INTRODUCTION

This booklet is written to relay to builders of TV tubes much of the knowledge we have gained through many years of experience. It is nevertheless hardly possible to cover absolutely every point that may arise.

We therefore suggest that the book be thoroughly read, understood and followed and that to the knowledge gained from these instructions each operator adds from his own experiences.

HANDLING OF TUBES

It is important that tubes be handled with care at all times to protect the tube and yourself.

To pick up or carry a tube, one hand is placed on the neck near the cone. The other hand lifts the tube by the face. When the tube is set down, it is set down GENTLY. Never directly on the glass face but always on some clean cushioning material. Never rotate a tube without lifting it off the bench to avoid scratches. Never bump the tube with another tube or any metal.

INCOMING DUD INSPECTION

Tubes should be inspected for the following characteristics:

(1) Screen Quality
(2) Scratches
(3) Cracks

Inspection For Good Screen Quality:

The tube should be inspected for blue spots, green spots, pin-holes, dag, ion burns or burns caused by poor magnet setting. If any of these are found, the tube should be rejected.

Inspection for Scratches:

The face should be inspected for any scratch. If the scratches are few, not too deep, or not too long, the tube may be processed. If in doubt, it is better to reject the tube.

Inspection for Cracks:

Any duds that have cracks around the anode button or in the cone or face proper should be rejected.

Should a tube have a crack and be evacuated, extreme care is necessary to prevent an implosion. The tube should be cut as described later, and the electron gun removed, since the tube is not dangerous when at atmospheric pressure.

WASHING OF DUDS

After the tubes have passed a visual inspection, any protective coatings, labels or plastics that may have been used in the installation of the tube in the set should be removed. It is recommended that the outer dag pattern be retained because of the fact that so many tube types requiring so many unique patterns are on the market and it is best merely to follow the outline of the tube as originally dagged. It is imperative that no tubes be processed with any foreign material on the glass, especially the face, other than dag, because after baking the foreign material is harder than ever to remove. Another important factor to remember is that any material around the anode button will definitely cause erratic and erroneous readings in final test.

During the washing, care should be taken that no water is splashed or used near the base due to the fact that the basing cement absorbs water. If the basing cement absorbs water, it is likely to release the water into the tube after the neck has been cut. Water may cause spots on some screens.

CUTTING OF THE NECK

After cleaning the tube, the neck of the tube should be cut with the hot wire cutter. It is important that a straight cut be made for it is easier to make a straight splice on the renecking operation.

If a partial vacuum is still present in the tube, it is very possible that the screen adherence would be lost and a blown screen would result. Because of this, the common practice is to allow air to enter the tube slowly after the hot wire cut before the gun is removed.

To make the cut, first make a light scratch on the neck of the tube with a glass cutter or file. The location of the scratch is not important. Usually it is made at least one inch above the base.

To make short gun tubes from those with longer necks, cut as close as possible to the base. Then the gun can be added without adding a neck.

Place the wire of the cutter around the neck so the scratch bridges the gap between the wires. It is important that the wires be in the scratch to obtain a straight cut. For beginners it is best to place the wires in position before turning the unit on. However, with practice, the cut off box can be turned on before placement of the wire, thus saving time.

Make sure the wire does not get red. Move the handle back and forth slightly (on the axis of the neck) to force the hot spot on to the glass. Watch to make sure the wire is not lifted by the wire holding screws. This condition is avoided by making sure the handle is perpendicular to the neck.

A short time after the unit is turned on, a "crack" will be heard. Begin counting slowly to about 10, then release the handle. The crack should continue all the way around the neck. The count will vary with the individual. Once learned, always count to the same number at the same speed.

Place the tube face up to allow air to seep into the tube. Do not turn the face down at any time after the cut, since glass particles may damage the screen.

RE-DAGGING THE NECK

Barium oxide, the white flaky material in the neck is very undesirable and can also cause a very short life tube if left in a finished new tube. For this reason a 10% ammonium bifluoride solution is used to wash out the old getter deposit.

After this, it is important that several rinses of clean deionized water or distilled water be used to wash away the residues of the ammonium bifluoride. Several fresh rinses are recommended. This means that the water must not be allowed to become a weak solution of ammonium bifluoride which will happen if the device used for rinsing is dunked back into the rinse water. This can also be avoided by changing rinse water several times a day.

After a thorough job of washing, followed by drying with paper towels, the tube should be dagged according to whether a magnetic or electrostatic gun will be used. It is important that the window openings specified be in the correct position with relation to the anode button and that the correct lengths be used. The dag length must be long enough to cover the entire snubber assemblies, not only the top portion of the snubber. It is poor practice to allow tubes to go into production with only the top section of the tripod used as the contact for the anode section. It is also important that the dag does not extend past the anode of gun. If it does, the high voltage may arc to the lower voltage grids.

It is important that the end of the dag line in the neck be as "clean cut" as possible. Uneven surfaces or points can cause stray emission or discharges that are not desirable.

After the dag has been applied, it is of utmost importance that it be dried. The dag should be as thin as possible to permit rapid drying, but not so thin it will run or streak. A heavy deposition will cause flaking and gassy tubes because of improper outgassing of the heavy dag. This operation while it appears to be relatively simple is of utmost importance, for finished tubes can be rejected because of poor contact between the dag or anode section and the gun when it is sealed in.

SEALING

In sealing, it is important for the operator to first make sure that the cut of the dud is straight and clean. If the necks on the tubes are not cut properly, it is recommended that they be returned for recutting. At this stage, the sealer must be alert to make sure that the dagging of the neck corresponds to the physical dimensions of the gun to be used. It is important that the windows in the dagged area correspond to the location of the getters on the gun so that during getter flashing the getter flash is visible to the operator. Because of the electrical operation of the gun, it is imperative that the extended glass be straight and no "dog-legging" takes place lest ion burns occur on the screen during operation. It is important that the springs on the gun be positioned so that a good physical contact is made on the dag.

A gas and air pre-annealing and annealing fire is used to anneal a wide area in the neck above and below the splice to prevent fire checks. The sealer must take care not to heat any section of the neck with an oxygen fire without taking precautions to anneal that section.

When finished, the seal should be clear and smooth without too much distortion.

During gun sealing, it is important that the gun structure is not handled with bare hands since human oils and other foreign matter will definitely cause leakage and, in some extreme cases, low emission due to cathode poisoning. Also, one should check to see if the gun is bent in relation to the button. If so, the gun should be rejected.

The gun should be annealed until the stem holder is warm to the touch. The oxygen flame should be applied slightly above the middle of the button with the fires hitting the sides of the neck. As the glass drops, the fires are brought closer together, in toward the seal, and down slightly below the center of the button. When the glass breaks away the lower edge of the button is heated until it is rounded off. At this time a bright red line usually appears. The fires are then brought up to force the neck glass to flow around the upper edge of the button. When a faint full red line appears, the seal is complete except for annealing.

For 110^{0} tubes, the fires must be sharper as mentioned above. Success of this seal is extremely dependent on accuracy of aligning the tube and gun. Alignment is hard to judge at first since the gun and the neck are both rotating. Even if they do not rotate on center, the distance between the inside of the neck and the edge of the button must remain constant. The seal is made as described above except the annealing is done with gas only. After the tube has annealed for one or two minutes, quickly remove the stem holder. The tube is then taken out of the machine and placed on the bench with an annealing tube around the neck.

Sometimes the glass will not split easily. In this case, one can take a pair of tweezers and pick the glass apart.

PUMPING AND CATHODE CONVERSION

Theory:

The mechanical pump removes about 90% of the air in roughly five minutes. However, it can not possibly remove the remaining 10%. A diffusion pump, which curiously can only operate in a vacuum, removes the remaining 9.99% of the air. Even with today's advanced technology and superior pumps, 100% perfect vacuum cannot be produced.

In order to achieve the high vacuum necessary, the glass must be heated to around 385°C to drive out the gas from the glass. In addition, the G_1, G_2 and the cathode must be heated to prevent their emission of gas during the life of the tube. Since the elements are enclosed by glass and in a vacuum, it is necessary to resort to a bombarder (or high power radio frequency generator) to obtain the required heat.

The cathode is made of barium carbonate (B_2CO_3) a chemical which is easy to handle. However, it does not emit electrons readily and must be converted to a barium oxide compound by applying heat, both by bombarding and by operating the filament in a prescribed manner. The heat drives off Carbon Dioxide (CO_2) leaving Barium Oxide (BaO).

Since pumping is so extremely important, every operator should make sure his pumps are in top notch condition.

It is recommended that if an operator feels that he cannot follow a pumping schedule as designed, that he omit processing the tube lest it become a rework immediately.

The operator should examine a tube for cracks, especially around the seals, and for a properly installed gun. He should next locate the filament leads - these are the ones which have "fingers" inside the tube - and bend the ends toward the tubulation to mark them. The remaining leads are twisted together to keep them out of the way.

The tube is positioned on the bench with the button out so that when it is rotated 180° and placed in the oven, the filaments are then easily accessible, i.e. at the front of the oven. Load the tube into the oven.

The tip off coil is adjusted so that it is about 1/8 inch below the button seal. The wires of the gun should not touch or be inside the tip off coil nor should they touch the RF coil. The "O" ring is tightened. The filament leads are connected. Finally, a check should be made to make sure that:

(1) O-Ring is tight
(2) RF coil is in correct position
(3) Tip-off coil is in correct position
(4) Filament clips are connected to filament pins
(5) Turn on mechanical pump. After mechanical pump stops gurgling, turn on diffusion pump. Turn on water (top only) for diffusion pump.
(6) Turn on gas, light oven burner and close oven door.

DO NOT OPEN DOOR UNTIL TUBE IS FINISHED

Once the above has been done, the tube is processed according to the tube type:

90^{o}.	.385°C
100^{o}	.400°C
Metal & Color. .	.350°C
Bonded Face. . . .	90°C

It is extremely important that the G_1 structure and also G_2 be the two elements that should be uniformly heated during the evacuation cycle. To emphasize this: it is the G_1 structure that has to be outgassed the most thoroughly because of the carbon and other deposits that do deposit on the grid due to its enclosed type of construction. It is probably the only element other than the cathode and heater that runs hot during the life of the tube.

The operator must be familiar with the tip-off coil before the diffusion pumps are turned off since the tip-off time changes slightly during the life of the coil. Although the diffusion pump water flow must be checked periodically, the water from the lower housing should be warm (like a baby's bottle).

It is also important for the operator to note the small idiosyncrasies that arise in pumping a tube such as ascertaining that the tube does not touch bare metal when positioned in the tube holder.

When pumping metal tubes, it is a good policy to use protective coverings such as aluminum foil to try to hold the coefficient of expansions between metal and glass to the same constant. Do not exceed 350°C when pumping metal and color tubes. Again, a reminder to make sure that the "O" rings in the ports are good and not filled with pieces of glass or other foreign material that make a good vacuum seal impossible.

(Check "O" rings every 2 days). Other problems will arise in spite of all these "watch" steps and a certain amount of vacuum technique depends upon the alertness, the knowledge, and the care of the operator.

It is common vacuum knowledge that every pump seems to develop certain characteristics that require watching and make it mandatory that the operator be alert at all times to watch for these characteristics.

Removing the tube is the reverse of putting it in.

When the backer (mechanical) pump is turned off, the system should be opened to air immediately. Failure to do so results in mechanical pump oil backing up into the diffusion pump. This is caused by the air trying to get to the vaccum. In order to do so, it must push oil ahead of it; hence, "backing up."

The tipped tube may be removed by filing a nick in the cane portion of the tip off. It is then broken by a sharp tap on the end of the tube. The tip-off is then covered with Glyptol as an insurance against a slight leak.

The operator should make sure that his tip-off is of the type that presents a solid cane type of seal. If inverts or "suck-ins" appear, the tip-off can crack at any time because of the fact that it is under strain. The ideal tip-off has a small bump (or bubble) in the center. An invert appears when the tip-off is not hot enough or on long enough.

"Suck-ins" are air bubbles inside the glass bubble. These weaken the tip-off and are the result of a tip-off on too long or too hot. An additional problem is the glass bubble may fall to one side when it gets large resulting in a crack in the tubulation slightly above the tip-off.

The operator should learn whether the tip-off coil was heating non-uniformly or whether the coil was off center with relation to the exhaust tube causing the undesired result. It is not recommended that tubes continue in production if the tip-off is not good.

After the tube has cooled, the tube is ready for getter flashing.

Should an implosion occur, the oven should be shut down. It is imperative that this be done quickly to prevent the pumps from pumping air. Then the door can be opened to check the RF coil. MAKE SURE THE RF IS OFF! If the coil is shorted, the coils are spread apart or the gun is removed. Now the oven may be cleaned. Before removing any glass, cover the "O" ring and blow around it to stop any glass from getting into the pump. During cleaning, place a tipped tube in the diffusion pump to make sure no glass or foreign material falls into the pump.

GETTER FLASHING

While getter flashing seems to be a menial operation, it perhaps is of greater importance than most of the other operations described previously. It is almost impossible to obtain the vacuum necessary to make a good tube through the mechanical means described in pumping, therefore to reach the maximum vacuum we do have to depend on a getter flash.

The getter flash is a chemical process whereby the pure barium liberated in its vapor form has a great affinity for all free oxygen, carbon dioxide and other gases other than the inert gases. It is for this reason that we desire a getter flash as big as physically possible to give us the adsorption rate that is possible through a large getter flash area. It is also important that when flashing getters that the getter ring not be burned in half with the RF coil; for then, large amounts of gas will be liberated and metallic barium may be loosened which may fall on the screen thus contaminating it.

It is important that the getter be brought out over a period of approximately 30 seconds to give the greatest gettering effect. This technique is one that has to be properly understood in order to make sure that the utmost good is derived from the getter flashing operation.

It is wise to flash the tube in a canvas bag.

First heat is added slowly. When the getter becomes bright red-orange, it should begin to "flash." Flashing appears as a sudden darkening of the getter ring. This darkening is the vaporized barium depositing on the side of the neck and is actually silver. The flashing should be prolonged for a least 20 seconds but never longer than 45 seconds, since there is danger that the tube will crack due to excessive heat. Should this happen, cut the neck immediately.

The getter should be bright silver. Any other color is an indication of poor vacuum.

If the getter does not flash, the tube may have a poor vacuum. If the getter is discolored, the tube has definitely been flashed in air. Check the gun to see if it was bombarded in air in order to determine if the tube was cracked while in the oven or afterwards.

BASING

The wires should be cleaned with a fine emery paper to remove all oxide from the leads. Be sure to blow all loose emery dust off the button. The tubes should be based with the proper amount of cement in the base to assure good adherence to the glass. It is recommended that 1/8 inch of paste cover the entire circumference of the base. It is essential that the operator align the base so that it is straight.

After the tube has been based, the next operation is to solder the pins. File the ends flat with a file to obtain a clean surface for soldering. Be sure the pins are down so the filings don't get into the base and cause shorts. In order to make a good capillary type of solder joint, it is recommended that a non-acid and non-corrosive solder be used. This is important since any bakelite impregnated with acid will cause constant leakage and result in shorts through the bakelite base. It is important to touch the wires and the pins with a flux so that a good solder joint can be make. A solder similar to the 50-50 type should be used so that resins or acids do not impregnate the bakelite during soldering. A desired solder connection is one with a true radius across the pin or at least a filled pin but not one with excessive solder that increases the pin diameter to the point where the socket will not fit over the base.

AGING

Aging is strictly a process of further carrying out the cathode breakdown and stabilization. This is accomplished strictly by heat applied to the cathode by operating the filament. It is important therefore that the proper voltages and the proper time constants be adhered to very closely. It is worth remembering that while perhaps 1/2 volt does not seem to be a big factor, it must be remembered that perhaps this can cause as much as 50 to 75 degree temperature change in the cathode structure. A small variation of voltage may make the difference between a good and a bad tube.

TO OPERATE THE BOMBARDER

NOTE: All switches...variacs and meters are read from left to right.

1. Switch # 1 up
2. Switch # 4 up
3. Adjust variac # 2 to cause meter # 1 to read 10-1/2 volts.
4. Switch # 1 down
5. Switch # 3 up
6. Place clamp on foot switch.

NOTE: The above steps have prepared the bombarder for bombarding the electron gun...Now proceed with the following steps.

1. Switch # 5 up for 3 minutes.
2. Switch # 5 down
3. Adjust variac # 1 to cause meter # 1 to read 5-1/2 volts for 3 minutes.
4. Switch # 5 up for 3 minutes.
5. Switch # 5 down
6. Adjust variac # 1 to cause meter # 1 to read 7-1/2 volts for 5 minutes.
7. Adjust variac # 1 to cause meter # 1 to read 9 volts for 5 minutes.
8. Adjust variac # 1 to cause meter # 1 to read 12-1/2 volts for 1-1/2 mins.
9. Adjust variac # 1 to cause meter # 1 to read 9 volts for 5 minutes.
10. Switch # 1 up
11. Switch # 3 center
12. Switch # 2 up
13. Adjust variac # 2 to cause meter # 1 to read 8 volts for 4 minutes.
14. Turn off switch # 1, # 2, # 4, # 6.
15. Turn off variac # 1, # 2.
16. Turn on water for quick cool down coil.
17. Place canvas bag on top of oven
18. When diffusion pump is cool, the tube may be removed from the oven. Turn off switch # 7 before removing tube from oven.

TO FLASH THE GETTER

1. Switch # 1 up
2. Switch # 4 up
3. Make certain the clamp is not on the foot pedal
4. Switch # 5 up
5. Adjust variac # 2 to cause meter # 1 to read 10 1/2 volts

TO AGE THE TUBE

1. Switch # 1 down
2. Switch # 3 down
3. Adjust variac # 1 to cause meter # 1 to read the desired voltage

The following is an example of the procedure to follow on 600 MA 6.3 volt tubes.

FILAMENT VOLTS	TIME
6.3 volts	1/2 min.
13.0 volts	1 1/2 min.
9.0 volts	28 minutes.

WARRANTY

Marinite Oven	1 Year	Sealing Machine . . .	1 Year
Mechanical Pump. . .	1 Year	Sealing Machine Variac .	90 Days
Diffusion Pump . . .	1 Year	R. F. Bombarder . . .	90 Days

CRT Equipment Co., Inc., warrants each picture tube rebuilding plant to be free from defects in material and workmanship. When properly used, cared for and maintained, we will repair or replace, at our option, and install upon return to us any mechanical or electronic part which proves, upon our examination, to be defective under normal use.

This warranty does not apply to damage in transit or damage caused by misuse, negligence or accident, to alterations or repairs outside the factory, nor does it obligate us to assume any labor or transportation charges in connection with the replacement of parts claimed to be defective.

All parts claimed defective must be returned to the factory for inspection, repair or replacement, with transportation charges prepaid.

This warranty specifically excludes mechanical pump oil, diffusion pump oil, or solvents for cleaning the mechanical pump or diffusion pump.

We reserve the right to make changes in design and changes or improvements on our product without imposing any obligation upon ourselves to install the same on products heretofore manufactured.

The warranty is null and void if any parts other than original manufacturers parts are used.

Our obligation, under this warranty, shall be limited to the replacement to the original purchaser.

There is no other warranty expressed or implied. CRT Equipment Co., Inc., shall in no event be liable for consequential damages.

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Position the center flame and the flame closest to you into the center of the point of seal. Hold the carbon paddle on the left side of the point of seal and place the rubber hose in your mouth.

When the glass begins to melt, push the reneck glass up to join the tube neck. Make certain you raise the reneck glass enough to completely eliminate any holes.

Pull down on the reneck tool slowly, and push the torch assembly to the rear until only the edge of the flame nearest you is touching the back side of the glass.

Blow a small amount of air into the tube to produce a very slight bulge on the neck.

Hold the carbon paddle against the bulge to make the tube neck straight.

Turn off sealing flames, and move the torch assembly in to cool the tube for about 2 minutes, with a small gas fire.

Turn off gas and stop machine.

Remove reneck tool and lower center rod.

NOTICE: The operator must remain alert while sealing the tube to make sure the top of the reneck glass and the bottom of the tube neck are equally heated. The flames should be positioned closer to the bottom of the separation, otherwise the tube neck will get hot faster due to heat rising.

TO INSTALL THE NEW ELECTRON GUN

The filaments of the electron gun should be positioned on the side of the tube opposite the anode.

The electron gun should be pushed up into the neck of the tube until the button of the gun is slightly below the bottom of the neck glass.

Place the proper gun mount tool on the center rod, and slowly raise the center rod until the gun mount tool is touching the button. Make certain all wires go down into the gun mount tool.

Determine the proper neck length (remember to subtract 1 inch) and measure and mark the tube neck.

Raise the center rod until the button reaches the mark.

Position the top of the glass catcher 3/4" below the bottom of the reneck glass.

Start the machine slowly and check the button to make sure it is rotating in the center of the neck glass.

Light the gas fires only, (about 1/2" in length) and position the flames at least 1" below the button to warm the electron gun. Permit the tube to warm in this manner at least 3 minutes.

Adjust the flames on the torch assembly for sealing. The adjustment is made as follows:

1. Torch assembly should be moved as far to the right as possible.
2. Torch assembly should be brought forward.(toward operator).
3. Add gas (flames should be about 7 to 8 inches in length).
4. Add oxygen (total flame length should now be about 6 to 7 inches in length).
5. Raise torch assembly to the point of seal (the button).
6. Move the torch assembly in until the flame closest to the neck glass touches the edge of the neck glass. The glass should be permitted to warm in this matter for at least 1 minute.

Position the center flame and the flame closest to you in the center of the point of seal.

Hold the torch assembly in your left hand and release both thumb screws. Be careful to keep your flames in the center at the point of seal.

When the neck glass melts and drops down to touch the button the torch assembly should be lowered at once to the bottom side of the button. The torch assembly should then be moved in toward the bottom of the button until the tips of the torches are about 1 1/2 to 2 inches from the point of seal. Oxygen should be added to cut the melted neck glass.

After the neck glass has been cut the torch assembly should be moved back to the right and the oxygen decreased and the tube permitted to rotate 2 to 4 revolutions to complete the seal.

After the seal is completed, turn off the oxygen and reduce the gas to approximately a 1/2" flame. Position the flame about 1" below the seal and permit the tube to cool in this manner for at least 3 minutes.

Turn off the gas on the torch assembly and stop the machine with the tube saddle opening forward. Lower the center rod and remove the tube from the sealing machine. Set the tube on its face and place annealing cover over the tube neck to permit the tube neck to cool slowly.

DELAMINATING PROCEDURE

COLOR TUBES

1. CUT TUBE NECK.....RELEASE VACUUM.....REMOVE THE OLD ELECTRON GUN.

2. PLACE THE TUBE INTO THE OVEN (FACE UP) AND BRING THE OVEN TEMPERATURE UP TO 210°-220°C., PERMIT THE TUBE TO HEAT AT THIS TEMPERATURE FOR 30 TO 45 MINUTES.

3. REMOVE THE TUBE FROM THE OVEN AND PLACE FACE UP IN THE LAMINATING TABLE. <u>NOTE:</u> (IF THE TUBE HAS TAPE AROUND THE EDGE THIS SHOULD BE CUT ALL AROUND THE TUBE WITH A RAZOR BLADE OR OTHER SHARP INSTRUMENT).

4. PRESS THE SPATULA BETWEEN THE FACE PLATE AND TUBE TO BEGIN DELAMINATING. AS THE AIR ENTERS THE OPENING, LINES WILL APPEAR ACROSS THE FACE OF THE TUBE. ON SOME TUBES IT MAY BE NECESSARY TO INSERT THE SPATULA INTO DIFFERENT LOCATIONS AROUND THE TUBE TO COMPLETE THE DELAMINATING. AFTER THE FACE PLATE HAS BEEN REMOVED THE SPATULA CAN BE USED TO REMOVE MOST OF THE RESIN.

NOTE: CLEANING AIDS FOR REMOVING THE REMAINING RESIN ARE:

RAZOR BLADES
STEEL WOOL
CLOTH TOWELS
SOAP & WATER
COLD STRIP (OBTAINABLE FROM MOST CHEMICAL SUPPLY CO'S).

DELAMINATING PROCEDURE

BLACK & WHITE TUBES

1. CUT TUBE NECK.....RELEASE VACUUM.....REMOVE THE OLD ELECTRON GUN.

2. PLACE THE TUBE INTO THE OVEN (FACE UP) AND BRING THE OVEN TEMPERATURE UP TO 210-220°C. PERMIT THE TUBE TO HEAT AT THIS TEMPERATURE FOR 30 TO 45 MINUTES.

3. REMOVE THE TUBE FROM THE OVEN AND PLACE FACE DOWN INTO THE LAMINATING JIG. CLAMP INTO PLACE.

4. WITH THE SPATULA, DIG AWAY THE RESIN FROM ONE CORNER OF THE TUBE. DIG OUT ABOUT 4 INCHES ON EACH SIDE OF THE CORNER AND DEEP ENOUGH TO GET A WIRE BETWEEN THE FACE PLATE AND TUBE FACE.

5. USE A WIRE 5 OR 6 FEET IN LENGTH AND USING A SAWING ACTION, PULL THE WIRE THROUGH THE RESIN. THEN REMOVE THE TUBE FROM THE FACE PLATE. MOST OF THE RESIN CAN BE REMOVED WITH THE SPATULA OR OTHER SCRAPING INSTRUMENT.

   NOTE: CLEANING AIDS FOR REMOVING THE REMAINING RESIN ARE;

   RAZOR BLADES
   STEEL WOOL
   CLOTH TOWELS
   SOAP & WATER
   COLD STRIP (OBTAINABLE FROM MOST CHEMICAL SUPPLY CO'S)

NOTE: SPECIAL ELECTRON GUNS ARE AVAILABLE FOR REBUILDING BONDED FACE BLACK & WHITE PICTURE TUBES WITHOUT REMOVING FACE PLATE.

TO REPLACE FACE PLATE

1. After the tube has been completely processed and tested, the face plate and tube face should be cleaned.

2. Place a length of 3/16" X 1/4" weather stripping around periphery of the tube face plate...See figure 1.

3. Place the tube face down on the prepared face plate. Make certain the tube is centered on the face plate.

4. Now the tube and face plate can be bonded together using glass bonding material. The glass bonding material should be placed in the space, all around the tube, between the face plate and the tube.

5. To complete the bonding process, a length of Scotch brand tape 1 1/2" wide, should be placed around the tube. Permit about 1/4" to overlap the face plate and the remaining pressed against the tube.

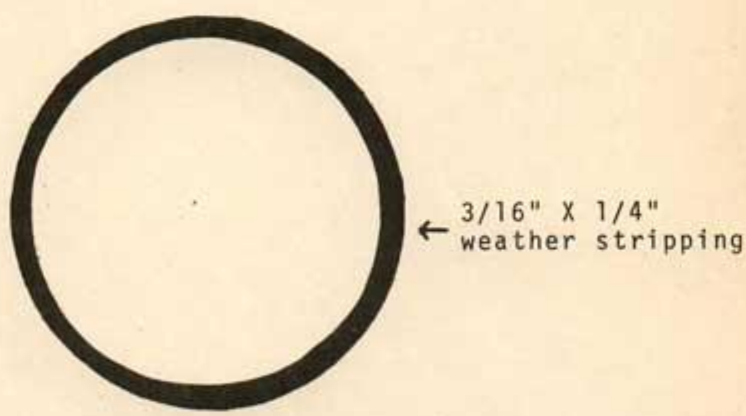


FIG. 1

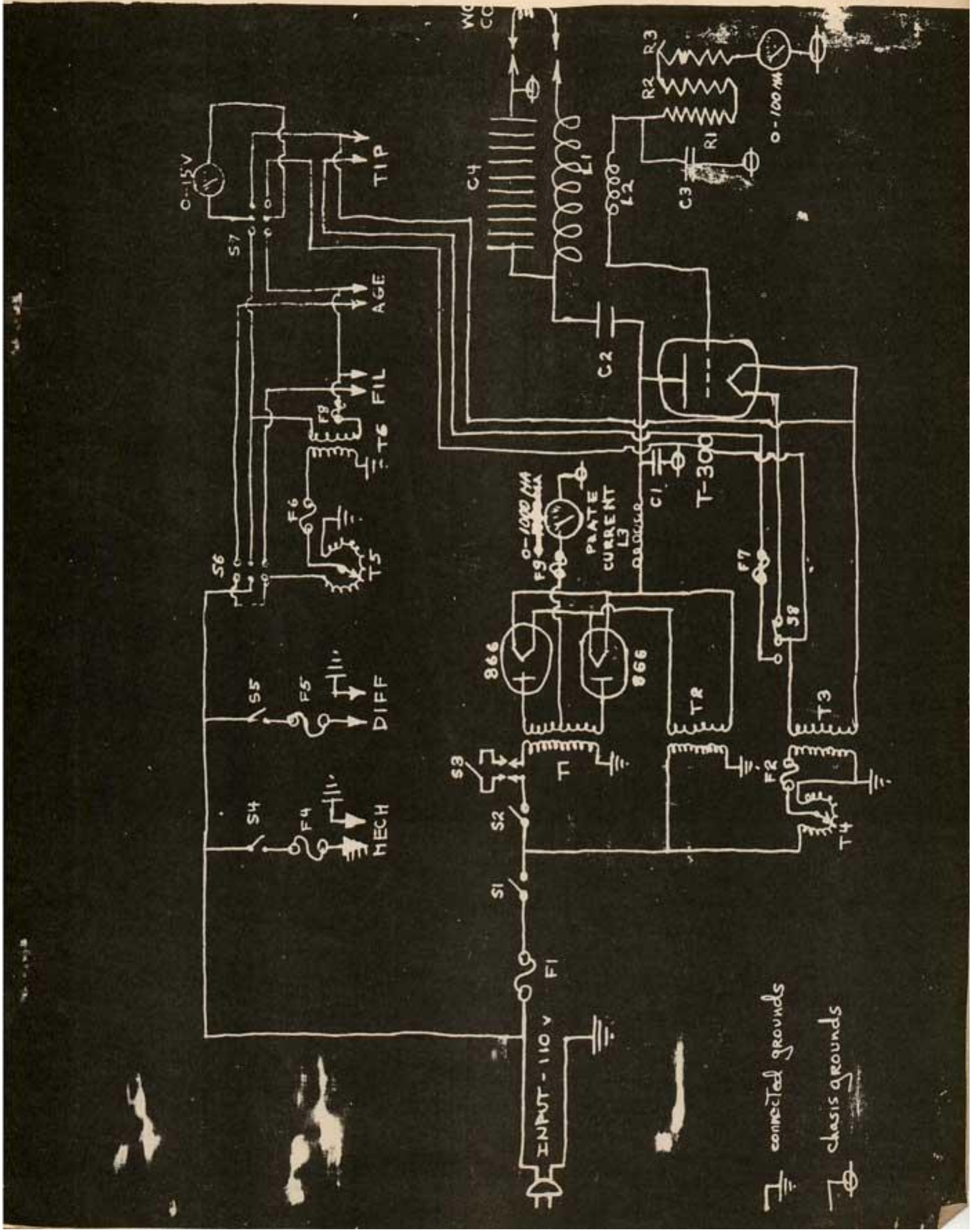
Source of supplies:

1. Weather stripping...Local hardware store
2. Glass bonding material...General Electric Co. # RTV-108
3. Scotch brand tape... 3M Company

INSTRUCTIONS FOR CLEANING DIFFUSION PUMP

1. Disconnect all water lines, vacuum hose, heater, etc., from the pump.
2. Remove the pump from the oven.
3. Remove the hex screw from the bottom of the pump and drain the old oil out. Remove and discard the old copper washer.
4. Replace the hex screw, and pour 1 1/2 pints reagent grade benzene into the top of the pump.
5. Turn the pump up and down to permit the benzene to clean the inside of the pump.
6. Remove the hex screw and drain the benzene from the pump.
7. Repeat steps 4, 5, and 6 two more times, using new benzene each time.
8. Repeat steps 4, 5, and 6 three times using 1 1/2 pints new reagent grade acetone each time.
9. Mount diffusion pump back on to the oven, and reconnect all water lines, vacuum hose, heater, etc.
10. Remove the hex screw from the bottom of the pump and install a NEW copper washer. Replace the hex screw and tighten it enough to flaten the copper washer.
11. Install a new o-ring, replace the port spacer and locking clamp.
12. Place a tip-off stem into the top of the diffusion pump and tighten the o-ring.
13. Put High Vacuum silicone grease at the vacuum hose fittings.
14. Turn on mechanical pump and diffusion pump. DO NOT TURN ON WATER.
15. After 15 minutes turn off diffusion pump only.
16. When the diffusion pump is cool, turn off the mechanical pump and remove the tip-off stem.
17. Pour 100 CC Diffusion Pump oil into the top of the diffusion pump.
18. Now, proceed to run tubes in the normal manner, except permit the first two tubes to run 2 hours longer, to break in the new oil.

A-9



Courtesy of Sandy LePort