



A tube is placed in the Windsor oven for baking. The temperature will be brought up to 240°F and evacuate the tube. This cycle normally takes two and one-half hours for a color tube.



Walter Zimmerman, one of Bud's supervisors, checks out tubes packed for shipment from the 350 tubes normally stocked.

most of the time. Presently, about 10 percent of his income comes from rebuilding color tubes but plans to expand that to 90 percent. "Color tube rebuilding will increase my gross income by three times with the same amount of help I have now," he indicates. "Our B/W tubes average \$14 while color tubes sell for about \$65. The difference in time it takes to rebuild the two isn't much—about an hour and a half more for color.

Rather than jump feet first into color rebuilding, Bud is hedging to see how his limited production goes first.

"Dealers are wary of shifting their business to a new man," Bud explains. "You have to prove you are going to be around and put out a quality product. Once you get their confidence and turn out quality tubes you've got it made."

In the rebuilding process, Bud can work with tubes ranging from 5 to 30in. He puts out only "Grade B" B/W tubes—ones which have had only the electron gun replaced—and guarantees them for one year. (A "Grade A" tube besides having a new electron gun also gets a new phosphor face and aluminization.) Dealers exchange rebuildable tubes for rebuilt ones. If the dealer's tube is unusable, he is charged extra.

Rebuilding Process

"There are about 14 steps in the tube rebuilding process," Bud tells

our ET/D reporter. "First, the tube is inspected with a 'black light' to see if there is any damage to the face. Chips, scratches, cracks or ion burns signal a dud. The tube is cleaned, slowly let down to atmosphere pressure and a new glass neck is welded on. We put the tube on a vertical lathe and make like an artisan glass blower and machinist as we weld the glass neck to the tube." He prefers the vertical lathe for gunning color tubes. "The vertical lathe is ideal," he says, "because the electron gun has to be perfectly aligned with the tube and when the tube is turning you can see small errors in the alignment you can't see as readily with a fixed apparatus. The lathe turns the tube while the flame is stationary, giving us greater control in the welding process. After that we apply a new inner dag—a combination of graphite and distilled water—then the electron gun is welded into the neck.

"The tube is then heated to 740°F in a special stainless steel oven—we have two of them to outgas the bulk aluminization and phosphor. During this 'cooking' process, the vacuum pumps take out the air.

"One of the most interesting parts of the rebuilding process," he continues, "is the oven action. A mechanical pump starts forcing air out of the tube until about 90 percent of it is removed. Then we throw a switching mechanism

putting the diffusion pump into action. The switching mechanism keeps air out of the diffusion pump and avoids burning the expensive (\$25 a pint) diffusion pump oil which runs in a vapor state. The pump uses about 100cc of oil at a time and uses the mechanical pump as a backer pump to maintain a vacuum on the oil reservoir. By adding the mechanical pump to the cycle we eliminate about 40 minutes from each cooking cycle and there is no cooling time needed. Without the mechanical pump it takes longer to preheat the diffusion oil." The pump evacuates the bulk initially enough to prevent diffusion oil oxidation, and in two shifts Bud can run about 20 B/W tubes through this process.

"Once the tube is under a vacuum," Bud explains, "it is 'flashed.' The flashing process vaporizes the barium inside the 'getter' by induction heating. If the vacuum is poor, the tube won't flash because barium won't vaporize at atmospheric pressure.

"We do this by applying filament voltage in large amounts. A tube that takes 6v is given a healthy 13½v for 1½min and 9v for another 28min. This cooks out any carbon dioxide in the barium carbonate cathode. After conversion, the cathode material is changed to barium oxide and is now considered a good emitter. After three hours of cooling, the tube is tested, an



Bud checks a rebuilt tube on his special test unit which indicates emission, shorts, leakage and gas content.



Video Electronics uses vans for delivery of rebuilt tubes to dealers within the city limits.



Bud's wife, Vivian, takes care of the office, answering the phone and processing orders.

outer dag is put on and it's labeled, boxed and ready for a dealer."

Production cost factors are \$1.50 per B/W electron gun and about one man-hour per tube. Color tube guns run about \$6.60 each. Bud sells the tubes for about 60 percent less than the price of a new one. Only about 2 to 3 percent of the tubes come out defective after processing and these are usually caught on the test run.

A color tube takes longer in the oven and on the lathe than B/W. This is because it has more glass mass—it takes longer to anneal the glass at the lathe and longer to cook it in the oven. At the beginning of the oven process for color, the tube is run for a half-hour on the mechanical pump and then to the diffusion pump for another half-hour before the full hour-and-a-half cycle is started. After the two-and-a-half-hour cycle, the tube is taken from the oven and a canvas bag is put over it to keep it from cooling too quickly and cracking the glass. The B/W cooking process lasts for about an hour.

Guarantee

Bud is so confident about the quality of his color production that he guarantees the rebuilt tubes for 18 months. He converges each color tube before sending it out. Currently, he's rebuilding about 20 color tubes a month. He plans to expand that to 50 a month, adding

about \$2500 more income per month to his shop. His ultimate goal in color tube work is 100 tubes a month. He says he can do the same monetary business rebuilding 50 color tubes as he now does rebuilding 200 B/W—without any increase in personnel.

Present and Future

Besides himself, Bud's personnel roster includes four employees and his wife, Vivian. She keeps the books and takes phone orders in the shop's 96sqft office. During the day, Bud has a plant manager and one driver/assistant. On the night shift he has a night supervisor and assistant. The crews get paid from \$1.75 an hour minimum to \$2.75 for plant manager. "As the business grows, so does the pay," says Bud.

"I have a training cycle here," says the 20-year Navy veteran, "the more you learn the more you get paid. There's no time requirement in any one phase of the operation. If a man catches on quickly and does a good job, he'll go right to the top." Bud still thinks Navy—he calls his shifts, "watches."

He cross-trains his men so if one is absent the other can handle the absent's man's area of responsibility.

Bud plans to activate a profit-sharing plan for employees earning \$3 an hour or more. He says the profit share will be about 2 percent of the monthly gross.

Bud has an attractive "anti-delivery" plan for his customers. If the dealer picks up his own tubes, 5 percent is cut from the price. Bud provides one-day delivery within city limits if the order is in before 12:30 p.m.

The shop has 1150sqft allocated to sales and stock storage and 1050sqft for working area. The business office commands a view of the entire retail area which takes up about 120sqft for selling and receiving picture tubes.

Contact Advertising

Bud has done little media advertising, relying mostly on monthly mailings to announce sales and discounts and for direct contact with dealers.

His most effective advertising campaigns have been the open houses he's held to give dealers the chance to come and get a look at his shop and its operation. "This particularly helped initially to gain their business," says Bud.

He conducts his business with the wholesalers on 30-day accounts. He has no credit policy for retail sales. "Future plans," he says, "call for just accepting bank credit cards and, of course, cash."

Bud Hycz spends a lot of time working with the Navy on defense systems, but explains, "I like to keep busy and I like running my own business and working for my country, too." ■