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TWO-STAGE IF AMPLIFIER CIRCUIT

With the use of the new very high gain frame-grid tubes, circuits can be designed that feature high performance characteristics with fewer stages. Such a circuit is the two stage IF amplifier used in the KCS 142 and KCS 146. With the RF and video output circuits as well as the IF amplifier employing the high Gm frame grid tubes, these chassis achieve with two IF amplifiers virtually the same performance as that of chassis using three IF amplifiers.

The tubes used in the IF stages are new frame-grid pentodes, the 4JC6 and the 4JD6. The 4JD6, which is AGC controlled, has a transconductance of approximately 14,000 μmhos with semi-remote cutoff characteristics. The 4JC6 is a sharp cutoff pentode with a Gm of approximately 15,000 μmhos. Both tubes have miniature 9-pin glass envelopes.

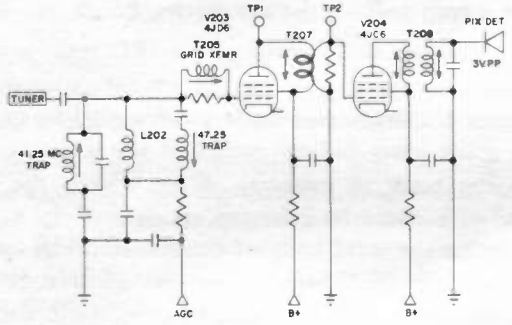

Figure 1—Two Stage IF Circuit

Link circuit loss is 3 db less than that of previous circuitry. Both the 41.25 Mc and 47.25 Mc traps are in the same shielded chassis area and are tunable from either top or bottom. The 41.25 Mc sound trap is a series type while the 47.25 Mc adjacent channel trap is a new lower-loss, high-efficiency, series-parallel type. The rejection of adjacent sound and picture is greater than 40 db while accompanying sound attenuation is approximately 25 db. The inductance, L202, in the link circuit can be knifed for bandwidth adjustment. AGC is applied to the 1st IF stage and becomes operative when the signal-to-noise ratio is approximately 20 db.

Overall bandwidth is 3.25 Mc at the 3 db point with picture at 50% on the slope. Video amplitude at the detector is 3 V PP. Thus it can be seen that the use of frame-grid tubes in conjunction with other circuit refinements makes possible a high performance picture amplifying system employing two stages of IF amplification.

THE KCS 146 CHASSIS

The new KCS 146 chassis is used in the 16" Petite and Debutante models, 64-A-02 and 03 series receivers.

A new aluminized 16AYP4 Kinescope with a 114° deflection angle and a rectangular uncapped face plate is used in these receivers. The separate safety glass is tinted and adequate picture power is available so that the instrument can be viewed comfortably even with adverse lighting conditions.

The KCS 146 chassis has been designed with the service technician in mind. Servicing these receivers will be a more efficient, faster, more simple operation due to the use of a single space-age sealed circuit board. Most components are mounted on the tube side of the circuit board and new more legible "roadmapping" is used to make circuit tracing and component identification easy.

All series of these instruments are available with factory installed UHF or can be converted to UHF in the field by use of the DK 152 UHF Tuner Kit.

The electrical circuits of the KCS 146 are similar to those in the KCS 142, although the chassis differ in appearance. All tubes have a controlled heater warm-up characteristic and require no dropping resistor in the series string.

The primary operating controls (brightness and off/on volume) are mounted on the tilted top panel, and the speaker is located in the center area under the carrying handle. Fine tuning is accomplished by means of a thumb control at the rear of the VHF tuner on the top edge of the cabinet, and the monopole antenna is matched to the input of the KRK 105 "power grid" tuner by a special balun coil.

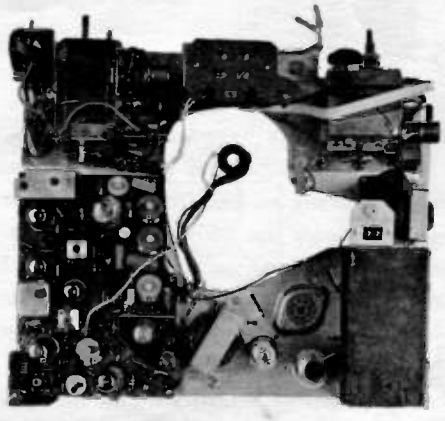

Figure 2—KCS 146 Chassis

THE KCS 142 CHASSIS

The new KCS 142 chassis is used in the 19" "Roommate" portable receivers, the 94-A-06 series instruments.

The chassis employs a total of five frame-grid tubes, both tuner tubes, both IF tubes, and the video amplifier tube. These high gain tubes, in conjunction with the new lower loss link circuit, permit the use of a two stage IF amplifier circuit.

The new KRK 105 "power grid" tuner is a three circuit switch type with concentric fine tuning. All models of the tuner have thirteen detent positions, twelve VHF channels and the UHF position in which the tuner is connected as a two stage 40 Mc IF amplifier. The RF amplifier is a grounded cathode frame-grid triode, the mixer is a frame-grid pentode operating at a low potential, and the local oscillator is a triode housed in the same envelope as the mixer tube. The tuner has an exceptional signal-to-noise ratio, which, with good selectivity assure high performance even in weak signal areas.

The 110° 19AYP4 Kinescope is supplied with 18 KV at the 2nd anode. The 11KV8 frame-grid video amplifier gives adequate contrast and good definition at all signal levels. The contrast control is in the plate circuit of the video amplifier so that contrast can be varied over a greater range while the tube operates in the linear portion of its curve. With this circuit arrangement, no sync clipping will occur at low contrast settings nor will distortion show up at high contrast levels.

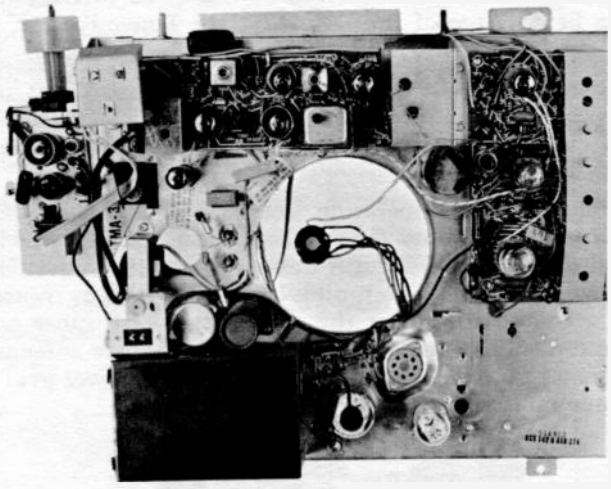

Fig. 3—KCS 142 Chassis

The chassis employs keyed AGC and has noise immunity features in both the AGC and sync circuits. The Vertical circuit as well as the horizontal output and damper circuits use Novar dark heater tubes for long trouble-free operating life. The 17JB6 horizontal output tube has its suppressor grid pin based so that a positive voltage can be applied for snivet suppression in the UHF region. A width control is incorporated so that raster width can be maintained with different values of AC input power.

The KCS 142 chassis incorporates several RF suppresson features. In UHF versions, the sound detector tube is a 6HZ6 which has additional shielding on the second control grid to eliminate parasitics. All versions have a 1 K resistor in the second anode lead to suppress RF radiation, a spark gap type resistor is used in the Kinescope screen circuit to protect against arc-over, and the silicon low voltage rectifiers are mounted on feed-through capacitors to bypass any interference generated in this circuit.

The set is equipped with a monopole antenna which is coupled to the tuner through a special balun coil for minimum signal loss. As an additional service feature, the antenna terminals are mounted to the chassis and isolated by capristors for safety.

KINESCOPE ARC-OVER PROTECTION

Arc-over in a kinescope is the result of a static charge building up somewhere in the bulb and then discharging to a ground point, usually through the gun to the heater filament ground point. During this spark occurance an effective path to ground through the heater filaments is formed. The higher the operating voltages the greater the chance that this arc-over can occur.

Since all the new Black and White chassis have second anode voltages in the range of 18 KV to 22.5 KV, provisions have been made to provide a safe path to ground by means of a spark gap resistor in the kinescope screen voltage divider network.

The construction details of an IRC resistor permit its use as a spark gap. In the manufacture of these resistors, the connector leads are fastened in each end of a small glass hollow rod, and the glass is coated with the resistive material. After which, the coated glass, with some lead length, is encased in a plastic that forms the solid body of the resistor. The air space between the lead ends inside the glass rods is approximately 1/16". The discharging static finds this small air space an easy ground path and the static build-up is dissipated without damage to the resistor or the tube itself. Arc-over occurs at approximately 2000 volts.

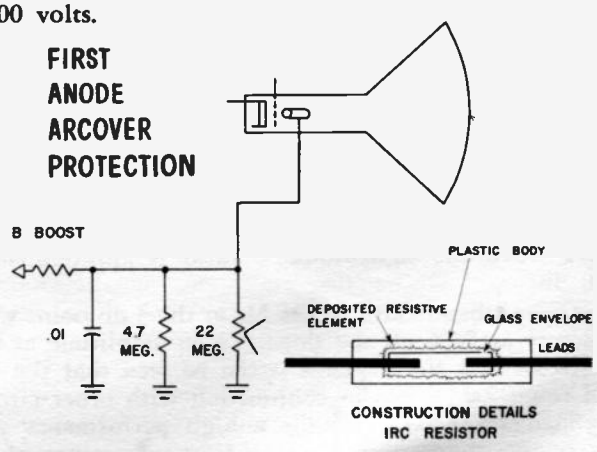

Figure 4—First Anode Arc-Over Protection

KCS 142 AND 146 VIDEO OUTPUT CIRCUIT

The KCS 142 and KCS 146 video output circuit is essentially the same as that in the current line of portables. The new 11KV8 frame-grid pentode-triode tube and some minor component changes constitute the main differences. The new tube has a transconductance of 20,000 μmhos with a gain or mu of 50. This is almost twice as much gain as the 10HF8 used in some of the current portables.

L209 is a 4.5 Mc sound take-off coil used to select the sound IF signal.

Resistor, R231, is in the circuit to stabilize the DC component in the AGC take-off. The DC level would be varied by changes in overall scene brightness if it were DC coupled to the plate only.

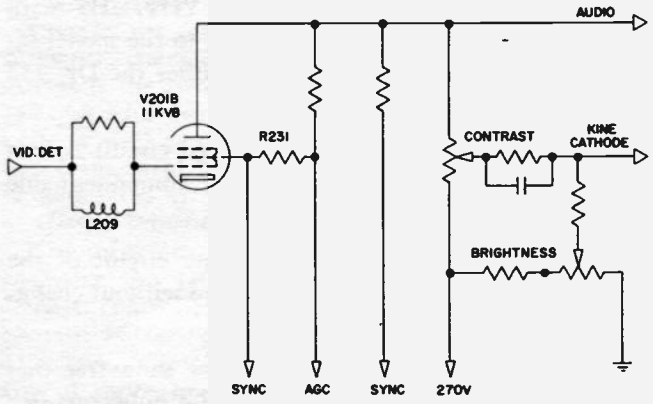

Figure 5—KCS 142-146 Video Output Circuit

The video signal is DC coupled to the cathode of the kinescope so that the overall brightness level information is maintained in the video signal.

Video information, brightness and contrast is fed to the kinescope via the cathode. One reason for this is that noise is easier to control if video is coupled to the cathode, and the other reason is that grid-cathode bias is easier to maintain. With the cathode as the signal point, the screen grid voltage can be kept constant, but if the control grid were the injection point, the screen voltage would have to be considered.

Contrast control operates by attenuating the video information amplitude before the kinescope cathode. The brightness control sets the static grid-cathode bias, in this way controlling the optimum illumination level.

"RECTIFIER HUM" ELIMINATION

Due to a transient effect, silicon and some other efficient solid state rectifiers produce oscillations. These oscillations are radiated by the circuit wiring, picked up at the UHF antenna, and appear on the kinescope face as drifting bars of varying width and shades. At times the shading extends over the lower half of the screen with the top half of the screen being light. At other times there can be up to four sets of light and dark bars that cover the entire screen. This condition is more noticeable when the video is at low modulation levels.

Feed-through capacitors at the cathode of each rectifier in the B-plus supply are used to by-pass this RF radiation to ground. Feed-through capacitors are used in this application, not only because they are very efficient RF by-pass units, but also because they provide a convenient tie-point for the silicon rectifiers.

SNIVET SUPPRESSION IN UHF

Most Barkhausen, or snivets, prevalent in the VHF frequency spectrum result from sudden changes in the plate current of the horizontal output tube. This problem has been virtually eliminated in recent years by the closer tolerances used in tube manufacturing and by improved circuit design.

Radiations that occur in the UHF frequency spectrum have a different origin and must be suppressed by other means. According to one theory, oscillations in the ultra high frequency range are generated when the electrons in the space charge at the plate are attracted by the screen grid during the time the plate voltage is negative in respect to the screen grid voltage. This phenomenon occurs during the period of greatest current flow and the oscillations show up as snivets on the last third of the kine face. The suppressor grid operating at ground potential has no control over these oscillations. By operating the suppressor grid at a positive voltage, it exerts enough control so that these oscillations either disappear or are moved out of the television frequency spectrum.

The level of this positive voltage is extremely critical. Best results are obtained in the 40-50 volt range. Below 30 volts, the snivets are still present. Above 70 volts the efficiency of the tube is impaired.

RCA has made a study of the phenomenon of "snivet" interference which has resulted in additional circuitry to minimize this source of interference.

In the UHF chassis, the suppressor grid is connected to the 270 volt bus through a dropping resistor and to ground through the R-C decoupler. The value of the components are varied in the different series chassis to obtain the correct value of B+ (about 40 V) at pin 8. In VHF models only, the suppressor grid is grounded.

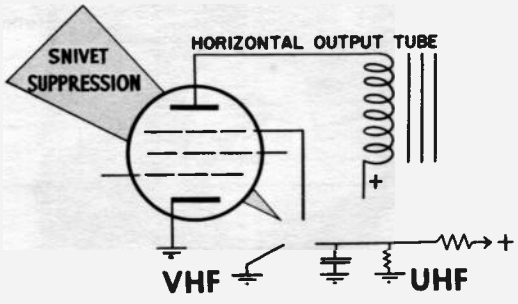

Figure 6—Snivet Suppression in UHF

ADDITIONAL NEW PORTABLES

The KCS 143, KCS 144, and KCS 147 comprise the additional new portables in the 1964 product line. All of these chassis employ the 19AYP4 Kinescope with 110° deflection angle. The KCS 143 and 144 are power transformerless instruments with 450 ma controlled warm-up filaments. The KCS 147 is a transformer powered chassis using long-life, cool-operating silicon diodes as low voltage rectifiers.

These three chassis use three stage IF amplifiers and feature cool-operating, long-life Novar tubes in the horizontal output damper and vertical circuits. All feature new "space-age" sealed circuit boards with more legible roadmapping.

An octal socket disconnect for the yoke, keyed AGC, high level contrast control, and DC coupling to the Kinescope are features used by all three chassis.

NEW AUTOMATIC BRIGHTNESS CONTROL CIRCUIT

The automatic brightness control circuit in the KCS 136Z chassis is completely new.

The circuitry has been greatly simplified and consists primarily of a Magic Eye Control potentiometer and a Light Dependent Resistor. These units are parallel connected from the low side of the brightness control to chassis ground.

The ABC circuit operates as follows. After the optimum brightness has been set, any change in room lighting acts on the light dependent resistor. An increase in overall room light causes the LDR to decrease in value. This places the low side of the brightness control nearer to ground potential, decreasing B+ on the kinescope cathode. Lower potential at the cathode decreases grid-cathode bias and causes the kinescope to conduct more heavily thus increasing raster brightness. A decrease in room brightness has the opposite effect.

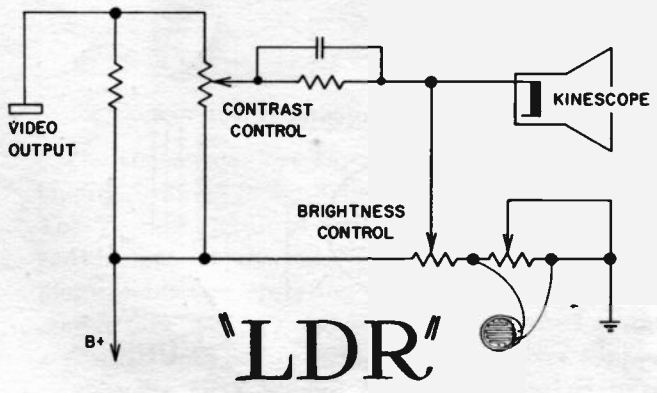

Figure 7—KCS 136Z Automatic Brightness Control

THE KCS 136Z CHASSIS

The KCS 136Z is a transformer-powered chassis using long life, cool operating, silicon diodes as low voltage rectifiers. It uses either the fritted 23BLP4 or the clear 23BKP4 92° kinescope. Both picture tubes have bonded, tinted safety glass and are operated with 22.5 KV second anode voltage.

All versions of the chassis are the performance proved four-circuit nuvistor tuners.

Remote control receivers use the KRK 113 four-circuit strip type nuvistor tuner with concentric pre-set fine tuning which are UHF convertible with the DK 156 UHF Station Inserts and the DK 89 Antenna Kit.

Manual models use either the KRK 103 or the concentric pre-set fine tuning Model KRK 107. These receivers can be factory equipped for VHF/UHF with the KRK 108/66 tuners or, according to the model involved, converted in the field with either the DK 154 or the DK 155 UHF Tuner Kit.

This chassis has two space-age sealed circuit boards with new solid line "roadmap" on the component side of the board.

The contrast control is in the plate circuit of the video amplifier for more contrast range without changing the video amplifier tube bias.

The KCS 136Z uses keyed AGC for snow-free picture with varying signal strength and a noise inverter circuit with threshold control; novar type damper and horizontal output tubes are used and a new optional automatic brightness control is available in the KCS 136Z.

The new 6JB6 horizontal output tube has a positive voltage applied to the suppressor grid for UHF snivet suppression and an improved 6HZ6 sound detector tube is used in the UHF versions of the KCS 136Z.

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