SPECIAL

APPLICATION INFORMATION

FOR OWNERS OF RCA RADIO TEST EQUIPMENT

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BULLETIN No. 1

THE RCA RIDER CHANALYST

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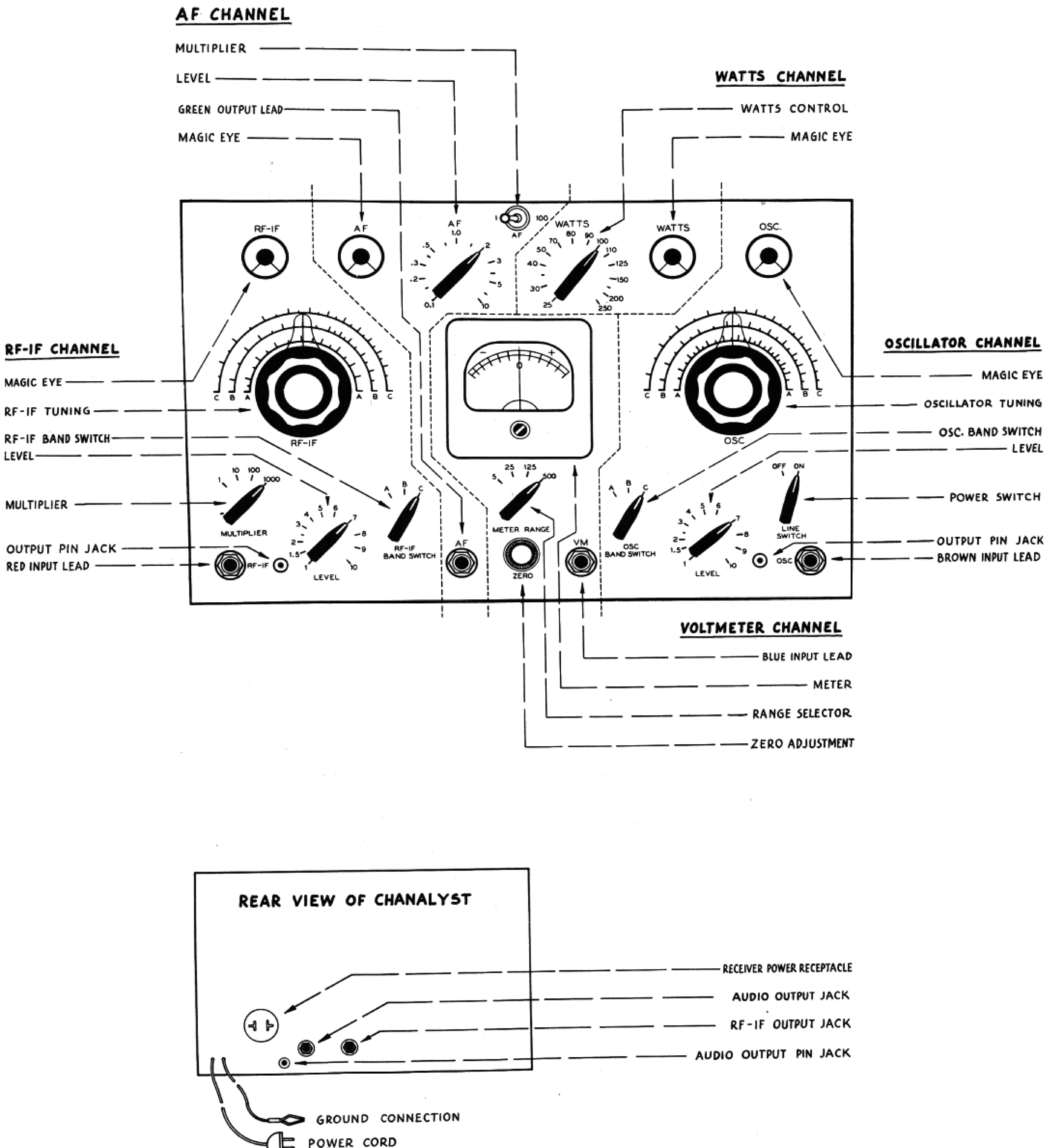

FIG. 1

INTRODUCTION

The RCA Rider Chanalyst is a basic and fundamental piece of test equipment because it operates on the incoming signal. With it the path of the incoming signal can be traced from the antenna to the loudspeaker. The gain per stage can be measured through the RF, IF and audio stages and the signal can be checked for the presence of noise, hum, or distortion in every circuit of the receiver. It can also be used to measure the oscillator strength and frequency; to measure all DC operating and control voltages (including AVC and AFC voltages); to measure the power in watts drawn by the receiver from the power line; to make accurate alignment adjustments easily and quickly when "rocking" the tuning condenser is specified; and is IDEALLY SUITED TO LOCATE THE TROUBLE IN AN INTERMITTENT (OR CUT-OUT) RADIO RECEIVER. It is the purpose of this publication to describe each of these applications in detail so that the Chanalyst may serve its owner to the fullest extent.

Figure 1 shows front and back views of the Chanalyst with all controls and indicators clearly marked. Figure 2 is a typical radio receiver schematic diagram with arrows pointing to the various points in the different circuits where tests can be made. References will be made to this schematic diagram in the following instructions which deal with specific applications of the Chanalyst. Figures 3, 4, 5, 6 and 7 show in block diagram form the essential units of each of the five channels.

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THE RF-IF CHANNEL

As will be seen in Figure 3 the RF-IF channel input circuit consists of the common ground lead and an input probe having a 1 mmfd. condenser built into its tip. The ground lead is clipped to the receiver chassis at all times and therefore it is only necessary to move the one input probe from place to place in the receiver circuit when making tests using the RF-IF channel. Due to the 1 mmfd. condenser in its tip the probe can be touched to grids or plates of tubes without detuning the circuits or affecting their operation to a noticeable extent. The signal picked up by the probe then goes through the multiplier and level controls and into a three stage tuned radio frequency amplifier which has high sensitivity and selectivity and is tuneable from 90 KC to 1700 KC. The output of this amplifier is a diode rectifier from which the audio and DC components go to the RF-IF output jack on the back. The diode output also passes through a filter which removes most of the audio component but permits the DC component to pass through to the RF-IF magic eye. This DC component is also connected to the output pin jack mounted on the front panel.

THE OSCILLATOR CHANNEL

The oscillator channel, as shown in Figure 4, is very similar to the RF-IF channel. Its input circuit is identical and the same type of level control is employed. No multiplier is used and the amplifier is a one stage tuned radio frequency type covering the frequency range from 600 KC to 15,000 KC. The diode rectifier, filter, output pin jack and magic eye are similar to the ones used in the RF-IF channel and serve the same purposes.

THE AUDIO CHANNEL

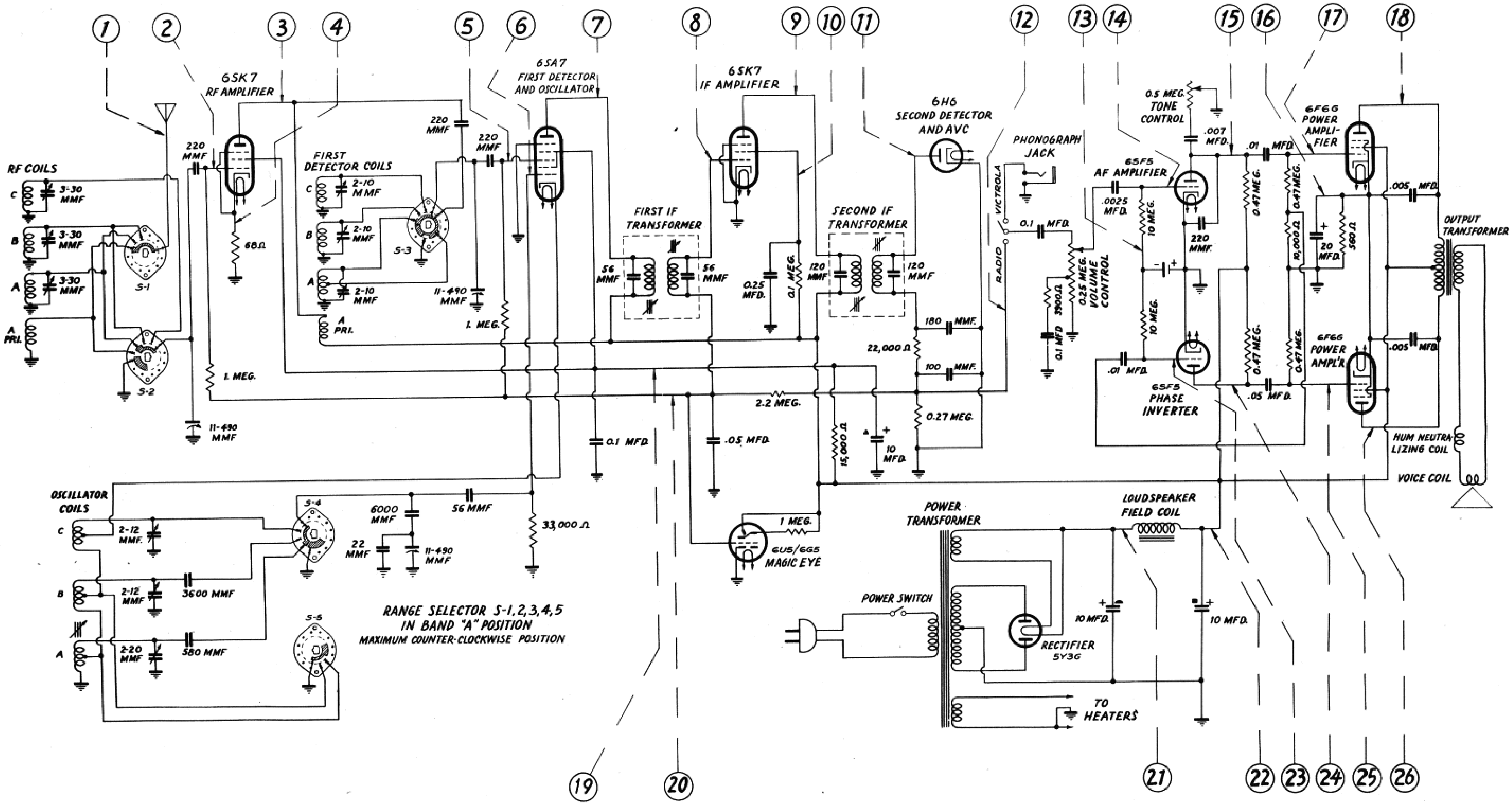
Figure 5 shows the audio channel. Its input circuit consists of the common ground lead and an input probe. This is the only probe in the Chanalyst which has no resistor or condenser built into its tip. The audio signal picked up by this probe goes through a 0.01 mfd. condenser (so that touching the probe to a grid or plate does not short circuit the bias or plate voltage) to the multiplier and level controls and then to a one stage audio amplifier whose frequency response characteristic is flat from 150 to 50,000 cycles per second. The amplifier output is connected to a closed circuit jack on the back from which the signal passes to a diode rectifier, a low pass filter, and then to the audio magic eye. When a plug is inserted in the jack it disconnects the diode rectifier, filter, and magic eye circuits from the amplifier output so that the rectifier will not cause distortion of the audio signal if it is being listened to with headphones or viewed with a cathode ray oscillograph. The output pin jack on the back is connected to the internal contact of the closed circuit jack and is used for connection of the extension jack supplied with the Stock No. 9798 rack mounting adaptor.

THE VOLTMETER CHANNEL

In Figure 6 is shown the DC voltmeter channel. Its input circuit consists of the common ground lead and an input probe into the tip of which is built a one megohm resistor. The lead from the input probe connects internally to ground through a ten megohm meter range resistor so that the total input resistance is eleven megohms at all times regardless of which meter scale is being used. Taps from the ten megohm meter range resistor go to a DC amplifier in whose output circuit the meter is connected. This meter is really a milliammeter with a zero center voltage scale marked on its dial. The voltmeter zero adjustment knob controls the plate current of the DC amplifier tube.

THE WATTS CHANNEL

As will be seen in Figure 7 the watts channel employs a current transformer connected in series between the main power cord and the power receptacle on back. The voltage output from this current transformer passes through the watts control to a diode rectifier and then to the watts magic eye. Calibration markings in watts are located around the watts control knob.



RF COILS
3-30 MMF
A PRI.
S-1
S-2
220 MMF
6SK7 RF AMPLIFIER
68Ω
1. MEG.
11-490 MMF
FIRST DETECTOR COILS
2-10 MMF
S-3
220 MMF
11-490 MMF
1. MEG.
6SA7 FIRST DETECTOR AND OSCILLATOR
OSCILLATOR COILS
2-12 MMF.
2-12 MMF
2-20 MMF
3600 MMF
580 MMF
S-4
S-5
6000 MMF
22 MMF
11-490 MMF
56 MMF
33,000 Ω
RANGE SELECTOR S-1,2,3,4,5 IN BAND "A" POSITION
MAXIMUM COUNTER-CLOCKWISE POSITION
FIRST IF TRANSFORMER
56 MMF
0.1 MFD.
6SK7 IF AMPLIFIER
0.25 MFD.
0.1 MEG.
.05 MFD.
2.2 MEG.
6U5/6G5 MAGIC EYE
1 MEG.
SECOND IF TRANSFORMER
120 MMF
6H6 SECOND DETECTOR AND AVC
180 MMF.
100 MMF.
22,000 Ω
0.27 MEG.
15,000 Ω
10 MFD.
PHONOGRAPH JACK
VICTROLA
RADIO
0.1 MFD.
0.25 MEG. VOLUME CONTROL
3900 Ω
0.1 MFD
.0025 MFD.
6SF5 AF AMPLIFIER
10 MEG.
0.5 MEG. TONE CONTROL
.007 MFD.
220 MMF.
.01 MFD.
6SF5 PHASE INVERTER
0.47 MEG.
10,000 Ω
20 MFD.
560 Ω
.05 MFD.
6F6G POWER AMPLIFIER
6F6G POWER AMPL'R
.005 MFD.
OUTPUT TRANSFORMER
HUM NEUTRALIZING COIL
VOICE COIL
POWER TRANSFORMER
POWER SWITCH
RECTIFIER 5Y3G
LOUDSPEAKER FIELD COIL
10 MFD.
TO HEATERS
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FIG. 2

RECEIVER POWER CONSUMPTION MEASUREMENT

The radio receiver under test should be plugged into the power receptacle on the back of the Chanalyst and the watts control knob should then be rotated until the watts eye is just exactly closed. The setting of the watts control knob now shows the power in watts which the receiver is drawing. This is a very useful test to make because it shows immediately the approximate condition of the receiver's power supply units including power transformer, rectifier tube, filter condensers, filter reactor, etc. The manufacturer's service notes usually show the normal power consumption which should be used as a guide in making this test. When the receiver is normal the power consumption measured in this manner should be within plus or minus 10 per cent of the value given in the service notes. When trouble exists in the receiver's power supply units the reading will usually deviate from that given in the service notes by much more than plus or minus 10 per cent.

SIGNAL TRACING AND GAIN MEASUREMENTS

If the radio receiver does not operate at all the signal picked up by the antenna is going part way through the receiver and at some point in the circuit, due to trouble, it stops. Also if the received signal is weak, one or more of the amplifying circuits are not amplifying the incoming signal by the normal amount. If either of these two conditions exists tracing the path of the signal through the receiver and measuring the gain of each amplifying stage will quickly and accurately show in what circuit the trouble exists. In the receiver whose schematic circuit diagram is shown in Figure 2 the principal test points are marked with numbered arrows. Use a suitable test oscillator and feed a 600 KC signal (modulated with 400 cycle audio) to the antenna and ground terminals of the receiver. Connect the Chanalyst ground lead to the receiver ground and the RF-IF probe to the antenna. Turn the RF-IF multiplier and level controls to position (1), the RF-IF band switch to position B, and the RF-IF dial to the position which gives maximum closing of the RF-IF magic eye. (This will be at approximately 600 KC on the dial depending on the accuracy of the test oscillator's dial calibration). Now tune the receiver to the test oscillator signal (600 KC) until maximum receiver output is obtained. If the receiver does not operate move Chanalyst RF-IF probe to (2) and tune receiver until maximum closing of the RF-IF magic eye is obtained. If necessary during these adjustments raise or lower the test oscillator output so that the RF-IF magic eye is partially closed but do not let it overlap since the tuning then becomes too broad.

Now put the RF-IF probe on (1) and adjust the test oscillator's output voltage until the RF-IF magic eye is just exactly closed. Move the probe to (2) and adjust the RF-IF level control until the magic eye is once again just closed. The ratio of the two settings of the level control represents the receiver's gain between points (1) and (2). If the magic eye does not overlap when the probe is moved to (2) it indicates a loss between points (1) and (2). In a similar manner the probe can be moved to points (3) and (5) and the gain or loss measured between these various points. In some circuits the gain will be great enough so that rotating the level control to position 10 will not bring the magic eye from the overlapped position to the closed position. When this is the case the multiplier should be turned to position 10, 100, or 1000 as necessary so that the magic eye will be just closed when the level control is rotated. Under such circumstances the settings of the multiplier and level controls should be multiplied together and their product used for all gain measurement work.

When making measurements at points (7), (8), (9), and (11) the Chanalyst must be tuned to the intermediate frequency. During all these measurements AVC voltage will reduce gain. When a strong signal from the test oscillator is used a high AVC voltage will be developed which will reduce the gain.

Gain measurements made in the second detector and audio circuits at points (12), (14), (15), (17), (18), (23), (24), (25), and (26) must be made with the audio channel. This is done in a similar manner to the RF and IF measurements just described except that the audio channel has a frequency response which is flat from 150 to 50,000 cycles per second and therefore does not have to be tuned to some particular frequency, which is necessary when making RF or IF measurements. The audio probe is simply touched to different points in the circuit and the multiplier and level controls adjusted at each test point until the AF magic eye is just exactly closed. At each test point the setting of the multiplier and level controls must be multiplied together. The product of this multiplication gives the attenuation for that particular test point. The ratio of the attenuation for any two given points is the gain between these two points.

It has always been difficult to properly test the action of a phase inverter circuit through the use of ordinary test equipment. Any defect in the phase inverter tube or its associated circuit will result in the push pull output stage being unbalanced which will produce distortion at high volume levels. With the Chanalyst, measuring the signal level at points (17) and (25) will show immediately and accurately whether the phase inverter circuit is normal or not.

OSCILLATOR FREQUENCY CHECKING

Improper receiver operation is sometimes caused by the local oscillator operating on the wrong frequency caused by improper alignment, shorted turns in the oscillator coil, or other circuit defect. The oscillator frequency can be quickly checked with the oscillator channel of the Chanalyst. Touch the oscillator probe to (6) and rotate the band switch and dial until the magic eye closes as far as it will go. If necessary turn the level control so that the magic eye does not overlap because this would cause broad tuning. The channel is now tuned to the receiver oscillator's frequency which can be read directly on the dial of the oscillator channel. During alignment of short wave receivers this test will tell to which side of the incoming signal the oscillator is tuned.

NOISE, HUM OR DISTORTION TESTS

If a radio receiver is noisy (caused by some internal trouble and not by picking up outside noise), has excessive hum, or distortion the Chanalyst will quickly locate the particular circuit in which the trouble exists thereby saving much time in locating the specific trouble. Listen-in with a pair of crystal headphones plugged into the AF jack on the back of the Chanalyst. By touching the AF probe to points (12), (14), (15), (17), (18), (23), (24), (25), and (26) it is now possible to listen-in to the signal at all these points in the second detector and audio circuits. The multiplier and level controls should be adjusted to keep the signal at a low level and thus avoid overloading the audio amplifier within the Chanalyst which would cause distortion. No "overlap" of the eye is a good guide to prevent distortion. When the signal is listened to at a point ahead of the source of trouble the signal will be normal and when it is listened to at a point beyond the source of trouble the defect (noise, hum or distortion) will be present. Therefore, tests at a few points will narrow down the source of trouble to one circuit or in some cases to the particular part that is defective. If trouble exists at point (12) it will be necessary to listen-in to the signal in the RF and IF circuits. To do this remove the audio input cable from the audio input jack on the front panel of the Chanalyst and plug into this jack one end of a special cable which should be made up locally for this purpose. Plug the other end of this special cable into the RF-IF output jack on the back of the Chanalyst. This special cable should be a single conductor shielded wire with a standard telephone plug on each end. The wire should be connected to the tips of the plugs and the shield connected to the sleeves of the plugs. The RF-IF probe can now be touched to points (1), (2), (3), (5), (7), (8), (9), and (11) and the incoming signal listened-to at all these points. The RF-IF channel must also be tuned to the proper RF or IF frequency as the case may be. When using the channels in cascade in this manner the RF-IF multiplier and level controls should be adjusted so that the RF-IF magic eye is just exactly closed at all times, the audio multiplier on position 1, and the audio level control on position 1.

If the cause of excessive hum is to be located (caused by open filter condensers, shorted filter choke or other defects) it is possible to listen-in using only the audio channel at points (10), (19), (21), (22), and at all other points in the circuit where supply voltages are present and in this manner determine exactly how much hum is present at all these points. When doing this no signal should be tuned in on the receiver.

DC VOLTAGE MEASUREMENTS

After the Chanalyst is turned on and thoroughly warmed up the zero adjustment knob of the voltmeter channel must be turned until the meter reads zero. The DC electronic voltmeter can now be used to measure all supply voltages (such as plate, grid, screen, cathode, etc.) throughout the receiver. These voltages can be measured accurately at the tube sockets regardless of series resistance in the circuit (such as at point (15) where measurement is made through a 0.47 megohm resistor). The common ground lead must, of course, be connected to the receiver chassis and measurements are made by touching the voltmeter probe to the various test points. Since the meter is a zero center type with polarity marked on the scale it indicates whether the voltage being measured is negative or positive with respect to ground. Because of its extremely high input resistance the meter can also be used to measure voltages that cannot be measured with an ordinary high resistance voltmeter. Examples of such voltages are—bias cell point (13); AVC at bus points (12) and (20); AVC at grid points (2), (5), and (8); oscillator grid voltage point (6); AFC discriminator voltage and others. When connected to point (12) it makes an excellent output meter for alignment work. In addition MAXIMUM METER PROTECTION IS PROVIDED EVEN IF 500 VOLTS IS APPLIED TO THE 5 VOLT SCALE.

RECEIVER ALIGNMENT

The instructions given in the manufacturer's service notes should always be followed for all radio receiver alignment. When the place in the alignment procedure is reached where the service notes specify adjustment of the magnetite core within the "A" band oscillator coil at 600 KC while "rocking" the gang condenser the Chanalyst can be used to make this adjustment very quickly and accurately. Tune the test oscillator to 600 KC and connect it to the receiver's antenna and ground terminals. Tune the RF-IF channel to 600 KC, set its multiplier and level controls to positions 1, and connect the RF-IF probe to point (5). Turn the receiver's tuning condenser until the RF-IF magic eye is at its maximum closed position (if necessary reduce the voltage output from the test oscillator so that the magic eye does not overlap since this would cause broad tuning). Be careful not to touch the tuning condenser after this adjustment. Now connect the voltmeter probe to position (12) and adjust the oscillator coil's magnetite core for maximum reading of the electronic voltmeter.

TESTING AC-DC RECEIVERS

Many AC-DC receivers have one side of the power line connected directly to the receiver chassis. This connection often causes hum when testing with the chanalyst and may short circuit the power line if an external ground connection is used. The best way to eliminate these troubles is to use a 1 to 1 ratio power transformer (having separate primary and secondary windings insulated from each other) connected between the power line and the receiver.

SERVICING INTERMITTENT RECEIVERS

The Chanalyst method of locating the source of trouble in an intermittent (or cut-out) receiver saves a great deal of time because it permits continuous monitoring of the signal passing through the receiver at five different places at the same time. Plug the receiver into the power output receptacle on the back; tune in a test oscillator signal on the receiver; connect the RF-IF probe to point (5); connect the oscillator probe to point (6); connect the electronic voltmeter probe to point (12); and connect the audio probe to point (15). Tune the RF-IF channel to the frequency of the incoming broadcast signal and tune the oscillator channel to the frequency of the local oscillator within the receiver. Set the watts, multiplier, and level controls so that the RF-IF, oscillator, and watts magic eyes are just exactly closed and the audio magic eye just reaches the closed position on modulation peaks. The RF-IF channel is now monitoring the RF amplifier of the radio receiver; the oscillator channel is monitoring the local oscillator; the voltmeter channel is monitoring the IF output by reading the AVC voltage; the audio channel is monitoring the first half of the audio amplifier; the loudspeaker in the radio receiver is monitoring the second half of the audio amplifier; and the watts channel is monitoring the power supply unit of the receiver.

The radio receiver should now be let alone until its output becomes weak or it stops operating entirely as the case may be. When this happens DO NOT TOUCH THE RECEIVER OR THE CHANALYST but simply look at the magic eyes and voltmeter on the Chanalyst. Any magic eye, or the meter reading, which has changed indicates that the portion of the receiver which it is monitoring or some preceding portion has developed trouble. Therefore, when this first change in receiver operation takes place the Chanalyst shows in what particular portion of the receiver the trouble is located. The Chanalyst probes should now be moved to other test points in this portion of the receiver until the trouble is narrowed down to the specific circuit or part which is defective.

BLOCK DIAGRAM SHOWING THE FIVE SEPARATE CHANNELS OF THE RCA CHANALYST. THE GROUND CONNECTION IS COMMON TO ALL CHANNELS.

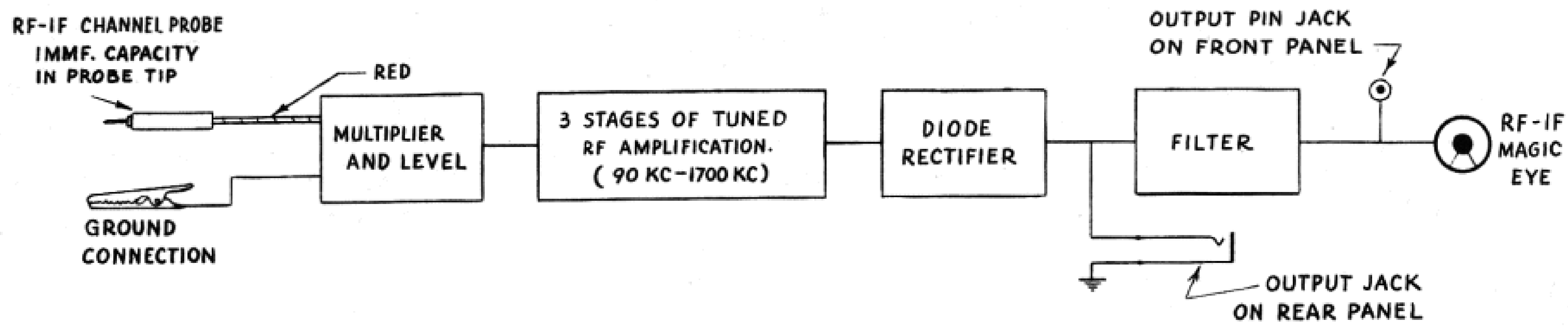


FIG. 3- RF-IF CHANNEL

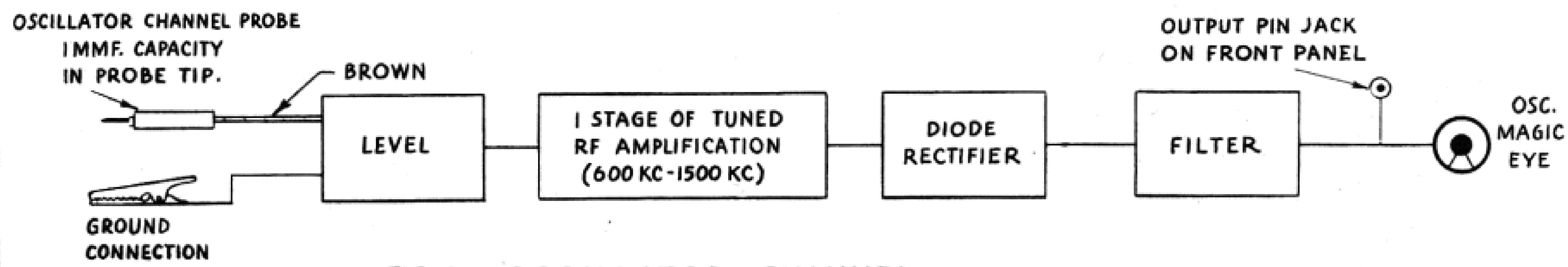


FIG. 4.- OSCILLATOR CHANNEL

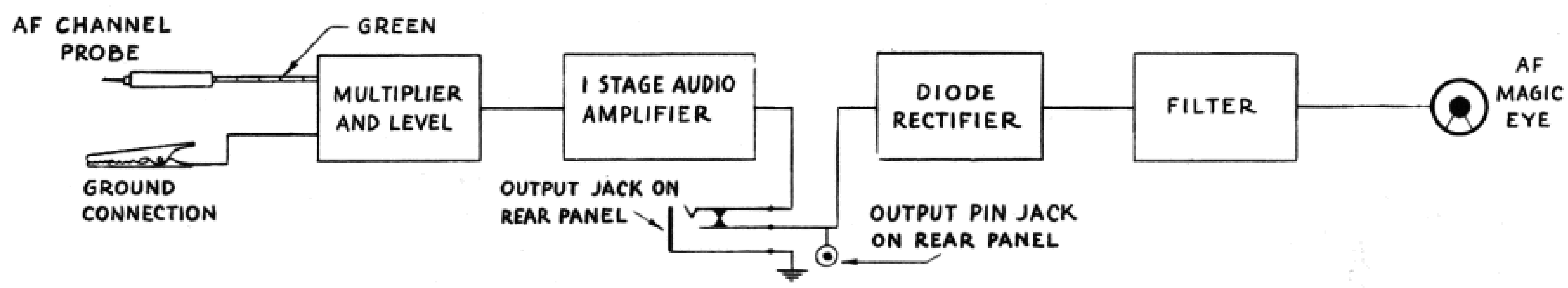


FIG. 5.- AF CHANNEL

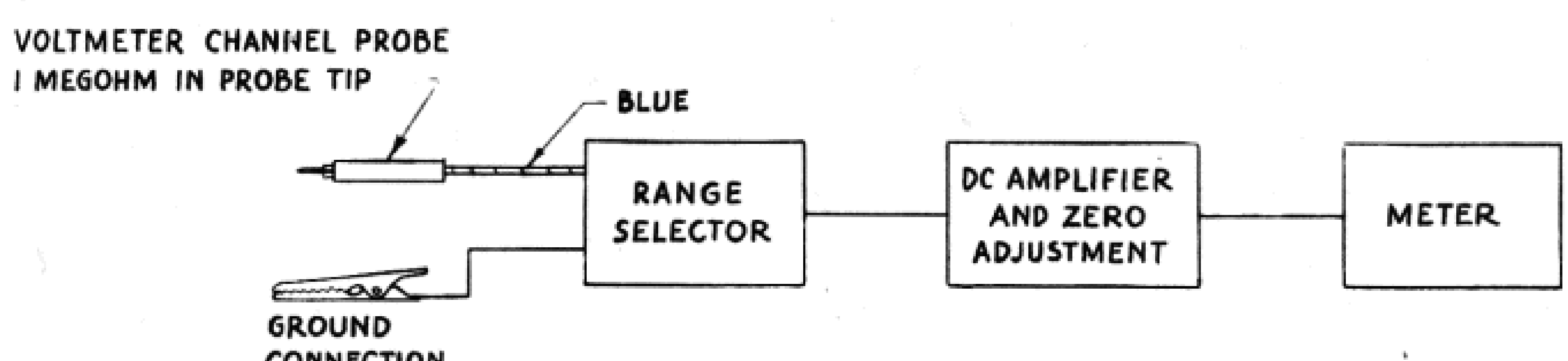


FIG. 6.- VOLTMETER CHANNEL

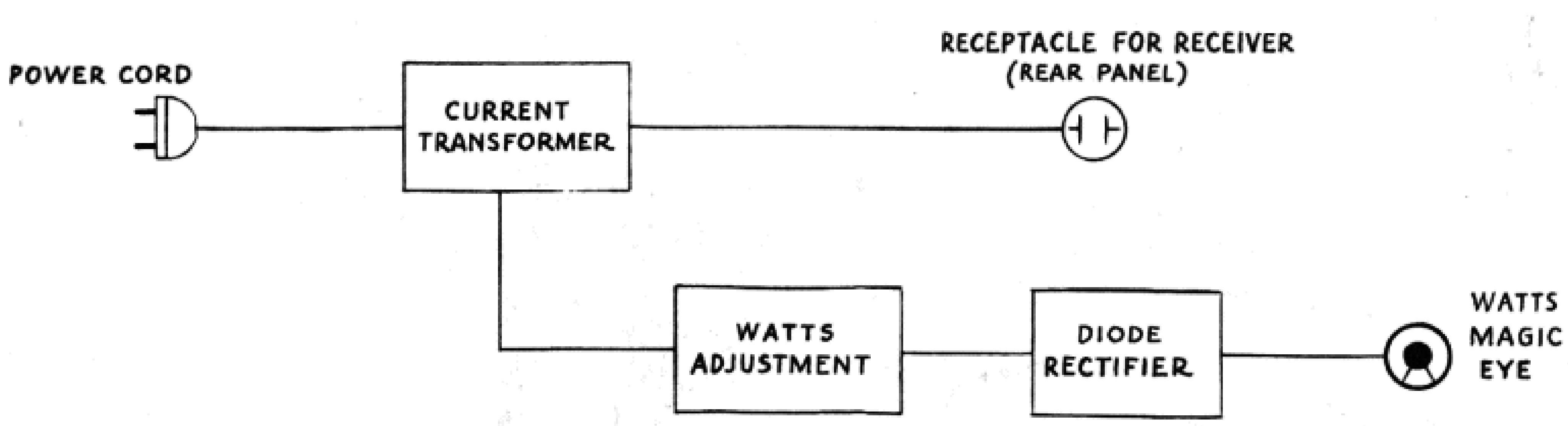
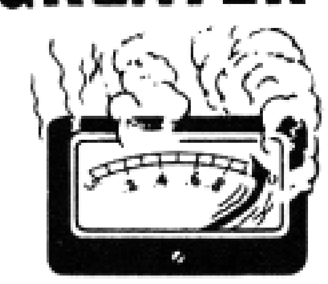


FIG. 7.- WATTS CHANNEL

Sensation OF THE INDUSTRY!..

and, so far, we've hardly even mentioned its GREATER METER PROTECTION!



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Not only is the RCA Junior Volt-Ohmyst one of the handiest, most versatile and amazingly efficient instruments on the market today . . . Not only does it pave the way for faster, more accurate resistance and both a-c and d-c voltage readings . . . Equally important, special protective features remove much of the danger of a costly meter burnout should you grab hold of more voltage than you had expected or accidentally check a "hot" resistor. Extremely rugged meter construction also guards against mechanical damage. This means that, besides giving you more for your money in the first place, this sensational little instrument *protects your investment.* What's more, the Junior VoltOhmyst will quickly pay for itself in the time it saves on a wide variety of jobs.

RCA Junior VOLTOHMYST

$34.95

Net Price Complete. Stock No. 165

A LONG-TIME INVESTMENT IN BETTER, FASTER WORK

The RCA Junior VoltOhmyst is a "junior" in price alone. In actual use it is an instrument that does a man's-size job *plus.* Costing only a little more than you'd pay for an ordinary volt-ohmmeter, it gives you Electronic Push-Pull operation with all the time- and trouble-saving features of the famous Rider VoltOhmyst circuits and with the addition of an isolated A-C Rectifier-type Voltmeter with 1000 ohms per volt sensitivity.

It measures d-c voltages with constant meter impedance of 11,000,000 ohms on all ranges. *This means a sensitivity up to 3,666,666 ohms per volt!* Yet it is extremely stable! It will not disrupt operation of sensitive circuits.

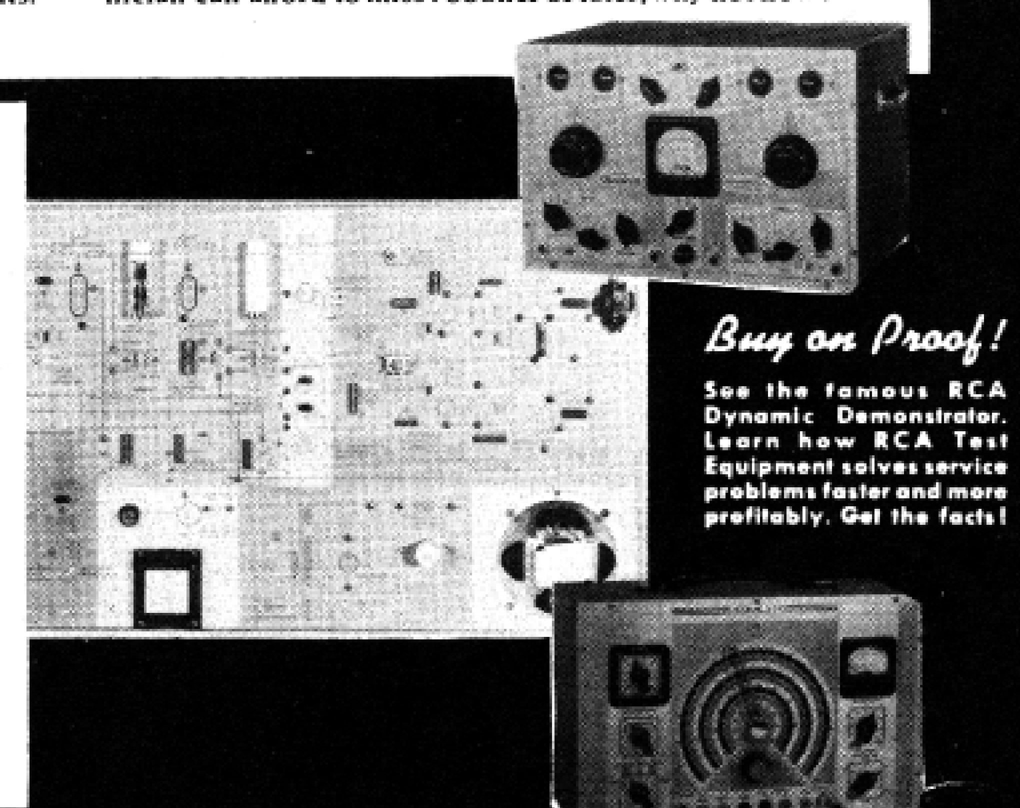
It has six full scale voltage ranges from 3 to 1000 volts and measures resistances from 0.1 to 1,000,000,000 ohms! It eliminates time-taking shorting of leads and zero re-settings when changing ohmmeter scales. One wide-spread ohms scale assures extreme accuracy and easy readability. In brief, the RCA Junior VoltOhmyst provides you with a quick, accurate and easy-to-use means of checking every conceivable A.V.C., A.F.C., FM discriminator circuit, or Oscillator Grid Voltage, *with the signal present,* checking bias cells or insulation resistance, obtaining practically any needed resistance and d-c voltage reading . . . as well as handling any a-c voltage checking job that might pop up in your work —at an absolute minimum price.

See it at your nearest RCA distributors—or write for bulletin. It is an instrument that no wide-awake technician can afford to miss! Sooner or later, why not now?

SOMETHING TO REMEMBER WHEN YOU BUY TEST EQUIPMENT

Although moderately priced, RCA Test Equipment is not built down "to a price." Instead, it is built up to a standard of efficiency—the highest in the field today. It is designed in the firm belief that the "cheapest" equipment any service technician can buy is the equipment which is quickest to pay for itself in the time it saves him, plus the extra jobs it permits him to handle. Moreover, RCA Test Equipment is built around the famous and pioneer Rider "Signal Tracing" system which replaces old-style, hit-or-miss service methods with a quick, systematic course of procedure. "Signal Tracing" has proved its tremendous value, not only to leading technicians, but to leading laboratories and manufacturing plants as well. It is your safest, surest road to faster, more accurate work with consequent greater profits—and the RCA-Rider Chanalyst, that originally made this system possible, is your "Open Sesame!" to its many benefits.

Not what you pay for your Test Equipment—*but what your Test Equipment pays you.* That's what really counts. And RCA's policy of "Minimized Obsolescence" protects your investment!



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