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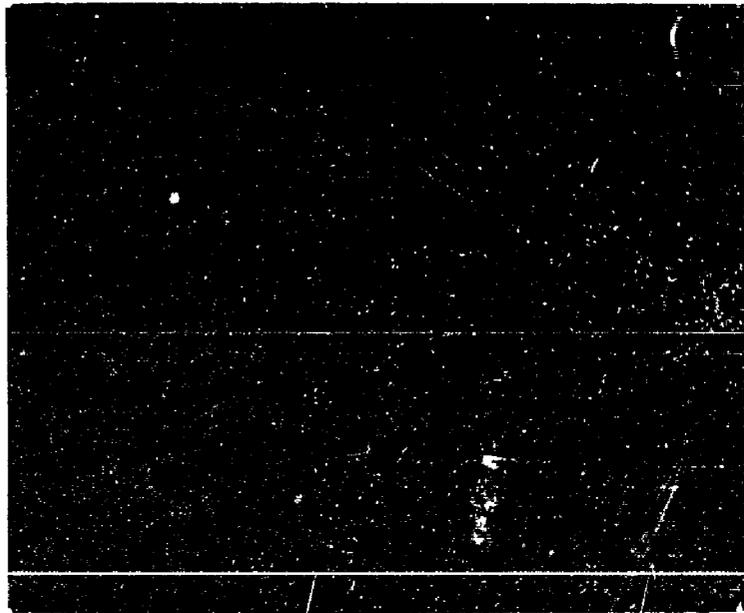


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**RADIO
CORPORATION
OF
AMERICA**



**ELECTRONIC COMPONENTS AND DEVICES
HARRISON NEW JERSEY**

SIXTH QUARTERLY PROGRESS REPORT
ON
PRODUCTION ENGINEERING MEASURE
FOR
TUBE TYPE 7587

DURING PERIOD OF:
1 SEPTEMBER 1963 TO 30 NOVEMBER 1963
CONTRACT NO. DA36-039-SC-86732
ORDER NO. 19054-PP-62-81-81

PEM & FACILITIES PROCUREMENT BRANCH
U. S. ARMY SIGNAL SUPPLY AGENCY
PHILADELPHIA 3, PENNSYLVANIA

PRODUCTION ENGINEERING MEASURE

for

TUBE TYPE 7587

for period of

1 SEPTEMBER 1963 TO 30 NOVEMBER 1963

OBJECT

To provide critical facilities for high volume, low cost, production of Nuvistor tube types, with special emphasis on tube type 7587, by the development and construction of an automatic grid lathe, exhaust machine, and lead loader.

CONTRACT NO. DA36-039-SC-86732
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Report Prepared By: W. Ackermann Approved By: E. Rudolph
W. Ackermann E. Rudolph

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I. ABSTRACT

This sixth quarterly report contains a detailed account of the progress and effort expended in bringing each of the tasks to a level of production capability, and in fabricating preproduction samples.

This report indicates that the truss grid and exhaust machines have achieved production levels of output and are in regular, scheduled factory use. The lead loader and copper washer machines were debugged, tested, and are ready for production use. The preproduction samples were fabricated in accordance with the contract provisions, and arrangements were made to test the tubes with Signal Corps personnel in attendance.

II. PURPOSE

The purpose of this contract is to obtain high volume, low cost manufacturing capability for the Nuvistor tube type 7587 by the creation of several critical equipment facilities. It is an intent of this contract that the subject facilities inherently contain sufficient flexibility to not only service the tetrode line of Nuvistors, but also a broad spectrum of existing triode types and contemplated future types, such as long leaded Nuvistors.

The contract is divided into six phases; namely the development, design, construction, debugging, testing and evaluation of three main tasks:

1. An automatic banded truss grid winding and brazing machine.
2. An automatic exhaust machine.
3. A semi-automatic lead loader.

This effort not only involves the creation and construction of the subject facilities, but a complete in-production evaluation of equipment performance and product quality.

The contract has joint sponsorship, with the development, design and evaluation costs funded by the Army Signal Corps, and the construction costs funded by Radio Corporation of America.

III. NARRATIVE AND DATA

The sixth three month period of the subject contract involved production testing of the equipment in each task, and the processing of preproduction samples of tube type 7587.

A. BANDED TRUSS GRID WINDING MACHINE

During this period, the unit was moved onto the production floor, and installation was completed. The machine was then placed in limited production use, processing truss grids for tube type 7587 and other tubes requiring truss wound grids. Simultaneously, additional tooling, in the form of cams and gears, was obtained to allow production of all Nuvistor grids on the machine. The unit was then retooled to a high volume entertainment type grid, and run on a continuous production basis. During continuous operation, several problems arose which were not apparent in the preproduction runs, primarily due to a low frequency of occurrence. These problems centered about mandrel feeding, both from the magazine and the roll feed. First signs of malfunction were detected as a sporadic tight wind which occurred randomly. This indicated that the mandrels had momentarily stopped feeding through the winding heads. By close observation during operation, it was found that the magazine feed did not always push a mandrel tightly against the preceding mandrel. Thus, when the forward mandrel left the last set of feed rolls, the feed motion would stop until the rear mandrel moved sufficiently to close the gap. The first attempt to correct this condition was made by removing the rear set of feed rolls and replacement by larger diameter units driven through a slip clutch. It was reasoned that these rolls would push the rear mandrel tightly against the forward unit, and any gap would be closed before the joint entered the front rolls. Once the gap was closed, the rear rolls would then only rotate at a rate governed by the front rolls, but would exert traction by virtue of the slip clutch.

A. (CONT'D)

First tests showed that this change worked very well, however, the grid lengths shortened, indicating slippage. Roll pressures were increased to maximum permissible values, but this did not correct the condition. At this point, it became apparent that two sets of positive feed rolls were required for slip-free traction and maintenance of feed rate while the joint between mandrels passed through either set of rolls. Therefore, the original rolls were put back in the unit, and attention was focused on the mandrel magazine feed, which was the basic cause of the problem.

The magazine was disassembled and critical points were carefully inspected. Considerable wear was observed in the area where the bottom mandrel is guided out of the unit, and these parts were replaced with carbide inserts. This inspection also revealed that the mandrels had dug into the worn parts, causing them to hang up. Further investigation showed that the mandrels being used were relatively new and had needle sharp points, as opposed to older mandrels with dull, rounded points. As a result, the new mandrels were stoned to remove the sharp points.

The unit was placed back into production, and results show no further problem with slippage or erratic feeding. Presently, the machine is in production use, under the surveillance of Equipment Development personnel.

B. EXHAUST MACHINE

This machine has been in production operation during this reporting period, with little change in status. In order to simplify the individual trimming of power to the heads, new resistance rod clamps were developed and installed. As pointed out in previous reports, each head is connected electrically to the power supply through a resistance rod. The connecting cables are clamped to these rods, and by sliding the clamps along the rods, each head can be adjusted. This procedure compensates for minor thermal variations in the heads, and provides for a means to bring all heads to equal output. The previous cable clamps required wrench actuation, and were somewhat inconvenient to move. The new clamps require only finger actuation, and appear to provide sufficient metal contact for good power transmission.

This machine appears to operate in a satisfactory manner, and will continue in use primarily for exhausting 7587 tubes.

C. LEAD LOADER

The lead loading machine was moved onto the production floor and installed. The overhead wire spool system was suspended from the ceiling over the unit, and final adjustments to the system were completed. An operator was trained in the function of the machine, and production commenced. Presently, this unit is used to load leads for all 7587 product, and operation appears satisfactory.

During this quarter the copper washer machine continued in the debugging phase. At the end of the previous quarter, it was reported that the unit had been timed and adjusted for satisfactory mechanical operation. Subsequently, steps were taken to run product at the rated speed of 1500 per hour.

C. (CONT'D)

The first problem encountered was washers sticking to the punch faces. As described in previous reports, the punches blank the washers from the strip, drive them through the die onto the leads and then, hollow strippers inside the punches are supposed to free the washers from the punch faces. In actual practice, the washers cling to the strippers and do not fall down the leads. It should be pointed out that this condition occurred infrequently, however, it is not tolerable because one sticking washer will be pulled back into the die and cause jamming. In an attempt to alleviate this condition, various combinations of stripper travel and motion were tried, to no avail. Finally, the strippers were removed entirely, and an air blast, down the inside of each punch was substituted. This action alleviated the problem, and there have been no instances of washer sticking in the interim.

The second problem encountered was washers falling off the stub leads after loading. This occurred quite frequently, and was a function of the length of stub lead extending above the base wafer. The internal structure of Nuvistor mounts is such that the leads are supported by the electrodes and flanges prior to brazing, and thus, the amount of lead projection above the base wafer is dependent on the position of the elements. Minor variations in lead extension are not critical on long socket leads, but can greatly affect the performance of this machine in relation to the stub leads, which extend only .025 inch above the wafer. The result of these variations became apparent when the stub lead washers fell off in many instances. This condition was aggravated by the fact that the washers had a conical shape, with the smallest inside diameter located .007 inch above the base wafer surface. Thus, the median engaged length was effectively reduced to .018 inch, increasing the possibility of washer loss. Based on these conclusions, it was decided to reduce the conical shape to a nearly flat configuration. The blanking die was suitably altered, and subsequent tests

C. (CONT'D)

resulted in excellent engagement. Since this modification, there have been virtually no instances of washer loss.

The final problem encountered was a large percentage of tilted flanges caused by the machine. This can only occur if the washers strike the ends of the leads during threading. The die heads were disassembled and the holes in the die plates were lined up with the wafer holes, using a crosshair microscope. This procedure reduced the problem considerably, to a level of 30%. Further observation revealed that the major portion of tilting occurred in the first die head, where the washers are threaded over the long socket leads. In this position, the long leads are aligned by combs fastened to the turret along with an auxilliary comb which aligns the heater leads. To alleviate the tilting problem, the latter comb was modified so that it not only aligned the heater leads, but also physically pushed the other leads firmly into the grooves of the turret combs. Again, the tilting condition was reduced to a lower level by these changes. The final alteration involved increasing the washer hole diameter. This was accomplished by drilling the strip to various hole sizes and checking results. With a .028 inch diameter, the tilting problem virtually ceased, and the strip blanking die was altered to suit.

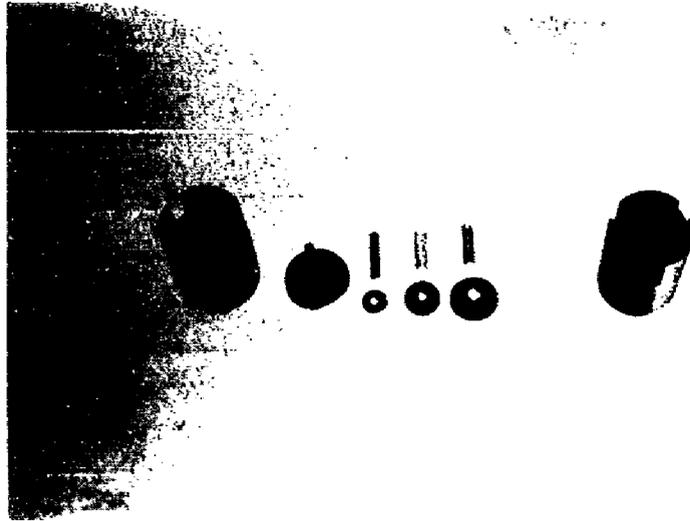
Presently, this machine has demonstrated an ability to process product at a rate of 1500 per hour with a loading efficiency exceeding 90%. In cases where tilting does occur, or washers fall off, it has been determined that some defect in the incoming product is responsible. Certainly, the machine is more critical of incoming product quality than a hand process, however, it appears that the unit can handle a reasonable variation in lead extension and wafer missorientation. At this time, attention is being directed towards improving the consistency of incoming product to suit the more critical demands of an automatic machine.

D. PREPRODUCTION SAMPLES

During the latter part of this quarter, fabrication of a lot of tube type 7587 was completed to provide preproduction samples in conformance with the contract provisions. This lot was processed through all of the contracted equipment in a manner, and at a rate, which simulated an actual production environment. These samples were then delivered to test personnel, who, in turn, submitted a Technical Action Request to USASIMSA, requesting that a representative of the Signal Corps be present to witness testing. A mutually agreeable date of 18 December 1963 was established for performance of tests.

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FIGURE 6.	Shell, Mount, and Seal Ring Assembled ready for Exhaust.	



*FIG.1 HEATER, WAFER, ELECTRODES & FLANGES
ASSEMBLED IN BRAZING JIG*

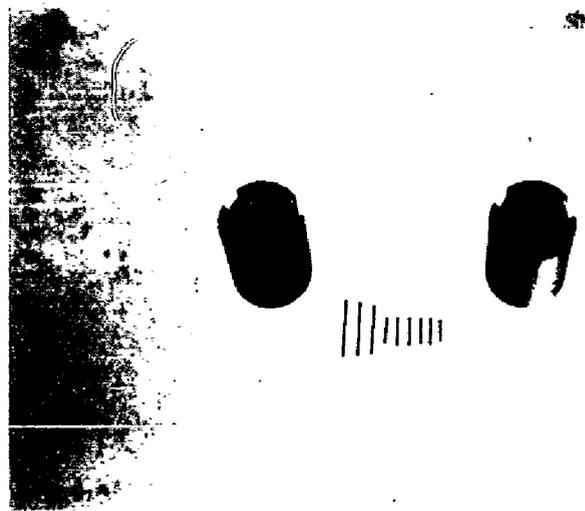


FIG.2 LEADS LOADED INTO ASSEMBLY

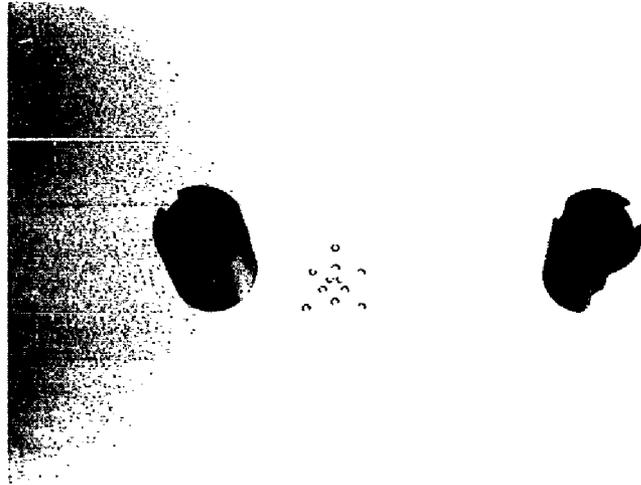


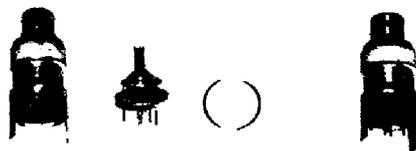
FIG. 3 COPPER WASHERS LOADED ONTO LEADS



FIG. 4 CATHODE CUP LOADED INTO BRAZED MOUNT



FIG. 5 SHELL ASSEMBLY



*FIG. 6 SHELL, MOUNT, AND SEAL RING ASSEMBLED
READY FOR EXHAUST*

IV. CONCLUSIONS

A. BANDED TRUSS GRID WINDING MACHINE

This unit has been placed in the production activity, and is in production use. Although several problems occurred, these were corrected, and the machine is now considered a factory facility.

B. EXHAUST MACHINE

There has been little change in the status of this unit, and it continued in operation as a production facility.

C. LEAD LOADER

The lead loading unit has been fully debugged, placed in the factory, and is being used to load leads in all 7587 product. The copper washer machine was debugged and test runs indicate satisfactory performance. Work is in process to improve the consistency of incoming product to further improve machine performance.

D. PREPRODUCTION SAMPLES

Preproduction samples of tube type 7587 were fabricated using the contracted equipment, in a manner conducive to production methods. Notification was forwarded to USASIMSA requesting the presence of a Signal Corps representative to witness testing, and a date of 18 December 1963 was established.

V. PROGRAM FOR NEXT INTERVAL

A. TURSS GRID MACHINE

This unit will continue in production use and will supply a broad variety of Nuvistor grids for the factory operation.

B. EXHAUST MACHINE

This machine will continue in production use with little change in status.

C. LEAD LOADER

The lead loader and copper washer machines will be placed in full production use.

D. PRODUCTION RUN

A quality control plan will be formulated for performance of the production run, and will be submitted for approval. Plans will be established to coordinate the production run between engineering and factory personnel.

VI. PUBLICATIONS AND REPORTS

Monthly Letter Report:

No. 15 for period of August, 1963

No. 16 for period of September, 1963

No. 17 for period of October, 1963

VII. IDENTIFICATION OF TECHNICIANS

A. MANPOWER EFFORT DURING SIXTH QUARTER

1. Technical

F. Feyder	77.5 Hours
J. Forman	51.5 Hours
G. Lalak	440.0 Hours
C. Lindsley	85.0 Hours
B. MacPherson	37.0 Hours
R. Nelson	66.5 Hours
J. Thompson	21.5 Hours
M. Tuttle	37.0 Hours

2. Semi-Technical

W. Abel	21.0 Hours
P. Agh	69.0 Hours
C. Berman	92.5 Hours
G. Caruso	80.0 Hours
L. Cottino	43.0 Hours
V. Riggi	189.0 Hours
B. Sherman	141.5 Hours
C. Trushell	19.0 Hours

B. PERSONNEL BIOGRAPHIES (For personnel added to manpower effort during this quarter).

J. Forman

Mr. John A. Forman received the B.S. degree in Electrical Engineering from West Virginia University in January 1956. In February of that year, Mr. Forman joined the Radio Corporation of America. After completing the Specialized Trainee program, he was assigned to the Test Engineering group in the Receiving Tube Engineering activity of the Electron Tube Division in Harrison. He worked on the various problems of testing, evaluating test data, and writing and evaluating commercial and military test specifications. His duties have

been concerned with industrial tubes in the Premium, Computer, and Mobile lines. In addition to these he has worked on several miscellaneous industrial tubes and the newly developed Nuvistor. Mr. Forman is a member of the Institute of Radio Engineers, an associate member of the America Institute of Electrical Engineers, and a member of Eta Kappa Nu.

B. MacPherson

Mr. Bruce MacPherson attended Eastern Nazarene College for a year in preparation for a degree in Electrical Engineering. He then joined Radio Corporation of America in 1947 as an Electrical Equipment Technician in the Life Test and Data group of the Receiving Tube Engineering activity of the Electron Tube Division in Harrison. He worked on the maintenance of static and dynamic life test equipment until assigned to environmental testing in the Mechanical Testing Laboratory. After two years he returned to Life Test and Data group as an Electrical Equipment Technician. In April 1956, he was transferred to the Rating Laboratory where he was made Manager, Rating Laboratory Testing. In this capacity he was responsible for all testing conducted by the laboratory. He later assumed responsibility for the maintenance and calibration of all Rating Laboratory equipment. During this period he attended the Newark Extension Division of Rutgers University for courses in supervision, cost reduction, labor relations, and electronic data processing. In March 1961, he was transferred to the Industrial Tube group of Test Engineering as an Engineering Technician, and remained in this capacity when the Industrial Tube Group became part of the Industrial Tube Applications Laboratory. In November 1963, he was assigned as an Engineering Technician in the Advanced Product Development Department. He holds an amateur radio license and a Commercial Radiotelephone license, 2nd class.