Instructions For Model 202 Signal Tracer

Grommes

PRECISION ELECTRONICS, INC.
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MODEL 202 SIGNAL TRACER

New all purpose signal tracer for speedy service of Radio, TV, Audio and Electronic Equipment. Checks all stages from antenna to speaker or picture tube.

Tests microphones, pickups, transformers, speakers, resistors, condensers etc.

Quickly locates intermittents, open circuits, hum, noise and distorted stages.

Both visual and aural tracing through the supersensitive indicator eye and built-in 5 inch speaker.

RF Probe contains amplifier-detector tube for extremely high gain and frequency response to 300 MC.

Audio channel has a three stage pre-amplifier featuring cascode circuit plus overall feedback.

Pre-amplifier channel is flat from 2 CPS to 300,000 CPS to indicator eye or scope output.

Three position attenuator provides accurate stage to stage gain measurements.

Gain control adjusts indicator eye and speaker sensitivity only.

Speaker can be shut off by voice coil switch.

Four position Selector Switch for selecting:
(1) RF Probe (2) Audio Probe (3) Special noise test with applied break down voltage (4) Wattmeter circuit for checking power consumption of set under test.

Substitution test speaker and output transformer permits direct connection to voice coil or output transformer by means of binding posts on front panel.

Plug-in type RF Probe and Audio Probe.

TUBE COMPLEMENT

6AB4	RF Amplifier-Detector (Inside Probe)
12AX7	Dual triode, 1st pre-amplifier stage, cascode connected
12AX7	Dual triode, 2nd & 3rd pre-amplifier stages
6V6GT	Beam power output pentode
6X4	Full wave rectifier
6E5	Indicator Eye
6AL5	Indicator Recifier

For use on 110-120 volts 60 cycles (off-on switch on back of watt control)

Signal Tracer Applications

Wattmeter

For use as a wattmeter, first set the Selector Switch to "watts" position. Since the amplifier section of this instrument is not required, reduce the

Gain Control to minimum position. The line cord plug of the unit under test should be plugged into the AC receptacle on the front panel marked "Wattmeter Load." Turn the Watts Control to maximum position. The unit under test should be turned on and allowed to reach operation conditions in a few seconds. Adjust the Wattmeter Control until the indicator eye has a narrow slot about 1/32" wide just before the sides of the eye close. Do not allow the eye to close and overlap. When you have the eye adjusted to this very narrow slot, read the power consumption in watts directly from the calibrated Wattmeter scale. Most manufacturers indicate the power consumption of their equipment in watts on their chassis label. Normal tolerance of plus or minus 10% should be allowed.

Valuable time saving tests can be made by use of this feature. Overload conditions in the voltage distribution circuits are immediately reflected in higher than normal power consumption readings. If you get a much higher than normal reading, immediately shut off the unit under test and check for a shorted by-pass screen condenser or a shorted filter or other shorted component to ground. Use of ohmmeter will quickly locate the defective item.

Some consideration should be given to the AC line voltage when using the wattmeter. Variations of line voltage will cause corresponding variations of wattmeter readings. The wattmeter circuit in the Model 202 Signal Tracer is calibrated for operation using a 117 volt line, since this is the average voltage normally found.

The useful range of this wattmeter will measure the power consumption of most radios and radio-phonograph combinations, as well as television receivers. On combination sets, the manufacturers chassis label indicates power consumption of the complete combination components operating simultaneously. If testing a single component, make allowances for the reduced power consumption of the single component being tested. An assortment of incandescent lamps can be used to test the wattmeter calibration by using different combinations of lamps. A variac or step-up transformer may be necessary to provide the 120 volt line voltage necessary to get correct reading from these lamps as they are rated at 120 volt line conditions.

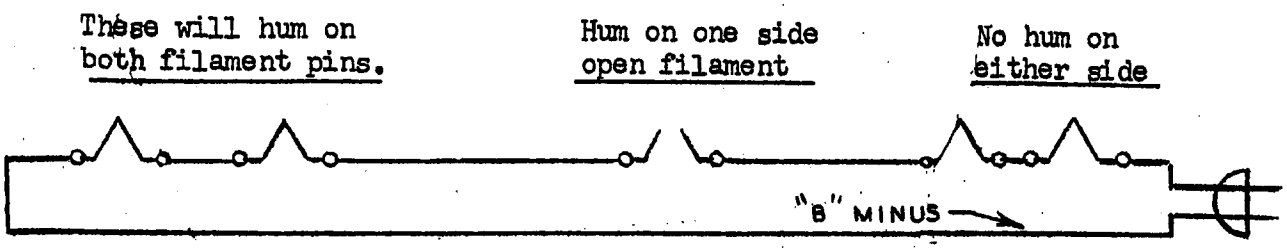
Signal Tracing Applied to a Typical Receiver

The first step, necessary in servicing all electronic equipment by any method, is to determine if the unit under test has current and is energized with the proper supply voltage. Of course, if there is a "dead short" in the power circuit or excessive overheating of any component, this obviously must be corrected before other tests can be of value; first to prevent damage to the equipment, and second to put it into some resemblance of the normal operating state. Tube filaments should have power. B plus should be present.

Note: In AC-DC circuits which have tube filaments wired in series, an open filament anywhere will keep all tubes from lighting. The Signal Tracer offers a speedy method of locating the defective tube filament.

Fasten the ground clip of the probe to the negative side of the filter condensers in the power supply and touch the probe tip to each of the tube filament connections in turn. (The Selector Switch is in the "Probe" position and the "Gain Control" is turned up slightly.) The tube with the open filament will cause a hum in the Signal Tracer speaker on one filament connection only. All other

tubes will either hum on both filament connections, or will not hum on either.



a. Once the power supply and filaments are known to be functioning, tune the set under test to a station. The Precision Electronics Signal Tracers are so sensitive that regular broadcast stations are recommended as a source of test signals.

b. If there is no apparent signal from the receiver speaker, you are only interested in locating at what point the signal is interrupted.

c. If the receiver output is weak, you will look for the stage where normal expected gain in signal strength does not occur.

d. If the receiver speaker sounds distorted, noisy or hums; you will look for the place where such irregularity first occurs.

e. Intermittent operation or distortion requires waiting until it occurs before proceeding. Further explanation later in this book.

To Operate the 202 Tracer

Turn the power switch "on" located on the back of the attenuator control. Plug in the RF Probe, set the selector to "Probe," attenuator to "X1," gain on full, and speaker switch "on."

As stronger signals are encountered, set the attenuator back to X10 or X100. The gain control is used for adjusting the speaker and eye and for levels in between the ranges of X100, X10 and X1. Strong signals cannot be controlled by the gain control alone, since they will overload the stage ahead of the gain control. The attenuator control located ahead of the pre-amp stages will prevent overloading.

Note: The ground lead on the RF Probe is purposely short. It may be necessary to move the ground clip to a convenient point on the chassis or B- as you progress through a large chassis or an added length of 12 inches or so may be added to make testing more convenient. This ground lead length is satisfactory when checking standard broadcast receivers for all RF, IF or Audio Frequencies. For high frequencies found in FM and TV, the ground lead length should be as short as possible.

Refer to Figure 1

With set on and tuned to a signal, proceed to check from the antenna stage through the output stage the grid and plate connections of each state until the point at which the signal becomes distorted or interrupted is located. Use a tube handbook to find tube base connection numbers for the various grid and plate pins, if you are unsure.

Figure 1 is practically speaking a standard AC-DC circuit, which will be often encountered in servicing. Minor differences may occur, but the signal tracing

technique remains the same.

Now we are going to take you through an AC receiver circuit at length to give you an analysis of circuit troubles and how to find them with the Signal Tracer. Figure 2 is a typical AC superheterodyne receiver chosenfor explanation.

After the power supply and tube filaments are functioning, we are ready to find the "genuine complaint" . . The principal signal test points are lettered consecutively in the order they are to be analyzed while following the signal pat

A resume of the faults that may be observed are listed for each test point, as well as the results that may be expected at each stage of the receiver.

Converter and Oscillator Circuit

Connect the ground clip to the chassis or B-. (You have turned the receiver"On" and ascertained the power supply is functioning, set the receiver volume control to a minimum, and tuned the receiver to where a strong local station is heard) Set attenuator to "X1" and Gain-on-full.

Touch the RF Probe tip to point "A" on the partial diagram, Figure 2a. A jumble of stations should be heard, depending on your location, of course.

Next touch point "B" Receiver dial may have to be rotated slightly to pick up the signal perfectly at this point. If the antenna system and the tuning condensers are functioning perfectly, the broadcast station may be heard clearly and with ample volume from the Signal Tracer speaker.

Lack of signal indicates an open or shorted to ground antenna coil or loop, a short-circuited tuning condenser (rotors touching stators), or a shorted shunt trimmer. Turning the dial may show a station signal elsewhere indicating a rotor-stator short at only one point.

A weak signal indicates an open tuning condenser circuit or trimmer, partially shorted antenna coil secondary, or an open .05 mfd AVC filter condenser.

Next place probe at point "C." No signal or a very weak signal is normal, but an appreciable signal shows the .05 condenser to be open.

Point "D". If signal is present, .1 mfd condenser is open.

Note: You may plug a scope or VTVM into the "scope output" jack if you wish to use a signal generator for signal input and an additional output indicator in addition to the eye.

Place probe back to "B". Adjust meter and listen to speaker to get a level for references. Now move probe to point "F," the plate or output section of the converter tube. A definite increase in signal strength and meter reading should be noted due to the normal conversion gain of the first stage and the signal tracer gain control will have to be reduced to a usable level.

No signal at point "F" where a signal was present at point "B" indicates: defective tube, open IF primary, shorted trimmer, no plate-voltage, shorted screen condenser or open cathode circuit to ground. A weaker signal than point "B" indicates: defective tube, open or misaligned IF primary trimmer, no screen voltage, leaky filter condenser, oscillator inoperative or misaligned, or partial fault in cathode

circuit. Distortion shows trouble with the screen bypass or filter condenser, again a defective tube or cathode circuit trouble.

Caution: Do not move alignment trimmer adjustments until all other sources of trouble have been thoroughly investigated and eliminated, as the cause of improper operation. Make sure the set has not been tampered with or circuits purposely changed.

Point "E" (stator of oscillator tuning condenser) is the next and very important test point. Hold probe at this point "E" and turn off receiver. Turn it on immediately and a "thump" heard in the Signal Tracer speaker shows that the oscillator circuit is working. A swing of the meter pointer will also be noted if you are using a VTVM as mentioned in the previous note, or if using the eye, it will flicker. Some practice is advised by the new-user on a set that is operating perfectly so that the thump and sudden swing be recognized in the future.

Point "G" no signal is normal, appreciable signal shows filter is open.

IF Amplifier and Second Detector

We are now progressing to the next diagram, 2b. Check signal at point "A", the IF amplifier control grid. No gain from previous point "F" or even slight loss is to be expected because the gain in the transformer may be less than 1. No signal indicates open or shorted IF transformer secondary or shorted trimmer. A weak signal indicates open or misaligned trimmer, partial open or short in IF transformer secondary, or open .05 mfd condenser. (Point "B").

Next check point "B". No signal is normal, appreciable signal shows open .05 by pass condenser.

Place probe at point "A". Adjust meter and speaker to get a reference level. Now check point "C". A good increase in signal is normal. No signal indicates: defective tube, shorted trimmer, shorted or open IF transformer primary, or no plate voltage present. A weak signal shows: defective tube, open or misaligned trimmer, partial open or short in transformer primary, low plate voltage, or trouble in cathode circuit.

Note: If the probe picks up a certain amount of unfiltered AC ripple from this B plus point, it is wise to hold the probe tip close to, but not touching the plate connection. This eliminates distortion from overloading the probe if present, but actually contacts the plate connection to check for gain in signal strength.

Next place probe at the detector diode, point "D". No gain or perhaps a slight loss is normal, because the transformer secondary is looking into a low impedance tube input. No signal indicates an open transformer secondary or shorted trimmer here. A weak signal here indicates a partially open or partially shorted transformer secondary, open or misaligned trimmer.

Signal at point "E" next should be about the same as point "D". Point "E" or AVC diode test shows how the diode coupling condenser is working. No signal means the condenser is probably open, thus accounting for no AVC action.

Some Tips on AVC

If no signal was present at point "E" there will be no AVC voltage because AVC voltage is derived from the rectifying or detector action of the diode portion

of the tube. The negative AVC voltage derived is fed back to the control grids of the previous tubes to supply them with controlled grid bias. Therefore, do not overlook the AVC circuit if a defective signal has been noted at one of these grids. Lack of, or too great an AVC bias voltage on the grid can cause distortion. Improperly filtered AVC due to defective condensers or resistors in the AVC circuit often result in a weak signal, oscillation, or distortion. By all means check the AVC circuit filter condensers and resistors for proper value.

Point "F" next, touch first point where the detected or audio signal appears. No signal indicates defective diode section of the detector tube, shorted condenser at volume control, open resistor at this point or open volume control. Distortion may be caused by a partially open or short condition in these components.

Point "G", the volume control is next. No signal indicates open resistor, or shorted by-pass condenser at this point.

Some Tips on Volume Controls

The signal reaches the first audio grid through the volume control. Since controls are a frequent source of trouble, it is advised that you always check the control for noise, roughness or opens which often cause distortion, blaring or intermittent operation. Place the probe on the arm contact of the control and slowly rotate the control through its full range several times. The volume should increase and decrease smoothly without breaks, scratch or noise. If not, replace the control.

First Audio and Output Stages

Refer to the next diagram, 2c, point "A", the arm connection of the control is explained above. Point "B", the first audio grid, has its level determined by the setting of the receiver volume control, with control on full, the signal will be as loud as point "D" previous, the detector diode. No signal would show the coupling condenser to be open. Point "C" any appreciable signal shows bias filter condenser is open.

Again take a reference level at point "B". Now place probe at point "D", the first audio plate. Substantial gain should be noted.

Note: Once you have been satisfied with the gain at point "B", you should then set the receiver volume control just high enough to get a good signal in the Signal Tracer speaker with the Signal Tracer Gain Control set fairly low. Otherwise, with the Signal Tracer volume control set at a high level to pick up a signal which has been greatly cut down by the receiver volume control, the Signal Tracer will amplify any hum present along with the weak signal. By setting the receiver volume control just high enough to over-ride any hum, the Signal Tracer can pick up a quality signal without hum.

No signal at point "D" shows: Bad triode section of the tube, no plate voltage, or open plate resistor. Weak signal indicates: poor tube or partially open plate resistor. Noisy signal indicates: poor tube, defective plate resistor.

Note: When checking with the probe in the audio section, a slight signal distortion is normal due to re-rectification of the signal. For quality tests, it is recommended that a condenser (from .01 to .1 mfd) be used in series with the hot tip of the audio probe.

Place the audio probe at point "E", the output amplifier grid. Signal should equal point "D". No signal indicates open coupling condenser at the first audio plate. Move the probe to point "F", the output amplifier plate, and a definite gain in signal should occur. No signal indicates: defective tube, shorted by-pass, open output transformer winding, open coupling condenser or no plate voltage supply. Weak or distorted signal shows: defective tube, lack of bias voltage, leaky coupling or by-pass condenser, partially shorted output transformer or shorted output transformer secondary. Too much signal at "G" indicates open filter condenser.

Now place probe at point "H", signal strength should be much lower than at point "F" because of low impedance condition. A weak or distorted signal indicates trouble in the speaker or output transformer secondary winding which is easily determined.

The Signal Tracer is an all around instrument that is so ingenious in its many and varied applications, it actually replaces the need for other servicing instruments. Many of our users tell us that a tube checker is not a necessity after they acquire a Signal Tracer. All elements of a tube can be checked while the tube is actually operating in the circuit for which it was designed, and the Signal Tracer gives an authorative result. It will easily detect a weak, gassy or noisy condition, loose elements, shorts, a non-oscillator or a low gain tube. No other tube testing method can possibly compare.

Alignment of FM Receivers

Alignment is the most important factor in the servicing of FM Receivers, because a receiver will function perfectly only when it is correctly aligned. Many manufacturers, in their service notes, consider the IF and Limiter alignment in an over-all procedure. The Signal Tracer is connected to the proper limiter grid circuit, the signal generator output is connected to the RF grid input of the converter or mixer tube. Turn on modulator on the RF generator. With these two instruments remaining in position, the very last IF transformer, including any between two cascaded limiters, is aligned first for maximum output. The speaker will be sufficient for this operation, but a VTVM can be used as noted before as an additional indicator in addition to the eye. The IF transformers ahead of the last stage are then aligned, working from the back to the front of the receiver in the same manner. The signal generator's output should always be kept at a minimum, to keep from saturating the limiters. If they do, the tuning adjustments will be very broad, and it will be difficult to find the true resonant position of the IF transformers.

Now move the Signal Tracer to the audio output of the discriminator. Tune the primary of the discriminator for maximum output. Then tune secondary for a null. This completes the alignment.

When tracing signals of very high frequency, such as FM, it may be necessary to slip spaghetti over probe tip to keep from loading the circuit.

Other Applications For Signal Tracer

A. Field strength meter. By use of TV booster worked with antenna under observation.

B. Checking electric blankets. Connect tracer to one side of line through a condenser and run up and down elements for no hum, which indicates an open circuit, or the presence of hum, which indicates the other side of the AC.

C. Noise detector. Connect crystal microphone to probe input; a valve manufacturer used this method to test the noise level of various valves. Eye indicates relative noise level. Also valuable in locating noise in automobile installations. Use extension cord on Signal Tracer and run probe up and down all wiring to find source of pickup noise. By-passing with various condensers will decrease noise to low level. For locating man-made noises, turn up gain on Signal Tracer and probe will act as noise locator in short order.

The versatility of the Precision Electronics Signal Tracer is such that its users are limited only by the ability and imagination of the operator.

Servicing Television Receivers With Signal Tracer

Television receivers, in their present state of development, are critical mechanisms that require accurately adjusted circuits if the maximum enjoyment is to be derived.

When the action of the picture tube is analyzed, it is found to be the recipient of voltages from four different sections of the receiver. They include:

1. Horizontal deflection circuits
2. Vertical deflection circuits
3. Video circuits
4. The power supply - both high and low voltage units.

Although the final image, as seen on the viewing screen, represents a combination of these four voltages, each voltage has certain definite characteristics that enables the viewer to identify the particular section at fault.

Horizontal Deflection Circuit

The purpose of the entire horizontal deflection system is to provide sawtooth voltages or currents that force the electron beam to move from side to side.

The synchronizing pulses contained in the incoming signal keeps the frequency of the horizontal deflection voltages at a value determined at the transmitter. Any distortion becomes immediately apparent on the viewing screen. The most positive indication of complete failure of horizontal deflection circuits is the appearance of merely a vertical line on the screen of the viewing tube. With the aid of the Signal Tracer, it is possible to locate the point at which the signal is interrupted.

Note: An oscilloscope can be connected to the scope output jack with the selector switch in "probe" position.

Usually, there will be at least two stages in the horizontal section, the oscillator and amplifier. Place the probe on plate of the oscillator tube. If the circuit is functioning, a high frequency whistle will be heard from the Signal Tracer speaker. Frequency of this signal is 15,750 CPS. If using a scope at this point, it will double check the eye indicator and prevent an error of omission, since some human ears cannot hear a frequency this high. If no signal, the components in this circuit should be checked.

Now let us assume that the oscillator is working. Place probe on the grid of the horizontal amplifier tube. If scope is used, a waveform similar to Fig. 4 will be observed. The voltage of the horizontal amplifier plate will be about 6,000 volts AC. Do not connect probe to this point. Instead, place probe near the plate

lead or near the fly-back transformer and the 15,750 CPS signal should be present n the Signal Tracer speaker. An increase in amplitude should be noted. Referring to fig. 5, this waveform was observed on the scope, by holding the Signal Tracer probe near fly-back transformer. The signal is radiated by the transformer.

Vertical Deflection System

Due to the similarity of the two deflecting systems, many of the defects arise in both. The only difference in the present case is that now the image is affected in a vertical direction. Start at the blocking oscillator or multivibrator oscillator and progress by stages toward the picture tube of the receiver. Place the Tracer probe on the plate of the vertical oscillator. If circuit is operating properly, an audio frequency of about 60 CPS should be heard through Signal Tracer speaker. As before, this can be observed on the eye of the Model 202 or on the scope. Refer to Fig. 6. This waveform represents the signal that is developed in the plate circuit of the vertical oscillator when using the scope in conjunction with the Signal Tracer. Next, place the probe on the plate, or near the plate lead of the vertical amplifier, the same 60 CPS signal should be heard from the Tracer speaker. Refer to Fig. 7. This waveform represents the signal on the scope at this point. Note that the amplitude is increased and the signal is inverted in polarity.

Video Circuits

When working on video circuits, do not lengthen the ground lead of the probe. Tune receiver to a station and advance the contrast control to near maximum. Place probe directly on plate of last video amplifier. A low frequency noise will be heard from Signal Tracer speaker. The vertical sync pulse and the video will be heard at the same time.

Fig. 3 shows waveform on the scope, when used with Tracer, at this point. The same procedure can be used on the preceding video stages, up to the video detector. The signal passing through the video IF amplifier is a radio frequency. The best results can be obtained by putting the probe across the cathode resistor of each stage, working from the video detector towards the front of the set. The cathode circuit is at a very low impedance and therefore using the probe will not detune the circuit. Approximately the same waveform as shown in Fig. 3 will be observed on the scope which MUST be connected to the Signal Tracer.

The Signal Tracer can also be used in the Sync Circuits. Place probe on plate of sync clipper, DC restorer, and sync amplifier. At each of these points, a low frequency sound should be heard through Signal Tracer speaker. This is a 60 CPS frequency. The audio portion of the TV receiver can be serviced with the data covering FM given previously.

A little experience and the use of a signal tracer will prove to be a big time saving device for servicing TV receivers. Even with the complex circuits found in these receivers, it is possible to single out the stage which interrupts the signal, in the shortest time.

Noise Locator

The ability to locate noisy and intermittent components in various circuits is a most useful and valuable feature of the Model 202 Signal Tracer. A DC voltage of

approximately 200 volts is applied to the Audio probe tip while the Audio probe ground clip is the return circuit for this voltage. When this voltage is applied to any component in the circuit, the action of the DC voltage is picked up and amplified in the Signal Tracer and displayed by a flickering of the eye or aurally by the speaker. Due to the proper internal resistance of the circuit, even a dead short between the probe and ground clip will result in not more than one mil current drain. This will prevent damage to the component under test.

When using the noise locator feature, the unit to be tested should be disconnected from the AC line, as these tests should be made on an inoperative unit. Set the selector switch to "noise" position. Use the Audio probe connected to the Audio Input Jack. A DC voltage of 200 volts is present at the probe tip, so take precautions to avoid the shock hazard even though it is relatively harmless due to the small current drain.

One example of the proper use of this feature is the checking of the components of an IF stage in the following manner. The ground clip is connected to a B plus supply point in the circuit under test. The probe is then applied to the plate terminal of the IF tube. The Gain Control of the Signal Tracer should be turned to near maximum position. As the probe is placed on the plate terminal of the IF tube, a sharp click will be heard in the Signal Tracer speaker. Proper circuit continuity and operation will cause a sharp, clean click to be heard. If some difficulty is present in the circuit, there will be a frying or crackling sound present in the test speaker.

The most important thing to remember about this test is that a good component will provide a clean, sharp click in the speaker while defective components, such as noisy resistors, cold or rosin soldered connections and shorted turns in IF transformers, will cause a characteristic buzzing or crackling noise.

This test can be applied to any component in the unit under test. Jiggling or prodding the component under test may show up a condition that is not apparent while stationary. When checking volume controls and variable condensers, rotating the controls will show up noisy conditions if they are present. Shorting of the rotor to the stator sections of variable condensers is instantly apparent when the rotor is being rotated with the external circuit wiring disconnected from the condenser terminals.

Transformer windings that are faulty will produce noise in the Signal Tracer speaker. Leakage from frame to windings and continuity of windings can be instantly determined.

These are but a few of the countless applications of this feature available to the user of the Model 202 Signal Tracer. Your own imagination and investigation should enable you to find many more time and money saving uses.

Test Speaker

A large percentage of service calls require the set to be removed to the shop bench. The difficulty of speaker removal and possibility of damage to the speaker cone during transit make the elimination of this part of the job very desirable. The use of the Model 202 Signal Tracer eliminates the necessity of speaker removal and reinstallation where a PM type speaker is used. The test speaker and output transformer in the Signal Tracer permits substitution of these items for those in the unit being tested. They are easily connected into the circuit by the binding posts on the front panel.

Output Indicator

The Model 202 Signal Tracer can be used as an output indicator by connecting the Audio Probe to some point in the audio system of the unit under test and adjusting the amount of gain until the eye indicator is almost closed. While making alignment adjustments, the eye will act as a very sensitive output indicator and indicate the amount of gain or loss caused by the adjustments being made.

Audio System

The audio system in the Signal Tracer can be used in the checking of FM tuners or other equipment requiring an audio amplifier and speaker. Phono cartridges, microphones, musical instrument pickups can be tested by connecting their leads to the Audio Probe and its ground clip.

Service

The 202 Signal Tracer is guaranteed for 90 days from the date of purchase. Fill out and return the enclosed card. If trouble develops, check all tubes. The 202 is serviced in the same manner as a high gain audio amplifier. You may return the 202 to the factory for service at any time. Send well packed in original carton to "Service Department" together with a letter of explanation. Send by Railway Express only. Service is free within the guarantee period; afterward a $5.00 charge, plus parts, will apply. For any additional information write to "Technical Service Department."

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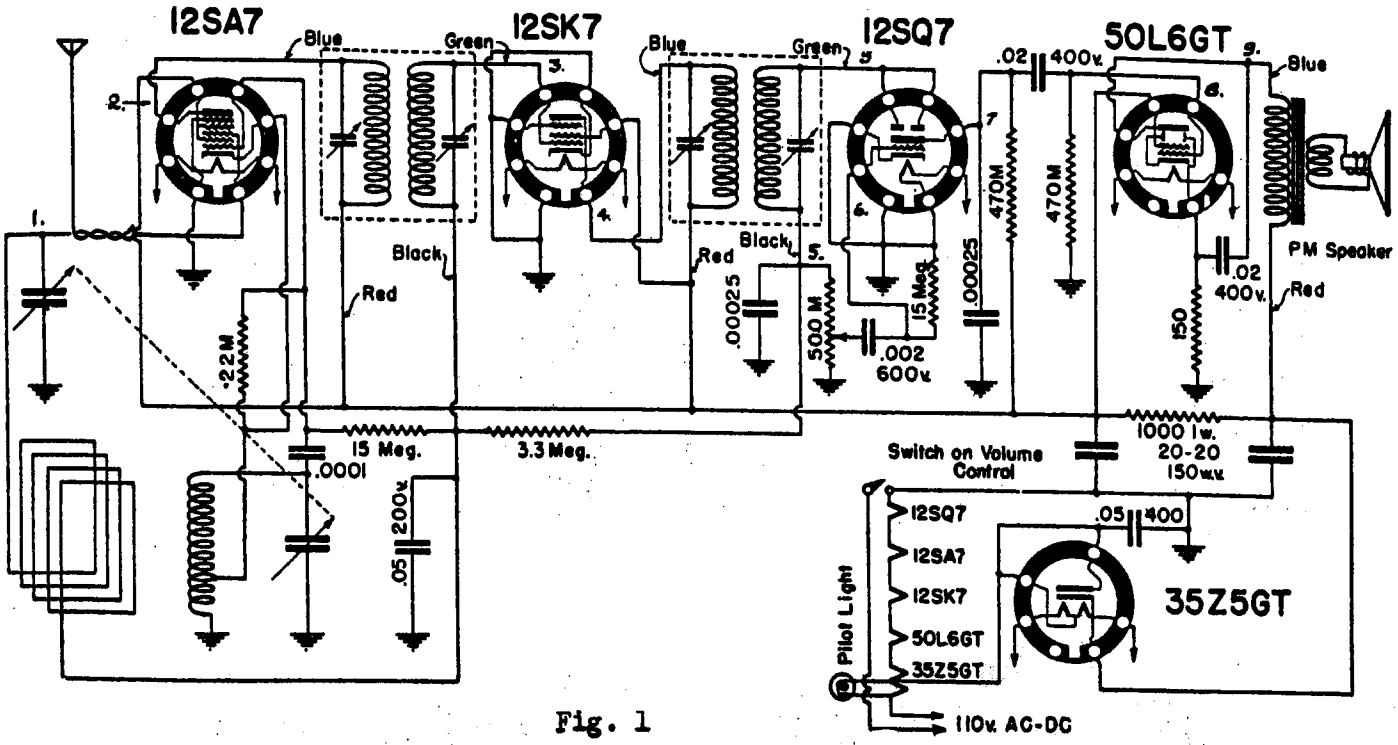

Fig. 1

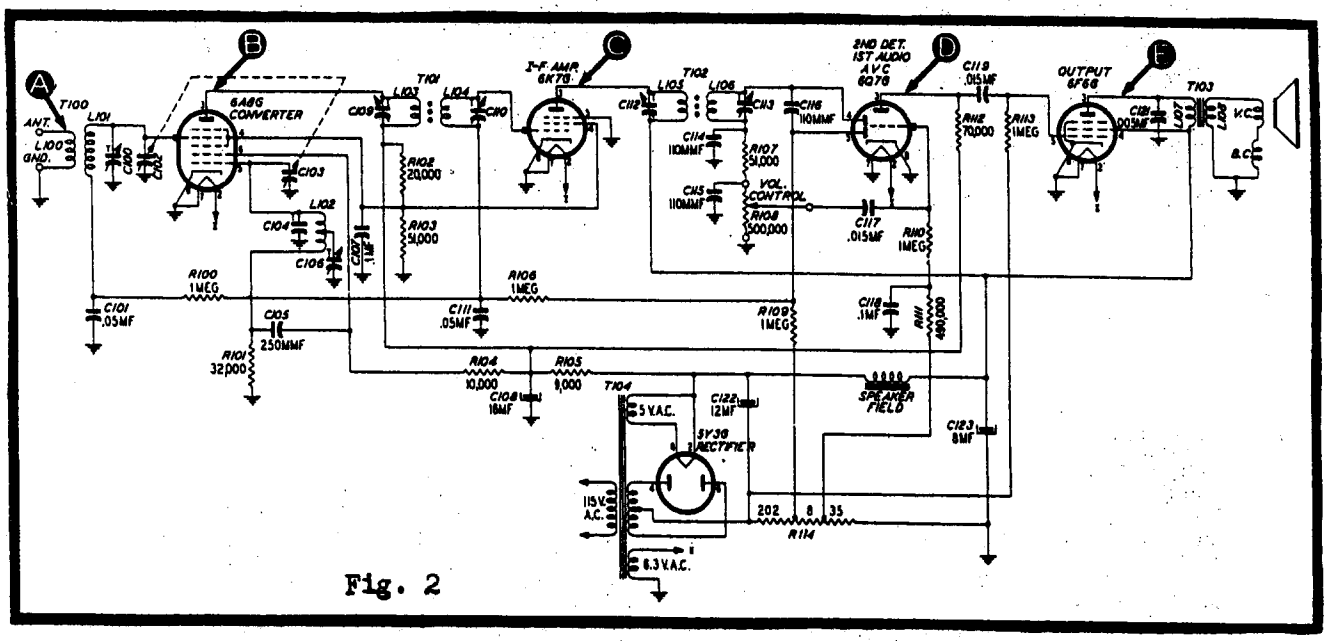

Fig. 2

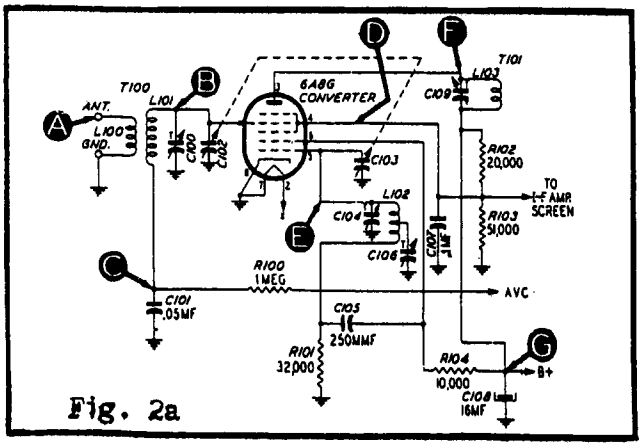

Fig. 2a

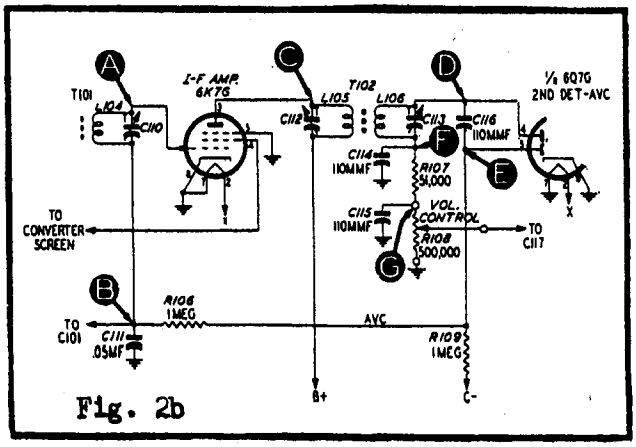

Fig. 2b

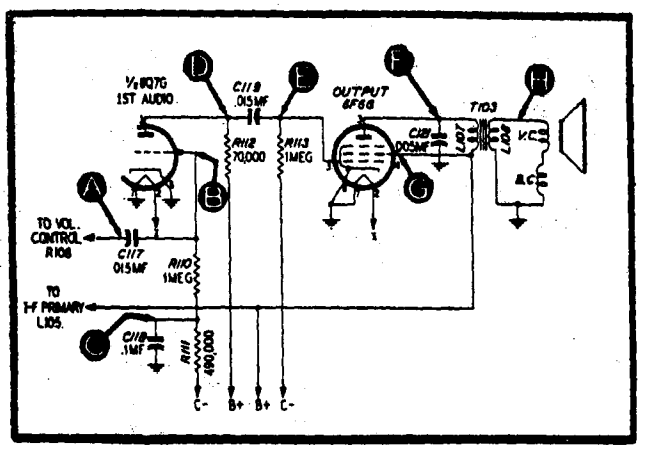

Fig. 2c

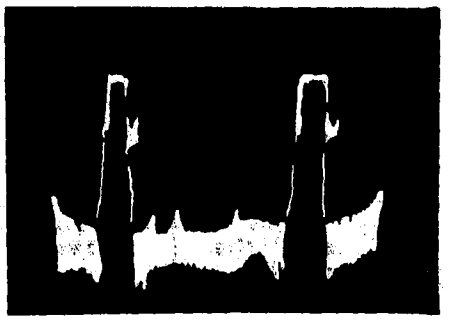

FIGURE 3

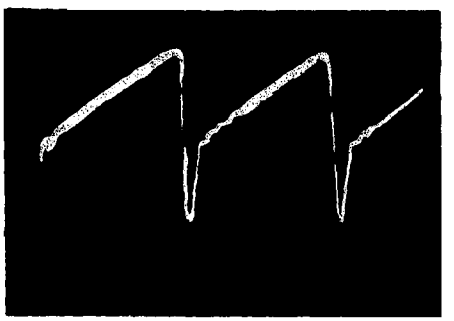

FIGURE 4

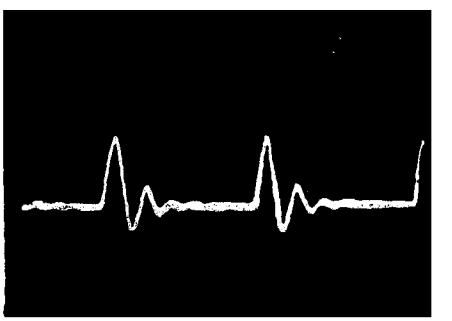

FIGURE 5

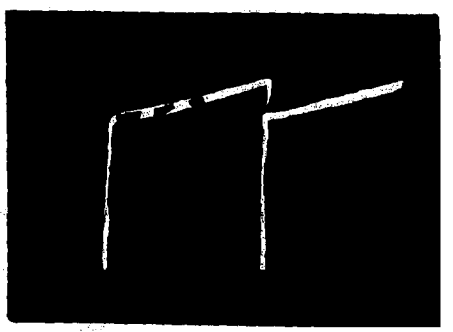

FIGURE 6

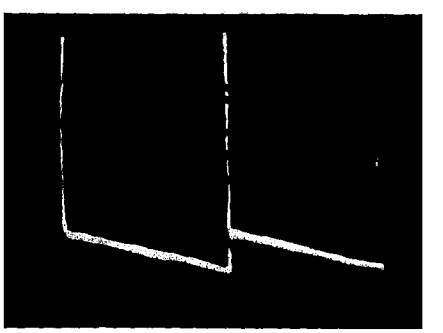

FIGURE 7

NOTES ON TEST EQUIPMENT

6AB4

Signal Explorer

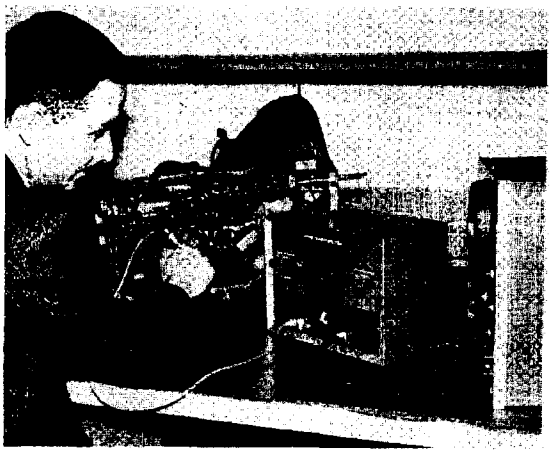

Fig. 4. Precision Electronics' *Signal Tracer* isolates audio, video troubles.

Where is most of your time spent when fixing a radio or TV set? It's not in the customer's home, nor in the mechanics of replacing a faulty part, to be sure. So the answer is, of course, in isolating the trouble to one particular section, stage, or group of components.

There are a number of troubleshooting procedures that can ease the task of isolation, but the most versatile and perhaps most expedient yet devised is known as signal-tracing. Precision Electronics, Inc., of Franklin Park, Ill., has an instrument, the Model 202 Signal Tracer shown in Fig. 4, that helps you trace signals from the antenna to the speaker or picture tube.

Specifications are:

1. *Power Requirements — 110/120 volts, 60 cps; power consumption approximately 40 watts; panel off-on switch combined with wattage control.*
2. *Monitoring Features — built-in eye tube and 5" speaker plus output jack for monitoring signals with scope; input attenuator, speaker switch, and gain control provided; output cable for scope also supplied.*

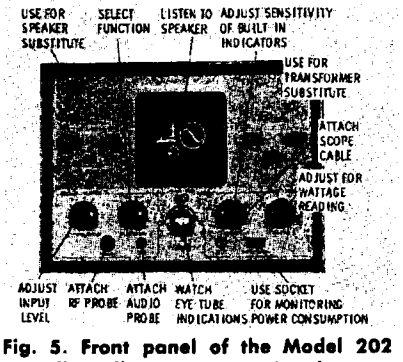

Fig. 5. Front panel of the Model 202 actually tells own operational story.

3. *RF Tracer—includes sensitive amplifier-detector stage; frequency response to 300 mc; separate plug-in RF probe and cable supplied.*
4. *AF Tracer — includes three-stage preamplifier featuring cascode circuit with over-all feedback; frequency response flat from 2 cps to 300 kc into eye-tube indicator or scope output; separate plug-in audio probe and cable supplied; system may be used as audio amplifier and speaker for testing tuners, phono cartridges, microphones, etc.*
5. *Noise Tracer — special position for noise test provided on function selector; audio probe supplies test voltage; eye tube and built-in speaker used as indicators.*
6. *Wattmeter — power consumption of apparatus under test indicated by eye tube and calibrated watts control; AC receptacle provided on front panel.*
7. *Substitution Unit — built-in speaker and/or transformer available for external use; individual jacks provided on front panel; transformer serves as substitute in either single-ended or push-pull applications.*
8. *Size and Weight — case 11½" x 8½" x 6½", 11 lbs. less probes and cables.*

After using the Model 202 in the lab, I soon discovered that its usefulness was not merely confined to troubleshooting conventional radios and sound systems, but extends to transistor portables, TV receivers, test equipment, and just about any other electronic gear you care to mention. Its sensitivity and frequency response impose little or no limitations on the types of signals it can handle, and it has about all you could ask for in the way of indicating devices. Visual presentations, for example, include a panel eye-tube and scope output connection, while aural monitoring is accomplished through the instrument's built-in speaker.

The *Signal Tracer* acts as a convenient sensing device capable of sampling either signals developed within the apparatus under test or those supplied from an external generator source. By probing a circuit at various points and using a little deductive reasoning, one can isolate a fault to a certain stage or even a specific component. About the simplest way to picture the instrument's over-all operating features is to take a closer look at its front panel. The location and use of each item is pointed out in Fig. 5.

Since signal-tracing a radio is very elementary, I thought I would concentrate on checking some of the TV troubleshooting uses outlined in the 202 manual. When tracing the signals in various TV stages, for example, I plugged the RF probe (Fig. 6) into the instrument panel and placed the function selector in its PROBE position. With power applied to both the set under test and the *Signal Tracer*, I tuned in a station and adjusted the input attenuator and gain control as required for each point I explored with the probe.

In the IF strip, I found it best to sample the signal across the cathode resistor of each stage, and to use a scope to monitor the signal. When encountering a stage without a cathode resistor, I noted the signal could be picked up on the grid; however, this often detuned the circuit. By placing the probe tip on the body of a plate or grid component, I was usually able to detect the signal satisfactorily.

Examining the video and sync sections, I found I could pick up a signal on the grid or plate of each stage and monitor it through the instrument's speaker. The audible frequency present is derived from the 60-cps vertical sync signal. Since the vertical sweep energy likewise produces an audible buzz, the speaker can also be used as an indicator in troubleshooting the vertical oscillator, output, and yoke circuits.

In the horizontal sweep section, I could place the RF probe on the plate of the oscillator and obtain a high-frequency whistle from the Model 202 speaker; but this is not always easy to detect, so I found it more accurate to use the eye tube or scope as an indicator. When signal-tracing beyond the grid of the horizontal output tube, the probe should not be brought in direct contact with high-voltage points; instead, you need only bring the probe near the plate-cap lead or flyback to obtain a usable signal.

The instruction manual pictures typical waveforms found in certain sections of a TV receiver, and also describes methods for aligning FM sets, checking noisy components, and employing the instrument as a wattmeter. After using the Model 202 on a few normally-operating receivers, you'll find it easy to single out the faulty stage or group of components interrupting a signal path. ▲

Fig. 6. RF probe for Model 202. Audio probe and scope probe also supplied.

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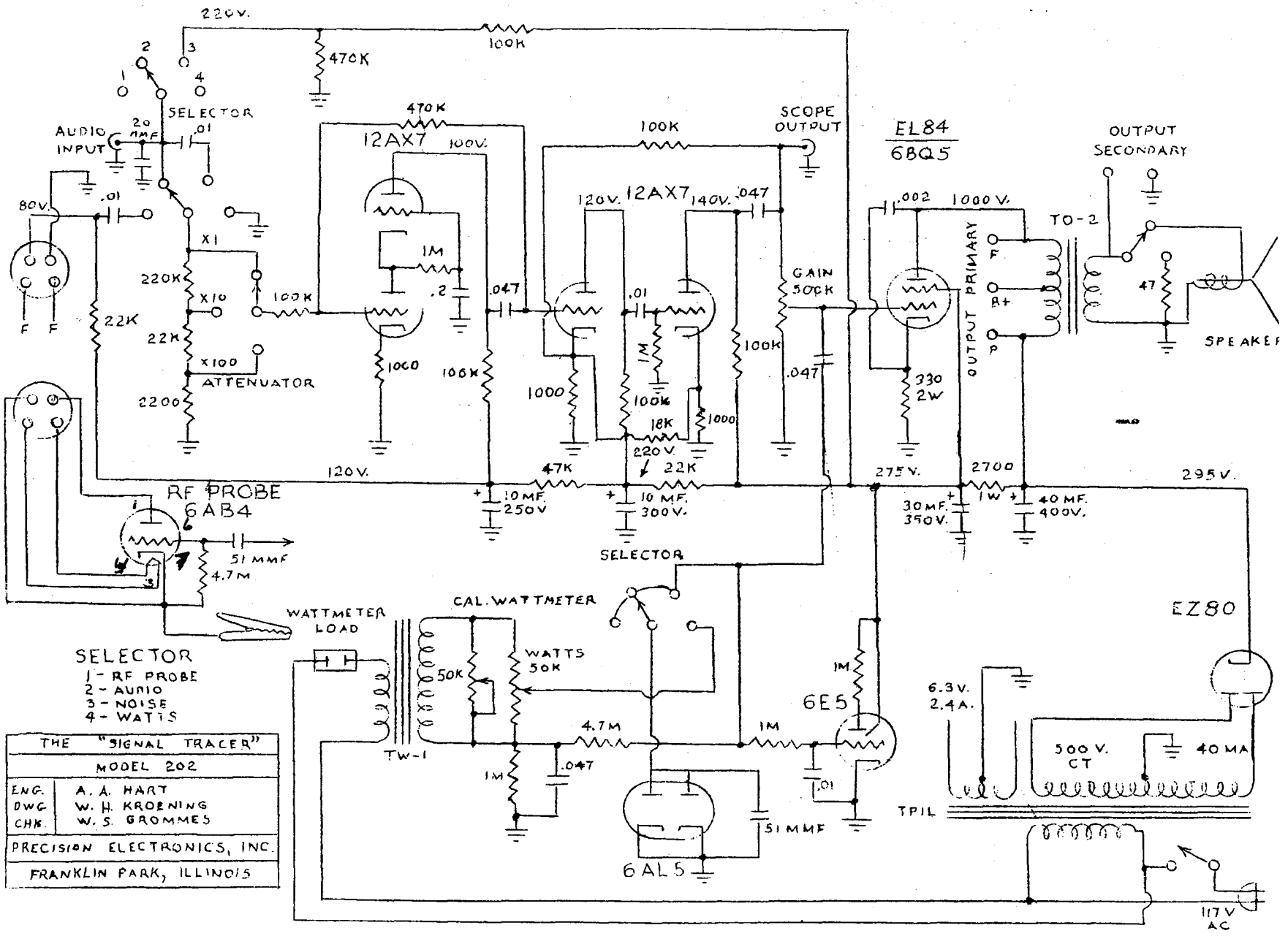
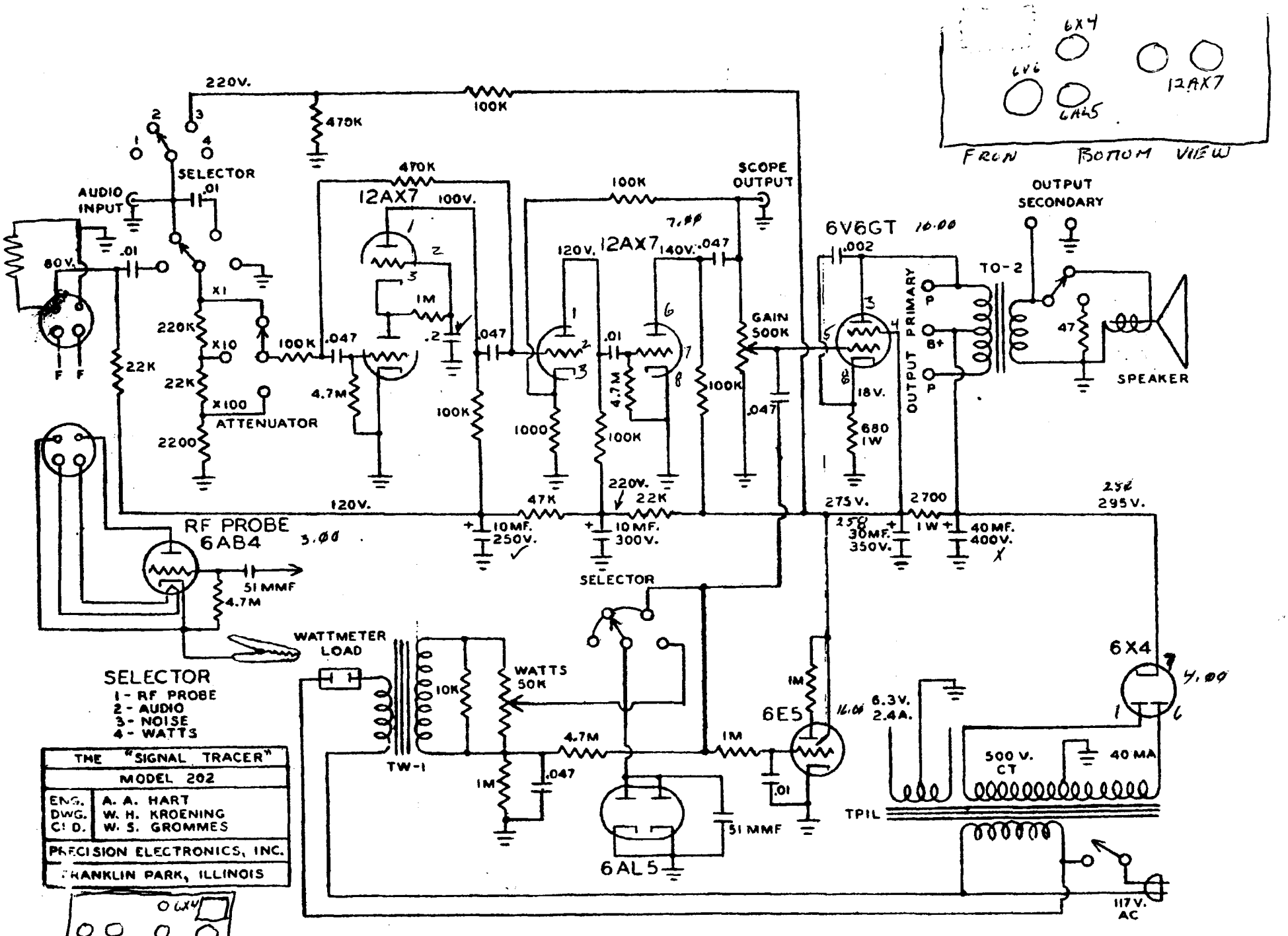

220V.
470K
100K
SELECTOR
AUDIO INPUT
20 MMF
.01
80V.
X1
220K
X10
100K
22K
22K
X100
ATTENUATOR
2200
F F
470K
12AX7
100V.
1M
.2
.047
1060
106K
120V.
12AX7
140V.
.047
.01
1M
1000
100K
18K
1000
220V.
22K
100K
SCOPE OUTPUT
GAIN 500K
.047
EL84
6BQ5
.002
1000 V.
330
2W
275V.
OUTPUT PRIMARY
F
B+
P
TO-2
OUTPUT SECONDARY
47
SPEAKER
2700
1W
295V.
120V.
47K
10 MF.
250V
10 MF.
300V.
30 MF.
350V.
40 MF.
400V.
RF PROBE
6AB4
51 MMF
4.7M
SELECTOR
WATTMETER LOAD
CAL. WATTMETER
50K
WATTS
50K
TW-1
4.7M
1M
.047
1M
6E5
.01
51 MMF
6AL5
EZ80
6.3V.
2.4A.
500 V.
CT
40 MA
TP1L
117 V
AC
SELECTOR
1 - RF PROBE
2 - AUDIO
3 - NOISE
4 - WATTS
THE "SIGNAL TRACER"
MODEL 202
ENG. A. A. HART
DWG. W. H. KROENING
CHK. W. S. GROMMES
PRECISION ELECTRONICS, INC.
FRANKLIN PARK, ILLINOIS


220V.
100K
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SELECTOR
AUDIO INPUT
.01
80V.
X1
220K
X10
22K
22K
X100
ATTENUATOR
2200
F F
100K
.047
470K
12AX7
100V.
1M
.2
4.7M
100K
1000
120V.
SCOPE OUTPUT
7.00
12AX7
140V.
.047
.01
4.7M
100K
GAIN 500K
.047
6V6GT 10.00
.002
18V.
680 1W
OUTPUT PRIMARY
P
B+
P
TO-2
OUTPUT SECONDARY
47
SPEAKER
RF PROBE
6AB4 3.00
51 MMF
4.7M
120V.
47K
220V.
22K
10MF. 250V.
10MF. 300V.
275V.
2700
1W
25Ø
30MF. 350V.
40MF. 400V.
295V.
SELECTOR
WATTMETER LOAD
10K
WATTS 50K
TW-1
4.7M
1M
.047
1M
6E5 16.00
.01
51 MMF
6AL5
6X4 4.00
6.3V. 2.4A.
500 V. CT
40 MA
TPIL
117V. AC
SELECTOR
1 - RF PROBE
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FRANKLIN PARK, ILLINOIS
6X4
12AX7
6AL5
6V6
TOP VIEW FRONT
6X4
6V6
6AL5
12AX7
FRON BOTTOM VIEW

K4XL's  BAMA

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