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SUBJECT OR TITLE

Equipment Description of Proposed RDA-5

Canning Machine

TO

File

FROM

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EQUIPMENT DESCRIPTION OF PROPOSED

RDA-5 CANNING MACHINE

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SPECIFICATIONS

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EQUIPMENT DESCRIPTION OF PROPOSED

RDA-5 CANNING MACHINE

Scope of Work

The General Engineering Laboratory has submitted a cost estimate and a proposal covering the design, fabrication, construction, and testing of a uranium slug canning machine. This machine will cover requirements for mechanization of only the operations occurring within the aluminum-silicon canning bath. These operations are:

- (a) Can and cap preheating
- (b) Can and cap wetting
- (c) Canning assembly
- (d) Quenching

Stated briefly, the machine is required to insert a prepared uranium slug into an aluminum can and close the can opening with an aluminum cap. All assembly operations will be carried out beneath a molten bath of standard Hanford aluminum-silicon bonding alloy. The uranium slug is preheated and prewetted before being manually transferred to the slug assembly and quench machine. The process performed by the machine will be intergrated with the manual slug preheating and wetting equipment so that proper preheating and wetting is attained before the slug is inserted into the machine. After assembly the completed canned slug will be transferred to the water quenching station, where the components are held firmly together until the molten aluminum-silicon has frozen, forming a homogeneously bonded assembly.

The equipment will be designed for ready accessibility and ease of inspection and maintenance.

The unit will be flexible enough to be capable of operating at any given setting or dimension within the following operating ranges by "set up" adjustments.

1. Aluminum-silicon bath temperature 580 to 600° C
2. Water quench temperature range $15 \pm 5^\circ \text{C}$ to $100^\circ \text{C} \pm 5^\circ \text{C}$
3. Slug Dimension:

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Length 4" to 9 5/8"

Diameter 1.350" $\pm$.001" to 1.400" $\pm$.001"
- .002" - .002"

4. Aluminum Can Dimension

Outside diameter: 1.442" Max.

Inside diameter: 1.345 to 1.375"

Bottom thickness: 0.175 to 0.500"

5. Production rate: 5 units per minute maximum

The purpose of the machine is to improve upon present manual operations. This will be accomplished by:

- (1) Adequate wetting to promote good bonding
- (2) Adequate heating
- (3) Proper centering of components during assembly
- (4) Proper seating of the slug and cap in the can
- (5) Reproducibility of operation so that all slugs are processed uniformly

DETAILED DESCRIPTION

Cycle, Production Rate, and Flexibility

The proposed cycle of operation is:

1. Preheat can and sleeve assembly in an oven.
2. (Station 1) Flare can, submerge and load can-sleeve assembly into a turntable which carries the assembly to succeeding stations.
3. (Station 2) Wipe inside of can.
4. (Station 3) Skim bath, insert and seat slug.

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5. (Station 4) Preheat, wet, and seat cap.
6. Unload finished assembly, carry to quench tank, and submerge.

The exact timing for each operation of the cycle can be established only by trial with the completed machine. It is proposed that the controls will have a sufficient time range for each operation so that any reasonable time combination can be set. The production rate of the machine will be affected by the timing of the various operations. By proper machine set up, production rates up to 5 units per minute per machine can be had.

Sleeves

In order to assure good alignment of the various parts during assembly, it is proposed that the present sleeve used to protect the can be modified to have two chucking rods as shown on the attached layout of station 1. These chucking rods are held by a chuck at each station to accurately center the can on the center line of the station tools. The use of these modified sleeves has other advantages. The number of tools required to contact the aluminum-silicon bath is reduced, and the change over from 4" to 8" slugs is greatly simplified. With this system most stations will operate on 4" or 8" slugs with no change over.

Furnace and Bath

The bath will be heated in a resistance furnace. The furnace unit will be sealed to permit the use of an inert atmosphere to reduce slag formation and oxidation of the mechanisms. Heat insulation will be provided to reduce heat loss and to equalize temperatures. An attached preheat oven with its own control will preheat the can-sleeve prior to submersion.

The furnace top will be removable to permit servicing the bath and the tools.

Can-Sleeve Feeder

A feeding mechanism will introduce the can-sleeves into the preheat oven, carry them through the oven and pass them to the loading tools of station 1.

Station Tools

Each of the stations referred to in the cycle description will be provided with appropriate tools for the task involved. The loader will accept the can-sleeve from the preheat oven, and flare the can against the sleeve to prevent aluminum-silicon

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leakage between the can and sleeve. It will then submerge the assembly, placing it on the turntable. (This station is shown in detail on the attached layout). The turntable carries the can-sleeve to each of the stations in turn.

The wiper is a graphite tool slightly smaller than the inside diameter of the can. It will be inserted into the can and rotated to encourage uniform wetting of the inside surface of the can.

The slug inserter will accept the slug, insert it into the can and seat it with a definite force. Just prior to immersion of the slug, the surface of the bath will be skimmed to avoid contaminating the assembly with slag.

The last station will take a cap from the cap preheater, wipe it in a cup under the bath to assure uniform wetting and seat it with a rotating motion at definite force in the assembly. The tools will then remove the assembly from the bath and make it accessible to an unloading mechanism which will remove it from the furnace and quench it in a tank of water. The components of the assembly will be held firmly together until the bond has solidified.

Quench Tank

The quench tank will be provided with an automatic mixing valve to mix hot and cold supply water to give inflow temperatures in the desired range.

Control and Instrumentation

To measure temperature of the aluminum-silicon solution, we have considered using a Leeds and Northrup Speedomax, Model S, resistance thermometer. Scale range to be 500° C to 700° C. Each division on the chart will equal 2° C. The primary element will be made of platinum, which in turn will be enclosed in a graphite well.

For indicating the temperature between the furnace and the crucible, we have considered using a Leeds and Northrup Micromax

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Model C indicator, with a scale 0-800° C. Each scale division will equal 10° C. The instrument will be equipped with a set of contacts to operate an over temperature alarm. The primary element will be a platinum -- 10% rhodium thermocouple.

The furnace control under consideration is a General Electric Reactrol system in conjunction with a Leeds and Northrup catalog #10769-J electric control unit, which is equipped with an automatic droop corrector. The control signal may come from the Speedomax recorder.

A visible device will be furnished to aid the operator in preparing, at the correct time, a slug for insertion in the machine.

All instruments and control switches will be mounted on a panel.