(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 104 938**
B1

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **22.03.89**

(51) Int. Cl.[4]: **H 01 J 33/04,** H 01 J 5/18

(21) Application number: **83305776.3**

(22) Date of filing: **27.09.83**

(54) **Readily attachable and detachable electron-beam permeable window assembly.**

(30) Priority: **29.09.82 US 427903**

(43) Date of publication of application:
04.04.84 Bulletin 84/14

(45) Publication of the grant of the patent:
22.03.89 Bulletin 89/12

(84) Designated Contracting States:
CH DE FR GB IT LI NL SE

(56) References cited:
EP-A-0 059 249
DE-A-3 022 127
DE-C- 760 042
US-A-3 440 466
US-A-4 324 980

(73) Proprietor: **Tetra Pak Finance & Trading S.A.**
70, Avenue C.F. Ramuz
CH-1009 Pully-Lausanne (CH)

(72) Inventor: **Cheever, Richard Norcross**
38 Pope Road
Acton Massachusetts (US)

(74) Representative: **Allsop, John Rowland et al**
Rowland Allsop & Co. Black Boy Yard 15 High Street
West Wycombe High Wycombe, Bucks. HP14 3AE (GB)

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Courier Press, Leamington Spa, England.

Description

The present invention relates to electron beam irradiation apparatus and more particularly to such apparatus incorporating electron beam permeable windows as of thin metal foil and the like, being directed to improvements in enabling the more facile and fast replacement of such window structures as the electron beam irradiation exit for evacuated electron beam generator housings and the like.

The problem of damage in use and ultimate wear and burning of the thin electron beam pervious foil windows utilized in electron beam irradiation apparatus has plagued the art for some time, and has given rise to all kinds of proposed solutions to the problem including the utilization of supporting structures as described, for example, in United States Letters Patent No. 3,440,466, and the use of stronger or more durable alloys and the like.

A window assembly for the passage of an irradiating beam has also been proposed in DE—A—3022127 to the Hahn-Meitner-Institute for Nuclear Science, Berlin GmbH. This essentially comprises a thin metal window housed in a frame for insertion between supporting flanges.

In accordance with the present invention however, a different approach to the problem has been taken in providing for the ready attachment and detachment of relatively inexpensive and rapidly replaceable electron beam window assemblies in the form of pre-prepared and easily employed frames or cassettes that can be removed or installed with vacuum and gas seals in very short periods of time.

According to one aspect of the invention there is provided apparatus for electron beam irradiation of a moving web comprising a housing, means in the housing for emitting a beam of electrons through an opening in the housing to irradiate the web, an electron beam window assembly between the housing opening and the web characterised in that the window assembly has a movable frame provided with an opening for passage of the electron beam, an electron beam permeable window overlying the frame opening and having a marginal region secured to one side of the frame and a peripheral region supported by the frame laterally inwardly of the marginal region, a sealing ring between the electron beam housing and said peripheral region of the window, tab means extending laterally outwardly from the frame and fixed thereto, flange means for supporting the frame in the housing, and locking means cooperative with the flange means and the housing and adapted when inactivated to permit insertion or withdrawal of the frame by the tab means respectively to or from a position under the sealing ring, and adapted when activated to cause a locking force to be exerted against the flange means to seal the window to said sealing ring.

As described in my earlier United States Letters Patent No. 4,305,000 and in other United States Letters Patent Nos. 4,252,413 and 3,702,412, 3,745,396 and 3,769,600, exit for electron beam generators is generally a titanium or aluminium thin window or composites of the same or similar materials. In applications where the electron beam generator is subject to chemical attack, as where it is being used in an environment where hydrogen peroxide or other sterilization vapors are involved, the thin window may have to be replaced on a relatively frequent schedule, which is a serious problem in production operation. The corrosion from the vapors weakens the windows and, of course, they fail. Other catastrophes occur with windows as of aluminum, for example, where the moist air products, such as nitric acid, are generated and also corrode or attack the window. Titanium windows are subject to the hydrogen peroxide or other vapor attacks. No windows currently last long periods of time, but for one reason or another perforate from the corrosion effects. While composite metals i.e. noble metal overlays may be employed in some instances, there may be presently economically out of the question for production equipment. As before stated, the present invention ameliorates the problem of the costly and time-consuming replacement of windows in conventional fashion by providing a novel readily attachable and detachable electron-beam permeable window assembly or cassette that enables rapid replacement of windows, say every few weeks for aluminum, or even every day, and by relatively unskilled individuals. This concept means that the present and past constructions involving conventional bolted flanges for the windows may be discarded. This is not only time-consuming, but it certainly is not adaptable for the concept of a quick release or readily detachable or attachable construction. A second requirement is that the window assebly should be fool-proof in the handling of the thin fine foil, both in terms of the user not touching the foil to damage the same and also in terms of the assembly being self-locating to lock-seal in the housing exit region against resilient O-rings or the like with no question or error in insertion or removal, and without the necessity for fine adjustment.

The invention will now be described in connection with the accompanying drawing illustrating a best mode of utilization of the same and in which the single figure is a longitudinal cross section of the invention in preferred form.

Referring to Fig. 1, a pair of longitudinally spaced opposed normally evacuated electron-beam housings H are shown assembled for purposes of irradiating opposite sides of a web, so-labelled, or materials carried thereby passing longitudinally along a tunnel T. Each housing H supports within its interior the electron-emitting cathode C, as of the types described in said Letters Patent or of other conventional types, and is shown provided with an exit region at the bottom (or top for the lower unit) at which there is an opening O over which the electron-beam permeable thin metal window W is to be sealed.

This sealing is effected against resilient marginal O-rings designated at 1 and peripherally clamping against the window W and holding it in sealed assembly. The thin electron beam window W, in accordance with the invention, overlies an opening O' in a rectangular frame F that supports the thin window over the opening O', with the window W resting on the upper side of the frame F and secured thereto near outer margins as at M by a thin layer of adhesive or tape A. The margins are outside the region where the sealing ring 1 will ultimately clamp against the window W, such that a peripheral region supported by the frame is provided against which the sealing rings 1 will ultimately bear, this being inward of the sealing near the margin of the window. Further in accordance with the invention, tab means of other handle means T' is provided extending beyond the frame F to permit the user to handle the frame assembly without touching the window and to be able to insert and remove the same from under the sealing ring 1.

Below the frame F, on the opposite side from the window W, is shown a peripheral flange FL which supports the frame assembly on the side opposite the window, and this bears against the outer wall of the tunnel T bounding a pathway or region R through which the article or material to be sterilized or otherwise electron-beam-irradiated for other purposes, labelled "Web", is passed. As shown, the housing H is bolted to the tunnel conduit at B so that the two form a single structural unit. Between the flange FL and the upper surface of the pathway R there is shown a locking means in the form of an inflatable resilient balloon I which, when inflated, bears against the under side of the flange FL and forces the frame F carrying the window W against the sealing ring 1.

In operation, the user inserts the assembly or cassette comprising the window W carried by the frame F by the tab T', with the locking mechanism I deflated or inactivated; and the same is pushed in, stopping as a result of a limit step S on the tab T' engaging the outer edge of the flange FL, providing for positive location in just the right position. Inflation or activation of the locking mechanism I will then force the flange FL and thus the frame F and window W up against the sealing ring 1 and effect the desired seal to the housing H, whereupon the housing may again be evacuated and operation may continue with the replaced window. Sponge rubber resilient seals 3 adjacent to the lock-sealing balloon I and between window frame F and flange FL are shown provided to seal the cassette in the wall of the tunnel T against leakage of ozone. The frame FL is depressed against the gas-seal 3 to permit insertion and removal of the window assembly. If desired, a cam (not shown) at either transverse end could be employed and rotated to assist in this depression step. In operation, as before stated, upon the deflation of the locking member I, one depresses the frame assembly or cassette to remove the cassette, as for replacement by another cassette.

Typical dimensions for a suitable frame and window operable with electron beam energy in the range of 150 KEV, more or less, for such purposes as sterilizing packaging or the like, are 40 cm by 15 cm with a 12 micrometer titanium window foil W.

The effective loading or quick-release resilient action attained by the structure I can, of course, be obtained with springs or cams or similar mechanisms, though the best mode embodiment illustrated appears to have considerable advantages for these particular applications.

Claims

1. Apparatus for electron beam irradiation of a moving web comprising a housing, means in the housing for emitting a beam of electrons through an opening in the housing to irradiate the web, an electron beam window assembly between the housing opening and the web characterised in that the window assembly has a movable frame (F) provided with an opening (O') for passage of the electron beam, an electron beam permeable window (W) overlying the frame opening (O') and having a marginal region (M) secured to one side of the frame (F) and a peripheral region supported by the frame (F) laterally inwardly of the marginal region (M), a sealing ring (1) between the electron beam housing (H, T) and said peripheral region of the window (W), tab means (T') extending laterally outwardly from the frame (F) and fixed thereto, flange means (FL) for supporting the frame (F) in the housing (H), and locking means (I) cooperative with the flange means (FL) and the housing (T) and adapted when inactivated to permit insertion or withdrawal of the frame (F) by the tab means (T') respectively to or from a position under the sealing ring (1), and adapted when activated to cause a locking force to be exerted against the flange means (FL) to seal the window (W) to said sealing ring (1).

2. Apparatus as claimed in claim 1 wherein stop means (S) is provided on said flange means (FL) for limiting the position of insertion of said frame (F).

3. Apparatus as claimed in claim 1 or 2 wherein said locking means (I) is an inflatable resilient balloon.

4. Apparatus as claimed in any preceding claim wherein said housing is comprised of a first chamber (H) for the electron emitting means (C) and a second chamber in the form of a tunnel (T) for passage of the web to irradiate one side thereof, attached to the first chamber (H), and sealing means (3) for sealing said window assembly to said tunnel (T).

5. Apparatus as claimed in claim 4 wherein a said first chamber (H) with a said window assembly is disposed with respect to said tunnel (T) to irradiate the other side of said web, at a region displaced along the tunnel (T) from the point of irradiation of said one side of the web.

Patentansprüche

1. Vorrichtung zur Elektronenstrahlbehandlung einer sich bewegenden Bahn, mit einem Gehäuse, mit Mitteln in dem Gehäuse zum Aussenden eines Elektronenstrahls durch eine im Gehäuse vorgesehene Öffnung für die Bestrahlung der Bahn, sowie mit einer Elektronenstrahl-Fensteranordnung zwischen der Öffnung im Gehäuse und der Bahn, dadurch gekennzeichnet, daß die Fensteranordnung folgende Elemente besitzt: einen bewegbaren Rahmen (F), der mit einer Öffnung (O') für den Durchtritt des Elektronenstrahles versehen ist, ein für den Elektronenstrahl durchlässiges Fenster (W), welches die Öffnung (O') im Rahmen überdeckt, einen an einer Seite des Rahmens (F) befestigten Randbereich (M) besitzt sowie innerhalb des Randbereiches (M) einen vom Rahmen (f) getragenen Umfangsbereich aufweist, einen Dichtungsring zwischen dem Elektronenstrahlegehäuse (H, T) und dem erwähnten Umfangsbereich des Fensters (W), Laschenmittel (T') die sich seitwärts nach außen von dem Rahmen (F) wegerstrecken und an diesem Rahmen befestigt sind, Flanschmittel (FL), die den Rahmen (F) im Gehäuse (H) halten, sowie Verriegelungsmittel, die mit den Flanschmitteln (FL) und dem Gehäuse (T) zusammenwirken und im nichtaktivierten Zustand ein Einsetzen oder Entfernen des Rahmens (F) mit Hilfe der Laschenmittel (T') in bzw. aus einer Position unter dem Dichtungsring (1) gestatten sowie in ihrem aktivierten Zustand eine Verriegelungskraft auf die Flanschmittel (FL) ausüben, um das Fenster (W) dicht gegen den Dichtungsring (1) zur Anlage zu bringen.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß Stopmittel (S) an den Flanschmitteln (FL) vorgesehen sind, um die Einsetzposition des Rahmens (F) zu begrenzen.

3. Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Verriegelungsmittel von einem aufblasbaren, elastischen Balg gebildet sind.

4. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das Gehäuse von einer ersten Kammer (H) für die Mittel (C) zur Aussendung des Elektronenstrahles sowie von einer zweiten Kammer in Form eines Tunnels (T) für den Durchtritt der auf einer Seite zu bestrahlenden Bahn gebildet ist, wobei die zweite Kammer an der ersten Kammer (H) befestigt ist, und daß Dichtungsmittel (3) vorgesehen sind, um die Fensteranordnung am Tunnel (T) abzudichten.

5. Vorrichtung nach Anspruch 4, daß eine erwähnte erste Kammer (H) mit einer erwähnten Fensteranordnung am Tunnel zur Bestrahlung der anderen Seite der Bahn vorgesehen ist, und zwar an einem Bereich, der entlang des Tunnels gegenüber dem Bestrahlungspunkt der einen Seite der Bahn versetzt ist.

Revendications

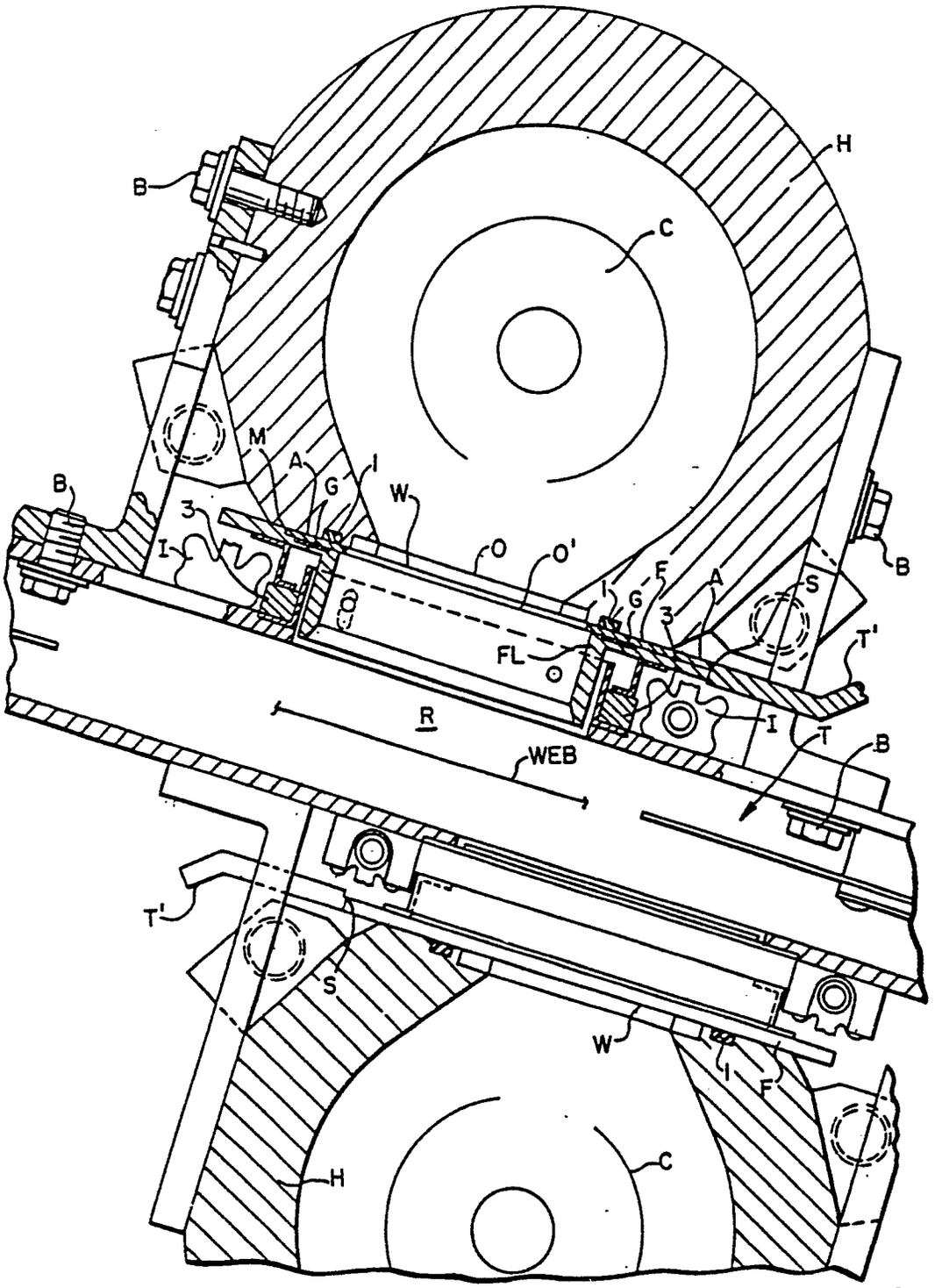
1. Appareil pour irradiation à faisceau d'électrons d'un tissu amovible comprenant un carter, un moyen dans le carter pour émettre un faisceau d'électrons à travers une ouverture dans le carter pour irradier le tissu, un assemblage de fenêtre à faisceau d'électrons entre l'ouverture du carter et le tissu, caractérisé en ce que l'assemblage de fenêtre possède un cadre amovible (F) pourvu d'une ouverture (O') pour le passage d'un faisceau d'électrons, une fenêtre (W) perméable au faisceau d'électrons, surplombant l'ouverture (O') du cadre et possédant une zone marginale (M) fixée à un côté du cadre (F) et une zone périphérique supportée par le cadre (F) latéralement à l'intérieur de la zone marginale (M), un anneau d'étanchéité (1) entre le carter (H, T) à faisceau d'électrons et la zone périphérique de la fenêtre (W), un moyen de fixation (T') s'étendant latéralement à l'extérieur à partir du cadre (F) et fixé à cet endroit, un moyen à bride (FL) pour supporter le cadre (F) dans le carter (H), et un moyen de blocage (I) en coopération avec le moyen à bride (FL) et le carter (T) et conçu quand il est rendu inactif pour permettre l'introduction ou le retrait du cadre (F) par le moyen de fixation (T') respectivement dans ou à partir d'une position sous l'anneau d'étanchéité (1), et conçu quand il est rendu actif pour provoquer une force de blocage qui doit s'exercer contre le moyen à bride (FL) pour isoler de manière étanche la fenêtre (W) sur cet anneau d'étanchéité (1).

2. Appareil selon la revendication 1, dans lequel le moyen de stoppage (S) est prévu sur le moyen à bride (FL) pour limiter la position ou l'introduction du cadre (F).

3. Appareil selon la revendication 1 ou 2, dans lequel le moyen de blocage (I) est un ballon élastique gonflable.

4. Appareil selon l'une quelconque des revendications précédentes, dans lequel le carter comprend une première chambre (H) pour le moyen (C) émettant des électrons et une seconde chambre sous la forme d'un tunnel (T) pour le passage du tissu à irradier sur un côté, reliée à la première chambre (H), et un moyen d'étanchéité (3) pour isoler de manière étanche l'assemblage de fenêtre à ce tunnel (T).

5. Appareil selon la revendication 4, dans lequel une première chambre (H) avec un assemblage de fenêtre est disposée par rapport à ce tunnel (T) de façon à irradier l'autre côté du tissu, dans une zone décalée le long du tunnel (T) depuis le point d'irradiation d'un côté du tissu.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