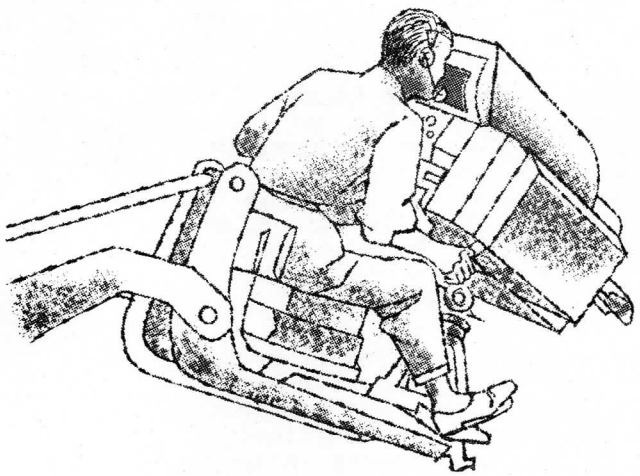
De Var Electronics Co.



COLORDAPTOR

COLOR TV CONVERTER

Although rapid advances are being made in commercial color TV, as yet most circuits are very complex requiring expensive and difficult to obtain components such as the tri-color kinescope. For the experimenter interested in color TV, the Colordaptor offers a method of obtaining good color TV from present black and white receivers at a minimum of expense and complexity.

The Colordaptor system employs a simple ten tube circuit and a rotating color wheel to convert any black and white, direct view or projection TV to full color operation.

The Colordaptor decoder employing only seven tubes is the heart of the system. This new and ingenious circuit converts the NTSC compatible dot sequential color signal, now standard in the United States, into a field sequential signal. The field sequential signal is supplied to the black and white picture tube and, when viewed through the rotating color wheel, a full color picture results.

The Colordaptor can be built from parts most experimenters have on hand. The tubes are standard receiving types and all the coils may be hand-wound by the experimenter. The Colordapter decoder has undergone extensive development work to simplify all circuits and remove critical adjustments. The completed system has only two color adjustments, hue and saturation. An r.f. signal generator and a standard volt-ohmeter are the only test instruments required for alignment of the system.

Figure 1 shows the complete Colordaptor system. The installation shows the color wheel mounted on a removable unit which is placed on the top of the TV set. The Colordaptor chassis may be permanently attached to the rear of the set since when left connected it does not affect normal black and white reception. The color wheel may be removed when color reception is not desired.

There have been numerous articles in radio and television publications describing the NTSC compatible color television signal. The reader should be reasonably familiar with the basic concepts embodied in the NTSC signal. As is explained in these articles, the color signal is transmitted as a sub-carrier at 3.58 mc. The color information is separated into two parts, hue and saturation. The hue is the color, that is red versus yellow, and the saturation is the depth of color, that is bright red versus pink. At the color receiver the hue of the picture is determined by the phase of the received color sub-carrier and the saturation is determined by the amplitude of this signal. The reference phase, which is transmitted during the horizontal retrace as an eight cycle burst, establishes a reference for the phase information.

As is shown in Figure 2, a certain phase angle corresponds to each of the primary colors. That is, 90° from the reference phase is the red information angle, 180° the blue, and 300° the green. In the conventional color TV set, two synchronous demodulators are used which measure the amplitudes of two phases 90° apart. The most common system now in use is the R and B system which demodulates along the 90° and 180° directions. The third color G is obtained by adding these two signals in the proper proportion. Hence all these systems have the common characteristic that there are three color signals being produced at all times.

However, in the Colordaptor system only one signal at a time is required. When the red filter is in front of the TV tube, the Colordaptor demodulates along the 90o phase, for blue it switches to 180o and for green it switches to 300o. This switching operation is continued automatically from red to blue to green and the rotation of the color wheel is locked in with this switching operation. Consequently, a complete red picture is followed by a complete blue picture, and finally a complete green picture. The switch operates at 60 cps so that a set of three color pictures is produced each 1/20 second. The eye then superimposes these three colored pictures to give the full color effect.

Operation of the Colordaptor

The block diagram of the Colordaptor is shown in Figure 3. The video is taken off at the second detector and, after going through a stage of preamplification in the set, is fed into a high gain chroma amplifier, V1. This stage is designed to discriminate against both the low frequency black and white video signal and the high frequency 4.5 mc sound channel. The output of the chroma amplifier is fed to the demodulator, V2, and the burst gate, V3A. The burst gate is normally biased off until the horizontal synch. pulse drives it into conduction. This occurs towards the end of the horizontal flyback which is exactly when the 8 cycles of 3.58 mc reference occurs. Thus the burst gate output consists of bursts of 3.58 mc reference signal. The crystal filter with associated V3B drive tube, converts these bursts into c.w. 3.58 mc r.f. reference.

The reference phase shift network then supplies exactly the correct delay so that reference phases for the three colors, as shown in Figure 2, are generated and fed into the tritch (tri-stable switch). The tritch, made up of triodes V4A, B and V5A, is essentially a three position rotary switch "rotating" at 20 cps. It is triggered among its three stable conditions by the vertical synch. pulse via V5B. The output of the tritch is then 3.58 mc which has a phase of alternately 90°, 180°, and 300° relative to the reference signal. After amplification in the reference amplifiers V6 and limiting in diodes D1 and D2, the tritched reference is applied to the demodulator, V2.

The output of the demodulator is then amplified in V11 and applied to the cathode-ray tube grid (B and W video on the cathode) or cathode (B and W video on the grid).

The delay line is added in the black and white video circuit so that the black and white signal and the color signal arrive at the picture tube at the same time. Connections are made to the vertical and horizontal sweep circuits to provide synchronizing signals for the Colordaptor.

The color wheel and associated drive mechanism includes a small magnetic pickup which gives a voltage pulse once for each set of red, blue and green filters. This synchronizing pulse is compared with the plate wave form of the blue tritch triode and the phase difference detected by V7.

The resulting control signal is applied to the control tube, V8, which in turn controls the motor speed through the control transformer.

Constructing the Colordaptor

The Colordaptor chassis layout is shown in Figure 4, and parts list in Figure 5. A 3 x 12 x 8 chassis is large enough to hold the entire system including power supply and synchronizer.

A suggested procedure for construction is to first locate all socket, transformer and trimmer condenser holes. After these holes are all cleaned and drilled, mount all the large components in place. Wire the tube heater leads using the chassis as a common ground. The heater lead should be by-passed to ground at V6 with a 0.01 ufd capacitor. Using tie points run a B+ bus as in Figure 4.

Since most of the components associated with V4 and V5 are not critical as to wire length it is advisable to mount them on a terminal board. This terminal board layout is shown in Figure 6. Then mount the terminal board as shown in Figure 4.

Mount and wire in place all inductors and trimmers. These should be placed approximately as shown in Figure 4. The windings and dimensions of the coils are given in Figure 7. It is important that L7, L8 and L9 are well separated, since oscillation is possible in the high gain reference amplifier. For those not wishing to wind their own coils, special coils designed for the Colordaptor are available in kit form as listed in the attached price list.

When wiring the crystal diodes into the circuit great care must be taken not to overheat the diode. It is best to hold the diode with a pair of long nosed pliers on the lead being soldered. The diode end marked "C" or having a colored dot or band is the cathode which corresponds to the bar side of the schematic symbol.

If external controls are desired for the Colordaptor the "color gain" control R9 and the "reference phase" control C23 may be located on the TV set front panel. The connection to R9 should be kept away from any high voltage pulses, but otherwise is not critical for length. The connection to C23 may be run through a shielded cable for a length up to about 4 feet. The additional capacity of the cable reduces the amount of capacity which must then be added as the reference control. A 100 uuf variable capacitor should be satisfactory.

The connections which attach the Colordaptor to the TV set are shown in Figure 8. All the connections except the twisted pair (wires B and C) and the color signal connection to the C-R tube may be run in a cable. The vertical synch. pulse required is taken from the grid of the vertical output tube of the TV set through a 18-180 uuf padder capacitor. This is a <u>negative</u> pulse of about -10 to -30 volts.

The horizontal synch. pulse is taken from the plate of the horizontal output tube. This pulse has a <u>positive</u> amplitude of about 3000 to 5000 volts. This is reduced in amplitude by a divider network to approximately <u>30</u> volts. An alternate connection is to wind about 10 turns of wire about the horizontal output transformer core. One side of this winding is grounded at the TV set and the other connected directly to the Colordaptor.

The chroma signal for Colordaptor is amplified by the 6CB6 V9. The power for V9 may be obtained either from the Colordaptor or preferably from the

TV set. The addition of V9 to the set makes it possible for the Colordaptor system to operate from any standard TV since the preamplifier may be adjusted to compensate for insufficient i.f. amplifier bandwidth. The chroma preamplifier 6CB6 can be mounted on the TV chassis, or on a bracket near the video detector. The trimmer should be mounted in such a manner that it is accessible for tuning when the chroma amplifiers are aligned.

A delay line shown in Figure 9 is added to the video amplifier of the TV set in the plate circuit of the output video amplifier as shown in Figure 8. This delay line has a delay of about 1.3 usec and an impedance of 5 K ohms. The delay line winding should be made about 6-1/2" long and after the set is operating its length can be trimmed to accurately align the color and black and white picture. The delay line is also available from Colordaptor (K-5).

In addition vertical and horizontal retrace blanking signals are added depending on the present method of connection of the black and white video to the picture tube. The proper retrace connections are shown in Figure 10a and b. The connections in Figure 10a apply when the video is on the cathode of the kinescope, and Figure 10b when the video is on the grid. The color signal is applied to the grid in the first case and the cathode in the second.

Color Wheel

The color wheel consists of six specially curved color filters mounted on a frame of sheet aluminum or plexiglass. This wheel gives two complete color pictures per rotation and therefore operates at a speed of 600 revolutions per minute. The six filter segments consist of two each of the three primary colors, red, blue and green. The colors and densities of these filters must be carefully selected such that white light when viewed through the rotating filter wheel appears white. Color filter material having these properties is available from Colordaptor (K-10, 12 or 13).

The color wheel layout is obtained by redrawing Figure 11 to full scale. The color wheel radius is found by measuring the distance from the drive hub (which is located directly above the left edge of the picture) to the lower right hand corner of the picture tube. After determining the color wheel diameter, a full size cardboard template of the color filter segment can be made. This template may then be used to cut out the color filter segments and to lay out the supporting web. The supporting web which has spokes approximately an inch wide is constructed of sheet aluminum, masonite, or other light material. The color filter segments are attached to the web with transparent tape or cement. It is important that the color filters are arranged such that they pass the picture tube in red - blue - green sequence.

Another method of color wheel construction is to sandwich the color filter segments between two heavy sheets of transparent celluloid or similar clear plastic. Acetone, or clear airplane cement, is applied along the edges of the color filter segments. The assembly is then held under pressure until the cement is dry. This construction method protects the filters and offers less wind resistance.

Color wheels for up to 17" TV sets can be made from heavy duty celluloid color filter material available from Colordaptor. For smaller sets, these wheels will be self-supporting and for larger sets three wire ribs will make the wheel self-supporting. In general, the wheel operates much better if placed in a housing cabinet which is easily made from plywood or fiber-

board. This cuts down the air friction which in turn reduces the motor load, reduces the loading on the wheel, improves the control characteristics and eliminates the noise generated by the wheel.

A typical color wheel drive mechanism is shown in Figure 12. The motor is bolted to a plywood or fibreboard backplate and a small pulley attached to the motor shaft by a setscrew. The color wheel is mounted on a second pulley which in turn rotates on a stationary shaft fastened to the backplate. This pulley is made from brass, aluminum or bakelite and has pressed into it a bushing bearing. On the back face of the pulley are mounted two soft iron pole pieces next to which the synchronizing pickup coil is mounted. The color wheel is attached to the front face of the pulley. The two pulleys are connected with a rubber belt. The pulley diameter ratio must be selected such as to give a speed of slightly greater than 600 rpm (with the color wheel attached). Stops must be fashioned on the shaft to prevent any front to back motion of the color wheel hub. This is necessary to maintain constant spacing between the synch. pickup coil and the rotating pole pieces.

The Colordaptor system is also adaptable to a projection type TV receiver. This is simple conversion since it requires a color wheel only large enough to cover the lens of the projection unit. It is suggested that the color wheel be composed of three pie shaped segments and the wheel driven at 1200 rpm in which case the synchronizer pickup should give one pulse per revolution of the wheel.

The color wheel drive motor should have about 1/70 HP for projection and 7" TV sets, 1/30 HP for 10 to 17", and 1/15 HP for 19 to 21" TV sets. An induction type motor is preferred such as a two phase capacitor or shaded pole motor. A series universal motor may also be employed, but the AC supply to the motor must be adequately filtered to prevent TV interference.

The color wheel drive motor speed is controlled by V7 and V8 to synchronize the color wheel with the TV picture. The synch. pickup coil, shown in Figure 12, generates a pulse which is compared with a switching signal from the plate of V4B in the phase detector V7A. The voltage on the grid of V7B is about -2 to -5 volts when the pickup coil signal and V4B signal are both positive at the same time. The voltage goes to zero when the two signals are out of phase. The signal is amplified in V7B and applied to V8 which acts as a grid controlled rectifier and saturates the control transformer, T2, which in turn reduces the voltage drop in the transformer secondary winding. The control transformer, T2, is a Stancor A3852, universal output transformer. The two plate leads are connected as a primary and the voice coil windings connected in series with the motor. Standard power transformers have also been used by connecting the high voltage winding across V8 and using the filament windings in series or parallel as a control winding.

The synchronizer pickup coil is constructed from a surplus 24 VDC relay by disassembling the relay and removing the relay contacts. The relay is then modified by bending the relay side support at a right angle as in Figure 13. An alnico magnet, such as is employed in PM speakers, is then fastened to the relay using an aluminum or brass clamp. The pickup coil is then mounted so that the rotating iron pole pieces on the color wheel drive pass across the face of the pickup coil, complete the magnetic circuit and thus induce a signal voltage in the coil. Alternately an earphone magnet may be used in place of the modified relay. The location of the two rotating pole pieces is shown in Figure 12. The synch. pickup coil should give a voltage of at least 5 volts rms when the color wheel is rotating at 600 RPM. The addition of the synch. pickup coil to the color wheel drive mechanism completes the construction of the Colordaptor system.

Alignment and Adjustment

Before beginning adjustments carefully recheck all wiring connections against the schematic. Check the B+ voltage from the power supply after the Colordaptor has been on for about three minutes. This voltage is set to between 200 to 225 volts by adjusting the power supply series resistance R60.

The next adjustment, alignment of the chroma amplifiers, requires a signal generator calibrated to cover the range 2.5 to 5 mc and a detector. The detector may be a high frequency probe on a vacuum tube voltmeter or simply a crystal diode and a multimeter connected as in Figure 14.

Attach the signal generator output to the grid of V1 and the detector across L4. Set the signal generator to 3.5 mc and first adjust C8 and then C7 for maximum response. Now set the signal generator to 4.5 mc and tune the sound trap C5, for minimum response. As the signal generator frequency is varied a response such as shown in Figure 15 should result. Some retuning of C7 and C8 may be necessary to obtain this response. If sharp peaks are obtained reduce the value of R3 to flatten the response. Now leaving the detector across L4 attach signal generator input to the TV video detector, so that the signal goes through the TV set preamp, V9. Set C1 at about half capacity. The longer the twisted pair length the lower will be the final value of C1. Set the signal generator at 4.5 mc and tune the sound trap C2 for minimum response. Set the signal generator at 4.0 mc and adjust C3 and the preamp trimmer C16 for maximum response. Then tune signal generator to 3.0 mc and adjust C1 for maximum response. Repeat these adjustments until the response curve (Figure 16) has sharply peaked gain at 4 mc and is designated to compensate for reduced IF and video bandwidth of many sets. For TV sets having wide band IF strips reduce the value of R4 and shunt the preamp coil L16 with a suitable resistance to obtain flat response from 3 to 4.1 mc. As a final check readjust the sound traps C2 and C5 for minimum response at 4.5 mc. This completes the alignment of the chroma amplifier circuits.

The reference channel adjustment is begun by connecting the signal generator to the grid of V6B and a voltmeter to the test point, diode D6. Tune the signal generator to 3.58 mc and adjust C18 for maximum response keeping the test point voltage below 2 volts by reducing the signal generator output. Move the signal generator to the grid of V6A and with the signal generator at 3.58 mc repeat the above procedure for adjusting C23.

The reference channel phase tritch is now checked for proper operation. This is most easily done by connecting an oscilloscope, synchronized by the TV set vertical synch. pulse, to each of the tritch plates. When properly operating the waveforms of Figure 17 are obtained. If an oscilloscope is not available, connect a multimeter between B+ and each of the tritch plates, in turn. All plates should indicate a voltage of about -20 volts with respect to B+.

If the tritch is not functioning as above, disconnect the vertical sync. pulse from the TV set. Cycle the tritch by momentarily shorting to ground each of the grids, V4A, V4B, and V5A in sequence. Then momentarily short the V4A grid to ground. Now the V4B plate should be 60 volts less than B+ and the other two plates should be near B+. Similarly shorting the V4B grid should lower the V5A plate voltage and raise the other two plates to B+. The cycle is finished by shorting the V5A grid to ground which restores the original condition of the V4A plate to 60 volts less than B+ and the other two plates at B+. If shorting a grid does not cause the next tube in sequence to conduct, increase the grid resistor (R35, R36, or R37) of that next tube slightly and repeat sequence test. Reconnect

vertical sync. pulse from TV set and adjust 18-180 padder capacitor to lowest capacity which will give reliable tritch operation.

Final adjustment of the reference tuning is accomplished while receiving a color telecast. While making the following adjustments keep the TV set fine tuning detuned sufficiently so that the test point voltage is less than 2 volts (This prevents limiting action of diodes D1 and D2). Adjust C43, C23 and C18 to peak the test point voltage. C42 is set at midrange. To obtain best performance from the burst gate, adjust the value of R49 (which controls the horizontal pulse amplitude to the Colordaptor) to obtain maximum test point voltage.

Also, adjust the horizontal hold control to obtain maximum test point voltage. When the TV fine tuning is then adjusted for proper color operation, the test point voltage will rise to a limiting value of about 3 volts and then be relatively independent of the fine tuning adjustment.

The color wheel may now be started and adjusted for synchronism. Turn the R58 slider to B+ side and adjust R61 so color wheel goes slightly too slow, that is when bars appear to go in the opposite direction as the color wheel rotation. When the color wheel speed is correct, a white picture is seen with a clear gray bar occasionally crossing the picture. Now turn R58 slider to the ground end. The gray bar should now go through the picture in the same direction to the color wheel rotation. The color wheel can now be synchronized by adjusting R-58.

To obtain proper phasing of the color wheel, the synchronizer pole pieces should be moved relative to the color wheel, so that as the blue filter starts across the TV screen the pole pieces are just passing the pickup coil.

If proper color wheel speed cannot be obtained as above, check pulley ratios, and if the wheel is too fast, additional series resistance can be added in the motor circuit.

With the color wheel properly synchronized, a full color picture should now be obtainable. The color gain is controlled by R9 and will also be strongly affected by the TV set fine tuning. In an intercarrier set adjust the fine tuning until the sound interference just disappears from the picture. C42 the neutralizing capacitor is adjusted to remove the rainbow like color distortion at the left hand side of the picture.

The final adjustment is the color phase. With the color wheel properly synchronized and a color signal present, the reference phase, C23 can be adjusted to obtain pleasing flesh tones and red lipstick. Capacitor C23 gives the greatest color phase range, but C43 also affects color. If proper color phase is unobtainable reverse the leads to either L3 or L4 but not both, and again adjust phase controls. Do not adjust C18 to change color phase.

SERVICE NOTES

Troubles are listed and possible remedies noted. It is suggested that a non-functioning unit be checked in the order given. The Resistance and Voltage Measurements Chart will be useful in checking an inoperative unit.

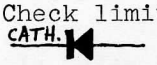
No Black and White Picture

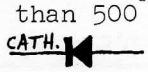
1. Turn COLORDAPTOR off, if still no B. and W. picture, check delay line installation.
2. If COLORDAPTOR "on" cuts off B. and W. picture, check C11 for leakage.
3. Remove COLORDAPTOR entirely and check TV set.

No Color Wheel Sync.

1. Tritch not operating.
2. No vertical sync pulse or V5B defective.
3. Insufficient voltage from sync pickup coil. Decrease spacing between pickup coil and pole pieces.
4. Check phase detector V7 operation by measuring plate voltage of V7B. As color wheel slips sync this voltage should vary from about 200 to 70 volts. If not, see 2 and check V7 and associated circuits.
5. With R58 turned to ground end adjust R61 so color wheel runs slightly fast. Then adjust R58 to obtain color wheel sync. If color wheel speed does not change check V8.

No Color

1. No color program transmission or improperly connected color bar generator.
2. Reference test point voltage less than 2 volts.
   a. Insufficient horizontal sync pulse. Adjust R49.
   b. Incorrect horizontal locking phase. Adjust horizontal lock control on TV set.
   c. Preamplifier V9 incorrectly attached. Check voltages and check twisted pair to insure that same wire is grounded at both ends.
   d. Adjust fine tuning control for max. test point voltage consistent with good B. and W. picture.
   e. Check limiter diodes in V6B output circuit for polarity 

. Back resistance should be greater than 20,000 ohms.
   f. Check tubes V3 and V6.
   g. Adjust color reference tuning C43, C23 and C18 for max. test point voltage.
3. Quick rotation of color gain R9 should produce temporary fluctuation of brightness. If no fluctuation, check video output amplifier tube, V11. Also check connection from COLORDAPTOR to TV set pix tube, Figure 8.
4. Short pin 1 to pin 2 of V2. Picture brightness should fluctuate. If not, check V2 and item 3 above.
5. Check chroma amplifier response V1 as outlined in COLORDAPTOR specifications.
6. Reference phase switch V4A, V4B, and V5A (Tritch) not sequencing. Plate to B+ voltage should be about 20 volts on all three tubes.
   a. Check V4 and V5 and diode polarities. Back resistance should be greater than 500 K ohms.


   b. Insufficinet vertical sync voltage. Adjust R22.
   c. If vertical sync OK and one plate voltage is at about 60 volts measured from B+, shunt grid resistor (560K) of that tube with 10 meg resistor until other tubes start switching.

d. If one plate voltage at B+ and other two plates at about 30 volts measured from B+, shunt both of the latter tube grid resistors (560K) with 10 meg to get third tube switching.

Incorrect Colors

1. Adjust C43 and C23 to obtain pleasing flesh tones and red lipstick. If insufficient adjustment range, reverse leads of L4 and again tune C43 and C23.
2. Adjust fine tuning on TV set and R9 color gain for proper color balance.
3. Adjust crystal neutralizing C42 to eliminate color fringe or rainbow on left side of TV screen.

Multiple Images (that look like ghosts)

1. Delay line is not matched. Shunt load resistor of video output amplifier until ghosts disappear. (This will decrease video gain also).

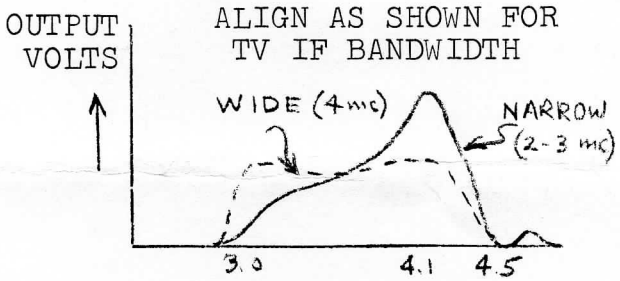
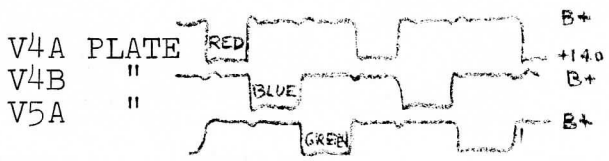


FIG 16



TRITCH WAVEFORMS
FIG 17

ERRATA:

FIG. 11 - Change Blue to Green
Change Green to Blue

VOLTAGE-RESISTANCE CHART

V_8 pin 1 and 7 - Resistance should be 1.4M
V_5 pin 7 - Resistance should be 105K-
V_3 pin 8 - Resistance should be 5K

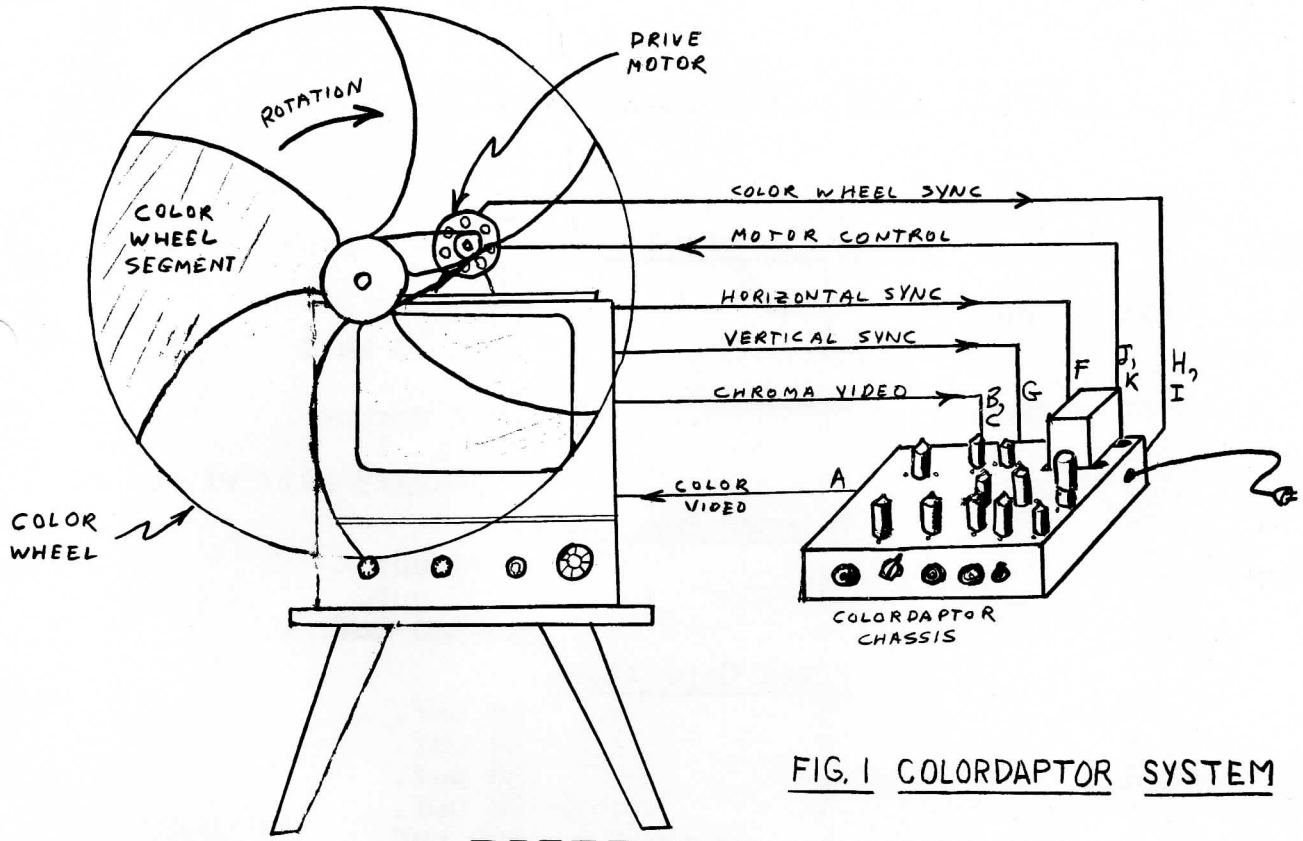


FIG. 1 COLORDAPTOR SYSTEM

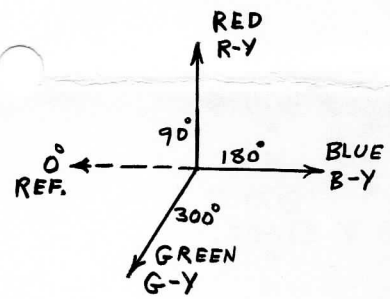


FIG. 2 DEMODULATOR COLOR PHASE

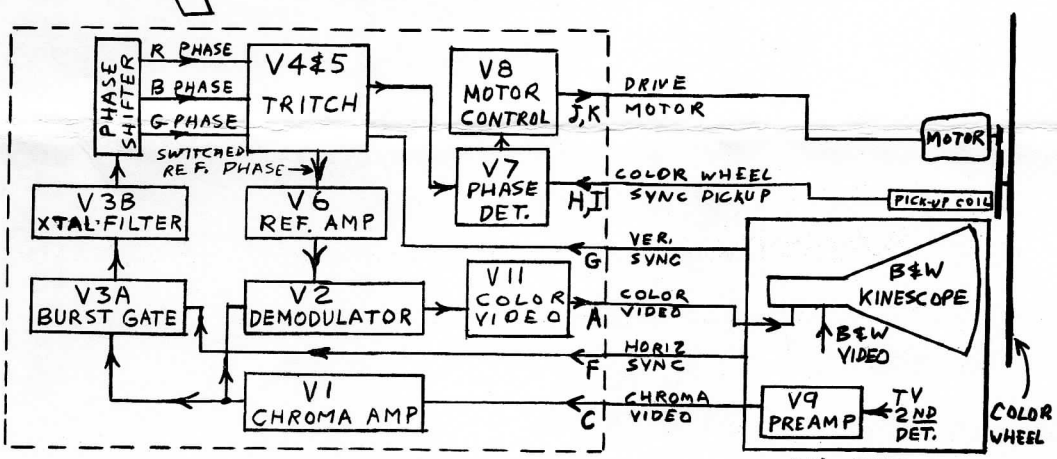


FIG 3. BLOCK DIAGRAM

FIG. 6. TRITCH BOARD

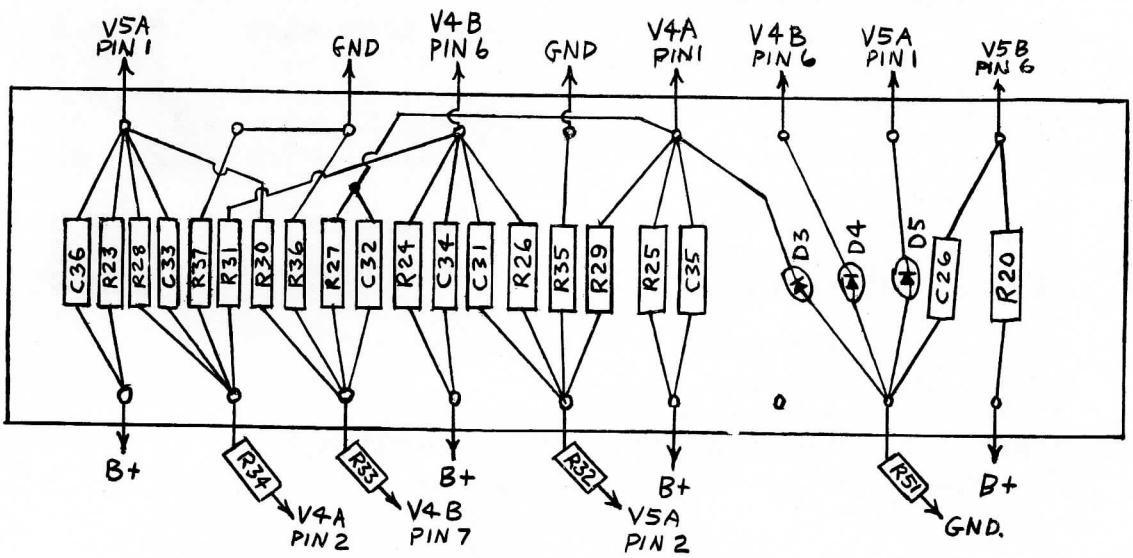


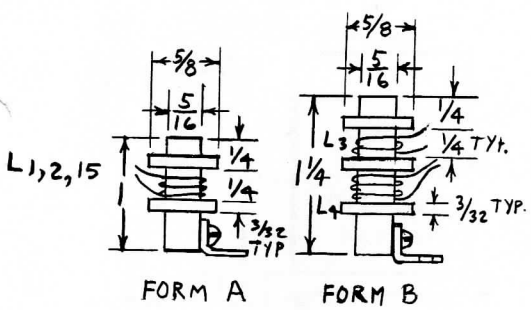
FIG. 5 - Mod. C415A - PARTS LIST

Qty.	Item
Vacuum Tubes	
2	6U8
1	6AU6 or 6BH6
2	12AU7
1	6BE6
2	6CB6 or 6AK5
1	12AT7
1	6AQ5
1	5Y3GT
Resistors 1/2 Watt	
3	270
3	560
2	1 K
4	4.7 K
3	10 K
2	15 K
5	22 K
6	33 K
2	39 K
2	47 K
3	100 K
1	220 K
1	390 K
3	560 K
8	1 meg.
2	1.8 meg.
1	4.7 meg.
Resistors 1 Watt	
1	10 K (R45)
1	22 K (R11)

Qty.	Item
Resistors 2 Watt	
1	390
1	33K
1	1500 10 Watt
Potentiometers	
1	10 K Carbon
1	100 K "
1	25 ohm/25 watt wirewound
Trimmer Capacitors	
1	7-70 uuf.
6	3-30 uuf.
4	30-300 uuf.
Fixed Capacitors	
5	15 uuf.
2	24 uuf.
1	56 uuf.
1	68 uuf.
6	100 uuf.
3	250 uuf.
4	.001 uf.
11	.01 uf.
2	.05 uf. paper 400 V
3	.1 uf. " "
1	.25 uf. " "
1	.5 uf. " 200 V
1	40 uf. 350 V Elect.
	80 uf. 350 "
	5 uf. 350 "
	25 uf. 50 "

Inductors			
L1	80 uhy 100 turns	No. 2-38 Litz wire	Form A
L2, L15	60 uhy 85 turns	"	Form A
L3-L4	80 uhy 100 turns each	"	Form B
L5	2.5 uhy 12 turns	No. 28 enamel wire - 1/4" dia. form	
L7,L9,L14	15 uhy 40 turns	No. 28 enamel wire - 1/4" dia. form	
L8	200 uhy peaking coil		
L10, L11	38 uhy 64 turns	No. 2-38 Litz wire	Form C
L12	45 uhy 73 turns	"	Form C
L13	21 uhy 51 turns	"	Form C

D1,D2,D6,D7	1N34A or equivalent
D3,D4,D5	1N294 or equivalent
Xtal	3.579545 mc series resonant crystal.
T1	Power transformer Merit P3151 or equivalent
T2	Control transformer Stancor A3852.



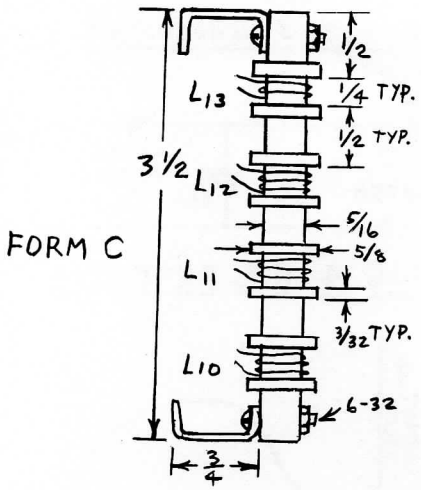
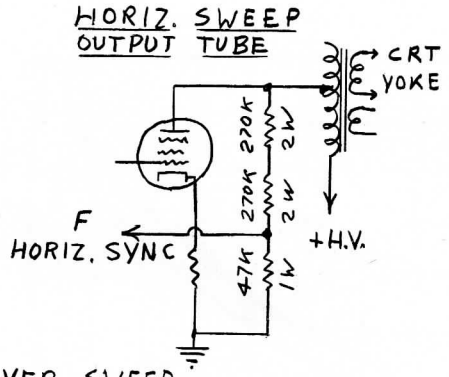
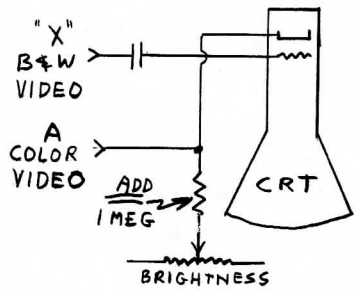
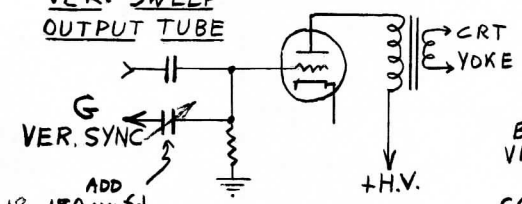


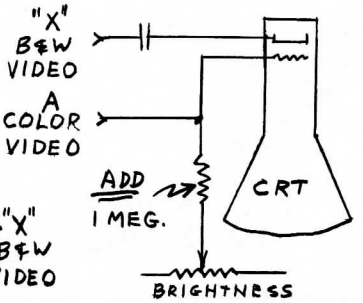
FIG. 7. COIL FORMS





B&W ON CRT GRID





B&W ON CRT CATH.

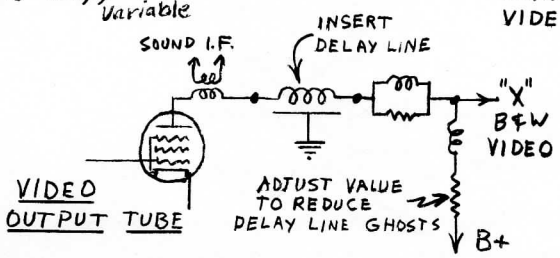
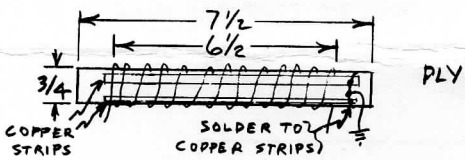
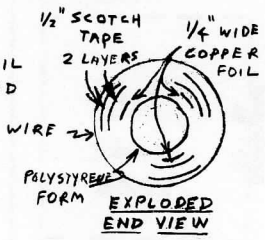


FIG. 8 CONNECTIONS TO TV SET





DELAY LINE COIL MUST BE WOUND ON A LATHE USING A CROSSFEED OF .0039 IN/REV. WITH #32 ENAM. WIRE

FIG. 9 DELAY LINE

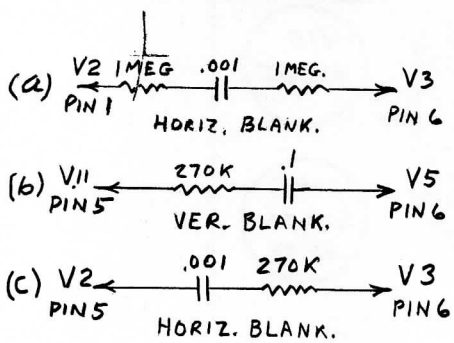


FIG. 10. RETRACE BLANKING

USE (a) AND (b) FOR B&W TO CRT CATHODE.
USE (c) FOR B&W TO CRT GRID

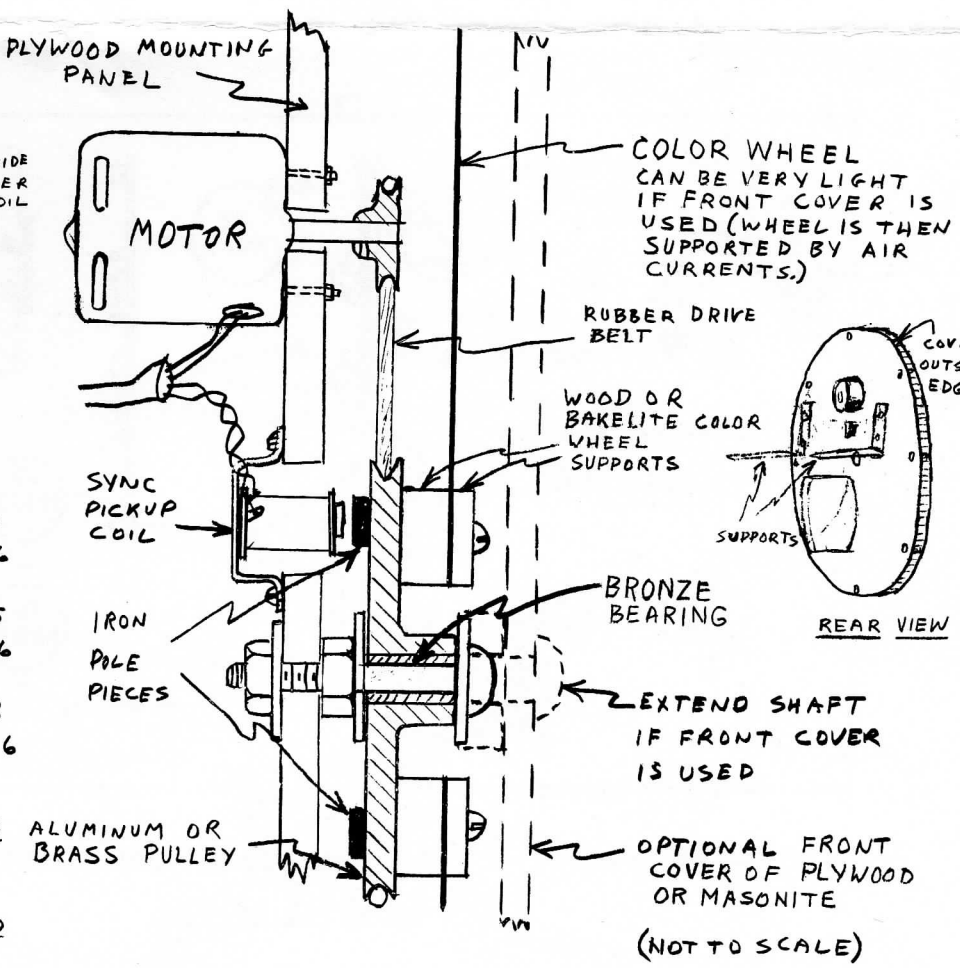
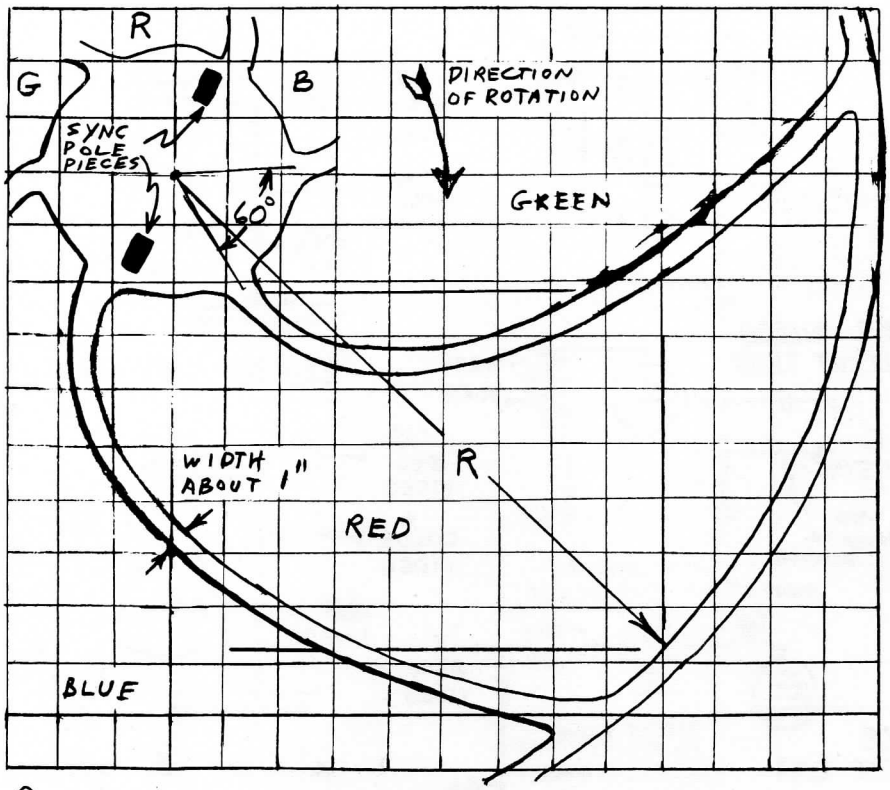


FIG. 12 COLOR WHEEL DRIVE



R = WHEEL RADIUS ACCORDING TO PIX TUBE SIZE

FIG. 11 COLOR WHEEL

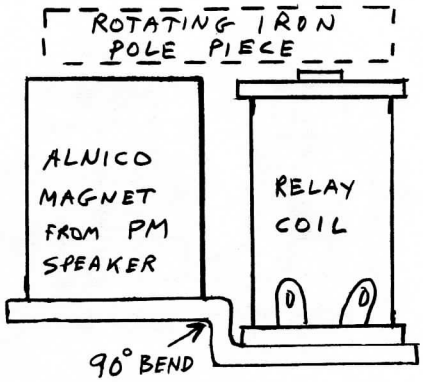


FIG. 13 SYNCHRONIZER COIL

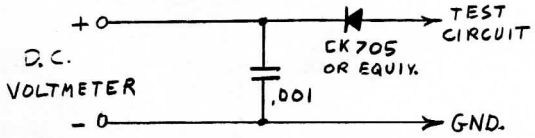


FIG. 14. R.F. DETECTOR

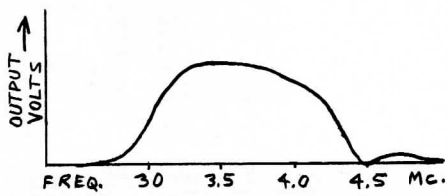


FIG. 15. CHROMA AMP. RESPONSE

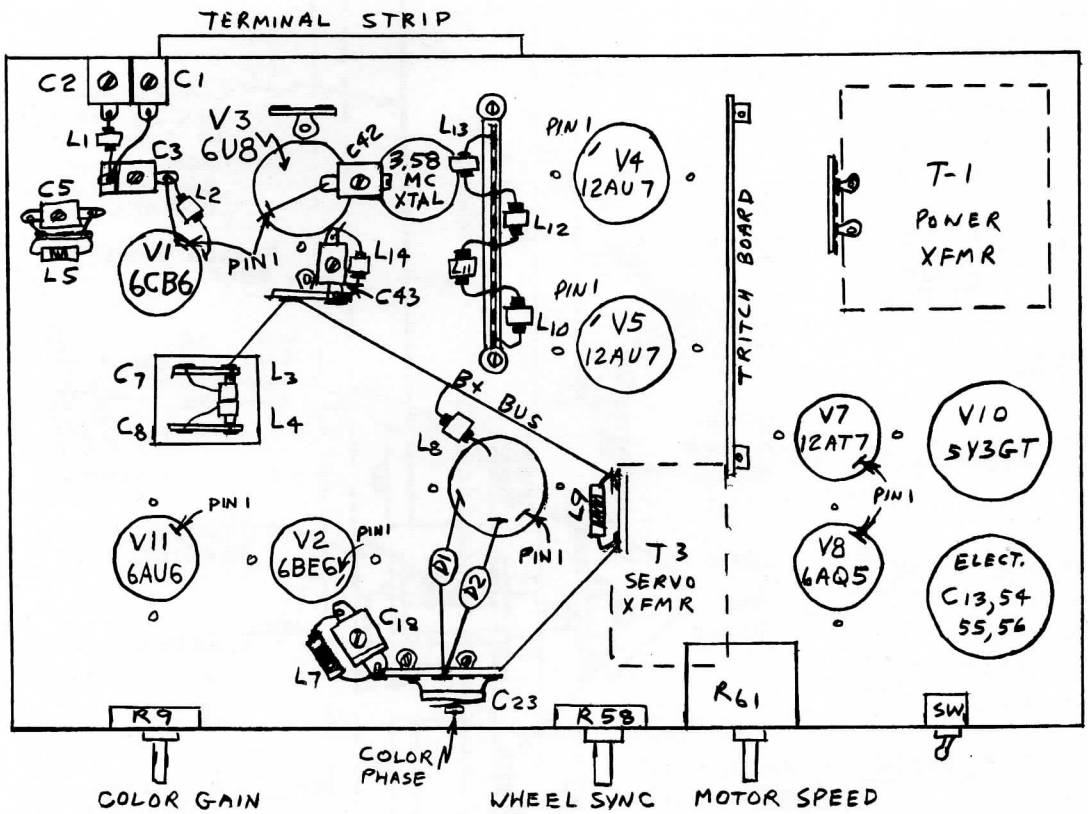
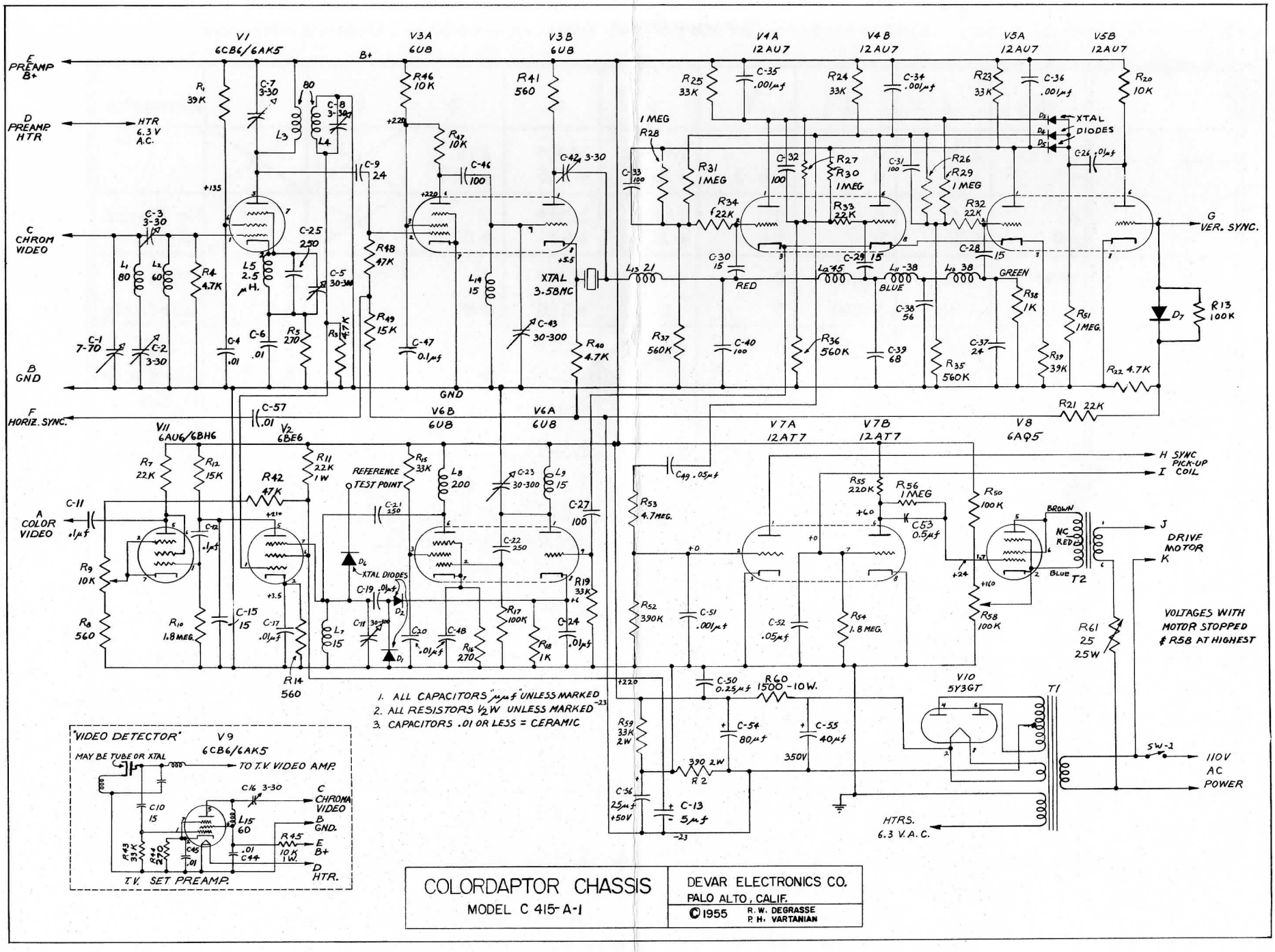


FIG. 4. CHASSIS LAYOUT


V1 6CB6/6AK5
V3A 6U8
V3B 6U8
V4A 12AU7
V4B 12AU7
V5A 12AU7
V5B 12AU7
V11 6AU6/6BH6
V2 6BE6
V6B 6U8
V6A 6U8
V7A 12AT7
V7B 12AT7
V8 6AQ5
V10 5Y3GT
T1
T2
E PREAMP B+
D PREAMP HTR
HTR 6.3 V A.C.
C CHROM VIDEO
B GND
F HORIZ. SYNC.
A COLOR VIDEO
G VER. SYNC.
H SYNC PICK-UP
I COIL
J DRIVE MOTOR
K
XTAL DIODES
XTAL 3.58MC
REFERENCE TEST POINT
VOLTAGES WITH MOTOR STOPPED & R58 AT HIGHEST
110V AC POWER
SW-1
HTRS. 6.3 V.A.C.
1. ALL CAPACITORS "µµf" UNLESS MARKED
2. ALL RESISTORS ½W UNLESS MARKED
3. CAPACITORS .01 OR LESS = CERAMIC
"VIDEO DETECTOR" V9 6CB6/6AK5
MAY BE TUBE OR XTAL
TO T.V. VIDEO AMP.
C CHROMA VIDEO
B GND.
E B+
D HTR.
T.V. SET PREAMP.
COLORDAPTOR CHASSIS
MODEL C 415-A-1
DEVAR ELECTRONICS CO.
PALO ALTO, CALIF.
©1955 R. W. DEGRASSE P. H. VARTANIAN

COLORDAPTOR MODEL C-415A RESISTANCE AND VOLTAGE# MEASUREMENTS

	1	2	3	4	5	6	7	8	9	Remarks
V_1	2 +0	270 +2.7	0 0	0 ±6.3	2* +220	39K* +125	270 +2.7			
V_2	2 +0	560 +2.5	0 0	0 ±6.3	15K* +205	22K* +62	2 +0			No Horiz. Sync
V_3	560* +217	62K −26	10K* +220	0 0	0 ±6.3	20K* +220	0 +0	58K +4.7	2 +0	V5A Conductg.
V_4	33K* +205	300K +83	39K +107	0 0	0 0	33K* +205	300K +83	39K +107	0 ±6.3	V4A Conductg.
V_5	33K* +205	300K +83	39K +107	0 0	0 0	10K* +160	5K+ 1 Meg − −5.5	0 +0	0 ±6.3	Meter Polarity Pin 7
V_6	2* +220	100K +0	33K* +135	0 0	0 ±6.3	7.5* +220	270 +3.3	1K + 620 − +6.0	33K +0	Meter Polarity Pin 8
V_7	1.8 Meg +0	390K +0	0 +0	0 0	0 0	220K* +42	1.8 Meg +0	0 +0	0 ±6.3	R58 at B+ end
V_8	420K +15	50K +100	0 0	0 ±6.3	50K +100	50K +100	420K +15			
V_9	33K +0	120 +2.3	0 0	0 ±6.3	10K* +1	10K* +135	120 +2.3			
V_{10}	NC	~750 +310	NC	620 ±290	NC	620 ±290	NC	~750 +310		R9 at B+ end
V_{11}	1.8 Meg +0	9K +43	0 0	0 ±6.3	22K* +220	22K* +220	9K +43			

* Resistance measured to 220 bus

Voltage measurements made with 20,000 Ω/v. multimeter, with color wheel inoperative and with no synchronizing pulses.

COLORDAPTOR

At last a reliable and proven color converter for your black and white TV set - Yes, COLORDAPTOR is your ticket for admission to the ever expanding number of COLOR SPECTACULARS, Join the thousands who have already converted their black and white sets to color and are now enjoying the marvels of modern color tele-sion.

Expensive? Not with COLORDAPTOR. This proven color conversion can be made at a price even the budget minded experimenter can afford. The basic parts kit costs less than $20 and all the remaining parts can be obtained from the scrap box or from your TV parts supplier.

COLORDAPTOR consists of a ten tube electronic chassis which in conjunction with a rotating color wheel will convert any size black and white TV, direct view or projection, to receive compatible color TV. Attachment of the COLORDAPTOR to the standard TV set is simple and in no way affects its normal operation.

COLORDAPTOR was first described in the January and February 1956 issues of Radio-Electronics. We now offer the new COLORDAPTOR Model C415A embodying the improvements of four years of field testing. This is a simple and soundly engineered converter which has been designed for optimum performance and a minimum of troubles. The following construction plans and parts kits for the Model C415A are available to aid and simplify the construction of your COLORDAPTOR.

PRICE LIST*

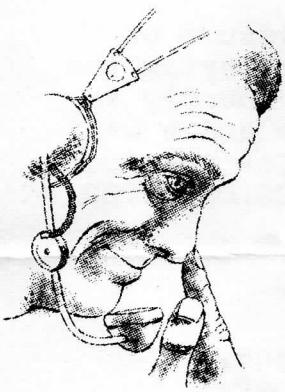
CD-S1	Complete specifications of NEW Model C415A COLORDAPTOR including theory of operation, simplified construction plans, schematic diagram, resistance and voltage measurements, operating and service hints, sample color filters	$ 1.95
	(S-1 with any order for a "K" or "M" kit)	.50
CD-S3	Full 11" x 17" COLORDAPTOR schematic	.75
CD-K11	Essential parts kit - contains all coils, rf transformer, 3.579545 mc crystal, delay line, and tricolor filter material. (includes K-5, 6, 7, 8, 9, 10).	
	K11A for sets up to 16"	19.95
	K11B sets 17" or larger	20.95
	K11C Heavy duty filters up to 16".	25.95
	K11D Heavy duty filters up to 21".	32.95
CD-K1	Complete COLORDAPTOR electronic chassis includes pre-punched chassis, all components including tubes, preamplifier, delay line, assembly instructions. This kit and your color wheel give brilliant color on any black and white TV. Color wheel and drive not included in kit. Ready to assemble and wire. Model C415A	99.85

*Prices subject to change.

October, 1962

SPECIAL COLORDAPTOR PARTS

CD-K5	Delay line - easily adjustable to give correct delay for any set	$5.75
CD-K6	Ref. Phase Shift Coils $L_{10,11,12,13}$	3.65
CD-K7	Double tuned xfmr. L_3 - L_4	2.35
CD-K8	Miscellaneous Coil Kit $L_{1,2,5,7,8,9,14,15,16}$	3.95
CD-K9	3.579545 mc Crystal	3.25
CD-K10A	Color Filter Material - sets to 16"	2.35
CD-K10B	Above Filters - sets 17" and larger	4.15
CD-K12A	Special heavy duty celluloid color wheel filters, .010" thick . Red, green, and blue sheet - up to 16" wheel	7.95
CD-K12B	Same as above except two sheets each - up to 21"	15.95
CD-K13	Above filters for self-supporting projection color wheel	4.95
CD-T3	Signal generator plug-in crystal 3.579545 mc	3.95
CD-T4	Signal generator plug-in crystal 3.563795 mc	3.95



Here's a LOW COST COLOR TV CONVERTER

That REALLY PERFORMS

COLORDAPTOR

1798 Santa Cruz Avenue ••••• Menlo Park, California

MOTORS - Following motors are all compact lightweight induction motors especially suited to drive a color wheel. All operate from 115V 60 cps line at a speed of approximately 1500 RPM.

CD-M1	- 1/70 HP motor may be used to direct drive a 1200 RPM projection wheel. 1/4" dia. shaft 2 bolt mounting	$11.9
CD-M2	- 1/30 HP motor to pulley drive up to 14" TV set color wheel. 5/16" dia. shaft 4 bolt mounting	14.95
CD-M3	- 1/15 HP motor to pulley drive up to 21" TV set color wheel. 3/8" dia. shaft 4 bolt mounting	17.95

SHIPPING All Kits postpaid except: K-1 - 12 lb; K-11C - 3 lb; K-11D - 5 lb; K-12A - 2 lb; K-12B - 4 lb; M-1 - 3 lb; M-2 - 4 lb; M-3 - 6 lb; Enclose postage with order - Excess will be returned.

TERMS Net cash - International shipments add 10%. California residents add 4% Sales Tax.