October 30, 1950

TRIP TO RAULAND CORPORATION - CHICAGO, ILLINOIS

10/26/50 & 10/27/50

We were very well received by Mr. Phillips and his staff. All information requested. Every courtesy was extended to us, and every member of the Plant was at our disposal.

Rauland are currently making approximately 2500 Cathode Ray Tubes per day. They are carrying inventories and are committed to manufacture some twenty-three different types (this includes variations between clear and dark, and clear and etched faceplates). This consists of approximately 600 per day 19" metal tubes (Zenith are pressing for greater deliveries on this type due to G.E. Syracuse failure to meet committments to Zenith on this type), 1000 per day 16" metal, 800 per day 16" or 17" rectangular glass and 100 miscellaneous types. Shrinkage on 16" rectangular glass was running approximately 20% at screen check, 20% at vacuum check and 20% at first test. Losses on metal tubes are running higher than on glass rectangular, the 19" metal tube currently running 35% losses at first screen check. Everyone was in agreement that metal tubes are more difficult than glass rectangular.

NEW SCREENING CONVEYOR

Metal tubes only were being screened on the new (Allied Steel Company - Detroit, Michigan) screening conveyor. This conveyor cost approximately $35,000 - installed in the Plant. It is approximately 40 feet between centers, uses 6 foot sprockets, and is wide enough to hold four 19" bulbs. The panels are spaced on 20" centers.

This conveyor is massive, is built like a railroad bridge, with heavy structural members and cross bracing. The complete conveyor weighs 50,000 pounds. It is supported on each side at approximately 4 - 5 feet intervals with approximately 6" x 8" columns. These columns are not anchored directly to the concrete floor but terminate in an enclosed mounting box which floats the entire conveyor on either spring or rubber shock mounts. These do not make the conveyor subject to vibration, probably due to its tremendous weight. The foregoing may be important considerations, but the main distinction of this screening conveyor is in the drive mechanism.

Credit for the development of the unique drive is given to Mr. J. J. O'Callahan, Rauland Corporation's Chief Engineer. Allied Steel carried out his recommendations in this respect. Mr. O'Callahan felt that the jumping of the conveyor was due to the difference in the coefficient of friction between the moving and stationary system, and the cyclic transfer from kinetic energy of motion to the potential energy of a twisted drive shaft. He felt that if the twist of the drive shaft could be limited to an amount that would not allow the system to stop moving, and therefore prevent the stationary friction coefficient from playing a part, the jumping would be eliminated. The final solution, described below, is said to equal a six foot diameter shaft in the amount of torsion allowed.

Both front and rear axles are stationary. The sprockets ride on bearings around the stationary shaft. At the pouroff end each 6 foot spracket has a 6 foot Herringbone gear fastened to it with bolts in its outer circumference. Synchronization between the two independent gear sprocket combinations is maintained by the Herringbone spur gears approximately 6" diameter which are on a common shaft. This shaft is center driven by another Herringbone reduction drive 6" diameter to 12" diameter. The 6" diameter drive Herringbone gear of this combination is fixed to the output shaft of a double worm reduction unit mounted to the conveyor. This is belt driven at approximately 5 - 10 rpm from a drive unit which is bridge mounted from the floor, and independent of the conveyor. This drive unit consists of motor - reeves type speed control - double worm reduction box. Thus the high frequency vibrations are isolated from the screening conveyor. These vibrations can be felt in the bridge mounting but cannot be felt in the conveyor proper. This separate bridge mounting was an afterthought - installed as a result of tests conducted in Detroit when the machine was first set up.

The panels are cast aluminum - solid top - each panel is supported by a ball bearing wheel between the panel and chain. This wheel is on a rigid axle solidly connected to the leading edge of each panel and through a knuckle joint to the trailing edge of the preceeding panel. The chain drive is 2" pitch and was supported on skid rails on both top and bottom straightaways. The chain was covered, except at the sprockets, with an inverted channel, and was continuously lubricated with an oil saturated felt wiper approximately 2 feet long. The ball bearing support wheels were supported on a cam track on the bottom half of the pour off cycle, and the chain did not noticeably slip off the bottom sprocket teeth. The chain provided foreward drive only and was not used to support the panels.

This conveyor was operating very smoothly without any brake, and Mr. O'Callahan reported the only case of jitters was cured by oiling the chain, knuckle joints, and support wheels. Chain tension is maintained by a dead weight whose force is transmitted by a pivot arm to push the carriage holding the load end sprocket axle away from the drive end. The movement of this weight is restricted within narrow limits, but at the time of our visit it was riding free and no vibration could be felt in this weight.

The tube clamps on this conveyor were suitable only for metal tubes and Rauland were working with the Buck Engineering Company of New Jersey who were developing a new clamp which will cost approximately $30.00 per tube position. This will consist of one fixed and one toggle clamp with provision for variable spacing.

SCREENING

While the screen shrinkage on rectangular tubes was approximately 20% they had just recently recovered from an epidemic of bubble lines (similar to our scratched screens 551Y) which had caused screening losses to reach almost 50% about three weeks ago. They divide scratched screens into two categories - (a) when the scratch starts at the edge first uncovered and is somewhat wavy, it is said to be caused by bubbles.

If the scratch starts in the middle and is somewhat straight it is blamed on dirt or silicate crystals. Their main problem was bubble lines. They claim these are caused by small (1/64" diameter) air bubbles whose buoyancy is so slight that they are depressed below the surface by the surface tension of the water. These act like needle points to scratch the screen. The trouble has since cleared up by itself and the bubbles have also disappeared. They say the bubbles are a function of the oil content of the water, the oil running 2 ppm in the midst of their trouble and only 1/4 ppm now. This is oil in the water as received and is not added by their equipment. The quantitative oil determination is done by extracting the oil from five liters of water with one pint of ether. A qualitative analysis is performed by dropping crystals of camphor on the water. Oil will cause these crystals to dance. Clean water will allow them to float easy.

Metal tubes screened on the new dispenser are loaded approximately 20 feet from the end and have 15 minute settle plus 5 minutes for 135° pour off. Glass rectangular tubes are screened on their old conveyor, equipped with brake, and uses between 15 and 20 minute settle with approximately 4 minutes for 135° pour off. Glass rectangular are also screened and poured on tilt tables with from 9 - 15 minute settle, depending on operator speed. The same formula is used for all 16" glass rectangular screening, i.e. 6200cc cushion water + 95cc of 1.6% Barium Nitrate to which is added 4.4 gms 1619 phosphor, 90cc of 1:1 Ludox and enough water to make 2/3 quart. Hand dispensing from milk bottles is used throughout, spray tip for metal tubes, a straight through funnel for glass rectangulars. The cushion water is maintained 15°F below room temperature (room temperature is controlled - approximately 75°F) in order to get proper distribution on metal tubes. This same water temperature is used on glass rectangulars but is said to be unnecessary. No heat is used for any settling. The pour off water on both conveyors is cloudy blue in color but there is no definite gel noticeable.

The spray tip for metal tubes has much finer holes than any we have used. The rate of spray is much slower, and the powder mixture for this equipment has only enough water to fill the quart bottle 1/3 full. No water rinse is used with this tip but it is kept submerged in a glass of water to keep the holes from plugging.

Both the spray and straight through funnels have a 325 mesh screen in the top. This screen does not hold back any noticeable amount of phosphor probably because they wet ball mill their phosphor for one hour before using.

Hot air dry and light transmission check is used on glass tubes, vacuum dry and vacuum spark check used on metal tubes. Twenty-eight vacuum dry positions are available and the process is said to require 10 minutes. The vacuum is purposely restricted so as not to freeze some water by too rapid evaporation. Elaborate Kinney oil recirculating system has been installed, including an oil purifier and water remover as made by Hilliard Corporation of Elmira, New York, trade name, Hilco Oil Purifier.

Water and barium are metered by timed flow through a fixed orifice. Pressure is increased by pumps and then reduced and regulated by stainless steel body diaphram pressure regulators manufactured by A.W. Cash Company, Decatur, Illinois. The solenoid valve and orifice follows this regulator. To prevent erratic metering only one bulb at a time is dispensed from one regulator.

Inside painting is done at a much slower speed of rotation than ours, and with a smaller yield per operator hour. The holders for the rectangular bulbs on the paint chucks are the same as for these bulbs on the screening conveyor. Mr. Frank Zartler, Production Manager, has promised to send us a drawing or sample of this holder which appears to be easier to close and open than ours, yet hold the tubes as well. A long soft brush is used and the neck is so badly messed that it must be wiped every time.

All tubes are hot air dried after inside painting and then loaded on a Ross Oven similar to our #1. The speed of conveyor travel is equivalent to 155 tubes per hour on ours but because of a "plumbers nightmare" method of mounting tubes they get up to 235 tubes per hour, depending on type. The method of loading cannot very well be applied to our oven, as it depends on (a) no air dry in the oven, (b) a certain proportion of glass and metal tubes with sizes ranging from 10" to 19" including both round and rectangular and (c) the use of bulbs as ballast to give balance if this proportion is not realized. In this connection Mr. O'Callahan reported that 10" bulbs used as ballast began to break after their fourth or fifth time around and he believes repeated baking will eventually break any bulb. The Ross Oven control settings are: 150°C, 270°C, 350°C, 400°C, 210°C, 80°C total time in oven 69 minutes. They reach a higher temperature than Buffalo, but reach the peak at about the middle of Zone 4 instead of the beginning. Rauland's rectangular bulb losses are 2 - 2 1/2%. No claim is made on the bulb companies for credit on this loss and their records are not complete enough to show the difference between A.S.P. and Corning. Mr. O'Callahan said their next oven would be a radiant type, probably similar to one made by Selas for Sheldon Electronics. This oven is said to have less than 1% losses on rectangular bulbs. Bulbs come out of the oven very hot. They are unloaded by men, with gloves, and ride around the overhead conveyor to cool sufficiently for vacuum checking. This conveyor section is four loops and was installed purposely to give cooling.

Rauland have no intention of making any new aluminized tube types. They are making a few 10" and 12" aluminized for replacements but these are screened and filmed on tilt tables in a special "cats and dogs" screen room. These tubes are aluminized on the old bench aluminizer (the D.P.I. machine has been converted to a rotary vacuum checker - not quite ready for production use) and baked out in their original batch ovens, on dollys with a flexible air hose. Since the Ross oven has no air flush they must be done separately.

Vacuum check is done on benches and while they claim to have eliminated leaker trouble on rectangular bulbs by a change in port rubber, the only difference in the old and new rubber that I could see (we have had samples) or that they could point out was an outer rubber flange to bumper the port and reduce cracked neck and cracked flare losses. However, Rauland profess to have no trouble with leakers. It should be noted that they are using cold bulbs, are not running any significant number of aluminized tubes and are not yet using a rotary vacuum check machine.

Two G.E. 8 head 16 position Sealing Machines running at 60 per hour and 63 per hour and one 12 head 12 position Kahle Sealing Machine running at 100 per hour are doing the sealing. Their sealing MA believes it will be possible to seal at 100 per hour on the G.E. machines as soon as the whip during indexing can be eliminated. While the sealing seemed very good on the day we were there it seems to be a major problem. Mr. Bailey, Rauland Superintendant, was in Syracuse while we were in Chicago, ostensibly to investigate sealing techniques. They have recently made an improvement in sealing losses by eliminating all fires in the position after cut off on all machines.

They believe sealing losses have gone down since they started making and using their own stems. These are made on a Kahle Stem Machine. An important feature of this machine is that it flares the tubulation on the machine. This is done early in the cycle and is followed by more fires and then two press positions. This machine has approximately the same diameter as ours, but closer spaced and therefore more heads. A graphited oil is sprayed the tubulation flaring tool to prevent sticking. No carbon disulphide is used.

The Rauland gun is an exclusive Rauland development. It embodies the advertised ion trap indicator, which is Willimite (P1) phosphor sprayed on the gun to indicate when the ion trap magnet is not properly adjusted. It has however two other advantages - it does not use angle cut anodes or second grids, but instead uses components similar to our 10FP4 gun. The anode is offset from the second grid which seems to make up for the absence of the angle cut. This eliminates the need to locate the anode and second grid at pin welding. The second advantage to Rauland is that they consider that this gun design does not infringe on patents held by Sylvania and RCA for which they were apparently not able to procure license to use. They are using a cathode grid spacing of .008" which allows better control over cut off rejects and are therefore probably using a .036" diameter first grid aperture. RCA has been reported to be using this combination to insure good emission throughout life. This gun, and these spacings should be investigated by our Design Group and the advantage of pin welding without angle locating should be investigated to determine if it offsets the disadvantage of changing the glassing mandrel and fixture and the necessity to jig mount the top anode spacer ring at three degrees without the anode cylinder so cut.

Rauland have finally (after one year of work) succeeded in getting an automatic anode cylinder pin welder to work. This unit flattens a segment of wire, welds the wire to the cylinder and then cuts the wire. The flattening and cutting are done in one operation of a hammer die. The anode holder is a six position indexing table. Two pins are welded to the anode, the anode rolls on its own axis 180° - two more pins are welded and the turret then indexes to the next position. An unusual feature is that there is no mandrel inside the cylinder, the cylinder being pinched at both open ends to make contact and hold it in the turret. The unit was purchased for $10,000 from Tweezer Weld Company and when running will pin 1050 anodes per hour.

Rauland are exhausting on the DPI Inline Exhaust Machine with glass tubes separated by metal tubes to eliminate the need for baffles. The index speed is 42 seconds, buggy spacing 15.1" (19" round tubes can be exhausted if 16" or 17" rectangular are alternated) oven settings 187°C, 370°C, 465°C, 390°C, 270°C, 180°C, 85°C. Zone 3 will not reach the 465°C setting so the burners go full on at all times and generally reach 440°C. They are planning to install an additional burner in this heater house. Thus Rauland reach a peak bulb face temperature of 390°C at the beginning of Zone 4 and hold it throughout this zone. This compares with our 350°C for the same space but for a shorter time in proportion to our 30 second index as against their 42 second. Rauland have slowed down their recirculating fans in Zones 5, 6 and 7 of this unit to 35% of the original speed.

They have trolley exhaust capacity equal to the Inline Exhaust (some not quite ready to run) and are expanding exhaust capacity in this direction only. The dual benches have a 2 position gas fired oven, VMP 80 Welch 1405 Pumps. They believe these can be made (30" diameter) at about one half the cost of Inline Machines, and do not intend to purchase any more machine exhaust. The Inline Exhaust carts make filament connection to the tube by welding wire leads with a tweezer welder. They long ago changed to aluminum tubing for the RF coils and then stopped running water through them. They are now experimenting with coils edge wound of .091" x 1/2" aluminum ribbon. A National Research salesman was in Rauland Friday and disclosed that their H2P pumps (used on Murphys buggies) use some aluminum parts screws and bolts. Caustic or caustic containing cleaning agents should, therefore, not be used on this pump.

They are using dioctal pthalate as a vacuum pump oil but are distilling it first in a glass vacuum still purchased from H.S. Martin Company, Evanstown, Illinois for approximately $400. After this distillation they add approximately one teaspoonful of sodium carbonate per quart of dioctal pthalate to prevent oxidizing.

Aging is still done on stationary cord positions but equipment is in and awaiting erection for a conveyor aging using Feedrail. The present aging schedule lasts only one half hour, i.e. 2 minutes 12 volt Ef 28 minutes 8 volt Ef / 5 volt EC1 / 250 volt EC2. They are running considerable emission trouble but this may be due to their use of Superior cathodes.

Rauland are building an experimental rotary test machine, but it was not far enough along to evaluate. It will commutate about 12 voltages or currents from a stationary meter and generator rack to a six position tube table.

They have decided that bump checks (they call them kiss marks) are safe to pass and that any treatment only makes them worse.

They are well satisfied that ethylene glycol wiped on tube faces, including 16" rectangular helps to reduce silicate on face troubles.

Rauland have clear face 10" bulbs for sale. They would probably be interested in purchasing 12LP4A tubes if we have any for sale.

They are experimenting with decals for marking which will be perforated for date coding. They fear obliteration of base date code and false claims for tube warranty.

Rauland are using paper board pallets for tube shipments in order to stretch out their small allotment of packing material.

Raulands total force was set at 800 people. They are using men on all jobs which require continuous handling of the bulbs, such as screening conveyor loading, exhaust tipping, Ross Oven loading, bulb wash, etc..

The source of Raulands water is the North Side Chicago City Water Supply. The water delivered is not previously filtered and is generally heavily chlorinated. Rauland treat all their process water with an alum plus lime coagulant and then filter in sand filter before deionizing. Their piping after deionizing often accumulates a slime and is cleaned out at approximately six month intervals.

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