the supply impedance, the collector voltage rating may be exceeded when a discharge path is provided through the aerial input transformer. In this case a VDR connected across the transistor supply will provide adequate protection.

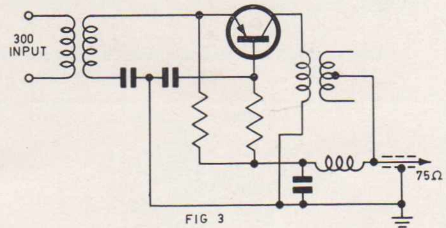


FIG 3

FREQUENCY COVERAGE OF BROADCAST RECEIVERS

The following information was recently circularised to the electronics industry by the Australian Broadcasting Control Board:

"The Radio Regulations of the International Telecommunications Union (Geneva, 1959) provided, inter alia, for the medium frequency band allocated to broadcasting in the region including Australia to be extended from 535-1605 kc/s to 525-1605 kc/s. The Australian Broadcasting Control Board has been notified by the Postmaster-General's Department that the extended band is now available for the broadcasting service and the additional channel (530 kc/s) will, at the appropriate time, be allocated to one or more Australian broadcasting stations.

It is desirable, therefore, that all medium frequency broadcast receivers manufactured in the future should be capable of reception over the band 525-1605 kc/s.

In the high frequency bands, the allocations for broadcasting purposes are as follows:—

2300-2495 kc/s	9500-9775 kc/s
3200-3400 kc/s	11700-11975 kc/s
3900-4000 kc/s	15100-15450 kc/s
4750-4995 kc/s	17700-17900 kc/s
5005-5060 kc/s	21450-21750 kc/s
5950-6200 kc/s	25600-26100 kc/s
7100-7300 kc/s	

It is unlikely, however, that local broadcasting transmissions intended for reception in Australia or the Territories will be in the band 2300-2495 kc/s or the bands above 15450 kc/s.

Because of the scarcity of receivers suitable for reception in the high frequency bands below 6000 kc/s, very limited use has been made of those bands in Australia in the past. However, more of these receivers have recently become available and it is expected that use will be made of the bands above 3200 kc/s in the future, particularly as they are very suitable for serving remote areas of the mainland and the Territories of Papua and New Guinea. In recent years stations VLM Brisbane and VLX Perth have been transmitting on these frequencies to listeners outside the normal range of medium frequency stations, and additional stations will probably commence operation on these frequencies in other parts of the Commonwealth or Territories. It is hoped that receiver manufacturers will give due consideration to including the appropriate high frequency bands in the tuning range of at least some of their future models."

BREAK-BEFORE-MAKE

The Mullard Technical Service Department is frequently asked why it is stipulated that the section SA8 of the record-playback switch in the Mullard amplifier and pre-amplifier tape circuits (*"Circuits for Audio Amplifiers," pp. 88 to 112) should be "break-before-make".

This switch section connects the HT supply to the oscillator valve. If the connection is not broken when switching from "record" to "playback", the stage will continue to oscillate. The momentary break introduced by a break-before-make contact is sufficient to stop oscillation.

Once oscillation has been interrupted, it is then important to ensure that the decay of the oscillatory current is not too rapid. Too sudden a decay can result in permanent magnetisation of the record-playback head. To prevent this, a delay is introduced by means of a 0.5μF capacitor connected between the oscillator tuned circuit and the chassis.

*"Circuits for Audio Amplifiers" is available from Mullard Offices and Distributors throughout the Commonwealth, price 12/6 plus 1/5 postage.

Mullard

NEW VINKOR WOUND COMPONENTS

FOR MULLARD AUDIO CIRCUITS

WINDING DETAILS OF VINKOR INDUCTORS

Vinkor assembly	WF1738		WF1932	WF1933
Reference diagram	LA2304		LA2403	LA2403
	A		C	C
No. of turns	Primary	Secondary		
	(1-8) 107	(9-7) $134\frac{3}{4}$	(1-8) 863	(1-8) 1595
	(1-6) $43\frac{3}{4}$	(9-5) $13\frac{1}{2}$		
	(1-4) $53\frac{1}{2}$	(9-3) $89\frac{1}{4}$		
	(1-2) $63\frac{1}{4}$			
Wire	9/46 s.w.g. (e.s.s.)		42 s.w.g. (enamelled to BS1844F)	45 s.w.g. (enamelled to BS1844F)
Impregnation**	wax		wax	wax
Inductance (low-level)	3·4mH ± 30% (at 1kc/s)	5·3mH ± 20% (at 1kc/s)	350mH ± 10% (at 1kc/s)	1·2H ± 10% (at 5kc/s)
DC resistance	3·7Ω ± 10%	5·65Ω ± 10%	78Ω ± 10%	280Ω ± 10%

In the Mullard publication "Circuits for Audio Amplifiers"* type numbers of wound components are given for the oscillator transformer in the tape pre-amplifier circuit, the treble-equalisation inductor in the tape amplifier and pre-amplifier circuits and the low-pass filter coil in the three-valve pre-amplifier circuit. These components are now superseded by the following wound Vinkor assemblies:

WF1738—which supersedes WF1388 as the oscillator transformer;

WF1932—which supersedes WF816 as the equalisation inductor; and

WF1933—which supersedes WF1428 as the filter coil.

Full winding details of the three Vinkor components are given in the Table.

Two features of the new components are:—

1. The termination of all leads (except the earth lead of the WF1738) at solder tags;
2. Single-hole mounting (a fixing nut and shake-proof washer being supplied with the component).

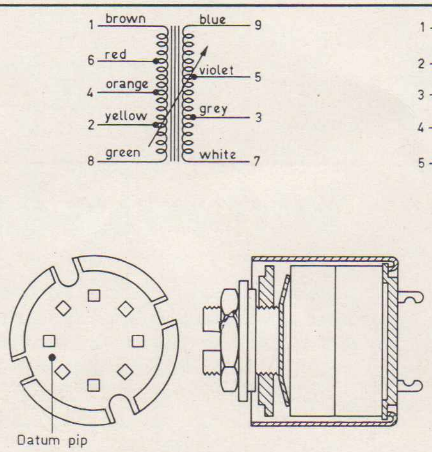
The complete wound components are available from Special Transformers Pty. Ltd., 139 Sydenham Road, Marrickville, N.S.W.

Where enthusiasts wish to wind their own coils, care must be taken that the fine wires used do not become contaminated. It is essential that the completed unit be impregnated with a non-hygroscopic wax such as that manufactured by Vacuum Oil Co. Pty. Ltd. **type number Mobilwax 2305.

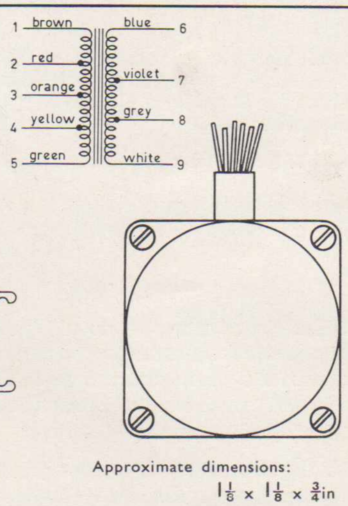
Vinkor data may be obtained by forwarding a stamped, addressed, foolscap envelope.

*"Circuits for Audio Amplifiers" is available from Mullard Offices and Distributors throughout the Commonwealth, price 12/6 plus 1/5 postage.

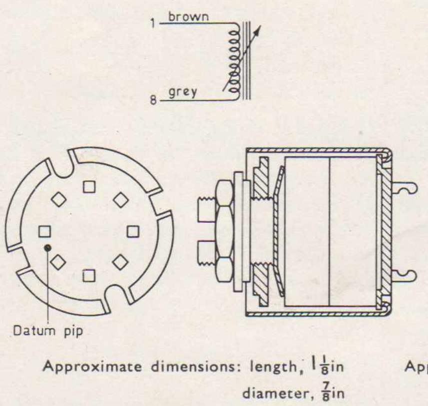
Diagrams illustrating physical differences between the new Vinkor wound components and the old components which they have superseded.



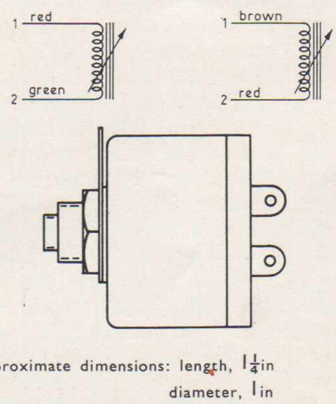
(A) Vinkor wound transformer, type WF1738



(B) Ferroxcube wound transformer, type WF1388



(C) Vinkor wound inductors, types WF1932;WF1933



(D) Ferroxcube wound inductors, types WF816;WF1428

(The drawings are not to scale.)

IF you change your address:

1. Notify Mullard-Australia Pty. Ltd. immediately.
2. If possible let us know in advance. Thirty days' notice will enable our mailing system to operate more efficiently.
3. Notify us in writing and include the address label from one of the recent issues showing your old address and code line.

THANK YOU.

Printed in Australia by The Langlea Printery Pty. Ltd., 31 Princes Highway, St. Peters