



COLOR TELEVISION - COLORIMETRY - II

In the last issue the nature of light was explained. Subtractive and additive primaries were described and the results of mixing various colors. In this issue the chromaticity diagram will be explained.

COLOR DIMENSIONS

Before venturing further into colorimetry, a few definitions are in order. To be completely catalogued a color must be described three-dimensionally. The three dimensions are hue, saturation and luminosity.

1. Hue = dominant wavelength.

No matter what primaries are used to make a color, the resulting color or hue cannot be resolved into its component parts. This new color has a dominant wavelength which would correspond to that hue when seen on the visible spectrum.

2. Saturation = color purity.

This is an indication of the spectral purity of a color or, in other words, the amount of white light present along with the dominant wavelength. As an example of the effect saturation can have on a hue, compare fire-engine red with baby pink. The only difference between the two is saturation. Fire-engine red is a highly saturated color because it contains very little white light in addition to its dominant wavelength. Baby pink, on the other hand, has the same dominant wavelength but also has a good amount of white light contaminating this hue. As might be expected, 100% saturation indicates a pure spectral hue while 0% saturation of any color is white.

3. Luminosity = brightness.

This indicates the amount of light energy which is contained within a given hue. There are certain factors concerning the brightness of a color which should be mentioned.

(A) The total brightness of a mixture is equal to the sum of the individual brightnesses of all colors in the mixture.

(B) If a color match is obtained at one brightness level, the match will be maintained over a wide range of brightness levels.

CHROMATICITY DIAGRAM

The last fact concerning color match is very helpful because it will

allow the use of a two-dimensional "road map" for color determination. Color has three factors — hue, saturation and brightness, as previously stated. To lay out a two-dimensional representation of color, one variable must be held constant. Because hue and saturation are unaffected by variations in brightness, it is possible to hold brightness constant and show two-dimensionally the remaining two variables — hue and saturation.

This representation of the colors visible to the human eye is commonly called the Chromaticity Diagram, and is the result of exhaustive investigation on the part of the International Commission on Illumination who, in order to standardize colors and color-mixtures, developed a psychophysical system of color specification. The system makes use of the "Standard Observer" and a standard light source. This means that any experiment can be dupli-

cated at any time without the result being dependent on the visual characteristics of a single individual.

It will be recalled that when three-primary-color reproduction was first discussed, it was implied that all visible colors could be matched by the proper proportions of the primaries. This is not true. The chromaticity diagram will be very useful in visualizing the limitations of this color reproduction system.

Figure 6 is a black and white representation of the ICI Chromaticity Diagram. Starting at the lower left corner of the horseshoe-shaped boundary and moving clockwise, the eye passes a familiar gamut of colors. The horseshoe-shaped boundary does indeed represent the spectrum of visible colors. The boundary itself is indicative of 100% saturated colors. In about the center of the area bounded by the horseshoe

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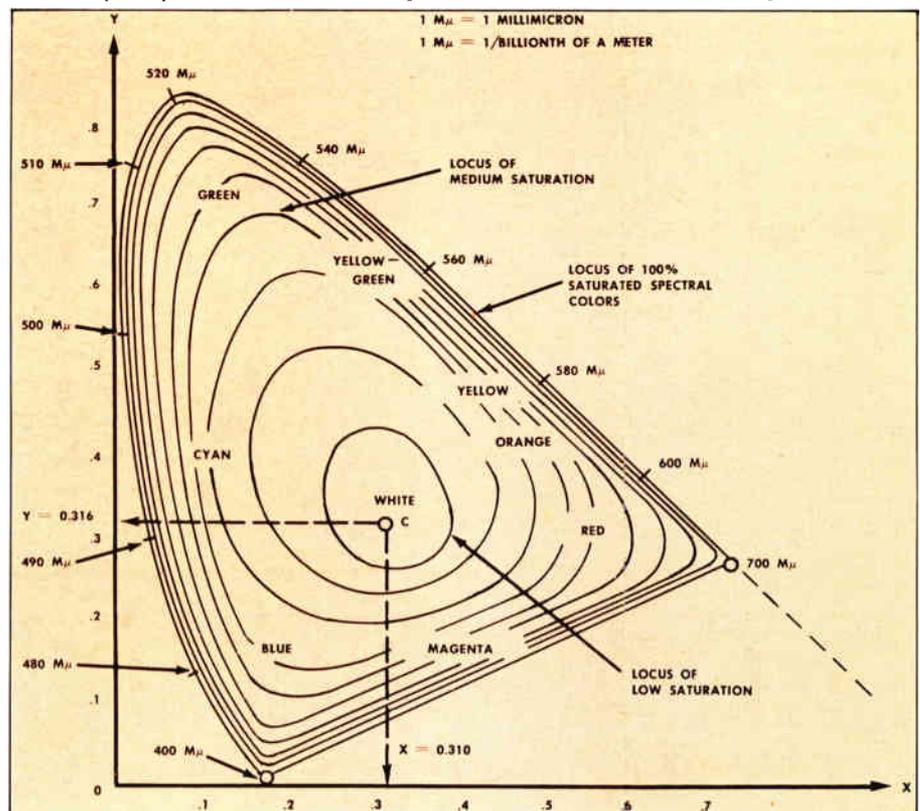
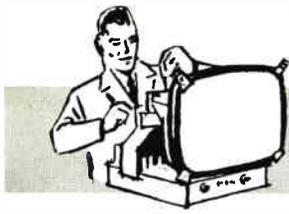


Fig. 6 — STANDARD XYZ CHROMATICITY DIAGRAM: Any color completely defined by two numerical quantities specifying chromaticity (hue and saturation) plus brightness information.



BENCH NOTES

SPEAKER REPAIR

While servicing television and radio sets, I find many speakers with damaged cones. Where the damage is not so excessive so as to require replacing the cone, I have found that it can be repaired quickly and inexpensively by using plastic rubber.

This compound can be purchased in almost any store handling hardware items. It is wet when applied but will dry soft and elastic within 24 hours. This makes it ideal to apply to speaker cones, even at the outer edge, because it does not hinder the free movement or stiffen the cone which is the case when other cements are used.

The product I use comes in a 4 oz. tube retailing for about \$1.00. The brand name is Duro Plastic Rubber manufactured by the Woodhill Chemical Co., Cleveland, Ohio.

*William A. Pierce
122 Wesley Ave.
Cherry Hill, N. J. 08034*

SOLDER REMOVAL

In regard to the trouble (bugaboo), of removing components with multiple leads from printed circuit boards, I recently stumbled on to a system, which has, anything yet devised beat by a country mile.

Secure an air storage tank. The kind oil stations use for emergency inflation of flat tires on the road. Equip the tank with about 6 to 10 feet of hose and a hand operated squeeze valve or blow gun. On the gun fasten on a piece of copper tubing with the opening on the end cut down to about 1/16 of an inch or slightly larger. Inflate tank to about 140 lbs. of pressure.

When terminal is heated, a short burst of air, not only loosens the connections, but, completely cleans out the holes, so that, after all the terminals are loosened, the part will fall out by itself.

The only precaution to be taken, is to clean the board, for about an inch radius of the part, as a very fine spray of solder will cling to the board.

*F. B. Callahan
J. P. Scherrman, Inc.
Farley, Iowa*

FUSE SAVER

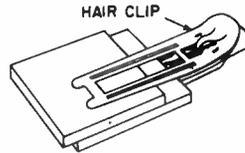
On the new line of Color TV, instead of using circuit breakers as in the past, manufacturers are now using plug in fuses.

If on a job and you find the fuse blown, instead of plugging in a new fuse, I made up a circuit breaker by taking the old plug in fuse pins and soldering them to a breaker. I plug in this breaker until I find what is causing this fuse to blow. When repaired I plug in regular fuse. This way you can save many fuses until you find the short.

*Jay Kohler
171 Franklin Ave.
Hubbard, Ohio*

INEXPENSIVE HEAT SINK

Women's flat hair clips, bent to appropriate shape for the job, make excellent clamps to hold small components



together for soldering. They also serve as a heat sink.

*S. Clark
Box 2162
East Bradenton, Florida 33507*

EASY OFF

When a can of soldering paste gets messed up, it's a job to pry the lid off. This becomes easy when a cuphook is soldered onto the top cover and used as a handle.

*Harry J. Miller
Advance Television-Radio
991 Forty-Second St.
Sarasota, Florida*

HORIZONTAL SYNC

Philco TV-8II25 (and other sets using diodes for phase comparators in horiz. sync.)

We have had several Philcos wherein the horiz. would suddenly lose sync and the horiz. frequency would change drastically. A readjustment of the horiz oscillator would return the set to normal, however, at any moment it would do as stated. It appeared that the oscillator was at fault, however, a measurement of the diode pack showed one section as apparently open. The diodes were replaced with GE 1N538 and in each case stability has been perfect.

*Leonard Chioma
2020 Natalen Rd.
Winter Park, Fla.*

ARCING COLOR TV

Most color televisions employ a high voltage supply of approximately 25 KV (25,000 volts).

There may be some crackling that is normal due to moisture in air and dust collection.

If you encounter a color television that arcs repeatedly, replace the high voltage regulator tube 6BK4 — many manufacturers use this tube as a regulator.

Due to its high power most tube checkers cannot check this tube, and turning brightness control shows everything operative.

Direct replacement will usually correct trouble because when this tube fails voltage rises to about 27 KV which can cause the excessive arcing and corona discharge.

*Bernard H. Serota
2502 S. Philip Street
Philadelphia, Pa. 19148*

INSULATE SCREWDRIVERS

When working on radios, T.V.s and other devices where you need insulated screwdrivers, don't go out and buy a set. Just take your favorite screwdriver and measure the diameter of the shank. Find a piece of spaghetti the same diameter and slip it over the shank. This, as you can see, is a very inexpensive way to insulate and you can leave it on permanently or just slip it on when you need it. You can also reinsulate your old torn insulated screwdrivers this way.

*Ed LaPour
908 Hayward
Bremerton, Wash.*

FREING COIL SLUGS

Often coil slugs are stuck so that any attempt to turn them will result in a cracked slug or stripped hole or stripped alignment tool.

If on the first tug the slug doesn't turn easily don't force it, insert an ice pick into the hole and apply heat to the ice pick with a soldering gun as near to the coil as is practical for about one minute.

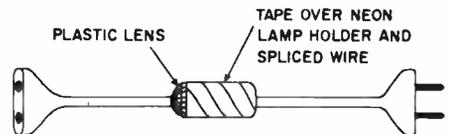
Remove the ice pick and insert the alignment tool into the slug and it will turn freely.

I have used this method for some time on IF's, ratio detectors etc. with almost 100% success.

*William J. Praetz
59-23 Cooper Ave.
Glendale 27, N. Y.*

OUTLET TESTER

I've found one out of about forty dead or intermittent TV sets to be victims of poor electrical outlet contacts or a blown fuse. One neat way to detect this "TV fault" is to permanently



wire a neon test light on to your cheater cord. Before I pull the back off of a set, I plug in my "cheater indicator". With this device, I know the relative condition of my customer's electrical source immediately with no extra effort. The "cheater indicator" is used as a conventional cheater, as soon as the set's back is off.

*M. L. Shapiro
75 Hunting Rd.
Needham Hts., Mass. 02194*

Note:

Those desiring to have letters published in this column should write the Editor, Techni-Talk, Electronic Components Division, General Electric Company, Owensboro, Kentucky. For each such letter selected for publication you will receive \$10.00 worth of General Electric tubes. In the event of duplicate or similar items, selection will be made by the Editor and his decision will be final. The Company shall have the unlimited right without obligation to publish or otherwise use any idea or suggestion sent to this column. Caution: The ideas and suggestions expressed in this column are those of the individual writers. These ideas and suggestions have not been tried by the General Electric Company and therefore are not endorsed, sponsored or recommended.

RECEIVING TUBE POPULARITY LISTING

Listed below are the 267 most popular tube types based on distributor usage. One list is in order by usage and the other by alpha-numerical sequence. The figure

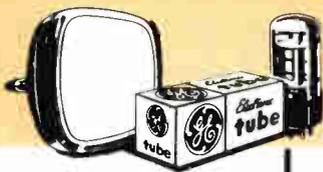
following each tube indicates popularity. Number 1, 5U4GB/5AS4A had the highest volume; Number 2, 50C5 was next, etc.

LISTING BY VOLUME

5U4GB/5AS4A	1	6EM7	38	6BE6	76	6BL7GTA	114	6JH8	153	6DE7	192	6EJ7/EF184	231
50C5	2	6CM7	39	6GM6	77	1R5	115	6SJ7	154	6FH5	193	6ES8/ECC189	232
6CB6A/6CF6	3	6JS6A	40	6CU5	78	6BN4A	116	6X5GT	155	6HF8	194	6EW7	233
6DW4B	4	3AT2	41	3GK5	79	6CX8	117	15KY8A	156	6HQ5	195	6J5	234
6JE6A	5	5Y3GT	42	5CG8	80	6DA4A/6DM4A	118	17AX4GTA	157	11KV8	196	6U10	235
6AQ5A/6HG5	6	6V6GTA	43	6CY5	81	6GY6/6GX6	119	17AY3A	158	12SN7GTA	197	8BQ5	236
6DQ6B/6GW6	7	12AX4GTB	44	6X4	82	6KT8	120	21CY5	159	17D4	198	10GK6	237
6AX4GTB	8	12AV6	45	17DQ6B/	121	6SL7GT	121	6AH6	160	22BW3	199	12AQ5	238
35W4	9	1X2A/B	46	17GW6	83	8AW8A	122	6AK5/EF95	161	7025/12AX7A	200	12AV5GA	239
6BQ7A/6BZ7	10	3BZ6	47	1K3	84	25L6GT	123	6AS8	162	3BN6	201	12DT8	240
6SN7GTB	11	1V2	48	5AN8	85	2AV2	124	6AX3	163	6CB5A	202	12SA7	241
6AU6A	12	5U8	49	6AS5	86	4BQ7A/4BZ7	125	6JT8	164	6ER5	203	12SK7	242
6EA8	13	6BK7B	50	6AU8A	87	5CL8A	126	6LF8	165	12DT5	204	12W6GT	243
6BZ6	14	12DQ6B/	46	6JU8	88	6EA7	127	13GF7A	166	1U5	205	1AD2	244
6GH8A	15	12GW6	51	6KZ8	89	6HS8	128	22DE	167	4DT6	206	4EJ7	245
6FQ7/6CG7	16	1G3GT/1B3GT	52	6W6GT	90	6JH6	129	2BN4A	168	6CY7	207	5BR8	246
6CG8A	17	6CD6GA	53	12AU6	91	33GY7	130	5AT8	169	6EU7	208	6BH11	247
0Z4	18	6L6GC	54	6AF4A/6DZ4	92	6CL6	131	5KE8	170	6HE5	209	6BK5	248
6U8A/6KD8/	19	6J6A	55	6AM8A	93	6GN8	132	6AB4	171	6JN6A	210	6BS3A	249
5KD8	19	6AV6	56	6JC6	94	6JM6A	133	6BH8	172	6JZ8	211	6BX7GT	250
3A3A/3CA3/	20	6T8A	57	6KA8	95	6B10	134	6BS8	173	12BL6	212	6B5	251
3AW3	20	6AF4	58	6BC8	96	6BJ6A	135	6CN7	174	13DR7	213	6EA4	252
6AW8A	21	6DE4	59	6BN6/6KS6	97	6BN8	136	6CS6	175	17BE3	214	6EH7/EF183	253
12AX7/ECC83	22	6GH6	60	6EM5	98	6CW4	137	6CS7	176	19AU4GTA	215	6FS5	254
12AU7A/ECC82	23	6S4A	61	3DG4	99	6FM7	138	6DS4	177	19T8	216	6FV6	255
12BY7A	24	35C5	62	6BQ6GTB	100	7AU7	139	6W4GTA	178	22JU6	217	6GC5	256
6AU4GTA	25	6DT6A	63	6BR8A/6FV8A	101	8FQ7/8CG7	140	12AT6	179	23Z9	218	6KE8	257
12BA6	26	6EB8	64	6C4	102	12AD6	141	12AV7	180	35L6GT	219	6L6	258
12BE6	27	3CB6/3CF6	65	6GE5	103	12GN7A	142	12CA5	181	1U4	220	6SQ7	259
6BK4A	28	6BU8	66	6HZ6	104	5AM8	143	12SQ7	182	2AS2	221	8B10	260
12BH7A	29	6GK5/6FQ5A	67	6K6GT	105	6AF3	144	13EM7/15EA7	183	2FS5	222	8JV8	261
12AT7/ECC81	30	2CW4	68	12B4A	106	6AL3	145	3V4	184	2GK5/2FQ5A	223	10CW5	262
6AL5	31	4BZ6	69	17JZ8	107	6DK6	146	6AF11	185	3CY5	224	12AB5	263
6X8A	32	6AY3B	70	50EH5	108	6DN7	147	6BA8A	186	3DT6	225	12AF3	264
6EW6	33	6CL8A	71	50L6GT	109	6EV5	148	6BA11	187	4CB6	226	12FX5	265
6GF7A	34	10DE7	72	6DE6	110	6FG7	149	6BG6GA	188	5EA8	227	22JG6A	266
6GU7	35	35Z5GT	73	6CQ8	111	6GJ7/ECF801	150	6BQ6GA/6CU6	189	6AT8A	228	25DN6	267
6BQ5/EL84	36	6AN8A	74	6DR7	112	6GK6	151	6CA4	190	6BY8	229		
6DQ5	37	6BA6/EF93	75	12AZ7A	113	6HB7	152	6CZ5	191	6CU8	230		

ALPHA-NUMERICAL LISTING

0Z4	18	5U4GB/5AS4A	1	6BK7B	50	6DE6	110	6GU7	35	6W6GT	90	12FX5	265
1AD2	244	5U8	49	6BL7GTA	114	6DE7	119	6GY6/6GX6	119	6X4	82	12GN7A	142
1G3GT/1B3GT	52	5Y3GT	42	6BN4A	116	6DK6	146	6HB7	152	6X5GT	155	12SA7	241
1K3	84	6AB4	171	6BN6/6KS6	97	6DN7	147	6HE5	209	6X8A	32	12SK7	242
1R5	115	6AF3	144	6BN8	136	6DQ5	37	6HF8	194	7AU7	139	12SN7GTA	197
1U4	220	6AF4	58	6BQ5/EL84	36	6DQ6B/6GW6	7	6HQ5	195	8AW8A	122	12SQ7	182
1U5	205	6AF4A/6DZ4	92	6BQ6GA/6CU6	189	6DR7	112	6HS8	128	8B10	260	12W6GT	243
1V2	48	6AF11	185	6BQ6GTB	100	6DS4	177	6HZ6	104	8BQ5	236	13DR7	213
1X2A/B	46	6AH6	160	6BQ7A/6BZ7	10	6DT6A	63	6J5	234	8FQ7/8CG7	140	13EM7/15EA7	183
2AS2	221	6AK5/EF95	161	6BR8A/6FV8A	101	6DW4B	4	6J6A	55	8JV8	261	13GF7A	166
2AV2	124	6AL3	145	6BS3A	249	6EA4	252	6JC6	94	10CW5	262	15KY8A	156
2BN4A	168	6AL5	31	6BS8	173	6EA7	127	6JE6A	5	10DE7	72	17AX4GTA	157
2CW4	68	6AM8A	93	6BU8	66	6EA8	13	6JH6	129	10GK6	637	17AY3A	158
2FS5	222	6AN8A	74	6BX7GT	250	6EB8	64	6JH8	153	11KV8	196	17BE3	214
2GK5/2FQ5A	223	6AQ5A/6HG5	6	6BY6	251	6EH7/EF183	253	6JM6A	133	12AB5	263	17D4	198
3A3A/3CA3/		6AS5	86	6BY8	229	6EJ7/EF184	231	6JN6A	210	12AD6	211	17DQ6B/	
3AW3	20	6AS8	162	6BZ6	14	6EM5	98	6JS6A	40	12AF3	164	17GW6	83
3AT2	41	6AT8A	228	6C4	102	6EM7	38	6JT8	164	12AQ5	238	17JZ8	107
3BN6	201	6AU4GTA	25	6CA4	190	6ER5	203	6JU8	88	12AT6	179	19AU4GTA	215
3BZ6	47	6AU6A	12	6CB5A	202	6ES8/ECC189	232	6JZ8	211	12AT7/ECC81	30	19T8	216
3CB6/3CF6	65	6AU8A	87	6CB6A/6CF6	3	6EU7	208	6K6GT	105	12AU6	91	21GY5	159
3CY5	224	6AV6	56	6CD6GA	53	6EV5	148	6KA8	95	12AU7A/ECC82	23	22BW3	199
3DG4	99	6AW8A	21	6CG8A	17	6EW6	33	6KE8	257	12AV5GA	239	22DE4	167
3DT6	225	6AX3	163	6CL6	131	6EW7	233	6KT8	120	12AV65	45	22JG6A	266
3GK5	79	6AX4GTB	8	6CL8A	71	6FG7	149	6KZ8	89	12AV7	180	22JU6	217
3V4	184	6AY3B	70	6CM7	39	6FH5	193	6L6	258	12AX4GTB	44	23Z9	218
4BQ7A/4BZ7	125	6B10	134	6CN7	174	6FM7	138	6L6GC	54	12AX7/ECC83	22	25DN6	267
4BZ6	69	6BA6/EF93	75	6CQ8	111	6FQ7/6CG7	16	6LF8	165	12AZ7A	113	25L6GT	123
4CB6	226	6BA8A	186	6CS6	175	6FS5	254	6S4A	61	12B4A	106	33GY7	130
4DT6	206	6BA11	187	6CS7	176	6FV6	255	6SJ7	154	12BA6	26	35C5	62
4EJ7	245	6BC8	96	6CU5	78	6GC5	256	6SL7GT	121	12BE6	27	35L6GT	219
5AM8	143	6BE6	76	6CU8	230	6GE5	103	6SN7GTB	11	12BH7A	29	35W4	9
5AN8	85	6BG6GA	188	6CW4	137	6GF7A	34	6SQ7	259	12BL6	212	35Z5GT	73
5AT8	169	6GH6	60	6CX8	117	6GH8A	15	6T8A	57	12BY7A	24	50C5	2
5BR8	246	6BH8	172	6CY5	81	6GJ7/ECF801	150	6U8A/6KD8/		12CA5	181	50EH5	108
5CG8	80	6BH11	247	6CY7	207	6GK5/6FQ5A	67	5KD8	19	12DQ6B/		50L6GT	109
5CL8A	126	6BJ6A	135	6CZ5	191	6GK6	151	6U10	235	12GW6	51	7025/12AX7A	200
5EA8	227	6BK4A	28	6DA4A/6DM4A	118	6GM6	77	6V6GTA	43	12DT5	204		
5KE8	170	6BK5	248	6DE4	59	6GN8	132	6W4GTA	178	12DT8	240		



GENERAL ELECTRIC



EXPERIMENTER HOBBYISTS KIT

Easy to assemble and wire simple electronic circuits.

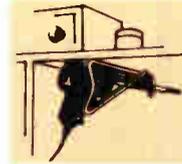
Some typical circuits can be found in the new G E Hobby Manual, ETR-3960.

Rubber feet (4) — fasten with self-tapping screws to each corner.

Push-In terminals (15) — fit board holes. Serrated slots go on top.

3 1/2" x 4 1/2" terminal board will fit many small metal boxes or can be cut to size.

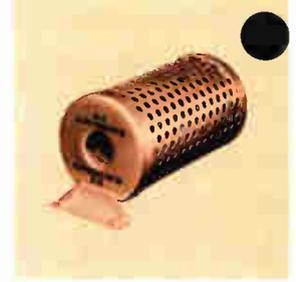
ETR-4288 Cost \$.98



SOLDERING GUN OR ELECTRIC DRILL HOLDER

This G E Soldering Gun or Electric Drill Holder prevents burns and damage to instruments, wires and service manuals. Holds an electric drill in a safe, ready-to-use position. It can be easily mounted to any surface with clamps and screws supplied with units.

ETR-2582 Cost \$0.75



SOLDERING IRON HOLDER

Made to mount on bench edge or bench top. Will accommodate soldering irons up to 3/4" in diameter. Protects your hands, wires, diagrams, other tools from burns. Cadmium aluminum finish resists heat discoloration. Holes in both inside and outside cylinders provide maximum air circulation.

ETR-2790 Cost \$1.70



FIRE EXTINGUISHER

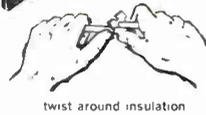
Effective against all types of fires — grease, gasoline and electrical. Chemical contents is an electrical "non-conductor." It won't "short out" line circuits.

Small enough to carry in service case and economical enough to have one in shop, home, car and service truck.

Needs no inspection or recharging — does not corrode or deteriorate. Guaranteed for 20 years.

Effectiveness of chemical makes it possible to extinguish a fire very quickly — as fast as three seconds — reducing fire damage.

ETR-4500 Cost \$3.95



twist around insulation



pull off insulation

WIRE STRIPPER

Four cutting edges for most wire sizes. Select cutting edges slightly smaller than outside dimension of insulation. Press insulated wire fully into cutting channel.

Rotate wire stripper completely around wire and pull.

ETR-2376 COST \$0.65

BENCH MIRROR

A mirror that saves you valuable time because it's designed specifically for the TV workbench. Adjusts quickly to any desired height.

ETR-1275 Cost \$3.60



TUBE PULLER

Never be without it on your workbench or in your service case. It protects you against burns, cuts and shocks — no matter how firmly the tubes may be wedged in their socket. Fits all regular glass types, all metal tubes, plus seven- and nine-pin miniatures, and compactrons.

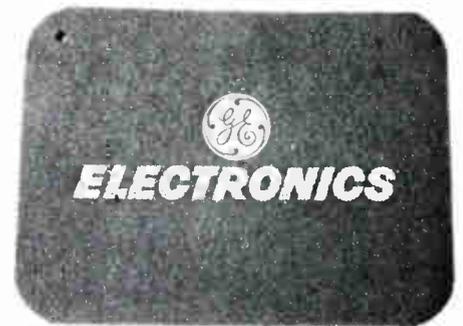
ETR-1094 Cost \$0.35



SAFETY GLASS PULLER

It's exactly what you need to remove safety glass quickly, easily — and safely! Prevents cracking, chipping and other damage while you remove the glass. The three-inch suction cup holds firmly, is easily removed from the glass by unique vacuum release tip. Won't leave marks on glass.

ETR-1592 Cost \$0.95



PICTURE TUBE PILLOW

This 1/2" thick foam-plastic cushion provides the surest possible protection against scratches on the tube face and edges. Order at least one for every technician in your shop. Never lay a picture tube on anything else.

ETR-1469 Cost \$0.75

SERVICE AIDS

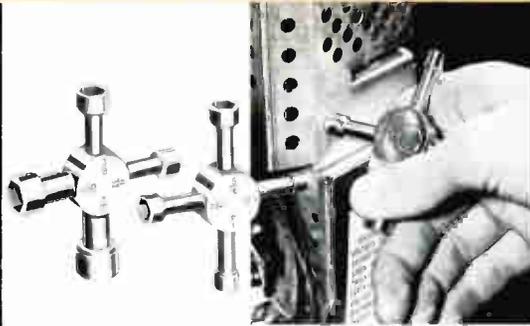
specifically engineered and field-tested
for the TV/radio service dealer



SERVICE DROP CLOTH

A rugged, hard-wearing plastic sheet that does double duty: It protects furniture and floor coverings, even against hot solder. It serves as a protective cover for radio and TV cabinets when moving them to or from the home.

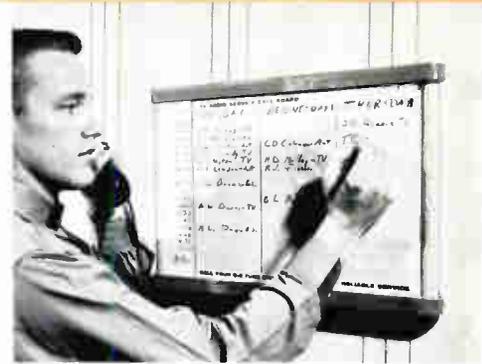
ETR-1021 Cost \$1.95



TWIN-X-WRENCH SET

The two wrenches in this set actually do the work of eight hex-head socket wrenches, save plenty of space and weight in your repair kit. They're designed especially for TV and radio service work, where you need to get maximum leverage, often in very close quarters.

ETR-752 Cost \$3.45



SERVICE CALL BOARD

In a single glance, this easy-to-use rolling chart tells you where your work stands — shows you your work schedule for days or weeks in advance — enables you to schedule work immediately. Marking pencil and complete instructions included.

ETR-2144 Cost \$1.49



FUSE AND HEATER CHECKER

Pocket-size — yet it will check virtually all tubes used in series-string TV sets and radios (AC, DC, and portable), including compactrons, novars and picture tubes. Also tests pilot lamps and fuses. Rugged construction. Battery powered. Actual size — 4" x 2 3/4" x 1 3/4".

ETR-981 Cost \$2.95



COMPACTRON SOCKETS

Two 12-pin sockets for compactron devices in each package. New feature — a raised "key" ridge between pins 1 and 12 to help when inserting the compactron in hidden locations. The pins are numbered on the bottom of each socket.

ETR-2976 Cost \$0.39



CAPACITOR TAB ADJUSTER

Simplifies removal and installation of twist-prong electrolytic capacitors and also some types of variable controls. Hollow tip fits perfectly over mounting tabs. With a twist you break off old tab . . . lock in new.

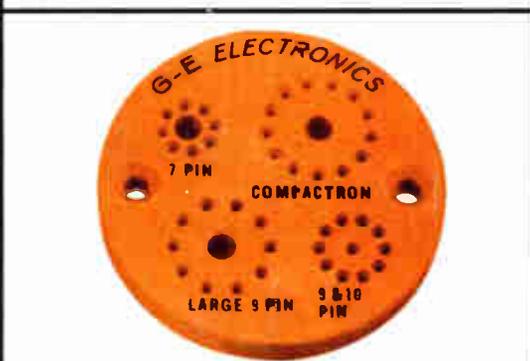
ETR-2958 Cost \$1.00



REAR CONTROL EXTENSION

Permits quick, sure adjustment of TV controls without removing back of set. One end tapered to fit snugly over knurled control shafts. Pin in other end fits slotted shafts and, unlike screwdrivers, cannot slip off.

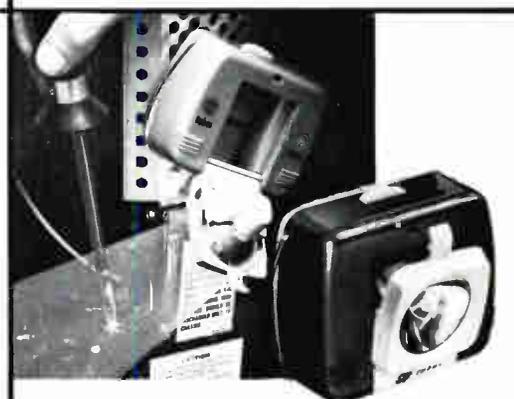
ETR-2089 Cost \$0.35



MULTI-TUBE PIN STRAIGHTENER

Straightens pins in a jiffy. Helps to eliminate tube damage caused by bent pins. New small size just right to slip into trouser or shirt pocket. Red-orange color makes it easy to find.

ETR-3200 Cost \$0.60



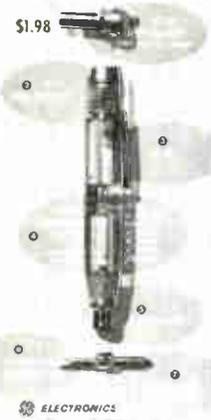
MAGNETIC SWING-BEAM SERVICE LIGHT

This TV Service Light has a magnet that holds it firmly to the chassis, leaving both hands free for work. The front of the lamp swings out to any desired angle, allowing you to aim the beam exactly where you need it.

ETR-1593 Cost \$2.25

Multi Purpose
POCKET TOOL

\$1.98



POCKET TOOL

Here is a practical and useful tool that will make servicing easier and faster. This new pocket tool will enable you to remove the back of any receiver regardless of the type of fastening without opening your tool or service case.

Lightweight pocket tool clips to a shirt pocket and contains Phillips and standard screw driver; 1/4", 5/16" and 3/8" hex sockets; high voltage tester and level.

Use screwdriver end as prod, neon bulb in handle indicates presence of high peak voltage at plate of horizontal output tube or high voltage rectifier.

Lay unit flat with G E monogram down to use as a level when installing phonographs, air conditioners, etc.

ETR-3594

Cost \$1.98



PRINTED CIRCUIT BOARD CUTTING TOOL

This new G E Service Aid is a real time saver when servicing printed circuit boards. This versatile tool makes Printed Circuit trouble shooting easy. Use tool to cut through — make test — then flow solder across cut.

Blade slides horizontally — adjusts to cut "paper thin." In this position tool cuts only the printed circuit and does not weaken board.

Handy for opening packages and numerous other daily tasks. Blade retracts — safe to carry in pocket or service case.

Uses standard single-edge blade.

ETR-3896

Cost \$0.25



Part Holder

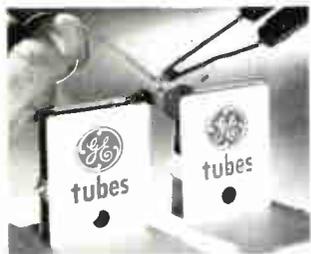
\$1.35

PART HOLDER

The General Electric Part Holder is designed to stand upright or attach to edge of service bench. Many times a "third hand" is needed to hold parts in position particularly while soldering. Other times something is needed to hold a piece of solder or some other item when both hands are being used. More than one G-E Part Holder can be used to hold different parts in a fixed position until solder "sets."

ETR-3851

Cost \$0.35



FIVE-IN-ONE COMBINATION TOOL

Here is a new lightweight tool that will save time either on the bench or on home service calls.

It is five tools in one with a pocket clip. Contains No. 1 Phillips screwdriver and standard screwdriver; 1/4", 5/16" and 3/8" hex sockets.

ETR-3910

Cost \$0.98



Adjustable Door Clock

\$3.50

DOOR CLOCK SIGN

Let your customers know when — you are OPEN, you are CLOSED, you will be BACK.

It can be used to hang on front door or in a visible location. Hands movable to time of return when leaving for lunch — for the day — for service calls — for emergencies. Sign turns around so OPEN is visible when you return.

ETR-3826

Cost \$0.50

WILL RETURN at



PROMPT - EFFICIENT SERVICE

OPEN

ELECTRONICS
Best for any set!

GENERAL ELECTRIC

regress in lectronics



NEW G E TUBE AND PARTS CABINET

Here is the answer to your tube and parts storage problem. Dress up your store with one or more for over-the-counter stock. Save time by having another at the bench to hold servicing supplies.

Six shelves provide over twelve feet of storage space. The pegboard hanger holes on each side give additional capacity for numerous items such as capacitors, semiconductors, tape, etc.

Cabinets can be mounted side by side or stacked one above the other.

Designed for shipping via parcel post. Can be assembled in a few minutes. All parts snap into place without use of nuts or bolts.

ETR-3803

Cost \$11.75

TELEVISION

**CB — 23" CHASSIS
INSUFFICIENT WIDTH**

This problem may result from several conditions which should be investigated in proper order as follows. If step 1 or 2 corrects the condition, do not perform step 3.

1. Check value of yoke capacitors C-121, C-122.

ET77X91 Transformer used in chassis stamped EN151 and lower in conjunction with C121, C122 @ 260 pf in Deflection Yoke. ET77X93 Transformer used in chassis stamped EN 152 and higher in conjunction with C121, C122 @ 470 pf in Deflection Yoke.

Yoke - Deflection. In ET76X42 and ET76X47, C121 and C122 are 260 pf. In ET76X44 and ET76X46, C121 and C122 are 470 pf. ET76X47, used as a general replacement, is supplied with both 260 pf and 470 pf capacitors with instructions.

2. Adjust line voltage to 117 volts and check Horizontal Deflection alignment as given below:

Horizontal Deflection Alignment

Test equipment connections:

GENERAL — Tune receiver to signal and synchronize the picture.

MILLIAM METER — Open the jumper and insert a 0-500 ma. meter between pin 2 (cathode) of V103 (Horizontal Output) and ground. Bypass meter with .47 uf. capacitor at the tube socket. See Fig. 1 and 2.

VACUUM TUBE VOLT METER — Connect to high voltage anode lead through high voltage probe at picture tube.

Use Order Coupon Below

ORDER COUPON

Order from your local G E electronic components distributor or mail this form to:

General Electric Company
Department "B"
3800 N. Milwaukee Ave.
Chicago, Ill. 60641

Enclosed is money order or check payable to General Electric Company for:

Quantity		Price
.....	ETR-15M Essential Characteristics	\$ 2.00.....
.....	ETR-752 Twin-X Wrench Set.....	3.45.....
.....	ETR-981 Fuse and Heater Checker.....	2.95.....
.....	ETR-1021 Service Drop Cloth.....	1.95.....
.....	ETR-1094 Tube Puller35.....
.....	ETR-1275 Bench Mirror	3.60.....
.....	ETR-1469 Picture Tube Pillow.....	.75.....
.....	ETR-1592 Safety Glass Puller.....	.95.....
.....	ETR-1593 Magnetic Swing-Beam Service Light.....	2.25.....
.....	ETR-2089 Rear Control Extension.....	.35.....
.....	ETR-2144 Service Call Board.....	1.49.....
.....	ETR-2376 Wire Stripper65.....
.....	ETR-2582 Soldering Gun or Electric Drill Holder.....	.75.....
.....	ETR-2790 Soldering Iron Holder.....	1.70.....
.....	ETR-2968 Capacitor Tab Adjuster.....	1.00.....
.....	ETR-2976 Compactron Sockets39.....
.....	ETR-3200 Multi-tube Pin Straightener.....	.60.....
.....	ETR-3594 Pocket Tool	1.98.....
.....	ETR-3803 Tube and Parts Cabinet.....	11.75.....
.....	ETR-3826 Door Clock Sign.....	.50.....
.....	ETR-3851 Part Holder35.....
.....	ETR-3896 Printed Circuit Board Cutter.....	.25.....
.....	ETR-3910 Five-in One Combination Tool.....	.98.....
.....	ETR-3960 Electronic Components Hobby Manual.....	1.50.....
.....	ETR-4288 Experimenter Hobbyist Kit.....	.98.....
.....	ETR-4500 Fire Extinguisher	3.95.....
.....	(Include applicable state and local tax) \$.....	
.....	TOTAL \$	

NAME.....

STREET ADDRESS.....

CITY, STATE and ZIP CODE.....

(Please Print)

Alignment Procedure

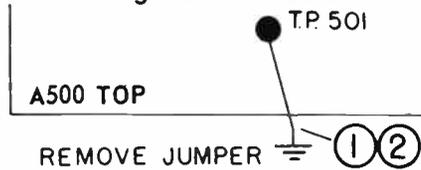


Fig. 1

STEP 1: Short jumper from TP501 to ground. Adjust horizontal hold control R130 to the center of its range. See Fig. 3.

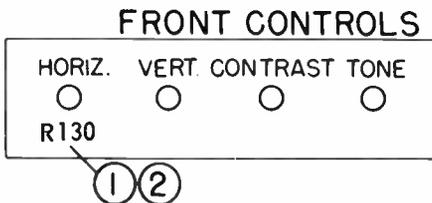


Fig. 2

STEP 2: Adjust L502 slug until picture drifts very slowly and sides are vertical. Remove TP501 jumper. Check R130 at both ends.

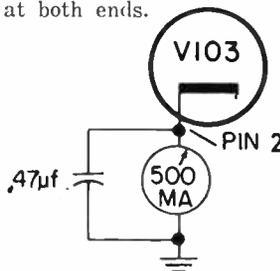


Fig. 3

STEP 3: Adjust L520 for minimum current dip on the millimeter in the cathode of V103. See Fig. 4.

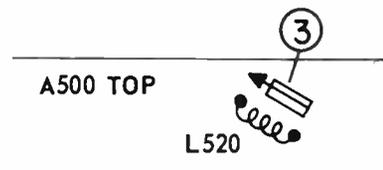


Fig. 4

STEP 4: Adjust R140 for 25 kilovolts at the anode of the picture tube with minimum brightness. Check V102 regulator operation by adjusting brightness from minimum to normal. High voltage should not vary more than 300V to 400V over this brightness range.

Be certain to replace jumper when millimeter is removed.

3. Add an 82pf, 6KV Capacitor (ET18X579) from junction of L-105 and C-107 to ground. (See C-117, on 21" CB schematic.) Check for sufficient size while operating set on 107V line, horizontal size should fit screen at this line voltage.

**COLOR TELEVISION
COLORIMETRY - II**

Continued from Page 1

is Illuminant C. This is the color specified by the color television standards as white. Its coordinates on the chromaticity diagram are $x = 0.310$, $y = 0.316$. This point, then, corresponds to 0% saturation of any color. As might be expected, between this point (Illuminant C) and the outer periphery (100% saturated spectral hues) the colors will range from low to high saturation. Thus, the ICI Chromaticity Diagram gives the desired results. First, the hue is determined by the point on the outer boundary of the horseshoe curve. Second, saturation is determined by the position between Illuminant C (white) and the 100% saturated

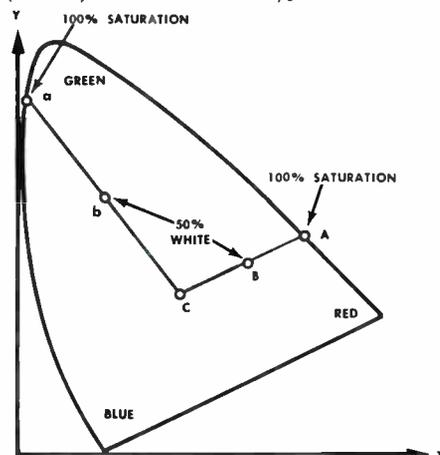


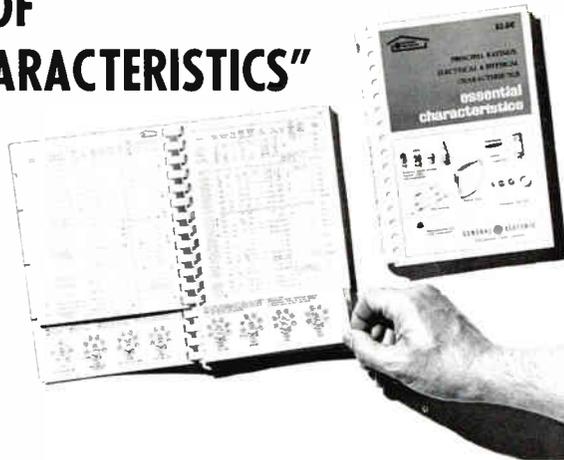
Fig. 7 — The Meaning of Saturation: The distance from point "C" determines the saturation or purity.

boundary. For illustration, Figure 7 shows two separate hues whose saturation is varied. Color A and color B have the same hue, but vary in the amount of white light contamination. Color a is the same saturation as A since it is on the outer boundary but is different in hue. Color b is the same hue as a but lower in saturation.



LEADERSHIP IN ELECTRONICS!
LEADERSHIP IN SERVICE AIDS . . . and here is another

1967 EDITION OF "ESSENTIAL CHARACTERISTICS" NOW AVAILABLE



The 360 page twelfth edition of "Essential Characteristics" (ETR-15M), the General Electric handbook on receiving, five-star and special-purpose tubes, compactrons, thyratrons, gas filled diodes, ceramic tubes, television picture tubes, reed switches, photoconductive cells, photoconductive cell-lamp combinations and replacement capacitors, now is available from your General Electric tube distributor.

New tube characteristics added to this edition bring to 3287 the total number of tubes, including 741 monochrome and color picture tubes.

The new edition contains a number of improvements which will make this booklet easier to use and even more practical in electronic servicing.

One such improvement which first appeared in ETR-15K is the rearrangement of base diagrams which have been enlarged to make them easier to read. All tube types using the same base drawing are listed with each diagram.

Also, the basing diagrams are arranged in numerical-alphabetical order with four on each individual page. The base diagram portion of each page has been cut so the basing can be viewed

at the same time as the tube characteristics. First the base diagram number is located in the "Base Connections" column for any tube type. Then, without turning the top section, the appropriate base diagram can be located in the lower section and opened so both the electrical characteristics and base drawings are visible at the same time.

The listing of all tube types using the same base diagram should be of considerable value particularly when servicing older model receivers. If a tube type is not available, a check of the electrical characteristics for other tubes with the same basing will enable the technician to determine whether or not a substitute can readily be made with another type.

As before, the book includes typical characteristics curves, tube outline drawings, circuit diagrams showing typical applications of receiving tubes and capacitors, and construction data for speaker enclosures.

Tube classification charts have been expanded to facilitate reference to similar types. Cross-reference listings of prototypes for five-star and special-purpose types and a listing of Foreign Types and American near-equivalents are included.

New additions include outline drawings, characteristics for reed switches and photoconductive cells.

Get the new ETR-15M from your distributor — or if he is unable to supply you, use order coupon on page seven. The price is \$2.00.

Radio HI-FI TV **Techni-talk** COMPLETE ELECTRONIC SERVICING INFORMATION

Vol. 19 No. 2 Summer 1967

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