Nov. 22, 1966 M. ROME ETAL 3,287,581

X-RAY VIDICON TUBE HAVING SCREEN HERMETICALLY SEALED TO ENVELOPE

Filed April 30, 1962

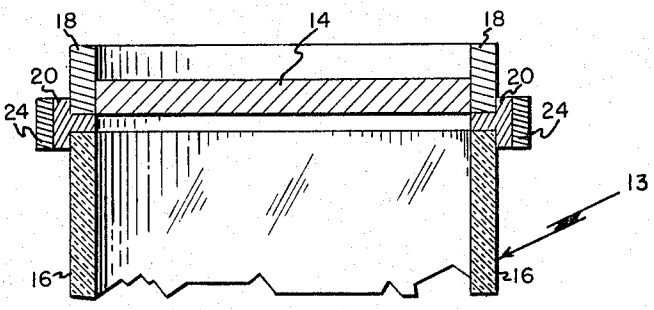


FIG 1

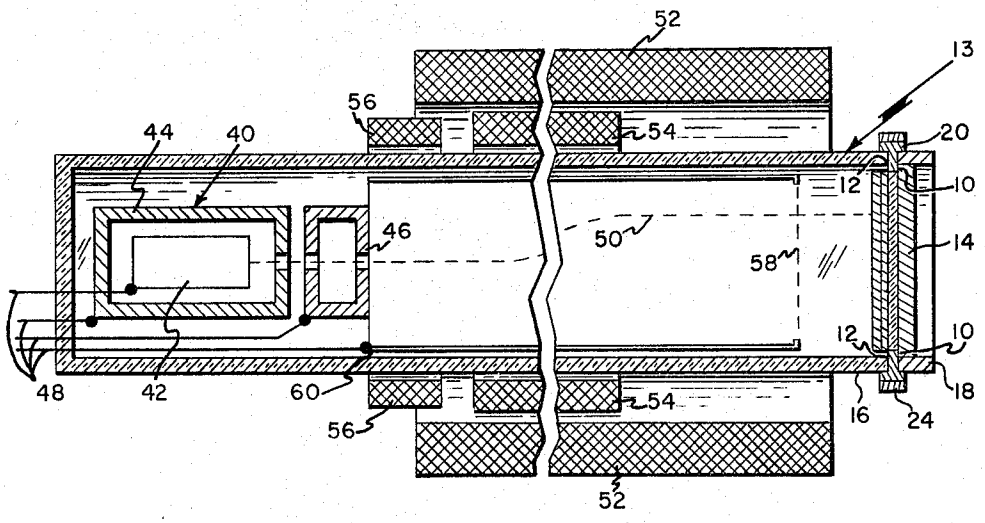


FIG 2

INVENTORS
MARTIN ROME
HAROLD O.W JORDAN
BY
AGENT

United States Patent Office 3,287,581 Patented Nov. 22, 1966

3,287,581

X-RAY VIDICON TUBE HAVING SCREEN HERMETICALLY SEALED TO ENVELOPE

Martin Rome and Harold O. W. Jordan, Stamford, Conn., assignors to The Machlett Laboratories, Incorporated, Springdale, Conn., a corporation of Connecticut

Filed Apr. 30, 1962, Ser. No. 191,085
1 Claim. (Cl. 313—59)

This invention relates to an X-ray vidicon and, more particularly, to a novel X-ray vidicon window assembly.

The application of television techniques to X-ray pick-up devices has necessitated utilizing a window minimum X-ray absorption in place of the conventional glass window as the vacuum-tight terminating element. Beryllium metal, noted by its low X-ray absorption characteristics, is an ideal window for use in X-ray sensitive pick-up tubes, particularly in applications involving low X-ray energy level incident radiation. The low X-ray absorption of beryllium metal, compared to glass, enhances the sensitivity of the camera tube, particularly at low energy levels, simply by permitting more radiation to become incident on the photoconductive surface.

However, beryllium surfaces cannot be conveniently prepared with the high degree of uniformity and polishing required for high resolution pick-up tubes. Both the microcrystalline structure and the protective oxide layer are detrimental influences on the selenium photoconductor substrate used with the beryllium window. That is, if the selenium photoconductor is vaporized directly onto the beryllium metal, there occurs a detrimental recrystallization of the selenium from the amorphous to a lower resistivity crystalline form due, at least in part, to the beryllium.

Accordingly, it is a primary object of our invention to provide structures in which the beryllium window may be sealed to a glass bulb forming the vacuum-tight envelope for the camera tube.

Another object of our invention is to provide a means for preventing a reaction or change in crystal structure by interposing a barrier layer between the beryllium and selenium.

Still another object of our invention is to provide a smooth polished uniform substrate for the selenium without a substantial increase in X-ray absorption.

Yet another object of our invention is to provide a thin smooth uniform metallic substrate for the selenium that is an exact replica of the original beryllium surface and which may be more readily polished than the refractory beryllium.

A further object of our invention is to provide a thin, metallic, thermally conductive substrate which will also meet the requirements of low X-ray absorption and a smooth uniform surface.

A still further object of our invention is to provide a smooth, uniform, thermally conductive substrate for the selenium without a substantial increase in X-ray absorption.

The features of our invention, which we believe to be novel, are set forth with particularity in the appended claim. Our invention itself, however, both as to its organization and method of operation together with further objects and advantages thereof, may be best understood by reference to the following description, taken in conjunction with the accompanying drawings in which:

FIG. 1 is a partial sectional view of our basic face-plate structure for an X-ray vidicon, and

FIG. 2 is a sectional view of a schematic representation of our novel beryllium window structure as used in a typical X-ray vidicon.

Referring now to FIG. 1, there is shown the basic structure utilizing a beryllium window in an X-ray vidicon. In the basic structure, there is provided an envelope **16**. A cylindrical ring **18**, having the same configuration as envelope **16**, is affixed to the end of the envelope by means of the "T"-shaped solder ring **20**. Around the cross-bar portion of the "T"-shaped indium solder is a stainless steel ring **24**. The whole assembly comprises window assembly **13**.

The window assembly is formed by joining beryllium window **14** to the kovar or monel ring **18**. It has been found that monel is preferred since it is more easily brased than kovar and lends itself more readily to grinding and polishing. Grinding and polishing the mating surfaces is essential for the cold seal technique that is utilized in this invention. Having provided the seal between the beryllium and the monel ring the window assembly **14**, **18** is sealed to the edge of envelope **16** by means of indium solder **20**. The indium or indium alloy is first cast or joined to the inside surface of the stainless steel ring **24**. The indium, which is soft and pliable, may be formed by machining or any other well-known means to the precise and desired configuration.

The indium stainless steel assembly **20**, **24** is then interposed between the monel ring **18** and the envelope **16** and the window assembly is joined to the envelope by simultaneously applying a uniform pressure to both ring **18** and envelope **16**.

Referring now to FIG. 2, it will be seen that when uniform pressure is applied to the mating surfaces of ring **18** and envelope **16**, that portion of the solder lying therebetween is squeezed out into the inside of the envelope to form a shelf having upper and lower surfaces **10** and **12**, respectively. It now becomes obvious that a photoconductive layer and a barrier layer (if necessary) may be applied to the under surface of beryllium layer **14** in accordance with the principles set forth in our copending application Serial No. 191,099 filed April 30, 1962 and entitled "X-Ray Vidicon Assembly and Method."

FIG. 2 shows our invention incorporated in a typical X-ray vidicon-type tube. The basic structure **13** is shown having ring **18** sealed to envelope **16**, as previously described. The wall **16** and the structure **13** together comprise a vacuum-tight envelope having an electron gun **40** mounted in one end thereof. The components that make up gun **40** include the usual cathode **42**, control electrode **44**, and one or more accelerating electrodes **46**, all of which are connected to lead-in means **48** in a well-known manner. An electron beam **50** emanating from gun **40** is directed onto the target **62** of photoconductive material at the other end of envelope **10**, and means is provided for focusing beam **50** and scanning it over the photoconductor **62**. Such means may include a focussing coil **52**, a deflection yoke **54** and an alignment coil **56**, all of which are arranged approximately as shown. Another electrode such as grid **58** having a suitable potential applied thereon is positioned adjacent the photoconductive material **62** and, in operation, functions cooperatively with focussing coil **52** to insure that electron beam **50**, in its final approach to the surface **62**, is normal thereto. A final accelerating electrode **60** is also provided and may take the form of a metallic cylinder or a conductive coating painted on the interior wall of the envelope between electrodes **46** and **58**. The lead-in means **48**, not shown in detail, are provided for the purpose of connecting electrode **60** as well as the gun electrodes **42**, **44**, and **46** to the appropriate source of electrical potential located externally of the tube.

While there has been described what is presently considered a preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without depart-

ing from the inventive concept contained therein, and it is, therefore, aimed in the appended claim to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

An X-ray vidicon tube comprising a glass envelope having one open end shaped to an annular configuration, and a window assembly mounted over said open end of the envelope comprising a metal ring and a beryllium disc sealed throughout its periphery within the ring, the ring having inner and outer surface configurations substantially the same as the annular open end of the envelope and superimposed thereon, brazing material sealing the ring to the open end of the envelope, metal means encircling the brazing material, an X-ray sensitive target on the inner surface of the window assembly, and an electron beam-forming device in the envelope for scanning the target with electrons.

References Cited by the Examiner

UNITED STATES PATENTS

2,394,984	2/1946	Claussen	313—59 X
2,909,686	10/1959	Zunick	313—59
2,951,962	9/1960	Miller et al.	313—65
3,061,664	10/1962	Kegg	313—65 X

HERMAN KARL SAALBACH, *Primary Examiner.*

S. CHATMON, JR., *Assistant Examiner.*