May 12, 1970 L. W. SCHOPP ET AL 3,511,023

APPARATUS FOR PACKAGING MICROWAVE DIPOLES

Filed Aug. 16, 1967 2 Sheets-Sheet 1

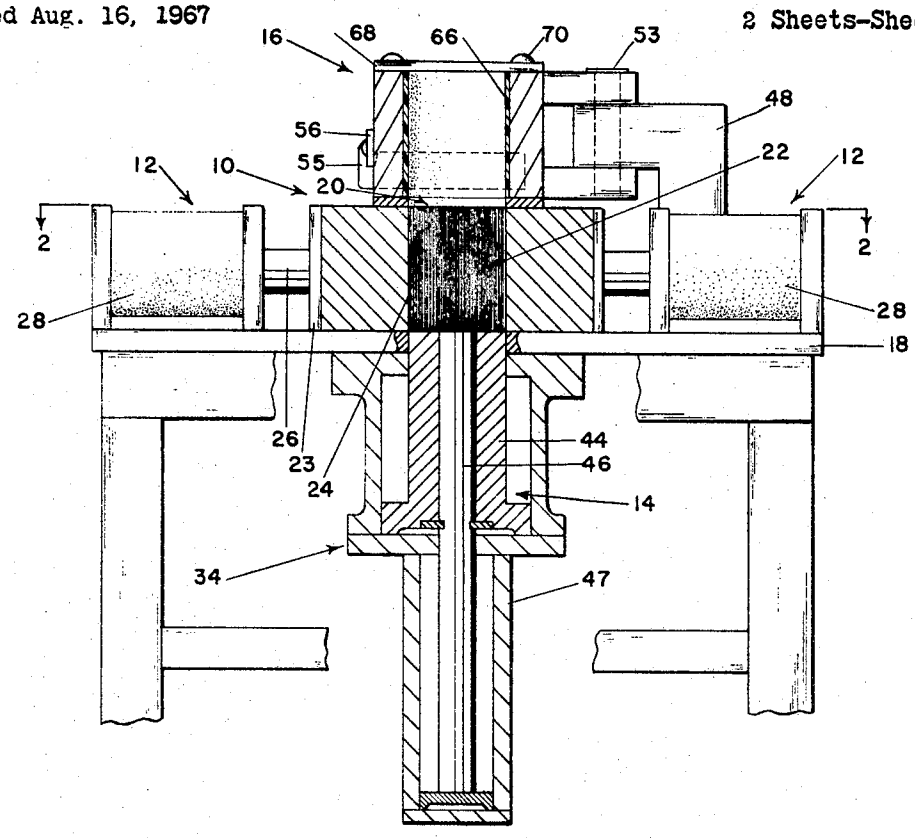


FIG.-1

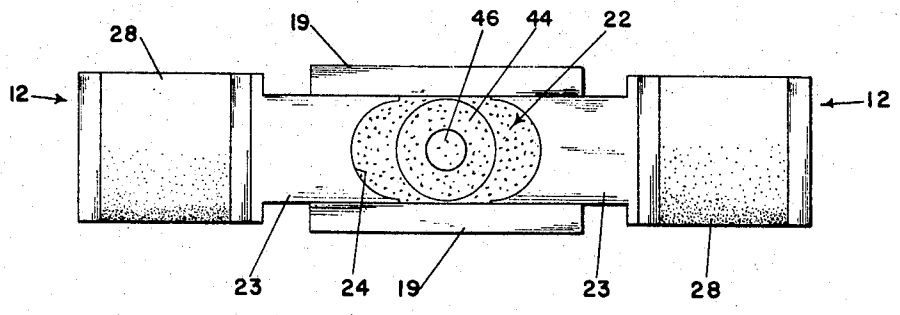


FIG.-2

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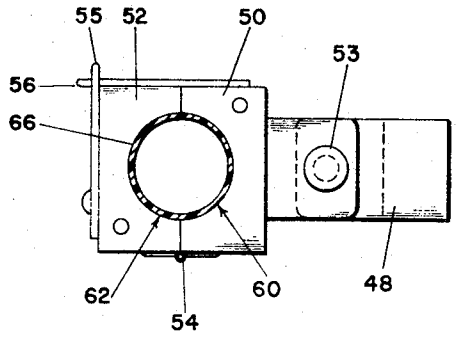


FIG.-3

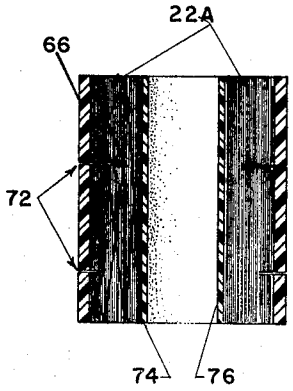


FIG.-4

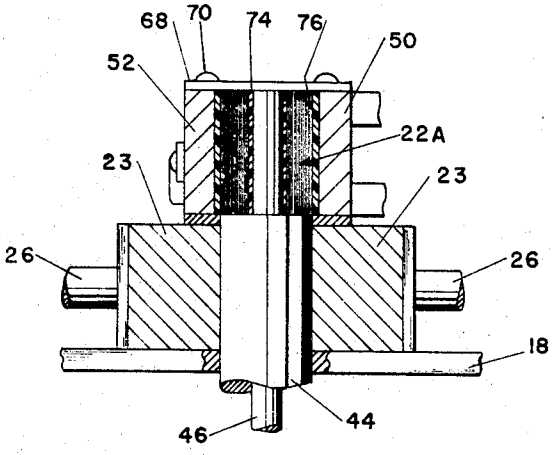


FIG.-5

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APPARATUS FOR PACKAGING MICROWAVE DIPOLES

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U.S. Cl. 53—123 3 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for compacting a plurality of metallic slivers into a compact bundle and packaging the bundle in a suitable disposable container. The containers with the metallic slivers compacted inside are then cut to a specific length in order to form microwave dipoles.

It has long been known that microwave dipoles adapted to a particular radar frequency provide quite suitable chaff which can be dispensed from an airplane in order to confuse enemy radar. These microwave dipoles are usually formed from some type of metallic slivers which are all cut to reflect an individual wavelength so that as a cloud of the dipoles are dispensed from an airplane, an effective image is formed on the enemy's radar.

It is the general object of the present invention to provide apparatus which is adapted to effectively efficiently, and quickly compact a multitude of the small metallic slivers or the like into a compact bundle and then transfer the tightly packed bundle into a tubular shaped disposable container which holds the metallic slivers, but which can be readily removed from the bundle to allow the slivers or chaff to be dispersed from an airplane.

Basically, the invention is comprised of an open-ended die means into which the metallic slivers are deposited, a pair of oppositely positioned pistons which when actuated enter the opposite open ends of the die means to compress the slivers into a substantially tubular shape, disposable container means removably positioned above the die means, piston means positioned below the die means, and pressure means actuating the piston means to force it upwardly into said die means whereby the piston means pushes the compacted metallic slivers out of the die means and into tight fitting enclosement within the disposable container means.

For a better understanding of the invention, reference should be had to the accompanying drawings wherein:

FIG. 1 is a broken away side elevation of a preferred embodiment of the apparatus of the invention;

FIG. 2 is a plan view of the embodiment of FIG. 1, taken on line 2—2 thereof particularly illustrating the open-ended die means and the piston means which when actuated enter the opposite open ends of the die means to compress the slivers deposited therein;

FIG. 3 is a plan view, partially broken away, of the holder means utilized to removably hold the disposable container means as the slivers are pushed therein;

FIG. 4 is a cross sectional view particularly illustrating the way in which the disposable container means utilized to package the microwave dipoles have annular grooves cut therein to form various wavelength chaff in the same container; and

FIG. 5 is a fragmentary vertical section illustrating a concentrically mounted frangible tube which may be utilized in the container means packaging the microwave dipoles.

Now referring to the drawings, and particularly to FIG. 1, the apparatus of the invention basically consists of four components. These are an open-ended die means generally indicated by the numeral **10**, a pair of punches or piston means positioned on opposite sides of the die means, generally indicated by the numeral **12**, a plunger positioned below the die means, generally indicated by the numeral **14**, and a holder member positioned above the die means, generally indicated by the numeral **16**.

Referring to these components in greater detail, the die means **10** is mounted on a suitable base **18** and is best illustrated by FIGS. 1 and 2. The die means **10** is formed from a pair of vertically extending stationary side plate members **19** which are mounted on the base plate **18** so that the die means **10** is open on both ends thereof. Adapted to be dropped into the top opening **20** of the die means **10**, as best seen in FIG. 2, are a plurality of small metallic slivers **22**. Generally the entire area between the side plates **19** is completely filled in a loosely stacked relation with the metallic slivers **22** which are to form the microwave dipoles.

In order to compress the metallic slivers **22** which have been dropped into opening **20** between the side plates **19** into a compact shape, a separate piston means **12** are positioned in the opposite open ends of the die means **10** in opposed relation. The forward ends of piston heads **23** of the piston means **12** are concave in shape as at **24**, and the piston heads **23** and rods **26** of the piston means **10** are driven or powered by suitable pressure cylinders **28**, respectively, which are mounted to the base **18**. As is best illustrated by FIG. **2**, when the two piston heads **23** are powered inwardly into the die means **10**, the concave leading edges **24** of the piston heads **23** complement with each other to form a substantially circular shaped opening therebetween. Thus, as the piston heads **23** of the pistons **12** are pressured inwardly, the metallic slivers **22** contained within the opening **20** are compressed into a substantially tubular shape.

The plunger means **14** is positioned adjacent the die means **10** in direct axial alignment with the circular shaped opening formed by the concave leading edges of the piston heads **23** as they are forced together in the die **10**. It should be noted that the plunger means **14** extends through a circular shaped opening provided in the base plate **18** which positions it in direct axial alignment adjacent to one end or one extremity of the circular opening formed by the concave forward edges of the piston heads **23**.

A hydraulic pressure cylinder, generally indicated by the numeral **34**, receives the plunger means **14** and is adapted, upon actuation thereof to effect a sliding movement of the plunger means **14**. The purpose of the pressure cylinder **34** is to provide a pressure source which selectively forces the plunger means **14** in an axial direction and into the formed opening between the concave forward edges of the piston heads **23**. It should be noted that any suitable plunger means which achieves this effect of removing the compressed dipoles can be adapted to the apparatus of the invention.

As is best illustrated by FIG. 1, the plunger means **14** actually consists of two separate plunger members **44** and **46** with the plunger **46** being concentrically and slidably positioned inside of the plunger **44**. The inner plunger **46** is capable of separate and selective sliding movement relative to the outer plunger member **44**. Pressure cylinder **47** is provided to achieve separate movement of plunger **46**. It should be noted that under standard operating conditions of the apparatus of the invention, as will be explained in greater detail hereinafter, the forward or inner end of plunger member **46** will be positioned flush with the inner end of outer plunger member **44**.

The holder member **16**, mentioned briefly hereinbefore, is positioned vertically above the die means **10** and

it is supported by a frame **48**. The holder member **16**, as is best illustrated by FIG. 3, consists of two halves **50** and **52** which are hinged together along an adjacent lateral margin thereof by a suitable hinge member **54**. Half **50** is pivotally mounted to the frame **48** by a suitable pivot pin **53** to allow the holder member **16** to be swung away from the die means **10**, as will be explained hereinafter. A suitable bar **55** is pivotally secured to the half **52** and a latch member **56** is mounted to the half **50** so that the bar and latch can be utilized to firmly lock and hold the two halves **50** and **52** together. Both halves have cut therein semi-circular grooves **60** and **62** which complement with each other when the two halves are positioned together to form a substantially circular shaped opening.

The purpose of the semi-circular grooves **60** and **62** is to firmly hold a container member generally indicated by the numeral **66** which is adapted to be positioned and firmly held therein when the halves **50** and **52** of the holder member **16** are latched together. The container member **66**, best illustrated by FIGS. 3 and 4, is generally made from a plastic or paper tube which is open on both ends with the tube **66** having substantially the same inside diameter and length as the opening formed between the concave edges **24** of the piston heads **23**.

In a summary of the actual operation of the apparatus of the invention, an empty tubular container member **66** is dropped into the grooves **60** and **62** in the halves **50** and **52**, respectively, of the holder member **16**. The halves are then latched together by the bar **55** and latch member **56**. An end plate **68**, not shown in FIG. 3, is mounted to the holder member **16** by suitable bolt means **70** and once the bar **55** is pivoted into engagement with latch member **56**, the empty container **66** is firmly held in the holder member **16** of the apparatus.

After such occurs, a plurality of the metallic slivers **22** are dropped into the opening **20** of the die **10** with the piston means **12** then being pressured inwardly into the die means **10** to effect a compression of the metallic slivers into a substantially tubular shape. With the piston means **12** remaining in a fully extended or non-actuated position, pressure cylinder **34** is actuated so that the plunger member **14** is directed axially against the compacted slivers. It should be noted that the diameter of the plunger means is substantially the same as the diameter of the compacted slivers so that the movement of the plunger means **14** against the compacted slivers forces all the metallic slivers **22** out of the die means **10** and into the empty container **66** which is positioned adjacent to and in axial alignment with the compacted slivers by merely swinging holder member **16** about pivot pin **53** until it locks into proper, vertically aligned, position. As explained earlier, inner plunger member **46** normally will be in a flush position with the outer piston member **44** so that the plunger **14** effects a push of all the tightly compressed metallic slivers **22** into the empty container **66**. After such has been accomplished, the bar **54** is unlatched from the latch member **56**, half **52** of the holder member is pivoted away from the half **50**, and the tubular container **66** is removed from the holder and sawed into slugs of a specified length so that the metallic slivers contained therein can match up to the particular radar wavelength desired. The tube **66** holds the metallic slivers **22** therein and also serves to protect the slivers from being damaged in transportation and handling. The metallic slivers **22** can be transferred from tube **66** to an aircraft discharge tube and dispensed as radar chaff.

Referring to FIG. 4, it sometimes is advisable to cut a plurality of circumferentially extending grooves **72** around the outer peripheral surface of the tube **66** and at the desired depths into the metallic slivers **22** contained therein so that the length of metallic slivers can match up to the particular radar wavelength desired. For example, the two radial cuts shown in FIG. 4 provide chaff

of 5 different lengths as indicated by the crossed configuration on the top half of the drawing.

FIG. 5 illustrates that the chaff package **66** can be formed with a concentric frangible tube **74** positioned therein with metallic slivers **22** being tightly compressed between the inner frangible tube **74** and the inner wall **76** of the container **66**. In order to utilize tube **74**, all that need be done is to fully extend the inner plunger member **46** independently of plunger **44** by actuating cylinder **47** until the plunger member **46** completely extends into the die means **10**, but not into the opening between grooves **60** and **62** of the holder **16**.

The frangible tube **74** is then placed over the end of plunger member **46** until its lower end rests on the upper end of plunger **44**. Next metallic slivers **22A** are dropped into opening **20** of the die means **10**. An empty container **66** is placed in grooves **60** and **62** of the holder member **16**. Holder member **16** is then closed and latched shut. The holder member **16** is then swung into position above the die means **10** so that it is in direct axial alignment with plunger **44**.

The metallic slivers **22A** are then compacted by the piston means **12**. While the piston means **12** is holding the slivers in a tightly compacted condition around the frangible tube **74**, the plunger **44** is actuated which forces all of the slivers and the frangible tube **74** into the container **66**. During this time there is no relative axial movement between the plunger **44** and the inner plunger **46**.

Plunger **46** is next withdrawn from frangible tube **74** until the end of plunger **46** is flush with plunger **44**. At this time both plungers return to their starting point with their ends flush with each other.

While a certain representative embodiment and details have been shown for the purpose of illustrating the invention, it will be apparent to those skilled in this art that various changes and modifications may be made therein without departing from the spirit or scope of the inveniton.

What is claimed is:

1. Apparatus for compacting metal slivers to form microwave dipoles including open-ended die means adapted to receive a specified amount of metallic slivers or the like, piston means cooperating with the die means to compress the slivers into a substantially cylindrical shape, plunger means positioned adjacent said die means in axial alignment with the compacted, cylindically shaped slivers, means to force said plunger means in an axial direction against the compacted slivers, holder means positioned adjacent said die means, opposite from but in axial alignment with the said plunger means, container means removably held by said holder means wherein actuation of the means forcing said plunger means against the compacted slivers pushes the slivers in an axial direction and into the container means, and wherein the diameter of the plunger means is substantially the same as the diameter of the compacted slivers whereby axially directed movement of the plunger means against the compacted slivers forces all the slivers compacted by said piston means into the receptacle provided by said container means, and where radially directed grooves are cut through the container means and at various depths into the compressed slivers to provide slivers of selected length all within a single container means.

2. Apparatus according to claim **1** where the piston means comprises a pair of pistons positioned oppositely to each other in the open ends of said die means, the forward ends of said pistons being concave in shape.

3. Apparatus according to claim **1** wherein said holder means consists of two halves hinged together along adjacent lateral margins, both halves having a semi-circular groove therein which fits the outside diameter of said container to firmly position the container in said holder, and wherein said container is a plastic tube

opened at both ends and having a slightly greater inside diameter than the outer diameter of the cylindrically shaped slivers compacted by said piston means.

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U.S. Cl. X.R.

53—12, 124; 83—1; 93—93