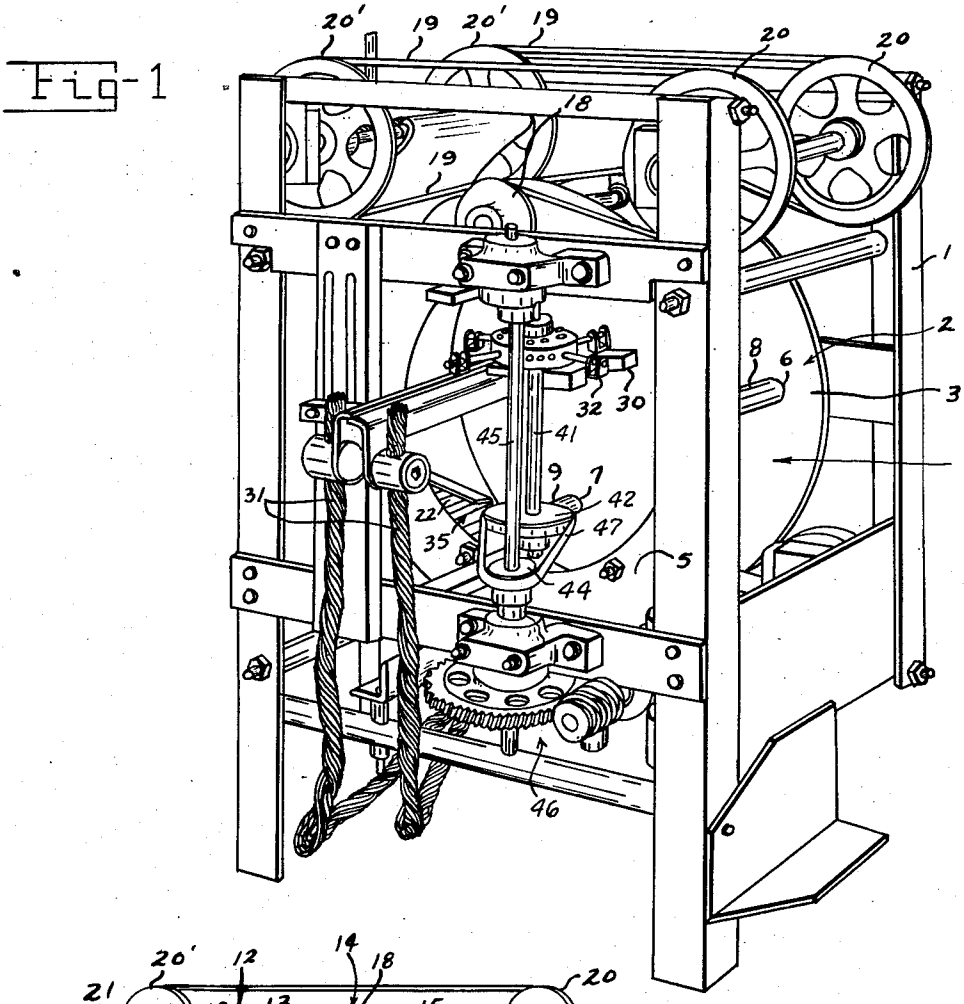
Sept. 8, 1959 E. H. LAYER ET AL 2,902,972

APPARATUS FOR AUTOMATICALLY COATING CERAMIC RODS WITH METAL OR METAL ALLOY BY THERMAL EVAPORATION

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Fig-1



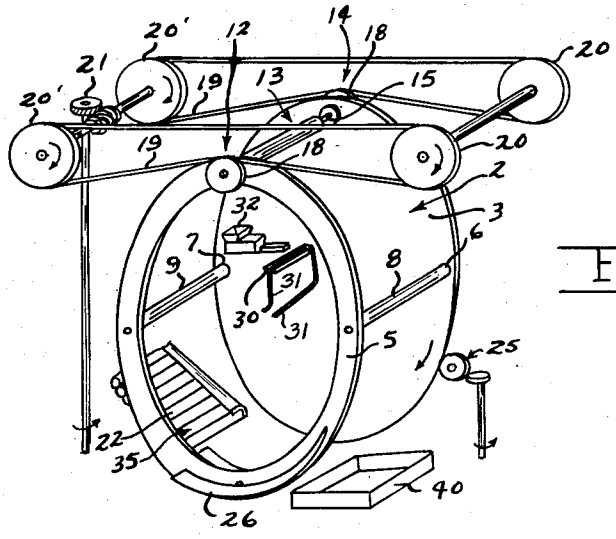




Fig-2

INVENTORS
EDWIN H. LAYER
EARL P. OLSON
BY Wade Langlois
Charles W. Wagner
ATTORNEY

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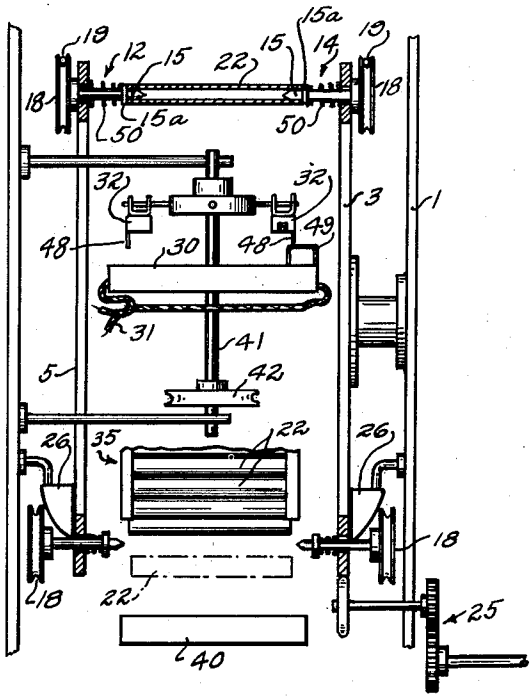



FIG. 3

INVENTORS.
EDWIN H. LAYER
EARL R. OLSON
BY
Wade Lowry
ATTORNEYS

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# APPARATUS FOR AUTOMATICALLY COATING CERAMIC RODS WITH METAL OR METAL ALLOY BY THERMAL EVAPORATION

Edwin H. Layer, Columbus, Ohio, and Earl R. Olson, Redondo Beach, Calif., assignors to the United States of America as represented by the Secretary of the Air Force

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6 Claims. (Cl. 118—48)

This invention relates to apparatus for coating ceramic rods such as resistor bodies with metal or metal alloy by thermal evaporation. This apparatus is adaptable for operation in a vacuum system.

An important object of the invention is to provide a machine for partially automatic coating of ceramic rods with metal or metal alloys.

Another object is to provide an apparatus in which ceramic rods or resistor bodies are uniformly coated with metallic vapor.

A further object is to provide an apparatus in which the ceramic rods or resistor bodies are individually coated with a metallic vapor while the rods or bodies are automatically and continuously travelling through a container.

A still further object is to provide an apparatus in which the evaporation of metal or metal alloy takes place automatically and continuously while the rods or resistor bodies are travelling through a container.

The above objects, as well as other objects, features and advantages of the apparatus of this invention will be more clearly apparent in view of the following description and claims when taken in conjunction with the accompanying drawings wherein

Figure 1 is a perspective view of the apparatus showing the invention being supported by a frame.

Figure 2 is a second perspective view of the apparatus for coating ceramic rods with metal or metal vapor after being removed from the frame.

Fig. 3 is a schematic end view, partly in section and partly broken away, looking in the direction of the arrow illustrated in Fig. 1 of the drawings, illustrating additional details of the work holder, rod-supporting means, loading buckets and evaporation boat, and the actual mounting for the spreader cams of the inventive apparatus.

Referring now to Figure 1 the reference numeral **1** indicates a suitable metal frame which incloses the invention. Vertically mounted within the frame **1** and rotatably attached thereto is the turntable **2** of the invention comprising the solid disc shaped portion **3** and the hollow disc shaped portion **5**. The portion **5** is rigidly attached in substantially parallel relation to the portion **3** at the points **6** and **7** by the spacers **8** and **9**.

Referring specifically to Figs. 2 and 3 of the drawings, there is illustrated a work holder indicated generally at **13** and comprising a pair of spring loaded rod-holding means indicated respectively at **12** mounted in the hollow disc portion **5** of the turntable **2** and at **14** located diametrically opposite thereto and mounted in the solid disc portion **3**. Both rod-holding means **12** and **14** are mounted in ball bearings loosely enough to allow both axial rotation and longitudinal translation and incorporate spindle shaped chucking means **15** for engaging and holding the ceramic rods **22** to be coated and annular flange means **15***a* rigidly positioned thereon for respective engagement with the opposite ends of each rod **22** and thereby limit inward movement of said chucking means **15** in each end thereof. The outer sides of rod-holding means



**12** and **14** incorporate sheaves **18** adapted to be frictionally and drivingly engaged by belts or cables **19** from the driving sheaves **20'**. The sheaves **20** are so arranged as to be driven by the drive gear **21** at a relatively higher speed than that of the turntable **2**, said turntable being frictionally rotated by the O-ring friction drive **25** past the pair of spreader cams **26** which are rigidly attached to the frame **1** and are shown schematically in Fig. 2 and in more detail in Fig. 3. Said spreader cams **26** are actually hidden by the aforesaid frame **1** as shown in Fig. 1 of the drawings; however, the cams **26** are illustrated in Fig. 2 for purposes of showing their adjacent relationship to the hollow disk shaped portion **5** and together with the showing in Fig. 3 to more accurately illustrate their relation to a ceramic rod **22** when the latter is being released.

The numeral **30** designates the evaporation boat adapted to hold the metal to be evaporated, said boat **30** being heated through the electrical leads **31**. A plurality of evaporation boat loading buckets **32** are rotatably mounted in frame **1** and extend between solid disc **3** and hollow disc **5**. A respective boat loading bucket **32** is brought over the evaporation boat **30** by operation of the shaft **41** seen in Fig. 1 on which shaft **41** said plurality of buckets **32** are rotatably mounted. Said shaft **41** is rotated by means of the relatively large pulley **42** affixed thereon, the relatively small pulley **44** affixed on the adjacently mounted shaft **45** which shaft **45** is driven by the motor-driven gear means indicated generally at **46**, and the cable **47** between pulleys **42** and **44**. A lever **48** is mounted as shown in Fig. 3 on each of said buckets **32** which lever **48** contacts or engages with a fixed inclined plane indicated at **49** as attached to said evaporation boat **30**. Continued rotatable movement of said bucket **32** effects inversion and unloading thereof to deposit the metal charge carried therein into the evaporation boat **30**. These buckets may be made of tantalum sheet material and mounted on a stainless steel arm so that it may be pivoted and made to unload.

The reference numeral **35** indicates the rod loading station and the numeral **40** indicates the rod discharge station.

In operation, the work holder **13** is spread apart by its movement past the pair of spreader cams **26** mounted upon the frame **1**, which engage sheaves **18** (note Fig. 3) thus spreading or separating rod-holding means **12** and **14** from their respective engagement within opposite ends of a selected rod **22** against pressure of the springs indicated at **50** which springs normally maintain engagement therebetween. This spring loading allows the holder **13** to pick up a rod **22** when released at the end of the spreader cams **26**. The holder **13** may engage and pick up a new rod **22** by means of the spindle chucking means **15** as further rotational movement continues. Said holder **13**, in conjunction with the rotating turntable **2**, the spreader cams **26** and the high speed drive indicated schematically at **25** picks up a selected uncoated rod **22** from the loading station **35**, spins each rod as it passes over the evaporation boat **30**, and deposits the coated rod at the discharge station **40** after chucking means **15** of the work holder **13** is spread apart again by the spreading cams **26**. As each rod passes over the evaporation boat **30**, the work holder **13** is caused to spin on its axis by means of the pulley and cable arrangement, indicated at **19**, **20**, and **20'**, engaging with the sheaves **18** and at the same time, electrical power is applied through leads **31** to the preheated evaporation boat **30**, and the entire metal or metal alloy charge such as chromium-titanium deposited therein from a respective loading bucket **32** is evaporated. The rotating turntable **2** then drives the work holder **13** against a respective spreader

cams **26** which engage and spread respective sheaves **18** on chucking means **15** to release the coated rod **22** and deposits it at the discharge station **40**. The evaporation boat **30** is then manually recharged with metal for the next evaporation operation.

It is apparent that the system may be made fully automatic by making available weighed charges for loading, such as pallets.

The above specification and drawings describe a specific embodiment of the invention for purposes of explanation, it being apparent that various minor changes may be made therein without departing from the spirit and scope of the invention as defined by the following claims, whereby

We claim:

1. In a machine for coating ceramic rods with evaporated metal film, a turntable for rotation about a horizontal axis, power means drivingly connected to continuously rotate said turntable, a work holder rotatably mounted on said turntable, said work holder having axially movable elements incorporating spring means positively holding said elements in engaged position with the ends of a ceramic rod at a loading station and movable against said spring means to release the rod at a discharge station, means to feed rods to be coated to the loading station, a metal evaporation boat positioned such that evaporated metal can rise to coat a rod positioned thereover and driving means for rotating the work holder and ceramic rod held thereby while the rod is in the zone of metal evaporated from said boat, and cam means for actuating said work holder to disengage said axially movable elements against the action of said spring means to release the coated rod at the discharge station.

2. Machine as claimed in claim 1 and rotatably mounted bucket means positioned adjacent said turntable and adapted to contain and periodically feed the metal to be evaporated into the said evaporating boat.

3. Machine as claimed in claim 2 in which the means



to feed rods to be coated includes an uncoated rod loading station mounted adjacent said cam means so as to simultaneously feed uncoated rods to the work holder after discharge of a preceding coated rod by said cam means.

4. Machine as claimed in claim 3 in which an electrical heating element is interconnected with said metal evaporation boat and adaptable to be energized so as to vaporize the metal delivered thereinto by a respective rotatably mounted bucket means when the rods to be coated are positioned over said evaporating boat in a vapor receiving position.

5. Machine as claimed in claim 4 in which said turntable comprising a solid rotatably mounted disk portion and a hollow rotatably mounted disk portion positioned parallel to and spaced therefrom and said axially movable elements comprising spaced spindle shaped chucking means loosely mounted respectively in said spaced rotatably mounted disk portions to drivingly engage the ceramic rods, said spring means yieldingly urging said chucking means into driving engagement with the opposite ends of a respective rod and said cam means being mounted stationary relative to said chucking means and constituting a pair of spaced, parallel spreader cam arms adapted to move the spindle shaped chucking means axially against the urging of said spring means to disengage said rod therefrom.

6. Machine as claimed in claim 5 in which the driving means for rotating the work holder and ceramic rod held thereby while the rod is in the zone of metal evaporated from said boat comprises power driven belts for frictionally driving the spindle-shaped chucking means, said chucking means incorporating a sheave thereon at each end thereof adapted to engage said power driven belts and be driven thereby during a predetermined arc of rotation of said turntable.

No references cited.