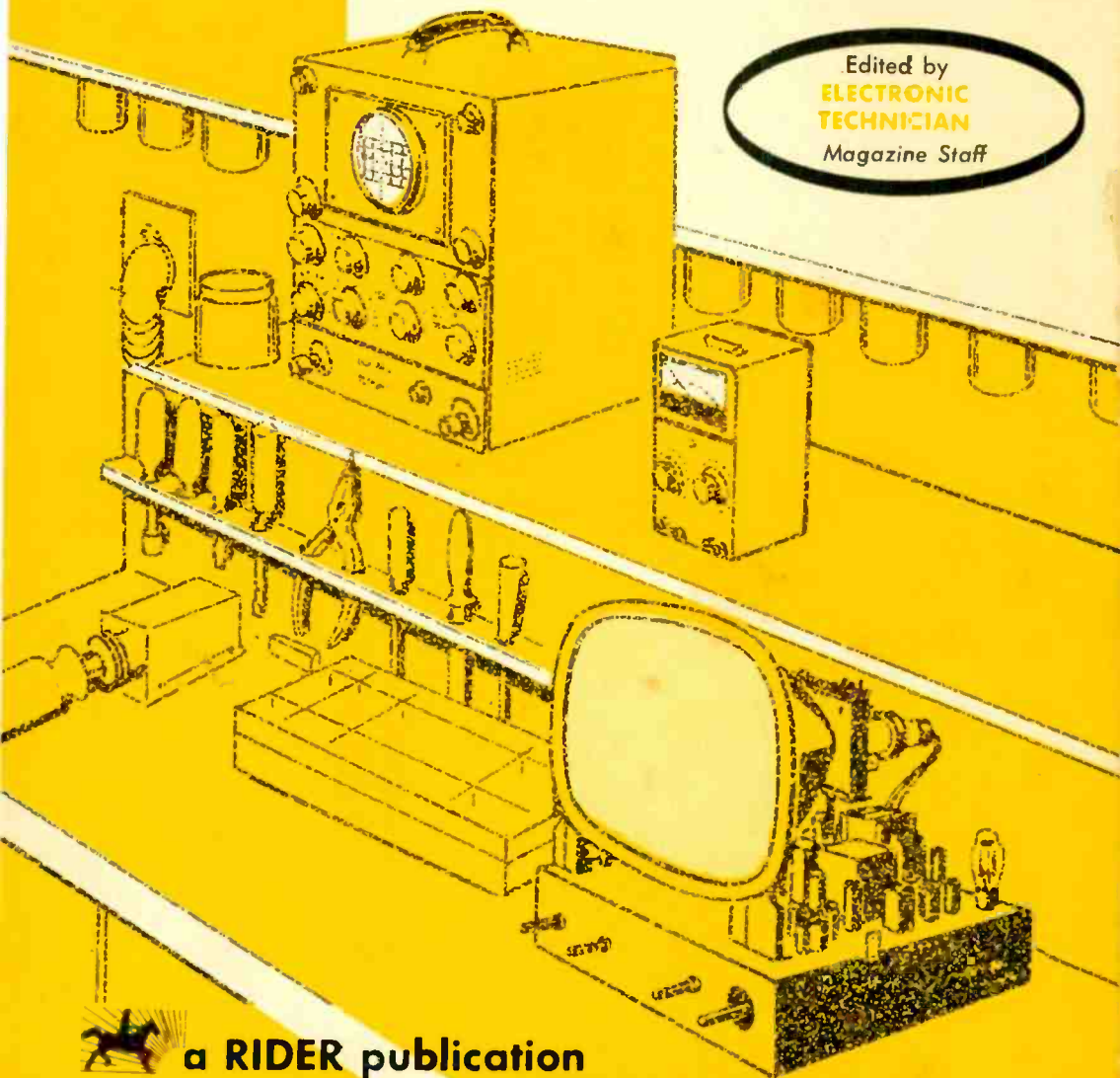


USEFUL ELECTRONIC SHOP HINTS

Edited by
**ELECTRONIC
TECHNICIAN**
Magazine Staff



 a RIDER publication

Edited by
ELECTRONIC TECHNICIAN
Magazine Staff

useful

ELECTRONIC SHOP HINTS

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preface ■

The successful practice of electronics, for business or pleasure, requires a knowledge of both theory and practical know-how. This volume focuses its attention exclusively on the practical aspect of working with electronics at the bench and in the field.

There is no substitute for experience, says the old adage, and our purpose here is to present the shop hints, the shortcuts, and the time and work-saving ideas based on the practical experience of many professional electronic technicians. These hints were selected from among those submitted to and published by *ELECTRONIC TECHNICIAN* magazine. Some are prosaic, even obvious; others show a high degree of ingenuity. Some dig into the innards of electronic equipment, while others deal with simple nuts and bolts. Some will keep you from gnashing your teeth when on occasion you run into that really tricky problem. Others will save you a few minutes every day.

Not everyone can use all these shop hints. However, these ideas were developed because solutions were needed to meet actual problems encountered in electronic shops. So we feel certain that some goodly number will be an answer to numerous problems you have encountered, or will encounter.

Our sincerest appreciation to the many electronic technician readers who had the resourcefulness to develop these shop hints, and the generosity to share their know-how with others.

ALBERT J. FORMAN

New York, N. Y.
April 1962

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Screwdriver Improvement

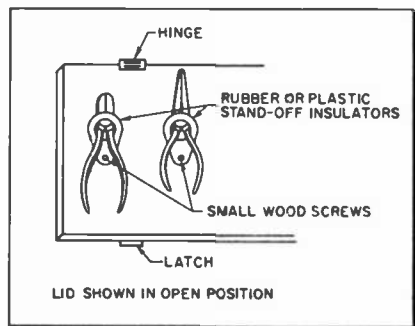
Considerable burring of all types of Phillips-head screws often results from slippage of the Phillips-head screwdrivers. The slippage may be decreased considerably by filing down the tips of the no. 1 and no. 2 screwdrivers about $\frac{1}{32}$ in. This measure will insure better traction in the screw heads.

Nut Driver Extension

I ran into a situation in which I had trouble removing a high-voltage cage. Because of the location of the cage in a tight spot, I would have needed a nut driver with a shaft at least 6 in. long to get to the $\frac{1}{4}$ -in. hex-head screws that were securing the cage to the chassis. My $\frac{1}{4}$ -in. nut driver has a shaft only 3 in. long. I procured a length of separate shaft 4 in. long, which I was able to fit snugly into the head of the nut driver. At the outer end of the shaft extension, I connected another $\frac{1}{4}$ -in. socket head. This made the nut driver more than long enough to do the job. Incidentally, any size socket head can be secured to this type of shaft for different types and sizes of nuts. Sets of these heads and shafts are available in hardware stores.

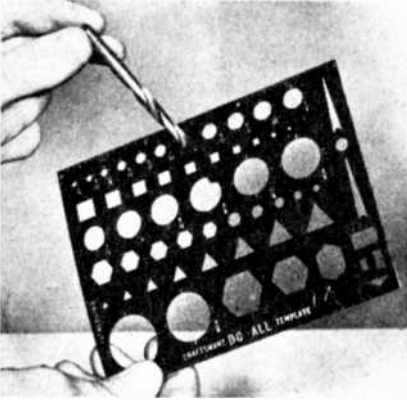
Tool Mounts in Tube Caddy

The service technician's tube caddy never has enough space for all the equipment required for home calls. The space on the removable lid in caddies of certain types is often overlooked as a possible place to mount hand tools. I find that rubber stand-off insulators provide a quick, easy method of holding long-nose pliers, diagonal cutters and similar tools in place on the lid. When the lid is up and the caddy is closed, these tools hang securely with their handles up and fit snugly into the openings of the standoffs. When the lid is open, as shown in sketch, the tools slip easily down and out of the holders.



Versatile Draftsman's Aid

A template of the kind used by draftsmen, made of heavy celluloid and containing openings of various sizes and shapes (as shown in the photograph) has many uses in the service shop. The template illus-



Draftsman's template checks drill sizes.

trated here is about 4 by 5 in. and has circular openings that are very close to common drill sizes. These openings are very convenient for accurately checking drill points. While the circles were not intended for this purpose, they provide an additional function for an already useful aid. These templates may be purchased from any office supply stores.

Smooth Chassis Holes

A round file serves as an effective reamer when it becomes necessary to make or enlarge holes in metal chassis, without introducing the danger of tearing the metal. To get a clean hole of the right size, drill a hole just large enough to admit the small end of the file. Next, chuck the file in a brace, and turn it *counterclockwise* into the hole, with a light feed. Turning it in this direction prevents the right-handed cut of the file teeth from binding in the hole.

Insulated Screwdriver

A piece of rubber tubing or plastic hose slipped over the shank and tip of a screwdriver serves as a screw-holder and insulator. It can be used to pry control knobs loose. The tubing also acts as padding to prevent scarring.

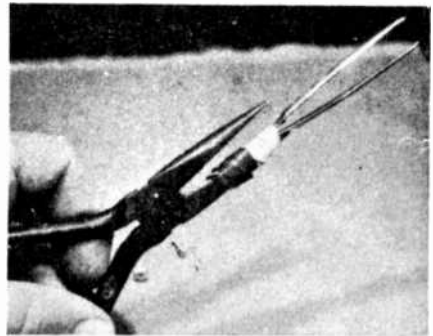
Long Handle Tweezers

Tool users occasionally need tweezers with a greater reach, more stable holding action, or stronger gripping power. When needed, it is a simple matter to meet these requirements in the following manner:

Tape a tweezer to one jaw of a needle nose pliers or spring type clothespin, as illustrated.

The tweezer should be positioned between the jaws of a plier or clothespin so their jaws are closed when the tweezer jaws are closed, and vice versa.

When using the clothespin arrangement, no pressure is required



A simple extension tool can be devised to get those inaccessible screws, nuts, etc., by taping tweezers to long-nosed pliers or a spring-type clothes pin.

from the hand or fingers to maintain the tweezer's grip.

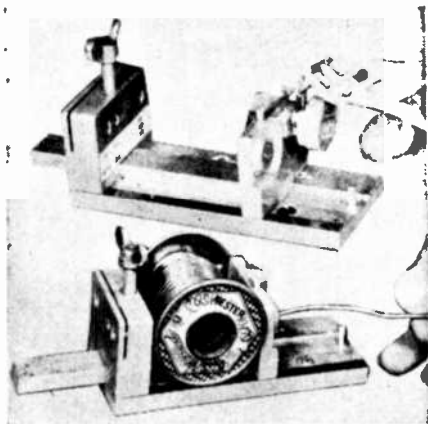
This arrangement provides a handy tool—quickly improvised—for picking up small objects from inaccessible places.

Versatile Jig

A commercially available jig for cutting control shafts can be adapted to many other uses by the technician. The example below illustrates two practical shop applications.

By mounting a control in the jig, it is easy to remove excess solder or straighten lugs.

When not being used for its original purpose, the jig can also serve as



Ordinarily used for cutting control shafts, this popular jig can double as a "third hand" when lying idle.

a solder dispenser. A large spool of rosin-core solder handles well when placed between the two upright sections as shown. The solder can then be pulled through one control opening, as needed.

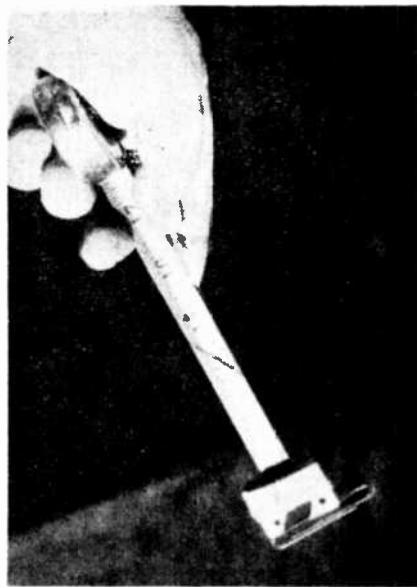
Allen Wrench Assist

We keep some very thin automobile shim stock around the shop, for use in removing Allen set screws that have become rusted or otherwise so firmly seated, that removing them may require a major job (particularly when the Allen wrench cannot grip the screws). Clean out the set screw head with a piece of

stiff wire, then place a small piece of the shim stock over the head of the Allen wrench. Now tap the wrench into the opening in the screw head. This provides a firm grip for the wrench and often eliminates a time-consuming and irksome chore.

Handy Retriever

When small screws, washers, nuts, clips or similar objects drop into an inaccessible place, such as a TV or radio chassis or cabinet, they can be quickly recovered with a small mag-



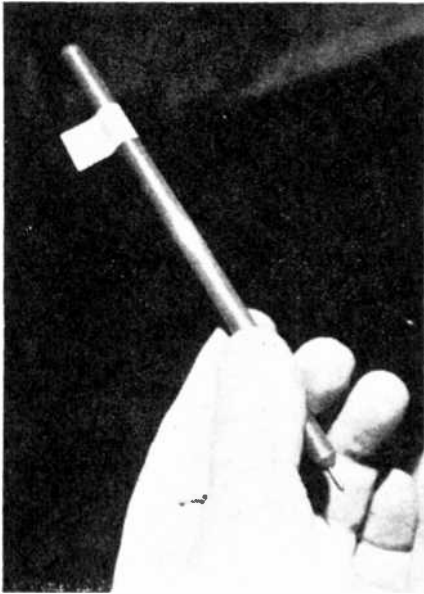
A small magnet attached to the end of a steel tape can retrieve lost objects from various inaccessible places and is instantly adjustable to the required length.

net attached to the end of a steel tape, as shown above. The magnet is fastened to the end of the tape by means of a rubber band or masking tape. If the article to be recovered is non-magnetic fasten a bit of masking tape, sticky side out, to the end of the tape and this will pick up any

small objects. Also, it is extremely useful for removing lost washers from the shell of a speaker or from the speaker housing.

Flag That Tool!

Small often used tools have a habit of "disappearing" when you need them most. A favorite, much used adjusting tool can roll off your test bench or desk. Perhaps it became hidden in a clutter of tools and small parts on the work bench. To quickly end this problem, "flag" the alignment tool, probe or pen with a bit of pressure tape, as shown below. A band



A color coded pressure-tape "flag" attached to alignment tools, prevents their rolling from bench top. Locating tools is simplified in cluttered surroundings.

of tape is placed near one end of the tool, with the tape ends squeezed together, to make a flag. This flag prevents the tool from rolling when it is placed on a flat surface. A daub of red paint or other color code on the flag

will make a popular tool easy to spot at a glance if it's buried among other tools.

Screw Holder

After a few exasperating, not to say painful experiences with a slashed thumb or forefinger, I devised a method for starting wood screws without a starting hole by clamping the screw between the



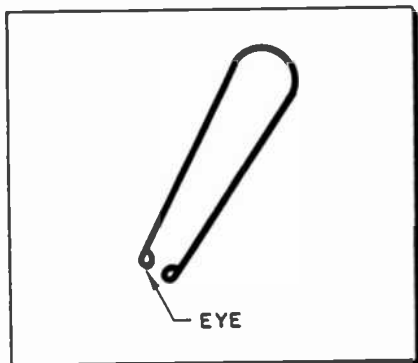
Spring-type clothespin saves fingers when starting screws and short nails.

jaws of a spring-type clothespin, as shown above. For a tighter grip, twist a heavy rubber band around the jaws of the clothespin. When starting screws in soft wood the rubber band is unnecessary. This method is also a finger tip saver if used when driving short nails or brads. They can be started against the wood, in close quarters, above the head without difficulty and with no danger of smashing your finger.

"Tweezers" for Bearings

In replacing elusive, small ball bearings, like those used in variable tuning condensers, the tiny bearings are more easily handled with a pair of "tweezers" fashioned from a 10-in. length of no. 14 bare copper wire.

Form a small eye in each end of the wire (as in the accompanying

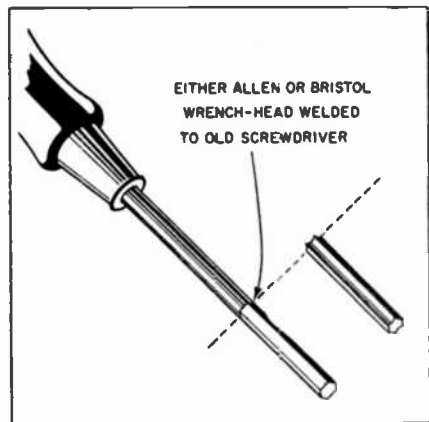


Home-made tweezer lifts ball bearings easily.

illustration), then bend the wire in a U-shape so that the two eyes line up when the tweezer is pinched together. In use, the eyes fit against the curved surfaces of the balls and grip them far more positively than fingers can.

Allen-Wrench Driver

There are many allen and bristol set screws in out of the way places which are difficult to reach. Sometimes it is even necessary to dismantle some of the equipment just to expose one of these screws. There



Speed wrench driver for Allen or Bristol screws can be easily made from an old screwdriver.

are times when an extension or handle can provide extra reach and leverage. A simple solution is to weld part of an allen or bristol wrench on to the end of a spare screw driver.

**Dial Belt Replacement—
Managing on a Shoestring**

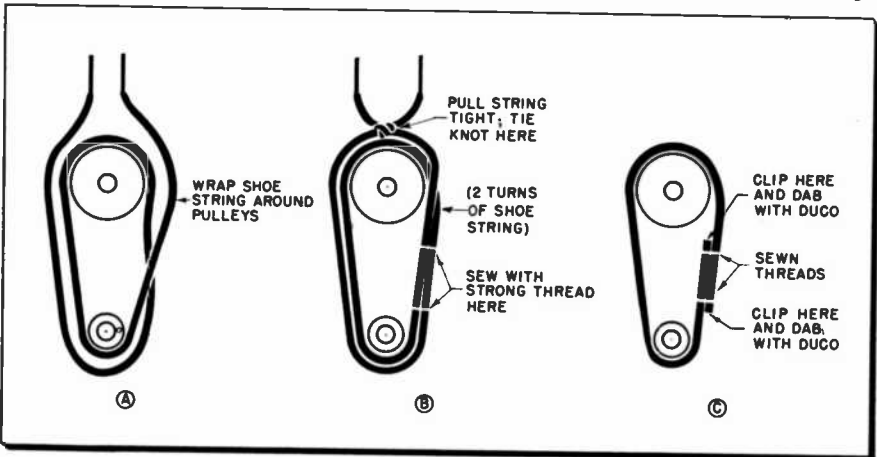
Many radio receivers still use belts instead of cables to operate the dial movement mechanism. Sizes of these belts vary. There is no standard, and keeping many sizes in stock is a problem. However, the ordinary shoestring is a near approach to a "universal" belt.

To make the substitute belt, wrap the string twice around the pulleys, as shown at A. Pull the two ends

tight and knot them as shown at B. With needle and very strong thread, sew the string at the two points as shown; after which snip the strings beyond the sewn places (sketch C). Put a dab of cement under each clipped end, applying a clamping pressure with long-nose pliers until the cement has set; then let dry.

Thus prepared, the belt will glide smoothly over the pulleys, especially after a liberal coat of dial cord dressing. I've used one such shoestring-belt for over two years.

Step-by-step procedure for custom-fabricating dial belt substitutes with ordinary shoestring.



Odd Buzz Cause

As the saying goes, there is always a first time. Recently we found ourselves face-to-face with a case of "intercarrier buzz" that wouldn't lend itself to the customary cures. After a while, the condition was traced to an open screen bypass condenser in the sound i-f amplifier or ratio-detector driver tube. This was the first failure of its type in the writer's experience. The information is worth keeping in mind for future reference. It can save the technician considerable time in finding out the hard way that the condition is *not* caused by vertical circuit radiation or undesirable coupling from the sync circuits, before he investigates the simpler possibility.

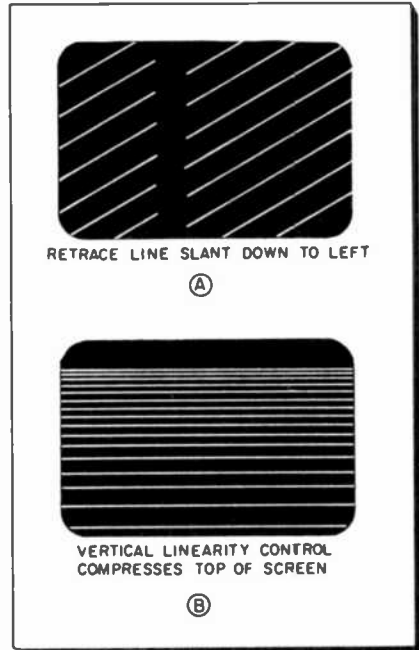
Wiring Replacement Yokes

When a defective deflection yoke is replaced with another that is entirely acceptable, but that is of another brand, it often turns out that the picture is upside down or reversed from left to right or both, because of differences in the color coding of wires. With a picture on the air, it is not difficult to get the raster right side up, but there is often no way to identify the hook-up of the horizontal section unless one wants to spend time waiting for some writing or lettering to show up in the picture.

Delay can be avoided, I have found, by using the vertical retrace lines as an indicating device. The retrace lines always slant down to the left and, when a picture is on, have a break in their structure on the left side of the screen. See part A of the illustration. By reducing contrast and increasing brightness, these lines can be made visible on most sets.

When no picture is on the air or no antenna is handy, the vertical

linearity and height controls can be used to determine whether the raster is right side up. Manipulation of the linearity control will compress or expand the top half of the screen, while the height control will show similar action on the bottom half. (See part B.) In some receivers,



the reverse effect is shown by the vertical controls.

(As far as left-to-right deflection is concerned, you're still not cooked if you have no picture or if an effective blanking circuit kills off all retrace lines. You can temporarily misadjust the horizontal drive control to produce bright vertical lines. If the yoke is properly wired, these lines will appear at the left of the raster. When using this method, be sure to note the original position of the control, to which it should be restored after misadjustment has served its purpose.—Ed.)

Antenna Helper

Did you ever stand on a ten foot ladder leaning against a guyed TV mast, on a peaked roof forty feet from the ground, removing a defective rotor and holding a stacked yagi in one hand—wondering whether to drop the yagi and then fall, or vice versa? If so, you may be interested in this time-and-life-saver. This gimmick will hold the antenna while you remove the rotor.

A piece of $1\frac{1}{2}$ " tubing 18" long is bolted over a piece of $1\frac{1}{4}$ " tubing about 3' long. Two pieces of $1\frac{1}{2}$ " angle iron about 12" long are attached with antenna "U" clamps to the main body. At the opposite ends of the angle irons, drill $\frac{3}{8}$ " holes for a pair of $1\frac{1}{2}$ " muffler clamps. See Fig. C.

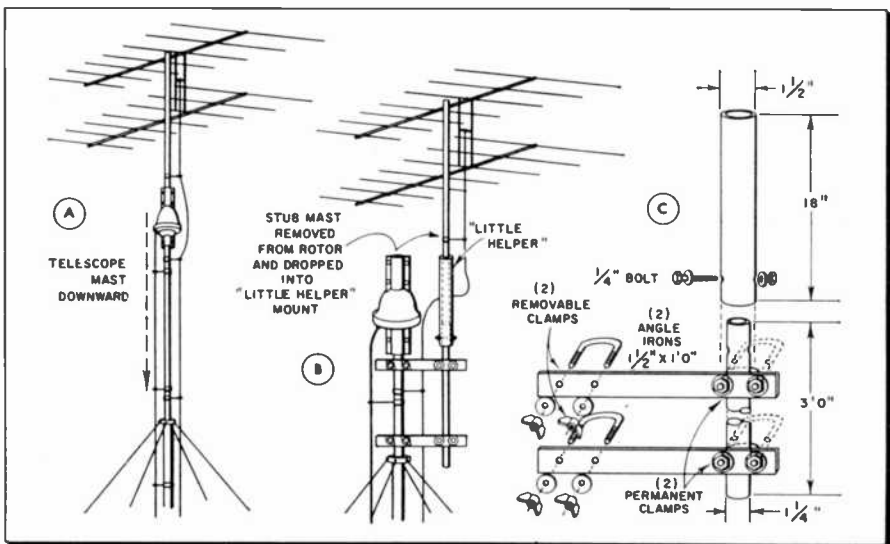
Here is how it works. When the mast is telescoped down to a point where the rotor can be reached, the "little helper" is clamped to the mast, as shown in Fig. B. The antenna with stub mast is lifted out of the

rotor and dropped into the big end of the helper, as illustrated. This procedure now frees both hands for removing the rotor and supports the antenna until the repaired rotor is returned. It has the added advantage of allowing the customer to use his antenna in one fixed direction while repairs are made.

Buzzing Radio

An ac-dc set was brought in with the complaint of intermittent buzzing noises, which were finally traced to an unexpected source. On a similar complaint, you are advised to check the pilot bulb, if any, on the set. In this receiver, the bulb appeared to have a steady normal glow, but the guess is that it was arcing. In any case, replacing the light corrected the buzzing condition. I now make it a routine practice, on complaints of this nature, to make a quick test of the pilot bulb before anything else is attempted.

Fig. (A)—The antenna helper is clamped to the mast after the mast has been telescoped down to position. (B)—The short mast holding the antennas is disconnected from the motor and then lowered into the helper's large end. (C)—Component dimensions of the "little helper."

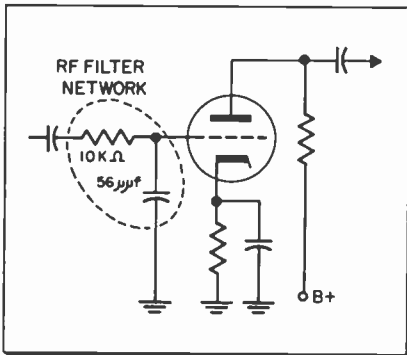


RF In Audio

In many high gain audio amplifiers, in P-A systems, tape recorders, radios, phonos, etc., particularly those with a very high impedance first audio grid circuit, there is a possibility that very strong local R-F signals, regardless of frequency, may appear at the grid of the first audio stage. Under certain conditions, this R-F signal may drive the tube to the extent that it is caused to operate on a non-linear portion of its characteristic curve, and rectification (detection) could occur. If the R-F signal is amplitude modulated, the audio modulation could be detected, fed to succeeding audio stages, and

due to the fact that the audio amplifier tube is no longer operating over the linear part of its characteristic curve.

The usual correction for this type of R-F interference is to install a simple R-F filter at the grid of the first audio amplifier tube. The diagram illustrates how a 56 μf ceramic capacitor and a 10,000-ohm $\frac{1}{2}$ -watt resistor may be hooked up. Keep all leads as short as possible and get as close to the tube socket as possible. A filter at the grid of the first audio stage is usually most effective because the R-F interference is eliminated regardless of its frequency or the means by which it entered the instrument.



RF filter inserted in the grid of the first audio amplifier will bypass interference.

be heard from the speaker. This could result in interference to the desired audio signal. If the volume control is located ahead of the first audio grid, it is possible that the control would have no effect on the volume of the interfering signal.

The interfering signal could cause all sorts of harmonic and other types of distortion in the audio amplifier, even though the R-F signal itself contained no audio or other amplitude modulation which could be heard, even after slope detection had taken place. The distortion would be

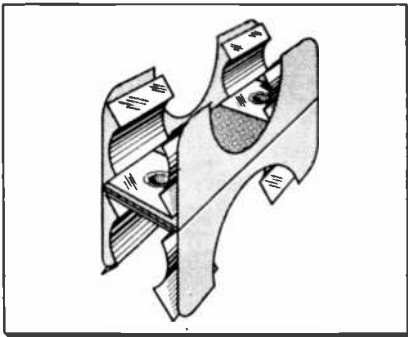
Control Replacement

I recently had a popular 21" TV receiver in the shop with vertical chassis and printed circuit boards facing front. The vertical linearity control was burnt out. Normal replacement would have meant pulling the chassis and possibly the vertical horizontal sync board as well. These controls were the reversed type with the shafts through the control cover.

In an effort to avoid removing the chassis, I proceeded as follows: Remove the metal cover, the shaft and all the innards from the old control, leaving only the fiber base mounted on the board. Then, take the metal cover and sweat it back on a standard control, which in this instance was 5000 ohms at $\frac{1}{2}$ watt. Install the original control to the fiber base of the control still mounted to the printed board. Then, bend the tabs and, if necessary, solder on each side. Jump the lugs and a new control is installed without pulling the chassis from the cabinet or disturbing the printed circuit board. This procedure saves me immeasurable time.

Intermittent Fuse Clips

This could happen on any TV set equipped with a pigtail fuse which has been jumped by a fuse clip. This fuse is usually located in the horizontal damper stage. I have serviced many sets with intermittent rasters. On quite a number of them I have found one or both of the rivets in the fuse clip to be either loose or corroded; causing intermittent operation. How many hours of work or



Loose connections caused loss of raster.

waiting I could have saved if an article like this were written previously? The majority of the complaints were that the raster would operate at highly irregular periods of time, cutting in and out; thus making TV viewing a thing of chance rather than a certainty. Many times when the raster went out, it could be brought in again by flipping the on-off switch several times. The surge would cause the defective connections to arc together, momentarily effecting a cure. There are two things to watch for when the set is being serviced, assuming the tubes and fuses are all right. If the raster does not come in when the set is turned on, short out the original blown pigtail fuse using a jumper wire. If the clip is at fault the raster will come in. If the raster does come in when the set is turned on, grasp

the insulated portion of the clip in your fingers and twist it. If the clip is at fault, the raster will go out with little effort. Soldering the fuse clip connections would eliminate this source of trouble. One hand on the cheater cord may save a flyback when jumping the fuse.

Supply Voltage Polarity

A customer brought in a dead transistorized auto radio that had been removed from his car. He returned a few days later and was told that the radio played perfectly on the bench for two days and all the usual routine checks had been made. Suggesting that the speaker or antenna may be defective, the customer brought in the speaker. The speaker checked out good and with radio and speaker installed in the car, the antenna also proved to be good; however, the radio still didn't play. Again, one of our servicemen removed the set from the dashboard and connected it on the test bench. To our amazement, the radio immediately played again. The next step was connecting it under the dash of the car where some measurements could be taken. The first voltage reading gave a clue to the dead auto radio. The minus lead of the meter was connected to the chassis and since the 12 volt battery supply voltage was being checked, the 50 volt range on the meter was switched on. The meter needle hit the peg in the opposite direction! The schematic indicated that the polarity of the supply voltage was negative ground. A further check was then made of the car battery. The hot lead and post was plainly marked POS and the NEG post went to the frame. Here again, the voltmeter indicated opposite polarity.

Confronting the customer, I learned that he had recently serviced the car and battery, and shortly thereafter, his radio stopped playing.

Evidently, one of the station attendants reverse-charged the battery. A dead battery can take a charge of reversed polarity and the car's electrical system will work properly, including the generator, since the field voltage will then be reversed and continue to maintain the battery's new polarity.

Fortunately, the transistors were not damaged and the customer was referred to a gas station to correct the wrong battery polarity.

Battery Eliminators For Transistor Car Radios

Hybrid and transistor car radios may be operated satisfactorily from the ordinary battery eliminator by the addition of the filter network shown in the diagram. As these sets have a low drain, a 3 to 5 ampere choke will pass sufficient current. The shorting switch by-passes the choke when regular sets are under test and when more current is needed. With this switching method, no extra terminals are needed to connect the transistor sets. The extra filter capacitor is always in the circuit and provides better filtering action even with the choke shorted out. The voltmeter connection should be attached to the output side of the choke, to allow for the

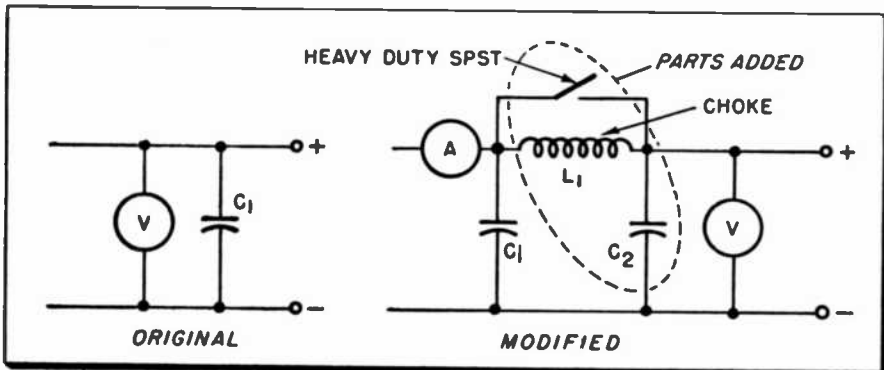
voltage drop across the choke, and to indicate the actual voltage delivered to the unit under test. The two extra components may be mounted externally if there is insufficient room in the original power-supply cabinet.

Improved Sensitivity

A fairly recent model TV receiver had a very annoying case of RF interference with its typical herringbone design superimposed on the picture. Since this interference persisted at all times it seemed likely to be coming from the set itself. Quite by accident it was found that when a hand was placed on the shell of the 6AC7 video-output tube, the interference would be completely eliminated. Further investigation disclosed that pin 1 was grounded to the chassis by means of a lead about 1½" long. By bending the lug of pin 1 and soldering it directly to the chassis, the RF radiation is eliminated.

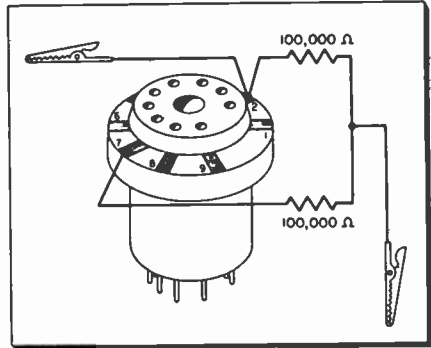
It is interesting to note that in receivers cured of this or any other type of RF interference the sensitivity of the sets is also improved. RF interference when picked up as a signal effects the AGC voltage and tends to reduce the sensitivity.

Modified battery eliminator can be used to service transistor and hybrid auto radios.

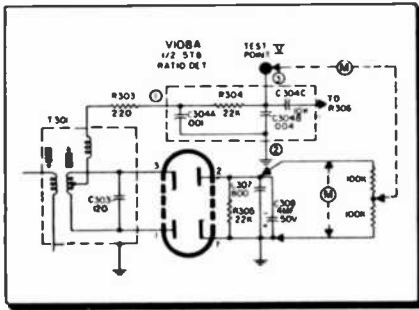


Alignment Jig

When aligning the ratio detector in the audio section of a television set using a 5T8, it is necessary to obtain zero output at the electrical center between pins 2 and 7. Normally it would be necessary to temporarily solder in a pair of matched resistors across these two points. The zero output indication would then be taken from the junction of these two resistors and test point V. The top of T301 (secondary) is the adjustment for this purpose. Tune for a dip between two peaks. Other adjustments call for a



Vector Socket becomes handy alignment jig.



Typical ratio detector showing meter and resistor connections for sound alignment.

maximum from pin 2 to ground. Top of T154 (secondary) and bottom of T301 (primary) are used for these adjustments.

To avoid soldering and unsoldering to the printed wiring board, and to speed up alignment procedure, two matched 100,000 ohm resistors are tied together at one end and the other ends soldered to the external portion of pins 2 and 7 respectively of a q-pin miniature vector socket. One alligator clip with a short lead may be soldered to pin 2 and another to the junction point of the two resistors. Insert socket between tube and chassis, tune in a station and hook up a VTVM.

Watch Those Phony Symptoms

The design of the agc system and the use of intercarrier sound in some receivers can often work too well, in the sense that they serve to mask some symptoms that would otherwise lead clearly to antenna faults, as this case history shows:

The picture on the set would occasionally flicker, roll and pull to the right. The antenna appeared in order. The set worked perfectly in the shop, and was returned to the owner. When the symptoms re-occurred, since the owner did not want to be without his TV, arrangements were made to provide him with a loan-out set. Although the latter was in good working order, it did not have an agc system, being an older set. When this set was operated from the customer's antenna, there was sputtering evident in the sound and the picture flickered snowily. Examination of the lead-in wire, which looked good externally, revealed several small breaks at different points in the separate strands once the plastic coating was stripped away. The agc network in the customer's own set had served to equalize the changes in signal level due to the break, and thus mask the condition.

Alignment Time "Shaver"

Like many useful tips, this was found by accident. I had some TV sets in noisy locations and found that, by carrying my electric razor with me, putting it into operation beside the set, and adjusting the ratio detector secondary carefully for a definite and critical null in the noise, I could achieve very good noise rejection.

But that isn't the end of the tip. There came a day when it didn't work. I eliminated the AM noise all right, but the FM sound was then garbled. Good sound and good AM rejection occurred at different settings of the secondary slug. Fortunately the primary adjustment is also accessible from the top of the chassis on this set if the correct hexagon alignment tool is used. I turned the primary a little clockwise, and then tried the secondary again. The two points (good sound and good noise rejection) had moved a little closer together. A touch more clockwise on the primary, and good sound and good rejection then coincided on the secondary. I later confirmed this procedure on the bench.

Now I can set up both the primary and secondary of the ratio detector transformer without using instruments—unless you call the razor a test instrument!

Damper Kills Sound

When some technicians confront a TV with no raster and no sound, they suspect, and rightly so, B+ trouble. After checking the fuses, low voltage rectifiers, etc., and the trouble is not corrected, they frequently determine it's a shop job.

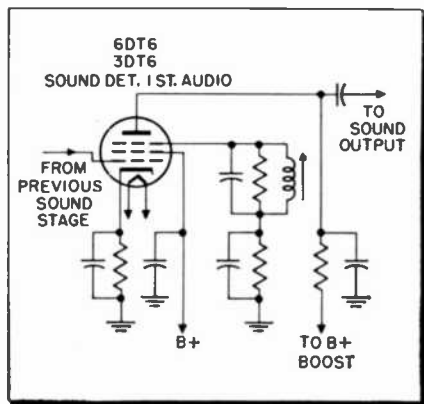
A set with these symptoms was brought into my shop recently and, once on the bench, the trouble was quickly traced to a defective damper

tube. A glance at the schematic showed that the 6DT6, a gated-beam sound discriminator, received its B+ from the boost line (below). Sound was promptly killed when the boost voltage line became defective.

To avoid an embarrassing situation, the damper should therefore be checked when both sound and raster are missing.

When making voltage checks at the plate of this tube, a multiplier probe should be used on the VOM or a 1 meg resistor connected in series with the regular meter probe because of the high pulse from the boost line.—

● *It also follows: since the boost voltage is the sum of regular B+ and d-c voltage developed from the flyback pulse, if a stage that contributes to the flyback's operation fails, the added d-c voltage in the boost circuit will be missing. Therefore, if the horizontal oscillator or output stages are defective, not only will the raster disappear, sound may also be reduced due to the lowered B+ to the sound section.—Ed.*



When a TV set's first audio stage is powered from B + boost, loss of raster and sound occurs when damper tube ceases to conduct. Failure of preceding horizontal stages results in lowered sound volume.

Weak Tuner Contacts

As turret-type tuners age, the contact springs, which are made out of brass, lose their springy quality. As this happens they become flatter, and the result is poor contact with the various r-f and oscillator slugs as the drum is revolved, with impaired or intermittent reception. This condition is illustrated to the right in the accompanying illustration.

The remedy described here for this flattening has proved its success for the writer. After the individual contact springs have been brought back to original shape as much as possible, a strip of spaghetti is used to retain that shape. The writer uses polystyrene spaghetti, about $\frac{1}{8}$ in. in diameter, and pushes it through the openings in the contact springs. This spaghetti keeps the springs open, preventing flatness and thereby assuring continued good contact between the revolving drum and the stationary springs. A strip of foam rubber with an oval cross section would be just as practical for this function. The position of the strip is shown to the left in the accompanying illustration, which is an internal view of the tuner with the turret drum removed for the sake of clarity.

If any of the contact springs are found to be broken when this job is

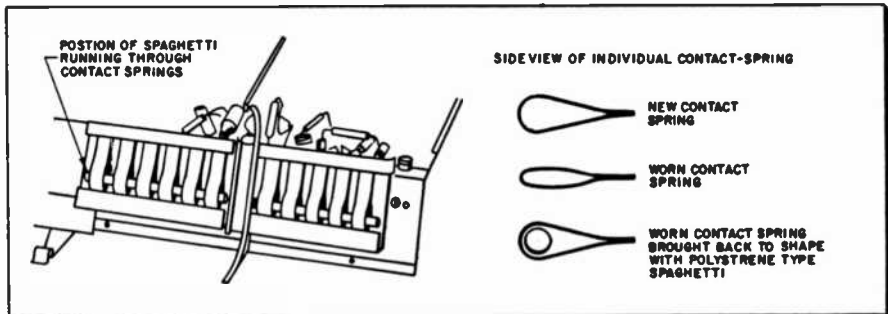
undertaken, the entire contact plate should be replaced. The spaghetti can be run through the new springs, as a preventive measure, before the plate is mounted in the tuner. Another good practice is to remove permanently the slugs for all channels not used in the area. This gives the springs a chance to "stretch" between channels as the drum is revolved, thus prolonging life of the contacts.

Radio I-F Xformer Checker

A common complaint in today's 5- and 6-tube AM radios is low volume, and quite often one or both of the i-f transformers are at fault. Because defective i-f transformers may often show the proper resistance and appear to tune normally even when they are bad, it is difficult to reach a decision concerning them without going to the trouble of unsoldering all leads, removing them, and trying out a replacement transformer. A simpler and less time-consuming test substitution can be made with the unit described here.

Procure a good i-f transformer tuned to 455 kc and solder four 3-in. leads to each terminal; then attach a narrow, insulated alligator clip to each lead. The leads should be coded by using wires of different colors.

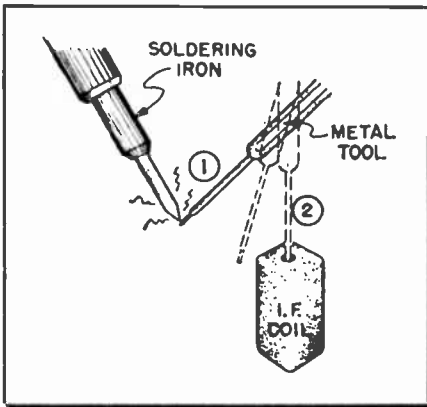
Spaghetti run through turret-tuner springs restores their shape and maintains good contact.



Now when an i-f transformer is suspected of being defective, simply unsolder *one* lead from its primary and *one* lead from its secondary (it generally won't matter which) to remove the old transformer from the circuit, and clip the substitute unit in its place. Check alignment. If the original unit was defective, the clip-on substitute will restore normal gain and performance. Because of the long leads, an occasional set may squeal. If it does, try reversing one or both of the windings. Squeal or no squeal, positive results can be obtained.

Aligning Auto I-F's

In auto radio production, wax is normally dropped into the i-f core to prevent it from moving after alignment. The wax must be melted before attempting to turn the core, or damage to the transformer will occur.



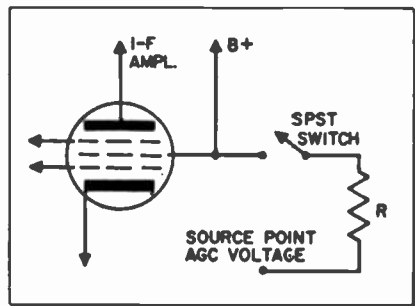
Heating an alignment tool unfreezes wax dropped into i-f cores during production.

To prevent damage, simply heat the tip of a small metal alignment tool and insert it into the wax as shown above. Repeat this two or three times until the wax is melted and the core turns easily. Avoid forcing the core.

Fringe Improvement

In an attempt to boost sensitivity and gain in fringe areas, some technicians either ground the agc voltage entirely, or attempt to reduce the no-signal agc voltage by sometimes involved and devious circuit modifications. When such receivers are returned to normal signal areas or when increases in transmitter power eliminate the need for the change, extensive alteration is again required to restore the receivers to proper operation. Also, a permanent internal change creates difficulties where the same set is required to work on weak and strong signals on different channels.

A much better idea is to install a simple "local-fringe" switch, if the circuit doesn't have one. This gives the owner some external means for adapting the set to different conditions without having to rewire it. A



Circuit for simple "fringe-local" switch.

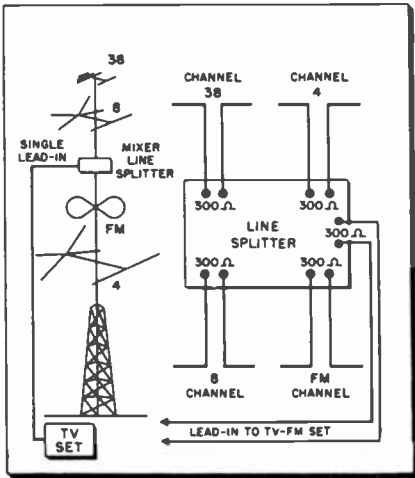
study of many commercial variations in actual sets and some actual experimenting shows the circuit presented here to be simple, easy to install and effective.

B-plus is taken off at some such point as the screen grid of one of the i-f tubes and applied to the output of the agc circuit through a resistor of high ohmic value. The point to which this bucking voltage is applied is the one at which external bias would be connected dur-

ing alignment. A typical value for resistor R would be 15 megohms, though experiment may indicate another value in individual cases. As illustrated, closing the switch will generally reduce the agc voltage from about minus 2 volts to about minus 1 volt, as measured with a vtvm.

Reverse Coupling

I have found it practical in fringe area installations to reverse the hookup of a line splitter and use four different antennas with but a



Coupler used to connect 4 antennas to 1 set.

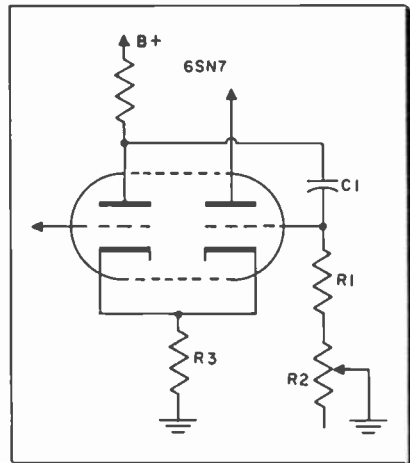
single lead-in to a TV set. On the line splitter I feed each separate antenna into the output and the single lead-in to the input. Instead of splitting the line this has the effect of mixing four different signals into the single lead-in.

In one case I have been using a commercial line splitter as a mixer for Channels 4, 8, 38 and an FM station. Results seem to be as good as using four separate lead-ins from each of the antennas stacked on the antenna mast.

Hor. Oscillator Blocking

When used as a horizontal multi-vibrator-type oscillator, the 6SN7 will sometimes show a tendency to block. The symptom is either a double image, which may be intermittent, or a sudden cutoff of a part of the horizontal scan for a number of lines.

The difficulty crops up if the value of the coupling condenser, C-1, going from one plate to the opposite grid (the one to which the hold control, R-2, is connected) is too high in value. If residual gas in the tube is high, a value for C-1 in excess of 2000 mmfd may cause blocking. Remedial measures include lowering the value of C-1 and trying other



tubes. Note that, as far as tube replacement is concerned, a seasoned tube is less likely to have excessive gas than a fresh one.

In substituting a part with less capacitance for C-1, note that the value of resistance in the circuit (R-1, R-2) may have to be increased correspondingly to maintain the proper time constant. The percent by which circuit resistance is increased should be about the same as the percent by which capacitance is decreased. For example, if a 2500-mmfd condenser is replaced with a

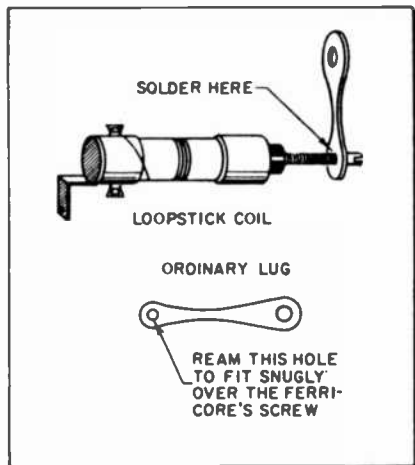
2000-mmfd unit, reduction is by about 20 percent; so resistance would be increased by about the same amount.

Loopstick Adjustment

Widely used as original AM receiver antennas as well as for replacement, the adjustable loopstick-type aerials are often annoying and tedious to adjust. As the coils come from the manufacturer, they are provided with a tiny screwdriver slot at the end of the core's screw, often making them difficult to tune. Much time can be wasted in attempting this procedure with the small screwdriver.

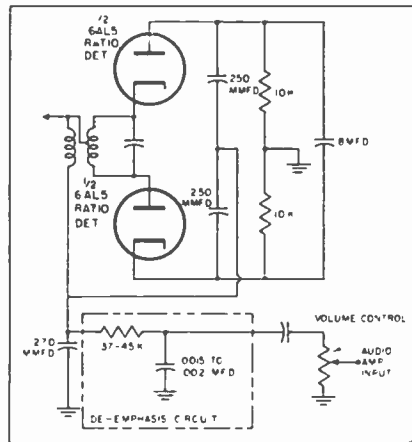
By soldering an ordinary lug on the screw as shown in the accompanying illustration, you can easily speed up the process of tuning and adjusting. If space around the loopstick coil is at a premium, the lug may be conveniently bent at right angles. Also, if it is desirable to do so, the lug can be snipped off shorter than is shown. It will still provide a convenient way of making the desired adjustments.

Lug on loopstick coil facilitates adjustment.



De-Emphasis Trouble

Shrill sound with ample volume and an apparent loss of low notes in TV or FM sets indicates possible trouble in the FM detector's de-emphasis circuit. This R-C network, located between the detector output and the volume control (or the grid of the 1st audio amplifier), consists of a series resistor-condenser combination (see sketch). It re-



stores normal tone balance—a measure made necessary by pre-emphasis of high frequencies at the transmitter. New sets often develop the trouble cited, due to excessive heating of the resistor-condenser components during assembly. Sometimes weakness of the internal connections (usually of the condenser) escapes inspection, showing up after a few days service in the set owner's home. The condenser may be tested for a partial or complete open circuit by shunting it with another unit. If this check restores the proper tone balance, replace the defective condenser—do not permanently shunt it with another one. If the resistor has changed value—usually the result of aging—the trouble can readily be located with an ohmmeter.

Tuner Substitution

The following gadget enables me to eliminate front-end trouble very rapidly; simply by substituting a tuner known to be good. Two TV front ends are mounted on a board together with an a-c power supply, coaxial leads with alligator clips attached and an AGC control to avoid overload. Two tuners are used to accommodate sets with different i-f frequencies, one for about 20 mc and the other for approximately 40 mc. If a set has low gain or other trouble and the front-end is suspected the tuner of the TV set is switched to an unused channel to avoid oscillation, beat frequencies, etc. Connect the proper lead to the first i-f tube, set the AGC control to avoid overload and a difference in picture quality will usually give a clue as to whether or not one has to dig into the tuner of the set or if the poor gain is caused in the i-f amplifier, demodulator, etc. The component values of the gadget are

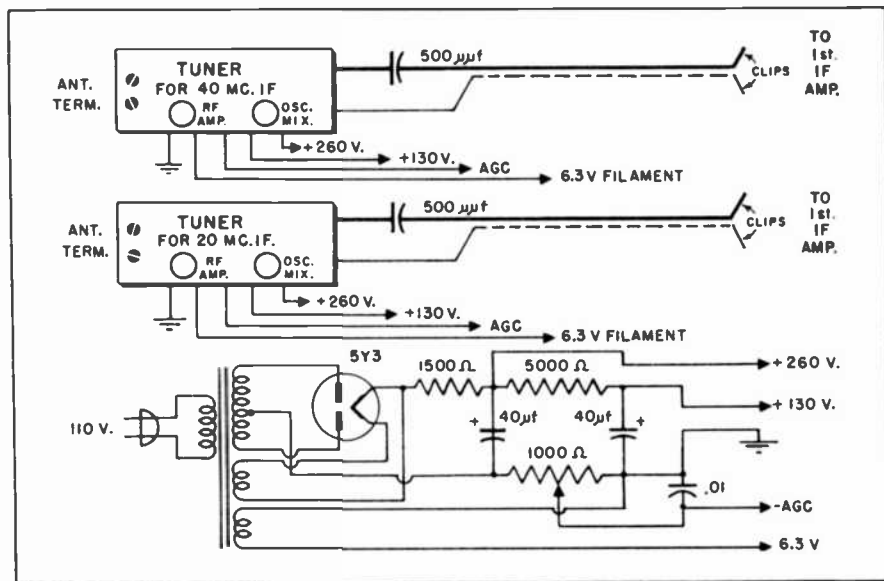
not critical and were found experimentally. The 1000-ohm control is wirewound, the 5000 and 1500-ohm resistors are 5-watt. The coaxial cable should be of the low-loss type and no longer than necessary.

• It may be necessary to disconnect the lead from the set's tuner, going to the 1st i-f, even though the tuner has been set on an unused channel —Ed.

Auto Radio Noise

Before attempting to troubleshoot an auto radio afflicted with undue static, open up the drain hole in the bottom of the aerial (with which some antennae are equipped) and let the water out. The drain holes in some of these aerials become clogged, and allow water to accumulate in the tube, with noisy reception resulting in consequence.

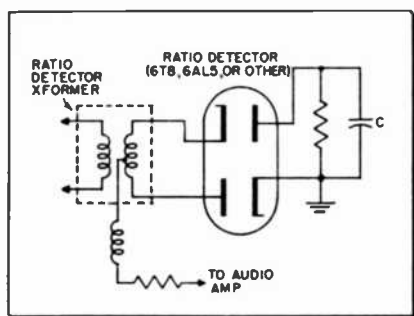
Two tuners and power supply mounted on a board quickly substitutes TV set's front end.



Buzz Correction

Leakage in an electrolytic condenser is a common component failure. When leakage occurs in an electrolytic condenser used in the ratio detector circuit of a TV receiver (condenser *C* in the figure), buzz results.

Before starting a time-consuming search for other sources of buzz, an ultra-fast check of this capacitor can be performed without even remov-



ing the back of the receiver. Rotate the fine tuning control back and forth rapidly. This will vary the average voltage across *C*. If the condenser is leaking, the rise and fall of volume will be erratic, and may be accompanied by a clicking sound, whereas if the condenser is good, the rise and fall of volume will be smooth.

Hot Shot

Elusive and troublesome intermittents in sync and video sections, plus buzz and many other difficulties have been caused by poor ground connections on some of the GE dip-soldered chassis. Riveted ground connectors, in time, develop high resistance joints due to electrolytic or corrosive action. Spurious signals sometimes develop across these high resistance ground joints and inject

themselves into TV circuits causing all sorts of weird effects. In some cases even the filament string will decide to dim a bit and really cause a few gray hairs. Soldering these eyelet ground connections is the simple solution, but it requires more heat than some of the soldering equipment is capable of producing.

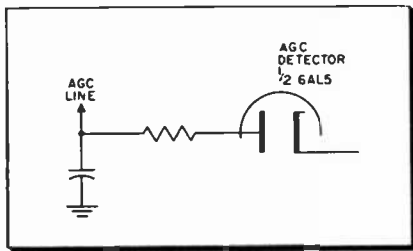
One very effective way to eliminate these poor grounds is to build up a bank of 300 or 400-volt electrolytic capacitors to about 500 μ f or more, then charge them up on a 300-volt B+ power supply, and then discharge them between the eyelet and chassis. The heavy current surge will effectively spot weld the eyelet to the chassis. All the ground eyelets can be treated in this manner in a matter of minutes. To prevent accidental discharge to other parts, contact the eyelet first, with one lead, and then the chassis with the other lead. It is advisable to use a separate fused power supply to charge up the capacitors to avoid drawing excessive current and damaging the set's rectifiers. An alternative is to charge the capacitors through a resistor and thus limit the current surge. Safety first, discharge the capacitors before putting them away, and avoid contact with the hot wires.

Tracing H-V Arcing

Many times arcing or corona cannot be easily located by sight. A convenient way to run down these elusive cases is to work with a length of spaghetti tubing, using it as a stethoscope. Cut a piece of tubing about 18 in. long. Use the largest diameter that will fit inside the ear. With one end of the tubing held to the ear, probe around the high-voltage supply until the one point is reached where the sound of arcing can be heard the loudest. Need it be suggested that the hand holding the tubing be kept away from dangerous points of contact?

Quick AGC Check

A shortcut that is frequently helpful in troubleshooting agc-related stages, such as the i-f strip or the tuner, involves a meter check on either side of the resistor in the agc line. Readings taken on either side of the resistor (usually 500k to 1 meg) shown in the sketch should be very close to each other. If the reading is noticeably higher (less negative) on the side of the resistor near-



Check on each side of resistor shows fault.

est the condenser than it is on the other side, a defective tube or a defect in the tube's circuit is permitting too much current to be drawn, and the agc line is being loaded.

To localize the bad tube or stage, leave the vtvm connected to the point along the agc line where the high reading is obtained and substitute or remove tubes in the video i-f and tuner sections. If substitution or removal of a tube restores the reading, so that it is the same on either side of the resistor, the fault is localized.

TV Oscillator Alignment

When aligning the lower channels of some wafer type tuners using series-type inductors it is sometimes necessary to compress or expand the oscillator coils to obtain the correct frequency. It is quite easy to mutilate the coils after a few attempts of first expanding and then compressing. I have found the following

method to be quick accurate and minimizes manipulation. Loosely couple a marker generator to the antenna or oscillator tube, center the set's fine tuning control and leave it there. Connect a wire from the grid of the mixer tube in the tuner, to the top of the set's volume control, and tune for zero beat. Start with the highest channel, and work down. It is important that the generator be properly set to the oscillator frequency of the channel being aligned. It is also desirable to disable the sound i-f section. This can be done by pulling one of the sound i-f tubes, or shorting the sound i-f signal to ground if the set is of the series string type.

Re-Mounting Pulled Chassis

Have you ever fumbled around trying to line up the mounting holes of a TV chassis with the holes drilled through the cabinet shelf?

Or have you ever had the customer tell you that the picture tube was just a bit farther to one side than it should be after you had bolted down the set?

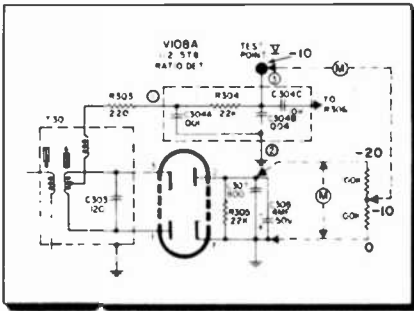
You can reduce such occurrences if you (before pulling the set) simply outline the position of the chassis on the wooden shelf by running the point of a pencil along the bottom edges of the two sides and the rear. When you re-install the set, simply fit the chassis to these guide lines. Then see how the bolts go easily into place. The picture tube should be where it was before, unless you moved it on the chassis.

Perhaps the time when this hint will be most valuable is when you try to locate the position of a side-mounted chassis on the board which slides vertically into the grooves of the cabinet. Since the chassis must be bolted to the board before the board is slid into place, there is no way of compensating for errors in

mounting. Marking the outline of the chassis on the board will enable you to fit the chassis in the same position it occupied before removal.

No Alignment Jig

The following method permits alignment of an unbalanced ratio detector without a jig or other external resistors. When the jig or other pair of equal resistors are placed across the load resistor, the junction point or center of the two resistors is at a potential of half the voltage across the load resistor, as shown by the dotted lines in the diagram. The meter is then con-



FM discriminator can be aligned without the use of jigs or external resistors.

nected between this point and the center tap of the ratio detector transformer circuit, test point V. The transformer secondary is then adjusted for zero volts.

Since the potential difference between test point V and the center point of the two resistors is zero, and since this center point is half the peak voltage (in this example—10 volts with respect to ground) test point V would also be half the total voltage, with respect to ground. Therefore, we can dispense with the jig, and make the alignment with the VTVM only. Attach the positive probe to the chassis and the nega-

tive probe to pin 2 of the tube. Adjust the primary and preceding stages for maximum voltage. Transfer the negative probe to test point V and tune the secondary for one half of the maximum voltage. Recheck the voltage on pin 2 for maximum and readjust if necessary.

Sometimes while adjusting the secondary of the detector transformer the primary becomes detuned. It is good practice to rock the adjustments to make sure that tuning is optimum.

To verify the meter reading for exactly half the maximum load voltage at test point V with respect to ground, alternate the position of the positive lead from ground to pin 2 of the 5T8, while the negative lead remains on test point V, the two readings obtained should be exactly equal.—Ed.

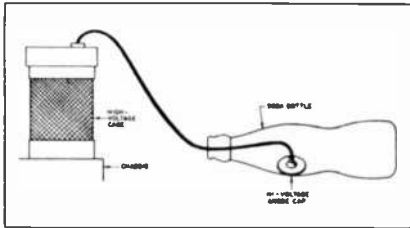
Inaccessible Adjustments

Sometimes the manufacturer of the TV set, showing little concern for the service technician, will mount i-f transformers and other tunable coils directly under the bell of the picture tube, where alignment or other adjustment is practically impossible without taking the set apart. With some of these adjustments, a little ingenuity will eliminate the need for dismantling.

For example, in the case of bifilar i-f transformers having cores with threaded brass spindles, the slotted spindle is generally brought through the top of the chassis and is often all but inaccessible, being under the picture tube bell or the yoke assembly. If the core is screwed all the way out of the coil form and a slot is cut with a fine hack saw in the molded end, it is generally easy to align the set from the underside. Bifilar i-f transformers are mentioned because one end of these units is often open. The idea is equally applicable to tunable i-f chokes and other units.

Safe "Cache" for HV Lead

In many of the older-model television sets, the picture tube is separate from the chassis. To eliminate danger of high-voltage shocks, when



working on this type of chassis (without the picture tube), just slip the high-voltage anode cap into an empty soda pop bottle, and put the latter to a side (see sketch).

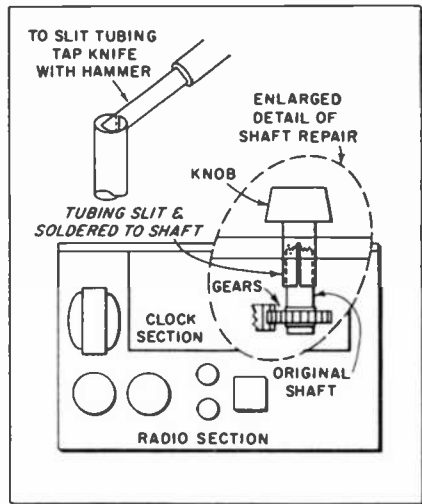
Deodorizing Receivers

It may sound strange, but some receivers have to be deodorized. This writer had to replace a burned-out power transformer. The job turned out quite well, except that the customer objected to the burnt odor that persisted despite a thorough clean-up attempt. Finally I hit on a very simple method that really worked. Reasoning that even a perfume does not smell when properly corked, I corked the burned areas by spraying two coats of plastic spray (Krylon) over the discolored areas. The smell disappeared. Do you have a customer allergic to odors of burned transformers, resistors, and selenium rectifiers? Try this method, it works!

Shaft Repair

I received a clock radio which had a broken "alarm-set" shaft. A gear assembly is attached to this shaft and to replace the entire unit would considerably raise the customer's bill.

Using an empty ball point pen cartridge, I repaired and extended the shaft by soldering this piece of tubing directly over the broken end,



Soldering an empty ball point pen cartridge to a broken clock radio shaft saves time and reduces cost of repair.

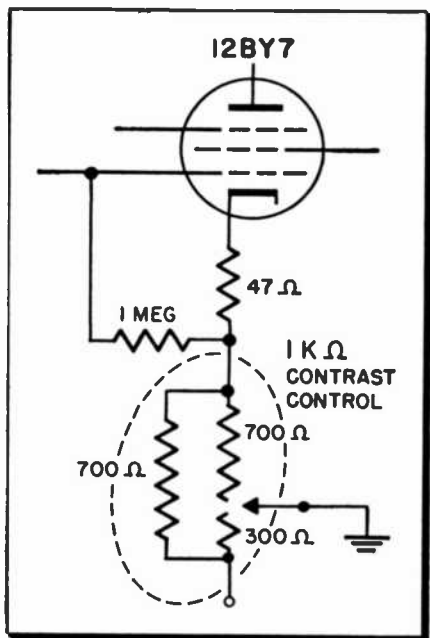
as shown above. I found the shaft to be slightly larger in diameter than the tubing, but made a small slit in one end of the tubing with a knife and small hammer. The tubing was placed over the broken end tightly by a few light taps with hammer, and then soldered to the shaft at the seam in the tubing.

The knob end of the extended shaft was pinched and heated with an iron while the plastic knob was pushed on.

The job required only a few minutes, circumvented ordering the entire assembly, and eliminated the necessity of having to present the customer with a relatively high repair estimate.

Shunt Control

The contrast control in the cathode circuit of the 12BY7 video amplifier had a clean break just at the point of optimum setting. No control in the tube caddy and the customer ready to pay a bonus if he won't have to miss the ball game. The break in the 1,000 ohm control was at the 300 ohm point from the cathode end. By reversing the connections I was now able to get a range of adjustment from 0 to 700 ohms which included the optimum point. Actually this was as far as I had to go, but the thought of establishing control over the remaining 300 ohms without getting a new control was a challenging one. For what it's worth, here's how I worked it out. By connecting a 680 ohm resistor (didn't have a 700 ohm



Shunt restores control range in an emergency.

unit) across the control, the remaining range from 1,000 to 700 ohms was easily covered. If the crazy way the

control works disturbs the customer, at least it works. I got the bonus too.

Weak, Noisy Radios

In our shop we have had an influx of radio sets with the following trouble: Reception is either weak or below normal with continuous static. Turning the volume control down eliminates the static, indicating that the trouble is not in the audio.

The fault is in the type of i-f transformer used in these sets. They are slug-tuned, with fixed silver mica capacitors built-in, one across each winding. Minute particles of the silvered mica cause high resistance shorts between these two capacitors, with the leakage being so small that it often does not show up on the ohmmeter. However, there is enough of it to cause the symptoms described.

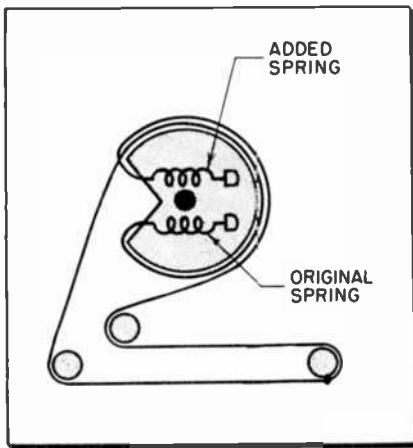
Where this trouble is suspected, it can be confirmed by disconnecting the leads to the secondary of the transformer and turning the set on. A meter is then used to check for positive voltage on the secondary. If there is none, the leads are reconnected and the remaining i-f transformer is checked similarly.

Once the condition is established, a simple and permanent repair can be made as follows: Use the high voltage (approximately 700 volts) available from the secondary of a conventional power transformer. Place a 5000-ohm 10-watt resistor in series with one lead. With the secondary of the faulty i-f transformer still disconnected, apply the high voltage between the two windings. This step will vaporize the particles of silvered mica and thus eliminate the short. After this operation, the i-f transformer should be retuned. This method has always worked for us.

Dial Cord Slippage

Repairing dial cable mechanisms on small radios is a frequent task. Often, because the sets are inexpensively made, annoying comebacks result as the repairs may not last too long.

In these receivers, the dial cable usually has only one spring at one of its ends. It is a simple matter to add another. Two springs will pull the cord much tighter, eliminating



Extra dial-cord spring improves radio tuning.

“sloppy” tuning and annoying backlash. Since they take up a greater amount of slack than one spring will, tuning action will remain “tight” for much longer. The very sharp tuning thus permitted is especially valuable if the set happens to have a short-wave band. In the long run, making the addition of the extra spring a standard practice results in a longer-lasting, customer-satisfying repair.

AGC Prescription

In most cases an aspirin will help. In many cases, I have found that a horizontal amplifier tube will check satisfactorily in a tube checker, but it will not function properly in the set. On those receivers deriving the

AGC pulse from the horizontal output, with poor AGC action, the first thing to do is change the 6BQ6, or 6BG6, regardless of how the tube checks out. Do not rely on this as a cure all. The more usual sources of this difficulty should not be overlooked. They are in part, gassy, leaky or shorted tubes, defects in the horizontal circuit, and defects in the load circuit of the flyback transformer. Defective damper tube, linearity coil and condensers, width coil, yoke, etc. and the flyback itself will affect the amplitude of the AGC pulse.

Improving TV Sound

Most standard TV and radio receivers use a single-ended audio output stage. Ordinarily, the cathode resistor is bypassed with an electrolytic condenser, which raises audio output somewhat, since it prevents some degeneration of the output by cathode signal. In such cases, removal of the condenser improves sound quality. This results from negative feedback (degeneration) at the cathode. The drop in sound output is usually not enough to prevent the user from obtaining as much volume as he desires.

Once the condenser is removed, the cathode becomes a good take-off point if it is desired to feed sound from the receiver to a separate amplifier or audio system, a tape recorder, or some other equipment, since it provides several advantages. Among these advantages, aside from good audio quality, are the facts that audio amplitude is appreciable, that this take-off point is at the desired low impedance (the cathode resistor is seldom over 1000 ohms), that the take-off is of the cathode follower type, that one end of the circuit is already grounded, and that coupling condensers of a low voltage rating may be used.

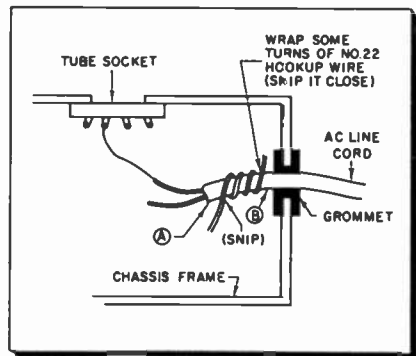
A word of caution: some TV receivers use a stacked B-plus supply. In these, the technique described is not possible, if the audio output tube is part of a voltage divider. In the latter case, there is about 150 volts on the cathode of the output tube, which is used as the low B-plus supply for other stages in the receiver, such as the i-f tubes. Removal of an electrolytic condenser will disturb voltage regulation to the other tubes.

Antenna Connector Gimmick

Clothespin type antenna clips are very convenient to use around the shop to allow quick connection to and disconnection from the antenna posts of TV receivers on the bench. However, any other technician will bear me out on this: so many times, in turning the chassis over for service or in mounting it on its side, the antenna lead gets caught on something, or else turns out to be too short, and the terminal strip is broken away from its mounting before one realizes it. After having this happen to several sets in the shop, I finally ended up with the idea of cutting the 300-ohm lead a foot or so behind the clothespin connector and inserting a pair of Mosley connectors (see illustration). Now, if there is any undue strain, it is the line itself that pulls apart, and no damage is done.

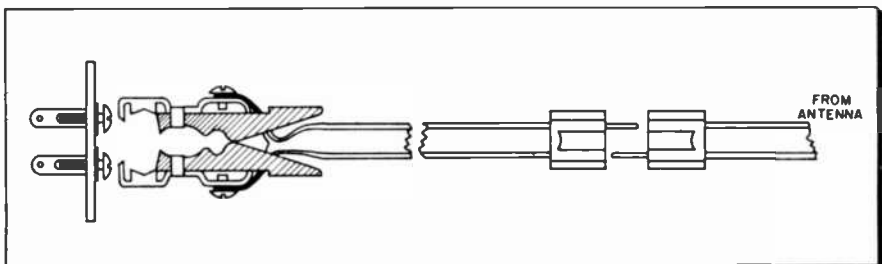
Line-Cord Anchor

Many receivers come into the shop without the protective knot on the line cord, inside the set. To unsolder the cord connections and knot the wire, then resolder the connections, takes a lot of time and work. Wrapping the cord with many turns of tape, while the cord is still in place, is also tedious if a sufficient number of turns to do the job properly are wound on.



A quick, easy method is the technique illustrated in the accompanying figure. First, wrap a few turns of insulated hook-up wire around the ac cord. Snip the ends close, as shown. Then start winding some tape around the line cord at point A. Wind in the direction from point A to point B. This anchors the hook-up wire which, in turn, protects the line cord connections, and keeps them

Pull-apart antenna connector for bench use prevents damage to receivers during servicing.

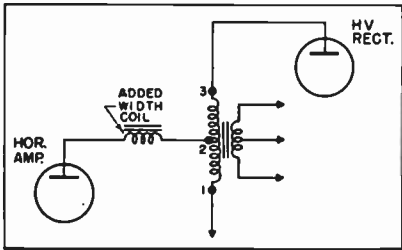


from pulling loose just as effectively as though a knot were tied on the end of the line cord. The whole job can be done in just a few minutes.

Instead of using ordinary friction tape for this job, I use the newer type of plastic insulating tape that may be stretched. It is easier to handle, is thin, is strong, and does not dry out, slide or unwind after exposure to heat, as does friction tape.

Flyback Repair

In a TV repair job the other day we found there was no RF voltage on the plate of the horizontal amplifier tube, and consequently no RF voltage at the input to the HV rectifier. When the 6BG6G horizontal amplifier tube was replaced with a new one, the RF voltage (as indicated by the spark drawn) returned to normal at the plate of the amplifier. A test of the original tube, however, indicated that it was good.

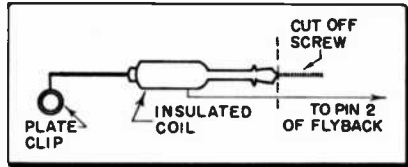


It was inserted into another TV set as a further check. Set operation was normal.

Several other new tubes were now tried in turn in the set being serviced. Only a few returned the set to normal operation. Circuit checks seemed advisable. Voltage readings and scope waveform checks revealed no trouble in the horizontal oscillator stage. Trouble in the flyback transformer seemed likely. Subsequent replacement of the flyback transformer verified that this was actually the case. When the original 6BG6G tube was used with the new transformer, the set operated normally.

Before the transformer was replaced,

a remedial measure was tried that worked out fine. The information just presented was intended to serve as an introduction to this little trick.



I took an ordinary width coil and inserted it between the primary of the flyback transformer and the plate of the horizontal amplifier, as shown in the sketch. When the receiver was tried after this change, it immediately worked as it should.

I believe that a few turns of the primary winding in the flyback had short-circuited. The loss of resistance was so low that the average ohmmeter could not register it. The loss of inductance, was, of course, the important one. It is this inductance loss that the insertion of the width coil compensates for.

On another set in which this method was tried, and results measured, an originally insufficient CRT 2nd anode voltage was raised 1500 V by the series addition of the width coil to the horizontal amplifier plate circuit.

The method has been used in other cases where small but critical losses in flyback transformer primary inductance impaired circuit operation severely. The technique restored circuit operation to normal in approximately 75% of the cases.

The brass screw should be cut off from the width coil. The coil must also be very well insulated. We were fortunate enough to have some liquid plastic on hand at the shop which we used to dip the coil in. The bottom of the coil winding was connected to the plate lead, and the top layer or the beginning of the coil was attached to the flyback connection (terminal 2 in sketch).

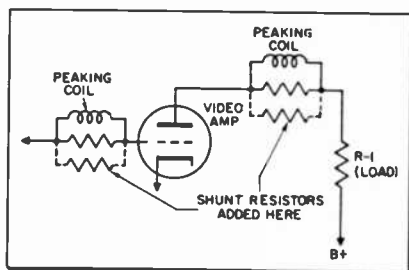
Hidden Sputter

Intermittent fuse blowing for no apparent reason and a slight sputtering sound clearly heard at times from the interior of the receiver were the symptoms on this portable television chassis. This trouble could also happen on other sets. All tubes checked ok, even when the damper, horizontal oscillator, high voltage rectifier and horizontal output tubes were replaced, the fuse would still blow out. Sometimes the receiver would operate for a day or two without trouble. With the rear cover plate off and a cheater cord plugged into the receiver, I allowed the set to operate while I went on about some other repair jobs. When the sputtering next occurred, I noticed a faint glow in the vicinity of the yoke. Fortunately I happened to be looking at the set just as it started to sputter. I removed the CRT socket and ion trap, unsoldered the four yoke leads from the terminal strip on the chassis, and slid the yoke off the neck of the tube. Close examination of the yoke showed a small burned spot at the edge of the winding closest to the bell of the CRT. Matching this spot with the bell, I found the cause of the trouble. A foil-covered, thin-cardboard strip clamped around half of the yoke opening in the chassis had bent inward (possibly from electrostatic attraction) and was just touching the edge of the yoke winding. I bent and dressed the cardboard back out of the way, and cleaned the burned spot. Two coats of coil dope and two strips of high voltage tape cured the trouble.

Ringings in the Picture

Whenever peaking coils are used as a means of increasing an amplifier's high-frequency response, the possibility of ringing or "echo effect" exists. This is the case with

video amplifiers in TV receivers. The symptom is often mistaken for tuner or i-f misalignment, with the result that there are fruitless and time-wasting attempts to align and re-align the set. If ringing occurs in the video amplifier, a simple solution is to shunt resistors across the peaking coils or, if resistors are already there, to reduce their value.



A good starting value is about 50k. This value may be lowered until the ringing is acceptably reduced. This method should be used when a test pattern is being received, so that the effect on high-frequency response can be noted. If high-frequency response must be reduced a great deal to eliminate the ringing, re-dress video amplifier leads so that they are as short as possible, and lower the value of the plate load resistor, R-1.

(Care should be taken in changing the value of the plate load resistor; reduction in the value of this resistor will lower the stage gain. The method may therefore be inadvisable where weak signals are being received.—Ed.)

High Voltage Checks

Rather than resort to the conventional but unreliable screwdriver method of probing for r-f arcs at the caps of the horizontal output and h-v rectifier tubes, the author uses a simple visual aid. Adapters were made to fit into the sockets of type

1B3 and 1X2 high-voltage rectifier tubes. Soldered into each of these adapters was a No. 47 (brown bead) pilot lamp, across the filament pins.

When the flyback system is normally putting out r-f (15,750 cps) of sufficient amplitude, the pilot lamp, when inserted in the h-v rectifier socket by way of the adapter, will glow with the same amount of brilliance as when powered by a 1.5-volt cell. With the adapter in place, a direct visual indication is provided for observing the effects of flyback output when various circuit adjustments are attempted or when component values are experimentally changed. These effects are readily noted as changes in the degree of illumination in the pilot lamp.

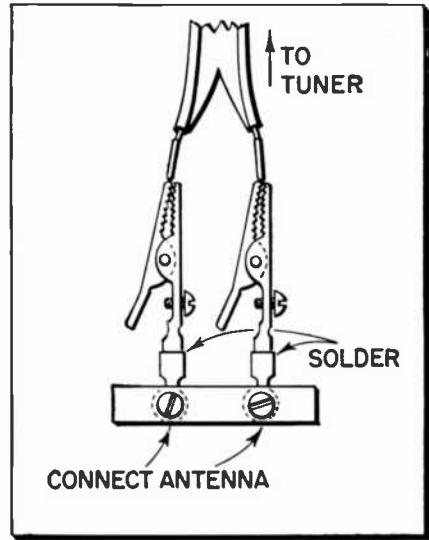
Of course, this method is not as accurate as the use of a vtvm in conjunction with a high-voltage probe. However, this application has certain advantages to recommend it, including low cost of equipment used, ease of assembly and application, elimination of danger from shock, and the small size of the equipment such that it can be conveniently taken along and readily applied for checks in the home. Continued use of this method makes the technician adept at properly evaluating output and overall operation of the flyback system under various conditions. One learns quickly to evaluate degrees and changes of brightness in terms of operation and circuit defects. Frequent application makes the user adept. The method is certainly superior to that of probing for high-voltage arcs.

Antenna Attachment Jig

When the back is removed from many TV sets having a vertical chassis, it is necessary to detach the short antenna lead connector going to the tuner. This makes it difficult to attach the antenna for testing the

set. I have solved the problem by making a jig, as illustrated, which I keep in my tube caddy.

Two alligator clips are soldered to the inside lugs of a regular screw-type antenna terminal strip. When the short lead from the tuner is detached and the set's back removed, the antenna can be easily connected



An antenna is easily attached to a vertical TV by a jig made with two alligator clips and a spare terminal strip.

to the strip and the connector tips from the tuner lead can be grasped by the alligator clips. The tuner lead is held taut, the leads kept well separated, minimizing the possibility of shorting the antenna leads.

Loose Back Covers

Push an appropriately sized paper clip into all corners and then insert the tri-mount clips. The paper clips enable the tri-mounts to make a positive mechanical hold in the enlarged plastic holes and keep the fiber back firmly in place.

3 cheater cords ■

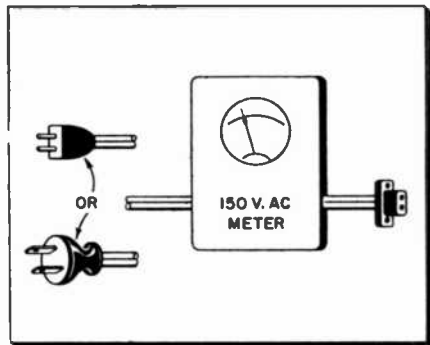
Antenna Cheater Cord

Many TV sets have a short 300 ohm lead connected between the tuner and the protective cover on the rear of the set. The length of this lead is just not long enough to permit the back cover to remain connected without causing a great deal of stress and strain. Broken strands and complete severance often occurs. The only remedy is to dig out the soldering gun, and then solder. After having to repair a number of these broken leads, I made up an extension consisting of 24 inches of 300 ohm wire, pins to fit into the socket on the back cover, and a double jack to accommodate the lead coming from the tuner. Some servicemen may be inclined to use insulated alligator clips instead of the plugs and jacks. It takes up little room in the tool box, and I haven't had a broken lead since.

Metered Cheater Cord

In those areas where line voltage variations cause TV difficulties, the combination cheater cord and a-c meter will serve a dual roll. In addition to providing the technician with a convenient arrangement for

determining the actual line voltage while the receiver is tuned on, it should help to convince the customer that external power conditions can cause trouble. A conventional male plug or a male cheater-cord plug can be used. The advantage of the latter is that it can be plugged directly

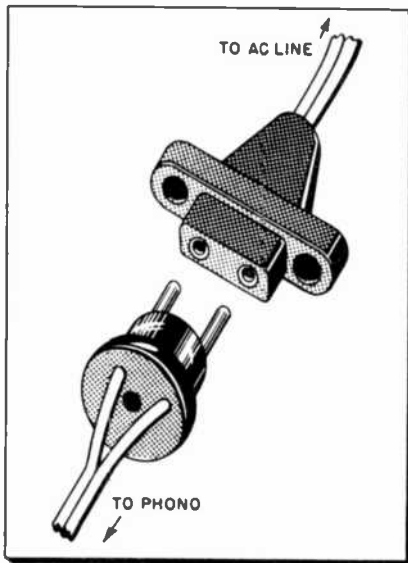


Metered cheater cord facilitates measuring line-voltage while the set is turned on.

into the back of the set; and eliminate having to move furniture to find a wall outlet. Other features may be built into the unit, such as additional outlets, a continuity tester using a neon light, etc.

Cheater-Cord Extension

In many cases it is virtually impossible to remove the record player from its cabinet and still have the line cord and phono input cord attached to the amplifier. When servicing the record player, power may be obtained by using a TV cheater cord which makes a safe and handy extension line cord. Where there



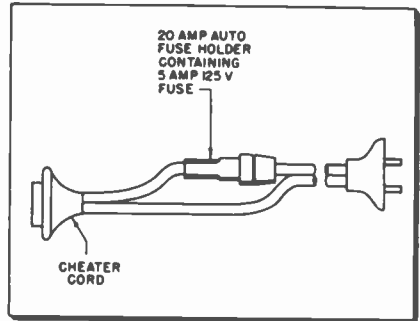
Cheater cord helps phono-motor servicing.

are more than two terminals, a careful check should be made to select the correct pair leading to the phono motor. Otherwise the fuses will pop. The cheater cord will accommodate the majority of record players. Some machines lend themselves quite readily to the use of regular electric-iron and the smaller waffle-iron type of plugs.

Fused Cheater Cords

To prevent the possibility of blowing the ac fuse in the home of a customer and creating the extra dif-

ficulties associated with such an occurrence, we fuse all cheater cords used in servicing. A 5-amp 125-v

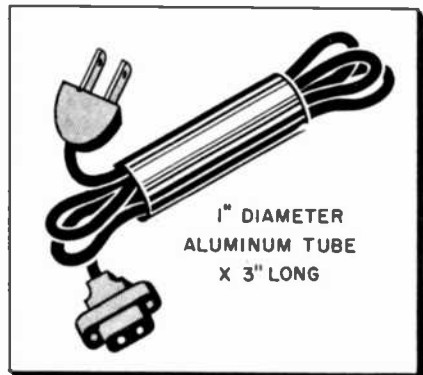


Fused cheater cords facilitate field work.

fuse is put in one leg of each cheater by inserting a plastic fuse holder, as shown in the illustration, in the cord. The holder used is the type made to accommodate a 20-amp auto-radio fuse.

Cheater Cord Storage

A piece of 1-inch aluminum tubing about 2½ inches long makes a handy holder for cheater cords and



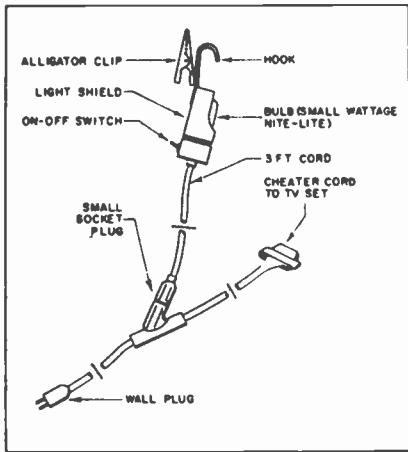
Aluminum tube provides a neat and rapid storage facility for cheater cords.

test leads. It can keep cords in good condition and in place in the tube caddy. Time can be saved by not having to tie a hangman's noose each time the cord is put away.

The ends of the tube should be reamed smooth, so that the cord, fingers and furniture are not snagged.

Light Inside TV Cabinet

When servicing a TV set in a customer's home, it is helpful to have a light inside the cabinet. Advantage may be taken of the fact that, with the back off the receiver, an AC

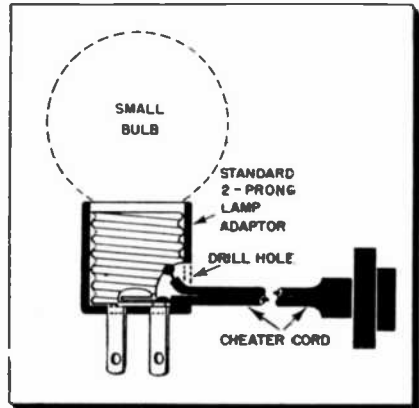


cheater cord is necessary for inspection of the set during operation. I parallel the cheater cord with another AC line, about three feet long, fixing a small light bulb at the other end of the added line (see sketch). On the small light I fasten an alliga-

tor clip and a hook, by either of which the bulb can be attached to any safe and convenient part inside the cabinet or on the chassis.

Cheater Cord

It wasn't until I had lost a half dozen cheater cords, by leaving them plugged into sockets, in customers living rooms, that I hit upon this idea. Take a standard 2 prong lamp adaptor, drill a $\frac{1}{4}$ " hole in the side, where there is a gap for the lamp center pin connection, cut the plug from the cheater cord and insert



Cheater cord and line voltage indicator.

in the hole, solder one wire to the center and one to the screw part of the lamp holder. This gimmick acts as an indication as to whether the customer's socket is OK, plus the fact that a light will always be noticed. I haven't lost a cheater cord since.

4 components and tubes ■

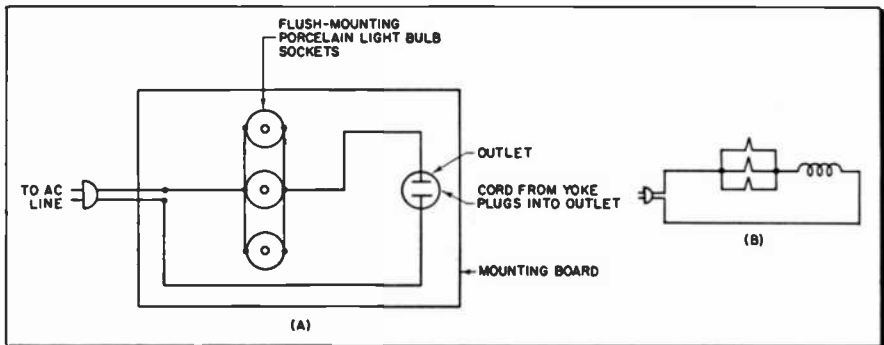
Removing Frozen Yokes

Now and then the TV serviceman is plagued by the necessity of removing a "frozen" yoke. If solvent applied around the neck of the picture tube fails to loosen the yoke, many manufacturers recommend the application of a suitable AC voltage (25 to 50 volts) to the yoke's horizontal windings. To reduce the line voltage, a variable voltage transformer is often recommended. The use of this device may be impractical for at least two reasons: less expensive transformers of this type do not permit a sufficiently gradual variation of voltage output in the desired range, introducing the danger of

yoke damage; and many service shops do not have such a transformer available at all. The following method requires an accessory that can be assembled easily and inexpensively:

Arrange three light-bulb sockets, an outlet and a line cord in the manner shown. Attach one end of a line-cord wire, to the other end of which a male plug has been connected, to the horizontal section of the yoke. (First disconnect the yoke from the circuit, of course.) Insert this male plug into the socket on the test device. By screwing various sizes of electric bulbs into the three parallel sockets, enough heat will be gener-

Set-up for removing frozen yokes. Porcelain sockets can be readily mounted on a board.



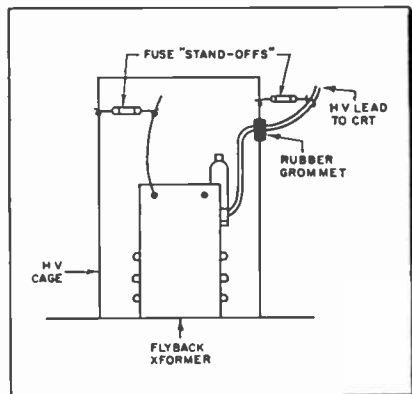
ated in the yoke so that it can be slipped off.

Use the smallest wattage (highest resistance) bulbs that will do the trick. Application of some vaseline or similar lubricant to the portion of the CRT neck over which the yoke must slide may prove helpful. Remove the yoke with a gentle, rocking motion.

Note that the light-bulb sockets are electrically in parallel with each other, but in series with the yoke and the AC line. Using higher wattage bulbs or placing bulbs in parallel reduces the resistance in series with the yoke. This increases current and voltage in the yoke's windings.

Unique HV Standoff

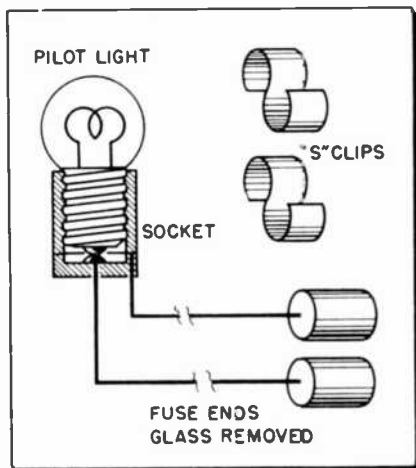
Don't throw those burned-out pigtail fuses away! When trying to dress leads inside high voltage cages, and in similar applications when it is desired to keep leads fixed in desired positions, the burned-out pigtail



fuses can be used as anchors. Since the fuse is blown, the glass envelope provides effective high voltage insulation. As with cellulose tape, the applications for these fuse "stand-offs" are only limited by the technician's ingenuity. The pigtails are used for tying purposes. Some possibilities are illustrated.

Fuse Saver

When repairing a TV receiver having a defective or intermittent horizontal sweep circuit, continuous replacement of the fuse can be quite bothersome. I made a little gadget out of an old fuse, pilot light socket



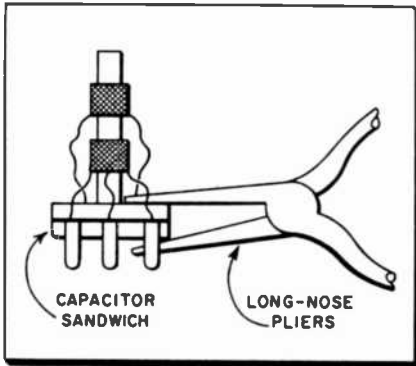
Pilot light adaptor speeds troubleshooting.

and some wire as shown in the diagram. Remove all the glass from the end caps of the old fuse. (No sense in ruining a new fuse.) Solder two wires to the caps and a pilot-light socket. A pair of "S" clips enables me to hook up my little device to any pigtail fuse. Where the fuse snaps in, just insert the end caps of this gimmick in place of the fuse.

The use of a pilot light in place of a fuse will permit an approximate overload of $1\frac{1}{2}$ times without blowing out and at the same time afford some protection. The brightness level in the bulb is a rough indication of the amount of current in the circuit. A 6.8-volt, 250-ma pilot lamp, #46 and a 2.5-volt, 0.5 ampere lamp, #43, can be used in place of $\frac{1}{4}$ and $\frac{1}{2}$ ampere fuses respectively.

Transformer Repair

Slug-tuned i-f and similar type transformers used in TV and radio, require capacitors to form parallel resonant circuits. On the older types these were regular capacitors which were wired inside or outside the transformer can. On current type transformers the capacitors are formed by silver-plating both sides of a piece of mica and then sandwiching it between two plastic wafers at the base of the transformer. The



While maintaining slight pressure on warped plastic wafers of a coil, heat is applied to correct intermittent failure.

sandwiching forms the necessary connections by pressure contacts.

I have found that many of these transformers, especially those used in audio detector circuits, become defective due to warping of the plastic wafers. When this warping occurs it releases the pressure contacts and produces intermittents, circuit failure after warm-up, and often complete circuit failure. This type of trouble is generally caused by mounting the transformer too close to a heat producing component, such as a power tube, high wattage resistor, or mounting the transformer directly above a hot tube on a vertical chassis. Trying to obtain exact replacements involves a considerable amount of time and

using a universal replacement generally leads to complications—especially if the transformer is mounted on a printed circuit board. All these headaches are unnecessary as it is easy to repair this type of defect.

Remove the defective transformer from the chassis and then remove its aluminum shield, thus exposing the coils and capacitor sandwich. Handle the unit carefully as many of these coils are wound with very fine wire which is easily broken. Next, grip the sandwich wafers with a pair of long-nose pliers, as shown at left, and exert a slight pressure. While applying pressure, use a clean soldering pencil to melt the two plastic wafers together near the point where the pressure is being applied. Repeat this procedure on all four edges of the sandwich. This will restore the pressure contacts. The unit is now ready to be reassembled. After the transformer is reinstalled a slight touch-up in alignment of the stage may be required.

Fusing the edges of the capacitor sandwich in this way makes future warping almost impossible at temperatures generally encountered in radio and TV receivers.

Transformer First Aid

Here is an idea I have used several times to repair TV sets with open 5U4—filament windings in the power transformer. I replace the 5U4 with a 6AX6 heater-cathode type rectifier tube. I have tried several other tubes of this type but find that the 6AX6 gives the best service. The change is as follows: Remove all leads to the 5U4 socket; connect the plate leads of the power transformer to pins 3 and 5; tie the cathodes, pins 4 and 8 together and connect the B+ lead to pin 4 or 8; connect the heater pins 2 and 7 to

the existing 6.3-volt winding on the power transformer and tape the old 5U4 filament leads. The 6AX6 requires 2.5 amperes for heater current; be sure the transformer can handle the extra load.

• So as not to compromise the built-in margin of safety, another alternative to replacing the costly power transformer, in the above situation, is to install a separate filament transformer capable of delivering 6.3-volts at 2.5-amperes. If a separate transformer were not used and if a cathode-to-heater short developed, B+ would leak into the 6.3-volt filament string and cause much damage. If a separate transformer is used, then the technician may as well get a 5-volt job and continue using the 5U4 tube type.—Ed.

Noisy Tuning Condensers

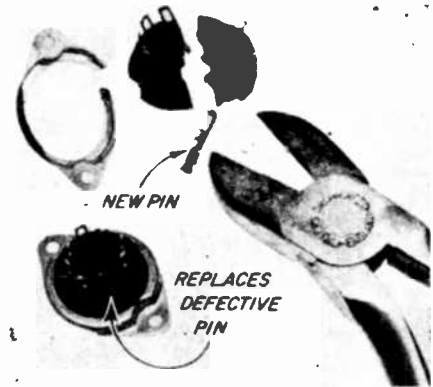
Quite often a small radio will come in with a complaint of noisy and intermittent tuning. This is often due to fine particles of the plating on tuning gang condensers flaking or powdering off the base metal of the plates, and shorting out as the plates are rotated. This difficulty can be quickly cleared up by removing the gang assembly from the chassis and giving it a bath in muriatic acid for a few minutes. This acid, which is very inexpensive, can be purchased in a local paint shop.

The tuning assembly is then bathed in water, rinsed in denatured alcohol and allowed to dry. When re-assembling the tuning unit into the set, make doubly sure that the oscillator and r-f trimmers are dry. Re-align the oscillator and r-f stages as usual, lubricate pivot points and bearings and—presto—clean, noiseless tuning.

Tube Socket Repair

On occasion, a tube socket pin may break and a spare pin is not readily available. Rather than replace the entire defective socket with a similar type usually stocked, repairing the socket will save considerable time and avoid the possibility of a wiring error.

Cut the bakelite of a similar type



A new socket pin avoids time-consuming replacement of an entire defective socket.

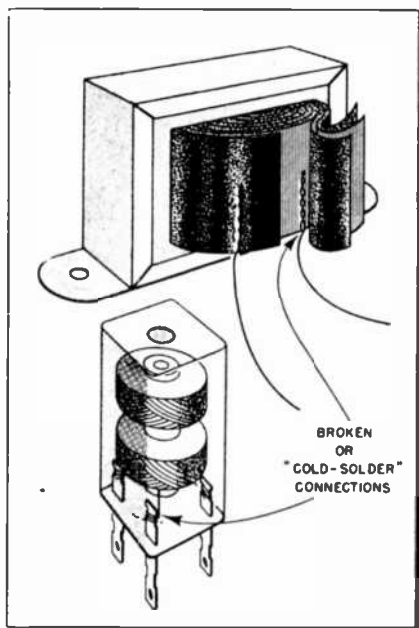
socket with a pair of diagonal cutters and remove a good pin. See above. Then, remove the broken pin of the original socket by exerting pressure from the bottom with a small punch or screwdriver. Insert the new pin into the original socket from the top of the chassis, pulling it through with needle nose pliers.

Salvage Handy Connectors

Small 45 and 67½ volt batteries are usually provided with one male and one female snap connector. When these batteries are discarded, I remove the fiber strip holding these connectors and save it. A pair of these make a very good connector for speaker leads or other two-wire arrangements. They are heavy and make excellent contact.

Transformer First Aid

What may appear to be a transformer replacement job in a fairly new set may in fact turn out to be only a minor repair to a major component. In many cases a winding which reads open or very high resistance may be due to a defective or broken solder joint inside the transformer, where the heavy leads are attached to the comparatively very thin winding ends. Power, audio output, i-f transformers, chokes and other coils may suffer



Breaks usually occur at these points.

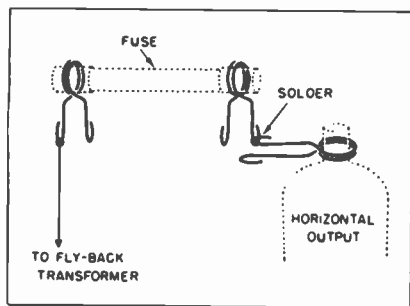
from this difficulty. All that is needed is to clean and re-solder the joint to restore the transformer to operating condition. It is more likely that this condition will be found in new equipment. Breakdown in older transformers usually occurs within the windings. In some cases it is possible to dig the coil, find the trouble and correct it. The chances for breakdown are ever present in

the latter procedure and is therefore not usually recommended. With a sharp knife, cut one layer of insulation at a time and fold back. Cut only as many layers as needed to expose the coil winding ends. Precaution against cutting too deep should be exercised to avoid damaging the transformer coil windings.

Extreme care should be exercised in preparing the short coil ends for connection, a break too close to the coil proper may terminate any further first aid procedure. Use fine emery cloth to remove the enamel coating. It is a good idea to provide strain relief on these leads. Fold the insulation back into place and tape.

Quicky Fuse Mount

On sets not already equipped with a fused flyback and where space permits, I have been able to modify and satisfy at a very nominal cost. Simply by soldering 2 spring clips and affixing them to the top of the



Improvised fuse holder.

6BG6 or 6BQ6. Place an appropriate size fuse between these clips and the lead from the high voltage transformer. Of the 2 clip sizes available, select the smaller one to hold the fuse.

Noisy Tuning Condensers

Curing a noisy tuning condenser by flashing with high voltage is a pretty well known trick by now. But that involves disconnecting all components from the tuning gang, such as the antenna loop, rf transformer, etc. This can be quite a tedious job on some sets. A high-voltage supply must also be available. Even so, I have occasionally run into stubborn cases which just won't clear up, with the flashing and burning technique. The latest trick is one which requires no unsoldering or high voltage supply and even works in stubborn situations. Just grab that can of high-dielectric plastic spray and cover both the rotor and stator with a generous coating. Allow to dry thoroughly. The loose particles are trapped in the plastic. The gang works smoothly and without noise.

- *When repeated complaints occur or when flaking becomes excessive, the best solution is to replace the condenser. If you must effect a permanent repair on the old job, then remove the tuning gang from the receiver and strip it of trimmer mica and screws. Immerse the gang in a bath of killed acid (muriatic acid with some zinc) until the coating has been removed. Then thoroughly wash in a bath of alcohol to neutralize and stop any further action. Avoid excessive "cooking."—Ed.*

Inaccessible Tubes

When it becomes necessary to replace the larger 6AF4 tube type, and only the smaller 6AF4A is available, the technician may find that the tube fits into a deep recess.

If the smaller 6AF4A tube is used, he will find much to his sorrow that he will be unable to remove it for future replacement. I recommend



Heat and shield conditions permitting, plastic tape forms handle for miniature tubes.

the use of a 3-inch length of $\frac{3}{4}$ -inch wide plastic high-dielectric tape. The smaller 6AF4A is pushed through the tape, gum side up, so that the pins make their own holes. The tape is then folded up along the sides of the tube and squeezed together so as to form a tab. This hint may be used in other inaccessible places provided the tube is not operating at a high temperature.

Binding in Dual Controls

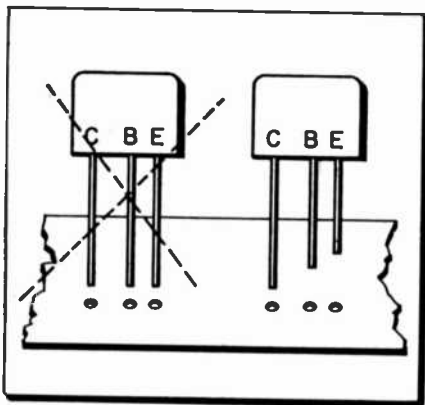
When two TV control knobs are mounted one in front of the other on concentric shafts, there is always the danger of their sticking together. It seems that, if the hole on the outer (more forward) knob is deep enough, people adjusting their sets

invariably manage to push this front knob against the inner one—thus making it impossible to turn one of them without having the other also move.

Since the cause is excessive depth of the hole in the outer knob, this trouble can be prevented by using little pieces of solder to fill the hole until its depth has been reduced by a satisfactory amount. With the right amount of filler, the outer knob cannot be jammed against the inner one. Solder is the recommended material because it is easily mashed into the proper shape, and is thus prevented from falling out.

Component Installation

I've always run into difficulties trying to install some components into their respective holes in a printed circuit board. Attempting to space and thread long flexible leads of tran-

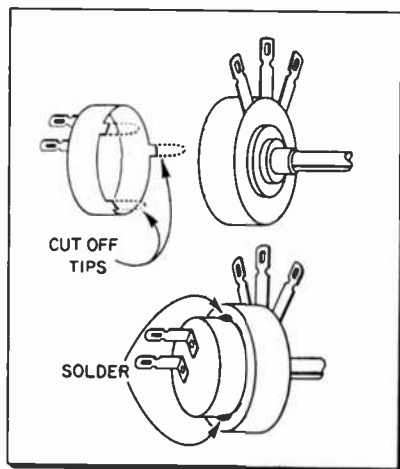


Ease the job of inserting individual transistor leads into their mountings by cutting the leads to different lengths.

sistors, diodes, etc. was a tedious task until I clipped each lead, as illustrated here (above), a quarter inch shorter than the previous one. This enabled me to insert the leads one at a time without any difficulty.

Switch Replacement

To replace a defective switch mounted on the back end of a potentiometer, without having to go to the expense of a completely new combination control, I have been using this quick method. In some cases it isn't even necessary to remove the control from the chassis.



Switch assembly.

Pry the old switch off with a knife-blade or a small screwdriver. Straighten the tips of the new switch, and cut them down to about 1/16th of an inch. With both control and switch in the on position, place the switch on the control and tack solder in two or three places.

- Before soldering, check to see that the control is functioning properly. —Ed.

Tube Saver

The heat developed in and around the horizontal output tube in the TV receiver, often causes the top cap to become loose and unsoldered. Sometimes the cap remains firmly cemented to the glass and the actual electrical connection becomes inter-

mittent and bad. Between the corroded wire and low-temperature solder used for servicing, it is difficult to establish a good connection just by applying the soldering iron to the top of the tube. If the tube is good, except for this condition, I change the connector, on the lead from the flyback, to the spring type if it already doesn't have one. I then spread the spring coils over the wire projecting from the top of the tube. To assure a good connection the wire should be cleaned. This can be accomplished by carefully scraping with a knife blade or emery cloth. When price is a factor, this idea should help improve customer relations. The spring-type connectors can often be salvaged from defective flyback transformers.

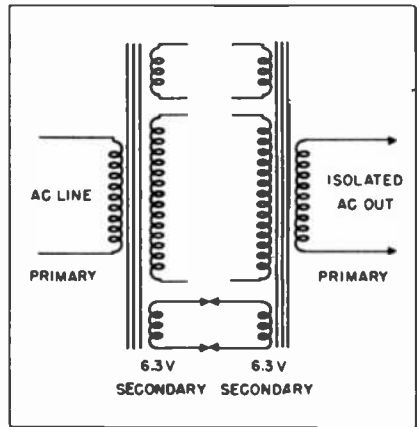
● *To avoid damage to the horizontal-output tube especially when it has been in service for some time, it pays to inspect the condition of the cap before attempting to disconnect the lead. Often the lead connection is stronger than the old bond between the glass and cap. A small screw-driver can be used as a lever to gently lift the connection without applying decapitating pressures.—Ed.*

Overheated Resistors

Dual triodes used as TV RF amplifiers, such as the 6BK7, 6BQ7, and 6BZ7, often develop intermittent shorts. When such a defective tube is replaced, go a little further: check the voltage-dropping resistors to the tube. Frequently the tube short results in overheating of these resistors, causing an increase in their resistance value and a subsequent loss of gain. Turn the set on and let the resistors warm up for a while before measuring their value. Replacing the resistors that have changed in value will restore the set to its original sensitivity.

Emergency Isolation

When the shock hazard becomes a problem especially when working on radio or TV sets whose chassis are tied to one side of the a-c power line, an emergency isolation transformer can be quickly hooked up by using any two similar transformers. Care must be taken not to exceed the transformer's wattage rating. Two TV power transformers will do. Where there are multiple windings, it is best to use the heaviest; this is



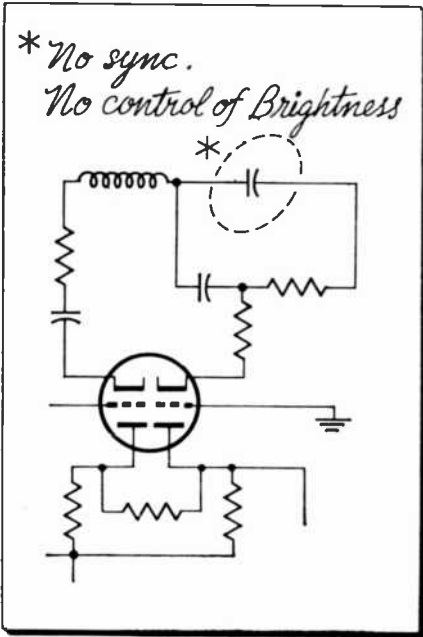
Emergency power line isolation device.

usually the 6.3-volt filament winding. One transformer steps up as much as the other transformer steps down in a symmetrical back-to-back hookup, as shown in the diagram. (Less a very small loss; the amount depending upon the efficiency of the transformer.) Exposed leads should be taped.

● *Commercial isolation transformers are available. Some have provisions for raising or lowering the voltage to facilitate certain trouble shooting procedures.—Ed.*

Case History File

When replacing components in TV chassis that have to be brought to the shop, I always circle the defective shop, I always circle the defective



Circling a defective component and entering symptom on the schematic simplifies future troubleshooting.

part on the schematic, as illustrated above. If it is an unusual kind of trouble, I will also make explanatory notes in the margin. This provides a case-history record on each schematic, and aids immeasurably in future troubleshooting of the same model.

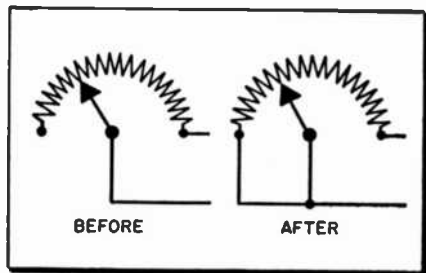
Intermittent Tube Filaments

My method of locating intermittent tube filaments cuts down most of the time usually required to "nail" this type of trouble. When an intermittently-open tube filament seems to be present, it can be easily located

by shunting a ¼-watt, 125-volt neon lamp across the heater pins. When the filament opens for even an instant, the neon lamp lights up. I usually place the set on the bench, with the neon lamp hooked to a tube socket, while I work on another set. If the neon lamp doesn't glow after a reasonable time, I move the lamp to the next socket, continuing this procedure until the open filament is found. On AC-DC sets, a flickering pilot lamp will often indicate the presence of this type of trouble. 50L6's have been found to be frequent offenders.

Quieting Controls

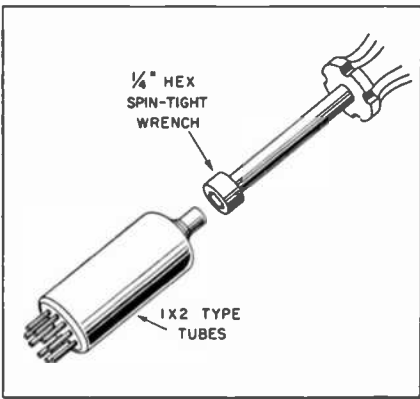
Potentiometers are often used as two-terminal controls in many TV, audio, and other electronic equipment. Noisy controls are quite common, regardless of how they are used. Quieter operation and longer control life can be realized by connecting the unused terminal to the center control arm as shown in the diagram. Should the arm fail to make a good contact, while it is being rotated, the entire pot is in the circuit, arcing tendencies and current surges are thus minimized. The unused portion of the resistance is shorted to the control arm, and does not affect the circuit in any way—



Less noise, and greater life expectancy can be obtained from potentiometers used in 2-terminal hookups, by connecting the unused terminal to the center arm.

Remove & Replace Tubes

Some of the new portable TV sets house the 1X2 high-voltage rectifier tube in almost inaccessible places. To avoid cramped fingers, scraped skin and loss of temper, I insert the cap



A spin-tight wrench may be used to position the 1X2 tube type in difficult locations.

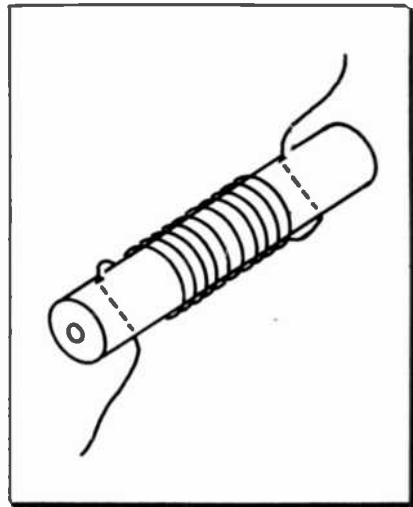
end of the 1X2 into a 1/4 inch spin-tight nut wrench. If the tube fits too loosely, use tape to build up the area to form a snug fit. When in a hurry to pull a red hot tube instead of burning the fingers or troubling the housewife for one of her pot holders, use an empty tube carton. Place the open end over the tube, squeeze adequately and pull. When removing or replacing a tube from a printed circuit board, use a rotary motion and avoid excessive pressure to avoid embarrassing breaks. A pin straightener will make life easier, and increase the useful life of a tube socket especially in a tube tester. Seven and nine pin indexing tabs will cut down some of the time and patience required to install miniature tubes in out-of-the-way and out of the line-of-sight locations. To avoid short circuits when replacing subminiature tubes, avoid excessive length of tube leads. When removing tight top cap connectors from an

old horizontal output tube use a screwdriver as a wedge between the cap and connector and avoid any pressure between the glass and cap.

Small Coil Making

Often a small coil is needed of an odd value not readily obtainable. In such cases, a home-made coil can be quickly fabricated by using a small length of insulation from a piece of coaxial cable as the core.

Cut off the required length of cable; pull the core out from the shielding; and then extract the copper wire through the center. With the soldering iron, heat one end of

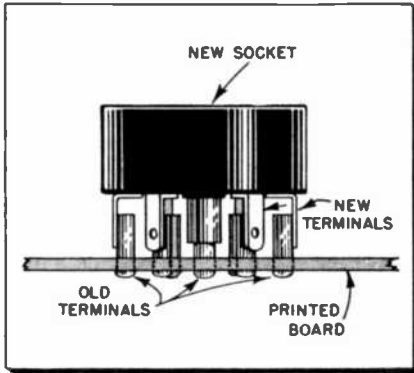


Simple hand-wound coil from cable insulation.

the wire that will be used to wind the coil, and quickly poke this heated end through the plastic insulation (see the figure). Wrap on the required number of turns and cut the wire to size. Then heat this other end of the wire with the soldering iron and plunge it through the other end of the insulation. You now have a good, low-loss coil, as shown in the illustration.

Socket Replacement

Some popular model television receivers use a tube socket that is mounted on metal posts on the printed circuit board. The contacts often break between the socket wafers. Since the replacement sockets when available are not better



than the original, we replace them with regular molded sockets, resulting in a more permanent repair.

Carefully break the formica wafers on the old socket and cut away the metal contacts, leaving the terminal intact on the board. Bend the soldering lugs of the new socket to lineup with the terminals left on the printed board. Slip the center ground contact of the new socket over the similar part of the old socket and solder the lugs to the appropriate terminals.

If the new socket has a mounting bracket, remove it before mounting.

Replacing Socket Lugs

Undoubtedly many of your readers, at one time or another, have broken a lug in a *molded* socket. Instead of replacing the socket, they have tried to replace the lug, only to have the socket (in a tuner, of course) also break. To remove the

broken lug from the socket, solder a short length of No. 12 or No. 14 wire to the top side of the broken lug and simply pull the wire out. The broken lug will come out with it, and a replacement may be readily slipped in.

Loose Flyback Ground

We encountered a severe frying and popping noise in a television receiver. The symptom was traced definitely to the flyback transformer. At first, it was thought that the cause might be one or more defective condensers, resistors, or corrosion in the windings. Close observation of the picture showed no picture pulling, distortion or other adverse effects. Behavior was similar to that when a severe corona discharge is present. The trouble was finally traced to the fact that the iron core of the flyback transformer was not solidly grounded to the chassis, with arcing as the result. Simply tightening the two bolts that fasten the transformer to the chassis corrected the trouble at once.

Loose Miniature Tubes

How often have you run into trouble because a miniature tube would not stay seated in its socket securely? This difficulty, which occurs when the receptacles in the socket become worn or loose, can be remedied quickly:

Remove the tube from the defective socket and secure another good socket from your stock. Start inserting the tube into the good socket, but only get it inserted half way. When the tube pins are half way in, give the tube itself a slight twist—just enough so that all of the pins are bent at a slight angle but all in the same direction, so that the spacing of the pins remains the same. Now, when you re-insert the tube in its original socket, you will find that you have a snug fit.

Go—No Go Tube Socket Test

To locate a loose pin socket on a 7 or 9-pin miniature tube socket: Carefully remove a pin from the base of a defective 7 or 9-pin tube. Mount this pin in any suitable holder and probe each opening in the socket. A snug fit indicates good contact. A loose fit points to a potential trouble spot. Bend the contacts to tighten, and retest. It may be necessary to replace the individual pin holder or the complete socket depending upon the circumstance. I would like to see this idea incorporated in a service tool with a 7-pin probe on one end and an octal on the other.

Determining Open Resistor Values

Occasionally I receive a set in the shop for which I have no schematic. This doesn't pose a great problem as far as locating the trouble, but a problem does arise when the defective part is not marked with its value. I have found this especially true of wirewound resistors which are seldom marked, or have had their markings burned away by the high temperatures at which these units operate.

To determine the original value of an open wirewound resistor, I

file away the insulation at the middle of the resistor, as shown.

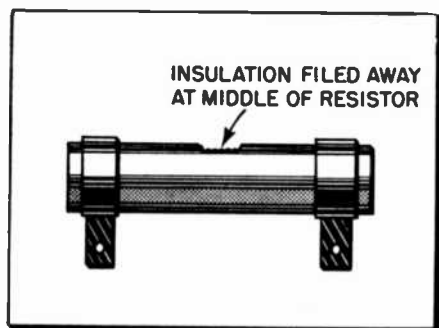
This exposes a few turns of the winding. Using an ohmmeter I measure the resistance from this midpoint to each end. One of these readings will be infinity, indicating the open half. The reading obtained on the good half when multiplied by two will be approximately equal to the original value of the resistor. A reading will usually be obtained on one half since it is uncommon for more than one turn to open.

Vector Socket

Inverted wafer socket permits testing tube voltages from top of chassis. In many receivers, particularly in early model radios and some portables, components and wiring completely block the path of the underside of a tube's socket. In the absence of a commercially available test socket, and when it becomes necessary to take readings from above the chassis, a wafer socket, with its lugs flattened, can be inserted between the tube and its socket. The exposed lugs provide readily accessible test points. Note, the wafer socket should be inverted, and the lugs should not come in contact with any chassis hardware. There may be occasion to modify the wafer socket to make it fit into tight places. This can be easily accomplished with a file or grindstone.

Economy Pilot Bulbs

Instead of using 6-watt 115-volt bulbs as pilot lamps in set-ups of shop or test equipment, as in panel set-ups, use a 200,000-ohm resistor in series with a NE-2T pigtail-type neon lamp. Put this combination across the 115-volt line. This cuts current consumption from 6 watts for each bulb down to about 1/25 of a watt. Space is also saved by

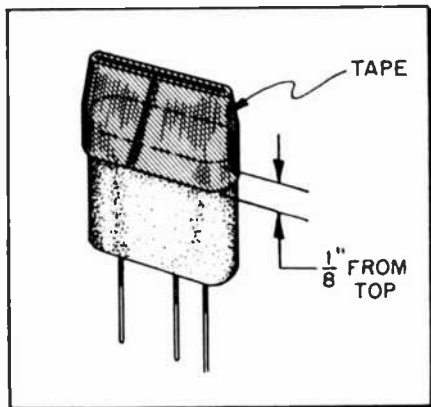


Exposing center coils of a defective wirewound resistor aids measuring its value.

mounting the little bulbs in grommets with $\frac{1}{4}$ -in. inside diameter, for a perfect fit. These neon bulbs can also be used to replace the regular 6-watt lamps in dial lighting and indicator applications.

Transistor Mounting

In many cases where the transistor is suspected as being defective, it must be unsoldered from the circuit for a final check or substitution. Whether it proved to be good or de-



Wrapping the top of a transistor with tape facilitates handling the component in almost inaccessible areas of small radios.

fective, either the old transistor or a new one must be replaced. If the area where the transistor mount is crowded with other parts, thereby making it impossible to hold the transistor while inserting it, try this suggestion: Wrap the top of the transistor with some tape, such as plastic electrical tape. This will make an easily held extension of the transistor height, as shown above. Tape only the top $\frac{1}{8}$ " of the transistor lightly, and then place it into its mounting holes. After soldering the leads in place, pull off the tape.

Hot Penny Removes Tube Socket

I have recently had trouble replacing defective tube sockets on a 1958 automobile hybrid radio. The tube socket pins break very easily especially when inserting tubes with bent pins. In an effort to replace these sockets with an improved type, it is necessary to remove the old socket. Not having the special tools, I imagined that this would be a prodigious job. I tried melting and wiping off excess solder from each pin with a stiff wire brush, according to instructions received at one time. After carefully melting and wiping off in this manner, I futilely attempted to pry the socket loose and almost cracked the board, but still no luck. I then placed a copper penny over the seven pins and applied my regular solder gun. The socket almost dropped out by itself.

Keeping Resistors Handy

A neat, space-saving way for keeping an assortment of resistors handy to the service bench is to stretch a length of a discarded coiled heater element between two hooks above the bench. Bend a hook on the end of one lead on each resistor, and hook the resistors along the coil. The color code will show readily and, if the resistors are arranged in the order of their value, a desired one may be selected quickly.

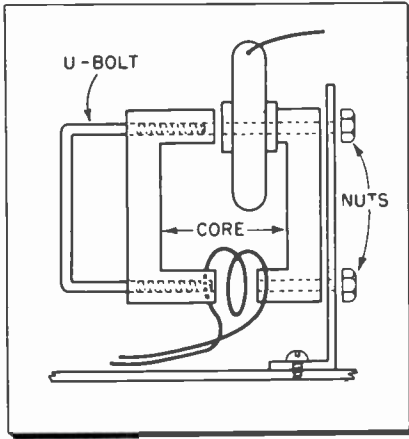
Shorted Tuning Condensers

Locating shorted plates in ganged tuning condensers may be simplified by using a strip of stiff paper, such as a calling card. Pass the paper successively between the different pairs of rotor and stator plates. When the shorted plates are separated, the receiver will resume operation.

Transformer Replacement

Considerable labor can be saved when replacing the horizontal output transformer by eliminating the need for disassembling the high voltage cup under the high-voltage rectifier tube and replacing the filament leads on some TV receivers. This can be accomplished by leaving the

transformer mounting bracket attached to the chassis and the filament leads attached to the tube socket. Remove the 2 nuts and U bolt holding the core to the bracket. Slip one side of the core out to free the filament winding, then remove the rest of the transformer. Install the new transformer in reverse manner, using original filament winding and transformer bracket.



Removal of 2 nuts and U-bolt releases filament winding and speeds flyback replacement.

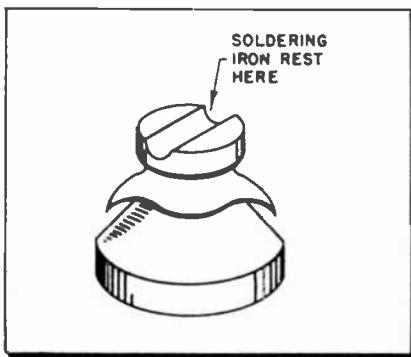
Tube Kink

A defective 6J5 vertical-output tube located in a 630 chassis, which was in a home about 15 miles from my shop, gave me a hard time because I did not have a replacement or even a poor substitute with me. What to do? I modified a 6K6 by snipping off part of pin 4 and soldering a jumper from pin 3 to pin 4. This tied the plate and screen together. Pin 4 was cut just in case the socket connection was used as a tie point. It worked very well. It saved me a long trip and the customer was happy. I replaced the contraption with a new 6J5 on my next visit to that area.

5 soldering ■

Stable Solder Iron Rest

Some rests for soldering irons on the market, and almost all of those made by the home constructor, have a tendency to get hot and burn the insulation from test leads which accidentally touch them. Some of these stands, especially the wire types, have a tendency to tip, spilling the hot iron on schematics, etc. An excellent stand which doesn't heat up and which is very stable is an old



insulator of the type used on telephone poles (see sketch). The depression in the top serves to hold the iron in a natural cradle, and the flanges serve to make an efficient radiator. The porcelain types seem to work the best, although a glass

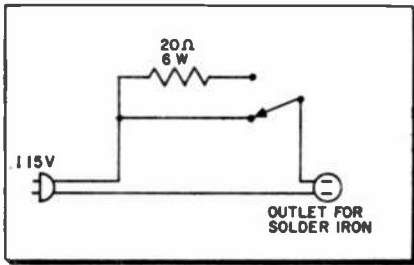
unit may be used. The insulators can be obtained anywhere the telephone company is replacing chipped insulators, or they may be purchased at any electrical wholesale store for a few cents each.

PC Desoldering

I recently found myself struggling with the removal of a defective six-connection oscillator coil from a radio's printed circuit board. Trying to remove a connection only resulted in the solder cooling-off before I could complete removal from its mounting hole. After spending a considerable amount of time and patience before successfully pulling out one connection, I hit upon an idea. Using an air compressor that I keep at my bench, I applied air through a fine nozzle, from the opposite side of the board, while I heated a connection. The air prevented overheating and each lead came out quickly and easily. In addition, unlike various PC soldering tips I have used, it cleaned the holes of excess solder—facilitating mounting of the new oscillator coil.

High-Low Solder Iron Heat

The unit illustrated will save many a hand from being burned; it will also save wear and tear on the soldering iron. It is a low-cost heat control for the iron that, with the flick of a switch, will provide normal heat for regular use or a lower heat for keeping the iron in a stand-by condition on the bench, when it is not



Switch for low or regular solder iron heat.

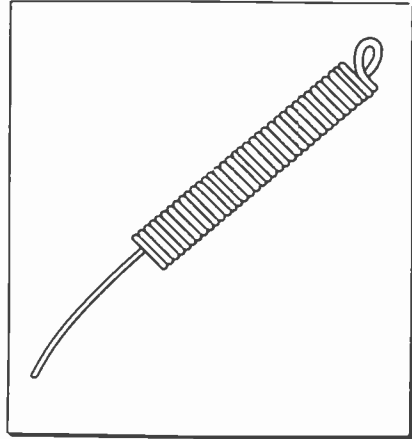
in immediate use. It is also a convenient method of reducing the heat of a conventional iron for such low-heat soldering techniques as are required on printed circuit boards. For particular applications, the value of the dropping resistor may have to be adjusted.

Clay Holds Small Parts

In assembling small units or a number of components for soldering, the work will often be made easier by clamping or sticking the objects together in a wad of children's modeling clay during the soldering process. The clay can be shaped to hold firmly any irregular pieces. Also, the clay will conduct away or dissipate the heat needed for the soldering operation. In addition, it will keep its shape when subjected to the heat of the soldering iron.

Neat Solder Dispenser

Odd lengths of solder used to be a nuisance on the bench until this handy trick was discovered. A length of solder is rolled around an ordinary pencil, to the shape shown



Handy solder dispenser prevents loose scraps.

in the illustration, and the pencil is removed. One end of the solder can then be pulled out through the "handle" as needed, and used down to the last inch without getting tangled or cluttered. I have found that a 6-foot length of solder (no. 18 size) makes the most convenient dispenser, with a 3-in. grip, and lasts more than a week. It appears as shown in the illustration. To summarize: Roll solder on pencil; remove pencil; push last six inches back through roll; pull out as needed.

Easier Soldering

Hammer cored or plain wire solder flat, before use in delicate operations where the solder must be melted instantly to avoid overheating the work. Hammered flat, the solder will flow almost at contact of the soldering iron.

Soldering Aid

Need a third hand to solve the problem of holding small parts while they are being soldered? A test clip was attached to a solder spool with a small self-tapping metal screw. The hole in the clip had to be en-



Convenient clamp on solder spool holds work.

larged slightly and a small hole punched in the spool's flange to give the screw a start.

The clip may be used to hold either the work, or the end of the solder. Additional clips may be kept with the spool, to be used as clamps when the parts to be soldered cannot be brought within reach of the solder spool.

Soldering to Lugs

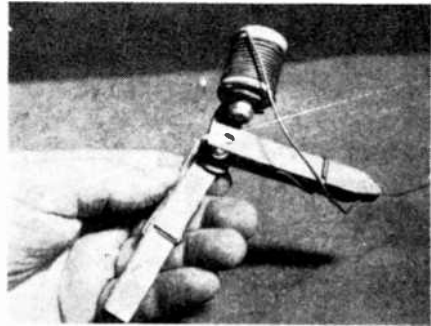
We all have trouble, at one time or another, in trying to solder a new wire to the hole in a soldering lug, or in trying to replace wires or leads in such a soldering lug, where there are already several wires using the same terminal point. This difficulty can be overcome by the use of an ice-pick. The pick is shoved through the hole in the lug or terminal while the heat of the soldering iron is being applied, and it is kept in position as the tie point is permitted to cool. After the terminal has cooled, the pick is withdrawn. This leaves a convenient round hole of good size, large enough to feed a couple more wires through.

Solder Iron Tinning Tip

As soon as you buy a new soldering iron, or when you have to clean or re-tip one you already have, remove the tip and heat it with a blow torch to the high temperature required for melting silver solder. Flux the tip, if necessary, then allow silver solder to flow all over the soldering surface, practically plating it. When the tip has cooled, it is inserted in the soldering iron. You now have a tip which will always stay bright and never require re-flexing, re-tinning or filing. The silver coating will not deteriorate because the normal operating temperatures of the iron will not approach the melting point of silver solder.

Solder Feeder

A useful wire solder feeder that serves as a "3rd hand" and keeps the solder handy and easy to locate, is made from two spring-type clothespins, a small bracket and an empty spool. Simply fasten the clothespins



Clothespin holder makes a handy solder dispenser and serves as "3rd hand."

together, handle-to-handle, and add a small corner bracket. Mount the spool atop the projecting bracket by means of a small bolt. It should turn easily. Wind the solder on this spool

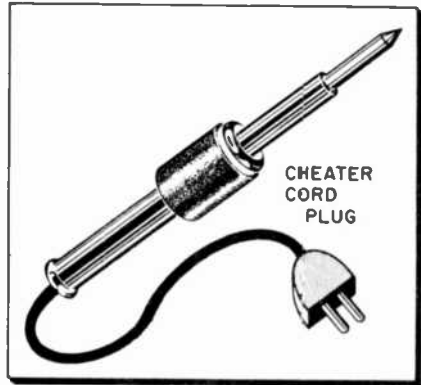
and bring the end of it to the sharpened jaws of one of the clothespins, as shown at left. The jaws of the other clothespin may be used as a clamp for holding the device to any protrusion (edge of chassis or brace, etc.,) or as a handle.

Solder Gun Mount

The accompanying sketch shows a soldering gun connected to a wire loop, by means of which the gun can be hung within reach but out of the way under or over the work bench, or elsewhere in some convenient place near it. The wire hook is made of no. 14 or some other comparable heavy wire, fashioned into the form of a loop with two small loops, one at each end. Most soldering guns have a long bolt that goes through the plastic case as shown, holding the case together. The two loops are fastened to the gun at either end of this bolt. Since one accidental fall from the work bench may be enough to break the entire gun case, this means of keeping the gun out of harm will be useful in preventing such accidents.

Space Saver

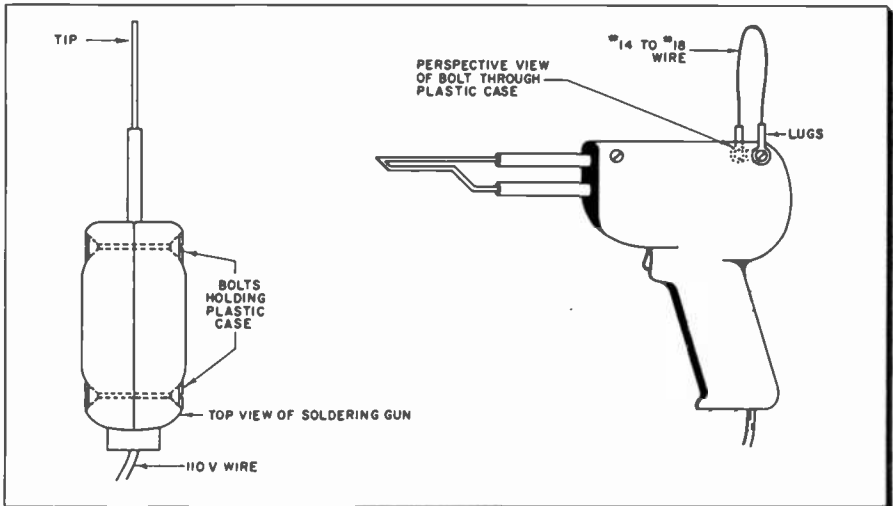
To save space in my already overcrowded tube caddy, I cut off all but a short length of the line cord on a small soldering iron and installed a male interlock type of plug.



Cheater cord plug attached to shortened line cord on soldering iron, saves space.

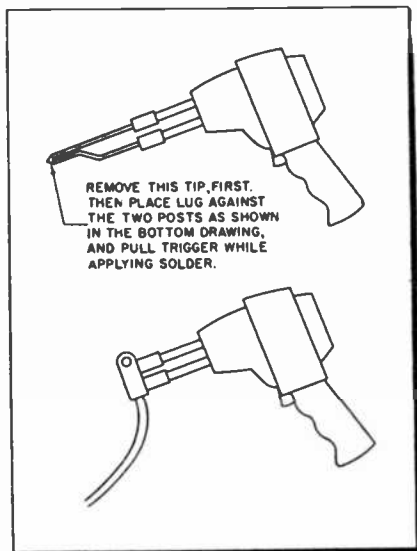
I can now connect the iron directly to the cheater cord. A small iron helps to conserve space, and is suitable for work on printed circuits.

Details for adding wire hook, used to hang soldering gun out of harm's way, to gun case.



Soldering to Heavy Cable

In shops where auto radios are repaired, it is often necessary to solder a large lug to a heavy wire cable. This calls for a big, hot iron, and lots of time. The job can be done very quickly, however, by using a gun, as shown in the drawing. First remove the tip from the gun. Then

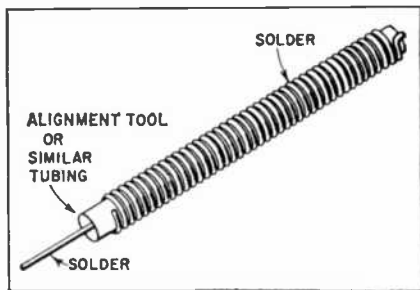


place the lug to be soldered against the two metal posts, as shown, and turn on the switch for a short period, while solder is applied. The method outlined works much faster than one using a simple, old-type iron. The high current drain will not harm the gun over a short period.

Solder Dispenser

A very convenient, easy to use, solder dispenser can be made from a 5" or 6" length of hollow tubing $\frac{3}{8}$ " or $\frac{1}{2}$ " in diameter. I use a hollow composition type alignment tool.

A length of solder is first fed straight through the tube until it protrudes a few inches from one end. Winding is started at the opposite end and solder is wound around



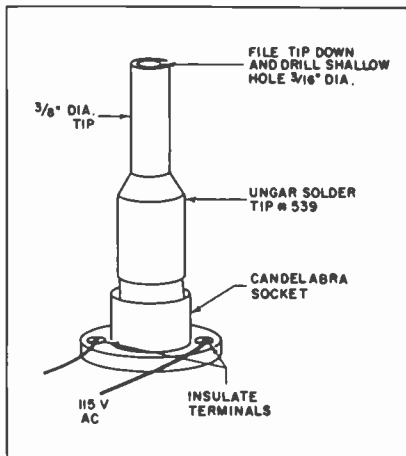
Made from a length of hollow tubing, this handy solder dispenser is used like a pencil—eliminating a spool or loose coil.

the tube until covered with one layer. It is then cut off.

The holder is used like a pencil, and when more solder is needed at the "feed-end" it is simply pulled out from the tube, easily unwinding from the other end.

Home-Made Soldering Pot

For tinning small parts, a convenient soldering pot can be constructed quickly in the following way: An Ungar soldering tip (No. 539) was used in this particular case. The tip is filed slightly to remove the point, and then a hole with a $\frac{3}{16}$ -in. diameter is drilled to a depth of about $\frac{1}{8}$

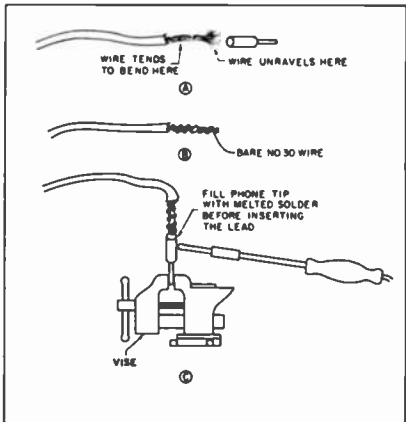


This pot facilitates fine work on small parts.

in. at the filed end. The entire tip is then screwed into a standard candleabra socket, to which the 115-volt line is easily connected. Exposed contacts on the socket should be insulated to avoid the possibility of shock.

Resoldering Phone Tips

Frequently, because no new unit is at hand, it becomes necessary to repair a break that has developed in a much-needed test lead or phone cord. The wire in these cords is often delicate and hard to handle; it tends to fray and bend when an attempt is made to insert the wire into the phone tip, as indicated in sketch A. To avoid this difficulty, wind a piece of thin no. 30 bare wire in a spiral shape around the wire that is to be inserted into the phone tip (see B). This keeps the end of the wire stiff, holds the loose ends in shape and keeps them from fraying out. It now becomes very easy to insert the wire into the phone tip, which is held in a vise, and resolder it, as shown in sketch C. Tin the no. 30 wire lightly *after* it has been wound around the broken end of wire that is being worked on, and *before* the end is inserted in the tip.

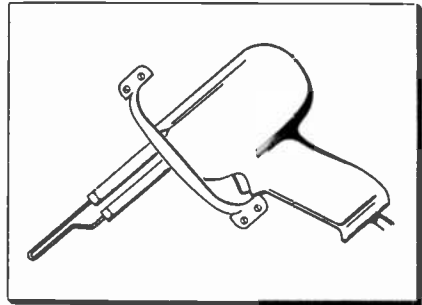


Solder Iron Tip Removal

When it's necessary to remove the copper tip of a soldering iron to replace it, a lot of time can be saved with this simple procedure. Sop a small amount of household ammonia around the tip, and in the recess around it. The tip can be withdrawn easily in a few seconds.

Solder Gun Holster

When left lying around indiscriminately on the work bench, to be handy for use, soldering guns usually take quite a bit of abuse. To



Handy holster keeps solder gun ready for use, but out of harm's way when not in operation.

protect the gun from such abuse by getting off the bench surface while at the same time keeping it practically at your fingertips, you can construct a simple holster for it.

Use an ordinary metal drawer pull that has screw holes on each side. Screw this drawer handle to any flat vertical surface on or near the work bench at a desirable angle (see the illustration) so that the soldering gun can be placed in it conveniently for easy withdrawal. If properly located, this holster keeps the gun quick and easy to get at, but also keeps it out of the working area when not in use.

Gun Holster

Instead of letting the soldering gun flop around the workbench, a wood stand built on a 45° angle keeps it



Soldering-gun holder.

handy for instant use. Cut a hole in the upright piece of wood to receive the gun body. See illustration.

Extra Hand for Soldering

Holding small parts together while soldering them can be quite a task. A piece of pressure sensitive tape, such as transparent cellophane tape, will take the place of an extra hand or so—you only have two hands, you know! The accompanying photograph illustrates the point. A capacitor and a resistor are being soldered

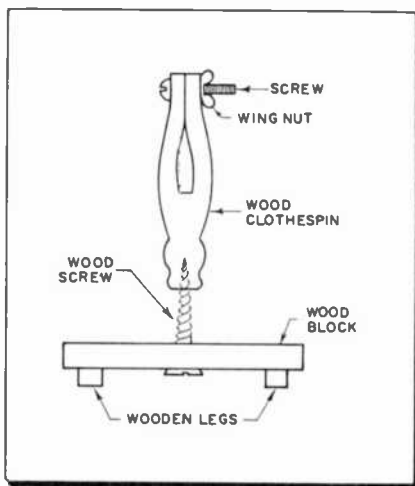


Cellophane tape is extra hand for soldering.

in parallel. The leads are to be kept rather short in this case. The tape is holding the resistor to the body of the capacitor. The tape may easily be removed after the soldering is completed and the "holding operation" is no longer required. In most cases, the tape can be left intact without causing any ill effects.

3rd Hand for Soldering

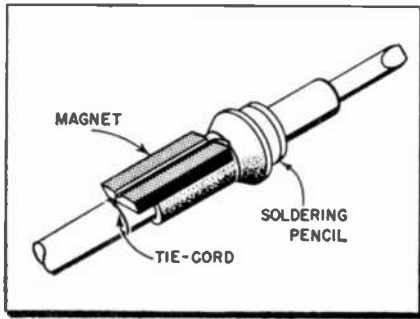
Here is an insulated vise which I have been using successfully for many years. It does not draw heat from the work and it is portable. It



is wonderful for small delicate work—i.e., RCA-make phono plug wiring, xtal wiring and other cases where a third hand would be most welcome.

Magnetic Soldering Iron

We use a number of pencil type soldering irons in our shop. To keep them handy when needed, and yet out of the way, I have attached a small magnet to each handle. The iron sticks to the metal chassis. This makes it especially handy on cabi-



Magnets holds soldering iron to chassis, metal cabinet, etc., for safety and convenience.

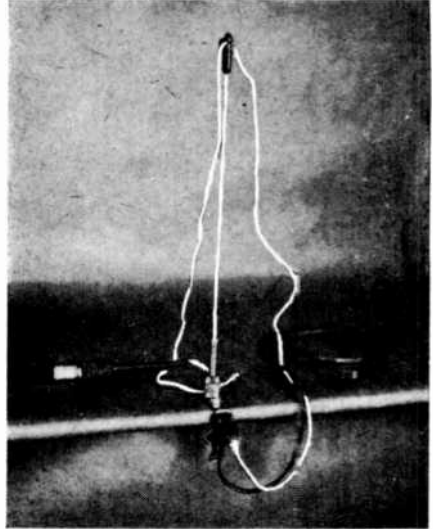
net and rack equipment. The magnets were taken from magnetic door catches and held in place by #16 copper wire.

Since most of these pencil type soldering irons can accommodate a 6 or 7 watt intermediate base light bulb in place of the iron tip this arrangement is also convenient on home service calls to light up the inside of a TV cabinet.—Ed.

Iron Cord Holder

To prevent a soldering iron cord from tangling with components on

the work bench or burning its own cord, I use an ironing cord holder, as shown below. The holder is a



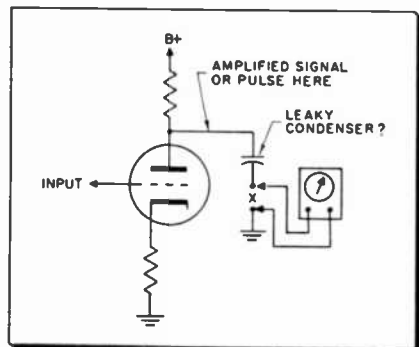
Cord holder prevents burning and tangling with components on work bench.

rod attached to a flexible spring and the spring can bend in any direction. This holder can be purchased at almost any department store and clamps easily to the edge of the bench.

False Leakage Indication

This suggestion was prompted by a technician of our acquaintance, who recently complained that he was finding plenty of leaky capacitors in various circuits in the course of troubleshooting, but that replacing them would not correct the complaint.

A few leading questions soon disclosed that the so-called leaky capacitors were not being tested with a condenser checker, but with the time-tested expedient used by many servicers and illustrated in the accompanying figure. In this method, the grounded (or more negative) end of the suspect capacitors is dis-



Time-honored leakage test gives false reading.

connected, the voltmeter is inserted at the point of this break (marked "X"), and the receiver power switch is turned on. The presence or absence of a dc voltage reading will respectively indicate whether the condenser is or is not leaking. Since an amplified signal or pulse is present at the plate of the tube, and since this signal is ac, it will pass through the coupling condenser. Although it is ac, it may give a false dc meter reading, often indicating leakage where there is actually no leakage at all.

To eliminate confusion in conducting this test, proceed as usual but remove the tube associated with the condenser from its socket. This removes signal, but leaves B-plus on the plate side of the capacitor. Any reading on the dc ranges of the meter will then definitely indicate leakage rather than the presence of signal.

HV Condenser Check

To find leaking condensers of the 500-mmf, 20kv type rapidly and easily in the high-voltage power supplies of some TV sets, I use the following procedure: Take a wooden

stick, rod or rule about 20 or 30 in. long and fasten a small square of cardboard at one end. This end is used as an earphone. Then apply the other end near the suspected condensers. The clearest noisy clicks will be heard when the stick is closest to the bad condenser. The trouble appears as black pips or streaks on one side of the screen at the same time that the clicks are heard. The wooden rod used must be very dry, to act as a good insulator and also to pick up the sounds better.

Testing PC Components

A problem encountered in troubleshooting printed circuits, as compared with conventional hand-wired sets, is the difficulty of isolating a stage drawing excessive current because of a leaking or shorted component. For example, if an i-f trans-

soldered into the board. The transistor may be ruined if removed for a check or substitution.

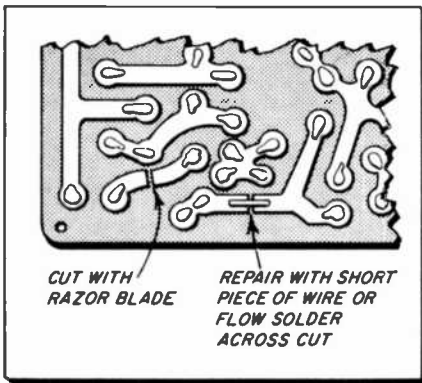
In all cases I use a very sharp, thick type, razor blade to cut through the printed circuit foil. The i-f is cut from ground and the emitter of the transistor drawing excessive current is opened (or one of the other elements, depending on transistor type and application).

After checking a component, this narrow cut in the printed circuit is then easily bridged with a piece of tinned hook-up wire, or in the case of low current lines, with only a bit of solder flowed across the cut, as shown at left. This system often prevents unnecessary loss of time.

Upside-Down Tube Test

This experience suggests some interesting possibilities for the correct use of tube testers. A Motorola car radio was brought in for repair and restored to perfect playing condition on the bench, then returned to the owner's auto. In a few days, the set was brought back to the store with the complaint that volume would drop when the set was jarred. More jarring would restore the volume.

With the set in normal position on the service bench, nothing could be found wrong with it. All tubes were checked out and found to be in good condition. However, this set happens to mount upside-down when installed in the car, with the tubes pointing downward. Turning the set upside-down in the shop, the intermittent volume could be induced by tapping the chassis. Now, turning the tube checker upside-down enabled a testing of the tubes in the same position they occupied in use in the auto! Sure enough, two tubes showed up as defective in the tube checker when held in this position, although they had checked out in the upright position.



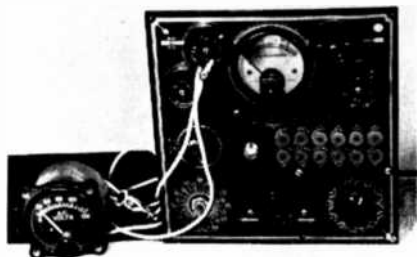
Components in PC are quickly isolated for testing by cutting with razor blade.

former is suspected of high resistance leakage it is not practical to remove the transformer from the board merely for testing or for a substitution check.

Another example is where a transistor drawing excessive current is

Voltages from Old Tester

Tube testers that may be obsolete for checking modern tubes are still worth keeping around the shop. A low voltage of some odd value is often required, as for testing an instrument over a range of scales. The



Outdated tube checker as low-voltage supply.

obsolete tester can supply a considerable range of such voltages by merely attaching test leads to the filament terminals of one of the sockets, as shown, and adjusting the instrument for the proper value.

Meter Checks Fuse Blowout

A 300-ma meter, which can be conveniently and compactly carried on service calls, may be used for determining the cause of fuse blowing in the high-voltage section. First clip the meter leads to either end of the fuse holder, with no fuse in the circuit, and turn the set on *with one hand on the power cord*. If the meter needle starts to swing up fast, a direct short is indicated, and the plug must be pulled out of the wall socket immediately.

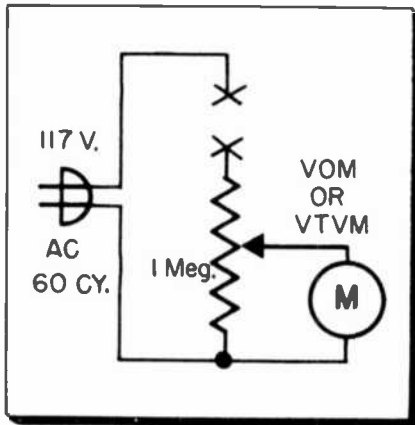
In most cases, the set lights up and works with the meter being used instead of the fuse. Normal current will be about 75 to 100 ma. Next the damper tube is tapped. If this procedure results in a kick of the meter needle, the indication is that the damper tube is intermittently shorting and should be replaced. In other

cases, the filament wiring of the damper may be shorting to chassis due to insulation breakdown, especially where the damper cathode is tied to the filament. This will show up when the set is jarred. By using the meter as a temporary replacement for the fuse, a considerable amount of assurance is provided that there will not be repeat blowouts, since the cause of fuse failure can usually be found and corrected.

Another use for the meter, while it is connected exactly as already described, derives from the fact that it is in series with the boosted B-plus line. Other circuits that receive B-plus from the same point may also be checked. For example, if the horizontal oscillator is getting B-plus from the damper, it is easy to determine whether the oscillator is functioning. If the oscillator tube is pulled out of its socket, there should be an increase of current (about 5 to 10 ma). This change will occur if the oscillator is functioning. If the oscillator is not working, no change in current will be noted, as there is no change in the amount of current being drawn by the output tube.

Capacity Readings With A VOM

A quick and inexpensive measurement of capacity can be made with your VOM or VTVM and a potentiometer. The device may also be used to match or pair new components. It consists of nothing more than your meter, an extra pair of leads and a linear potentiometer on the order of 1 megohm. The value is not critical. The only precaution is not to exceed the wattage and current rating; as the control is placed directly across the a-c line. The hookup is shown in the diagram. Even the line voltage is not critical. The important thing is to establish full scale deflection, using the a-c function and proper range. This is



Divider network permits reactance readings.

accomplished by shorting the test leads, at the points marked X and adjusting the pot. Graphs and charts could be plotted, but this is not necessary. To calibrate the meter, note the readings obtained from capacitors of known values. By using different potentiometer values and different a-c ranges, it is possible to obtain a fairly wide range of measurement. However, once the range and resistance have been selected and adjusted the scale will remain accurate.

• The above arrangement may also be used to determine the values of coils, chokes, yokes, etc. If 400-cycles, available on most signal generators, were used instead of the 60-cycle line voltage, even more accurate and wider range of readings would result.—ED.

Quick AC Outlet Test

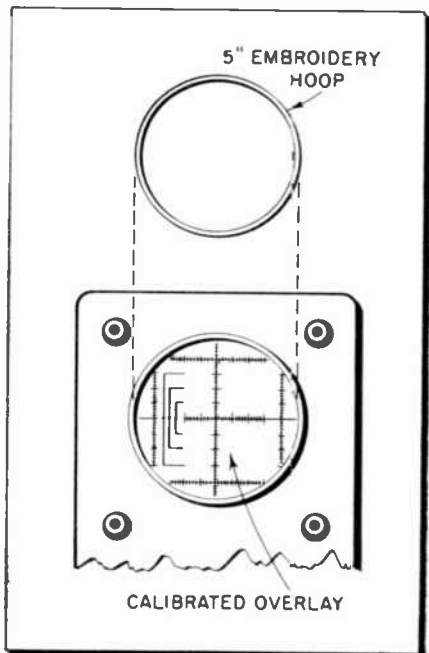
For testing ac lines in the customers' homes, technicians can easily carry along one of the small 2-watt neon "Nite-Lites," available at all dime stores, that plugs directly into the ac outlet. When the complaint is total inoperation, one of these units, which can be carried in

a vest pocket, will give an instantaneous indication as to whether the ac circuit is alive. It's better than asking the customer for a bridge lamp.

Scope Graticule Retainer

While visiting several technician friends, I noticed they were encountering a problem that previously troubled me for a while. The calibrated grid screen or graticule, in front of the scope CRT, frequently becomes tilted and even falls out at times.

Purchase a 5" wooden embroidery hoop (about 15¢ in a sewing shop) and fit the ring against the graticule,



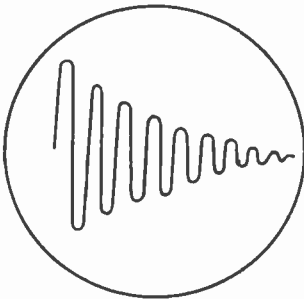
A wooden embroidery hoop fits snugly against scope graticule and prevents its shifting or falling out completely.

as illustrated above. It fits snugly, and retains the graticule firmly in place.

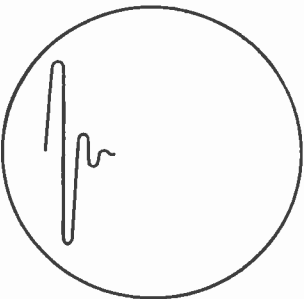
Scope Checks**Horizontal Components**

A defective horizontal output transformer, yoke or coil in the deflection circuit of a TV receiver can sometimes be difficult to diagnose. (Usually substitution with a good component is the only sure method.) An open winding is easy to check but shorted turns are not so easy, resistance measurements are not always conclusive.

The following method of checking horizontal deflection components will indicate shorted turns without removing the component from the circuit, with the receiver turned off. The individual component (or complete horizontal deflection system) is connected to an oscilloscope probe with a pulse (supplied by the oscilloscope) connected to the same point. A waveform can then be produced



GOOD COMPONENT



DEFECTIVE COMPONENT

Good parts show prolonged ringing. Fewer oscillations occur when shorts are present.

Component	Sweep Rate (CPS)
Width coil	2500/5000
Horizontal linearity coil	2500/5000
Horizontal output transformer	500/1000
Deflection yoke	2500/5000
Receiver deflection circuit with yoke connected	2500/5000
Receiver deflection circuit with yoke disconnected	500/1000

Set scope's sweep rate for part being tested.

that will look like the illustration if the component is good or bad.

To check a component, connect the scope's probe to one end of the coil and the probe's ground lead to the other end. Connect this pulse to the scope's probe. Adjust the horizontal sweep frequency of the scope according to the table.

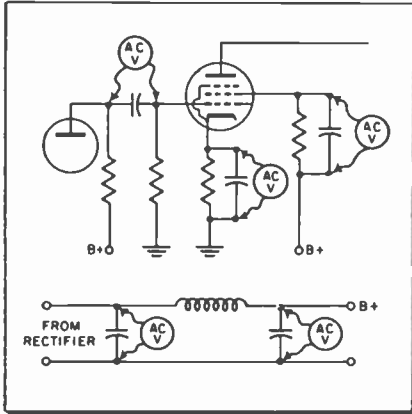
A complete receiver deflection system may be checked by removing the plate cap of the horizontal output tube and connecting the oscilloscope probe and pulse to the cap lead of the transformer. Connect the ground lead of the probe to the receiver chassis. One shorted turn of the horizontal output transformer will produce the short, damped waveform characteristic of a defective component. The effect of shorted turns may be seen by shorting the filament winding of the horizontal output transformer while checking the transformer with the scope.

To obtain the pulse from an oscilloscope a small modification is necessary that will not affect performance.

Remove the "GROUND" binding post on the front panel that is farthest from the vertical input attenuator. Enlarge the hole in the front panel and replace the binding post using fiber washers to insulate it from the panel. Connect one end of a 680 mmf. capacitor to the binding post. The other end is connected to the cathode of the horizontal sweep oscillator.

Capacitor In-Circuit Test

Most applications, of bypass, coupling and filter capacitors, for practical purposes, present a short circuit, or very low impedance path to ac. Therefore, the voltage drop across them should be zero or very



Measuring A-C voltage drop across capacitor to predict condition, while in circuit.

low. Measuring the a-c voltage drop across the capacitors will usually indicate whether or not they are open or have decreased in value appreciably. There is one notable exception—a low a-c voltage reading of about 10 to 15 volts is normal across the input-filter capacitor in a B+ capacitor input filter circuit. Most filters of this type have a high ripple content at this point.

Quick Testing Phototubes

A quick way to test photo-electric tubes, especially the emission type is to place it approximately 1 foot away from an unshaded 75-watt incandescent lamp. Position the tube so that the cathode is exposed to the light. Place the positive test lead of an ohmmeter on the anode and the negative lead on the cathode of the tube. Set the ohmmeter scale to

R X 10K. The readings may be somewhere in the region of 150,000 to 800,000 ohms. Next shield the tube, and the reading should rise to about 10 megohms. Another check is to reverse the test leads on the tube, an extremely high reading should be obtained. Some typical values are

Tube	Type	Age	Resistance
918	Gas	New	145,000
923	Gas	New	220,000
868	Gas	New	800,000
929	Vacuum	Used	145,000

A good idea is to check each new phototube type in this manner, and record the readings for future reference. While this type of test is not the most scientific one, it is simple, quick and does seem to work out well. Similar tests can be set up for the photo-voltaic and the photo-conductive cells.

Checking Open W-W Resistors

The next time you run into one of those sand-coated wire-wound resistors that has opened up, and you have no way of checking its value, try this procedure. Take a pair of diagonal cutters and use them to crumble off the coating along one edge of the resistor. This should be done with care, of course, so as to avoid any damage to the wire resistive element beside the damage that already exists, the open condition. Now connect one lead from your ohmmeter to one terminal of the resistor. Slowly slide the other probe of the meter along the wires you have just bared, beginning near the terminal to which the other probe is connected and working away from it. As you do this, the resistance reading should start at zero and increase until you reach the point of the break, at which point the reading will shoot up toward infinity.

When you have reached this point of the break, record the highest reading obtained just before the break became evident, and then switch the

fixed meter probe to the other terminal on the resistor. Now begin the same procedure from the other end of the resistor. That is, slide your free probe along the exposed portion of the resistor, beginning near the terminal to which the probe is now fixed, and moving away from it. Again, the reading will shoot up suddenly when the point of break is reached. The highest reading found on this side of the resistor just before the break is reached is added to the highest reading recorded on the other side. The sum of these gives the original value of the resistor before it became open.

Color CRT Test Adapter

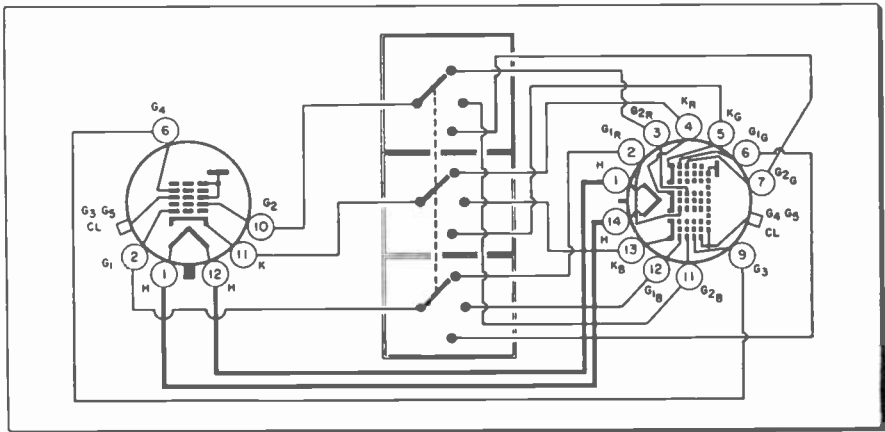
Versatile tester will check color CRT's on B&W tube checker, or regular tube checker with adapter. Simplicity, ease of construction and low-cost features make this a desirable project between service calls. Extremely flexible it tests each section of the color CRT individually. A 3-pole, 3-throw rotary switch (Malloy #1313L) is the heart of the gadget. It is enclosed in a 2 1/4" x 2 1/2" x 3" box. A Motorola color CRT

socket part number 733,794 is available already wired. The wires are



Completed version of color CRT test adapter.

fed into the box and protected with a rubber grommet. A 6-pin CRT base removed from a dud, is mounted on the box by drilling a small hole through the key projection and bolting. In addition to the small hole drilled in the box to accommodate the bolt, another hole is needed to allow the wires to pass through. Again it is advisable to use a rubber grommet. The electrical wiring is simple and is easily determined from the diagram. As a finishing touch a CRT-base cover is used to protect the pins while the gadget is in the tool kit.



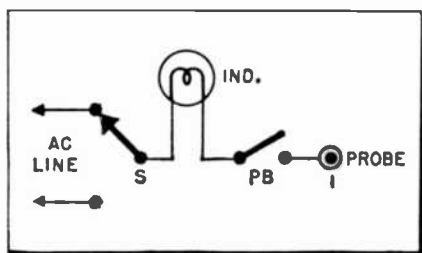
Schematic for color CRT test adapter showing simplified version of socket connections.

Life Saver

A great many TV receivers, especially portables, have been sold which are enclosed in metal cabinets. All service technicians realize the potential shock hazard this poses, but few check to see if the cabinet is "hot" upon completing a repair. Receivers that utilize a power transformer are not as dangerous as the ac/dc variety, but even a transformer type chassis bypasses the line to chassis with capacitors which may short. The chassis in portable receivers is mounted on insulators, but a splash of solder or a chassis bolt which is too long may easily defeat their purpose. A common sight is to see portable receivers going out of repair shops in good operating condition, but missing a few knobs. These exposed shafts may be 115 volt electrodes, depending upon how the line plug is inserted.

Illustrated is an inexpensive tester I constructed which will quickly locate a "hot" cabinet. The circuit is relatively simple and needs no explanation. To use the tester with toggle switch in position #1, the test probe is simply brought into contact with the metal cabinet and the pushbutton pressed. This is repeated with the toggle switch thrown to position #2. If the indicator lights in either position it indicates a "hot" cabinet. The set's line plug does not have to be reversed as this is, in effect, accomplished by the tester switch. I suggest using a 3 watt 115 volt bulb as an indicator rather than an a-c voltmeter not just because it's cheaper, but because a voltmeter sometimes gives an ambiguous indication on sets which have the chassis connected to the cabinet through an R/C network.

This tester can be built in a three inch square housing and perma-

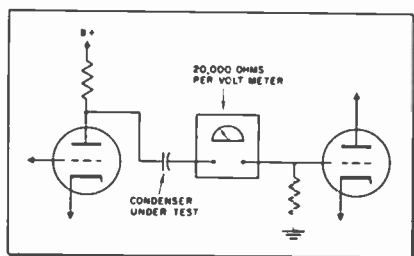


"Hot chassis" checker helps unmask those 115 volt electrodes. Parts list: Ind.—3-watt, 115v bulb; J—probe jack; S—SPDT toggle; PB—normally open, press-to-close switch.

nently attached to the test bench. For safety the press-to-close pushbutton switch in series with the probe allows a-c on the probe only when in use. This tester can also be used with radios and appliances where there is a possible shock hazard. The tester can be constructed for less than \$2. but if you find just one "hot" cabinet with this tester it may become the most priceless piece of equipment in your shop.

Dynamic Condenser Check

In many instances, condensers short only under load, and check ok when out of the circuit. When such a condition seems to be present, I use a voltmeter in series with the suspect part, as shown in the illustration. If the capacitor is shorted, a dc current flows through it and through the resistance of the meter. This sets up an IR drop, and the meter needle will swing up, verifying the existence of the short.



Checking capacitor dynamically with voltmeter.

Salt Water Test Battery

The photograph shows the two leads from a meter immersed in a salt water solution. The meter is set on its 60-microamp scale. The current reading on the meter is about 20 microamp. This small home-made salt-water battery is excellent for testing meters, such as milliammeters and microammeters, as there is practically no possibility of damage to the meter movement due to the low output from this type of rudimentary battery.

The movement of nearly any device that uses a meter can be checked with this salt-water tester. The meter movement of a photoelectric exposure meter, for example, can also be tested in this way. It is a good idea to use a silver coin and a length of copper wire as the two



Salt water battery tests meter movements.

electrodes in this solution, connecting each of these to one of the leads from the meter for the test.

Stop Tube Tester Wear

One of the annoying jobs we run into is the continual changing of wornout tube sockets in our tube checkers, a tough and time-consuming task. I have found that, by plugging a tube-testing adapter into each of the more frequently used sockets of my tester (see photo), I save this



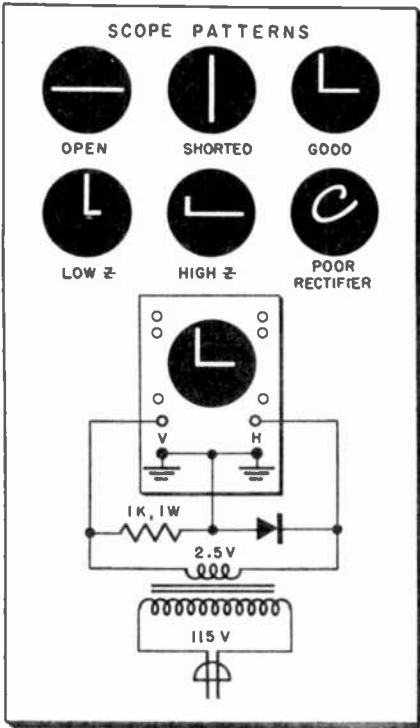
time. A small amount of service cement is used to hold the adapter firm. When the socket in the adapter itself is worn out, simply pull it out and insert a new one. The time saved more than compensates for the cost of the adapter.

Preventing Instrument Damage

Plastic or wood cases of various test meters are so smooth that the instruments are easily pulled from the bench during use. A few layers of adhesive tape placed on the bottom of the case will often remedy this kind of trouble. Tape also may be installed in a criss-cross manner to further prevent slipping.

Diode Checker

This simple diode checker may be used with any oscilloscope. The technique is interesting and accurate. The input signal is not critical. About 2.5-volts ac is all that is required. Any low-voltage transformer may be used. The plate side of an audio output transformer may be connected to the a-c line. The secondary winding usually develops about 2.3



Simple diode checker and typical waveforms.

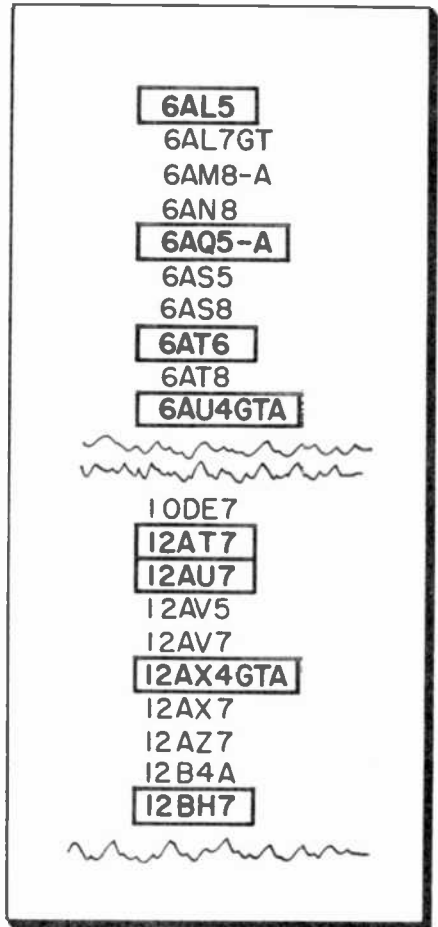
volts. Because there is practically no load, the size of the transformer is not a factor. The only other parts needed are a 1,000-ohm, 1-watt resistor and some terminals. The entire unit could be built into the scope. Calibration consists of comparison with a unit known to be good. Crystal diodes may be checked for match, open, shorts, high or low impedance, and ability to rectify. Diagram shows typical waveforms and schematic.

Faster Tube Tester Set-Up

Roll charts on roll-type tube checkers grow longer every year, making it difficult to quickly locate a particular tube type.

I've abbreviated this time-consuming process to a great extent as follows: When installing a new tube

checker roll chart, mark the designations of the most frequently used tubes on the roll. When the roll chart is spun around to locate the tube type and tube checker settings, the marked designations aid in rapidly locating the desired information. The tube numbers are either underlined or boxed in with a red pencil, as illustrated below. This

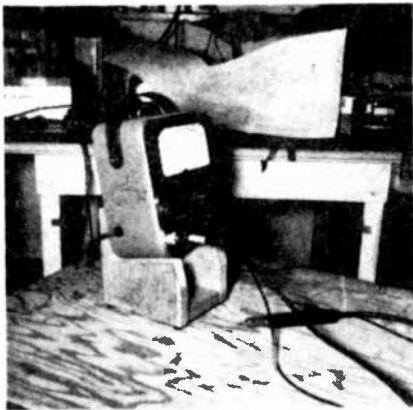


Rapid location of tube data on a roll chart is facilitated by enclosing frequently used tube designations with red pencil marks.

is done after installation of the roll chart, but before placing the roll back in the case.

Stand for Shop Meter

So that our meters don't get lost in the confusion of littered benches and so that we don't have to crane

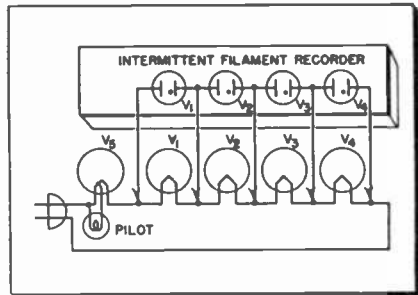


"Rocking-chair" stand makes meter handy.

our heads around the corners of TV chassis to see the readings, we keep our meters parked atop rocking-chair wood stands, like the one in the photo. The backs of these stands are tilted back to slope the meter's scale upward toward eye level. Attached to the bottoms are small metal buttons so that the stands can glide easily across the surface of the shop benches.

Intermittent Filament Recorder

Four neon test lamps, mounted in a small box, plus five test leads is all that is needed for finding an intermittent filament in an AC/DC radio. Place the leads across the tube filaments as shown in the diagram. Turn



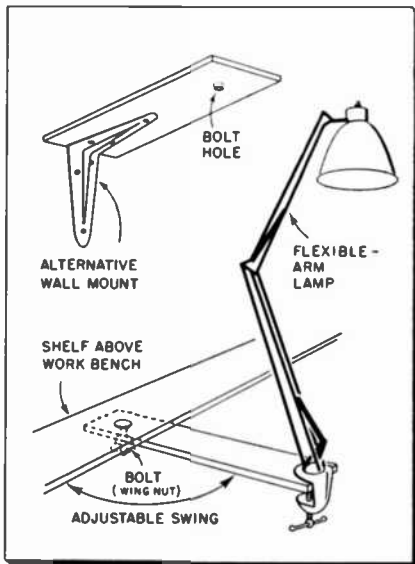
Intermittent filament recorder.

on the radio and allow it to play. When the filament circuit is interrupted, the neon light connected across the break will glow. In the event none of the lights go on, when a break occurs, then it can be assumed that the rectifier tube is the culprit. The beauty part of this procedure is that the technician is free to work on other equipment while the radio under test is in working order.

Bench Lamp Extension

To extend the usefulness of the adjustable lamp over the bench, install on the wall or shelf above the work area an extension arm about 2-feet long and 6-inches wide. A hole through the extension and shelf to accommodate a bolt will permit the entire assembly to swivel from

one side to the other and extend the range of the lamp. Large washers with a small amount of lubricant placed on either side and between the board and shelf will enable easy action for a long time. The lamp can be secured to the end of the extension arm in the usual manner.



Extension for flexible bench lamp increases the area of coverage and usefulness.

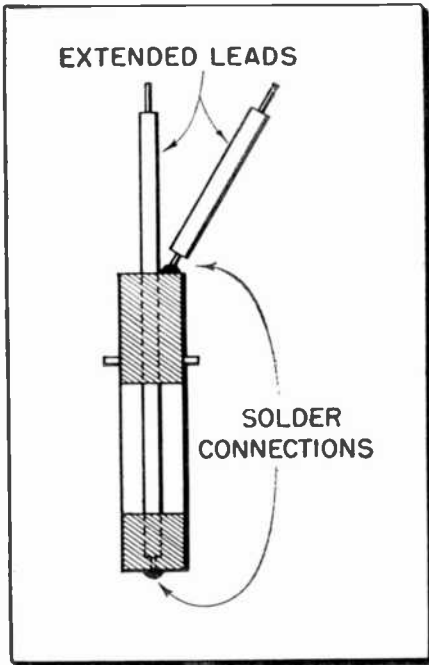
Broken Screw Threads

I have serviced several small radios and TV boosters, mounted in plastic cases, in nearly all of which one or more mounting screws could not be tightly inserted. The trouble was probably due to the screws being forced in, causing the plastic to break away from the hole. These mishaps can be prevented by putting a drop of light oil in the hole and on the screw, before insertion of the screw. The latter will now enter without danger of cracking or breaking the plastic while being inserted.

When a new case is used as a replacement, the holes are not threaded. However, if self-tapping screws are used with the oil, no difficulty will be encountered. This method also works very well for starting stud screws in selenium rectifiers.

Ammeter Test Aid

Many technicians use an ammeter to check circuit current before replacing a blown fuse or when troubleshooting in the event of a short. Also, ammeters are frequently used to monitor the current drawn by a set that has intermittent trouble: especially in the high voltage section.



Modified "twist-lock" fuses, as shown, will enable the technician to measure current without removing the TV chassis.

Meter test leads, although easily connected to the "snap-in" type fuse holders, cannot be connected to the new "twist-lock" fuse holders without first removing the chassis. The meter, however, can be connected without removing the chassis by modifying each "twist-lock" type fuse as shown above.

Carefully drill a small hole in each end of a "twist-lock" fuse and insert a short insulated lead into the "ear" end of the drilled hole. Maneuver the

lead into the hole at the other end of the fuse and solder it. Then solder a short lead to the end having "ears", being careful that it doesn't short to the lead already installed.

This modified fuse may now be inserted into the set's "twist-lock" fuse holder and the meter leads connected to the extended wires. Since there are a few different type "twist-lock" fuses, it will be necessary to construct modified units to cover all needs.

Formula Shy

If you are in a hurry, and have no desire to fuss with the reciprocal of the sums of reciprocals, or the $R_1 \times R_2$ divided by $R_1 + R_2$ formula, to determine the size of a shunt resistor; paste this table on your resistor-bin.

1% . . . x . . . 90	8% . . . x . . . 11.5
1.5 . . . x . . . 66.7	9 . . . x . . . 10
2 . . . x . . . 50	10 . . . x . . . 9.1
2.5 . . . x . . . 40	15 . . . x . . . 5.6
3 . . . x . . . 33.3	20 . . . x . . . 4
4 . . . x . . . 26.5	25 . . . x . . . 3
5 . . . x . . . 20	30 . . . x . . . 2.33
6 . . . x . . . 15.6	40 . . . x . . . 1.5
7 . . . x . . . 13.3	50 . . . x . . . 1

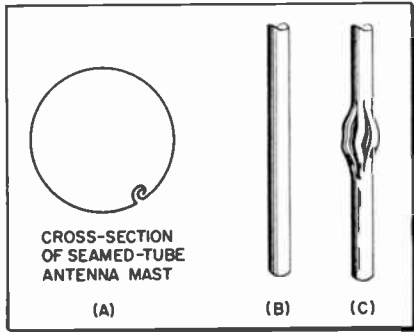
Example: To parallel a 100 ohm resistor to arrive at 95 ohms, which is 5% less, multiply 100 by 20. This indicates that a 2000 ohm resistor should be used.

For those technicians who want to feel safe and make use of the 2 resistors in parallel, formula here is another form of the $R_1 \times R_2$ divided by $R_1 + R_2$ rule. Let R_1 equal any resistor larger than the one desired and R_D equal to the desired resistance. R_x will be equal to the resistor needed to shunt R_1 in the following formula:

$$R_x = \frac{R_1 \times R_D}{R_1 - R_D}$$

What Freezing Can Do to Mast

Servicers who install seamed-tube antenna masts should take great care to make sure (1) the bottom of the mast is so positioned that it drains freely, or (2) that the top of the mast is so corked or stoppered that water cannot enter the hollow tube.



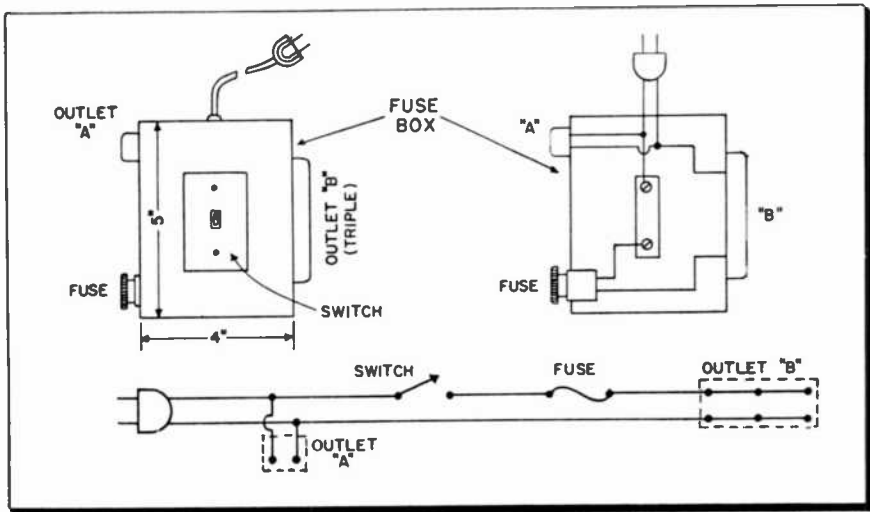
If water can get into the hollow tube and stays there, the mast may be destroyed at the base or other weakest point by the expansion force of freezing during cold snaps or prolonged zero weather. The accompanying sketch shows the re-

sults when A and B are filled with water changing to ice, with the destructive results shown by C.

Handy AC for Bench

For years, I've been using this handy set-up for ac power on the bench. The basic unit is a fuse box with outlets to use while I'm repairing radios, TV sets or other appliances. If a short in a chassis that is being serviced blows a fuse, a replacement can easily be made without a separate trip to the main fuse center. Three outlets are provided for appliances under test. The fuse should be no greater than 15-amp size, but less than the rating used at the main box. The switch is also handy for interrupting the circuit. The outlet for the soldering iron, unaffected by the opening of the switch or the fuse, will serve to keep the iron hot at all times and available for use regardless of what is happening to the fused circuit.

This fuse box on the service bench can save a lot of time when shorts occur in faulty chassis.



Sliding Rack For Test Equipment

Special trucks, racks, stands and tables for test equipment have been on the market for some time now. I find they leave much to be desired. The main trouble is that the test leads are usually in the way and when trying to get around one end of the set or the other, one has to be a contortionist to avoid shorts, broken tubes and leads. I have



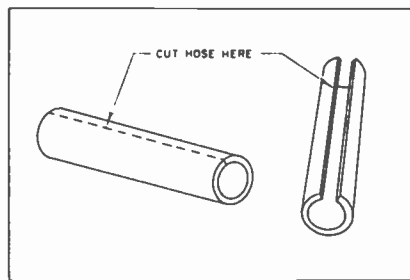
Overhead sliding equipment rack provides more room on the bench, and speeds servicing.

struggled and tried many devices and ideas in an effort to get a decent set-up, which would eliminate moving either the set to be serviced or the test equipment. I designed an equipment carrier which holds my scope, signal generator and electronic switch. The carrier is a cage-like framework made up of 1" angle iron, and some 1" flat stock. An old bedspring and parts of a large wall-mount antenna bracket set may also be used to build the carrier. After the cage is assembled, it can be mounted on a track installed over the bench. Track and roller kits de-

signed for roll-away doors were used. Since these kits are usually only 6 feet long, two of them were obtained and placed end-to-end. This permitted the cage to slide over a 12 foot length of the bench. The test equipment was mounted at an angle to facilitate viewing from either a standing or sitting position. When in use, the test leads drop almost straight down, thus assuring maximum freedom of motion and minimum damage. When the equipment is not in use, the leads can be conveniently hung on a couple of hooks installed at the top of the frame, as shown in the photograph. Total cost of the carrier is approximately \$27.00.

Gimmick for Chassis Carry

Sometimes the edges of a heavy TV chassis dig into the hands when the chassis must be carried any great distance. I got around this by making two cushions for my hands.



Grips made from an old rubber hose help take the pain out of carrying a heavy TV chassis.

These were made by cutting two 5-in. pieces from a rubber garden hose. The units were sliced lengthwise down the middle on one side. When slipped over the bottom edge of a chassis on either side, they tend to make good soft grips. They take very little room in the service kit and can be slipped off and on in a second.

Pilot Bulb Remover

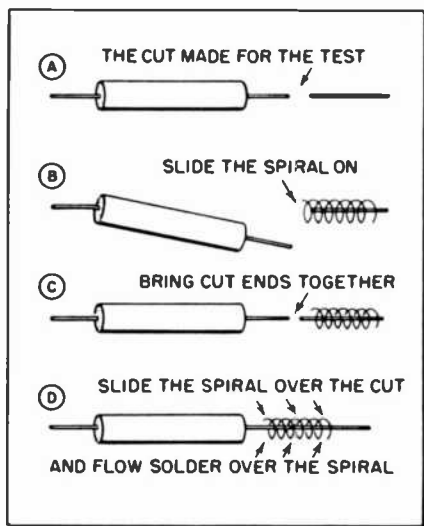
Two rubber crutch (or cane) tips attached to a dowel stick make a handy tool for removing pilot light bulbs in close, narrow, and otherwise hard-to-reach places. The prepared stick will remove both good bulbs and broken ones. Although the rubber tips come in different sizes, there is no difficulty, when a bulb is brought along, in matching up a pair of tips that will fit snugly enough over the bulb to grip it. The diameter of the dowel stick is chosen so that one of the crutch tips—the one shown at the right in the figure—will just fit on it as it would on a crutch or cane. At the other end of the dowel stick, instead of being slipped over the end of the stick, the tip is turned around and screwed on as shown.

In use, the left end of the tool will fit snugly over pilot bulbs to make removal easy. The other end of the tool is just right for removing broken pilot bulbs. The bottom of the crutch tip is shaped just about right for fitting into the broken socket. If the rubber is a little too large, a sharp razor blade can be used to taper it to fit. A slight inward and twisting pressure will soon remove even the most obstinate broken bulb or base. The tool works equally well on bayonet and screw-type pilot lights. I keep such a stick on my bench at all times.

The rubber tips are available in all novelty or dime stores at about a nickel each. The dowel stick can be purchased at a hardware store.

Splicing Aid

Did you ever want to check a resistor or capacitor but hesitated to disconnect a flock of wires at a tube socket or other tie point because of difficulties in proper resoldering? Here is an easy way to overcome this problem, equally useful in handwired or printed circuit sets.



After a lead is cut and component tested, slide a tight fitting tinned wire spiral over both ends, centering spiral over cut. Crimp spiral ends and solder.

Take a length of #22 bare tinned wire and two sizes of twist drills; one size to equal the thickness of the lead on one-half watt resistors and one size to equal the thickness of the lead on two-watt resistors. I use only two sizes. Wind the wire tightly on the shank of the twist drill, leaving a small space between the windings. Make the spirals three eighths to a half inch long.

Now cut the lead on the resistor or capacitor to be checked, leaving an equal amount of lead on each side of the cut. Make the test you desire and then slide a spiral over one end of the cut, bring the ends together and then slide the spiral back so that it covers the cut, as illustrated above. Crimp both ends of the spiral lightly with long nose pliers. Flow solder over the spiral and you are back in business in a minimum of time and effort with a neat, secure splice. I make up a few dozen in advance, having plenty on hand when needed.

Line Cord Protection

The line cords on electric drills and other equipment used in the shop often become frayed and damaged from constant use, requiring replacement from time to time. Premature damage and replacement can be avoided by using the twisted plastic cord wrappers of the kind universally sold to be used on telephone cords. Use of these protective wrappers prevents line cords on drills, soldering guns and other equipment from becoming twisted and fouled, thus prolonging their life.

Line Voltage Control

The most useful service-aid I have in my shop is a simple and inexpensive line voltage control. It is quite easily constructed from parts that will be found in any repair shop. The circuit is shown below. With this unit you can either raise or lower the line voltage by six-volts by making the filament transformer output boost or buck the line voltage.

If a portable radio works normally on the high position and it consks-

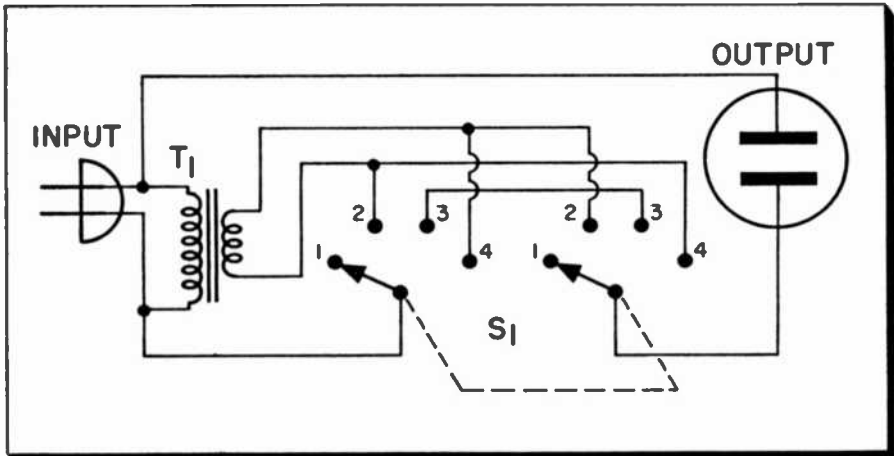
out on the low position, it's probable that the selenium rectifier or the oscillator tube needs replacing.

Used in conjunction with a TV it will save both time and money. In the low position there should be a complete raster with no shadows. If the set passes this test you don't have to worry about a call-back for insufficient width, etc. Operating a TV on the high position is one of the best methods I know of to make an intermittent set act-up. Due to increased voltages throughout the chassis a component on the verge of breakdown will be put under extra stress, often enough to cause its failure.

Oscillator Drift

The servicing of horizontal drift that appears after the set has been on for an hour or more is often difficult. The trouble is usually caused by some component heating up and changing in value. Putting a heat lamp near the horizontal circuits heats up too many of the components at the same time, I have found, mak-

Line voltage is controlled by boost and buck action. Switch positions are: (1) off; (2) -6v; (3) normal line; (4) +6 v. Two main parts are 6-volt filament transformer, rated 3 amps or more, and double-pole 4-position switch.



ing it more difficult yet to find the defective part.

A short cut to locating the defective component is to place the tip of a hot soldering gun just *under* each component being tested, while the set is still cold (i.e., immediately after the set has been turned on, after being off for a considerable period.) When the iron is placed under the defective component, the drift symptom will generally make itself evident immediately.

Glass Polishing

Glass rubbed against glass will result in a ground-glass appearance on either or usually both pieces. A spot such as this may occur as a result of contact between the safety glass and the CRT.

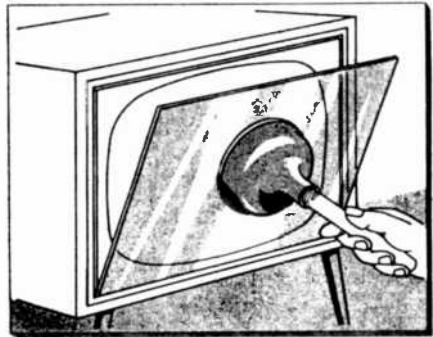
With reasonable care, these spots can be removed. The basic idea is to polish the glass with a soft cloth and a very mild abrasive. Bon Ami in cake or powdered form, or other similar product, slightly moistened so that it has a paste-like consistency, is applied to the spot and the immediate adjacent area. The glass is then polished by rubbing it with a soft cloth or a pencil eraser. A chamois cloth is also good for this purpose.

Inasmuch as quite a lot of patient elbow grease is required, an electric drill equipped with a cloth buffing wheel will save much labor. When using a power-driven tool on the face of the CRT, extreme caution should be used so that the picture tube will not be struck a sharp blow due to slippage of the drill, etc. Safety precautions in the form of gloves, goggles and a heavy apron are advisable. Also avoid excessive pressure. It is also advisable to experiment on another piece of glass before attempting the actual polishing. It is possible to make matters worse the first time.

Safety-Glass Removal

Many sets have provision for removing the safety glass from the front for cleaning. There is usually no way to grasp it, and prying with a screw driver may crack or chip the edge.

Removal of the glass is even more of a problem when it is stuck in place. If the glass does not come away easily, perform a thorough examination to make sure that all removable retainers have been removed. If the glass is still stuck in



Remove by tilting the top and then lifting.

place, then a plumber's helper may be used as a suction cup to provide a good hold.

Most glass is removed by tilting the top out and then lifting up. Exercise care and good judgment if the glass persists in staying put. A wrong move could prove to be costly and dangerous. In extreme cases, it may be better to pull the chassis and remove the CRT. In the field, large suction cups used on car-top carriers, are also suitable.

Glaziers have special types of suction cups equipped with a lever. This makes it unnecessary to apply inward pressure to force out the air and is an added safety factor.

Hook-On-Probes

Many times during the course of a day's activities at the bench, the need for a third hand, or even a longer arm, arises when trying to hold a meter probe in place, while trying to watch the scope or picture and manipulating controls all at the same time. When monitoring a circuit for any length of time, it is not feasible to have a man at the set just to hold a probe in place. There are many gadgets and adapters on the market that can be slipped over the probe end to form some kind of clamping arrangement. I have found a convenient way to quickly modify my various instrument probe tips, so that they will latch on to a test point easily and fit into tight spots. Simply saw or file a small diagonal cut near the end of the tip as shown. The inside upper part of the slot can

be beveled to form a knife-like edge to assure good electrical contact.

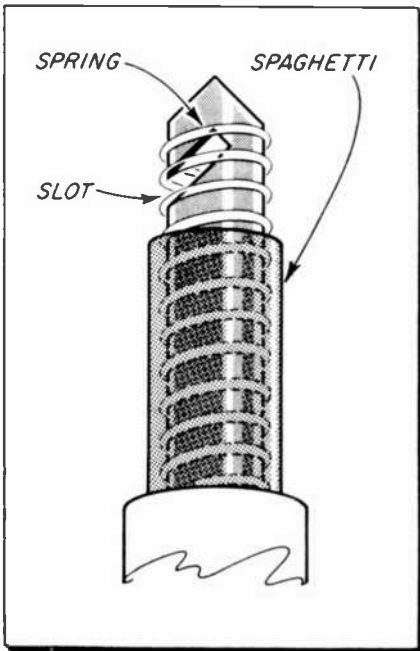
It is also possible to wrap a piece of small diameter music wire or other spring-like wire over the tip, so as to form a compression spring. The length of the spring is made to run almost the entire length of the tip. A small piece of spaghetti can be slipped over the tip to minimize accidental shorts. To use the probe, rest the top edge of the spring on the test point with the slot facing the connecting point, press gently and latch into place. To remove press gently and rotate probe.

Tight Alignment Cores

On alignment jobs, the service technician is often confronted with threaded alignment cores which just won't be budged by ordinary insulated (plastic or fiber) alignment tools. Sometimes the tool is broken when adjustment is attempted.

If it is possible, remove the core with some tool capable of turning it, and sprinkle a little talcum powder on the core. If it is not possible to remove it, try turning it *in* a few turns. Then put a little talcum powder inside the coil form. The core can now be backed out until it collects a coat of talc on its threads. This will generally make the core easy to turn with a regular aligning tool.

A word of warning: never use oil or graphite as a substitute for talcum powder in this application. Oil will swell the coil form and may also develop voltage leakage in the coil or associated parts. Graphite will most assuredly develop such leakage. While the measure recommended here is particularly pertinent to cores in i-f coils, it is also useful on other types, including the cores used in auto-radio tuning mechanisms.

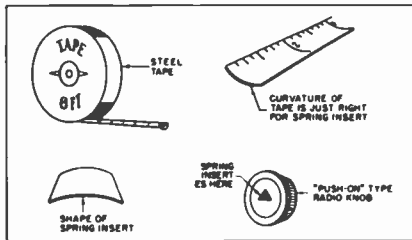


Slot cut at tip end of probe hooks on to test point. Spring provides a secure connection.

Replacement Knob Springs

The springs out of push-on type knobs, like those found in so many radios, are lost easily and often. It is not always easy to procure new knobs that match up with the old ones. In any case, this means that valuable time must be wasted in going to the stock room or the parts supplier; even then, the trip may be fruitless.

Avoid these difficulties by keeping a steel tape on the bench at all times. From this you can, with tin snips, cut out a new spring in a minute, and you can cut it to fit any size knob, as shown in the accompanying figure. These steel tapes, inexpensively available in "dime stores," can save many times their cost by saving time used finding lost springs or going for new ones.



Knob springs can be made up from steel tape.

Another valuable use for these home-made steel-tape springs is to tighten push-on knobs which, although retaining the original spring, have become loose on the shaft. To tighten the knob, just put an extra spring insert under the original spring still in the knob. When this is done, the new spring will stay in place securely and hold the knob fast.

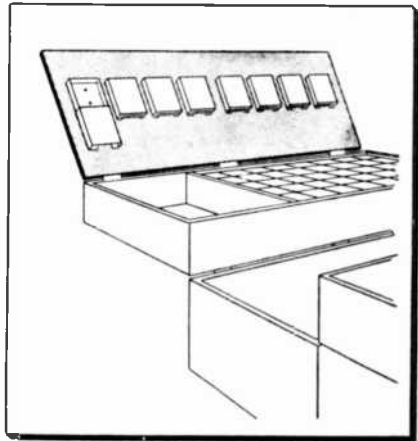
Pilot Bulb Removal

Extracting hard-to-reach pilot lamps, particularly those recessed in panels, is easier than it looks. Simply

push a short piece of rubber tubing over the bulb. Choose tubing of such a diameter that it makes a snug fit over the bulb. The latter may then be manipulated out of its socket easily.

Anti-Fuse Fumbler

Don't blow your fuse while searching your tube caddy for the correct size circuit protector. Remove the fuses, slide the cover from the box, punch or drill 2 small holes in the bottom, and attach these boxes to the plywood lid, as illustrated. Use small $\frac{1}{2}$ inch wood screws. Replace covers



Fuse rack.

and fuses. The fuse size and type can be marked on the top of each box.

• This idea can also be used on those tube caddies not equipped with lids over the tube compartment. Often in those boxes that do not have covers the tubes shift from one side to the other, and fall out as the box is opened. A $\frac{1}{4}$ inch plywood board can be made to cover these tubes and the fuse boxes fastened to this board. This cover may be friction fitted or hinged.—Ed.

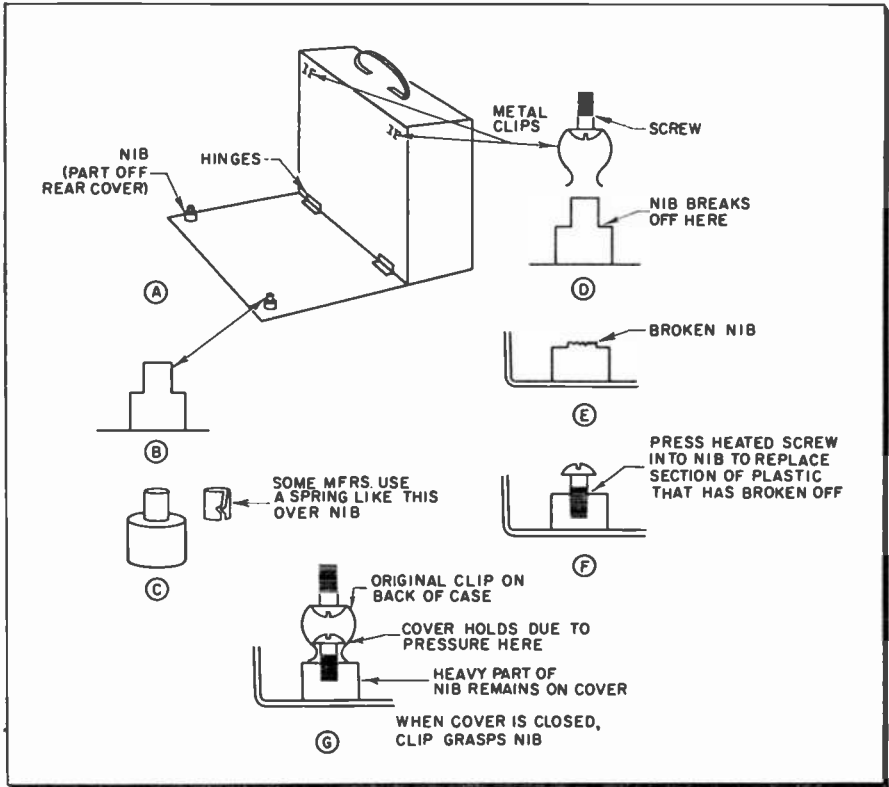
Cover Repair On Portables

The small plastic studs on the rear covers of some portables, which normally snap into the back of the receiver, often break off readily, allowing the cover to flop open. The normal snap-in arrangement is shown in sketch A; sketch E shows part of the cover with the stud broken off. The broken stud may be replaced by heating a round-head screw of the right size ($\frac{1}{8}$ or $\frac{1}{16}$, as required) and pushing it down the required depth into the plastic stud base with a hot solder-

ing iron (see sketch F). This will effect a permanent repair. Having a small wet rag handy to cool off the metal will allow the plastic to set in less than 10 seconds.

Third Hand Again

The often-needed third hand on the service bench in the shop can easily be provided by an ordinary rubber band, if it is used in the right way. Simply wrap the rubber band tightly around the handles of a pair of long-nose pliers. It's surprising



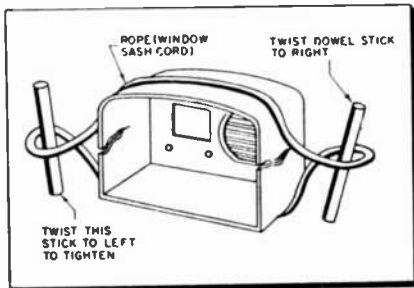
A—Rough sketch showing relative positions of nibs and clips used at the backs of some portables. B—How the nib looks. C—Another type of nib. D—Clip slides over nib, normally. E—Appearance of nib when its upper portion has broken off. F—Screw substitutes for missing nib section. G—Clip fastens on screw. Drawings shown above are not drawn to scale.

how much grip you can get to hold parts together because of the lever action that results, while both hands are free to hold solder and iron, or to manipulate other equipment.

Simple Cabinet Repair

A neat, quick, long-lasting repair of a broken plastic cabinet can be made by using the method shown in the accompanying drawing. All that is needed is a piece of looped rope, two dowel sticks and some household cement. First fill the cracks with cement. Then loop the cabinet with the rope, and twist one of the inserted dowel sticks toward you, the other one away from you. Place the cabinet on a table and let the cement dry for at least 24 hours.

A strong bond is made because considerable pressure is exerted by the twisted rope. This method is



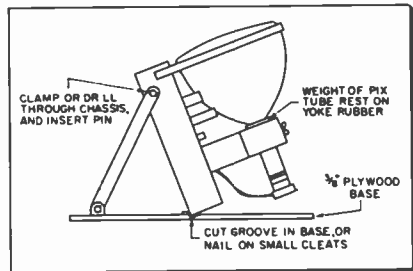
Simple "vise" facilitates cabinet repairs.

more satisfactory than the use of clamps. Wipe away excess cement before it starts to "set" or dry. In this way, no evidence of the crack or of the repair can be seen afterwards.

In putting the cabinet aside to dry, it will be found helpful to place the chassis back in the cabinet. The weight of the chassis will hold the unit down. The twisting action of the sticks in opposite directions will now lock the rope and keep it taut. With this method, I have repaired cabinets broken into as many as four different pieces.

Jig for Large TV Chassis

The illustrated jig, which can be made up from a section of $\frac{3}{8}$ -in. plywood and a few simple, easily available parts, provides a means for safely handling that bulky TV chassis. Sideward movement of the chassis, with resultant strain on the neck of the picture tube, is avoided; otherwise, the entire set-up can easily be rotated or moved around on the bench. When using this mount, details of which are shown in the accompanying sketch, some care may be necessary to prevent damage to the neck of the picture tube. Since the neck often projects beyond the back of the chassis, the mount must be adjusted so that the



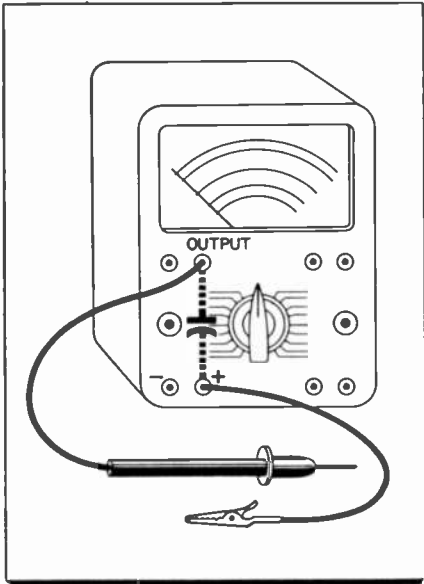
base of the crt does not contact the mounting board.

Convenient Probing Lamp

I find frequent need for using a pen-light in my bench work, but I have discovered that the life span of the tiny pen-light batteries is too short when the light is used fairly steadily. To solve this problem, I have eliminated the battery by running two leads from the pen-light and connecting the leads to a suitable voltage source. (I use the filament connections on a tube tester socket.) This provides a steady source of current without the nuisance of frequent battery replacement.

Handy Capacity Probe

A capacity probe is nothing more than a capacitor in series with a piece of wire, yet it can be of great help to the technician who has to troubleshoot a set in a hurry and without test equipment. Either the signal-injection or signal-tracing



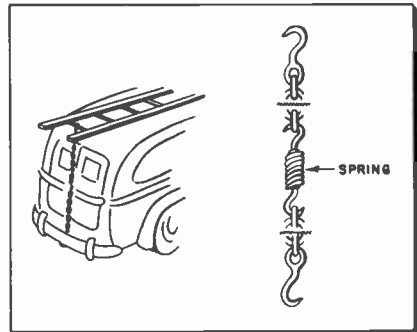
VOM's leads and internal capacitor serve as a handy capacity probe for troubleshooting.

procedure can be used. For signal injection, one end of the probe can be attached to a 6.3-volt a-c filament line; the other end can go from point-to-point injecting the 60-cycle signal. In the audio circuits hum will be heard; in the video circuits, it will show up as light and dark areas on the CRT; and in the vertical sweep circuits it can open up a completely collapsed raster when the oscillator is not functioning. As a signal tracer, one end of the probe can be connected to the top of the volume control and the set's audio system used as an indicator. Sync pulses and other signals can also be tracked from point-to-point.

Most VOM's have a jack marked output. It is used to extend the usefulness of the a-c voltage ranges. An internal isolating capacitor in series with this jack prevents d-c voltages from affecting the a-c voltage readings. By connecting one lead to the output jack, and the other lead to the hot (sometimes designated as positive) jack, the meter's internal capacitor is placed in series with the two leads. This arrangement can be used as a capacitor probe. The advantage being that no extra leads or capacitors are required for this setup. Because the meter itself is not in the circuit there is no need to consider voltage range settings. Of course, the capacitor's voltage rating should not be exceeded.

Fastening Ladders

We save a lot of time in our antenna service work by fastening our ladders to the roof of our trucks with two pieces of chain and a tension spring. This makes a speedy job of putting them on or taking



them off without the necessity of tying or untying ropes. If springs of sufficient tension are used, the ladders will be secure on short or long trips and rattling is prevented. Hooks are used at either end of the chain. One connects to a ladder rung, the other to the truck bumper.

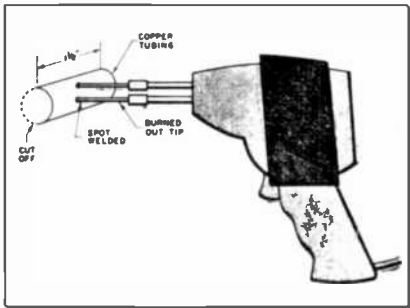
A Musical Slant

A handy accessory that we have been using around the shop for the past two years is an ordinary music stand. We use it as a stand for holding circuit diagrams. It helps provide more bench elbow room; it can be adjusted to a comfortable viewing level; and it is light enough to be moved out of the way without difficulty when it is not in use.

Heat for Intermittents

When heat is applied to a chassis, as with a lamp, to make an intermittent component break down, there is always the danger of damaging other parts. However, there is a way to concentrate heat on individual suspected components.

We took a burned out tip from a soldering gun and spot welded to it a half shell made from a length of $\frac{3}{4}$ -in. copper tubing. The length of tubing used was $1\frac{1}{2}$ in. The accom-

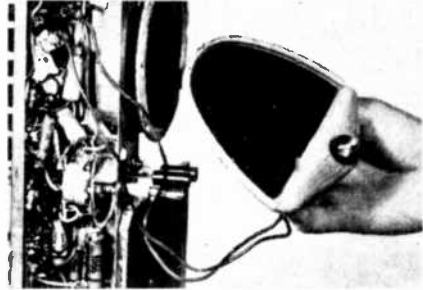


panying figure shows the completed job, with the tip replaced in the soldering gun. Different sizes and lengths of tubing can be made up on different tips, as required.

When using this device to concentrate heat on a suspected component, note that even a good part will break down if heat is applied too long. Only a few seconds are necessary if the component is intermittent to start out with.

Mirror-Lamp as Service Aid

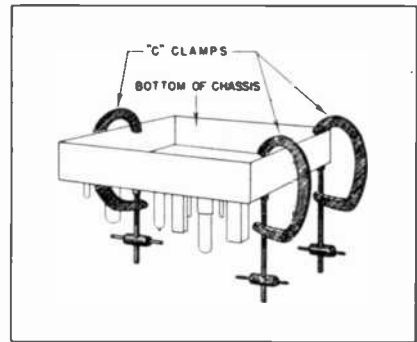
Certain cars come equipped with a mirror (see photo); similar mirrors can be purchased at supply stores. It is only necessary to equip



the mirror socket with a dial lamp of suitable voltage rating, and to clip the lamp's leads to that voltage source, to have a mirror for checking the values of parts. The voltage source may be in the receiver under examination. The mirror alone is convenient in making TV receiver adjustments.

Chassis Supports

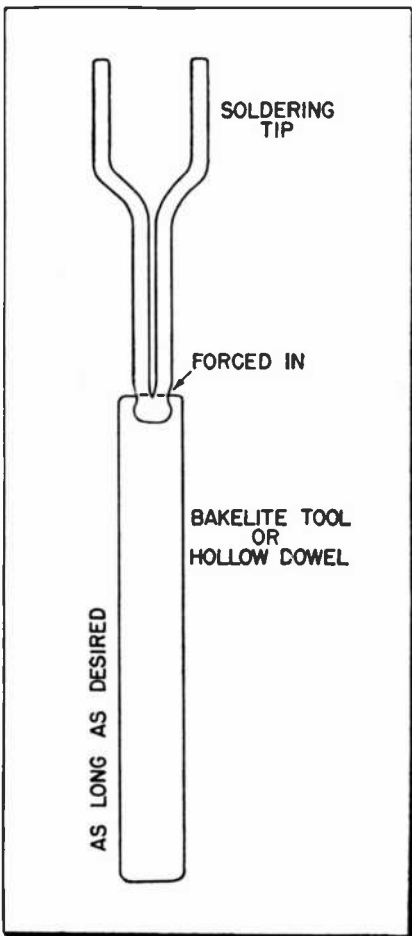
Large C clamps make ideal chassis supports. They take up little room, adjust to many sizes of chassis, are inexpensive, and they may often be



used where other chassis supports cannot be employed. Much time can be saved by their use, and needless damage avoided.

Handy H-V Jumper

When checking the horizontal output and high voltage circuits in a TV set where the fuse has blown, the tool illustrated here makes a handy jumper device for momentary shorting of the fuse-holder terminals. While prolonged jumping of the fuse terminals may cause damage in a defective circuit, it is often advantageous to short out the fuse temporarily to make observations. For example, arcing may thus become evident in one of the tubes or else-



Easily made shorting bar for jumping fuses.

where in the circuit, which will aid in localizing the defect. With the prods of this tool shorting the fuse holder, the tool can be pulled away quickly at the first sign of trouble.

The shorting bar can be made up easily. The one shown was made from a Type 7300 Weller soldering-gun tip, used for older model Weller guns. Other similar types will serve as well. The tip is forced into the shaft of a hollow alignment tool, as illustrated, or into a hollow dowel stick. A tool of any length may be used, but about 6 to 8 in. is enough to reach almost any fuse location conveniently. The open ends of the soldering tip may then be spaced to fit across any fuse holder.

Work Bench Mobility

Instead of having conventional 8-ft. long work benches in the shop, which are generally fixed in place, we use smaller tables of such a size that three of them side-by-side replace one shop bench. When they are pushed together, we have the equivalent of our old repair table back. However, they allow added flexibility.

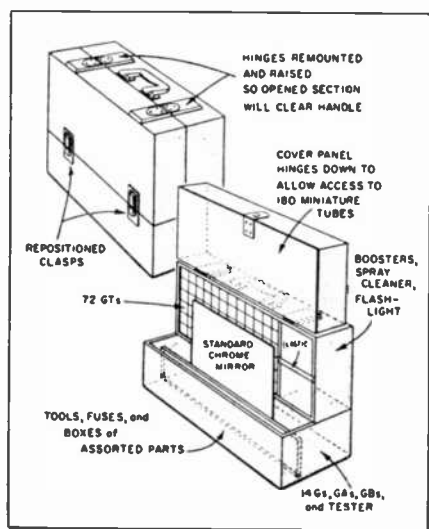
Each of the smaller tables is on casters. On the bottom of each is a shelf to hold the cabinet of the TV receiver under repair. If the set has to wait for a replacement part or if it is under prolonged test (as in tracing an intermittent), the table and set are simply pulled away and put aside. Another repair table bearing another repair job is put in the vacant spot.

Another refinement may be added to each table. Atop of each is a plywood panel large enough to hold the set under repair. The plywood top rotates on the regular table top by means of small furniture casters of the flat type. The casters have been countersunk into the table top so that the wheels project upward. The plywood rolls around on these cast-

ers, carrying the receiver with it. This minimizes lifting and twisting of the set.

Caddy Conversion

The usual tube caddy may take up too much room when opened. One way to solve this problem is to convert it to open vertically, instead of horizontally. To do this, remove the clasps from the top and the hinges from the smaller side. Mount the hinges on the top, built up by wood strips in order to clear the handle. Mount the clasps on the side where the hinges have been removed. Add

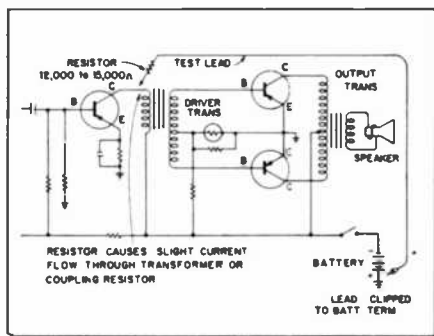


Caddy opens up instead of out when hinges and clasps are moved, saving floor space.

or remove partitions as desired. To prevent the tubes from falling when one is removed, use metal strips between rows. The converted caddy shown takes up no more floor space open than when closed. It is a good idea when using the converted caddy—with its higher center of gravity—to place its back against something to prevent it from being knocked over.

Click Probe

A click probe can be quickly assembled, as illustrated, and used to determine a break in the signal path. Connect a 12,000 to 15,000 ohm resistor to the positive side of the battery (may or may not be ground) and touch the free end of the resistor to



Quickly improvised click probe helps isolate a defective stage in a transistor radio.

the transistor terminals, starting with the output stage, and working back. Listen for clicks in the speaker. The absence of clicks will indicate a break in the signal path. Once the defective stage has been isolated, it becomes a fairly simple matter to find the bad component.

Shock Hazard

When bench servicing a TV chassis where only the CRT remains in the cabinet there is always the danger of shock from the joint of the H.V. extension wire and the short lead from the chassis. I have a 12" length of 1" O.D. polystyrene tubing that slides over this joint and is kept in place with a piece of scotch tape at one end. This does away with any chance of a short or shock. Any type of insulated tubing will do, as long as it will not breakdown under high voltage.

Screw Replacement Trick

Replacing screws in hard-to-reach places on the chassis usually takes a great deal of time and patience. One way to save on both is simply to scrape a little wax from a paper condenser in the set itself. The wax is pushed into the slot of the screw, and the screwdriver is then inserted in the slot. This fastens the driver and the screw to each other very well, and makes it simple to guide the screw into its proper place without losing it.

A similar trick works just as well on a hex-head screw as it does on slotted-head screws. Put a little wax along the outer edge of the head before slipping it into a spin wrench. The screw, which is now prevented from dropping out of the wrench, is easily maneuvered into its hole.

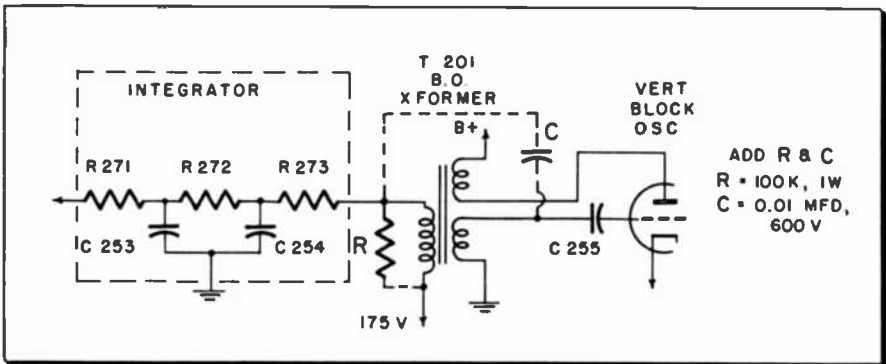
Cleaning Aid

A handy gadget for oiling or for cleaning controls and other parts may be obtained free of charge from any doctor. It is an empty, discarded penicillin shot syringe. It comes complete with a needle that can be inserted into very small holes and cracks. Since the plunger has very strong suction, the syringe can eas-

ily be filled by inserting the needle into the liquid to be used and drawing the fluid up. Since the syringe is made of plastic, danger of shock during use is avoided.

Auxiliary H-V Supply

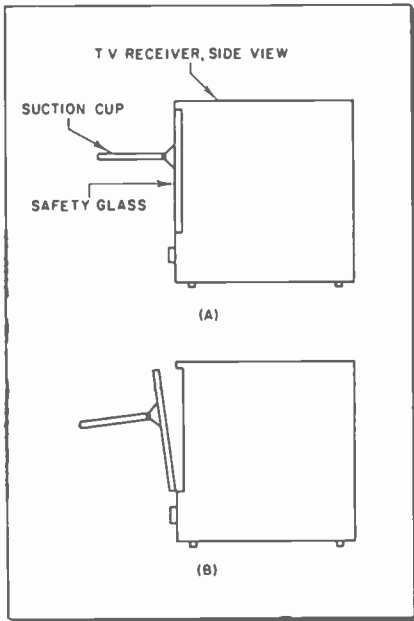
If you ever come across an old TV receiver with an r-f high-voltage power supply, taken in trade or procured any other way, don't scrap it altogether. I salvaged such an r-f supply from an old Du Mont taken in trade. It's worth its weight in gold for localizing high-voltage and horizontal-deflection troubles. When horizontal troubles occur, you generally lose the high voltage too. Consequently, you lose the service of the quickest indicator you have, the picture tube itself. Substituting the 10-kv r-f supply for the one in the receiver puts the tube back in business, and gives clues as to where the trouble may lie. With the picture far off sync, for example, horizontal oscillator or afc faults are indicated; inadequate width points to the output or flyback portions; a trapezoidal raster throws suspicion on the yoke; and a vertical-line raster directs attention to the flyback transformer or yoke.



If defective, the primary of this blocking-oscillator transformer need not be replaced.

Safety Glass Removal

If you have ever had to take out a safety glass to clean a dirty picture tube, and found to your horror you had chipped or broken the glass with a screw-driver, you will appreciate this time and money saver. I use a suction-cup dart from a child's toy gun. Simply moisten the rubber (after removing screws which hold the glass) and press the cup onto the top center of the glass (see illustration). Pull out-



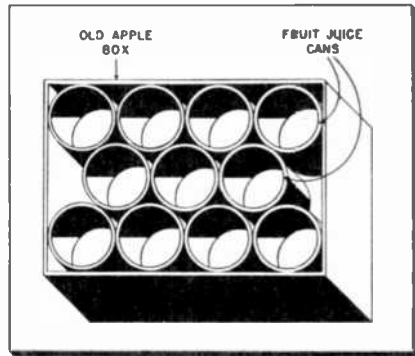
Simple method for removing crt safety glass.

ward, at the same time holding the bottom of the glass with your free hand.

Note: This works equally well with safety glasses that swing out from the bottom. On these press the rubber onto the *bottom* center, and hold the *top* with the free hand, pulling outward on the suction cup.

Small Parts Storage

It has always been a problem to keep small hardware easily accessible, especially hardware used for antenna installation and service. This problem can be solved simply with an old apple crate, which can be obtained from any grocer. Cut the sides of the box down to leave a depth of 7 in.; then insert 11 large fruit juice cans (the 1-qt., 14-oz. variety), as shown in the illustration.



Small parts can be stored in cheaply made bin.

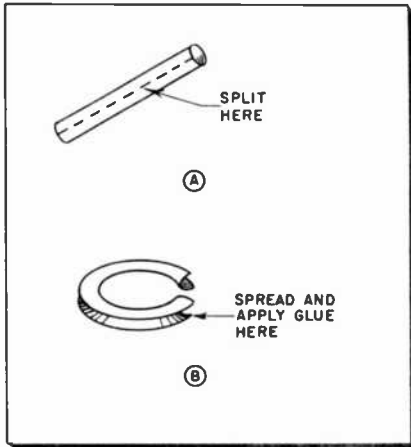
The cans will just fit snugly. I constructed two of these bins. For the small amount of time and effort required to make them, I have saved many, many hours of searching for lag screws, antenna lugs, U-bolts, stand-offs, turnbuckles, lightning arresters, tacks, etc. You can also tell at a glance when you are running low on any item.

Dial Stringing Shortcut

To replace hard-to-get-at dial strings, tie the new cable to one broken end of the old string; then pull the other end of the old cable through and out of the assembly. The new string will thread through, following the old one. This time saver can be used on many sets.

Home-made Grommets

We keep a length of auto windshield-wiper hose in the shop, to bush odd-sized or odd-shaped holes in all sorts of chassis and appliances. Suitable grommets are readily made to fit any shape of opening by cutting



Windshield wiper hose is source for grommets.

off the proper length of wiper hose, splitting it open (as shown in sketch A), applying cement to the cut edges, and curling the hose into shape (as at B) so that it can be put snugly into place to line the hole.

Extra Duty for H-V Aids

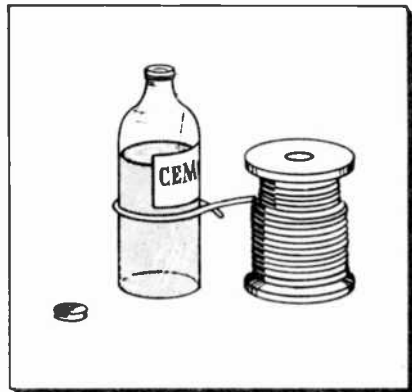
Accessories used in service work on high-voltage circuits can be employed for other unheralded jobs, in many cases. Anti-corona "dope," for example, makes an excellent replacement for the cement used in making speaker cone repairs. In fact, it does a much neater and more thorough job than regular speaker cone cement. Even when used with tissue paper patches, the black corona dope, heavy and undiluted though it is, sets evenly and smoothly.

High-voltage tape also has appli-

cations for which it was not originally intended. When wound around the base of a picture tube, it prevents the base from pulling out. It can also be wound around the neck of the picture tube at the point where the flare of the pix-tube bell begins. This protects the yoke windings whenever pix tube removal is necessary. The latter function is very important because, in many sets, the clearance between the neck of the tube and the yoke is very, very small.

Spill Insurance

When using a bottle of cement, soldering acid, contact cleaner or other fluid on the bench, there is always the danger of accidentally spilling the contents in the normal course of service work. An ordinary spool of solder wire provides excellent protection against such a pos-



No accidental spilling with this holder.

sibility. Simply stand the spool on end beside the bottle being used and twist a turn of the solder around the bottle, as shown in the accompanying sketch.

Hand-Made Springs

Handy springs of various diameters and lengths can be made uniformly and quickly to fit most jobs by winding any type of spring wire along the threads of any standard bolt. Start the winding at the tip of the bolt and work toward the head. After the desired number of turns is wound on, turn the bolt counter-clockwise. Your spring then winds off in finished form. This method is handy for fabricating dial or record-changer springs.

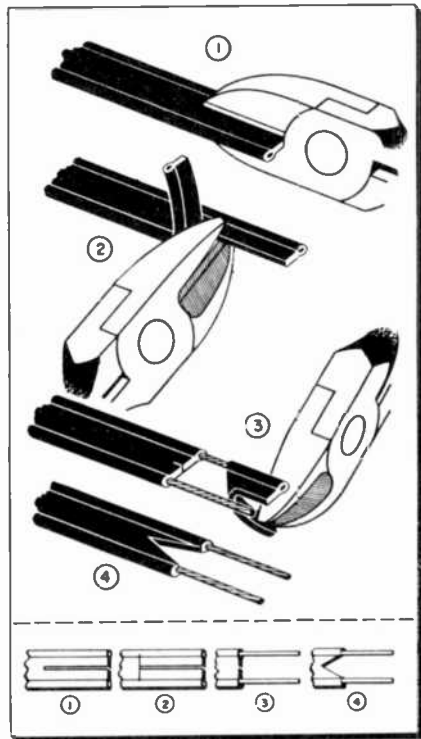
Auxiliary Power Supply

An external power supply can often be used to track down leaks and short circuits in TV and radio B+ supply lines, especially when seleniums and fuses are used and are bound to "pop." Disconnect the B+ lead from the cathode of the rectifier and connect the auxiliary power supply, observing proper polarity. Note, just before connecting the external supply, with the load disconnected, it is possible to plug in the set to check the transformer or selenium rectifier and other primary circuit components. Having ascertained that the trouble exists elsewhere, then proceed. The voltage should be monitored. The safest way to conduct this test without causing undue damage is to connect one lead at a time until an unusual voltage drop occurs. Tracing out the line that is causing this drop, will lead to the defective component. Since there is no filament voltage supplied, the tubes are not conducting. There are times when excessive voltage drop occurs across a power amplifier tube due to an upset in grid bias, or a shorted tube. Unfortunately this substitute power supply will not help in such a situation. However it is still worthwhile

having. It can be constructed from "junk-box" parts. A professional looking piece of equipment, with meters, may be obtained from the test instrument manufacturers.

Stripping Flat Transmission Line

All that is needed for a neat and efficient stripping job on flat transmission line, without nicking a few

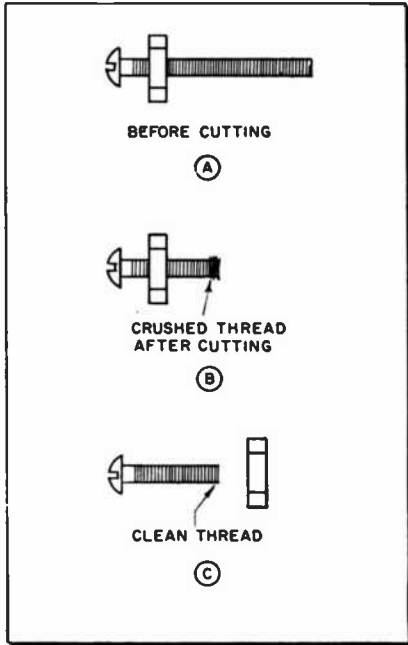


Diagonals used to strip transmission line.

strands of wire, is a pair of side-cutters. Cut the insulation down the center. At the end of the slot thus formed cut 2 right angles, one to the right, and one to the left, as close the wires as possible, without cutting into them. Grasp the tabs, thus formed, with the cutters, one at a time, and peel back towards the open end. Trim to shape.

Tip on Cutting Screws

When a hacksaw is used to reduce the length of a screw to the size desired for a particular job, the starting thread left after cutting is frequently so badly jammed that a nut cannot be threaded on. To pre-



vent this, thread a nut of the right size on the screw *before* cutting, as shown in A. After cutting, when the starting thread has been crushed by the hacksaw blade (see B), the nut is simply threaded off the screw. In coming off, the nut will clean the thread, as shown in C.

3rd Hand for 1-Man Jobs

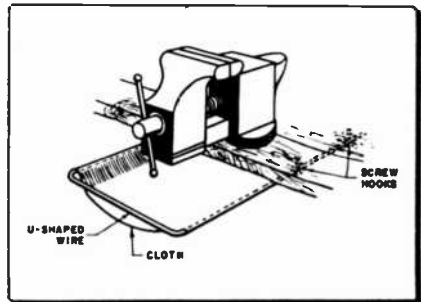
A third hand for soldering is available in the form of surgical locking forceps. Such a pair of forceps is shaped like a pair of scissors

and has the advantage that it may be locked in position. In addition, the use of these forceps in such operations as stringing dial cords, holding springs in position, and in reaching and picking up small objects or wires at the bottom of a crowded chassis, make them invaluable.

These surgical locking forceps should not be difficult to procure. They can often be found at surplus stores. Old ones can be obtained from a local hospital. While such old ones may no longer be useful for clamping arteries or the other critical requirements of the hospital's operating room, they will still work fine on wires and other components for which the technician will want to use them.

Vise Not Catches Parts

When parts are worked in a vise on the bench, there is often trouble because small parts fall from the



Net under bench vise catches falling parts.

vise to the floor of the shop. This can be avoided by the use of a simple cloth net, supported on a wire frame, placed right underneath the vise below the bench top. The frame is made of stiff wire bent into an approximate U shape, as shown in the illustration. The frame slides in and out of screw eyes or hooks, so that the net can be removed when needed. The edges of the cloth may be hemmed to fit over the wire, or held in place with safety pins.

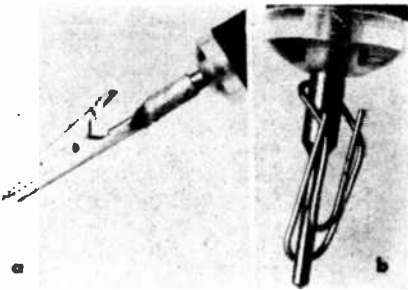
Self-tapping Screw Holes

Whenever making chassis mounts that require the use of sheet-metal (self-tapping) screws, *punch* the holes instead of *drilling* them. Drilling leaves a clean hole with a regular surface. However, the uneven surface left around the hole by punching is more desirable. There is more surface for the screw to cut into in making a grip for itself. Also, the slight hump caused by the punch will pull tighter against the screw.

Low-Cap Probe Clips

When testing with crystal probes in high-frequency circuits—about the only place these probes are used—tests should be made with the probe in relatively permanent contact with the circuit element. This is advisable to keep the hand, arm, body, etc. away from the tested circuit. Enough stray variation occurs from the very presence of the probe case and leads without adding any additional variation due to hand capacity.

To accomplish this type of connection for relatively low-frequency circuits, such as in the video amplifier of a TV set for setting 4.5-mc traps and the like, the hot probe tip may have an alligator clip slipped on it as is shown in photo A. If the probe tip does not fit tightly into the end of the clip, crimp the round end

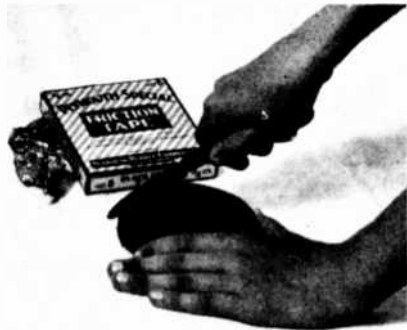


Probe clips for use in high-frequency tests.

of the clip to make a tight fit. For higher frequencies, such as in the i-f system, where even the additional capacity of an alligator clip may present a problem, a small paper clip may be used to make the connection. It is bent into the shape shown in photo B and slipped on the probe tip. The probe can be attached to circuit elements easily with this device.

Stop Tape Fraying

Before starting a roll of friction tape, use a knife to draw criss-crossing lines across both faces of the roll. These shallow scorings will pre-



Prevent tape fraying by scoring the roll.

vent fraying of the tape along the edges, which can be very annoying when pieces are torn off the roll.

Wire Fed Through Wall

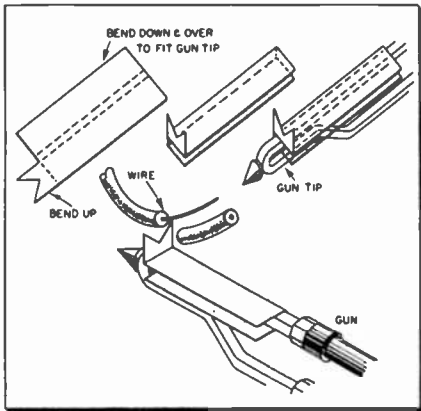
Did you ever have to run a flat lead through a hole in a wall in which a round lead was already installed? If you have, you know how difficult and tedious a job it can be. However, with a little ingenuity it becomes a snap. All you have to do is pull the round lead out of the wall by a certain amount. It should be pulled back by at least the width of

the wall you wish to go through. Then, using plastic tape, tape the flat lead tightly parallel to the round lead. If you have made a good bind—not too bulky—the additional lead can be pulled through the wall with the original wire with no trouble at all.

Wire Stripper

Because the tip of a soldering gun heats and cools quickly, it is quite feasible to have several attachments available which can slip on and off easily and which can often be improvised on the spot. Many different shapes and sizes of tips may be fashioned for close work, heat sensitive areas, and components with many terminals, which have to be unsoldered simultaneously.

Here is another gismo to remove

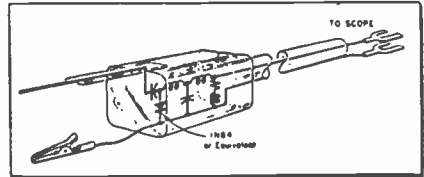


Solder gun attachment strips wire neatly.

that tough insulation on plastic-covered hook-up wire. Cut and bend a piece of copper as shown and slip over the tip of the soldering gun. If the V cut is sharpened a bit it can be used to clean the wire after removing the insulation. Apply to insulation, work around a bit and pull—presto, clean, neat stripped wire—ready to solder.

Salvaged Detector

An excellent crystal detector probe for signal tracing and observing waveforms in the i-f strip of a TV set can be made from a scrapped chassis. Any set having a crystal detector will do. Remove the detector circuit complete with can, coils, resistor, capacitor and crystal diode. Use a good quality coaxial lead from the can to the scope. The leads from



Crystal detector probe from salvaged set.

the probe head to the set should be as short as possible to avoid stray pickup. Use proper terminals to fit your scope. An alligator clip should be used on the ground lead and for convenience may also be used on the probe end. The can and probe tip can be mounted on a small board and handled as a unit. You may be able to construct an insulated probe tip right on the can itself.

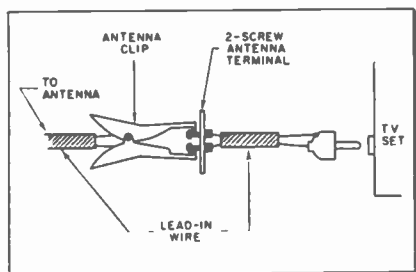
Installing Nuts and Washers In Inaccessible Places

Cramped fingers and frayed tempers can be avoided when installing nuts, washers, spacers, etc., on bolts in inaccessible places. Slip the nut and washers over a rod, stiff wire, or ice pick, in the proper sequence. Hold the small parts high on the rod with a finger, and place on the bolt. Allow the parts to slide down the shaft, one at a time, and if necessary dress the rod slightly so that the washer fits on the bolt properly. When the nut is dropped it can also be aligned in this manner, while another rod or screwdriver is used to turn the nut enough to catch a

thread or two. The rods can then be removed, and a spinner wrench can finish the job.

Antenna Link for Bench Use

Here is a time-saving hook-up I made for my TV service department. Many service shops are using antenna clips at the end of the transmission line coming from the shop's antenna. This is of no use with sets



that have an RCA-type female receptacle going to the tuner input. I use the connection link illustrated to provide a convenient means of hooking up the transmission line to the set.

Chassis Blower-Cleaner

An inexpensive garden plant duster may be changed easily to provide a source of air for blowing dust from radio, TV and other chassis. It is only necessary to remove that section of the duster which ordinarily holds some form of insecticide. It may also be necessary to solder up the small hole to which

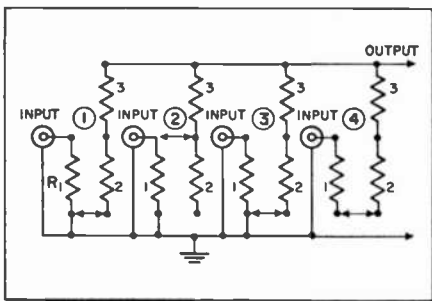


Garden sprayer altered to air-clean chassis.

this container section was attached; the full force of the expelled air will now be directed from the front opening.

Fader-Mixer

Not really a high fidelity set up, but it is a simple and handy circuit for multi-switching and mixing several program sources without the use of tubes, compensated controls, and capacitors. Varying load effects are reduced, and the bass response is not compromised as in a single potentiometer arrangement. I used this device recently with phonos, a tape recorder, and a radio for a public affair. The usual switching arrangement was inconvenient. Clicks and sudden application of the following



Use of dual pots for fading and mixing programs offers compensations for varying loads. Additional resistors enhance isolation between channels.

program was annoying. In the diagram, only Channel 2 is shown in the circuit, the 1 megohm stacked controls tend to maintain the same isolation between the input signal, and the stray capacitance of the output cable and amplifier input circuit. As the control is lowered, some loss of high notes may be experienced depending upon the amount of this stray capacitance. The addition of a 47,000 ohm resistor is desirable to improve isolation between channels being mixed. The loss in signal due to these resistors is negligible.

Audio Xformer-Speaker Check

When no sound emanates from the speaker of a TV or radio set, it is generally necessary to know whether there is an open winding in the secondary of the output transformer or in the voice coil. To make this check with an ohmmeter, one lead to the voice coil has to be opened. A simple check, while it does make use of the soldering gun, does not require the lifting of any leads.

Turn the soldering gun on and hold it close to the suspected transformer. If transformer and speaker are both okay, hum will be induced

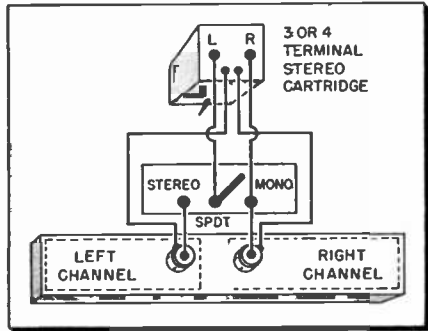
into the output transformer from the transformer in the gun, and it will be heard clearly through the speaker. If no such hum is heard, scrape the test leads of an ohmmeter across the voice coil connections. If a noise is not heard, the voice coil is suspect. If the noise is heard, the voice coil and speaker are okay, and the secondary of the transformer comes under suspicion.

Stereo—Mono Switch

Stereo cartridges are purposely designed to have almost as much vertical compliance as horizontal compliance, and to provide an output signal in response to vertical vibrations. This is fine for stereo discs; but for monophonic records, the only information in the vertical plane is undesirable noise and rumble. By paralleling the two elements in most stereo cartridges, the cartridge becomes insensitive to vertical motion. This is a fortunate circumstance, and is due to the fact that a strictly vertical stylus movement causes an output signal in each cartridge element that is equal, but 180° out-of-phase.

Many of the newer record changers are already equipped with SPST switch mounted close to the pickup arm, to parallel the cartridge output signals. There are millions of record changers that will be modified for stereo over the next year or two. It is even more desirable to install such a switch on the older players because not as much attention was paid to vertical rumble before the days of the stereo disc.

Some of the stereo preamps short out the input of the channel not in use, when the system is set for monophonic operation. If the stereo cartridge output is then paralleled the signal would be lost. A SPDT, instead of SPST, switch connected



SPDT switch parallels both elements in stereo cartridge for monophonic records without shorting the mono input of some stereo preamps.

as shown can eliminate this problem. It disconnects the unused and grounded channel from the cartridge.

Phono Cartridge Check

When it becomes necessary to check the output of a phonograph pickup cartridge to see whether it is working, a quick and simple test can be made with a pair of headphones or a single headset. The headset need simply be connected across the output terminals of the cartridge, or more conveniently, across the leads from the output terminals, so that the connections will not interfere with placing the pickup on the record. When the cartridge is then placed on the rotating record, one need simply listen to the output through the headset. Nearly all standard cartridges (crystal and ceramic types) provide enough output to cause the earphones to operate satisfactorily. The only exceptions are the magnetic and other low-level high-fidelity types of pickups, but even these can be checked through a suitable pre-amplifier known to be operating properly.

In addition to being quick and easy, the headphone method of

checking can be used in the field as well as on the bench. It is only necessary to keep a single headset, which occupies a small amount of space, in the tool box.

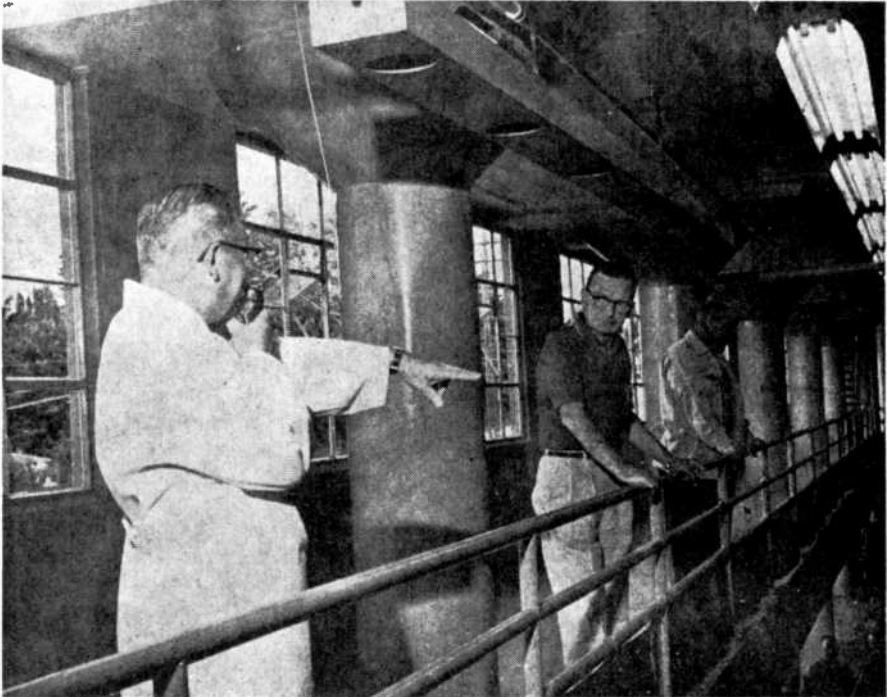
A Sound Idea

Overhead loudspeakers solved a tough sound coverage problem in the plant of Olympia Brewing Company. This public relations-minded beer manufacturer encourages the public to take a tour of the plant. Many people do visit the modern facilities in Washington's state capitol, Olympia.

A brewery is a noisy place, especially in the bottling department. The genial guide explains what goes on, and without a public address

system he cannot be heard. If a high power amplifier were used, the employees would hear the guide's talk several times a day. Even in a noisy department, stray sounds are distracting, especially where running machinery may sing out a warning that something is wrong by developing a new sound. John Andersen, who heads the company's electrical department, designed a sound reinforcement system which covers the visitors' gallery without interfering with the work area.

Six 7 inch p-m speakers are mounted in a 16 foot long wooden trough-like cabinet, which is 10 inches wide and 4 inches deep. The cabinet is suspended just above head level and the speakers face downward, as shown in the photo. A



Overhead speakers confine sound to visitors gallery in noisy brewery plant, without disturbing workers below. Microphone is suspended from a 7" reel above.

10-watt amplifier mounted in the cabinet provides more than ample volume. Tube life averages more than a year and a half in spite of the fact that the amplifier is never turned off. The microphone is pulled down when it is to be used. A 7 inch reel which operates like a window shade stores the cord and keeps the mike out of the way when not in use.

Phono Hint

In replacing phono cartridges, or often when replacing needles, it is necessary to remove the cartridge from the tone arm. When the time comes to replace the cartridge in the arm, the little screws are often hard to handle, especially when working from the underside of the tone arm. A dial cord stick can be used for such situations. Scrape the head of the screws across the stick, filling the slot with the compound. It is then a simple matter to make the screw stick to the end of the little screwdriver employed, permitting this screwdriver to be inserted from any position.

Cure for Noisy Speakers

When rattling or distorted output is the result of a defective speaker cone, I have found that coating the defective cone with ordinary shellac will instantly stop the noise in most cases. Apply shellac to the cone with the radio playing. By the time the application is completed, the noise should be all gone. Make sure to get the shellac on heavy around the edge of the cone.

The writer has repaired many speaker cones in this way, several of which have been in use for six months or more. They are still working as good as new, with no apparent need to replace the cones.

Tape Head Cleaner

Small cotton-tipped sticks, sometimes called Q-tips or quills, are extremely useful for cleaning and oiling tape recorder and record changer mechanisms. They are especially

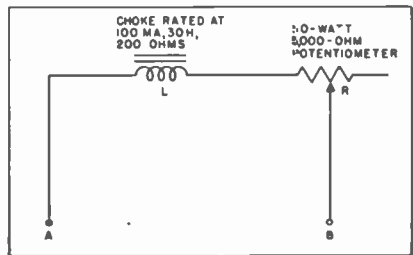


Q-tips are used to clean delicate tape recorder heads.

handy for cleaning delicate tape recorder heads. The Q-tips may be dipped in alcohol or special solvent and used on the tape head, as shown.

Unmarked Field Coils

In the absence of means to determine the resistance of a burned-out and unmarked speaker field coil, so as to supply a replacement, connect a variable resistance in series with coil L across the field coil terminals

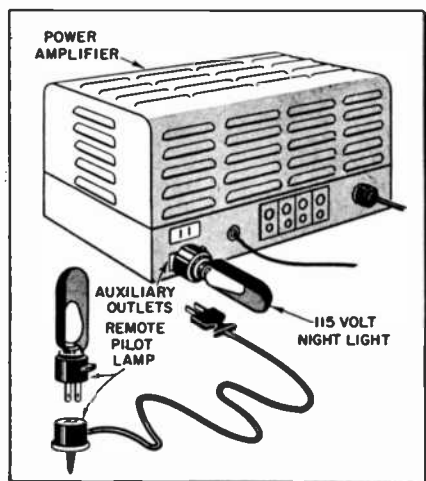


of the receiver. The set-up and recommended values are shown in the illustration. Vary R until proper plate and screen voltages appear.

Turn off the juice and measure resistance between points A and B. This is the ohmage for the replacement.

Pilot Light

To prevent the possibility of forgetting to turn off the amplifier of a sound system, a pilot light can be



Night lamp serves as amplifier pilot light.

quickly improvised from a plug-in type night light. It is quite discouraging to come back to your record player a couple of days after you last used it, and find that the system has been perking all the time. If the auxiliary outlets on the chassis are suitable, simply plug the lamp into one of these outlets. A suitable outlet is one whose power is turned on and off by the amplifier's on-off switch. Some amplifiers have two a-c outlets and only one of them is controlled by the switch. If the desired outlet is occupied, use a double socket.

If the chassis is concealed, a remote pilot lamp can be hooked up using an extension cord.

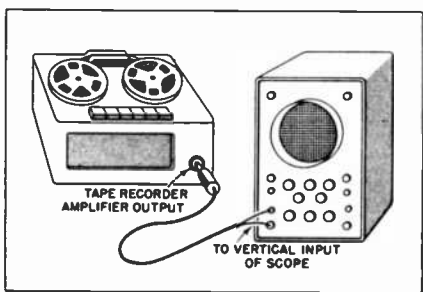
Checking Magnetized Tape Heads

Modern tape recorder heads with small gaps, are particularly susceptible to magnetization. This can be caused by magnetized tools in close proximity to the head. It can also be a result of injecting d-c current into the head windings; for example, when an ohmmeter is used to check winding continuity.

Symptoms of magnetization are generally indicated by a high noise level, hissing and popping sounds when a completely blank tape is played. To check, observe the following procedure:

1. Connect the vertical circuit of an oscilloscope to the speaker jack, as illustrated. (An audio voltmeter may also be used.)

2. With the amplifier warmed up and no tape on the transport, press the PLAY-RECORD button and adjust the loudness control and scope



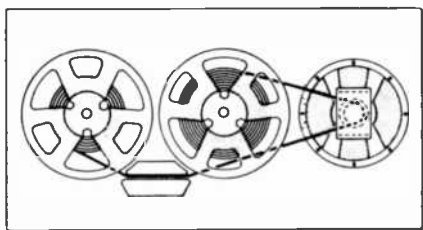
A tape recorder head can be checked for magnetization by first observing its output without any tape and, without changing the setting of controls, with blank tape. If any appreciable increase in amplitude is seen on the scope, then the head should be demagnetized.

gain for some convenient indication. Resulting indication will arise from normal amplifier noise. (Tube hiss.)

3. Place a completely blank tape on the transport and again press the

PLAY-RECORD button. *Do not change the control settings.*

Head magnetization will be indicated on the scope by an increase in signal amplitude—the amount of the increase being dependent on the degree of magnetization. A head that is not magnetized will show about the same average level when a blank tape is played, as was shown with no tape.



Using the permanent magnet in a PM speaker to erase tape information.

PM Tape Eraser

Here is a method of erasing tape with the aid of a permanent magnet speaker.

Take the roll of tape to be erased and place it on either side of the tape recorder on a box or tape boxes so that the magnet will be in line with the tape travel. Thread the tape around the permanent magnet of a speaker (the magnet has to be

one that is exposed and smooth) and back to the take up spool. Set the tape recorder to fast forward or fast rewind, as the case may be, and your tape will be erased.

- *This is not recommended for precise applications where retained magnetism on tape may have an undesired d-c bias effect.—Ed.*

9 cathode-ray tubes

Neck Shadow Remedy

Occasionally a slight case of neck shadow is due to an inadequate flare angle in the yoke windings. To replace the yoke is the easiest procedure, but it is also the most expensive. Before resorting to replacement, try this simple expedient; it works fine in most cases:

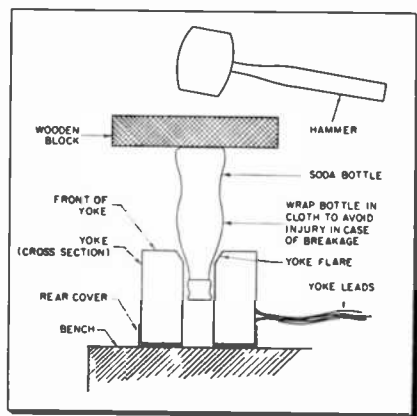
Place the yoke on the bench with the rear portion, out of which the neck of the picture tube normally protrudes, face down. Also obtain a small soda bottle ("coke" type or similar), a soft rag, a small wooden block and a hammer. Arrange these

items as shown in the drawing. The bottle—or that part of it which will be outside the yoke—is wrapped in the cloth to prevent personal injury in case of glass breakage. Tap the wooden block smartly with the hammer several times, to increase the angle of the yoke flare. Replace the yoke, making sure that it's as close to the picture tube bell as possible. You'll be surprised to find how often this gets rid of neck shadows.

Incidentally, I have never had a "coke" bottle break in the years I've used this method.

Ion-Trap Technique

When a picture tube has to be replaced, or even sometimes when a new set is being installed and set up, finding the proper position for the ion-trap magnet is a haphazard and often time-wasting procedure. The adjustment can be simplified greatly if the ion-trap assembly is started about one-half inch from the base of the tube, with the magnet itself in line with the socket keyway. While this positioning may not result in perfect adjustment, it will be close enough so that the optimum point can be found quickly from this starting point.



CRT Filament Checker

Many times before putting together the simple testing device described here, I found it difficult to determine whether the picture tube filament was truly open, or whether it was simply the socket that was defective. Simply connect two leads to a No. 44 panel lamp mounted in a suitable socket. Insulated leads are used, but the ends away from the socket are stripped bare so that they can be used as prods.

If the crt filament fails to light, I remove the socket from its base and insert the prods of the test lamp quickly into the filament connections. If the lamp lights, the crt itself is the source of the trouble. This compact tool may be carried easily on calls. The system really pays off in time saved that would be spent in pulling out and setting up a meter to make the same test.

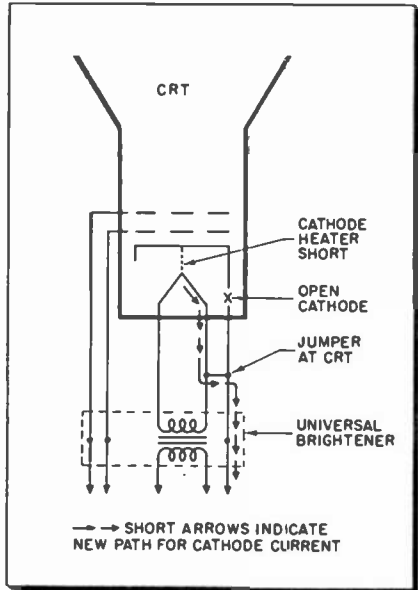
Saving a CRT

Some time ago a customer's set developed a heater-cathode short on the picture tube. Such a crt can be continued in use if a way is found to prevent the cathode from being grounded by the short, through the grounded side of the filament supply. This is done by using an isolation transformer between the crt filament and the filament supply. In this case, the set was restored to normal operation with the old picture tube still in use by means of a universal pix tube booster or brightener that had a separate primary and secondary.

Recently, the set lost its raster completely. High voltage was normal. However, while measuring the picture tube's bias, I accidentally had my test prod short the cathode to the heater. Strangely enough, this caused the picture to return.

Some thought on the subject led me to the following conclusion: now

the cathode was open, but cathode current could flow through the pre-existing cathode-heater short. With the external short in place, cathode current could flow to its normal return, as indicated in the accompanying diagram. Since either open cathodes or cathode-heater shorts



CRT with cathode-heater short and open cathode is restored with xformer and jumper.

separately are rather common pix tube troubles, it is logical to assume that they sometimes occur simultaneously.

In cases where the symptoms indicate an open cathode and the customer is unwilling to pay for a new tube, it is suggested that an isolation transformer be installed and that the cathode be shorted to the heater with a test prod or screw driver. If this experiment restores the picture, the full condition and the cure are both obvious. A permanent jumper from heater to cathode, as shown, will put the tube back in operation.

Neck Shadow Remedy

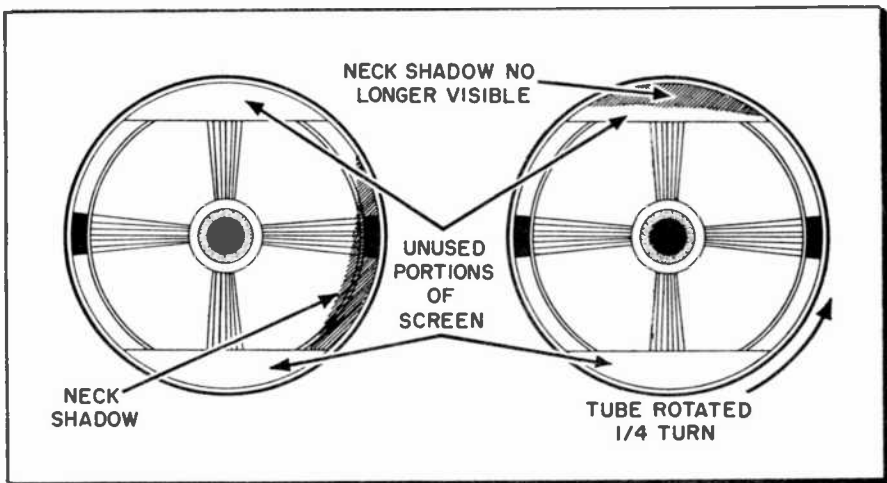
Many cases of picture tube neck shadow can't be completely removed by the ordinary methods, such as deflection yoke positioning, adjustment of centering magnets, focus coil positioning, and correct ion-trap magnet settings. These unremovable neck shadows are most often caused by slight irregularity in the construction of the picture tube itself, with the electron gun structure being out of alignment with the tube neck. Where round picture tubes are in use, there should be little difficulty in eliminating a shadow due to such a defect.

Assume that the shadow is evident in a portion of the screen as shown to the left in the accompanying illustration. Rotate the tube about a quarter of a turn one way or the other, so as to place the portion of the screen most subject to shadow in the normally unused area above or below the picture. Other controls may then be adjusted for best picture. If some shadow still exists, turn the tube either way until it disappears. Sometimes it will be

found that better results can be obtained by using the bottom of the tube in which to "lose" the shadow instead of the top, or vice versa. If no change can be achieved at all with this method, at least one other objective is accomplished: this would tend to establish the fact that the picture tube itself is not the cause of the neck shadow. To achieve proper adjustment, it is often necessary to lengthen the second-anode lead so that the tube can be rotated to best position.

Test CRT Yoke Support

I have always had trouble holding the yoke coil against the test CRT on the service bench. I have seen many ideas on this and have tried them all but this, in my opinion, is the best. The clamp shown is a wooden clothes pin, used by telephone men and electricians for holding cables while connecting and soldering. The opening is about the same size, when closed, as the neck



Easy cure for neck-shadow problems due to inherent gun misalignment works on round pix tubes.



Large wooden clothespins, such as used by electricians and linemen may be modified to support both the yoke and test CRT.

of the tube. It is made of hard wood and the spring tension is about right for holding the yoke without breaking the neck of the tube. Enough of the clothes pin sticks out past the yoke to serve as a rest for the CRT, and in most cases just at the proper angle. If desirable two clothes pins may be used to prop up the tube at other angles. They can be easily modified to suit most situations by cutting down, or by adding small rubber tack bumpers to the ends. If the opening is too large, it can be built up with felt, if it is too small, or if spring tension is too great, the opening can be enlarged and then lined.

Beam Aligner

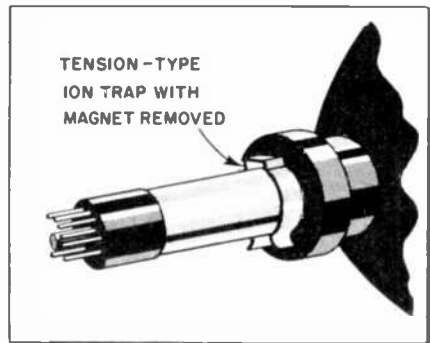
It may be noticed that on some non-ion trap tubes, another magnet, similar in appearance to the ion trap, is used. It is a beam alignment magnet and should not be confused with the ion trap. Its function is to ensure that the electron beam follows the path most conducive to highest picture quality. When replacing a non-

ion trap CRT equipped with this magnet:

1. Try the new tube without the magnet.
2. If objects appear to be smeared or fuzzy, focus may be improved by using this magnet.
3. To adjust the beam magnet, place and adjust in the same manner as an ion trap. Try to eliminate smear or fuzziness especially in those areas where there is a sharp transition from black to white.

Yoke Clamp

When working with a test CRT on the bench it is very aggravating to have the yoke continually slip down the neck. I have tried various clamps to hold the yoke against the test CRT flare, but found them all inadequate or too time consuming to put in place. After some experimenting I finally found an ideal yoke clamp as follows: Remove the magnet from a



A deflection yoke can be positioned against the flare of a test CRT without slipping, by using an ion trap as a clamp.

tension-type ion trap. This tension clamp can then be clipped on the test CRT neck behind the yoke—and then pushed up against the yoke, as shown.

The clamp does the job very well and can be installed in only a few seconds.

CRT Warning

TV receivers with series heaters are not new. But recently some manufacturers have made one important change that may have escaped the attention of many technicians.

On older series string sets accidental burn-out of a CRT heater was minimized by inserting the CRT at the end of the heater string. Recently, the trend has been to move the CRT further up on the string. The first change placed the CRT before the tuner tube heaters to reduce 60 cycle pick-up by the tuner. With this arrangement there was still little danger to the CRT heater as it remained near the low end of the string, as illustrated.

More recently, however, the CRT

heater is being connected toward the high end of the string, as shown at left. Consequently, accidentally grounding some point on the heater string can easily blow the CRT heater, since the voltage on one side of the heater may be as high as 65 volts in some sets.

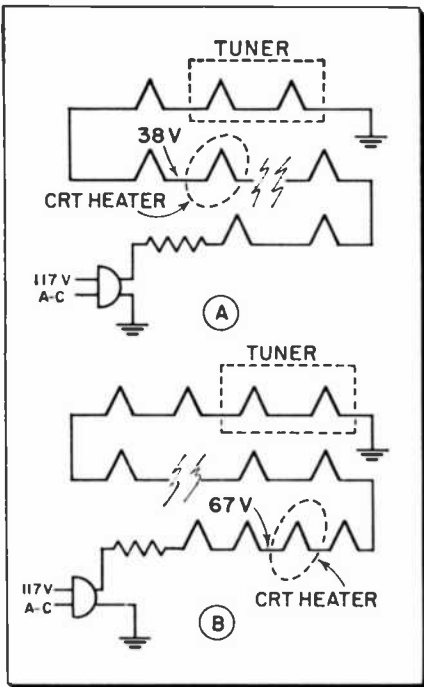
Because of this design trend, a misplaced or accidental ground could prove to be quite costly.

CRT Measurements

When voltage and resistance measurements are to be made at the CRT socket and an adapter is not available, I have found the following method to be quick and easy. Cut or scrape a small amount of insulation on the leads going to the CRT socket. It is a good idea to stagger and position these openings in the insulation to avoid contact with each other, or other parts of the chassis. Clip the leads of a VTVM or VOM and take a reading on the ohms scale, to be certain that a good contact has been established. Switch to the proper voltage scale, turn on the set and take the readings.

Another advantage this method offers, is that the CRT socket may be disconnected, in a parallel heater string set, to note changes of voltage. Troubleshooting procedure is greatly facilitated, and should help the technician localize troubles in and around the CRT area.

A reasonable amount of care to prevent nicking or cutting the conductors should be observed. A couple of turns of insulation tape should be applied to exposed wire after the tests have been completed. Needle-pointed probes may be used to puncture the insulation, and thus partial stripping is avoided. Ordinary straight pins may be used and the meter's leads clipped directly onto them. If this last method is used, make certain that a good electrical connection is established.



(A)—The CRT has better protection if placed near the low end of the heater string. (B)—When placed near the high end, an accidental short increases danger of a CRT burn-out because of higher heater voltage.

Pix-Tube Seat

When it becomes necessary to carry a crt, the top surface of a baby's bathinette makes an excellent seat. It will absolutely protect the face from being scratched.

If such a seat is not available, one can be made up easily by stretching some light canvas material over a wooden frame and tacking it down on all four sides. The actual size of the canvas used is 32 in. by 22 in. The wooden frame, which is 30 in. by 20 in., is made up of lumber 3 in. wide. With the full weight of the picture tube on this cradle, there will be no contact between the canvas and any flat surface on which the cradle is placed.

Boosting Soft CRT's

When one filament booster is used to restore brightness to an aging crt, it is often not sufficient if the tube has become too "soft." A simple method of achieving enough improvement to extend the life of the picture tube is to put two crt boosters in series temporarily. This will give the filaments approximately 3 or 4 additional volts. It is not advisable to leave the two connected any longer than is necessary to bring about the desired improvement. Then one of the boosters is removed. We have found that this procedure straightens out most of the very soft picture tubes.

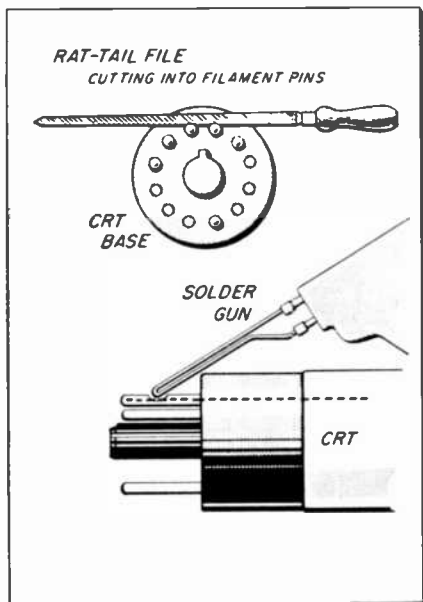
CRT Heater Repair

A high resistance solder joint frequently occurs on CRT pins 1 or 12, causing the heater to open. In some cases we have found new CRT's with insufficient solder or cold joints in the pins—rendering the tubes inoperative. The tube, regardless of age,

may be perfect in every respect but lack of heater voltage has made it a useless dud.

After trying many soldering methods we found the following procedure to be the most effective:

Using a small fine-cutting rat-tail file and holding the heater pins



CRT's with cold-solder filament connections can be permanently saved by baring the pin's heater wires before soldering.

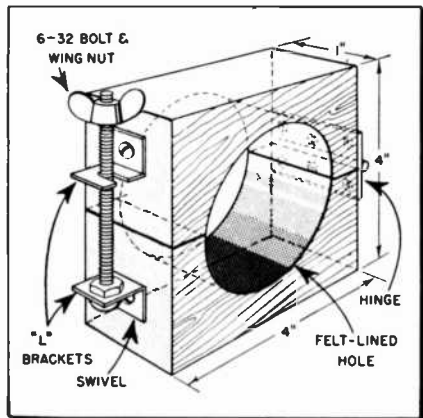
firmly with long nose pliers, carefully file into the heater pins to a point where the wire protruding from the glass bulb are exposed.

File the wire itself slightly—just enough to produce a clean raw surface. Apply a small amount of rosin core solder to the exposed area with a soldering iron, allowing solder to flow into the opening until the area is just filled.

When the job is done in this manner there is little chance of a second failure because of a poor joint.

Yoke Support

The problem was to make the yoke stay firm against the bell of the 8XP/8YP test CRT. I solved it by devising a neck stock block. The device is made out of a piece of fairly hard wood about 4" square and 1" wide. Find the center of the



Stock block supports yoke on test CRT.

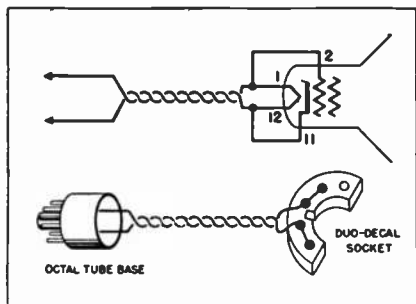
4" square face and drill a hole slightly smaller than the test tube neck diameter. Then cut from side to side and through the center of the hole as shown. Mount a 1" hinge so that the device can be opened and closed. Fasten two 1" angles on the side opposite the hinge. Tighten the upper angle but not the lower one. The lower angle should be free to rotate around its mounting screw. Before mounting the top angle, cut a slot from the hole to one of its sides. Insert a 6-32 machine screw through the bottom angle and lock it with a nut.

Add a wing nut, and line the opening with a piece of felt or cloth. The wing nut can be loosened and swung aside to open the block. The block can then be mounted around the neck of the tube. Use common sense when tightening the wing nut.

Excessive pressure can do damage. If it appears to be too hazardous, a rubber band slipped over the angles can be used instead.

CRT Rejuvenator

This CRT rejuvenator may be used with any regular tube checker. The same voltage used to energize the filament also appears between the grid and cathode of the CRT. Grid current will flow during the positive alternation. The duty cycle is sufficiently short to prevent damage to these elements. The only parts required are a CRT socket, and about 6 feet of 2 conductor wire. Wiring is self explanatory. Operation is simple.



CRT rejuvenator.

Tubes may be rejuvenated in the set or on the bench. Connect the 2 wires to the filament terminals on the tube tester, and the socket to the CRT. Apply the following voltages, for the approximate time as indicated: 12.5-v. for 20 seconds, and 10.0-v for 20 minutes, or less. The leads going to the tube checker may be connected to an old tube base, and plugged into the checker.

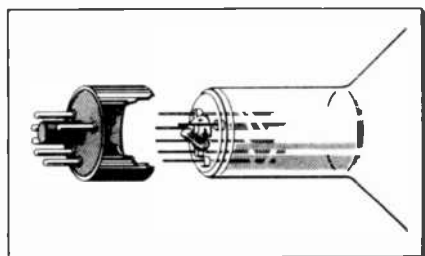
• *Another servicer has submitted the following item dealing with this same subject.—Ed.*

Instead of using the tube checker, which may not be available when in

the customer's home, merely hookup a pair of clip leads between the CRT and the filament supply. One lead from pins 1 and 2 to one side of the 6.3-v. filament supply, and the other lead from pins 11 and 12 to the other side.

CRT Base Replacement

I have fiddle-faddled with CRT bases trying to get them back on the neck of the tube when they have inadvertently broken off. I have tried cardboard templates and extension



Window formed in base of CRT to inspect connections and facilitate replacement.

wires. When I did succeed I had no confidence in the electrical connection, not being able to see if the leads had tacked on to the base pins. To save time and patience, clean out the base, remove the solder in the pins and break away a portion of the base opposite the area where the pins are located. A pair of diagonal cutters can be used to carefully chip away the material. It is now possible to see the leads and guide them accordingly. Solder and check the connections. The base can then be cemented to the tube. If not too much material is chipped away, there will be sufficient area to establish a firm support. A layer or two of tape will cover the opening, and reinforce the base connection.

Base and Rebase

As a result of heat, age and handling, tube bases become separated from their glass envelopes and electrode leads. It's easier to get a Camel (African or North Carolinian) through the eye of a needle than it is to get all of these errant wires back into their proper base pins at the same time. Loss of time and patience often dictate junking the dismembered tube. But with CRT and other expensive tubes and tubes for which no replacement is available, I use this shop kink. Shorten leads to approximately half the original length and form a small hook on the end of each lead. Connect 10" lengths of hookup wire to these leads using a hook joint. Solder and if desirable use spaghetti. Thread lengthened leads through the appropriate pin in the base. Keep the joint as small as possible and pretin the wire to facilitate soldering into the tube base. Use glue or cement, slide tube base home, bend wire over pins, clip excess and solder.

CRT Spots

Most spot eliminator circuits for receivers with magnetic-focus type picture tubes utilize a switch in the brightness control circuit to defocus or extinguish the beam when the receiver is turned off. Occasionally the technician gets a request to eliminate this spot or afterglow on the screen of a receiver which does not have the spot eliminator switch. Connect a 500 megohm resistor between the second-anode lead and the chassis. In most cases the trouble can be eliminated without taking the chassis out of the cabinet.

Some of the picture tubes used in the latest TV receivers are of the straight-gun type (do not use a beam bender) and have a high-capacity rating. These two characteristics increase the need for observ-

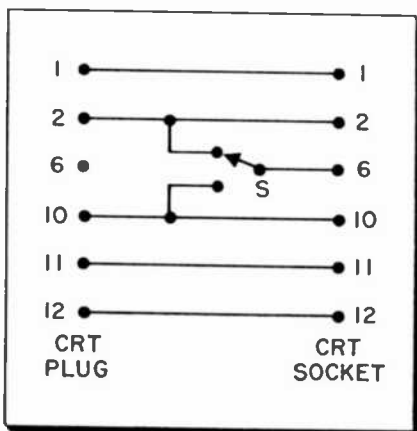
ance of correct service procedures at all times while checking or repairing the receivers. It is especially important that the sweep circuits should never be disabled while the picture tube is in the circuit, or damage to the phosphor screen may result. The screen damage may appear as a burn or a chip in the phosphor and will usually be located near the center of the screen. The damage can occur in twenty or thirty seconds and therefore does not allow for the margin of error in service procedures which could be tolerated with the older picture tube types. The overall improved characteristics of these new picture tube types result in greatly improved performance, and it is therefore desirable to use them. Since the necessary service procedure includes standard practices normally recommended for the service of all receivers, no new problem is presented. However, turn the set off before pulling tubes in the oscillator or sweep circuits of the chassis. This includes other tubes which might disable the oscillator or sweep circuits (damper, sync, or control tubes).

Do not unplug the yoke from a chassis while the receiver is turned on. Disconnect the second anode lead (high voltage) and discharge the second anode of the picture tube to ground before turning on a receiver which has the yoke disconnected or removed from its normal position on the picture tube neck. Do not trust to luck in switching tubes. Picture tube damage could develop during the short time required for the tube to be replaced and heat up to its normal operating condition.

CRT Focus Checker

Many manufacturers use a jumper strap on the CRT base for focus adjustment. This jumper is placed between pins 6 and 2 or between 6

and 10, whichever provides best focus. The change in focus in each position of the jumper is usually quite small, and selecting the best location of the jumper is difficult as the set is shut off during the jumper



A low-cost time-saving device selects proper CRT pin for focus jumper strap.

change. By constructing the unit shown (see above), the best position of the jumper can be readily determined as both jumper positions can be tried with a flick of the switch. The cost of construction can be made very low by using a discarded CRT brightener. The switch positions should be marked with the respective CRT pin numbers.

Burned Phosphors

Whenever a fixed test pattern such as is produced by a color-bar generator is used for testing a color TV receiver, care should be taken to prevent damage to the phosphor coating on the kinescope. When the receiver is on test for a considerable period of time, with color bars, the brightness and color controls should be set for a low level of brightness to pre-

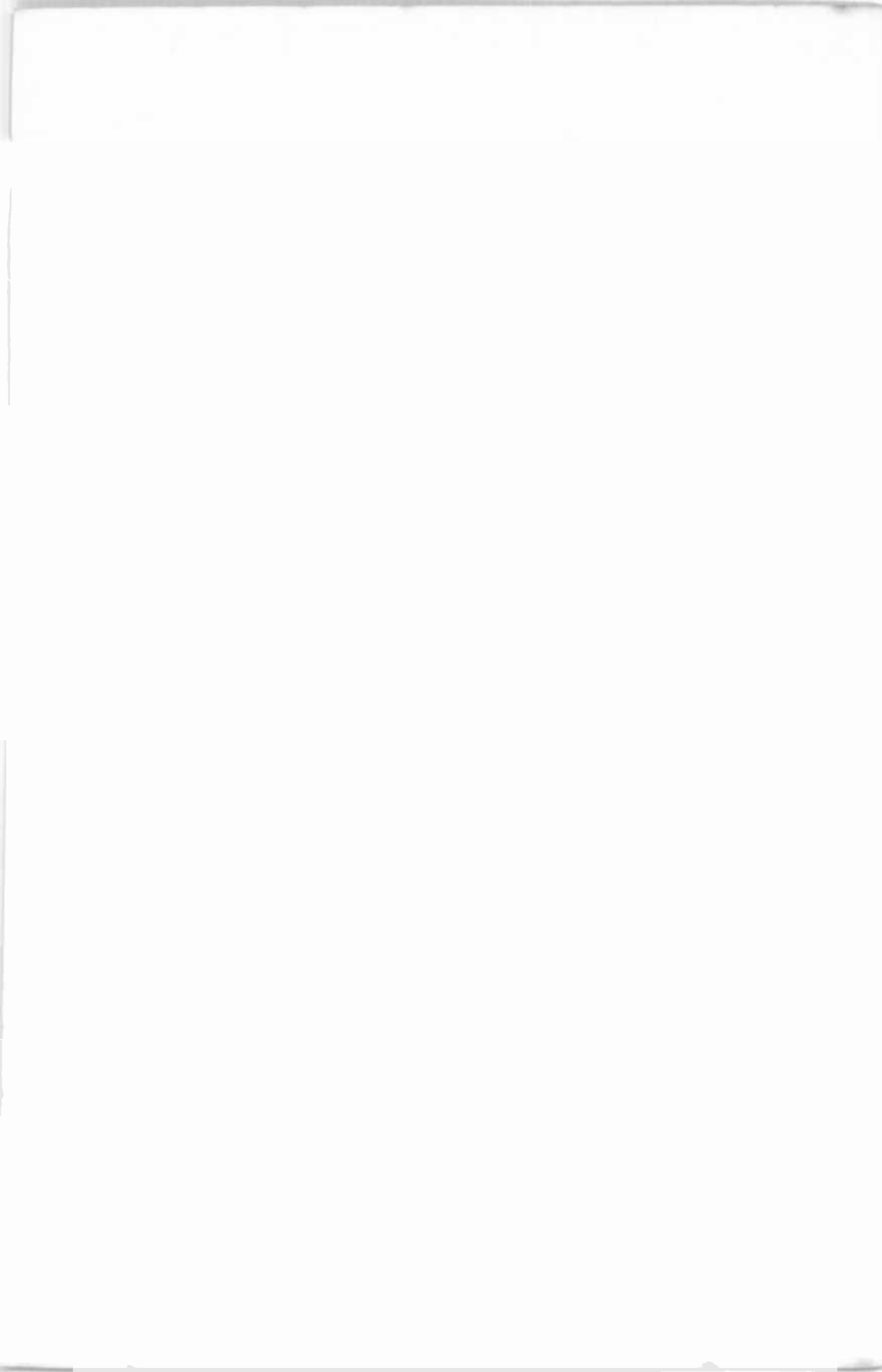
vent "burned in" bars on the face of the CRT.

Normal usage of the tube has the effect of aging the phosphors so that they are less susceptible to burns from a stationary pattern. It is recommended, therefore, that new tubes should not be operated with a fixed pattern of high intensity for more than 15 minutes. In the event that a kinescope has a burn in a localized area it can normally be scanned off in a few hours. This may be done as follows. Tune in a strong b&w signal

from a TV station and turn up the brightness and contrast controls. Adjust the vertical hold control until the picture rolls continuously.

Faulty CRT Prongs

I frequently find poor connections on the pins of picture tubes, especially filament pins. Inserting a piece of fine wire in the pin when resoldering establishes better contact, eliminating this trouble completely.



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