In radio communications, knowledge is progress. Only knowledge can mean progress; in turn, progress itself maintains our present high standard of living. Radio-communications has its place in the community and the expansion of this industry with the ever changing techniques require specially trained personnel to keep the picture of progress moving.

No one is in a better position to advance with this progress than the trained technician. The Marconi School of Wireless has combined training facilities with the most up-to-date methods to ensure that every graduate has the knowledge necessary to become thoroughly competent in this field.
WHEN IS A TRANSMITTER...?

RECENTLY, a personal friend, of some standing in the electronics industry, ran into serious interference problems with his television receiver. The interference appeared as a pattern of wavy lines, suggesting an unstable RF oscillator; it ceased half the screen, rolling slowly on and off, indicating no oscillator supplied from non-regulated AC. It seemed to occur at about half-hour intervals during the evening, lasting for about 10 minutes at a time.

Faced with the problem of a potential liability, my friend reported the matter officially to the Radio Branch of the P.M.G. Department. He gave all the relevant information and suggested that the interference was possibly being radiated unwittingly from equipment owned by a physiotherapist nearby.

An inspector, who ultimately came to investigate the complaint, was disinclined to do anything but blame the interference on somebody else's TV set, despite the detailed description of the interference and a duration lasting for about 10 minutes at a time. However, after further complaints by my friend and by other users in the neighbourhood, the interference was, in fact, traced to the aforesaid piece of physiotherapy equipment. Generally it was operated at the owner's home but, often, it would be taken to a patient's home, constituting a real mobile menace to TV reception.

But here's the main point of the story: Pressed as to what he could do about the interference, the inspector had to admit that he could request, advise, even bluster a little but he couldn't force the owner to cease interfering with other people's TV reception.

The reason? Because the department has no real authority over devices which transmit radio waves, although it does have authority over radio transmitters but little or none over devices which transmit radio waves.

Instant De-briefing

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Radio, Television & Hobbies, March, 1964
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(Place X in square)

Radio, Television & Hobbies, March, 1964
The Weather Eye That Never Sleeps

By Wesley S. Griswold

From 500 miles up and taking 1300 pictures a day, a Nimbus satellite can photograph every square foot of the earth's cloud cover every 24 hours. What's more, it can deliver cloud pictures to anywhere in the world.

Like it or not, we have to grow used to the idea that the sun will no longer be ostensibly alone in the mid-day sky, that, no matter where we are on earth, at mid-day, while the sun is pouring its energy-laden rays on to sea and land, a man-made weather eye is constantly reporting back the effects of these rays in terms of weather conditions. It can watch the clouds as they form or melt away, the movement of ice, huge swirling dust storms and tear-laden hurricanes. It can record them and report them to weather stations around the world. It can give weather forecasters data on a scale which, up till recently, would have seemed too fantastic for words.

It would be wrong to say that "there's nothing new about weather satellites," just because a flock of American "Tiros" satellites are already in orbit. Even the earliest of the "Tiros" vehicles went up less than four years ago.

But, even in that short time, weather satellite techniques have "grown up" in spectacular fashion, as also have the techniques for launching them.

Now a single "Nimbus" satellite, launched into an ingeniously devised polar orbit, can feed back as much useful information as several separate Tiros vehicles.

It can do this partly because of its improved design and secondly because, as it orbits in space, with the world hovering beneath it, Nimbus can look down upon just about any place on earth, round about midday.

Nimbus, the Latin word for cloud, is the basic code name of the next U.S. series of weather satellites. These will be more sophisticated birds than the Tiros series (that name incidentally, stands for Television Infra-Red Observation Satellite). However, the Tiros series has been so successful that Tiros satellites will continue to be orbited even after Nimbus program gets under way.

U.S. space engineers are justifiedly proud of the record established by Tiros, as I learnt when I visited a ground-control station to see how weather pictures are retrieved from a satellite. Eleven of the Tiros series had been placed in orbit at the time of my visit, and an eighth was scheduled to be launched. Since April 1, 1960, when the first Tiros was sent up, weather satellites have delivered over 200,000 usable photos of cloud and ice formations. These pictures, made with surprisingly small cameras from an average height of 400 miles, have improved weather forecasts everywhere. The satellites have sounded the alarm at the approach of the world's most dangerous storms. Last year, they detected Hurricane Esther two days before anything else did.

Their panoramic views of weather in the making have helped decide when airplanes were to be foliage. They have given long-range data for docking other satellites, and in determining when supply ships should visit an Antarctic expedition. They've even impressed the Russians, who have signed a treaty to share in their benefits.

If Tiros has been so successful, why is the Nimbus series necessary? For one thing, the cameras aboard Tiros don't always point at the earth. During part of each orbit, they're staring into space. The Nimbus series, on the other hand, will be "earth-oriented." Gas jets and flywheels will turn it to keep the cameras always pointed toward the center of the earth.

LIKE it or not, we have to grow used to the idea that the sun will no longer be ostensibly alone in the mid-day sky, that, no matter where we are on earth, at mid-day, while the sun is pouring its energy-laden rays on to sea and land, a man-made weather eye is constantly reporting back the effects of these rays in terms of weather conditions. It can watch the clouds as they form or melt away, the movement of ice, huge swirling dust storms and tear-laden hurricanes. It can record them and report them to weather stations around the world. It can give weather forecasters data on a scale which, up till recently, would have seemed too fantastic for words.

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For this purpose, sensors aboard will...
keep telling its control circuits where the earth is. Other sensors will locale the sun. so that the paddles carrying solar cells can be kept aimed in that direction.

Nimbus will also have a better orbit than Tiros. Crossing the equator at an angle of about 80 degrees, it will be essentially a polar orbit. Tiros satellites have orbits crossing the equator at shallower angles, up to 58 degrees, giving poor coverage of the high altitudes. Nimbus will be able to take pictures of every square foot of our cloud cover every day, with its cameras pointed at the earth's shadow.

Picture-taking will even continue "at night" (when the satellite is in the earth's shadow). Nimbus satellites will carry a high-resolution radiometer to take infra-red pictures of clouds by sensing their heat.

For daylight cloud pictures, two sets of three TV cameras will take three-frame composite shots of the earth's surface. From 500 miles up, each strip will cover an area 1,450 miles across (east-west) and 450 miles deep (north-south). As the satellite moves from pole to pole, 32 of these pictures will be taken during two complete orbits, for readout to ground stations. All six cameras together can take a total of 1,300 cloud pictures every day.

ANOTHER CAMERA

Nimbus satellites will also carry another TV-camera system, aptly called APT — Automatic Picture-Taking system. This uses a single TV camera, which shoots an area of the earth's surface 1,000 miles square. Every three minutes this camera will automatically take a picture and store it in an electrically charged layer on the face of its vidicon tube. The picture will then be scanned very slowly — taking 200 seconds for a complete readout — and transmitted to earth.

The slow readout means that relatively simple receiving equipment can pick up the signal, and that it can be converted into a picture by a facsimile printer instead of being photographed off a television tube. This adds up to a small, fairly inexpensive ground station — costing only about 30,000 dollars. Thus, satellite weather stations can be spotted all over the globe (even the poorest nations can afford them), spreading the benefits of the weather satellites more widely.

An APT ground station will be set up at the New York World's Fair later this year.

Since Nimbus will be overhead at the same time every day — around noon — an APT ground station doesn't need computers and complicated tracking antennas to locale the satellite. Getting pictures of the local cloud cover isn't much more complicated than pointing the antenna straight up and turning the facsimile printer on. Pictures of adjacent 1,000-mile-square areas can also be received, during orbits earlier and later than the noon orbit.

For the global weather picture, however, we'll still depend on complex...
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MODEL 127A
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Resistance—0.2000 to 200K
Output—5 ranges with condenser
Accuracy—DC 2 %, AC 3 %
Weight—4 lb.
Size—7 x 4 x 11

MODEL 105A
Sensitivity—20,000 opv, DC
1,000 opv, AC
Accuracy—DC 2 %, AC 3 %
Volts—DC—0.3 to 1200 (7 ranges)
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Weight—4 lb.
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Radio, Television & Hobbies, March, 1964
A foretaste of space conditions:

ground stations that signal the satellite to release the pictures it has taken during complete orbits and stores on tape. For Nimbus, this photo-gathering system will be substantially the same as that now used with Tiros.

The present system involves two Command and Data Acquisition stations operated by the National Aeronautics and Space Administration—one in Wallops Island, Va., and the other at Point Mugu, Calif., with its antenna 70 miles southwest on San Nicolas Island. To see how it works I went to Point Mugu one evening last spring.

The sky was bright with stars. My visit had been timed to begin a few minutes before Tiros VI made its incomparable appearance over the horizon.

"That's San Nicolas Island, on a microwave hookup," my NASA guide explained. "That's the radio beacon on Tiros.

"I can't see the pictures?" I asked.

"Not till they've been developed and printed. We've got a trailer darkroom, it's locked on it now. The bird is within receiving range—1,300 miles.

"Take a look," the guide pointed, "at three-second intervals. A NASA man headed for the loudspeaker, and I heard the camera clicking. A Nimbus satellite is lowered into a vacuum tank lor pre-flight testing under simulated space conditions."

Radio, Television & Hobbies, March, 1964
Check all circuits, pinpoint any TV trouble—*in minutes*

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This one instrument, with its complete, accurate diagnosis, enables any serviceman to cut servicing time ... service more TV sets in less time ... and satisfy more customers.

With the Analyst, you inject your own TV signals, at any point, while you watch the generated test pattern on the picture tube of the television set itself. This makes it quick and easy to isolate, pinpoint and correct TV trouble in any stage throughout the video, audio, r.f., I.F., sync and sweep sections of the television set — including intermitments. No external scope or waveform interpretation is needed. Checks any and all circuits — solves any performance problem.

The B & K Analyst is one of the most useful and valuable aids in TV servicing today! Its basic technique has been proved by thousands of successful servicemen everywhere.
LANDING a jet with a touchdown speed of more than 130 knots on an aircraft-carrier flight deck is a tricky operation requiring near-perfect precision, even under the most favourable conditions. Under adverse weather or rough seas with the ship pitching and rolling, landing becomes a severely taxing and hazardous operation for both aircraft and personnel.

Modern carriers have several ingenious devices to aid pilots in a safe landing; for example, the angled flight deck and the optical landing system — both British inventions. The latest aid to carrier landings has recently been introduced by the United States Navy — an American-designed system which, however, makes considerable use of British television equipment.

The new system, known as PLAT (Pilot Landing Aid Television) was developed by the Ampex Corporation in conjunction with the U.S. Navy. It is a completely integrated system of electronic picture and sound recording designed to monitor and simultaneously record aircraft landing operations from approach to final recovery, in daylight or in darkness, and to play the recording back immediately for post-flight analysis and evaluation.

CENTRAL CONTROL: Navy technician makes adjustments on Ampex Videotape television recorder system aboard a U.S. Navy carrier. In front of the operator are monitor screens covering the Marconi camera installations on board. Beneath the monitors is the press button panel of the PLAT system control.

PILOT DE-BRIEFING: Landing Signal Officer uses Videotape landing on monitor screen to show pilots their mistakes in graphic reality during "de-briefing" session in carrier's ready room. Formerly such de-briefings were based mainly on memory and notes taken during the flight operations.
Where there's action . . .
you'll find the

FI-CORD 202

This dramatic picture was taken at the scene of a recent South Melbourne tim-ber-yard fire. Here 3UZ newscaster, Gerard Flamming, takes the station's audience to the scene with an authentic on-the-spot recording . . . with a FI-
Cord 202 Portable Battery/Mains Rec-order. Complete fidelity and all the practical advantages of a full size rec-
corder, are incorporated in this com-
pletely portable, lightweight machine.

Why do men of action select the FI-CORD 202?
Because it's compact, reliable and efficient! This versatile recorder weighs only 6½ lbs, . . . and completely satisfies the professional user and the enthusiastic amateur who demand high fidelity recording. That's why leading television and broadcasting stations specify the FI-CORD 202!

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Specifications

- Frequency response: .5-12,000 c/s at 7 1/2 i.p.s.; 50-8,000 c/s at 3 3/4 i.p.s.
- Noise level: 50 db weighted.
- Erase frequency: 60 Kc/s.
- Back-wind: 1 minute at 7 1/2 i.p.s. for 4ln spool of long-play tape.
- Forward-wind: 2 minutes at 7 1/2 i.p.s. for 4ln spool of long-play tape.
- Input: Less than .2 mV at IN socket for fully modulated tape.
- Output: Maximum 1 V at OUT socket; this will not fall below .8V when loaded with 100 ohms.
- Direct line recording: Voltage required to load tape to standard level—0.2 mV.

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PLAT, which is being installed in 12 American carriers, consists of four Marconi television cameras, control synchronisation and distribution equipment, a network of monitor screens, and a standard Ampex Videotape installation.

Two unmanned Mark IV infrared image orthicon cameras are buried in modified lighting wells near the touchdown point in the angled flight deck with mirrors to align the optical axis of the camera with the correct aircraft approach path. Crossed hairlines in the camera optical systems help to define this path accurately. These cameras, which are operated automatically through the system's central control, monitor the landing aircraft's flight from the moment it enters the "final approach." A third Mark IV camera, manually controlled, is located on the island bridge, some 40 fl above the flight deck. It picks up the aircraft as it touches down, and a zoom lens gives a close-up picture of the aircraft throughout its landing run, and establishes which of the four arrester wires is engaged by the pilot. It can follow the aircraft out in the event of an overshoot, and can also be used to cover aircraft launchings, so providing the ship's combat information centre and pilots' ready rooms with direct information on deck operations.

A Marconi miniature vidicon camera is permanently focused on a data display board in the PLAT control room to record the date, time, wind velocity, aircraft approach speed and the wave-off signal. The picture from the camera is combined with that from any of the other cameras in a simultaneous display, and this composite picture, is recorded on a standard Ampex Videotape recorder. Conversation between the pilot and landing operation personnel is recorded simultaneously on one of the two audio channels on the tape, the second being kept as a "cue" track for additional commentary for de-briefing or for possible accident analysis.

Previously, carrier landings and takeoffs were recorded on 16 mm film. This had a number of serious disadvantages, not least that the film could not be used for immediate de-briefing of pilots because of the time required for processing it—at least six hours. With PLAT, however, pilots and landing control personnel can watch every detail of the completed landing within a matter of minutes and any errors of procedure or judgment can be assessed while the events are still fresh in their minds. Afterwards the tape can be "cleaned" and used again, or it can be preserved to assist in the training of new pilots. From carriers equipped with PLAT have come reports of a reduction in faulty landing approaches. Pilots are assimilating proper landing techniques more quickly. And PLAT is proving valuable in accident investigation.

The potentialities of closed circuit television in the naval, military and civil aviation fields are vast. In this latest application, in combination with the recording of television pictures on magnetic tape, it is providing another important safety and instructional aid to one of the most demanding of all occupations—piloting modern high-speed aircraft.

ATOM SMASHER

Britain now has the third most powerful "atom smasher" in the world.

The machine, Nimrod, a proton synchrotron at Harwell, recently successfully achieved an energy production of 8,000 million electron volts. This placed it after a 30,000 million e-V accelerator at Brookhaven in the United States and the European 27,000 million e-V CERN accelerator. A Soviet accelerator at Dubna is of the same power as Nimrod, which is designed to accelerate the atomic particles called protons to appreciable fractions of the speed of light.
wise enjoy. There was often, therefore, a profession of forgers of political documents. By means of these documents, princes were able to avoid displeasure of privileges which they would not otherwise enjoy. There was often, therefore, some division between those who had and those who had not.

For this reason, any ideas which tended to restrict the activities of these forgers were quickly grasped by those in authority, particularly Queen Anne her Royal self, who was suffering great inconvenience by the forgeries of these low grade subjects. It must also be remembered that, in those days, the art of handwriting and writing was restricted to the educated few so that forgery was not an easy task for those low grade subjects. It must also be remembered that, in those days, the art of handwriting and writing was restricted to the educated few so that forgery was not an easy task for those low grade subjects.

During the reign of Queen Anne from 1664 to 1714, there were many ill-disposed persons who took up the profession of forgers of political documents. By means of these documents, princes were able to avoid displeasure of privileges which they would not otherwise enjoy. There was often, therefore, some division between those who had and those who had not.

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The following is the wording of the patent:—"An artificial machine or method for the impressing or transcribing of letters, singly or progressively, on paper or parchment so neat and exact as not to be distinguished from print; on paper or parchment so neat and exact as not to be distinguished from print; all writings whatsoever may be embossed on paper or parchment so neat and exact as not to be distinguished from print; any writing whatsoever may be embossed on paper or parchment so neat and exact as not to be distinguished from print; any writing whatsoever may be embossed on paper or parchment so neat and exact as not to be distinguished from print; or engraved upon issued what turned out to be the first practical typewriter. That development of the machine Burt called a "Typographer." To make it, he borrowed an assortment of type from a printer friend. With this and an assortment of wood, he built a block-like affair for standing on a table, but which was later fitted with legs to stand on the floor. It bore something like the modern pin ball game table when in use, etc.

The printing element was a semicircular frame on which the type was mounted, similar to the present day typewriter. The idea was to move the frame until the desired letter came opposite the paper. Then, after being inked with a roller, it was pressed against the paper by means of a lever. The machine printed on a long strip of paper which was torn off a roll after the paper was filled. How much was printed on a page was indicated on a clock-like dial on the front of the machine.

The first United States patent was granted to William Burt, of Detroit, in 1829 by President Andrew Jackson. This machine Burt called a "Typographer." To make it, he borrowed an assortment of type from a printer friend. With this and an assortment of wood, he built a block-like affair for standing on a table, but which was later fitted with legs to stand on the floor. It bore something like the modern pin ball game table when in use, etc.

The machine printed on a long strip of paper which was torn off a roll after the paper was filled. How much was printed on a page was indicated on a clock-like dial on the front of the machine. The machine was the invention of the man who may have had claims to the invention of the first typewriter, it is to America that we must look in our history books for the development of the first practical typewriter. That development is the first interesting reading.

For Queen Anne, the last few words of the patent were, no doubt, the meat of the matter. It may also be remembered that, in those days, the art of handwriting and writing was restricted to the educated few so that forgery was not an easy task for those low grade subjects. It must also be remembered that, in those days, the art of handwriting and writing was restricted to the educated few so that forgery was not an easy task for those low grade subjects.

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One hundred and twenty years later, the first practical typewriter was invented. By means of these documents, princes were able to avoid displeasure of privileges which they would not otherwise enjoy. There was often, therefore, some division between those who had and those who had not.

For Queen Anne, the last few words of the patent were, no doubt, the meat of the matter. It may also be remembered that, in those days, the art of handwriting and writing was restricted to the educated few so that forgery was not an easy task for those low grade subjects. It must also be remembered that, in those days, the art of handwriting and writing was restricted to the educated few so that forgery was not an easy task for those low grade subjects.

Who actually invented the first typewriter? As with so many other inventions, it is hard to know who to credit with benefiting from previous failures, finally producing the successful article. For the original idea, we must look to England in the early 18th century.
Scientific American of April 30, 1887, of A. Ely Beach, an editor of Scientific American. A picture reproduced from the Scientific American of April 30, 1887, shows the idea of Thurber's machine. Basically it consisted of a revolving cylinder around the edge of which were mounted bars with the type on the lower end. The upper end of the bars carried a button, on which was engraved the appropriate letter, number, or character. Paper was wound around a cylinder.

**COMPLEX OPERATION**

To print, the operator put his finger on the required button, swung the type cylinder around so that the selected type was at the front and pressed the button. The type was inked by means of rollers on each side of the machine. The most advanced model of Thurber's machine received the paper cylinder automatically, and in a linear direction, unlike the early model where this operation had to be done by hand.

Although Thurber's machine did not achieve great popularity, it provided ideas that were later incorporated in modern typewriters.

Another instrument which included important features as used today was a small piano. The piano was fastened to a wooden ring which was fixed to a pivot and moved back and forth, varying in shape and size as a piano grand, and in black and white, in a similar fashion.

**OTHER INVENTORS**

There were a host of inventors up to the year 1850. In the United States and Italy, in 1829 Oliver Ditson invented a writing machine about as large as a baby grand piano. The machine was composed of 78 type bars arranged in 13 rows. The type bars were set in a circle and they struck up underneath the material to hand, the cost type, clockwork mechanisms and type parts which were in easy supply at the time. Prace's machine had the hammers hinging in a circle and they struck up underneath at one point onto a small suspended plate.

In 1867, a man named Christopher Latham Sholes became interested in the typewriter. Sholes worked on the idea without much success until one day in July 1867. Then he conceived a new key from a telegrapher named Charles E. Storrs and went into his workshop the next day he exhibited a one-letter machine similar to the reproduction herewith. This is a sketch drawn from a telegraph key bar and odds and ends. Operating the key bar was fastened a vertical pin. To the end of the Morse key, a line of Ws were printed on the table. This was pressed against the carbon paper against the glass and moved it again was a metal plate. Thus when the type came up it hit against the paper. This was pressed against the ribbon and simultaneously the impression was then made ON TOP of the paper.

So the first practical typewriter was born. With the backing of an enthusiastic business fellow from Pennsylvania named James Densmore, Sholes and his partners continued work on the machine and took out several patents. However technical difficulties dogged the way of the trio, whilst Densmore became more and more enthusiastic in the possibilities of the machine.

**In 1873**: Sholes and Densmore turned to a man named Christopher Latham Sholes, a typewriter manufacturer in New York, in 1873. He called it a Literary Piano. In appearance, it looked just like a small piano, in black and white, with a wooden ring. On the face of the instrument there were a whole string of type which were in easy supply at the time. There was a movable framework over the top of the disc which held a piece of paper, flat over the roller. Over the paper was an inked ribbon and over this again was a metal plate. Thus when the type came up it hit against the paper. This was pressed against the ribbon and simultaneously the impression was then made ON TOP of the paper.

To print, the operator put his finger on the required button, swung the type cylinder around so that the selected type was at the front and pressed the button. The type was inked by means of rollers on each side of the machine. The most advanced model of Thurber's machine received the paper cylinder automatically, and in a linear direction, unlike the early model where this operation had to be done by hand.

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**A single letter mechanism developed by Stiles in 1867, from a telegraph key and odds and ends. Operating the key, the type against carbon paper on the underside of the glass plate.**

This machine also had an action similar to the present day typewriter. It consisted of rods with buttons on the top which were in easy supply at the time.
to put the typewriter into production" ("A Brief History of the Typewriter"; Remington Rand, New York).

Known manufacturers of sewing machines ("A Brief History of the Typewriter"; Remington No. 1, was made in September 1873."

Mark Twain, the famous American humorist, was among the first purchasers of a typewriter, and he was the first author to submit a typewritten manuscript to a publisher. Naturally, Sholes and his associates were not the only ones in the field. In the next few years there were a number of other attempts to achieve the same end. Among the more ingenious of these, and one which is of particular interest in the light of current design, was one which is of particular interest in the light of current design, was patented by Lucien S. Crandall in 1881.

The distinctive feature was a type sleeve, a small vertical post carrying lines later. Although at first, sales of typewriters were slow, impetus was gained as the first machine was encased in metal with black japan finish with gold flowers stencilled thereon. It wore only capital letters and the type bars struck upwards so that the operator could not read what he had written until four lines later. As late as 1951-52, John E. Hickerman experimented with a similar kind of machine. As late as 1951-52, John E. Hickerman experimented with a similar kind of machine. As late as 1951-52, John E. Hickerman experimented with a similar kind of machine. As late as 1951-52, John E. Hickerman experimented with a similar kind of machine.

Text. Advantages include ease of operation and of impression, giving a cleaner impression. The heart of the IBM machine is the carriage carrying the type head and ribbon cartridge. Touching a key rotates and tilts the hand to select the character, then presses the head against the paper. The carriage moves to the right as each character is printed.

Another form of electric typewriter, is made by Remington Rand. This uses the more common n e n manual typewriter, an electric motor Couple m e is a n m isch is thoroughly and explained in the operation of electric machines. Considering the operation of electric machines in connection with this type of impressing, giv-
Confused? Worried?
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So often audio enthusiasts are perplexed by the confusion of equipment and advice offered them; they are completely blinded, with science! When you deal with Excel Electronics you cannot possibly err — for here is equipment from the world’s major manufacturers — sold to you at Australia’s lowest prices. Write us for a quote on any items you require — you’ll be delighted! The benefits of Australia’s highest turn-over and bulk purchasing are passed on to you. All Excel equipment is BRAND NEW, SALES TAX has been paid — there are NO HIDDEN EXTRAS. Now examine our "specials" for this month — here’s true Excel value! And an after-thought — be quick for the Medding lines . . . these represent outstanding purchasing for you . . .

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2. High-quality Medding 10 watt amplifier, 20 mV sensitivity, with P 67 control unit. List price £38-2-0. Our price £23-10-0


4. Medding tuners with built-in power supply, vernier dial. £23/13/6. Our price £13-19-0

5. Pioneer 100 stereo amplifier with AMP/AM SW input, Labcraft 605 turntable. All balance pickup with Decca Deram cartridge, two Wharfedale 12 RS/DD surround speakers. List price £38-10-0. Our price £28-10-0

6. Pioneer SMQ 300 amplifier, AM/AM/FM SW input, Orpheus Silex turntable, Ortofon SMG 212 tone arm and ADC cartridge. Two Wharfedale 12 RS/DD surround speakers. £166

7. Medding Four-Four stereo amplifiers, range 20 c/s to 80 kc/s, plus £57 control unit, Labcraft turntable with stereo diamond, two 10 in Wharfedale or Richard Allan 8 in spkrs. £98-10-0

8. Medding Mullard twin 5/10 stereo amplifiers with matching control unit, Labcraft turntable with stereo diamond, two 10 in Wharfedale or Richard Allan 8 in spkrs. £79-10-0

9. J.H. turntable and JH MK. II tone arm, ADC-1 cartridge, two Wharfedale 12 RS/DD speakers . . . £98-10-0

10. LEAK stereo 5/10 amplifier and control unit, Commodore or oscillator 301 turntables. SME 3009 tone arm and ADC-1 . . . £189

11. Orpheus Silex turntable. All balance pickup with Decca Deram cartridge. Only £43

12. Two LEAK sandwich speaker systems, Pioneer SMQ 300 . . . £249

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(Continued on Page 110)

Radio, Television & Hobbies, March, 1964
WATER LUBRicates HIGH SPEED SLIP RINGS

Take a gleaming gold alloy ring and the brass bristles from a 98-cent clothes brush. Add water and operate at 50,000 r.p.m. The result is a major breakthrough in a sizeable problem for gas-turbine manufacturers—how to find out what stresses and temperatures turbine rotors undergo during operation.

By Allen Hobbs

The task involves slip rings—devices that make it possible to pick up an electrical impulse from a rotating part. In effect, they join two ends of an electrical wire—once wire spinning at high speed while the other wire is stationary.

Test engineers test time, stress and temperature gauges in the high-speed wheel. Some of these ride the edges of the rotor at more than 1,800 miles per hour. For example, 200 h.p. Boeing helicopter turbines, produced by this company's industrial products division in Seattle, operate at rotor speeds up to 39,000 r.p.m. and other turbine models exceed 45,000 r.p.m.

The big hurdle is how to gather and read the signals of these gauges which are spinning with the rotors. Most commonly used is the practice of passing the signal to an electrical pickup point on the rotor shaft. The signals are gathered for data recorders by brushes pressing against the shaft's pickup point.

In conventional slip-ring technology, the pickup point is a coin-silver ring. The brushes are blocks of silver-graphite. These were long thought to be the best materials for the job, although they had some serious drawbacks for speeds above 25,000 r.p.m. The contact between the brushes and the ring created obscuring electrical noise; the device had a short life and low reliability; it was expensive to manufacture, assemble, maintain and operate. In short, something better was needed.

Boeing engineers had sought other methods of obtaining their data, including a new system using radio transmitters which pick up turbines components and broadcast data to receiving recorders—although having several definite advantages over conventional slip rings, the system was complex, bulky and expensive.

The electronics design team of the aerospace division was contacted for assistance in developing a more efficient rotating radio transmitter unit—an approach which soon was leap-frogged.

The new concept puts water at the source of all slip-ring problems—the spot where the stationary brush touches the spinning ring. Flowing through the slip ring, water cools, lubricates and cleanses that delicate area, greatly reducing wear and electrical noise. The rings have long life and, in contrast to previous devices, are inexpensive to manufacture. Good is required, as the slip ring alloy because of its excellent characteristics and resistance to oxidation.

NEW BRUSH MATERIALS

Effective lubrication has meant that slip-ring designers are no longer held back by brush materials such as silver-graphite which has dry lubricating qualities. For brushes, designers turned to electromechanical brass which has one important feature—can be made into very fine wire. Brittle and bulkier steel wire strands touching the slip-ring surface required separate grooves to hold them in contact with the high-speed slip ring. Tufts of brass wire strung touching the slip ring with featherweight pressure have many advantages. The tufts dampen vibration and provide many thousands of electrical paths which prevent any interception of the data signal. The rings bounce an individual strand out of contact.

Liquid cooling permits slip rings to be much smaller than the conventional apparatus. This cooling also allows slip-ring units to operate at extremely high temperatures.

The water-lubricated slip-ring units have been run up to 110,000 r.p.m. with no measurable decline in signal clarity. The device is being used for other tasks than turbine-engine research. One of these new slip-ring jobs is to supply power to electronic parts.

A paper on the newly invented water-flooded slip ring was given recently in Philadelphia at the annual meeting of the American Society of Mechanical Engineers by Francis D. Reynolds, aerospace division unit chief, and Richard Ahrens, industrial products division unit chief.

Clothes brush manufacturers who may be led to expect a big run on their 98-cent brass-plated models will have to be content with their original market. Engineers figure that their fine clothes brush has enough bristles to last through 1965.

(From "Boeing Magazine" 12/63)
The LABCRAFT family of quality comprises 3 models to cater for all possible needs of music lovers. All are belt-driven from a motor unit which hangs freely on a unique suspension system isolating all vibration from the pickup stylus. Motors are provided with 4 speeds, each variable by 10%. Model 605 motors are "potted" and shielded for use with all magnetic pick-ups. Model 573V is complete with arm, head, switch and velvet-action arm-lowering lever. Rumble is completely inaudible, wow and flutter completely absent. Your music is heard pure and clear. Danish design and craftsmanship have achieved this superb performance in compact, attractive tables at a reasonable price.

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Radio, Television & Hobbies, March, 1964
The world's largest radio-telescope is currently under construction in a partly natural, partly artificial, spherical hollow in the hills 12 miles south of Arecibo, Porto Rico. This is a story of its need, construction, and capabilities is reprinted from Radio-Electronics.

By ERIC LESLIE

WHY such a telescope? And why at Arecibo? What is the new instrument expected to accomplish?

Its chief purpose is to study the ionosphere. Satellites and rocket probes as well as radar soundings have given us many new facts about this region whose rotation and a rotation expected to accomplish that criss-crosses the bowl north-south. DOFW to theTne feed K

This would make it possible to measure electron density and temperature, determine auroral motion and direct transient currents in the ionosphere. Prof. William Gordon of Cornell University envisioned a system using an extremely powerful transmitter and an extremely powerful transmitter and an antenna of much higher gain than any that the solar system would be included in the scanning angle.

The mounted reflector bowl with different intensities. The lengths of its radiating slots are varied to scan the ecliptic, in which the usual parabolic reflector a spherical one be used with a phased-line feed. This would make it possible to direct the beam over an angle of 20 degrees from the zenith, a much wider angle than similar performances. A beam of parallel rays is produced directly observable at the Dish is 1,000 feet across (a total of 8 acres), at 500 miles. The study has been limited by the small amount of information that could be obtained from existing instruments. Prof. Gordon estimated that the antenna would probably have to be a stationary dish in a natural bowl in the earth. It should be near the equator, he said, so that the solar system would be included in the scanning angle.

The Returned signals are very much interested in all information available about the ionosphere, as it is used in ICBM detection and decoy discrimination. Therefore, funds were supplied by the Air Force Cambridge Research Laboratories for exploring ICBM detection techniques. The Air Force Cambridge Research Laboratories was named as one of the technical organizations involved in the ionosphere project. This laboratory has been interested in the usual parabolic reflector a spherical one by using a phased-line feed. This would make it possible to direct the beam over an angle of 20 degrees from the zenith, a much wider angle than similar performances. A beam of parallel rays is produced directly observable at the Dish is 1,000 feet across (a total of 8 acres), at 500 miles. The study has been limited by the small amount of information that could be obtained from existing instruments. Prof. Gordon estimated that the antenna would probably have to be a stationary dish in a natural bowl in the earth. It should be near the equator, he said, so that the solar system would be included in the scanning angle.

MILITARY VALUE

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How signals are beamed into the bowl to produce a parallel beam. The line feed, a simple way of doing this, is shown at the left. All the feeders of the array radian at each point along its length. The vertical angle of the beam can be varied by moving the line feed along the feed arm.
These two Rola models, 8MX and 9-6LX, offer the best possible approach to good quality stereo reproduction at a moderate cost.

The eight-inch model 8MX is recommended for use in the small, 1.9 cubic foot, Rola-designed vented enclosure, but is also suitable for use in conventional open-back radiogram-type cabinets. The elliptical model, 9-6LX, is also designed for open-back cabinets, and when mounted with its major axis on the vertical plane has the advantage of wide-angle radiation of the higher frequencies. The power-handling capacity of each model, 10 watts peak for the 8MX and 7 watts peak for the 9-6LX, is more than adequate for domestic needs, and their frequency response such as to do justice to the finest recordings.

All in all, the 8MX and the 9-6LX represent the best and most practical approach to low-cost high-fidelity stereo.
NEW USES FOR Cds CELLS

One of the most intriguing devices developed by "solid state" engineers is the photoconductive cell, based on Cadmium Sulfide and similar materials. In addition to simplifying photography, these cells have characteristics which make possible a whole new range of applications, from photography to space travel.

The new Polaroid Land Model 100 Camera represents the most recent advancement in photoconductive cells. For the first time, a truly electronic shutter has been designed for a camera, using a photoconductive cell to measure light for the proper time has fallen for advancement in photoconductive cells.

A TYPICAL of such applications are two dates described by the Clairex Corporation of U.S.A., manufacturers of Cadmium Sulfide and Cadmium Selenide semiconductors.

The new Polaroid Land Model 100 Camera represents the most recent advancement in photoconductive cells. For the first time, a truly electronic shutter has been designed for a camera, using a photoconductive cell to measure light for the proper time has fallen for advancement in photoconductive cells.

The eye of this amazing system is a specially developed Cadmium Sulfide cell.

The Land Polaroid Automatic 100 camera fitted with automatic shutter control responsive to both general illumination and flash. It uses a specially developed Cadmium Sulfide cell.

'both normal light, and the brief light of a flash bulb, automatically. This makes the camera fully automatic under all conditions. Even a child can take perfectly exposed pictures every time.

The eye of this amazing system is a specially developed Cadmium Sulfide cell.

and manufactured by Clairex. This cell measures the light and charges a resistor-capacitor circuit, which in turn determines the speed of the shutter. It can be seen from this shutter circuit that, if a high illumination falls on the cell, it will charge the capacitor quickly, firing the trigger circuit and thus giving a fast shutter speed. At low illuminations the current through the cell will be small, thus it will take a correspondingly longer time for the capacitor to charge, slowing down the shutter.

For the first time, a truly electronic shutter has been designed for a camera, using a photoconductive cell to measure light for the proper time has fallen for advancement in photoconductive cells.

This new shutter required two characteristics in its light sensor not available in the average cells. To measure light like that of a flash bulb, the cell had to provide rapid response, three to four times faster than a Cadmium Sulfide cell's normal saturation. While Cadmium Selenide would offer a rapid response, its spectral response, light memory, and temperature characteristics were unacceptable. Therefore, the photoconductive cell had to be linear over a wide light range.

The new cell, now available in mass quantities, can transmit flashes of light with response times of two to three milliseconds; it has a resistance versus voltage of 9, yet still retains all the excellent characteristics of Cadmium Sulfide necessary in photographic applications. The cell is also very fast in its response to different colour temperatures of light, having a ratio of 1.10 for colour temperatures from 2,500 deg. K to 6,000 deg. K.

The shutter "shut" to Venus was assisted by photoconductive cells, also developed and manufactured by this company. Their CL603 cells, selected to rigid specifications, were used as the sun and kept the vehicle's solar batteries properly oriented. They also played an important role in the mid-course correction procedure.

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The Mariner II space "shot" to Venus was assisted by photoconductive cells, also developed and manufactured by this company. Their CL603 cells, selected to rigid specifications, were used as the sun and kept the vehicle's solar batteries properly oriented. They also played an important role in the mid-course correction procedure.

The eye of this amazing system is a specially developed Cadmium Sulfide cell.
The ADC Story

OR HOW TO BE NUMBER ONE IN FINE CARTRIDGES, AND STAY THERE

Peter E. Pritchard, a brilliant American audio engineer, worked for many years on pick-up designs as a key-member of Shure Bros. Inc., until he developed and perfected an entirely new and different cartridge in his own, private laboratory. As the performance was so much superior to other high-grade pick-ups, Mr Pritchard made a very big decision and he left Shure Bros. Inc., to start his own organization, Audio Dynamics Corporation, in order to manufacture and to promote his dramatically new product. Was there really anything different about his new pick-up head? Indeed, there was, as both IM and harmonic distortion tests revealed a drastic reduction of over 80%, and, as playing weights could be reduced to 0.75 gm resulting in spectacular tracking ability and an incomparable listening quality provocatively close to the real thing.

How could Mr Pritchard achieve such a performance? By inventing an ingenious, gyro-suspended stylus assembly and thereby completely redesigning the conventional armature mechanism. This major breakthrough lowered the stylus tip mass by a ratio of 4 to 1 due anything previously attained and the associated, fantastic increase in compliance became not only possible (eliminating for ever the plaguing need for heavy damping), but was necessary, so that this latter did not become the limiting factor.

The ADC-1 was introduced in 1960 and after extended practical tests Percy Wilson, M.A. and Cecil Watts reported from London (in the "Gramophone"): "We can now say, that we know at last for certain, that it is possible to trace a stereo groove of any configuration perfectly with a playing weight of no more than 1 gm and with no observable wear after 50 playings—even under a microscope; the cartridge we used for this conclusive demonstration was the American ADC-1." Thus the FIRST CARTRIDGE IN THE WORLD made its appearance with a genuine stylus mass of 0.5 mg and a guaranteed minimum compliance of 20 micro-cm/dyne. (The modern version has a minimum compliance of 30 and the incredible R30 of 40 micro-cm/dyne); for the first time permanent AND temporary groove wall distortion could now be prevented.

"Had the specification given above been suggested 5 years ago, most engineers would have stated most emphatically, that it was impossible and a futuristic dream. But the dream has become fact." (Excerpt from J.C.G. Gilbert's glowing report on the ADC-1).

ADC OWNERS RECOGNIZE THE VALUE OF THESE ENGINEERING FIRSTS AND EXPECT TO BE YEARS AHEAD. THEY ARE. TODAY, THERE IS A WORLD-WIDE DEMAND FOR ADC CARTRIDGES and the growth of an unknown fledgeling company of 3 years ago into one of the most reputable manufacturers of quality cartridges almost resembles a fairy-tale.

ADC-1. Beyond argument, the finest cartridge on the world market today. £31

ADC-2a. Outperforming any other p.u. head other than the ADC-1. £20

ADC-3. Equal to heads retailing for double the money and outselling today any other cartridge in Australia because: "IT WOULD BE DIFFICULT TO FIND ANOTHER CARTRIDGE, CAPABLE OF ITS PERFORMANCE, WHICH SELLS FOR ANYTHING NEAR THE QUOTED RETAIL PRICE OF £13, MAKING IT SPLENDID VALUE FOR MONEY." (Excerpt from the technical review in Radio, Television and Hobbies, September, 63.)

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Exclusive importers and Australian Representatives for ADC, U.S.A., and makers of the J. H. PICK-UP ARM AND SYNCHRONOUS TURNTABLE.

Radio, Television & Hobbies, March, 1964
Takes Out Colour
A process for stripping dyes from incorrectly processed tex-
tiles is announced by Canadian Industries, 1253 McGill College
Avenue, Montreal.

Materials like Terylene are soaked for about an hour in a
solution containing small quantities of sodium hydroxide and
sodium hydrosulphite at 127 degrees C. The treatment has no
adverse effect on the fabrics, states the company.

Intruder Alarm
Burglar alarms which sense the footprints of an intruder in
the garden have been patented by Walter Kilbee and Co. of
Belleville
New Jersey. Sensor beads are buried in the ground
about half a mile apart and 20 feet from the outer limits
of the property.

Kidde, which is now perfecting the apparatus for sale, says
the sensors will react to nearby ground waves but ignore those
coming from a distance.

Two-In-One Spray
A lightweight portable spray gun that will spray both paint
and a drying or setting agent simultaneously through the same
nozzle, though they are separately controlled, has been developed
by Officine Meccaniche Areografi Compressori, of 61, Via
Paolo Sarpi, Milan, Italy.

It has been designed for spraying two liquids which cannot
be used together—paint and primer beforehand. Besides being used
for painting it may also be used for the chemical spray cleaning
of metals.

Air-Fuel Engine
The Leibniz Institute of Aeronautical Engineering is report-
ed in the October issue of Teknika Molodezhi to have developed
a so-called "linked piston" design of internal combustion engine
claimed to combine the best features of diesel and petrol engines
and to operate on almost any fuel.

A prototype engine, with three pumps and four working
 cylinders, has been tested in the Volga car but it will probably
go into production for tractors and agricultural machines.

Automatic Air Dryer
A new automatic air dryer developed by Gillbarco in the United States will be re-
leased on the Australian market by Gilbert
and Barker Mfg. Co. (Aust.) Pty. Ltd.,
Huntley St., Alexandria, N.S.W.

The Gillbarco air dryer works by passing
compressed air through desiccants. These
are solids which have affinity for water.

The dryer uses two chambers containing
desiccants and the air flow is changed
about every half minute from one chamber
to the other. While the air is passing up-
ward through desiccants from one cham-
ber and being dried, a small part of the
dried air is passed downward through the
other chamber, thereby drying out and re-
activating the desiccant.

In an echo-free chamber at their
Burbank Plant, Lockheed engineers are continuing their study into the
way bats and porpoises locate food and
navigate by means of their nat-
ural echo-location systems. In the
picture, scientist John Parnell
"locates" a 1-Inch diameter pipe, but
objects have been successfully distin-
guished down to 1/20th inch dia-
eter—ordinary fence wire, for ex-
ample.

Radio, Television & Hobbies, March, 1964

Internal Diameter
An inexpensive way of accurately measuring the internal
diameter of long, slender cylinders such as those used in instru-
ments and sensitive high-pressure control mechanisms is described
in a patent (B.P. 940-504) granted to a Japanese engineer, 11.
Kurokawa.

The cylinder is held in a vertical position and filled with
oil. An accurately machined and weighted ram of precisely cast,
easily measured external diameter is inserted and the time taken
for it to drop a given distance is recorded. The same operation
is performed with a slightly smaller ram.

Cable Resists Heat
Cable suitable for use at continuous temperatures of 250
degrees C. and which is stated to withstand a standard flame test
of 1,000 degrees C., has been developed by Wandleside Warren
Wire Company, of Dunmurry, N. Ireland.

The cable is recommended for use in aircraft on circuits
where lower temperature cables are available and for industrial
use—heat, corrosion and flame are problems.

Dyeing Technique
An improved dyeing technique has been developed which
claims the East German firm VEB Farbenfabrik Wolfen, of
Wolfen, Bonn, ensures that synthetic and natural dyes are
both used to exactly the same intensity of colour when mixed
together in fabrics.

The different affinities that each has for two dyes are levelling
out by heating the fabrics for three hours in a solution that contains
benzene, an organic compound known as a diketene, and a
catalyst.

Quick-Setting Cement
Quick-setting cement which has high compressive strength,
is lightweight and resistant to water, has been developed by
Setsuo Higashi No 19-8, Kasumigaoka-danchi, Fukuoka-machi,
Irumagun, Saitama-prefecture, Japan.

Finely divided calcium hydrogen phosphate, zinc silicate
and water mixed together are stated to give a highly adaptable
cement.
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MOST WIDELY USED

MOST WIDELY ACCEPTED

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Standard Iron for general purpose. Quick-heating and time-tested dependability...
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A.E.E. CAPACITORS PTY. LTD.,
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42-46 Cable Street, WELLINGTON, C.
H. W. CLARKE (N.Z.) LIMITED
10 Toor St., AMBERLEY, NEW ZEALAND.

24 Radio, Television & Hobbies, March, 1964
Cold Rolling
Cold rolling in mills can be automatically stopped when the metal strip is nearing its end with the aid of a device operated by servomotor which defines the length of the strip on the takeoff reel which still remains to be uncoiled.

Designs On Porcelain

Types of extremity amputations.

Riding On Air
Spherical auxiliary or springs for cars are being made by Tartis Patents N.V., P.O. Box 11, Geldrup, Holland.

Aid For Disabled
A store of Swedish and Danish scientists has developed an electronic hand, which can be controlled by electrical impulses from the granulated slag produced forms a useful by-product, say the inventors.

Road Surfacing Material
Societe Generale Metallurgique De Hoboken, of Hoboken-les-Emek Rafaim Street, Jerusalem, Israel.

Fuel From Waste
The coating is composed of chemically stable metal oxides and nitrides and other similar compounds, and is obtained by bringing the niobium successively into contact with the appropriate chemicals at a temperature above 900 degrees C. The coating reacts with one another and diffuses into the surface of the niobium.

Self-Lighting Torch
Torches with accumulator batteries, which switch on when the mains power goes off or when they are shaken, are now available from Nickel-Cadmium Electronics Company, 13, 711 East Seven Mile Road, Detroit, 5, Michigan, U.S.A.

Hidden TV Aerials
An automatic adding machine, possessing only 250 parts compared with the usual 1,500, has been developed by an Israeli in co-operation with the European Research and Development Company, Weizmann Institute of Science, P.O. Box 24, Rehovoth.

Paper From Desert Plant
A process for the production of paper pulp from juncus— a type of desert rush— which is stated to be considerably cheaper than other processes, has been developed by the Israeli and Woods Products Institute of the Ministry of Commerce, 1, Iedok Ralaf Street, Jerusalem, Israel.

Coating From Nibium
A way of forming a protective coating on niobium and its alloys so that the metal will not oxidize, even when used at temperatures around 1,200 degrees C., has been patented by the Societe Generale Metalurgique De Hoboken, of Hoboken-les-Emek, Belgium.

Fuel From Waste
The fuel is pre-graded on a grid to remove all bulky material, dried and then milled to a uniform particle size. It is then injected into a steam raising furnace together with oil and the temperatures at high as 7,500 degrees C. are obtainable and the resulting steam produced forms a useful by-product, say the inventors.

Cheaper Adding Machines
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Type HD1 Miniature Aluminium Electrolytic Capacitors

Full range available to 1000 microfarad and 150 volt working. Operating temperature range from — 20° C to + 70° C. Standard tolerance — 10% to + 100% of rated capacitance. Full technical details on application.

Type HD2 Tubular Electrolytic Capacitors

Pigtail-type standard electrolytic capacitors. For general application in the temperature range — 20° C to + 65° C. Standard tolerance — 10% to + 100% of the rated capacitance. Available to 7500 microfarad and 500 volt working. Full technical details on application.

Type HP3 Polystyrene Film Capacitors

For general application and replacement of mica capacitors in the temperature range 0° C to + 70° C. Normal tolerance ± 10%. Available tolerances to ± 0.5%. Voltage ranges available 50 volt to 2000 volt. Full specifications on application.

Type 150D Solid-Electrolyte Tantalum Capacitors

These capacitors are designed for the replacement of aluminium electrolytics where high reliability is desired over the temperature range — 80° C to + 85° C with derated operation to + 125° C. Capacity to 330 microfarad and 75 volt working. Normal tolerances ± 20% and ± 10%. Full technical details on application.

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Radio, Television & Hobbies, March, 1964
SCIENTIFIC NEWS

living specimen through a microscope, he
At present, when a scientist photographs a
cess by which instant photographic prints
ed in the B.B.C. program "Science and
take the picture again because the particu-
tne contrast, focus and exposure right. If
logists who want to make photographic re-
separate printing process. "The result," he
can be produced from a camera without a
both the microscopic and the Polaroid pro-
problems of existing delay lines.

Secam Delay Lines

The line of field steel as a medium for
the propagation of ultrasonic waves will
the ultrasonic wave guide is of square
section mild steel, while the associated
transducers are lead titanate piezoelectric

tors and the Polaroid process is considered
nally to disappear or change their nature.

Instant Micro-Photography

Scientist correspondent Nick Lloyd report-
ed in the B.B.C. program "Science and
british optical firm in bringing together
which by means photographic prints can
covering damps echoes to an acceptable

Rubber For Damp Houses

"Damp has been a problem in houses
for years and an answer to it is yet another
use for rubber," reported Denis Desoutter
mentioned are development of rubber for
damp-proofing and the heat insulation.

Top-Loading Balance

A top-loading balance, called the P120
which covers a range of measurement from
1 to 120 grammes and is accurate to
within plus or minus 3 mg., has been deve-
oped by Mettler AG., 19 Pelikanstr.,
Zurich, Switzerland.

Orlyx - World-famous miniature
Soldering Instruments

No Switch Necessary

The element is rated for
continuous running, thus
avoiding switch troubles
and warming-up delays.

Rubber For Damp Houses

"Damp has been a problem in houses
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Your Car... and Transistor Ignition

By Keith Jeifcoat

In last month's issue we did more or less express the hope that we might be able to feature two different systems this month, but space will not permit us to do justice to both systems. As a result, the alternative system must wait till next month to be published. It is a most interesting approach because it features an ignition "transformer" of quite unusual design.

As a sequel to the theoretical articles in the January and February issues, we now present a practical transistor ignition system, in both positive and negative ground systems, and for operation of either 6 or 12 volts. Full constructional details are given and anyone handy with a soldering iron and simple tools should be able to produce a working copy. Total cost should be in the £15 to £18 bracket, depending on details.

In last month's article we presented a circuit which readers found working quite satisfactorily and we now present a practical transistor ignition system, in both positive and negative ground systems, and for operation of either 6 or 12 volts. The circuit diagram underneath the text shows the circuit and may assist the reader in following the explanation.

At the conclusion of last month's article we presented a circuit which regulators interested in transistor ignition might like to try. Before going to press we had had this circuit working quite satisfactorily, and, as we mentioned in the article, it was basically the same as used in some commercial units, on the market.

Following further tests of this unit, however, we found ourselves unhappy about the manner in which the zener diode was connected, particularly in view of the fact that, if the ballast resistor were carelessly adjusted, the zener diode would be subjected to only very slightly warm. However, setting the regulator to produce the right voltage through the transistor could, too easily, result in the zener diode, leading to its eventual destruction.

Superficially, there is little to distinguish a zener diode from an ordinary semiconductor diode. Connect a multi-meter for voltages at least, and it will be found that its resistance is low in the forward direction and high in the reverse direction.

The vital difference is that, as the reverse voltage supplied to a zener diode is increased, the resistance suddenly and, by design, falls to a very low figure, allowing reverse current to flow. Characteristics of a zener diode include the voltage rating at which the "avalanche" effect takes place and the amount of reverse current which the diode can carry without damage.

In Fig. 1 is shown the characteristic curve for a typical 1-watt zener diode. From this we can see that, in this case, up to a voltage of 30 volts in the reverse direction, the diode draws little or no current. Beyond this critical voltage however, the diode begins to draw substantial amounts of current for a small increase of voltage.

The circuit diagram underneath the text shows the characteristic curve for a typical zener diode as a voltage regulator. Note that the supply voltage is gradually increased from zero; initially, the zener diode will have no significant effect on the circuit, the gradually increasing voltage being applied to the load (whatever it is) through the series resistor R.

However, as the voltage at point A reaches the zener or avalanche point of the diode, the latter will commence to draw current, and the current will increase rapidly without further increase in the supply voltage V. As a result of this action, the diode tends to limit the voltage at point A to its zener rating.

Proper design of the regulator system requires that the voltage at point A remains at the zener voltage, for any anticipated variation in load current. A small change in the values by which such the current through the diode can then exceed its maximum rating.

Coming back to the circuit shown on
The circuit above is designed for use in vehicles having the negative post of their battery connected to chassis. This will include the majority of Australian made and imported American vehicles.

If a ballast resistor in this circuit is adjusted so that the E.M.F. from the coil does not run much higher than 70 volts (and this is something that can really only be done on a good quality CRO) then the diode will typically be asked to dissipate less than one watt under the worst possible conditions, which would be with the motor running at 5,000 r.p.m.

If, however, the ballast resistor is set so that excessive current is drawn through the coil primary, the back E.M.F. could run to 80 or even as high as 100 volts. Under these conditions, the ballast resistor would be asked to dissipate well in excess of one watt, at which rate it would soon overheat and destroy itself.

In a commercial unit using this circuit, the ballast resistor would logically be set by the manufacturer to keep the zener diode within its safe dissipation rating, but with a home constructor who would not, in all probability, have the equipment needed to properly set the ballast value, we felt that the circuit was decidedly risky.

It would, of course, be possible to use a higher wattage zener diode across the TO-IGNITION SWITCH +12 V and ballast, but this would add to the cost of the unit.

Vehicles having the positive side of their battery connected to chassis will need an ignition system wired to the circuit below. Note that both sides of the distributor points are above ground. How to arrange this is explained elsewhere in the article.

Fig. 1

Fig. 2

\[ \text{Quality Assembled Test Equipment at a KIT PRICE!} \]

CRT REJUVENATOR TESTER £34/15/0
- Checks and corrects all 20 picture tubes, including Hi, mid and low voltages.
- Quality checked in accordance with B.S. 463.
- Repair for 100p a tube.

Fig. 3

TUBE TESTER £17/15/0
- Checks new cathode ray tubes, micro-amp tube testers, spot checkers, diodes, etc.

Fig. 4

SINE SQUARE WAVE AUDIO GENERATOR £28/10/0
- Factory calibrated and tested.
- Frequency range: Sine 50Hz to 200kHz in four bands; Square 20Hz to 25kHz.
- Frequency response +1 or -1db 50Hz to 150kHz.
- Etched circular dial (vibrator tuned).
- All equipment for 220-240V AC 50Hz.
- Price includes Sales Tax.
- Packaged for immediate delivery anywhere.

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■ RECORD PLAYERS—Portable
AC operated. Attractive Metal Cabinet—1 r.p.m. With variable control on each. ON-OFF switch combined with pickup rest.
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IMPORTED RECORDING TAPEx
Plastic base. Extra good quality.
3in, 2000ft—6/11.
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C/w Cable, plug and built-in stand.
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IMPEDANCE
Push-button operation. Works either from accumulator or from A.C. mains through transformer. Iron and Transformer.
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TRANSISTORISED MICROPHONE MIXER
Enables 4 microphones to be used from one Input.
Separate volume controls for each channel. Attractive metal box, 6in x 2Jin x 2in. Connections by standard phone plug. 9-volt battery supplied.
£5/7/6 Inc. postage.

NEW 2 WATT TRANSISTOR AUDIO AMPLIFIERS
Completely encapsulated in Epoxy Resin.
Works from voltages of 4i to 12.
£8/7/6 Post Free.

NEW SWISS PRECISION
Oiler LUBRISTYL
The pocket oiler that’s always clean. Leakproof, draws back excess oil. Not just an oilcan, but a precision-made, controlled flow oil applicator. Similar in appearance to a fountain pen. Supplied complete with instructions and 2 capsules of oil. 18/11 Inc. post.

NEW DUAL 1009
TRANSCRIPTION RECORD PLAYER
Auto/Professional turntable with dynamically balanced tonearm, for single play and changer operation. Tonearm has built-in pressure gauge and will track at 1 gram. Any cartridge may be fitted or the unit can be purchased with the famous dual crystal or magnetic cartridge as required.
Dual 1009, less Cartridge .. £47/15/-. Dual 1009 w/crystal Cartridge Sapphire Stylus £53/12/-. Dual 1009 w/magnetic Cartridge Diamond Stylus £59/15/-.
transistor and to remove all element of risk, but high-wattage zener diodes are, as yet, quite expensive and we therefore set about a way of safely protecting the transistor whilst still using a 1-watt unit safely within its ratings.

Basically, this circuit is the same as that shown in last month's issue with the exception that the zener diode (or in this case a pair of 30-volt zener diodes connected in series) is now placed across the collector/base junction instead of across the collector/emitter circuit as formerly.

In this circuit the diodes are connected so that, at their zener voltage, they will apply a negative voltage spike to the base of the transistor and by forward biasing, will cause it to turn back on again for a brief interval, thus dissipating the excess voltage safely in the transistor.

Under the worst possible conditions—with the ballast set so that the primary back E.M.F. is around 100 volts and the motor running at 5,000 r.p.m.—it is virtually impossible to exceed the rating of the zener diodes with this circuit.

Another alteration from last month's circuit, and this is a feature we felt most desirable, is the inclusion of a wing-nut terminal system to enable the car's ignition to be simply and easily changed from the transistor to the conventional method.

Although transistor ignition has proved, in practice, to be reliable we felt that some sort of "back-up" system was necessary. Readers who do not feel inclined to entail the extra expense and trouble of including the terminal board should, at the very least, retain the conventional ignition coil, either mounted on the motor or kept in the toolbox.

It should be noted that, if the transistor or any other portion of the circuitry in a transistor ignition system should fail by some unlucky chance, it is not very practical to bypass the transistor and connect the special coil directly to the ignition points in the manner of the conventional system. For one thing the coil would soon overheat and for another the points would soon be destroyed by excess current. The resistance of the transistor coil is only 0.3 ohm so that, by Ohm's Law, the current drawn from a 12-volt battery would be 40 amps!

Even assuming that a certain amount of roadside re-wiring were done, to include the special coil and ballast resistor in the primary circuit, current through the points and voltage drop across them would still add up to a highly dubious situation.

For our positive ground system we have chosen to use a PNP transistor in virtually the same circuit as the negative ground system and to insulate the normally grounded distributor point. The circuit of this system is shown as Fig. 3. We did not use an NPN transistor for the reasons given in last months' article, expense being the main one, however.

Although, at first glance, the positive ground circuit may appear to be somewhat different from the negative ground circuit, and this is a feature we felt most desirable, is the inclusion of a wing-nut terminal system to enable the car's ignition to be simple and easily changed from the transistor to the conventional method.
WHY has the TELEFUNKEN 504 Stereo record changer become the favourite of hundreds of thousands of music lovers in Europe and America?

BECAUSE it has brought high-quality entertainment within the reach of everybody. The TELEFUNKEN 504 STEREO RECORD CHANGER combines fine sound reproduction, easy operation and graceful appearance at an extremely low price!

SPECIFICATIONS:

- Speeds: 78, 45, 33-1/3, 16-2/3 r.p.m.
- Operation: manual or stereo, runs as a single changer or manually parallel.
- Records: 7", 10", 12" can be mixed.
- Response: 30-15,000 c/s.

PRICES:

- Standard TW504 £23.12.6
- Deluxe Model.

Added Features:

1. Freely suspended motor.
2. Belt Drive.
3. Reinforced turntable with heavy rubber surface.
4. Removable changer spindle and auxiliary player spindle.

£29.6.6
2 sapphire styli
Diamond Stylus £3.15.11 extra.

If you strive for superb music recordings and if you attach great importance to outstanding reproduction features, then the Magnetophon 85 hits the mark of your desire. The D.C. heating of the input valves, the double screen around the motor, a Philberth transformer with extremely low stray and the built-in push-pull oscillator give full security for an everlasting signal-to-noise ratio of more than 50db. Brilliant 3-D-effective sound radiation is achieved via outputs push-pull output stage and 2 built-in Albatros PM loud-speakers. The internal tape for always-spanned-towards progressive tape experiments will find further valuable features, such as the bi-line switch button for any kind of editing recording, or the bi-line switch which allows you to mix two different sound sources.

- Tape speeds: 3 ips (9.5 cm/sec) with 30 to 15,000 cps frequency response and 300 to 20,000 cps frequency response (+3 db).
- Equalization following NARTB standard, for playback turntable to CCIR standard.
- Electric remote control of Start/Stop.
- Separate controls for modulation and playback volume.
- Extra sensitive automatic brake mechanism for protection of heads and tape in case of sudden stop.
- Connections for microphone, radio/phone set, earphone, extension speaker, mixer, time switch, sound mixer, 2 built-in trick button for any kind of double recording, or the built-in mixer which allows you to mix two different sound sources.

THE ULTIMATE IN QUALITY

TELEFUNKEN KL85
the circuits are actually identi-
ically 30-35 minutes.

While all this might seemingly add up
to a certain amount of tedious work, it
is important to realize that this properly
modified set of points should last for a
very long time—perhaps for as long as
the average person retains a particular

If either of the points should acciden-
tally short to ground, this fuse would
protect the wiring and no damage would
be caused either to the distributor or any
other portion of the circuit.

The actual job of insulating the point
was accomplished in the following man-
ner. The riveted-over side of the con-
tact point which normally faces the dis-
tributor cam was filed away until the
tact point which normally faces the dis-

The illustration above shows a set of
points which we have modified for
use in an electronic ignition system. Produc-
tion modified points may soon be avail-
able from several manufacturers.

We do NOT recommend simply drill-
ing a hole through the distributor to fit
Insulated points, as this could result in a
short-circuit. The passage of both

In this circuit the points remain stan-
dard and an inexpensive low power NPN
transistor is used to switch the base cir-
cuit of the power transistor.

Also, for some small alteration in
rester voltage and the addition of three
eextra components (the 2N699 transistor
and two resistors) this circuit is basically
the same as the insulated points posi-
tive ground configuration. The cost of the

Radio, Television & Hobbies, March, 1964

The prin-
Model 576. Unsurpassed quality for TV, broadcasting and recording studios. Slim, trim — striking design makes other studio probes seem ugly by comparison.
Non-reflecting grey-finish steel case, complete with slip-on swivel stand adapter.
Frequency Response: 40—20,000 cps
Impedance: Dual—50 and 150 ohms (matches all low impedance inputs 50 to 250 ohms)
Diaphragm: Shure Duracoustic

Model 570. Specially "shaped" response does away with the "booniness" usually encountered in lavalier mikes. Also far less susceptible to pickup of clothing noise. Moderately priced for a unit of this quality.
Frequency Response: 50 to 12,000 cps, shaped for optimum lavalier performance, with rising response to 6,000 cps.
Impedance: Low
Diaphragm: Shure Duracoustic

Model 578: Smaller, slimmer — with superior response to omnidirectional probes near its price. Only 1" diameter, 7½" long. Rugged unit, designed for use and abuse.
With Satin Chrome finished steel case, complete with On-Off switch and slip-on swivel stand adapter.
Frequency Response: 50—17,000 cps
Impedance: Dual—200 ohms and high
Diaphragm: Shure Duracoustic
extra components should be under £3. From a constructional point of view it would probably be more convenient to see this circuit rather than go to the trouble of insulating points, etc. However, one point should be noted. In the circuits of figures 2 and 3 the current drawn through the points is approximately 0.5 milliamps average. Our own experience, and the test results of other researchers, has shown that it is necessary to draw at least 400 to 500 milliamps through the contact points in an average vehicle in order to maintain a self-cleaning action of the points.

In the circuit of Fig. 4 the current drawn through the points will be only 4.5 milliamps, due to the current amplification achieved by the use of the npn transistor. Under these conditions the points will not be self-cleaning and gummy deposits may form on them, thus reducing the current drawn through the points. This condition will, in turn, not produce proper bottoming of the 2N174. This condition can be overcome by using a zener diode, one end of the 2N174 reverse biased resistor and one end of the 5-ohm resistor which is connected between the base of the transistor and the points. The transistor is mounted with the little plastic 'lip' which protrudes from the body facing toward the centre of the heat sink. When thus mounted, the emitter connection is toward the top left-hand corner in our illustration and the base connection toward the bottom left-hand corner. The collector connection is made via a solder lug which goes underneath the nut securing the transistor to the heat sink. The 12F15 power diode is mounted at the right-hand end of the heat sink. The "body" connection of this diode is in cathode and should be connected to the emitter of the transistor in both systems. It may be noticed that in our negative ground system, the main body of this diode is above the heat sink while in the positive system it is below the heat sink. Electrically, one method of mounting is as good as the other, but placing the diode on the underside of the heat sink will reduce the possibility of mechanical damage and is therefore preferred.

The terminal board, with its six 3/16in brass bolts and wingnuts, is mounted above the heat sink with two 3/16in by 1/2in long brass bolts. It should clear the top of the heat sink by approximately 3/8in. In the wiring of the negative ground system, the 470-ohm resistor has its leads cut short (approx. 3/8in) and is soldered directly between the collector and emitter of the transistor. The 30-ohm resistor is mounted between the base pin of the transistor and pin 8 of the tagstrip. A short length of wire is also run from pin 8 through the heat sink to the anode of the 12F15 diode, which is above chassis. The 5-ohm series base resistor is mounted between the base pin and an A drawing of the terminal board to be mounted above the heat sink is also included.

The tool is a standard type used in many parts plentiful and measures 6-3/8 by 4 by 2 inches. Both the transistor and the polarity protection diode should be insulated from the heat sink with the mica washers supplied. It is a good idea to allow a little silicone grease to either side of these washers to aid in heat conductors away from the semiconductors. Holes drilled for the transistor to the heat sink will reduce the possibility of such effects by reducing the risk of such effects by reducing the value of the resistors in the base circuit of the 2N899, to increase the point current. However, as yet we have not been able to check this.

With our other two circuits the vehicle ignition should operate for extended periods (50,000 miles is quite common) without maintenance. In the construction of our ignition systems, we used the same type of heat sink and protective case for both the positive and the negative ground versions. The heat sink measures 6 by 4 inches and a drawing of it, with the holes which need to be drilled, is included in the article. A drawing of the terminal board to be mounted above the heat sink is also included.

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A short length of wire connected from the emitter of the transistor to the cathode (body) of the 12F15 diode and another short wire run from the collector of the transistor to the terminal board above chassis completes the underneath wiring of the unit.

In our circuit diagram, it will be noticed that four of the leads are given colour codes. These four leads should be made about 3 to 4 feet long and should be of wire normally used for auto ignition wiring. Radio "hook-up" wire would not be satisfactory. Apart from being physically frail, it would not carry the current (approx. 10 amps) without appreciable voltage drop.

These four leads can be twisted together as a cable form and should be terminated at one end with a spade lug. Their other ends are soldered, as shown in the circuit diagram, to the lug. The lug is attached to the change-over terminal board in the same manner as for the negative ground unit.

Installation of the ignition system, whether positive or negative ground, should be commenced by bolting the transistor unit to the engine bulkhead, preferably inside the car. This unit can be placed on the engine side of the bulkhead in a position well away from heat, but a position inside the car is best, since this will ensure that it runs cooler, but will keep it away from moisture and grime, etc.

When the transistor unit has been mounted, the four leads should be run through the bulkhead and down to the vicinity of the existing ignition coil. The special transistor coil should be installed in place of or close to the conventional coil. The ballast resistor can be bolted to the engine side of the bulkhead or perhaps to the side wall of the engine compartment. This unit can be mounted vertically so that air can, by convection, flow through its centre tube.

The actual wiring of the system can now be commenced by removing the HT lead from the centre of the existing coil and placing it in the centre of the transistor coil. The blue wire from the transistor coil. The blue wire from the ballast resistor can be bolted to the engine side of the bulkhead or perhaps to the side wall of the engine compartment. This unit can be mounted vertically so that air can, by convection, flow through its centre tube.
The Japan Electronics Research Institute has recently put on sale what it claims to be the "easiest assembly kit" for a transistorised tape recorder. The manufacturer claims anybody can assemble the four-transistor tape recorder in half an hour without any soldering. It is priced at £15.
of this coil being left connected to the switch and the terminal of the coil which formerly went to the ignition low lead will connect to the terminal which was formerly connected to the ballast resistor.

For positive ground systems this lead would be connected to the transistor coil — negative terminal if a negative ground vehicle and positive terminal if a positive ground vehicle. The coil should, in both cases, be connected to the negative of the battery, as shown in the circuit diagrams.

The black or red wire (depending on which system is being used) should be connected to one end of the ballast resistor. The other end of the ballast resistor should be connected to the lead from the ignition switch which was connected to one terminal of the conventional ignition coil. This completes the wiring of the system.

Connecting links made from 18 gauge tinned copper wire covered with insulating sheathing should now be placed between terminals 3 to 6 and 1 to 2. If there would be no confusion, it should be emphasized that in changing over to transistor ignition, certain precautions should be taken.

For example, the transistor coil could be marked with red paint and a red line drawn between terminals 3 to 6 and 1 to 2. The straight lead could be marked with green paint and green lines drawn between terminals 2 to 6 and 1 to 2.

In order to simplify changing over to transistor ignition at some future date, when these connections could easily have been labeled, we suggest that the transistor coil and the standard coil be marked with a dash of different colored paint and that colored lines be drawn between the appropriate terminals for changeover.

The only job which remains to be done is the installation of the Ignition Transformer. If the vehicle has no ammeter, one could be marked with red paint and a red line drawn between terminals 3 to 6 and 1 to 2. The straight lead could be marked with green paint and green lines drawn between terminals 2 to 6 and 1 to 2.

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The system now is ready to operate but, before switching on and styling it, it is a good idea to check over the HT wiring and spark plugs. Transistor ignition will provide higher voltages which will seek out any weakness in the wiring. Any weak or shorted leads should be replaced and the whole of the HT wiring should be cleaned. For best results, the glow plugs should be removed and the porcelain of the plugs should be cleaned. For best results, the glow plugs should be removed and the porcelain of the plugs should be cleaned.

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Radio, Television & Hobbies, March, 1964
A NEW
Playmaster
TUNER-
AMPLIFIER

Following the success of our Playmaster 106, described in the December issue, we present an alternative and somewhat simpler version, with single-ended output stages. Of special interest is the fact that this new version has inbuilt provision for high-performance electrostatic loudspeakers, recently released on the Australian market.

By John Davidson

As we explained in the December issue, the physical presentation of high-fidelity amplifier equipment is influenced both by technical requirements and by "fashions" in design. These influences have variously dictated separate interconnected units, certain combinations of units, odd units which were intended to be hidden in the vastness of a cabinet or displayed for all to see on a bookshelf.

Of late, single-unit equipment has been much in favour, combining amplifier, control facilities and radio tuner in one decorative case. While this can pose problems which become progressively greater as the complexity of the unit is multiplied, there is no special difficulty in combining, in one case, the functions of a broadcast radio tuner, and a stereo amplifier designed to operate from a crystal or ceramic pickup.

Our Playmaster 106, described in the December issue, represented just such a combination, the amplifier having full tone control facilities and being capable of delivering an output of 7.5 watts R.M.S. per channel.

However, there are invariably those who doubt that a double push-pull amplifier is really necessary in an ordinary lounge room and an ordinary family circle. To support the contention that it is not, they point to the fact that all but the most pretentious commercial radiograms have modest speakers and ordinary single-ended output stages behind their imposing cabinet work.

This is undoubtedly true and we doubt that many would want to use this new Playmaster at anything like full nominal output in an ordinary listening room.

The reserve of power output which would be available from a larger amplifier — like most "reserves" — is nice to have, if you can afford it and ever need it!

But, take your pick. If you plan to build the 106 Playmaster, you'll be very happy with it.

By any reason, you have ideas about a single-ended version, the new 107 Playmaster offers exactly the same facilities and the same kind of performance up to its more modest power ceiling.

Radio, Television & Hobbies, March, 1964
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D.C. Amps:— 50uA, 2.5mA, 25mA, 250mA.
Ohms:— 0.5 ohm to 30 meg ohm in 4 ranges.
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A.C. Volts:— 2.5, 10, 50, 250, 1KV.
D.C. Amps:— 50uA, 500uA, 5mA, 25mA, 250mA.
Ohms:— 1 ohm to 50 meg ohm in 4 ranges.
Size:— 3½" x 3½" x 1½"
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MODEL SP-6

Ranges:— D.C. & A.C. 2K O.P.V.
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A.C.:— 10, 50, 250, 500, 1000.
D.C. Amps:— 500uA, 25mA, 250mA.
Ohms:— 0.1 ohm to 1 meg ohm in 3 ranges.
Size:— 5½" x 3½" x 1½"
Price:— £5/10/- plus 12½% Sales Tax.

MODEL 320-X

Ranges:— D.C. 50K O.P.V., A.C. 5K O.P.V.
D.C.:— 5, 25, 100, 500, 1KV & 5KV ± 25K O.P.V.
A.C.:— 5, 25, 100, 250, 500, 1000.
D.C. Amps:— 25uA, 2.5mA, 25mA, 250mA.
Ohms:— 1 ohm to 100 meg ohm.
Size:— 6½" x 5" x 3½"
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Radio, Television & Hobbies, March, 1964
The use of small wiring components and carefully planned component panels gives the underside of the chassis an orderly appearance. Wiring diagrams below and overleaf should assist intending constructors. Note that the tuner layout and wiring is identical with the Playmaster 106 unit and reference can be made, if necessary, to the tuner wiring photograph on page 35 of the December issue.

The power rating in each case is 5-watts and therefore adequate for the present purpose.

Negative feedback is taken from the full 15-ohm winding via a selected value resistor to an unbypassed 150-ohm resistor in the cathode circuit of the triode voltage amplifier. This provides voltage feedback of about 14db.

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To minimise the risk of instability at high frequencies, particularly with electrostatic tweeters in circuit we gave special consideration to feedback and phase shift components.

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The components have been selected for best compromise between overall frequency response, square wave response and stability under a variety of load conditions.

The power supply is very similar to that suggested for the 106 Playmaster, even to the use of the same 150-milliamp power transformer. A transformer cap.
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Radio, Television & Hobbies, March, 1964
able of delivering the same voltage, for
a D.C. drain of 100 milliamps could be
actually substituted, if you find it con-
vvenient to do so.

Since the 107 unit can conveniently
be built on exactly the same metalwork
as the earlier 106, we made things easier
for ourselves, on this occasion, by ob-
taining a basic 106 chassis and dial
kit from one of our advertisers. How-
ever, if you want to tackle your own
metalwork, a chassis blueprint is avail-
able from our office for $/.

The panel is attached to the chassis
with four countersunk head bolts. One of
these should be long enough to hold two
nuts, a 3/8-inch long bush carrying a
dial pulley, a washer and a nut. The
detailed photograph of the dial mechan-
ism shows the part played by this par-
ticular bolt.

It would be wise, at this early stage,
to mount the 4-pole 4-position switch,
while the dial drive spindle can also
be mounted, using two countersunk bolts
and nuts.

As a next step, the dial glass can be
fitted. Measuring approximately 4 x 10
inches, it is intended to fit hard agend
the inside face of the front panel, resting
in a natural recess provided by the shape
of the chassis mounting brackets. If any
packing or file work has to be done,

Wiring the input and control circuitry calls for some care and it is suggested
that construction work to this diagram. Note particularly that earth returns
are initially insulated from the chassis, the only earth return being made
through the leads of the isolated and shielded cables running back to the
pickup input sockets.

this is obviously the time to do it.

The dial glass is held forward against
the front panel by two clips bent from
springs and mounted under the two
top chassis-to-panel mounting nuts.

Next step is to cut the shafts of the
controls to the appropriate length and
mount them in position for preparation
for wiring. Make sure that the mains
switch tags at the rear of the volume
control are clear of the chassis.

Actually, the combination volume con-
trol and switch can be treated as an
optional item. Some may prefer to keep
the mains wiring away from signal cir-

cuits; others like the convenience which
the combined control affords.

To mount the two-gang capacitor, the

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BEXLEY, N.S.W.

LW4911 LW5385

Radio, Television & Hobbies, March, 1964
normal brackets are used but it needs to be raised above the chassis with four 3/8in spacers and Jin bolts. The dial drum is 3-7/8in diameter. It should be in position on the shaft when the gang is mounted, being dinked and adjusted so that it rotates just clear of the chassis end-bracket and cutout.

Before mounting the gang, incidental-

attach leads to the two sets of fixed

plates.

The dial glass backing plate, which
doubles as a guide for the pointer slide,
can be attached at this stage. Looking
from the rear, the left hand mounting
bolt is Jin long while the one to the
right is Jin long, both having countersunk
heads.

Two 3/8in spacers separate the back
plate from the panel, providing room
for the pointer between the two. Two
sets of bushes and pulleys are required
on the left-hand bolt, while only one is
needed at the right-hand side.

Reference to the dial mechanism photo-
graph will reveal a fifth pulley at-
tached to the side flange of the chassis.
If drum and pulleys are correctly aligned,
you will find that a Jin bush used in
this position will allow the cord to
move along the outer edge of the drum,
preventing the cords from rubbing.

With the dial pieces in position, the
mechanisms can be "strung" using, for
preference, proper woven nylon dial cord.

Two dial lamp holders attach to two
small brackets at the rear of the front
panel below the dial glass.

Next step is to mount the remaining
rubber grommets and valve sockets, mak-
ing sure that the latter are orientated
in the direction detailed by the arrows
in the under-chassis photograph.

The orientation of the coil cans in the
tuner is equally important and these
should also be mounted in accordance
with the marking on the under chassis
photograph.

Before mounting the output trans-
formers, it is essential to fit the two
countersunk head bolts used to support
the two audio terminal boards. These
should be at least Jin long preferably
5/8in. Each is fitted with a Jin spacer
on the underside, then secured with a
nut. This will leave sufficient unused
thread to accommodate the terminal
board and a second nut to hold the
board in place.

Wiring can begin with the power sup-
ply and heater circuits. Referring to the
underchassis photograph, an earth point
is provided at the right of the transfor-
mer anchoring the electrostatic shield.

The full circuit diagram of the Play-
master 107, with built-in radio tuner
and designed for use with a stereo
output is out-standing and the output ample for a
normal living-room.

Radio, Television & Hobbies, March, 1964
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This photograph shows clearly the dial winding arrangement. It was "taken during construction of the prototype", and before the original pointer bar was replaced by the final version.

Radio, Television & Hobbies, March, 1964

### Parts List & Specifications

#### Capacitors

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.047 mfd 125VW paper or plastic</td>
</tr>
<tr>
<td>2</td>
<td>0.01 mfd 400VW paper or plastic</td>
</tr>
<tr>
<td>3</td>
<td>.0047 mfd 125VW paper or plastic</td>
</tr>
<tr>
<td>4</td>
<td>25 mfd 10VW electrolytic</td>
</tr>
<tr>
<td>5</td>
<td>0.1 mfd 400VW paper or plastic</td>
</tr>
<tr>
<td>6</td>
<td>2.200-ohm</td>
</tr>
<tr>
<td>7</td>
<td>6,800-ohm 1-watt</td>
</tr>
<tr>
<td>8</td>
<td>2,200-ohm</td>
</tr>
<tr>
<td>9</td>
<td>2,700-ohm</td>
</tr>
<tr>
<td>10</td>
<td>1 meg.</td>
</tr>
<tr>
<td>11</td>
<td>6,800-ohm 1-watt</td>
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</table>

#### Resistors

<table>
<thead>
<tr>
<th>Part</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>470-ohm 1-watt</td>
</tr>
<tr>
<td>2</td>
<td>2,000-ohm 3-watt</td>
</tr>
<tr>
<td>3</td>
<td>6,800-ohm 1-watt</td>
</tr>
<tr>
<td>4</td>
<td>2,200-ohm</td>
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<tr>
<td>5</td>
<td>2,700-ohm</td>
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<tr>
<td>6</td>
<td>47 K.</td>
</tr>
<tr>
<td>7</td>
<td>470K.</td>
</tr>
<tr>
<td>8</td>
<td>2.2 meg.</td>
</tr>
</tbody>
</table>

#### Inductors

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bias coil (one to be insulated)</td>
</tr>
</tbody>
</table>

#### Transformers

- Primary winding, 7,000 ohms, secondary 15-ohm, switch.
- DC resistance 125 ohms.
- Power transformer, voltage doubler type, secondary 104 volts AC, 130mA DC, 6.3 volts, CT.3A.
- Filter choke, 150mA, 2 Henries.
- DC resistance 125 ohms.
- Power transformer, secondary 104 volts, AC, 130mA DC, 6.3 volts, CT.3A.
- Filter choke, 150mA, 2 Henries.

#### Diodes

- 5-pin valve socket.
- 150 pF (not high K).
- 560 pF (not high K).
- 2.2 meg.
- 100 pF (not high K).
- 150 pF (not high K).

#### Diode Voltages

- Prior to choke (full HT) 275V.
- 2nd filter cap. (HT.2) 240V.
- 1st filter cap. (HT.1) 265V.
- Full HT and green to the plate, correct polarity of the diodes both arrows point towards positive voltage.
- Along the 5-pin strip we have made the following connections: Choke of circuit and 47K-ohm resistor, HT.1, earth, HT.2, HT.1.

#### Frequency Range

- Within plus and minus 1.5db from 18Kp to 15Kc.
- Normal tolerance, non-selected components, using a VVTVM. Power output: 3 RMS watts per channel.
- Sensitivity: 240V (12AU7), 60V (12AX7).
- Frequency response: Within plus and minus 1.5db from 18Kp to 15Kc, continuously variable. Range of controls: Bass +10db to -10db at 50Hz. Treble +10db to -10db at 15Kc.
- Mains Voltages

#### Potentiometers

- 3 Dial gang, 2500 ohms per section (one with switch optional).
- 1-meg linear.

#### DIAL PARTS

- 1 Dial glass 25" diam., with lon mounting.
- 1 Dia glass to suit drum (6in span). 10" x 1/2" overall.
- 1 Dia glass spindle, 48 Nylon cord, spring, pointer.
- 5 Pushes, 6 x 1/16 long bush, 1 Dia long bush.

#### Supplies

- Two lengths light duty 3-core power flex.
- 2,200-ohm.
- 2 2,700-ohm.
- 2 47 K.
- 2 470K.
- 2 82K.

#### Bass and Treble Controls

- +/-10db at 50Hz.
- +10db to -10db at 15Kc.

#### BATTERY CHOICES

- 60W pentode cathodes 7.1V.
- 60W tetrode cathodes 1.2V.
- 12AU7 cathodes 3.5V.
- 684A cathode 0.8V.
- 6AE8 cathode 2.0V.

#### Screw Connections

- 100-ohm 1-watt.
- 120-ohm 1-watt.
- 150-ohm 1-watt.
- 180-ohm 1-watt.
- 220-ohm 1-watt.
Every Switch-user wants

ABSOLUTE RELIABILITY

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MANUFACTURERS SPECIAL PRODUCTS PTY. LTD.
47 YORK ST., SYDNEY. 2-0223.

When all the wiring is complete, a (Continued on page 184).

Radio, Television & Hobbies, March, 1964
ON a recent visit to the "Radio, TV and Hobbies" office, I was rather interested by one item of mail handed to me. It was an ordinary envelope, postmarked Mildura, Victoria, but so bulky that the sender must have had considerable difficulty sealing it. To emphasise its bulk, it carried three stamps instead of the usual one.

"Looks like one of your readers has sent you a piece of wedding cake," remarked the staff member who handed it to me. "Know anyone in Mildura?"

I shook my head. "No, but I must admit that what it looks like, I hope there's some icing on it."

But my gastric juices had started to flow prematurely, so I didn't want wedding cake, or anything like it. It was just a very bulky envelope which I opened carefully in order to get in the them.

The writer was a fellow serviceman who had been the unfortunate victim of a motor accident, finishing up in Broken Hill about 1952, where I had been employed as a country serviceman.

Strange things do happen in one's career as a radio serviceman and one incident as a country serviceman.

In the early fifties, I worked for a local telephone exchange which served a network of small country towns throughout the outback. The office was fairly small. First we had a 100-watt speaker - the "king-size" inter-office P.M.G. speaker - and beside the window was a shelf. On the shelf was a small radio sitting on a specially made mantel shelf. An aerial lead-in from the set ran up a giant chimney, emerging eight storeys out along a wall before disappearing in a huge box before entering a giant chimney, emerging eight storeys out along a wall before disappearing in a huge box. The office was located in what was called the "hotel" on whose premises my workshop was situated.

"You're a lucky fellow," said a Greek proprietor to me one day, "to have a radio to keep you company in the hotel all of the time." I thanked him and went back to my work. The hotel owner said that he wanted to have a telephone, but he said, "No, definitely not."

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"But my gastric juices had started to flow premature
547 ELIZABETH STREET, MELBOURNE — PHONE 30-0271
BRANCHES THROUGHOUT VICTORIA AND RIVERINA

Radio, Television & Hobbies, March, 1964
The aerial was just as he said it was. Plenty of height and length and I could see no reason to fault it. Tuning across the band I heard hails of stations — but not SLO I was baffled.

A close check of the aerial revealed that there was no short at the mast, no carrying of the wire, no ground faults, nothing that could prevent signals from being received at a reasonable level. And so the antenna was dug up and put back in again. And, as usual, the station remained silent.

Well, J.B., many thanks for a couple of odd problems, and I hope you are up and about again by the time you read this, ready for some more. I can't tell you, but it was a long time before I could get 3LO on the air.

— J.B.

Radio, Television & Hobbies, March, 1964
## ELECTRONIC DEVELOPMENTS

### KITS

**AUSTRALIA'S LARGEST VARIETY IN KITS OF TOP QUALITY COMPONENTS AT LOWEST COST**

<table>
<thead>
<tr>
<th>Kitsets</th>
<th>Description</th>
</tr>
</thead>
</table>
| **CONTROL UNITS** | 1. Playmaster No. 8  
2. Playmaster No. 9  
3. Playmaster No. 10  
4. Transistor Low Noise (Monaural)  
5. Transistor Low Noise (Stereo)  
6. 4 Channel Audio Mixer |
| **CONVERTERS** | 7. S/W I (Batt or A.C.)  
8. S/W 2 (Batt or A.C.)  
9. ALL WAVE 2 (A.C.)  
10. Transistor 2 Band  
11. 50 Mc/s.  
12. 144 Mc/s  
13. 50-144 Mc/s x'tal Locked  
14. D.D.-D.C. 40 watt  
15. D.C.-D.C. 60 watt  
16. D.C.-A.C. 40 watt |
| **GUITAR AMPLIFIERS** | 17. Golden Series I2W  
18. Golden Series 20W  
19. Standard Series I2W  
21. Standard Series 35W  
22. Standard Series SW |
| **HI-FI AMPLIFIERS** | 23. HI-FI 3  
24. Mullard 3-3  
25. Mullard 5-10  
26. Mullard 5-20  
27. Transistor HI-FI (Monoaural)  
28. Transistor HI-FI (Stereo) |
| **PREAMPS** | 29. Transistor 1W  
30. Transistor 2W  
31. Transistor 5W  
32. Transistor 10W  |
| **SPEAKERS** | 33. Transistor Stereo |
| **RECEIVERS** | 34. Transistor Stereo |
| **TAPE DECKS** | 35. D’yers I (Batt or A-C)  
36. D’yers II (Batt or A-C)  
37. D’yers HI-FI (Batt or A-C) |
| **STILL OTHERS** | 38. 222 FLINDERS LANE  
MELBOURNE . . . VICTORIA |

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WE STOCK METALWORK AND PANELS FOR RADIO, TV & HOBBIES PROJECTS AND NUMEROUS OTHER TYPES.

| **ALUM. & STEEL CHASSIS** | 57. Transistor Stereo |
| **ALUM. PANELS AMPERSANTS PREAMPS SPEAKERS MICROPHONES TAPE DECKS** | 58. Transistor Stereo |
| **RECORDING TAPES VALVES TRANSISTORS PICTURE TUBES TRANSFORMERS CHOKES TV AERIALS** | 59. S/W 3-Band (AC) |
| **PRINTED CIRCUITS COILS** | 60. Little General 1961 |
| **TV COMPONENTS** | 61. Interstate 5  
62. Dust Wave 5  
63. Dual Wave 6  |
| **RESISTORS RECORD PLAYERS RECORD CHANGERS TRANSSCRIPTION UNITS METERS** | 64. 1962 S Program  
65. Fremadrome 4  |
| **TEST EQUIPMENT PICKUPS CARTRIDGES STYLIS VIBRATORS** | 66. Transistor 1  
67. Transistor 2  
68. Transistor 3  
69. Transistor 4  
70. Transistor 6  |
| **PRINTED CIRCUITS** | 71. Transistor 7  
72. Transistor 8  
73. Transistor 3/Band |
| **INSTRUMENTS cont.** | 74. Playmaster No. 3  
75. Playmaster Program source  
76. Transistor High Gain  
77. Transistor Med. Gain  
78. Mullard Wide Band  |
| **DATABASE CONTROLLER** | 79. Philips Wide Band  |
| **RECEIVERS** | 80. R.T.V & H. 3” Cro.  
82. R.T.V B.H. R/C Bridge |
88. R.T.V & H. Valve and Transistor Tester  
89. Transistor Wave Meter.  
90. Standard Audio Oscillator.  
91. 1962 Wide Range Audio Oscillator.  
92. Transistor Signal Tracker.  
93. Transistor Pattern Generator.  
94. V.T.V.M.  
95. Millivoltmeter.  
96. Distortion, Noise & Millivoltmeter |

**INSTRUMENTS cont.**

| **MICROPHONE** | 97. Light beam Relay  
98. Flasher Unit  
100. Universal Battery Charger.  
101. Intercom Unit  
102. Stereo Phone Amp.  |
| ** Painits** | 103. Stereo Phone Adaptor.  
104. Porte-Player  
106. Transports Gram. 7  
108. Decade Boxes  
109. Wide Band [Cro.] Preamplifier  |
| **MISCELLANEOUS KITS** | 110. Remote VFO |

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63-5973
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All types... all sizes... all ratings... BUT with a single common factor - TOP QUALITY AND LOW COST

CHECK THE VALUE FOR BARGAIN BUYING—(all Meters meet BSI standard)

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>Movement</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>15&quot; x 1&quot;, 50 Microampere</td>
<td>52/6</td>
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<tr>
<td>1&quot;, 100 Microampere</td>
<td>44/6</td>
<td></td>
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<td>50 Microampere</td>
<td>34/6</td>
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<tr>
<td>50-0-50 Microampere</td>
<td>42/6</td>
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<tr>
<td>0-100-0-100 Milliampere</td>
<td>39/6</td>
<td></td>
</tr>
<tr>
<td>0-1 Milliampere to 0-500 Milliampere</td>
<td>32/6</td>
<td></td>
</tr>
<tr>
<td>&quot;V.U. Meter</td>
<td>52/6</td>
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**ELECTRONIC TACHOMETER**

**KIT**

6 OR 12 VOLT SYSTEM

4, 6 OR 8 CYLINDER ENGINE... only £9-12-6

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63-5973 MELBOURNE... VICTORIA 63-5973

Radio, Television & Hobbies, March, 1964
A Simple Signal Tracer

By Keith Woodward

While this instrument is capable of serious service work, it retains simplicity in design, so that the connection can be tackled with confidence by even a beginner. A time saver for the serviceman it also is an excellent building project for the young hobbyist.

The signal tracer is built in the case specified. A breadboard type of construction could be used and the audio amplifier section tried with various inputs, e.g. pickups, microphones, crystal set tuners, etc. While there is no reason why a signal tracer could not be constructed with valves and an AC power supply, it was thought that a transistorised unit would lend itself to field servicing. Also it would give a good account of itself in the workshop with the added advantage of reduced power loads. As featured, the signal tracer fits into a neat little corner of a tool box, or use a simply case but, with a little ingenuity, it would be possible to fit the unit into one corner of a tool box or use a simply constructed carry case or tool bag.

A signal tracer is designed for the purpose of pinpointing faults that otherwise may be impossible to locate. It can be used and simple amplifier-detectors for signal tracers, such arrangements are seldom given faithful performance in actual practice. These "play-toys" are usually found to be only moderately successful for locating faults in audio circuits. A serious signal tracer consists of a high gain amplifier preceded by an efficient detector probe. Considering what a signal tracer of reasonable quality must achieve, we must have a high order of gain, yet recovery, well above that obtainable by any other type tried. The RF choke installed in the probe gave high audio recovery and allowed the voltage doubler diode detector, illustrated in figure 3. While the loading effect of the diodes is still evident we achieved a much greater output with the voltage doubler diode detector, illustrated in figure 3. While the loading effect of the diodes is still evident we achieved a much greater output with the voltage doubler diode detector, illustrated in figure 3. While the loading effect of the diodes is still evident we achieved a much greater output.

Another probe quite commonly used was a half wave detector utilising a small thermionic diode. This eventually led to the use of a semi-conductor diode of more modest proportions, as in the circuit shown in figure 2. However the half wave detector leaves quite a lot to be desired. It severely loads the circuit, and the audio recovery is very bulky probe. Although the input circuit was untuned the efficiency was very good.

Further, and most important, it must exhibit this effective high gain and sensitivity. The completed unit is shown on the top of the page. Note how the cable entrance is in the middle of the probe barrel. The plastic peel insulators are of different colours to aid identification. To the left of the illustration is a view showing the placement of components. Care should be paid to position. The input cable wound around a transformer to give clearance to the speaker body.
Radio, Television & Hobbies, March, 1964

Also remind the reader that care should be taken to avoid excessive heating of the transistor when soldering it to the circuit. This may be prevented by using a heat sink, such as the pliers used to hold the lead to the point of soldering. Another source of failure when working with transistors is a 240 volt soldering iron which is imperfectly earthed and allows AC leakage voltages to be applied to the transistor circuit.

The circuit used for the last two transistors is will be protected against thermal runaway by DC feedback stabilisation. At the same time the circuit uses a

The cable from the probe to the audio amplifier should be a shielded type, with the shielding connected to the main chassis of the probe case. Ordinary shielded wire with spagetti covering could be used but micro-phonc cable or small diameter coaxial cable would be better. Either type would be suitable, being flexible enough to allow the probe to be moving in and out of circuits. The cable would be at least 2 feet long.

Audio amplifier

As already mentioned, the probe in use is based directly on a tuning system, but has been modified to suit the particular requirements of our test. The basic system is a 2-Ret 1 setting with the input being taken to the probe and the audio amplifier.

The 110 volt mains filter is a 2N280. The output transformer probe wires may be soldered to lugs fitted to the transistor circuit. As there will, at times, be very strong signals fed to the first stage, the volume switch should be set to "low" when testing.

The transistor circuit. As there will, at times, be very strong signals fed to the first stage, the volume switch should be set to "low" when testing.

The signal tracer is straightforward and inherently stable. Any of the transistors named, or equivalents, will produce satisfactory results. Only a single shielded wire is required between the probe and the amplifier.
your choice of quality from the range of...

SPECIFICATIONS

DUAL CONE TYPES

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>6A7</th>
<th>8A7</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-16,000 c/s</td>
<td>50-16,000 c/s</td>
<td></td>
</tr>
<tr>
<td>Lowest Resonance</td>
<td>90 ± 15 c/s</td>
<td>85 ± 15 c/s</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>94 dB</td>
<td>98 dB</td>
</tr>
<tr>
<td>Max. Power Input</td>
<td>50 W</td>
<td>80 W</td>
</tr>
<tr>
<td>Voice Coil Frequency</td>
<td>8, 16 Ohm</td>
<td>8, 16 Ohm</td>
</tr>
<tr>
<td>Overall Diameter</td>
<td>6&quot;</td>
<td>7.5&quot;</td>
</tr>
<tr>
<td>Baffle Opening Diameter</td>
<td>5.5&quot;</td>
<td>7&quot;</td>
</tr>
<tr>
<td>Depth</td>
<td>3.5&quot;</td>
<td>4.5&quot;</td>
</tr>
<tr>
<td>Net Weight</td>
<td>1 lb.</td>
<td>2 lb.</td>
</tr>
</tbody>
</table>

PRICE: £3.7.6 ea. (6A7) Postage extra 5/- each (8A7) Postage extra 5/- each

PEAK HI-FI SPEAKERS

SPECIFICATIONS

TWIN-SPEAKER TYPES

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>6CX-1</th>
<th>8CX-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-16,000 c/s</td>
<td>40-16,000 c/s</td>
<td></td>
</tr>
<tr>
<td>Crossover Frequency</td>
<td>3000 c/s</td>
<td>1500 c/s</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>100 dB</td>
<td>96 dB</td>
</tr>
<tr>
<td>Max. Power Input</td>
<td>10 W</td>
<td>10 W</td>
</tr>
<tr>
<td>Voice Coil Frequency</td>
<td>8, 16 Ohm</td>
<td>8, 16 Ohm</td>
</tr>
<tr>
<td>Total Magnetic Flux</td>
<td>Tweeter: 16,000 Maxwell, Woofer: 60,000 Maxwell</td>
<td></td>
</tr>
<tr>
<td>Overall Diameter</td>
<td>6&quot;</td>
<td>7&quot;</td>
</tr>
<tr>
<td>Mounting Pitch</td>
<td>5.5&quot;</td>
<td>7&quot;</td>
</tr>
<tr>
<td>Baffle Opening Diameter</td>
<td>7&quot;</td>
<td>7&quot;</td>
</tr>
<tr>
<td>Depth</td>
<td>4 lb.</td>
<td>4 lb.</td>
</tr>
</tbody>
</table>

PRICE: £7.0.0 ea. (6CX-1) Postage extra 5/- each (8CX-1) Postage extra 5/- each

PEAK HI-FI SPEAKERS reliably made to give superior performance over their extended frequency range are now available in Australia. Reasonably priced, a test will convince you of their superior performance.

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Radio, Television & Hobbies, March, 1964
The earthing lug falls underneath one of the securing holes.

The audio amplifier will be constructed on another piece of matrix board approximately 4 in by 3 in. The layout may be clearly seen in the illustrations and if these are followed carefully there will be no crossovers in the wiring. Because of this, it would be simple to design a printed wiring board, if it was so desired. There was no trace of any instability in the original model so there is no reason why the amplifier should not work satisfactorily from the moment it is wired correctly.

Because of this, it would be simple to produce a printed wiring board. Note the long leads on the switch-potentiometer. These simplify the task of battery changing.

The layout of the probe components as viewed from the front of the matrix board.

The rear view at the matrix board clearly shows the simple wiring at the unit. No crossovers are needed and it would be simple to produce a printed wiring board. Note the long leads on the switch-potentiometer. These simplify the task of battery changing.

The prototype had a current drain of 20 milliamps which should give reasonable battery life. Although standard size

Specifications

- **Max. Output Power:** 10 Watts, 5 Watts per channel
- **Frequency Response:** 50 to 15,000 cps ± 1 db
- **Harmonic Distortion:** Less than 2% at normal levels
- **Crosstalk at 1 kHz:** Better than 40 db
- **Hum and Noise:** 40 db below rated output
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  - Phono x-tal: 0.24 V, 50,000 Ohm.
  - Aux.: 0.15 V, 150,000 Ohm.
- **Output Impedance:** 4. 8 and 16 Ohm (Each Channel)
- **Select Switch:**
  - 1. Phono Stereo
  - 2. Aux. Stereo
  - 3. Phono Mono
  - 4. Aux. Mono
- **Volume Control:**
  - Channel 1 with Power Switch and Channel 2
- **Vacuum Tube:** 2-6GW8, 1-6CA4
- **Power Supply:** 240 V, 50 c/s, A.C.
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'I 2N280 or OC71. <

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100 mfd. 12VW electrolytic,

Jim Speaker.

<1 2 mfd. 12VW electrolytic.

<1 .001 mfd. 125 VW paper.

■ 2 .1 mfd. 25VW ceramic.

1 1 mfd. 400 VW paper.

CAPACITORS

TRANSISTORS

<1 small 10,000 ohm "low hop-on" type.

220 ohm.

100 ohm.

330 ohm.

270 ohm.

10,000 ohm.

1000 ohm.

82,000 ohm.

1 1000 ohm.

1 33,000 ohm.

<1 82,000 ohm.

1 1000 ohm.

1 Single pole two-position wafer switch.

1 Battery, .9 volt, Eveready 2362 or similar.

2 Battery connection.

1 Speaker transformer 375 ohms to 2 inches.

1 Single pole two-position wafer switch to "low." In fact, even with this precaution, the signal may be embarrassingly high.

To minimize this problem, and confer still another advantage, we evolved another very simple, but very effective attenuator. This is simply a length of spaghetti tubing fitted over the metal probe tip so that it covers all but the tippest portion. This enables the tip of the detector probe to be laid adjacent to the signal source without making metallic contact. This gives the effect of placing a very small capacitor in series with the capacitor already present in the probe. Two advantages are gained by this, the first being negligible loading of the circuit under test, and the second being an effective capacitive attenuator available for very high signal levels.

After passing the detector stages reversal of the probe allows checking of the audio stages. These may be checked for increasing gain and freedom from distortion. There is sufficient gain in the signal tracer to allow a check to be made at the low impedance speaker or voice coil terminals; a quick way of checking for an open circuit speaker. Needless to say, the tracer is just as versatile in the checking of transistor amplifiers. As even this probe loads the tuned circuit slightly, it may be necessary to tune the aerial, and RF stage if used, for best performance. If the tracer is used in a very well shielded location, it may be possible to use an aerial, or inject a signal into the front end of the set.

Good strength signals should be found at the gate of the converter valve, while it will probably be necessary when checking at the detector end of the IF strip to set the sensitivity switch to "low." In fact, even with this precaution, the signal may be embarrassingly high.

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Finally, if you are a radio amateur one of the bonus features of this equipment is that a small amount of coupling to the aerial tuning unit will result in a very clean output from the aerial tuning stage if used, for best performance. If the tracer is used in a very well shielded location, it may be possible to use an aerial, or inject a signal into the front end of the set.

The signal tracer in use will be found a very versatile instrument. Starting from the front end of a standard radio the detector probe should in most cases give acceptable output from the aerial tuning capacitor. As even this probe loads the tuned circuit slightly, it may be necessary to tune the aerial, and RF stage if used, for best performance. If the tracer is used in a very well shielded location, it may be possible to use an aerial, or inject a signal into the front end of the set.

Good strength signals should be found at the gate of the converter valve, while it will probably be necessary when checking at the detector end of the IF strip to set the sensitivity

PARTS LIST

1 Standard instrument case 6 x 4 x 2 inches.

1 Speaker transformer 375 ohms to 2 inches.

2 Battery connection.

1 Battery, .9 volt, Eveready 2362 or similar.

2 Battery connection.

1 Speaker transformer 375 ohms to 2 inches.

1 Single pole two-position wafer switch.

1 Speaker, 3 in.

1 Speaker transformer 375 ohms to 2 inches.

1 Standard instrument case 6 x 4 x 2 inches.

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RT-19 900 1 Mil. 7" 1 9 9
RT-12 1800 1 Mil. 7" 2 2 6
RT-13 2400 1 Mil. 7" 2 12 6

COMPONENTS 100 mfd. 12VW electrolytic, etc.

COMPONENTS

1 1000 ohm.

1 33,000 ohm.

1 82,000 ohm.

1 1000 ohm.

1 Small 10,000 ohm "low hop-on" type.

1 Speaker transformer 375 ohms to 2 inches.

1 Speaker transformer 375 ohms to 2 inches.

1 Single pole two-position wafer switch.

1 Battery, .9 volt, Eveready 2362 or similar.

1 Speaker transformer 375 ohms to 2 inches.

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1 Battery, .9 volt, Eveready 2362 or similar.

1 Speaker transformer 375 ohms to 2 inches.
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* Use Model MRCT Current Transformer available as an accessory.
AC Volts: 0-10, 50, 250, 1,000.
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Output Level: minus 6 to plus 22 dB, plus 8 to plus 36 dB, plus 22 to plus 50 dB, plus 34 to plus 62 dB (ref. IMW in 600 ohms equals 0 dB)

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Calibrated to well within BS89:1954 specifications.

RELIABILITY
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Radio, Television & Hobbies, March, 1964

Escape of energy as electromagnetic waves from charging and discharging reactance. The transmitting aerial.

The use of a high-frequency carrier. Frequency and Wavelength.

Generating the RF Carrier. The RF oscillator. Quartz crystal oscillators. The RF amplifier. Keyed CW transmitters. AM and FM transmission. The AM transmitter.

In the first seven chapters, we have begun to answer some of the practical questions of electronics. However, there are no doubt many readers who have so far been thinking along the lines—"All these components may be very interesting, but how are they used to send messages and music—or even pictures—from one point to another without wires?" We are now going to look at the components or "building blocks" of electronic circuits, and the ways in which these components may be put together to make useful electronic circuits.

With this chapter we begin to answer such questions. For we are now in a position to start examining how electronic components may be put together to transmit intelligence (whether it be messages, signals, or pictures) from one place to another—without wires. In other words, we are now going to look at the basic principles of radio transmission and reception.

The whole of radio depends upon the FACT that a certain form of energy, called "electromagnetic radiation," can travel from one place to another practically instantaneously, AND EVEN THROUGH A VACUUM or the near-vacuum of outer space. You are already familiar with at least two types of electromagnetic radiation—light and heat. You are also aware that these two forms of energy radiation can travel through the near-vacuum of space or EMF to a capacitor caused the ripples—"charge up." We saw that this was a process whereby the space between the two capacitor plates became "strung out" in a state of tension. We called this state of tension an electric field, and in a capacitor or in an inductor, in which these components may be connected together to make elementary circuits.

The reason why the energy radiated is in the form of a combined field is that a changing field of either type is accompanied by the other type. One can't have a changing electric field without a magnetic field along with it, nor can there be a changing magnetic field without an electric field.

In actual fact, however, NOT QUITE ALL the energy stored in an electric or magnetic field is returned to the circuit. Some is lost—it escapes, and flows or "radiates" away from the capacitor or inductor like the ripples from the surface of a pond disturbed by a stone. It can be picked up at a distant spot, by a suitable detecting device.

It happens that the form in which it radiates is the same in both cases—it doesn't escape from the capacitor as electric field alone, nor from the inductor as magnetic field alone. In both cases, the energy radiated as COMBINED electric and magnetic fields—hence the name "electromagnetic radiation."
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(as featured in "Radio, TV & Hobbies," March, 1963
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A range of vibrator modules is under development to cover vehicles with both positive and negative electrical systems and to suit a range of Transceiver units.

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Radio, Television & Hobbies, March, 1964
I.1 Means must, therefore, be used where electromagnetic energy which will radiate away in waves having the same frequency as that of the alternating EMF to the capacitor or inductor. A continuous series of electromagnetic waves will be produced. The continuous build-up-decay-reversal nature of the field in the capacitor or inductor will produce electromagnetic energy which will radiate away in waves having the same frequency as that of the alternating EMF.

What we know as RADIO WAVES are electromagnetic waves produced by an alternating current of a certain frequency. It so happens that higher frequency buildup-decay-reversal nature of the field and saw that it could be picked up at frequencies, but these need not concern us here. It so happens that higher frequency waves are easier to radiate. Efficient aerials may be made in convenient sizes, which will radiate suitable amounts of energy if high frequencies are used.

Traditionally, we do not radiate components of voice-frequency radio waves. We radiate radio frequencies for various purposes such as TELEGRAPHY TRANSMITTER, TELEVISION, TELEPHONE and COMMUNICATIONS.

In practice, if high frequencies are used, we do not radiate components of telegraphy frequencies, but we do radiate components of higher frequencies. The wave energy radiates away in waves having the same frequency as the alternating EMF applied to the inductor and capacitor. Several forms of special radiating devices, which you will be familiar with as AERIALS. We shall see a little later on.

We said before that light and heat radiation is in effect heat radiation is in effect electromagnetic waves, but the mechanism is different.

R.1 By combining the features of a capacitor and an inductor, we can combine the features of both these devices to produce an electric circuit which will radiate amounts of energy. The broadcast radio stations radiate waves in the frequency range 550 Kc/s to 1,500 Kc/s. Long-distance communication stations operate from about 2 Mc/s to 10 Mc/s. In the past these waves have been used to combine the features of a capacitor and an inductor, but now we use specialized radiating devices.

In general, waves are inversely proportional to frequency, which means that the higher the frequency, the shorter the wavelength. Wavelength is measured in METRES, and the length of wave in a metre is given by its frequency in Megacycles/sec (Mc/sec) divided by 300. The frequency of a wave of 100 Mc/sec has a length of less than 3 metres, and so on.

We said before that light and heat were electromagnetic radiation. The wave theory permits us to combine the features of a capacitor and an inductor. Varying potential across a capacitor and an inductor will produce a magnetic field, and currents in the aerial itself create a varying magnetic field.

Incidentally, when discussing the frequency of radio waves or of the currents which produce them, the simple unit of "cycles per second" often becomes unwieldy. Things are simplified by using the KILOCYCLE/sec, which is 1,000 cycles/sec, the MEGACYCLE/sec, which is 1,000,000 cycles/sec, and the GIGACYCLE/sec (formerly called the Kilo-MEGACYCLE/sec), which is 1,000,000,000 cycles/sec.

The radio frequency spectrum extends from about 10 Kilo-cycles/sec to about 1,000 Giga-cycles/sec (10 Gc/s or 10,000,000,000 cycles/sec). The alternative descriptions in terms of wavelength (long, short, medium, micro-waves) are less often used, but detect the length of one cycle of the electromagnetic waves conveniently.

Wavelengths are inversely proportional to frequency, which means that the higher the frequency, the shorter the wavelength and vice-versa. Wavelength is measured in METRES, and the length of wave in a metre is given by its frequency in Megacycles/sec (Mc/sec) divided by 300. Wavelengths of a frequency of 100 Mc/sec have a length of less than 3 metres, and so on.

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waves.

CW stations, amplitude modulate (AM) in send information, besides the simple on- T to be radiated as dots and dashes.

One way of describing keyed carrier wave transmission is as a way by which the carrier is AMPLITUDE MODULATED. This is because the code information is carried by the waves as differences in their strength or "amplitude.

Keyed carrier wave transmission is quite satisfactory as a means of transmitting simple messages, but it obviously lacks something where speech, music or pictures are concerned. Who would be able to recognise their favourite piece of music translated into dots and dashes? Fortunately, there are other ways of doing the same job. Figure 5 shows the basic operation of a simple tuned circuit oscillator. The amplifying device may be a valve, a transistor, or any other suitable device of doing the same job. Figure 7 shows several circuits for tuned oscillators using a valve and a transistor. The transistor circuit does the same thing in a different way. It connects the tuned circuit to a collector (output) circuit of the transistor, and uses a small feedback winding to supply energy back to the tuned circuit.

In the remainder of this chapter, we will see how this is done. Following chapters will be devoted to the operation of the receiving end of the system, to show how the receiver is able to recover the original transmitted voice or music from the amplitude modulated waves.

Before we examine how the signals to the transmitter are fed in to modulate the RF carrier, we should have a look at the way in which they are fed.

RF carrier is generated in the first place. In other words, we should look at the RF oscillator, which perhaps can be regarded as the "heart" of any radio transmitter.

You may remember that in chapter 5 of this course, we saw that a capacitor and an inductor may be connected in parallel to form a parallel tuned circuit. We saw that when such a tuned circuit is fed with a short burst of energy, it tends to oscillate, producing a decaying or "damped" alternating voltage.

The frequency at which the circuit oscillates, which is the frequency of the alternating voltage, is determined by the resonant frequency of the tuned circuit. This in turn depends upon the values of the capacitor and the inductor, as one might expect.

In fact, the frequency of the voltage produced is given by

\[ f = \frac{1}{2\pi\sqrt{LC}} \]

where \( f \) is the frequency in cycles/sec., \( L \) is the coil inductance in henries and \( C \) is the capacitor value in farads.

A tuned circuit can thus be used to generate an alternating EMF of any desired frequency, by suitable choice of the inductor (coil) and capacitor. So if we want to generate an RF carrier of a certain frequency, we can select a capacitor and coil to resonate at this frequency.

But a tuned circuit alone is not sufficient. It has coil and resistance and other losses which make it alternating voltage decay. To produce a continuous, steady supply of alternating EMF for the frequency, we must arrange for the tuned circuit to be continually fed with energy. To overcome its losses and keep it oscillating, we will see how valves or transistors or other amplifying devices enter the picture. For by means of a valve or transistor we can keep the tuned circuit going.

By the way, note that wording care- fully. It is always THE TUNED CIRCUIT which oscillates, NOT the valve or transistor. The amplifying device simply keeps the tuned circuit going.

Figure 6 gives the basic operation of a simple tuned circuit oscillator. The amplifying device is connected so that it picks up the oscillatory voltage \( E \) appearing across the tuned circuit. The output of the amplifying device is then connected to a FEEDBACK or "tickler" winding which is placed close to the inductor of the tuned circuit.

The feedback winding is arranged so that it can magnetically induce voltages into \( L \), which RE-ENFORCES the voltage \( E \) when fed with an amplified version of \( E \) by the amplifying device. In this way, the tuned circuit is fed with energy which keeps it oscillating steadily.

The amplifying device may be a valve, a transistor, or any other device capable of doing the same job. Figure 7 shows several circuits for tuned oscillators using a valve and a transistor. The amplifying device may be a valve, a transistor, or any other suitable device capable of doing the same job.
This versatile electronic tachometer may be operated with internal combustion engines with 4, 6 or 8 cylinders and 6V or 12V positive or negative earth electrical systems. Whilst this tachometer may be used for marine engines, it is primarily designed for use in electrically operated battery ignition.

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This unit contains a Wideband AM tuner with a selectable bandpass, together with a four-valve stereophonic pre-amplifier. Although primarily designed for the Mullard Stereo "Ten-Ten" Amplifier, this unit may be used with most other high quality amplifiers.

First published in 1958, and originally intended as a means of communication with the Industry, Mullard Outlook circulation has increased year by year. It is now in great demand, not only within the Industry, but with teaching establishments, home constructors and enthusiasts alike.

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the amplifier circuit, which is to be connected to the output.

L-C CIRCUITS

In our discussion of oscillators so far, we have been talking in terms of L-C coupled tuned circuits. However, oscillators using such tuned circuits tend to wander or "drift" in frequency. Only to a small degree, if the circuit is well designed, but enough to make them unsuitable as a source of RF carrier energy in a broadcast transmitter—transmitters must radiate on a fixed frequency, or one would never quite know where to find the receiver dial! Actual radio transmitters do not use L-C tuned circuits in the RF oscillator, for this reason. They use instead a carefully prepared wafer of quartz crystal, which has the property of resonating automatically when an EMF is applied to it. The quartz oscillator, as it is called, oscillates, does so with every high-frequency cycle of the L-C tuned circuit, particularly if it is kept at a constant temperature in a thermostatically controlled oven.

The frequency of such CRYSTAL-CONTROLLED RF oscillators is set by the dimensions and material of the quartz crystal. To change the frequency, the crystal must often be replaced by another, or taken out and altered in use. So much, then, for the source of the RF carrier energy in our transmitter. But the output of the oscillator is seldom strong enough to be fed directly to the transmitting aerial. Usually, it must first be amplified by one or more valve or transistor stages in the RF amplifier, as we mentioned before.

An RF amplifier using a pentode valve is shown in Figure 8. It has a tuned circuit in both the grid and plate circuits, and both tuned circuits are made to a multiple of the oscillator frequency, Other types of RF amplifier stage called "multipliers" have the plate circuit tuned to a multiple of the oscillator frequency, and the stage is arranged to multiply the frequency. This is used where the required carrier frequency cannot conveniently be generated directly by the oscillator.

For instance, multiplier-type RF amplifiers must be used with crystal-type RF oscillators, if very high carrier frequencies are required, as it is impractical to make quartz crystals to oscillate at very high frequencies.

Link windings couple the tuned circuit of the RF oscillator to the input of the amplifier, In this case if the RF oscillator used a crystal rather than an L-C tuned circuit, one of the other types of coupling would be used.

Negative bias is applied to the grid of the valve to ensure that it operates at a convenient point and amplifies efficiently. The amplified RF carrier which appears in the plate tuned circuit (the "TANK" circuit) is coupled to the next stage—or to the aerial if this is the last stage—via another coupling loop.

CARRIER STRENGTH

We have now arrived at one of those parts of a radio transmitter responsible for the generation and modulation of the carrier. By adding a Morse key to this, we have a "wire" wave or CW transmitter, but let us progress a little further. The carrier may be varied in strength so that it can be used to transmit voice, music, or even pictures. In other words, let us see how continuous-amplitude modulation is performed.

The strength of the RF carrier fed to the aerial depends on a number of factors, but one of these is the supply voltage of the valve RF amplifier stage. The output is, in fact, proportional to the plate voltage, with a circuit constant of the valve.

Because of this, to vary the strength of the RF carrier, we have to vary the plate supply of the valve RF amplifier.
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Radio, Television & Hobbies, March, 1964
of the RF carrier—to amplitude modulate it—all that need be done is superimpose the audio (sound) frequency signals on the plate supply voltage. In this way the audio signals add to and subtract from the plate voltage, and vary with the sound waves reaching the microphone.

There are other ways of modulating the carrier, but they all produce the same effect and need not concern us here. The basic idea of a PLATE-MODULATED AM TRANSMITTER is shown in Figure 9.

There is an RF oscillator and an RF amplifier, as with the CW transmitter, in order to generate the RF radiation energy. However, added to this section is the microphone, an audio amplifier (the MODULATOR) and a transformer used to superimpose the amplified audio frequency signals onto the plate voltage of the RF amplifier.

Instead of the microphone, we can use a gramophone pickup, a tape recorder, and so on. In television transmission, we would use cameras, film scanning machines and picture (video) tape recorders instead. And with the description of a basic AM transmitter, we must end this chapter. Now that we are reasonably familiar with the nature of radio waves and the way in which information can be transmitted, we are ready to look at the way in which the radiated radio waves are used. In the next chapter, then, we will start at the “other end” of the radio system—the receiver.

Figure 10. The final RF amplifier stage in a radio transmitter has to handle quite a lot of power, and the valve or transistor used must be arranged accordingly. The valve shown here is a type used in medium-power transmitters, and is air-cooled. In the higher-power transmitters large water-cooled valves are used.

The audio amplifier may use either valves or transistors, and builds up the strength of the tiny voice-frequency voltages generated by the microphone. The output of the audio amplifier is fed to one winding of the MODULATION TRANSFORMER.

The other winding of the transformer is connected in series with the plate circuit of the final RF amplifier, so that the amplifier receives its plate current through the transformer winding. In this way, the amplified audio voltages induced in this winding of the transformer add to or subtract from the supply voltage, and can vary the strength of the carrier fed to the aerial. The small waveform sketch shows what the modulated carrier would look like if we could see it. In fact, we can see it if we use an instrument called an oscilloscope, as in the two photographs shown.

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MORE ABOUT ACOUSTIC FEEDBACK

Last month we introduced the subject of acoustic feedback but only got so far as to talk about the problem in relation to public address amplifiers. If we left untouched three other aspects which we mentioned in the introduction — acoustic feedback in electric guitar amplifiers, in short-wave receivers and in home recording equipment.

By Neville Williams

THE problem of acoustic feedback in an electric guitar is one which has been raised quite frequently of late in readers' correspondence and, in particular, since we featured a series of articles on electric guitar amplifiers. While many readers have constructed three amplifiers successfully, a few have run into trouble. The amplifier systems rumble or vibrate, or whenever they are turned up to the level needed for on-stage entertainment. In most cases, the constructors have jumped to the conclusion that amplifier designs have been faulty in some way.

In fact, the trouble has turned out almost invariably to be—you've guessed it—acoustic feedback. Observers, completely perplexed by the situation discussed last month in relation to public address amplifiers. It generally transpires that the amplifier which they are trying to use is an acoustic model which also carries a pickup unit to feed an electronic amplifier. The instrument can be played with or without amplifier, depending on whether the additional volume and/or control effects are required. Being basically an acoustic instrument, it has the normal thin, hollow body specifically designed to radiate into the surrounding air, as direct sound, the vibrations of the strings.

Unfortunately, from the present viewpoint, the pickup unit is still in reverse, the thin hollow body picking up sound from the surrounding air and feeding it back into the strings! When these vibrations, as a result, induce signal voltage and current in the electronic pickup units, the guitar is behaving as a kind of microphone. The more efficient it is as a microphone, the more efficient it is like a loudspeaker in the reverse role.

When such an instrument is coupled to an amplifier and loudspeaker, trouble is just around the corner. The guitarist 'turns up the amplifier gain and strikes an introductory chord. The amplifier, which drives the loudspeaker, which excites the guitar body, in turn, induces sound waves in the guitar body to a large extent. These sound waves, in turn, induce a signal in the pickup unit.

This drives the amplifier, which drives the loudspeaker, which excites the guitar body. A sound feedback loop is now in operation which generates a signal which drives the amplifier . . . and so on.

Before the guitarist knows what's happened, the whole system has begun to ring or rumble or roar, depending on the frequency where the highest gain is evident. And, in a guitar, with deliberately tuned strings, there is no lack of resonance peaks. The fundamental way around the problem of acoustic feedback in a guitar is to use a solid-body instrument which is incapable of radiating significant sound effects.

Of course, this is not always possible. Many guitarists prefer acoustic instruments, and there are many decisions which have to be made here. He may have a second-order effect on the whole system, since we featured a series of articles on electric guitar amplifiers, in short-wave receivers and in home recording equipment.

The whole point which we are trying to make here is that his problem is not basically one of amplifier design, even though differences in amplifier response may have a second-order effect on the feedback loops in the guitar. There is an element of chance about whether or not acoustic feedback will cause trouble in an individual case but.

While the basic problem is present, there can be no real grounds for complacency if trouble does arise as a result. To be sure, the lot of the electric guitar specialist would be easier if he did not have to worry about acoustic feedback.

The reference to acoustic feedback in short-wave receivers is admittedly out of place in an audio column but we decided to relate it because its effect is certainly not confined to many readers, whether or not they recognize the cause.

It works this way: A short-wave receiver appears to be perfectly normal and stable in its behaviour, until it is tuned to an incoming station.

The feedback loop is then turned on in the loudspeaker. It is not a feedback loop in the normal sense but a feedback loop with an added amplifier in the loop.
This kind of trouble has a purely electrical origin, when current drawn from a regulated voltage network. While vibration of the oscillator tuning capacitor, and of the signal fed through the power output stage modulates the audio output, it is heterodyning down to the intermediate frequency, which is the reason why it is worst in shortwave receivers, any other receivers. If the receiver's loudspeaker is mounted in the same cabinet as the rest of the set though, in the carrier immediately reappears in the retarded. If the receiver's loudspeaker is mounted sufficiently close to the suspect loudspeaker is merely close to the feedback is picked up from a regulated voltage network. The magnitude of the trouble increases with the order of change from a regulated voltage network. An extreme case, it can happen when the loudspeaker is merely close to the carrier immediately reappears in the retarded.

Acoustic feedback in a shortwave receiver, any other receivers. Once again, however, the problem is a consequence of the amount of the electrical feedback element. The voice of the oscillator tuning capacitor, and of the signal fed through the power output stage modulates the audio output, it is heterodyning down to the intermediate frequency, which is the reason why it is worst in shortwave receivers, any other receivers. Acoustic feedback can be picked up from an incoming signal is reproduced. This kind of trouble is known as something different from electrical feedback (via the high tension line, etc.) by the simple expedient of operating the receiver into a loudspeaker placed well away from the chassis.

In practice, to cure the trouble is often a lot harder than it seems to do so immediately the carrier immediately reappears in the retarded. A capacitor with thick plates and a heavy frame will usually show less sensitivity to acoustic feedback than one with thin plates or split rotor plates, or a motor of considerably greater capacity. The voice of the oscillator tuning capacitor, and of the signal fed through the power output stage modulates the audio output, it is heterodyning down to the intermediate frequency, which is the reason why it is worst in shortwave receivers, any other receivers.

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Radio, Television & Hobbies, March, 1964
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Radio, Television & Hobbies

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There's performance of the formidable score on RCA's new Dynagroove pressing before taking it away. Mine is a pious bore. Much of this is due to the careful nature of its conception and execution. Raubimann's piano part is an out of perspective. Experienced by the composer after Wagner—Das Rheingold. Excerpts.

Some of the work is gravely reverent, some of it fiercely affirmative of a simple, faithful faith. All of it is noble. And though in it all emerges the temperament experienced by the composer after recovery from a spiritual crisis that came close to threatening his sanity.

For Gore's performance brings out the cold-blood quality of true spirituality, submerging fussy treatment of the orchestral line plinks way out of perspective. Experienced by the composer after Wagner—Das Rheingold. Excerpts.

But, to me, there is no one recording recent recordings of Orson Welles that I prefer the now 10-year-old Gertler/Ketižek disc which is still available from a record-office. It is an understated performance by members of the Record Society. The sound on this disc is quite well in terms of modern standards but, if you're seeking something more recent, I suggest you wait a while to see what turns up.

Schumann—Carnavale: Fantasiestucke. Arthur Rubinstein (piano). RCA (1958). Stereo LCS2669. Generally speaking, despite his current problems, I cannot imagine anyone with an interest in music who was a music lover in the old days who did not enjoy 'barnstorming' of the work all their customary clarity, even when one searches for it aurally with the aid of a score. Now you see it, but now you don't hear it, so to speak. And the harp contributes to confuse in crystal-like gists way out of perspective. Experienced by the composer after Wagner—Das Rheingold. Excerpts.

The first thing to strike the listener familiar with Bruckner's heavy, Germanic style is the unusual spareness of the textures in the F Minor Mass, a spareness that gives the work a quite extraordinary, modern flavour. And less than is at once persuasive and valid. The chorus and orchestra are splendid, emotional and expressively. And the soloists sing their difficult parts with rare accuracy and good taste, if one excepts a monotonous present at the high solo soprano line at the beginning of the Kyrie. The sound, too, is clear, spacious and well distributed, though I personally like to hear a trifle more edge in Bruckner's brass. These, however, are minor shortcomings which should in no way be construed as likely to inhibit complete enjoyment of a beautiful work admirably performed and recorded.

Bruckner—Piano Quintet in F minor Op. 34, Juillard String Quartet with Leon Fleisher (piano). Epic Stereo ELCS9104. Those who look to the Juillard String Quartet for just about the best recordings of the Brahms piano quintet. They bring to work all their customary clarity, precision and nuancing of the utmost fine musician. But, in chorus and orchestra are splendid, emotional and expressively. And the soloists sing their difficult parts with rare accuracy and good taste, if one excepts a monotonous present at the high solo soprano line at the beginning of the Kyrie. The sound, too, is clear, spacious and well distributed, though I personally like to hear a trifle more edge in Bruckner's brass. These, however, are minor shortcomings which should in no way be construed as likely to inhibit complete enjoyment of a beautiful work admirably performed and recorded.

Bruckner—Mass No. 3 in F Minor. Berlin Symphony Orchestra, conducted by Karl Forster. HMV (1955). Stereo ASD515. There is not a passage that doesn't seem at once persuasive and valid. The chorus and orchestra are splendid, emotional and expressively. And the soloists sing their difficult parts with rare accuracy and good taste, if one excepts a monotonous present at the high solo soprano line at the beginning of the Kyrie. The sound, too, is clear, spacious and well distributed, though I personally like to hear a trifle more edge in Bruckner's brass. These, however, are minor shortcomings which should in no way be construed as likely to inhibit complete enjoyment of a beautiful work admirably performed and recorded.

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Radio, Television & Hobbies, March, 1964

This artificial spotlighting of the goldfinch continues more or less throughout the concerto to such an extent that much of the detail in the orchestra is missed even when one searches for it aurally with the aid of a score. Now you see it, but now you don't hear it, so to speak. And the harp contributes to confuse in crystal-like gists way out of perspective. Experienced by the composer after Wagner—Das Rheingold. Excerpts.

The first thing to strike the listener familiar with Bruckner's heavy, Germanic style is the unusual spareness of the textures in the F Minor Mass, a spareness that gives the work a quite extraordinary, modern flavour. And less than is at once persuasive and valid. The chorus and orchestra are splendid, emotional and expressively. And the soloists sing their difficult parts with rare accuracy and good taste, if one excepts a monotonous present at the high solo soprano line at the beginning of the Kyrie. The sound, too, is clear, spacious and well distributed, though I personally like to hear a trifle more edge in Bruckner's brass. These, however, are minor shortcomings which should in no way be construed as likely to inhibit complete enjoyment of a beautiful work admirably performed and recorded.

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**Mastersound**

**Radio, Television & Hobbies, March, 1964**

Together without any sense of having done, done bleeding from the context. Kempe's orchestra plays magnificently. The voices are sometimes a little too forward for all of the orchestral detail to be heard comfortably, but this has only occasionally and, for the most part, the sound is artfully rich and vibrant.
controlled as his brilliant technique. In a work that lends itself — in the right hands—to subtle changes in ornamentation, Katin takes full advantage of every opportunity presented. He delivers the most bravura passages with gem-like separation of their component notes. He is always rhythmically exhilarating and altogether I found this one of the most attractive performances of the work I have ever heard.

A film like Scherzo Fantastique is enchanting. Katin takes it at tremendous speed, about as fast as possible. I should say, but without tearing a single note. It is, however, a piece of Bizet economy price, and it is perhaps the best example of a single note in a piece of Bizet, except in only one mono. A pity, because though the stereo sound is generally good, without blurring of their component notes. He is more bravura passages with gem-like separation of their component notes. He is almost always rhythmically exhilarating and altogether I found this one of the most attractive performances of the work I have ever heard.

The Inimitable Sir Thomas Beecham, conducted by Anthony Collins, and broadcast on the "London Symphony Orchestra Season," features parts of the "Faure" Symphony and the "Rachmaninoff" Piano Concerto, conducted by Peter Kerman. Columbia Stereo SXAX2468.

The World Record Club, conducted by Colin Davis, offers "The British Symphony," with "The Litolf Scherzo" as the fill. The January, 1960, issue. This issue I rated the quality as very good, but with traces of distortion on the minute, much of a difference. This adds up, in fact, to a brief but powerful performance. Some of the music are here for your rehearing.

It was considered as a devotional entertainment, intended to support the visual story and the composer's basic concept. If you haven't, each excerpt is explained on the jacket, in terms both of the story and the composer's basic concept. This adds up, in fact, to a brief but powerful performance. Some of the music are here for your rehearing.

Stage and Screen


Stereo: Used to advantage. For those interested in the theme music of the current "Cleopatra" film featuring Elizabeth Taylor, it is possible to get closer to the original than on this disc, as a record of this general type. In this respect, the arrangements and orchestrations appear to intrude upon what is presented on the record. The Welshman, "The Welsh Marches," is the closest to the original, but with a distinctly thematic ingredient, the disc provides excellent sound throughout. However, it does have the same quality as a stereo pickup, switched to mono, the last month, which was also a reissue of an American Capitol disc, this kind of music should gain a great deal more interest. The Wales Record Club release is a reissue of an American Capitol disc, which I reviewed in the mono version, in the July, 1960, issue. In that issue I rated the quality as very good, but with traces of distortion on the minute, much of a difference. This adds up, in fact, to a brief but powerful performance. Some of the music are here for your rehearing.

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RECOMMENDED. 


SACRED SONATA, by Bryan Powell. The Roger Wagner Chorale, conducted by Kenneth Thomas and Recorded in St. Peter's Church, Eaton Square, London, World Record Club SMC-2111. 


This adds up, in fact, to a brief but powerful performance. Some of the music are here for your rehearing.

Bryan Powell has a pleasant tenor voice and, no less important, the ability to sing strictly on pitch. For this interested in the theme music of the current "Cleopatra" film featuring Elizabeth Taylor, it is possible to get closer to the original than on this disc, as a record of this general type. In this respect, the arrangements and orchestrations appear to intrude upon what is presented on the record. The Welshman, "The Welsh Marches," is the closest to the original, but with a distinctly thematic ingredient, the disc provides excellent sound throughout. However, it does have the same quality as a stereo pickup, switched to mono, the last month, which was also a reissue of an American Capitol disc, this kind of music should gain a great deal more interest. The Wales Record Club release is a reissue of an American Capitol disc, which I reviewed in the mono version, in the July, 1960, issue. In that issue I rated the quality as very good, but with traces of distortion on the minute, much of a difference. This adds up, in fact, to a brief but powerful performance. Some of the music are here for your rehearing.

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2- or 4-track monaural record and playback with 2- or 4-track stereo playback facilities. Sound with sound recording. 3-speed 1/4, 3/4, 7/1 I.P.S. Automatic shut-off device

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Radio, Television & Hobbies, March, 1964
who are of the opinion that locally made.

The stereo is used deliberately and effec-

tively to achieve separation without,

however, enticing the disc a real winner.

The orchestra and W.R.C. are well

arranged and individual instrumentalists

are most of the releases from the King

with feeling. (W.H.C.)

NORTHERN CUBAN ORCHESTRA.

Phase 4, SKLA 7550.

Phase 4, SKLA 7550.

The Tokyo Cuban Boys first appeared

in Japan in 1961. The orchestra is a

variety of up-tempo and other arrange-

ments and trucks with their well-known

cuban groups, it is speaking,

and melodic sound.

industrial instruments.

Stereo: Normal spread.

Quality: Excellent.

Performance: Excellent.

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- Output 4 watts per channel (8 watts.
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AMPLIFIER AND TUNER, £45.15.0.
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- Output 13 watts per channel (26 watts).
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- Output 20 watts per channel (40 watts).
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Now using the new 6GW8 output Valves

AMPL. & TUNER ONLY £45.0.0

SPECIFICATIONS:

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- Valves 4 6GW8—12AU7—1 6AE8—1 6BA6—1 KM84—2 EN1763 Rectifiers.
- Supplied in wooden case finished in natural wood.
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Radio, Television & Hobbies, March, 1964
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ca's engineers have added their quota
commendable best with the baton, Dec-
treatment and sound.

In an atmosphere of parade, pomp u J
and ceremony, Sousa marches are as " SOUSA MARCHES. Sealand Air Force |

Anders Segovia with the Guitar Soloists. (J.R.).

Quality: Good.
Performance: Good.
Recording: Fine.

A guitar-and-strings quintet such as the Quintetto Chigiano playing a sens-
ance, restless work like the Castellnuovo- Teodoro Quintet always conjures up
rather vivid visual pictures for me. It
is as if the composer were an artist and
the various instruments of the quintet
his tools.
The violin are like fine wash-brushes,
swirling in delicate lines and shapes
and so forth, and the cello and doublebass, and fill in
the shadows to produce the contrast.
And the "Alcazar" in Hawaii is as a
detail-pen, delineating outlines, de-
finitions, contrasts, and filling in the
contrasts. All those play their part in
putting over the music, and Segovia
plays it all with a nearness about this par-
ticular performance that is the picture
perfect composition. The violins and the other
members of the Quintetto Chigiano give
a well-balanced and sensitive perform-
ance.

On the reverse side Segovia plays
half-a-dozen solo pieces in his usual
manner; the sparkling, racy technique,
outstanding pieces, any of them, but if
nothing else there is a splendid vehicle
for his virtuosity.
The recording is a very high stan-
dard, with low noise and negligible hiss.
All told, then, a disc which can be heartily recommended to guitar
lovers (J.R.).

SQUA MARCHES, Eastland Force Band
Directed by Thomas Mur-
ray. Stereo, Festival SPL-391,162.
Interest: Military marches.
Performance: Good.
Quality: Good.
Stereo: Effective, spread.

In a red, white and blue, pomp and
ceremony. Some marches are as real
in their effect as the real band itself.
In the home, they're better taken in
with a lot of vibrato added. And when
it becomes too con-

VARIETY FARE — Continued

Another day in the life of Frank Fontaine
and his band. Frank's show is recorded
here to give you a close look at the day-to-day
life of this master clown. You will see how
Frank prepares for his shows, how he gets
ready to go on the road, and how he
spends his off time.

This disc is a fine example of an
entertainer at ease in his own
environment. Frank's funny
tales, his songs, his sketches,
and his impersonations are all
presented with the same
energy and enthusiasm that
characterizes Frank's perfor-

Radio, Television & Hobbies March, 1964

Apple Blossom White," 1954, Perez
Prado and Orchestra, "Day-O," 1953,
Harry Belafonte and Tony Scott's Or-
chestra; "In the Mood," 1919, Glenn
Miller Orchestra; "You, You, You,
Ames Brothers, with Hugo Wulffsholz-
 Orchestra; "Maria," 1937, Tommy
Dorsey and Orchestra; Jack Laurent and
Male Chorus; "Oh, My Pa-Pa," 1953,
Eddie Fisher, Hugo Wulffsholz's Or-
chestra and Chorus; "Summit Ridge
Drive," 1940, Artie Shaw and His
Bargain "Sampler"-Continued
GOLDEN FAVOURITES, VOLUME 1.
Twelve Million Plus Sellers.
Stereo, Electrecord, Electro-Republic
USP-2771.
Interest: Hits of yesteryear.
Quality: Clean with limited re-

Radio, Television & Hobbies March, 1964

As happens when one reviews an LP!
It's hard to connect Frank Fontaine's
smooth, unfurred baritone voice and
his almost perfectly constructed singing
style with the rubber-faced comedian so
familiar to movie fans and tele-

VARIETY FARE — Continued

While Weber Muller does his commendable best with the baton,
Dorsey's engineers have added their quota
commendable best with the baton, Dec-
treatment and sound. jj

In an atmosphere of parade, pomp u J
and ceremony, Sousa marches are as " SOUSA MARCHES. Sealand Air Force |

Anders Segovia with the Guitar Soloists. (J.R.).

Quality: Good.
Performance: Good.
Recording: Fine.

A guitar-and-strings quintet such as the Quintetto Chigiano playing a sens-
ance, restless work like the Castellnuovo- Teodoro Quintet always conjures up
rather vivid visual pictures for me. It
is as if the composer were an artist and
the various instruments of the quintet
his tools.
The violin are like fine wash-brushes,
swirling in delicate lines and shapes
and so forth, and the cello and doublebass, and fill in
the shadows to produce the contrast.
And the "Alcazar" in Hawaii is as a
detail-pen, delineating outlines, de-
finitions, contrasts, and filling in the
contrasts. All those play their part in
putting over the music, and Segovia
plays it all with a nearness about this par-
ticular performance that is the picture
perfect composition. The violins and the other
members of the Quintetto Chigiano give
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ance.

On the reverse side Segovia plays
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Kelly L.F. Drive Unit Mk. III
Kelly Ribbon H.F. Loudspeaker Mk. II
Kelly Crossover Network

The New Kelly "Mini" Full Range Reproducer

Sole Australian Distributors: Encel Electronics

Kelly Speaker Systems!
World-renowned U.K. manufacturer, Kelly Acoustics Limited, have appointed Encel Electronics as their Sole Australian Distributors. To re-introduce KELLY high-quality sound reproducers to the Australian market, our first shipments have been priced to represent outstanding audio value. We know there will be tremendous demand now that KELLY speakers are available once more. Write to us for full technical data and for cabinet specifications; these will be sent to you by return mail.

Kelly L.F. Drive Unit Mk. III
This fine bass reproducer has a frequency range from 30 c/s to 5000 c/s. Power rating: 15 watts. Total Flux: 10,000 max. Uniformly generous engine dimension, vertically and horizontally. Heavy-duty, precision, cast-iron frame with a large air gap. Unusually generous magnet dimension. Designed for use with Mk II tweeter. Crossover frequency: 2500 c/s.

Kelly Ribbon H.F. Loudspeaker Mk. II
An entirely new model of this renowned ribbon tweeter, the Mk. II has a performance comparable with any high frequency system irrespective of price. This tweeter unit has a frequency response from 2500 c/s to 25 kc/s. Maximum power capacity: 19 watts. Less than 1% distortion at 2.5 kc/s at 10 watts.

Kelly crossover Network
This crossover has been designed to feed the correct power to the Mk III L.F. Drive Unit and the Mk II Ribbon Tweeter. Crossover frequency: 2500 c/s.

Kelly "Mini" Full Range Reproducer
This modern enclosure has been designed for the smaller lounge room where space is of primary importance. In spite of its small size, the KELLY "Mini" incorporates a Mk III 12" unit and a 3" foam-surfaced fibre unit. KELLY's exclusive "acoustic-pump" back-up the main cone. The sensitivity is higher than any comparable Mini. Sensitivity: 95 db. Water proofed loudspeaker cabinets. Finish: Waxed Walnut. Frequency response: 60 c/s to 12 kc/s plus or minus 2 db. Input 8 ohms. Speaker units of similar cost in England cost over £60 in Aust.

Encel Electronics
354 Bridge Road, Richmond, Victoria
Tel. 42-2820

Factory: 47 Coppin St., Richmond, Vic. Tel. 42-2883

* Wholesalers * Trade-ins Accepted

Radio, Television & Hobbies, March, 1964
Dreams," "I Don't Know Why," "Till We Meet Again," "Love Letters In The Sand," "Oh How I Miss You Tonight," "We Meet Again," "Love Letters In The modern filtering and re-recording tech-

RICHARD CROOKS — "The Lost

at a pleasant level, the brass section

and "1 Want A Girl.

LoVely," "Let Me Call You Sweetheart," "Dreams," "I Don't Know Why," "Till

voices?

do. Division is very low and there

is low surface noise.

favour of the orchestra on some tracks.

recording balance is tipped a little in

"Shine On Harvest Moon," "I'll Get

If one turns up the volume to hear him

you're sure to enjoy this one. And if

would like to hear a smooth rendition

of the listed songs, this disc is certainly

worth a try. (J.R.)

I Sing On The Jackie Gleason Show," "Back Like A Song," "A Serenade To

Fred Astaire is heard on one track, and

Followers of Shirley Temple's current

Shirley Temple fans from the thirties?

RCA have done a fine job with these

them to the museum-cupboard. And in-

tracks. Mono, 20th Century Fox

Frankenstien on TV and now Buddy

Dracula meets the Bride of

material is apparently taken

from Original Film Sound-

Radio, Television & Hobbies, March, 1964

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The "Amplivoice" has a range up
to 1,000 yards depending on the

rawing mouthpiece gives distortion free

penetrating voice reproduction un-

surpassed in the loud hailer field.

No volume control necessary —

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Price $26.00 - 15% Discount

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THE HIGHEST QUALITY IN

PUBLIC ADDRESS SYSTEM!

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PUBLIC ADDRESS SYSTEM!

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Never before OSCILLOSCOPE VALUE like this!

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10-12E WIDE-BAND 5in. SCOPE featuring:

- New professional styling and features to fulfill almost every lab or service requirement!
- Full 5 mc band width!
- Heath patented sweep circuit—10 cps to 500 kc.
- Switch-selection of 2 "preset" sweep frequencies.
- Two circuit board and wiring harness for easy assembly.

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SUPPLIED FULLY ASSEMBLED AT SMALL EXTRA COST

Heathkit quality is recognized throughout Australia and the world, not only by TV and radio servicemen, but also in the fields of industry and education. Among the many users of Heathkit scopes are Technical Colleges, Universities, Government Departments and The Armed Services.

The receiver section of this equipment has been deliberately provided, sufficient to allow the natural heat of the unit to keep it dry, without sweating, yet small enough to prevent any serious build up of moisture under normal operating conditions.

The unit is housed in a sturdy metal case, attractively finished in Hammerdoc enamel throughout Australia, Papua, and New Guinea.

The most effective arky for this type of installation is a load or spiral whip. A CTR24 is available from Watkis Wynn Pty. Ltd. The price of the complete CTR24 is £8/7/6 in addition to the advertisement on page 127 of the February issue, should have read "£8/7/6 in- cluding sales tax," not "£8/7/6 plus sales tax, ..."

Oxford Instrument Cases, Chassis and Panels

C.R. Bridge, 63, Sept., 1963

Case

Chassis

Printed Panel

Engraved Panel

Sheet Metal.

Case 2 17 6

Printed Panel 19 6

Engraved Panel 2 10 0

MULLARD 10/10 AMP. STEREO

Chassis, etc.

Covers...

Printed Panel (Grey and White)

Printed Panel with Glass Dial

Engraved Panel with Glass Dial

PLAYMASTER 106

Case

Chassis

Printed Panel with Glass Dial

Dial Assembly

Case

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Chassis

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Printed Panel with Glass Dial

19 6

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Dial Assembly

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Engraved Panel with Glass Dial

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Printed Panel 19 6

Engraved Panel 210 0

Engraved (Red and Al) .. 2 0 0

Above 2 Items 25 per cent Tax.

INSTRUMENT CASES, CHASSIS AND PANELS

C.R. Bridge, 63, Sept., 1963

Case

Chassis

Printed Panel

Engraved Panel

Sheet Metal.

Case 2 17 6

Chassis, etc.

Printed Panel 19 6

Printed Panel (Grey and White)

Printed Panel with Glass Dial

Engraved Panel with Glass Dial

MARKET.
R.C.A. Transmitting Tubes, 12/6, Postage 1/6.
Basic Transistor Course, 224 pages, 44/6. Postage 2/6.
Basic Transistor Course, 224 pages, 44/6. Postage 2/6.
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The southeast quadrant of the South Australian Division was occupied by a VHF DX expedition on January 8 but were prevented by extremely poor weather conditions.

On January 11, the seventh day, still at Mount Gambler, south Australia, three good contacts were made, seventeen to VK1 and seven to VK2 stations.

The last night of operation was on January 11, at Cocklebird N.S.W. where fourteen contacts were made. VK1 and VK2 stations.

The DXpedition was conducted from the summit of Mount Motham on January 8 but were prevented by extremely poor weather conditions.

The DXpedition was made by David to ensure that as far as possible maximum results would be obtained.

All equipment was used cautiously in the weeks preceding the departure on the DXpedition, and consisted of an 80 watt 144 Mc transmitter with a plate and filler frequency.

Operations were planned from the summit of Mount Motham on January 8 but were prevented by extremely poor weather conditions.

Four transistorised DC-DC converters powered the equipment from a 12 volt battery and a petrol driven charging set. A design for a mulliband transceiver, using a high frequency crystal filter and a crystal locked .417A cascode configuration, as the topical interest of the subject covered.

A design for a multiband transceiver, using a high frequency crystal filter and a crystal locked .417A cascode configuration, was the subject of the search for more DX on the 144 m.c. band.

The January General Meeting of the South Australian Division was held on Easter Saturday night and included a paper by David MacKenzie on receiving equipment for the DXpedition, and consisted of an 80 watt 144 Mc transmitter with a plate and filler frequency.

The lecture for the evening was Arie Bles VK2AVA, for his article on the Jan/Feb issue of the W.I.A. magazine "Amateur Radio."

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Solar Constant Voltage Transformers. 240 Volt. 2.5 K.V.A. £27/10/- each.

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Hard surfacing 12 gauge. Bundle of 100 £2/- each.

High Voltage Plastic CAPACITORS
.02 Mfd. 5,000 D.C.W. £2/- each.
.03 Mfd. 3,500 D.C.W. £2/- each.
.05 Mfd. 2,000 D.C.W. £2/- each.
.1 Mfd. 1,000 D.C.W. £3/- each.
.2 Mfd. 500 D.C.W. £4/- each.
.5 Mfd. 100 D.C.W. £6/- each.
1 Mfd. 50 D.C.W. £8/- each.

350 Mc. suit conversion. £15/10/- each.

Solar Constant Voltage Transformers. 240 Volt. 2.5 K.V.A. £27/10/- each.

CARTON OF OVER £5 WORTH OF PARTS FOR ONLY £2/-

Two Man Tents with Collapsible Tubular Steel Framework. Heavy Duty Canvas. £12/10/- F.O.R.

America Collins Chokes, 4 Turns, 150 M.A. D.C. Resistance, 55 Ohms, 5/ each.

Single Headphone with Headband. Low Imp. 5/ each.

S.M.A.L. PHONE JACKS
Not Standard P.M.G. Phone Plugs. 2/ each.

WELDING ELECTRODES
Hard surfacing 12 gauge. Bundle of 100 £2/- each.

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Solar Constant Voltage Transformers. 240 Volt. 2.5 K.V.A. £27/10/- each.
The Lady holding the lucky ticket will re-

40

The Annual Meeting of the Branch will
be held in the General Meeting Room, Tigh-

on Friday March 6 at 8 p.m. Linnes on the

general topics which contribute to

the task at hand. The success

of the Linnes method has been

recorded in the literature with

testimonials from satisfied

customers.

The Annual Meeting of the Branch will
be held at the Western Hotel, Maitland, on

the 3rd and 4th. Keith Howard VK2ZHW, Mac

O'Brien VK2ZBR, and Stuart Fairbaim VK2AYF
will be among the first to speak.

VHF NEWS

The allocation of the 420-450 Mc. band,
VK2ZCW and Dr. Issac VK4IV, have used the
Australian Amateur Service at the 432-
Mc. band for a number of years. From New
South Wales, quite a deal of activity.

The success of the Linnes method has
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organism.
MULTIMETER Model 200H
20,000 ohms per v. d.c. 10,000 ohms per v. a.c.

NEW TRANSISTORS IN STOCK

PQ UL CHOKES

STEP-DOWN TRANSFORMER

NEW VALVES AT BARGAIN PRICES

GERMANIUM DIODES

CERAMIC CONDENSERS

WANTED TO BUY

WANTED TO BUY

SAKURA CIRCUIT TESTER

FERROCOURT POCKET MULTIMETER

STATOR 6AG5 5/-

PAIR 7/6

6T3 GT 10/-

10/-

10/-

16/6

16/6

2/- 10 a £1

19/6

3/- 100 yd roll. Clear or black.

PARCEL 3/- per offer.

CABLES

RECORDING TAPE

RECORDING TAPE

LAPEL MICRONE CABLES

WANTED TO BUY

CAR RADIO AERIALS

LATEST W.I.A. CALLBOOK 6/

LOG BOOKS 5/6

P.V.C. covered. 7/0/250. Black or Grey, ideal

WANTED TO BUY

SPORTS EQUIPMENT

ACCESSORIES

TV RIBBON, 300 ohm, 100yd or £3/15/0

STEP-DOWN TRANSFORMER

STEP-DOWN TRANSFORMER

TV RIBBON, 300 ohm, 100yd or £3/15/0

TV RIBBON, 300 ohm, 100yd or £3/15/0
ENJOY THE SEA

with Safety
with Crammond 24P

Product of Crammond Radio Mfg. Ltd.

Marine Communications

Perfect performance, lowest cost—that's why a Crammond 24P will pay you off. Crammond 24P provides 2 two-way phone channels; your ship with other ships, your ship with shore stations PLUS broadcast band listening. Simple to install and operate. Power packing for 24-A battery.

PRICE REDUCED: £10.00 per phone (tax included), money-back guarantee. All models up to 50 watts.

WATKIN WYNE PTY. LTD.
21 FALCON ST., CROW'S NEST, N.S.W.
PHONES: 43-1912, 43-2107

THE right safety equipment for your ship will pay you off in years to come. With Crammond you can be sure of the very latest in marine communications equipment. Safety at sea is in your hands, with Crammond.

SOLE N.S.W. DISTRIBUTOR.

Radio, Television & Hobbies, March, 1964

4.66.4. R.T.T.Y. CONTEST

The second period for operation in the A.R.R.L. DX contest is during March. The weekend March 14-15, has been set down for the phone section and March 28-29, for CW. Entries for the A.M. station are invited to participate in the phone section and the A.M. section is open to all. Entries close March 25, Times: GMT Saturday to 2400 GMT Sunday.

Object: DX stations try to contact as many W, K, VE, VO, KH6 and K3T as possible during the contest and as many different call areas as possible per band. Stations can send 5S or RST report followed by a two digit number representing the total power input in 7090 mW at 50 watts and Canadian stations a number consisting of 3S or RST report followed by the name of their state or province.

Scoring: Repeat QSO's on different bands are permitted, your multiplier is the total number of different call areas worked on all bands above 145 mc. 100 points, with a multiplier of 2 per band. All entries are then multiplied by the number of QSO points scored.

The DX contest is the one event for DX enthusiasts, which they like to participate in. It is a competition to see, who can work the most different areas and DX stations are encouraged to try and work as many as possible. The DX contest is the keenest of the amateur radio contests.

The proceedings of the day were brought to a close with a short address by the Division President, Vic Cuk, who expressed his thanks to all for making the day a success and to the various firms who had been so kindly invited to be present. The divisional chairman, who is also a member of the A.R.R.L. Council, expressed the hope that there would be other similar events in the future.
WIDE BAND OSCILLOSCOPE


3-inch £49.17.6
5-inch £55.15.6

PORTABLE RECORD PLAYER
Legged, 4 watt. Complete Speaker. £15/17/6

STROMBERG
PLAYMASTER ORGAN
TONE GENERATOR UNITS
£18/-
CONTROL PANEL ASSEMBLY
£14/-
REVERB UNIT & AMPLIFIER £29/17/6
MAIN AMPLIFIER
£37/-

All units wired and tested.

COMPLETE STROMBERG
ORGAN
£190
(Direct from Makers. Includes Speaker, Equalizer. and Tuning Fork, with lead. £25)

COLLARO STEREO
TAPE DICK
Adapted to 6. TV PC. Also, special adapter. Extras as required. £35
also for Sound, £36/17/6

NEW TRANSISTOR TESTERS
Tuned to 45, 65 cycles. N.C.E. £5/12/6
Post 6d.

TRANSPORTA 7 64
24 V. TV and B Dec. Correctly wired, good product. £21.17.6

Wired and Tested £27.15.6

MITTY-AMP
6 Transistors, 5 Watt 6 or 12V Input. 20-2200 cycle response. £23

Wired and Tested £27.15.6

PLAYMASTER 106
240V A.C. Stereo £40/15/-

Wired and Tested £40/15/-

TV FATTEN GENERATOR
TV & A.C. Amplifier £11/10/-

Wired and Tested £11/10/-

Resistance Capacitance Bridge
R. TV & M. Test. Inter. £8/15.6

Wired and Tested £8/15.6

Send for full details on Radio>Transistor TV. and Amplifiers.
Playmaster 2 Stereo Amplifiers

- Push-Pull
- 4 Input Channels
- Bass and Treble Boost
- 2 Twin-Cone Speakers, 9 x 6" (per channel)

Price: £15/11/-

Wide Range G.D.O.

- 35 Watt
- Channel Bass and Treble Boost, 4-Tone Cone Speakers

Price: £15/-

Guitar Amplifiers

- 30 Watt
- 2-Tone Channel, Bass and Treble Boost, 8 x 6" speakers

Price: £15/11/-

Battery Charger

- 240 Volt A.C. Operation
- 2 amp. 6V. 12V, 1 amp. 24V
- Standard
- Special

Price: £37/15/-

Service Stations Ignition Analyser Oscilloscope

- 20 Channel
- Perfect reproduction on 20 channels
- Adjustable frequency

Price: £51/11/-

Transistor P.A. Amplifiers

- 30 Watt
- 15 Watt
- £37/15/-
- £27/15/-

Price: £1/10/-

Radio, Television & Hobbyists, March, 1964

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Deutsche Welle Station In Africa

The voice of Germany has been heard using its new relay station at Kigal, in the Kingdom of Burundi, with normal Deutsche Welle programs for Africa.

PLANS for the new relay station were announced on January 1, 1973, when the station began transmitting on 15200 Kc. Its power is 600 Watts. The station is located on the northeast of the African continent, about 100 miles from the coast of Kampala, Uganda, and 50 miles south of the Lake Victoria. It is the first station in Africa to be built by the Deutsche Welle, and it is expected to reach all parts of Africa, including South Africa, Central Africa, and East Africa.

The station operates on the same frequency as the original Deutsche Welle station in Berlin, but it is positioned to improve the reception in Africa. The station operates for 24 hours a day, with short breaks for programming.

30,000 repeaters are adjusted to receive only those programs, and to provide some 150,000 persons to read and mail every week. Besides educational programs, the station also has special emphasis on agriculture and other rural programs.

Radio auditions. Programs are broadcast at 0700, 1100, and 1300 hours G.M.T., and during the usual transmission from 1945-2045. The station verified our reception of this new channel on 9915 Kc offers the best reception for reception, being close of the normal 31m band signals.

The station has made some schedule changes in its programs in Indonesian, to bring the frequency more in line in Indonesia since the old time start of the area were increased to fifteen.

The Radio Australia programs are now 30 minutes later than previously. The Dick Francis programs for Indonesia, have been moved from 1000 to 1100 G.M.T., and on the frequency of 1740 and 2320 Kc. The French program from 2133-0103 is now at 2153, and on 1775 Kc.

KARUL in Afghanistan has been moved on the new channel of 1351 Kc. By Dick Harris, of Melbourne, during the English service from 1110 to 1150 G.M.T., and on 930 Kc, and it is expected the frequency will be changed in 960 Kc shortly to enable the better reception of the signals with the continuing falling sunspot count, giving better transmission on the lower frequencies.

INDOEANIAN TIME CHANGE

From January 1, the Indonesian Republic adopted a new time zone system, and it is expected the new area will sign off at 1800, instead of those in the Central and Eastern parts of the country.

4 hours ahead of G.M.T., Western time is 1200, and Eastern time is 1500.

In the east Java coast has been the same as with the new time, that most stations in the Western Zone including Java, Sumatra, and East Java, will continue, while in the Central and Eastern parts of the country, times will change earlier than previously.

FROM OUR READERS

Included in the next 45 days is news from many parts of the world, who reports the arrival of All India Radio transmissions in Europe on 975 Kc, in English, from 1945 to 2045 G.M.T., with good signal strength.

More signals from All India Radio, are received, from its transmissions to the Pacific from 1000 to 1100, 1500, 1600 to 2000, and 2130 to 2330, hours G.M.T. Barry Williams, of Auckland, New Zealand, has been heard with an English program from 2045 to 2145, time G.M.T. Barry Williams, of Auckland, N.Z., who reports, this signal, also stated that after the 1960 G.M.T. announcement the station reverted to English. This is a very good signal in this part of the world with North America, and Central America, and it is expected the frequency will be changed to 960 Kc shortly to enable the better reception of the signals with the continuing falling sunspot count, giving better transmission on the lower frequencies.

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SOUND PROJECTORS

Sound Projectors, cine, radio, aviation, complete with speaker and mast. £47/10/-.

HEAD PHONES

Head phones (Wholesale price 12/6 each). Post £1/10/-.

REFLECTOR GUNSHOT

Complete These reflectors for £1 each. 1 lb. in a 10 lb. box. Price 10/-.

INFRARED PHONES

Complete with speaker, 10 ft. lead, £5. 1 lb. in a 10 lb. box. Price £1/6/-.

18 ft. lead. £1. Price 3/- each. Post 1/6.

SWITCHBOARD

SWITCHBOARDS. Special in Carrington. £5. Complete with PEPPER. £12/6 each. Post N.W. 4k. Int. 4/-.

VALVES BRAND NEW

SOUL VALVES. Brand New. 3000 Psi. £5/15/.-

SOUND PROJECTORS

Simple Taper 10 lbs. £3/6.-

SWITCHBOARD


TELESCOPES

“ASTRONOMICAL” QUALITY. Complete with General and Marine. Use for aviation, hunting, spotting, photography, marine. Use, etc.

SOLD BY WHOLESALE. No. 1. £37/10/- each. Post £3/6.-

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“ASTRONOMICAL” QUALITY. Complete with General and Marine. Use for aviation, hunting, spotting, photography, marine. Use, etc.

SOLD BY WHOLESALE. No. 1. £37/10/- each. Post £3/6.-

ON ALL ARTICLES.

DEITCH BROS.

70 OXFORD ST., SYDNEY

DEIRBY NO C.O.D.

Radio, Television & Hobbies, March, 1964

102
supplied to those who enrol in the course on 11730 and 9525 Kc, as well as in other
The setting up of the Ascension Island
Atlantic. Contracts have now been let with
Hilversum, Holland.
program approved by the British Govern-
improve B.B.C. programs in these two con-
B.B.C. London on its new relay base to be
overseas service ran a special course to
stations overseas.
B.B.C. programs to Africa and South
Commission short wave relay station, in
Penh, increased power to 50,000 watts, and
has been released re-
world.
last year Radio Nederlands in their
tion being heard through the Melbourne
ated by A.B.C., has been verified following
illgan, DXBC (630) Butuan, DXCD (590)
station network includes DZHP
Abello, the Chief Engineer of Radio DXMT.
mid-night in the Philippines, reports Mr Jose
FROST index sets are
the flag of the Uzbek Republic in colour.
1200-1230 with a repeat at 1400-1430 on
for children and adults, and is a great hit.
the Family and final transmission 0430-
our Australian listeners
frequencies of 1150 and 1250 are only
broadcast band frequency of 1250 Kc for
North America, and these will also give
FROST Twist Drills are designed to drill the toughest
when combined with a portable power tool.
thesexy index sets (1/4"") are available in five sizes, and
algeria will make an indispensable unit for the workshop. Ask to
see them at your local hardware store.

LITTLE BUDGET PROGRAMS

RADIO TAHITI
Details on the transmissions of the Radio
Tahitien programs in English, broadcast from
Tahiti in New Zealand, are given in the,
U.S.S.R., have been found.

BUDGET PROGRAMS

TOUGH HOLEs CALL FOR TOUGH DRILLS
Tough! I say they are, the
drills in FROST index sets are
maximum sharpness and the highest
quality HIGH SPEED STEEL
Power for the world-wide
FROST H.S.S. Twist Drills are
designed to drill the toughest
of metals and are unequalled
when combined with a portable power tool.
These handy index sets (1/4"") are available in five sizes, and
algeria will make an indispensable unit for the workshop. Ask to
see them at your local hardware store.
FROST SPECIFY
HIGH SPEED TWIST DRILLS MADE IN AUSTRIA

PHILIPPINES—Two interesting confirma-
tions have been received from
Philippines, in the past month, DYVP in Cebu
City and DXMT in Davao.

Station DXMT on 900 Kc. with 1,000
watts uses the slogan "The Sound of the
City" and is owned and operated by Radio
Mindanao Network Inc., and has stations in
the S. E. Philippines.

Station DXMT (1130) has increased its
broadcasts, and has given in metres, 261 and 240 metres. The
relay station, and if it is as strong as the
250 Kc signal in this country, it should
give reception throughout a wide area
during darkness. It is presumed the
station is located in Siberia, so as to
the 1250 Kc relay transmitter.

RADIO BUDGET

Radio Budapest, Hungary, has increased
its transmissions to five in its service to
North America, and these will also give
good reception in the South Pacific during
winter months. The station uses three
frequencies: 6234, 7215 and 9835 Kc.
and has given the details on the
stations of the B.B.C. External Ser-
Mexican, and has been forwarded by Robin Scattergood of
Everett, Wash. A mailbag session on
the first Wednesday of each month, included
a mailbag session each Saturday, with con-
fer and literary and musical programs on
the English service, and is a great hit.

RADIO SOUTH AFRICA

The English transmissions are heard at
Dar-es-Salaam, has announced that
a new aerial system to ensure that the signal
given in metres, 261 and 240 metres. The
relay station, and if it is as strong as the
250 Kc signal in this country, it should
give reception throughout a wide area
during darkness. It is presumed the
station is located in Siberia, so as to
the 1250 Kc relay transmitter.

THE VLX NOW 50 KW

The VLX transmitter operates as: VLX9
0300-0500 3251, 4945, 6150.
0505-0705 4810, 6005, 9650.
1540-1825 4810, 6005, 9650.
1545-1730 4895, 6095, 9525.
1715-2200 4895, 6095, 9525.
1725-2115 3320, 4810, 6005.
0705-1540 6005, 7230, 9650.
0430-0515 3370, 4895, 6095 Kc.
1000-1650 15155, 17885.
1600-1715 4945, 6150, 9720.
1725-2115 3320, 4810, 6005.
0330-0400 7270, 9525.
0400-0500 3251, 4945, 6150.
0515-0730 4895, 6095, 9525.
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1650-1830 11900, 15155.
1715-2200 3251, 4945, 6150.
1540-1825 4810, 6005, 9650.
1545-1730 4895, 6095, 9525.
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1600-1715 4945, 6150, 9720.
1725-2115 3320, 4810, 6005.
0300-0500 3251, 4945, 6150.
DENMARK has altered the schedule of its transmissions to North America and has retained one of its services for evening receptions in this area for one for morning listening. The new service is from 1200-1300 G.M.T. and is on 15165 Kc. The station broadcasts from studios at 5960 Kc. The station broadcasts from studios at 1545-1745 on 5960, 2200-0215 on 11720 Kc. The station broadcasts from studios at 2000-2145 is beamed for listeners in the northern Pacific area.
BULK ERASER

G.R.C. (Chatswood, N.S.W.) writes to say that the report by J.F.B. in the October 1963 issue was interesting and challenging. The Bulk Eraser could be made to plug into a standard can recorder in place of the normal erase head. He adds that the Bulk Eraser seems to be suffering from some personnel...
NEW ENGLISH MAZDA TRANSISTORS


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These new Resistors (mainly I.R.C.) and Condensers include many popular values. The condensers are paper, mica and ceramic, some are older types and shop soiled.

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NEW 8" and 4" EXTENSION SPEAKERS

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6in 45m Per Mag Heavy 4/6 7/6

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Speaker Transformers for above

6/5 or 7/10/.

NEW GARRARD RECORD CHANGERS

These new English Gendwm changers with high field magnetism and precision single gramaphone pickup have been introduced. We are offering these at LESS THAN HALF PRICE.

PORT AND PACKAGING EXTRA.

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NEW ACOS PICK-UP FOR 7IN RECORDS

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Radio, Television & Hobbies, March, 1964
The purpose of this publication has been to group together technical information on all brands of sets in a form which proves most useful in servicing. In most cases these are reprints of the manufacturer's original service sheets published by special arrangement. A large number of circuits are accompanied by coded chassis layout, photographs and waveforms. Provision has been made for the publication of every new circuit as the manufacturer makes it available and, at present, two or three supplementary issues have been made since the publication of the new small size edition. These are available at a small cost which is more than offset by time saved in any service operations.

Our copy was received from the Australian TV Circuits with supplementary information. The fifth chapter deals in detail with the subject being comprehensively covered in all, there are 15 chapters, including one devoted to the mathematics by which digital systems are designed or developed, circuits, and servicing equipment, together with discussion on aerials, power supplies and interference suppression. Further chapters cover workshop organisation and servicing equipment, together with factory plans.

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