United States Patent [19]

Rabusin

[11] **3,719,433**

[45] **March 6, 1973**

[54] **GETTER DEVICE**

[75] Inventor: **Elio Rabusin,** Milan, Italy

[73] Assignee: **S.A.E.S. Getters S.p.A.,** Milan, Italy

[22] Filed: **April 14, 1971**

[21] Appl. No.: **133,992**

[30] **Foreign Application Priority Data**

April 21, 1970 Italy.....86251
April 21, 1970 Italy.....28834

[52] **U.S. Cl.**.....**417/48,** 313/181
[51] **Int. Cl.**.....**F04b 37/02**
[58] **Field of Search** ...417/48, 49; 313/180, 181, 174

[56] **References Cited**

UNITED STATES PATENTS

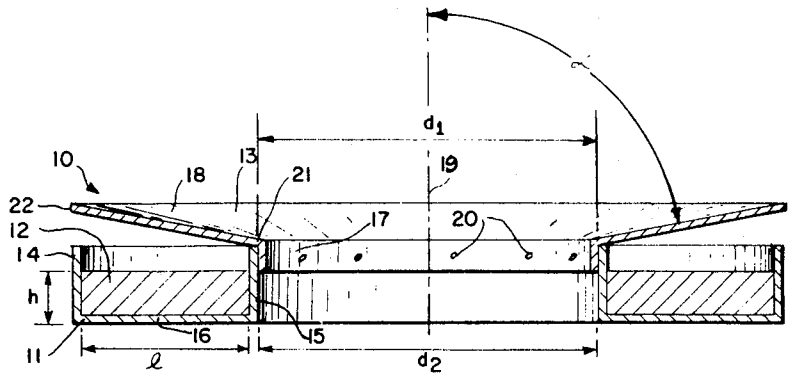
2,275,864	3/1942	Record	313/181
2,855,534	10/1958	Moubis	313/181
3,225,911	12/1965	Della Porta	417/48
3,385,420	5/1968	Della Porta	417/48

Primary Examiner—William L. Freeh
Assistant Examiner—John T. Winburn
Attorney—David R. Murphy et al.

[57] **ABSTRACT**

A getter device comprising an annular ring having (1) an outer wall, (2) an inner wall, and (3) a bottom wall joining the outer wall with the inner wall; a getter metal vapor releasing material in the annular ring; and a deflector for the getter metal vapor. Certain embodiments provide for a separate deflector; other embodiments provide for a gas releasing material admixed with the getter metal vapor releasing material.

22 Claims, 11 Drawing Figures



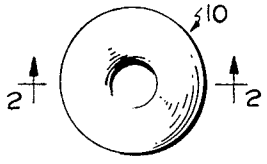


FIG. 1

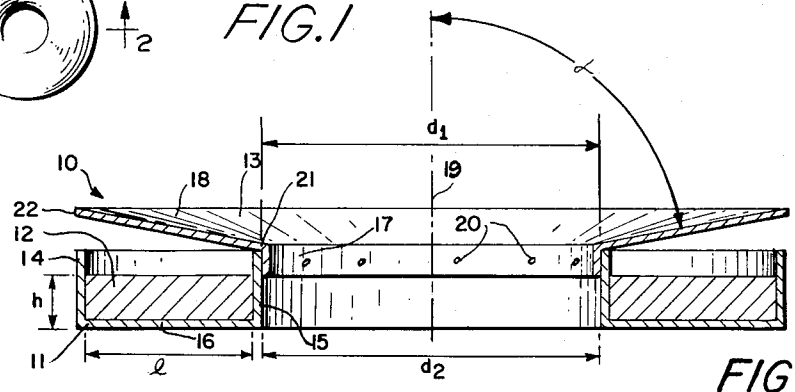


FIG. 2

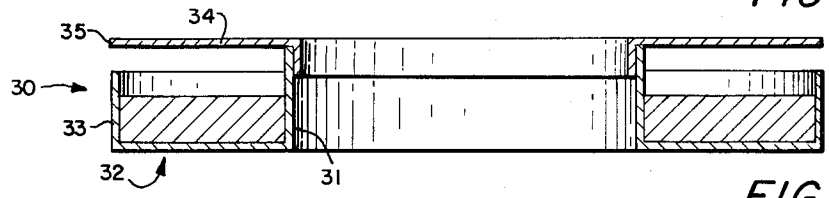


FIG. 3

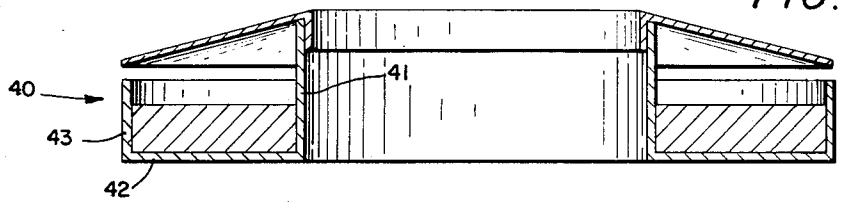


FIG. 4

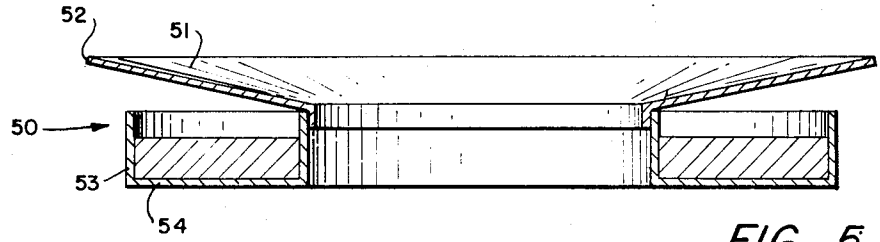


FIG. 5

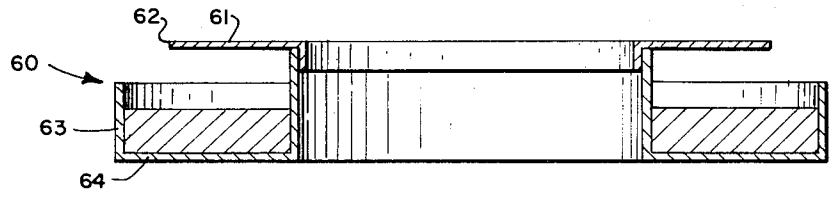


FIG. 6

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FIG. 7

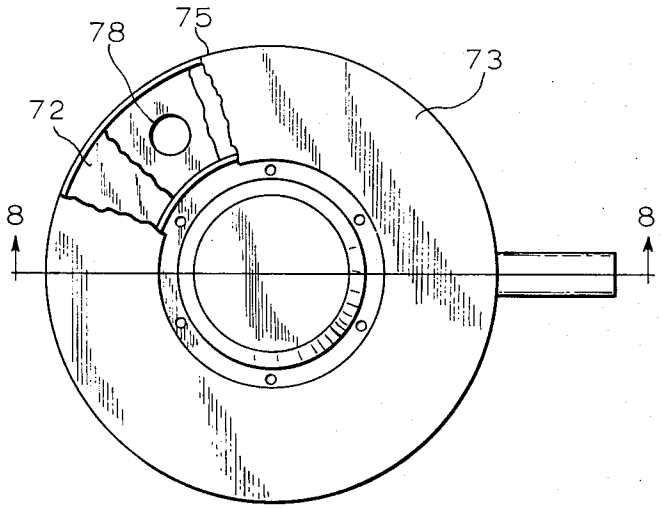

FIG. 9

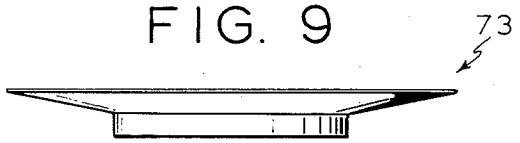

FIG. 8

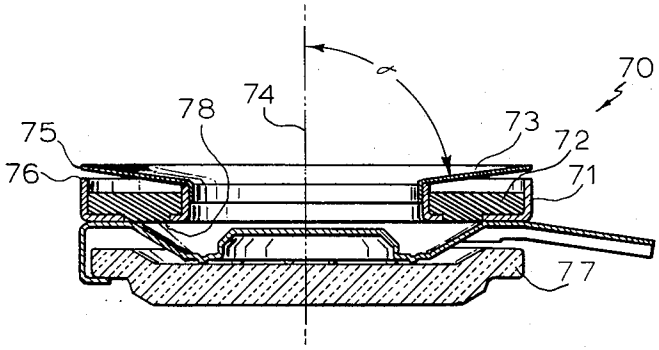

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FIG. 10

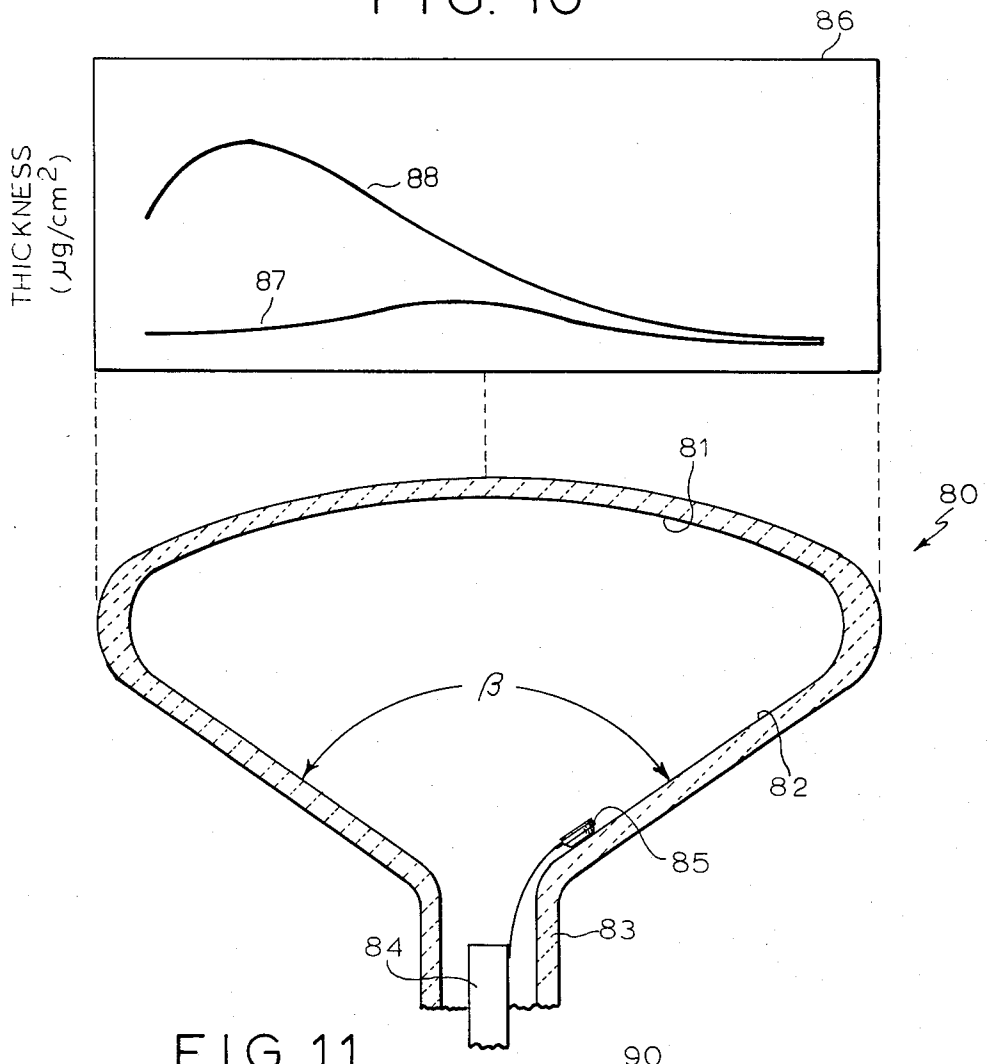
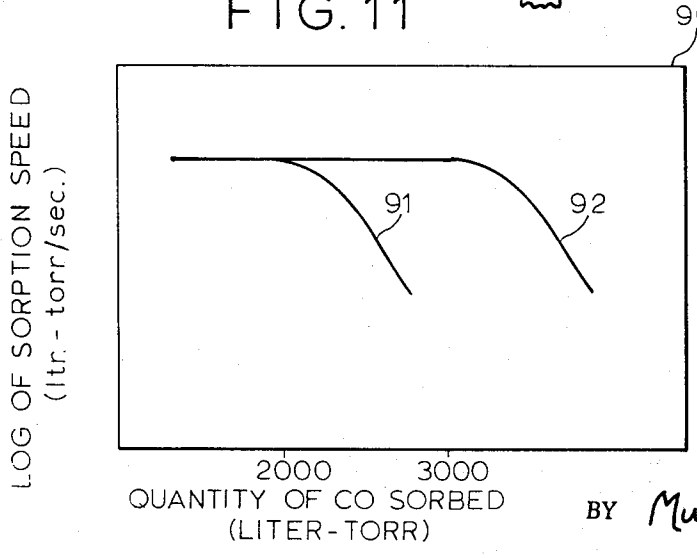


FIG. 11



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GETTER DEVICE

Getter devices of the annular ring type are well known in the art and have found wide acceptance since the introduction of the basic ring type getter device as described in della Porta U.S. Pat. No. 2,824,640. It is also well known to provide ring type getters with deflectors for directing the getter metal vapors which issue from the getter device as described in della Porta U.S. Pat. Nos. 2,907,451 and 3,225,911. However, these prior getter devices have normally employed deflectors which are integral with the ring. Furthermore, the ring and the deflector are normally formed of a single piece of sheet metal. Such prior getter devices have in general been found to be unsuitable for use in cathode ray tubes, such as television tubes, wherein the getter device is mounted in the "antenna" position. Furthermore, it has not been possible to adapt these prior getter devices for use in such tubes. Attempts to bend the deflectors of these prior devices in order to direct getter metal vapors at angles greater than 70° to the axis of the getter device have been unsuccessful.

Another problem is the presence of undesirable amounts of getter metal film on the screen of television tubes. In order to strike the screen electrons must pass through this film. The thicker the film the more the attenuation of the electrons.

Yet another problem is the undesirable decrease in sorption speed which occurs after a quantity of gas has been sorbed by the getter metal film. This decrease in sorption speed reduces the effectiveness of the getter metal film in maintaining a vacuum throughout the life of the tube.

Accordingly, it is an object of the present invention to provide an improved getter device having a deflector, which getter device is substantially free of one or more of the disadvantages of prior getter devices.

Another object is to provide an improved getter device having a deflector which is less expensive to manufacture than prior getter devices having deflectors.

A further object is to provide an improved getter device wherein the deflector will direct getter metal vapors at angles greater than 70° to the axis of the getter device.

Still another object is to provide an improved getter device especially suitable for use in cathode ray tubes.

Yet another object is to provide an improved getter device which deposits a reduced amount of getter metal on the screen of a television tube.

An additional object is to provide an improved getter device which deposits a getter metal film which maintains its original sorptive speed for a greater period of time, i.e. while sorbing a greater quantity of gas.

Additional objects and advantages of the present invention will be apparent to those skilled in the art by reference to the following detailed description thereof and drawings wherein:

FIG. 1 is a top view of a preferred embodiment of an improved getter device of the present invention;

FIG. 2 is an enlarged sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is a sectional view of an alternative embodiment of the improved getter device of the present invention;

FIG. 4 is a sectional view of another alternative embodiment of the improved getter device of the present invention; and

FIGS. 5 and 6 are sectional views of less preferred alternative embodiments of the getter device of the present invention;

FIG. 7 is a partially cutaway top view of yet another embodiment of the getter device of the present invention;

FIG. 8 is a sectional view taken along the line 8—8 of FIG. 7;

FIG. 9 is a side view of the deflector shown in FIGS. 7 and 8;

FIG. 10 is a sectional view of a cathode ray tube with a getter device of the present invention mounted therein and includes a graph showing the getter metal distribution across the screen of the tube, showing the reduced amount of getter metal deposited by the getter devices of the present invention;

FIG. 11 is a graph of the sorption speed versus the quantity of gas sorbed showing that getter metal films produced by devices of the present invention maintain their original sorption speed longer.

According to the present invention there is provided:

A getter device comprising:

A. an annular ring having

1. an outer wall,
2. an inner wall,
3. a bottom wall joining the outer wall with the inner wall;

B. a getter metal vapor releasing material in the annular ring;

C. a separate deflector for the getter metal vapor, the deflector having an axially extending segment and a radially extending segment, the axially extending segment being attached to the inner wall of the annular ring.

In a preferred embodiment of the present invention the angle between the axis of the getter device and the deflector is greater than 70° and preferably greater than 80°. By virtue of this important relationship the getter metal vapors are discharged from the getter device in a direction substantially perpendicular to the axis of the getter device. This arrangement is particularly suitable for getter devices intended to be mounted in the antenna position in a cathode ray tube. When so mounted the getter metal vapors are preferentially deposited on the cone of the tube and away from the screen of the tube.

The getter devices of the present invention having a separate deflector are especially advantageous when the getter metal vapor releasing material in the ring has a length to height ratio of over 1:1 and preferably over 3:1 commonly referred to as wide channel getter devices. Such ratios are advantageously employed in order to ensure that substantially all of the getter metal in the getter metal vapor releasing material will be released in the tube. The use of separate deflectors with wide channel getter devices is especially advantageous because of the impossibility of flaring the inner wall of the ring to form an integral deflector.

Any evaporable getter metal can be employed in the devices of the present invention such as the alkali or alkaline earth metals, examples of which include among others calcium, magnesium, strontium, and barium. Barium is the preferred getter metal because of its well-known sorption characteristics. The getter metal can be the sole component of the getter metal vapor releasing material. However, this material is preferably an

alloy comprising the getter metal and one or more less-reactive metals. Such alloys are less reactive towards air and are easier to handle. The preferred getter alloys are those of barium and aluminum, generally in weight ratio of about 10:5 to 10:20, and especially binary alloys containing about 50 to 56 percent barium, balance aluminum. The getter metals and getter alloys can be employed alone or in admixture with other substances. When employed alone so-called endothermic getter devices are produced. These devices rely upon induction heating in order to provide the heat of vaporization of the getter metal. More preferably the getter alloy is employed admixed with nickel to create an exothermic getter device wherein a portion of the heat of vaporization of the getter metal is supplied by an exothermic reaction between the nickel and the barium-aluminum alloy.

Referring now to the drawings and in particular to FIGS. 1 and 2 there is shown a preferred embodiment of the present invention in the form of a getter device 10. The getter device 10 comprises an annular ring 11, a barium vapor releasing material 12 in the annular ring 11 and a deflector 13 attached to the annular ring 11.

The annular ring 11 has an outer wall 14, an inner wall 15 and a bottom wall 16 joining the bottom of the outside wall with the bottom of the inside wall 15. The deflector 13 has an axially extending segment 17 and a radially extending segment 18. By the term, axially, is meant that the segment is substantially parallel to the axis 19 of the getter device. The outside diameter d_1 of the axially extending segment 17 is slightly less than the diameter d_2 of the inside of the inner wall 15 of the ring 11. By this arrangement alignment of the deflector 13 with the ring 11 is easily accomplished by positioning the axially extending segment 17 of the deflector 13 inside of the inner wall 15 of the ring 11. The axially extending segment 17 of the deflector 13 is preferably spot welded to the inner wall 15 of the ring 11 at a plurality of points as indicated by spot welds 20. The spot welding is preferably done to the ring 15 at points all of which are above the barium releasing material 12. This is in order to avoid overheating and consequent accidental discharge of all or a portion of the barium from the barium releasing material 12 during spot welding. The radially extending portion 18 of the deflector 13 rests upon the top 21 of the inner wall 15 of the ring 11. By virtue of this arrangement the deflector 13 is most conveniently axially positioned with respect to the ring 11 without the necessity of cumbersome manufacturing jigs. The extremity 22 of the deflector 13 is substantially coextensive with the outer wall 14 of the ring 11. The significance of this important structural relationship of preferred getter devices of the present invention is explained below with reference to the getter devices shown in FIGS. 5 and 6 wherein the deflector is not coextensive. The radially extending segment 18 of the deflector 13 is inclined to the axis of the ring by an angle, α, of approximately 84½°, in order to direct the getter metal vapor in the desired direction. By virtue of the above described structure the extremity 22 of the deflector 13 is positioned above the top of the outer wall 14 of the ring 11 a distance sufficient to permit escape of barium vapors from the barium vapor releasing material 12.

Referring now to FIG. 3 there is shown an alternative embodiment of the present invention in the form of a getter device 30 wherein the inner wall 31 of the ring 32 is higher than the outer wall permitting the use of a horizontal deflector 34. In this embodiment the distance between the extremity 35 and the top of the outer wall 33 is determined by the difference in height between the inner wall 31 and the outer wall 33, the other structural features being identical to those of the getter device 10.

Referring now to FIG. 4 there is shown yet another embodiment of the present invention wherein the inner wall 41 of the ring 42 is greatly higher than the outer wall 43 with the result that the angle α is greater than 90°. For the usual getter device to be mounted in the antenna position the getter device 40 exhibits few advantages and in fact is less preferred although it may be preferred for certain other specialized applications.

Referring now to FIG. 5 there is shown a getter device 50 having a deflector 51 the extremity 52 of which is beyond the outer wall 53 of the ring 54. The getter device 50 can only be employed with an appropriate combination of a thick deflector 51 and low activation power in order to minimize chances of overheating and melting of the deflector 51 in the vicinity of the extremity 52.

Referring now to FIG. 6 there is shown a getter device 60 wherein the deflector 61 has its extremity 62 at a point inside the outer wall 63 of the ring 64. This embodiment is less preferred since it permits escape of some of the getter metal vapor in a direction other than that desired. However, the getter device 60 may be suitable for certain other specialized applications.

According to another aspect of the present invention there is provided an improved getter device which deposits a reduced amount of getter metal film on the screen of a television tube and which produces a getter metal film which maintains its original sorption speed for a greater period of time. These getter devices have a gas releasing material admixed with the getter metal releasing material and are provided with means for directing the getter metal vapors radially to the axis of the getter device. The preferred means is by the use of one of the deflectors described herein. This deflector is preferably but is not necessarily separate.

Getter devices employing gas releasing materials are also known as described in U.S. Pat. Nos. 3,388,955 and 3,389,288; however such devices have not been employed with deflectors as described herein nor could the advantages of the herein described getter devices have been predicted.

In the broadest aspect any material which releases a gas is suitable for use as the gas-releasing material in the present invention. However, the preferred gas-releasing materials are those which are stable to temperatures up to 400°C in order that they can withstand the heating which normally accompanies de-gasing. Other preferred gas-releasing materials are those which are stable in air, by which is meant, those which neither decompose nor pick up undesirably large quantities of gas from the atmosphere.

The gas-releasing material can be selected such that virtually any gas is released under the desired conditions. However, the preferred gases are the active gases. An active gas is one which is sorbed by the em-

ployed getter metal. Examples of suitable gases include among others: carbon monoxide, carbon dioxide, oxygen, hydrogen, and nitrogen. The preferred gases are hydrogen and nitrogen, hydrogen because of its well-known incidental benefit to cathode activity, and nitrogen because of the rate at which it is sorbed by the preferred getter metals and because of its relatively high mass permitting a relatively small amount to be employed to aid in the control of getter metal film distribution. Nitrogen is most preferred.

Examples of suitable gas-releasing materials include among others: barium carbonate, the metallic hydrides, and nitrides such as barium nitride, barium hydride, titanium hydride phosphorous nitride, and most preferably iron nitride (Fe_4N). Iron nitride is preferred because of its stability in air and its decomposition temperature which is above that commonly employed in de-gasing and is below that of barium evaporation. Furthermore, it yields nitrogen, the preferred gas.

The gas-releasing material and the getter metal can be in any physical form but are generally particulate, and are preferably pressed together to form a cohesive mass. The gas-releasing material can be present in any amount which will release the gas in order to effect distribution of the getter metal film, and in the case of an active gas not saturate the getter metal. The gas-releasing material can be admixed with the getter metal in widely varying weight ratios, but generally is present in ratios of 0.5:100 to 50:100, and preferably 1:100 to 10:100, parts by weight of gas-releasing material per part by weight of getter metal. The gas-releasing material is generally present in an absolute amount sufficient to produce a pressure of 5×10^{-4} to 5×10^{-1}, and preferably 10^{-3} to 5×10^{-2} torr.

Referring to FIGS. **7**, **8** and **9** there is shown a getter device **70** of the present invention. The getter device **70** comprises an annular ring **71** and a barium vapor releasing material **72** therein. The barium releasing material **72** is admixed with Fe_4N. The getter device **70** is provided with a conically shaped deflector **73** which is coaxially positioned with respect to the ring **71** and with respect to the axis **74** of the ring. The conically shaped deflector **73** is attached to he inside periphery **75** of the ring **71**. The deflector **73** extends radially coextensively with the outside periphery **75** of the ring **71**. The periphery **75** of the deflector **73** is spaced from the outside periphery **76** of the ring **71** a distance to permit escape of barium vapor in a direction substantially radially to the axis **74**. The getter device **70** is also provided with an insulating member **77** as described in U.S. Pat. No. 3,381,805 and with holes **78** to permit escape of barium vapor as described in U.S. Pat. No. 3,385,420.

Referring now to FIG. **10** there is shown a cathode ray tube **80** having a cone angle, β, of 110°.

The tube **80** has a screen **81** attached to a cone **82** which in turn is attached to a neck **83**. Within the neck **83** is an electron gun assembly **84**. Within the tube **80** mounted in the antennae position is a getter device **85**. A graph **86** shows the quantity of barium in micrograms per square centimeter ($\mu g/cm^2$) plotted on the abscissa versus distance across the cathode ray tube screen portion plotted on the ordinate. In the graph **86** the line **87** represents the results obtained when barium is released from a getter device identical to the getter device **70**. The line **88** represents results achieved by use of a control getter device identical to the getter device **70** with the single exception that it has no deflector **73**. Thus it can be seen that the getter device **70** deposits much less barium on the screen **91** than does the control getter device.

Referring now to FIG. **11** there is shown a graph **90** of the sorption speed for carbon monoxide plotted on a logarithmic scale on the abscissa versus the quantity of carbon monoxide sorbed on a linear scale on the ordinate. The line **91** represents results obtained by a control getter device identical to the getter device **70** with the single exception that it contains no shield **73**. This control getter device is representative of the prior art. The line **22** shows results obtained from the getter device **70**. FIG. **11** clearly shows that the film produced by the getter device **70** illustrated by line **92** maintains its initial sorption speed until about 3000 liter-torr of carbon monoxide have been absorbed whereas the sorption speed of a film produced by a prior getter device represented by the line **91** begins to decrease its sorption speed after only 2000 liter-torr of carbon monoxide have been sorbed.

Thus it can be seen that by the present invention there have been provided improved getter devices which deposit a reduced amount of getter metal on the screen portion of a cathode ray tube and also produce a getter metal film which maintains its initial sorption speed for a longer period of time, i.e. while a greater quantity of carbon monoxide has been sorbed, than a film produced by prior getter devices.

As used herein liter-torr refers to the quantity of gas in liters when measured at a pressure of 1 torr. One torr is a pressure equal to that exerted by a column of mercury 1 mm high.

Although the invention has been described in considerable detail with reference to certain preferred embodiments thereof, it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described above and as defined in the appended claims.

What is claimed is:

1. A getter device comprising:

A. an annular ring having

1. an outer wall,
2. an inner wall,
3. a bottom wall joining the outer wall with the inner wall;

B. a getter metal vapor releasing material in the annular ring;

C. a separate deflector for the getter metal vapor, the deflector having an axially extending segment and a radially extending segment, the axially extending segment being attached to the inner wall of the annular ring.

2. A getter device of claim **1** wherein the ratio of the width of the getter metal vapor releasing material to the height of the getter metal vapor releasing material is greater that 1:1.

3. A getter device of claim **1** wherein the ratio of the width of the getter metal vapor releasing material to the height of the getter metal vapor releasing material is greater than 3:1.

4. The getter device of claim **1** wherein the outside diameter of the axially extending segment is slightly less than the diameter of the inside of the inner wall of the ring.

5. The getter device of claim 1 wherein the radially extending portion of the deflector rests upon the top of the inner wall of the ring.

6. The getter device of claim 1 wherein the extremity of the deflector is substantially coextensive with the outer wall of the ring.

7. The getter device of claim 1 wherein the radially extending portion of the deflector is inclined to the axis of the ring by an angle greater than 70°.

8. The getter device of claim 1 wherein the radially extending portion of the deflector is inclined to the axis of the ring by an angle greater than 80°.

9. The getter device of claim 1 wherein the extremity of deflector is positioned above the top of the outer wall of the ring a distance sufficient to permit escape of getter metal vapors.

10. The getter device of claim 1 wherein the getter metal is barium.

11. The getter device of claim 1 wherein the height of the inner wall of the ring is substantially equal to the height of the outer wall of the ring.

12. The getter device of claim 1 wherein the axially extending segment of the deflector is spot welded to the inner wall of the ring.

13. The getter device of claim 6 wherein the spot welding is at a plurality of points above the top of the getter metal vapor releasing material.

14. A getter device comprising:

A. an annular ring having
   1. an outer wall,
   2. an inner wall,
   3. a bottom wall joining the outer wall with the inner wall;

B. a getter metal vapor releasing material admixed with a gas releasing material in the annular ring;

C. means for radially directing the getter metal vapor said means comprising a separate deflector having an axially extending segment and a radially extending segment, the axially extending segment being attached to the inner wall of the annular ring.

15. The getter device of claim 14 wherein the radially extending portion of the deflector rests upon the top of the inner wall of the ring.

16. The getter device of claim 14 wherein the extremity of the deflector is substantially coextensive with the outer wall of the ring.

17. The getter device of claim 14 wherein the radially extending portion of the deflector is inclined to the axis of the ring by an angle greater than 80°.

18. The getter device of claim 14 wherein the gas releasing material is Fe_4N.

19. The getter device of claim 14 wherein the gas releasing material is admixed with the getter metal in a weight ratio of 0.5:100 to 50:100; and wherein the gas releasing material produces a pressure of 5×10^{-4} to $5\times10^{-}$torr in a cathode ray tube.

20. A getter device comprising:

A. an annular ring having:
   1. an outer wall,
   2. an inner wall,
   3. a bottom wall joining the outer wall with the inner wall;

B. a getter metal vapor releasing material in the annular ring;

C. A separate deflector for the getter metal vapor, the deflector having an axially extending segment and a radially extending segment, the radially extending segment being inclined to the axis of the ring by an angle greater than 70°.

21. A getter device comprising:

A. an annular ring having
   1. an outer wall,
   2. an inner wall of substantially the same height as the outer wall
   3. a bottom wall joining the outside wall with the inside wall;

B. a barium vapor releasing material in the annular ring;

C. a deflector for the getter metal vapor, the deflector having an axially extending segment and a radially extending segment, the outside diameter of the axially extending segment being slightly less than the diameter of the inside of the inner wall, the axially extending segment of the deflector being spot welded to the inner wall of the ring at a plurality of points all of which are above the barium releasing material, the radially extending portion of the deflector resting upon the top of the inner wall of the ring, the extremity of the deflector being substantially coextensive with the outer wall of the ring, the radially extending portion of the deflector being inclined to the axis of the ring by an angle greater than 80° whereby the extremity of the deflector is positioned above the top of the outer wall of the ring a distance sufficient to permit escape of barium vapors.

22. A getter device comprising:

A. an annular ring having
   1. an outer wall,
   2. an inner wall of substantially the same height as the outer wall, and
   3. a bottom wall joining the outside wall with the inside wall;

B. a mixture of barium vapor releasing material and Fe_4N in the annular ring in a ratio of 1:100 to 10:100

C. a deflector for the getter metal vapor, the deflector having an axially extending segment and a radially extending segment, the outside diameter of the axially extending segment being slightly less than the diameter of the inside of the inner wall, the axially extending segment of the deflector being spot welded to the inner wall of the ring at a plurality of points all of which are above the barium releasing material, the radially extending portion of the deflector resting upon the top of the inner wall of the ring, the extremity of the deflector being substantially coextensive with the outer wall of the ring, the radially extending portion of the deflector being inclined to the axis of the ring by an angle greater than 80° whereby the extremity of the deflector is positioned above the top of the outer wall of the ring a distance sufficient to permit escape of barium vapors.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,719,433 Dated March 6, 1973

Inventor(s) Elio Rabusin

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, Line 16, delete "FIG.11" and insert

--FIG. 12--.

Signed and sealed this 5th day of November 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,719,433 Dated March 6, 1973

Inventor(s) Elio Rabusin

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Claim 19, Line 5, delete "5 x 10^{-} torr" and insert --5 x 10^{-1} torr--.

Signed and sealed this 26th day of March 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.