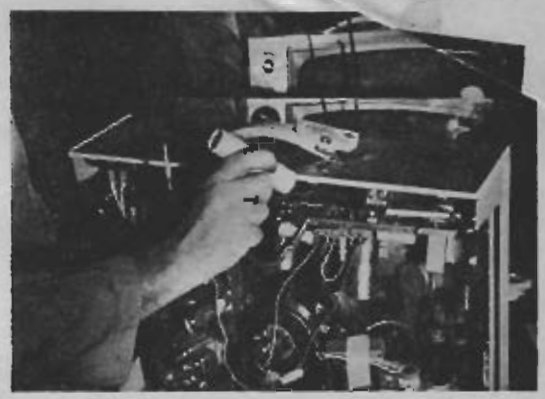
COPING WITH TV's No. 2 BAD GUY



By ART MARGOLIS

WHEN a TV set is on the blink, chances are good that a tube is to blame. If not, it probably is a power-supply capacitor—whether the TV is color or B&W, tubed or transistorized. So if you're quick on the draw at troubleshooting filter capacitors you'll be able to knock off a large percentage of TV repairs.

The only service equipment you need is a spare filter capacitor or two. Let me show you how simple it really is with four case histories from my notebook.

The first victim seemed to be in pretty bad shape. It had no sound or picture although the heaters of the tubes lit up. Its owner wrung his hands fretfully as I looked over the tubes.

Since there was no action in the TV at all the trouble had to be in a circuit common to all the others. Since the heaters were working, it looked like the culprit was in the B+ line from the power supply (Fig. 1). If the B+ voltage is not present at the plates of the tubes they will not operate even though the heaters are lit.

In transformerless TVs like this, the 60-cycle, 117-VAC house current is rectified and doubled to positive, rippling DC. Then the DC is passed through a filter network to remove the ripple. In order to get the high B+ voltage without a transformer, this type of supply relies on a large capacitor—say 150 μf, 150 V—in series with one side of the line.

Should it open, the B+ is stopped dead and all activity ceases. This is such a common occurrence that I carry a spare capacitor with me in addition to tubes.

The fix is easy. I locate the oversize troublemaker and snip the wires, making sure to note which one went to the plus end and which one to the minus end. Then, leaving the old capacitor in place, I mount the replacement nearby and attach the leads, taking care to observe polarity.

In this case, the TV resumed normal operation. The owner gave me that "Oh, thank you, dear Dr. Gillespie" look and I wrote out the bill.

Another case concerned a shrunken picture. All four sides had pulled in from the edges of the screen and the sides of the picture were not straight but curved. In addition, there was a loud hum in the sound.

Weak B+ will reduce the horizontal and vertical deflections and shrink the picture. Unadulterated weak B+ will do this evenly—the sides of the picture remain straight and there is no distortion in the sound. When open filter capacitors lower the B+ voltage they also allow DC ripple into the B+ line. The ripple appears as bending in the picture and hum in the sound.

The cure is fairly easy. Locate the filter capacitors and bridge them one by one with a spare. When you bridge the defective capacitor the condition will improve somewhat even if the replacement value is not exact. I took the one I carry with me (50 μf, 450 V) and, being careful to observe polarity, started testing.

The culprit (the third one I tried) turned out to be a 120 μf, 150 V. When I replaced it with a new one of the same value, picture and sound popped back to normal.

The next case involved one of those barely portable portables with a transformer power supply. The transformer makes B+ by stepping up the 117 VAC to about 350 VAC which is then rectified to DC and filtered to take out the ripple. In this type, the rectifier

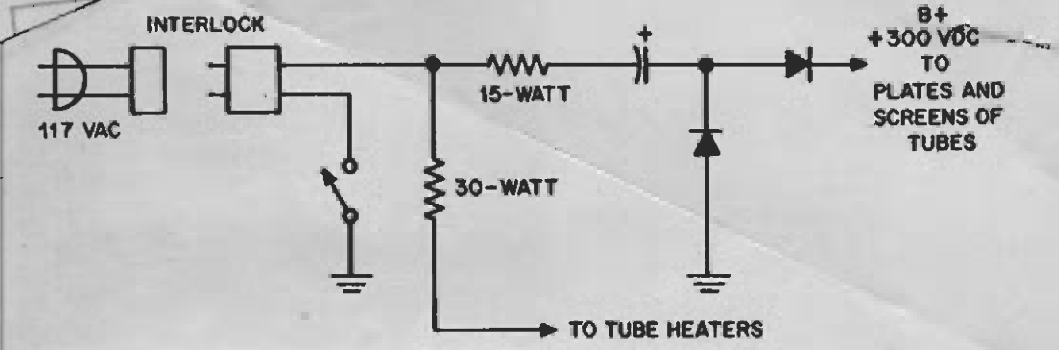


FIG. 1-POWER SUPPLY

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usually, is full-wave, changing the 60-cycle input to DC with a 120-cycle ripple. When the filters do not do their job the 120-cycle ripple gets into the B+ line. That puts a 120-cycle component into the picture and the sound.

I turned on the portable. The screen had two thick black bars going horizontally through the picture. They were 120-cycle bars. If they had been caused by 60-cycle ripple there would have been only one.

I took a 50 μf, 450 V filter capacitor and attached the negative end to the chassis. When I turned on the TV again the hum bars returned and I began touching the plus end of the filter methodically to the plus end of each of the TV's various filters. Nothing happened, except a bunch of loud pops as the filter charged and discharged. Still, it had to be a filter. Filaments in these circuits receive 60-cycle AC so a heater-to-cathode short in one of the tubes would have produced a single bar in the picture.

I began another tack. Bridging works only when a filter opens or has a high-resistance short. A capacitor with a low-resistance short must be disconnected to relieve the short be-

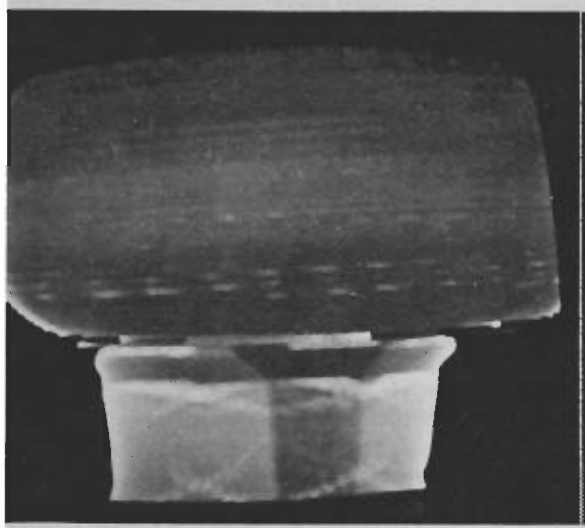

Fig. 3—This weird mushroom-cloud effect in picture is caused by open filter in the power supply.

Fig. 4—Commonest TV filter-capacitor breakdown makes picture shrink, pull and develop hum bars.

Simplified diagram of a transformerless power supply in Fig. 1 relies on capacitor for voltage doubling. Full schematic would show additional filter capacitors following diodes. Where multiple-capacitor cans are used, code markings at terminals may not look exactly as they do in the listing on side of can (Fig. 2). Positive connections are keyed with these symbols; common negative (ground) is unmarked.

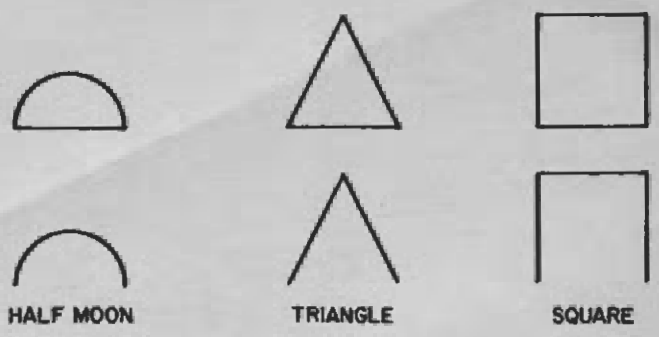

FIG. 2 – MULTIPLE FILTER MARKINGS

fore you bridge in a new capacitor. It's tedious, but it's the only way.

The fourth one I bridged did the trick. The 120-cycle hum disappeared. The bad capacitor was a 50 μf, 375 V. I installed a 50 μf, 450 V to give the replacement a little better safety tolerance.

I once took a service call from a boxing promoter. His trouble looked something like 60-cycle hum except that it was turned 90° and appeared as a vertical band (Fig. 6 shows the reverse effect, with a faulty filter in the vertical output). As he demonstrated his problem to me the promoter gave the set a sharp left hook to its side. The trouble cleared. Then he walked around and gave the set a right cross. Back came the banding.

This, too, was a filtering problem. The B+ to the horizontal circuits was not being filtered and each horizontal line was affected.

I began bridging the filters one by one. Some of the filter capacitors were in cans. You'll find two, three or four separate filters all in one can. Their positive terminals are separate but they share a single negative terminal—the can itself. You must be careful of this type.

Inside the can, the capacitors are separated by insulators. If the insulation should de-

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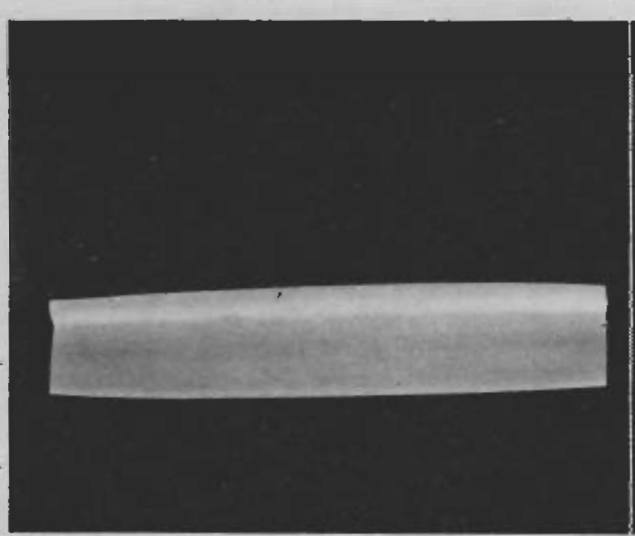

Fig. 5—The classic 60-cycle hum bar that you can hear as well as see is caused by a shorted filter.

Fig. 6—Banding is across screen for filter short in vertical output (up and down if in horizontal).

Kit Report

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transformer using a station as a signal source, and aligning the multiplex circuit with a stereo station as the signal source. No hitches here but we found that instrument alignment of the ratio detector later did lower distortion slightly.

Here are some of our measurements of the tuner portion of the receiver. IHF sensitivity: better than 2 μv (this met Heath's specs). 1-kc stereo separation: better than 35db. 15-kc stereo separation: better than 15db. (Separation figures were limited by our instruments.) Mono total harmonic distortion: 0.4 per cent. Stereo total harmonic distortion: 0.9 per cent. Mono signal-to-noise ratio: 60db. Stereo signal-to-noise ratio: 55db. The mono frequency response was down 1.5db at 20 cps, flat from 40 cps to 5 kc, down 1db at 8 kc and down 3db at 15 kc. The stereo response was down 1.5db at 20 cps, flat to 8 kc, then dropped 3.5db at 15 kc. AM performance met Heath's specs.

The amplifier portion of the receiver performed just as well. In all measurements both channels were driven. This is what we found: total harmonic distortion at 50 watts (rms) output was never greater than 0.2 per cent in either channel from 20 cps to 20 kc. Clipping level for each channel was 55 watts.

The frequency response at 1 watt (both channels) was down 0.5db at 10 cps and virtually flat out to 50 kc, where it dropped only 2.5db. The signal-to-noise ratio was 69db at the *aux* inputs, 68db at *phono*.

But enough of figures. Let's take a look at how the AR-15 performed. Our builder is located 50 mi. from New York City, out on Long Island. Simply touching antenna terminals pulled in almost every major FM station in New York. After we attached an 11-element VHF-TV/FM antenna, stations came in all over the dial from Connecticut, Poughkeepsie, N. Y. and New Jersey. The AR-15's sharp selectivity meant no difficulty tuning closely spaced stations.

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teriorate, the capacitors will short to each other. Bridging won't help in these cases because the short is internal and you won't be able to bridge out the short. Disconnecting the filters one at a time also won't help. You must disconnect all of the filters at the same time and substitute new filters for them. This is tedious but purely mechanical.

That's what I did with the filter cans when I found my routine bridging didn't help. Being careful to keep the wires together I labeled each with the appropriate symbol from the filter can (Fig. 2). I connected test filters to see if the trouble would clear. It did. So I replaced the entire can.

When I brought back the set I told the promoter it was fixed.

"I'll tell you when it's fixed," he growled, giving it a jab on the right side. The TV wobbled on its stand but the picture held.

"Okay, it's fixed," he said.

Do Stereo Records Last?

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however, still is a subject of argument. Under optimum conditions, with tracking force precisely adjusted, it might create somewhat less wear than a conical stylus tip. When the adjustment is off it might do more harm.

Another point affecting record wear was raised by a recent letter from W. L. Ferrigno, Manager of Product Planning and Market Research at General Electric's Consumer Electronics Division. He says, "In extensive laboratory tests it was found that polyvinyl chloride and polyvinyl acetate, the materials used in making LP records, suffer from a lack of resiliency. It takes about 16 hours for a record groove to recover from the expansion force generated by the stylus and until it returns to its normal configuration the walls are extremely brittle and subject to chipping if the record is played."

Findings of the 1959 test pointed to the same conclusion. Recovery of groove walls was demonstrated several times when a record was evaluated immediately after a test run and then again some time later. Conclusion then, as now: A record played once and put away for a day will last longer than one played over and over, even though total number of plays is the same.

All of which goes to show that no matter how the equipment changes the rules of record care remain the same. And if discs don't seem to last longer maybe it just proves your ear has improved with the gear.