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 [33] **Sweden**
 [31] **7174/68**

3,114,068 12/1963 Shortridge..... 313/237
 3,470,412 9/1969 Sakamoto..... 313/237
 3,478,244 11/1969 Meyer et al..... 313/237

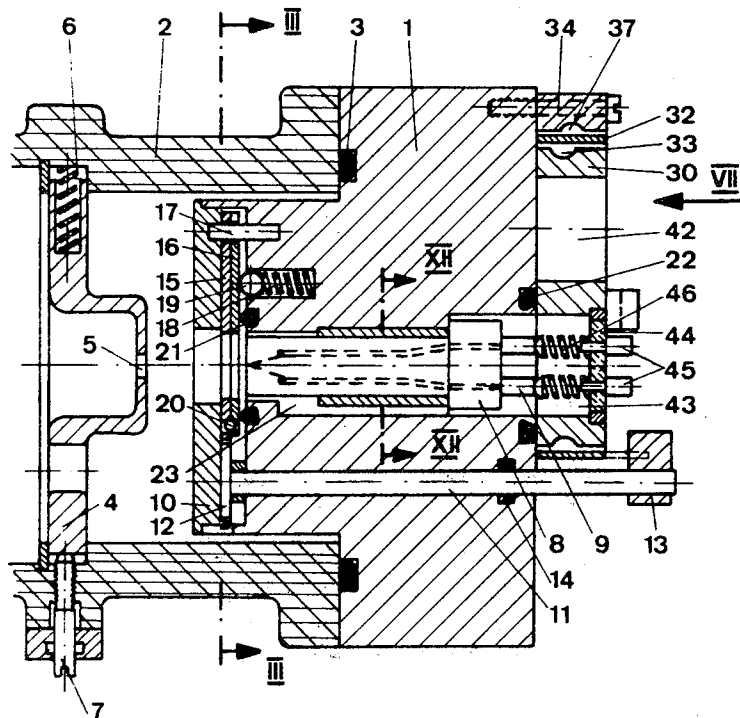
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[54] **CATHODE-RAY DEVICE WITH A REPLACEABLE CATHODE**
 13 Claims, 12 Drawing Figs.

[52] U.S. Cl..... 313/237,
 [51] Int. Cl..... H01J 1/00
 [50] Field of Search..... 313/236,
 237

[56] **References Cited**
 UNITED STATES PATENTS
 2,301,955 11/1942 Krause 313/237

ABSTRACT: A cathode-ray device has an electron-gun system with a replaceable cathode. The cathode is housed in a space in the base of the device. The space has a forward opening into the body of the device for the passage of electrons and a rear opening allowing withdrawal of the cathode. A vacuum lock is provided by respective closures at the front and rear openings, the operating mechanisms for the closures being interlocked to prevent one closure being opened unless the other is securely closed. Each closure has a plate engaging a sealing ring disposed about the associated opening, the plate being moved linearly away from the sealing ring prior to being turned to align an aperture in the plate with the associated opening. Closure is effected by a reverse sequence.



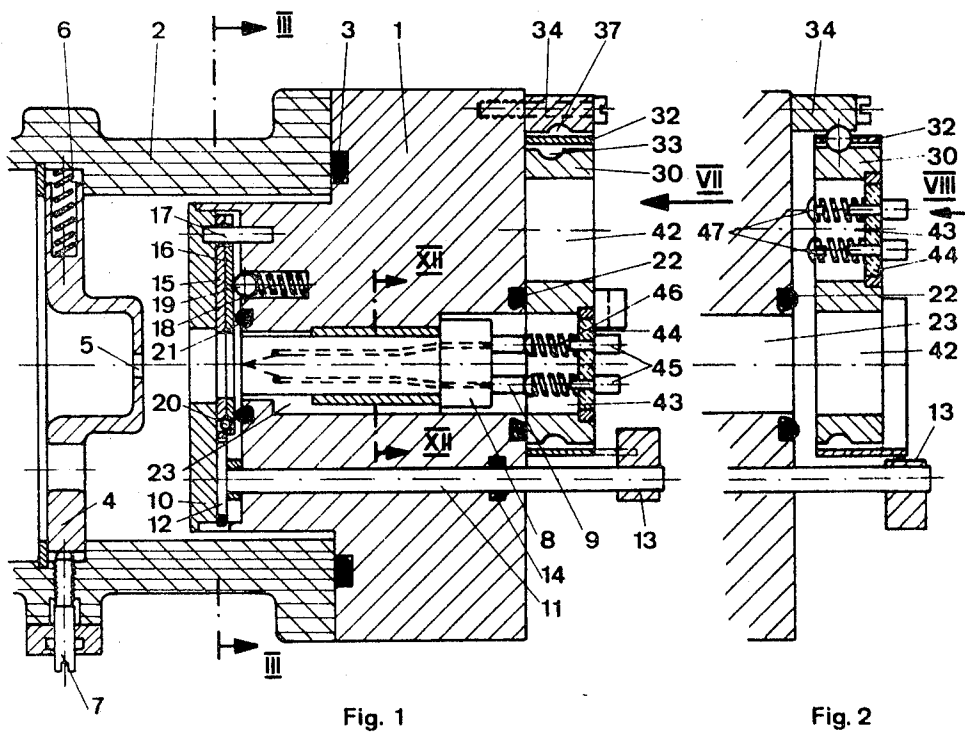


Fig. 1

Fig. 2

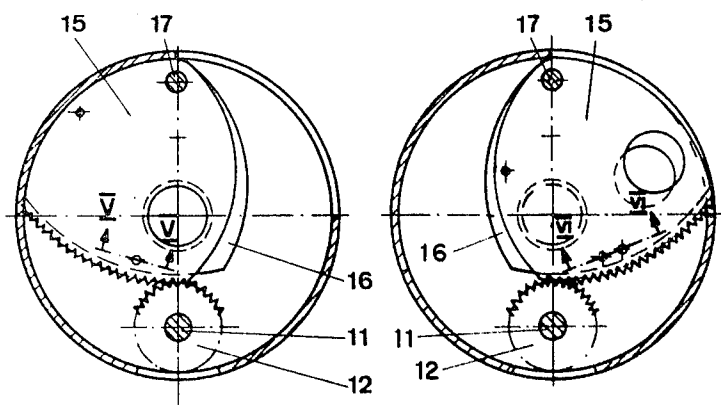


Fig. 3

Fig. 4

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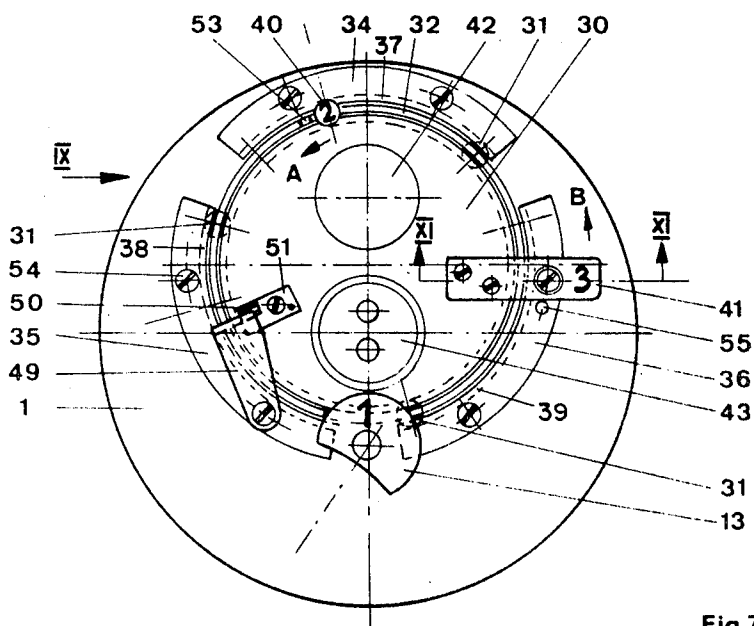


Fig. 7

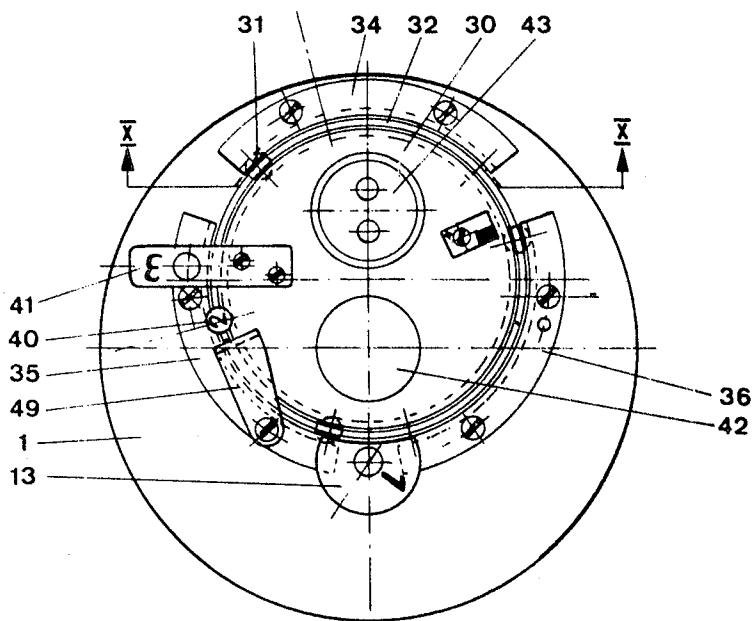


Fig. 8

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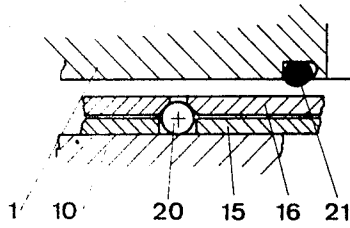


Fig. 5

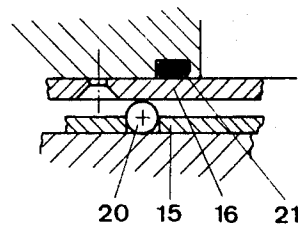


Fig. 6

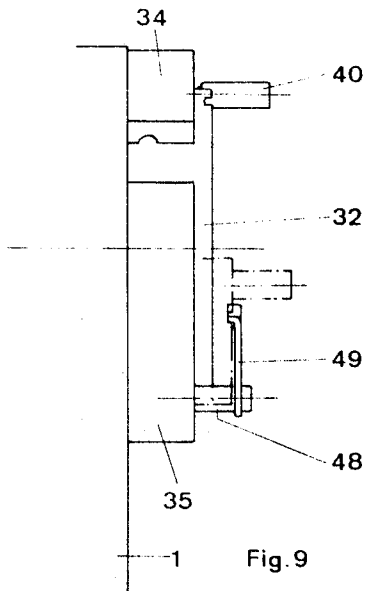


Fig. 9

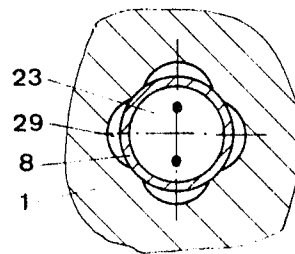


Fig. 12

Fig. 10

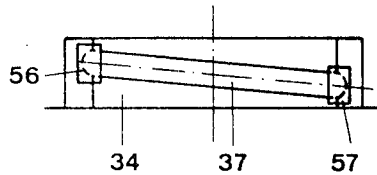
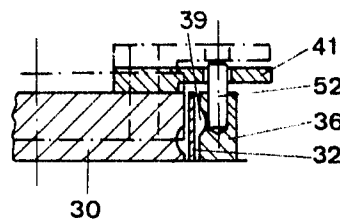


Fig. 11



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CATHODE-RAY DEVICE WITH A REPLACEABLE CATHODE

This invention relates to an electron-gun system having a replaceable cathode.

In some electron-gun systems, such as found in cathode-ray tubes, it is desirable to be able to replace the cathode of the gun with the least possible inconvenience and in particular it is desirable that the replacing of the cathode can be done quickly. To this end the cathode may be located in a housing from which it is withdrawable by movement rearward of the electron-gun system. In order to prevent the vacuum of the cathode-ray tube or other device being lost upon replacement of the cathode a closure is provided at the front of the housing which is closed off prior to withdrawal of the cathode. The closure blocks the electron path from the cathode and consequently the closure has to be opened to allow the device to operate upon the fresh cathode being inserted in the housing. In order to maintain the device vacuum a further closure provided at the rear of the housing, the further closure being closed during operation of the device but being opened to allow replacement of the cathode. The cathode is thus mounted in the housing between two closure arrangements forming a vacuum lock.

The rear closure of one known vacuum lock consists of a screwed cover plate. This has the disadvantage that after removal of the plate the sealing surfaces can easily be damaged or collect dirt. Moreover one of the directions of movement of the front closure for this type of lock involves sliding the plate backwards and forwards, so that the plate has to be carried between guides or some similar arrangement. These guides also bring several disadvantages with them in that they are prone to trouble, they require careful maintenance and they are expensive. Another major drawback of the vacuum lock in question lies in the fact that no form of interlock whatsoever is provided to guard against incorrect use. Therefor the front closure plate in particular can be moved to and fro even at those points where it is pressed against annular seals, resulting in wear and damage of these seals.

We shall hereinafter describe apparatus in which the above disadvantages are at least mitigated and it is out of the development of this apparatus that the present invention has arisen.

According to the invention there is provided an electron gun system including a housing having a pair of openings between which extends a space for receiving a cathode, one of said openings serving to allow insertion of said cathode into said space and the other of said openings allowing passage of electrons emitted by said cathode; and a vacuum lock for preventing airflow simultaneously through said openings, said vacuum lock comprising first and second closure means adjacent said one and said other opening and operable to close off said one and said other opening respectively and means interlocking said first and second closure means to prevent both closure means being simultaneously open, and said first closure means comprising a sealing ring disposed about said one opening, an apertured member cooperable with said sealing ring to close off said one opening, means mounting said member to have linear movement toward and away from said sealing ring to engage and disengage said member therewith said therefrom respectively so as to close off and open respectively said one opening, said mounting means further allowing rotation of said member, in said disengaged position only, between first and second angular positions in which said aperture therein is in and out of alignment with said one opening respectively, and said mounting means being such as to allow said linear movement of said member only when in said second angular position, said first angular position allowing access to said space through said aperture in said member.

The invention also provides a cathode-ray device comprising a body portion defining an interior volume; a housing portion for a replaceable cathode fitted to said body, said housing having a pair of openings between which extends a space for receiving a cathode, one of said openings serving to allow in-

section of said cathode into said space and the other of said openings allowing passage of electrons emitted by said cathode into said body portion, said body portion having a volume of the order of 10,000 times that of said cathode receiving space; and a vacuum lock for preventing airflow simultaneously through said openings, said vacuum lock comprising first and second closure means adjacent said one and said other opening and operable to close off said one and said other opening respectively and means interlocking said first and second closure means to prevent both closure means being simultaneously open, and said first closure means comprising a sealing ring disposed about said one opening, an apertured member cooperable with said sealing ring to close off said one opening, means mounting said member to have linear movement toward and away from said sealing ring to engage and disengage said member therewith and therefrom respectively so as to close off and open respectively said one opening, said mounting means further allowing rotation of said member, in said disengaged position only, between first and second angular positions in which said aperture therein is in and out of alignment with said one opening respectively, and said mounting means being such as to allow said linear movement of said member only when in said second angular position, said first angular position allowing access to said space through said aperture in said member.

The invention still further provides an electron-gun system as defined having a cathode, preferably in the form of a replaceable cartridge structure, operatively mounted in said space in said housing.

In order that the invention and the manner of putting it into practice may be better understood an electron-gun system embodying the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIG. 1 shows a cross section through the electron-gun with the front closure plate of the vacuum lock open and the rear closure plate closed;

FIG. 2 shows the right hand part of the cross section shown in FIG. 1, this time with the rear closure plate open;

FIG. 3 shows part of a section taken along the line III-III in FIG. 1;

FIG. 4 shows the same section as in FIG. 3 but with the front plate in the closed position;

FIG. 5 shows a section along the line V-V in FIG. 3;

FIG. 6 shows a section along the line VI-VI in FIG. 4;

FIG. 7 is a view in the direction of the arrow VII in FIG. 1;

FIG. 8 is a view in the direction of the arrow VIII in FIG. 2;

FIG. 9 is a view in the direction of the arrow IX in FIG. 7;

FIG. 10 is a view in the direction of the arrow X-X in FIG. 8;

FIG. 11 shows a section along the line XI-XI in FIG. 7; and

FIG. 12 shows a section along the line XII-XII in FIG. 1.

Speaking generally, the electron-gun system shown in the drawings is built into the end of a cathode-ray tube only part of which is shown. The system, which can be used in a television projector of the kind in which images are produced by passing light through a layerlike medium deformable by an electron beam modulated with video signals, comprises a cathode, a Wehnelt electrode and an anode. A high voltage, 15 kv. for instance, is applied between the cathode and the anode; for preference the anode is earthed and the negative pole of the high voltage source is connected to the cathode. As a rule the Wehnelt electrode is at the same potential as the cathode or slightly negative with respect to the latter, for example by about 100 Volts. The cathode, Wehnelt electrode and anode are, of course, insulated from one another.

The various devices needed to deflect and focus the electron beam produced are not shown. These devices could be designed according to the familiar principles, for instance with electromagnetic deflector plates or bars or alternatively with magnetic coils and the like. Such devices are incorporated between the electron-gun and some medium —also not shown —which could be fitted in the other end of the tube and on which the electron beam impinges. The medium could be a

deformable layer of the kind above-mentioned. In this case this internal screen is scanned by the electron beam in the familiar television manner. The tube is evacuated to about 10⁻⁵ Torr.

Turning now to the detailed construction as illustrated in FIG. 1, a base 1 is fitted to the body 2 of a cathode-ray tube preferably made of some insulating material, a seal between the base 1 and body 2 being provided by the ring 3. An anode 4 in the shape of a plate is inserted into the tube 2; this anode has a hole 5 in the center and can be centered by means of the screws 7 acting against springs 6. One of the screws 7 can also act as the electrical connection for the anode. A cathode constructed as a replaceable cartridge 8 fits into a continuous axial hole 23 in the base 1, the hole 23 extending through and having front and rear openings in the base 1 which provides a housing for the cathode. The hole 23 is sealable against the interior of the cathode-ray tube at the front and against the atmosphere at the rear by hermetic closures providing a vacuum lock. The hole 23 is hereafter referred to as the cathode space; it is sealed front and rear by plates cooperating with sealing rings 21 and 22 disposed about the front and rear openings respectively of the cathode space. As shown in FIG. 12 the diameter of the cathode space is about the same as that of the cathode cartridge 8, which ensures that the latter is accurately located. In order to improve the circulation of air the cathode space 23 is equipped with channels 29. The cathode cartridge contains a cathode which is preferably V-shaped at the front with the apex of the V in line with the axis of the system. The two electrical connections of the cathode are brought out towards the rear by means of contact pins 9, which are mounted in insulated relationship to the cartridge housing. The Wehnelt electrode consists of the disc 10 with a hole through the middle and is located in front of the base 1 in contact therewith, leaving room between the disc 10 and the front face of the base for the front closure of a vacuum lock. Both the disc 10 and the base 1 are made of an electrically conducting material, brass for instance, so that the external electrical connection for the Wehnelt electrode can be made to the base 1. A second hole is drilled in the base and a spindle 11 passes through this hole; the front end of this spindle carries a gearwheel 12 and the rear end a manually operable, exterior handle 13. Air is prevented from penetrating into the evacuated space of the tube body 2 by the sealing ring 14 which fits tightly around the spindle 11.

The front closure of the vacuum lock is provided by two plates 15 and 16 which pivot about a pin 17 borne in apertures in the disc 10 and the base 1. The base 1 also accommodates a coil spring 18 which holds a spring-loaded ball 19 against the plate 16, the spring being shown at 18 and urging plate 16 toward plate 15. The plates 15 and 16 are generally triangular with curved edges. One arcuate edge of the plate 15 is toothed, these teeth engaging with those of the gearwheel 12. The plates 15 and 16 are each formed with a hole, the pair of holes being in alignment with the system axis, when the closure is open, for passage of the electron beam from the cathode. The plate 15 has a second hole accommodating a ball 20 with a diameter exceeding the thickness of the plate 15. A countersunk hole is provided in the plate 16 into which the ball 20 notches when the closure is open.

The principle of the front closure will now be explained in greater detail with the aid of the FIG. 1 and FIGS. 3 to 6. FIGS. 3 and 5 depict the front closure in the open condition, while FIGS. 4 and 6 show it closed. Starting from the open condition, rotation of the actuating handle 13 (FIG. 1) pivots the toothed plate 15 in the closing direction (anticlockwise in FIGS. 3 and 4). Plate 16 is moved along with plate 15 due to coupling between the plates provided by ball 20 under the pressure of the spring 18 and ball 19 until the leading edge of plate 16 contacts a stop, for instance a shoulder of the base 1. If the plate 15 is pivoted further by continued turning of the handle 13 then the ball 20 rides out of the countersunk hole in the plate 16, forcing this plate into contact with the sealing ring 21 against the pressure of the spring 18 (FIG. 6). This en-

sures that the cathode space 23 is hermetically sealed from the interior volume of the tube body 2. Opposite rotation of the handle 13 pivots the plate 15 until the ball 20 notches in the countersunk hole in plate 16 again (FIG. 5), thus allowing the spring and ball 19 to displace the plate 16 away from the seal 21 towards the plate 15. Further rotation of the handle 13 now causes both the plates 15 and 16 to pivot together until they strike a stop simultaneously (FIG. 3), which again is a shoulder of the base 1.

As illustrated in FIGS. 1, 2 and FIGS. 7, 8, the rear closure of the vacuum lock uses an eccentrically mounted plate 30 which is free to rotate on edge mounted balls 31 running between the segments 34, 35 and 36 attached to the base 1 and equiangularly disposed about the rear opening of space 23. The balls 31 are held in apertures in an intermediate, radially apertured, ring 32 acting as a rotating cage between the plate 30 and the segments. The balls 31 run in races secured to the plate and the segments. The race 33 (FIG. 1) attached to the plate rotates in a plane perpendicular to the system axis. The races 37, 38 and 39 secured to the segments 34, 35 and 36, however, follow a helical path. As an example, FIG. 10 shows the race 37 of segment 34, rotation of the intermediate ring 32 being limited by the rear stop 56 and the front stop 57. Races 38 and 39 are of like construction. The plate 30 contains two holes 42 and 43 at positions eccentric to the plate axis, so that when the rear closure is open for replacement of a cathode cartridge the hole 42 is aligned with the cathode space 23 (FIG. 2); rotation of the plate 30 through about 180° prior to closing the rear closure brings the hole 43 in line with the cathode space 23 (FIG. 1). The diameter of the hole 42 is slightly larger than the outer diameter of the cathode cartridge 8. The hole 43 is hermetically sealed by the insulated plate 44, this plate accommodating connecting pins 45 which are joined with contact studs 47 through springs 46. The connections through plate 44 are made in a hermetically sealed manner. When the closure is closed the studs 47 are held against the contact pins 9 of the cathode cartridge 8 under the pressure of the springs as shown in FIG. 1.

As illustrated in FIGS. 7 and 9 a leaf-spring latch 49 is fitted to a spacer pin 48 on the segment 35. With the closure closed (FIG. 7) this latch rests on the dwell 50 of a cam 51. The cam 51 is mounted on the plate 30.

FIGS. 7 and 11 show an arm 41 screwed to the plate 30 acting as a rotary lock between the plate and the segment 36 fixed to the base 1. With the closure closed a pin 52 housed in the segment 36 enters into a hole in the arm 41.

The operation of the rear closure will now be described with the aid of FIGS. 7 to 11, starting from the closed position (FIG. 7). The intermediate ring 32 holds the balls 31 in the forward limit positions of the races 37, 38 and 39, so that the plate 30 is forced against the sealing ring 22 (FIG. 1) and the arm 41 is locked by the pin 52. To open the closure the intermediate ring 32 is turned in the direction of the arrow A by means of a handle 40 fixed to the ring until the ball 31 contacts the stop 36 of the race 37 (FIG. 10). This rotation runs the balls 31 rearwards along the helical tracks 37, 38 and 39, so that the plate 30—which is still prevented from turning by the locked arm 41—is moved clear of the base 1. Once the plate is away from the base, and thus also from the sealing ring 22 (FIG. 1), the contacts 47 lift off as well and the arm 41 disengages from the pin 52. As a result both the arm 41 and the plate 30 are now rotated in the direction of the arrow B. During the initial stage of this rotation the cam dwell 50 moves out from under the latch 49, which now engages in a groove 53 in the intermediate ring 32, thus preventing this ring from turning further and thereby providing a lock between the base 1 and the ring 32 (shown dotted in FIG. 9). The plate 30 is turned until the arm 41 contacts a stop 54 projecting from segment 35. In this angular position the hole 42 is in line with the rear opening of cathode space 23 enabling the cartridge 8 to be removed rearwards—preferably with the aid of a suitable tool—and to be replaced by a new one.

The rear closure is reclosed by turning the plate 30 against the direction of the arrow B until the arm 41 strikes a stop 55 adjacent the pin 52 on segment 36. Since the latch 49 is now engaged, the intermediate ring is prevented from turning as well, so that the balls 31 remain stationary relative to the races 37, 38 and 39 of the segments 34, 35 and 36. Accordingly the plate 30 only carries out a rotary motion, thus avoiding wear of the contacts 47 and of the sealing ring 22. Just before completion of the rotary motion, the cam 51 moves beneath latch 49 and the latch rides up the dwell 50 of the cam 51 to disengage from groove 53; the intermediate ring 32 is now unlocked and in this angular position of the plate 30 is now free to turn opposite to the direction of the arrow A. During this rotation the balls 31 roll along the helical tracks in the segments until they contact the stop 57 (FIG. 10). At the same time the plate 30 is displaced forward so that the contacts 47 meet the contact pins 9 and the sealing ring 22 is compressed, the pin 52 entering the aperture in arm 41 as the plate 30 moves toward sealing ring 22 from the disengaged position and thereby preventing rotation of the plate 30.

In order to exclude the possibility of both the front and rear closures of the vacuum lock being opened simultaneously the handle 13 of the front closure passes within range of the intermediate ring 32 of the rear closure; the handle 13 is in the form of a disc (FIG. 7 and 8) with a segment-shaped cutaway so as to provide a shape asymmetric about the axis of spindle 11. In the closed condition of the front closure this cutaway coincides in position with the outer periphery of the intermediate ring (FIG. 8), so that the ring can be turned and the rear closure opened. As already described, when the rear closure is open the intermediate ring 32 is displaced rearwards and enters the cutaway. The cutaway in the disc then prevents turning the handle 13 and thus makes opening of the front closure impossible. As soon as the rear closure is securely closed the handle 13 becomes free to rotate. When opening the front closure a portion of the disc of the handle 13 enters into a recessed portion in the intermediate ring 32 in the form of a gap (FIG. 7). Ring 32 is therefore prevented from turning so that the rear closure cannot be opened. This cooperation between the handle for operating the front closure and the operating mechanism for the rear closure thus provides in an interlock ensuring that both closures cannot be open simultaneously and in fact that one can only be opened if the other is securely closed so that airflow simultaneously through the openings of space 23 is prevented.

As described, therefore, the front closure remains sealed during replacement of the cathode cartridge 8, so that the vacuum in the tube 2 is retained. When the cathode has been changed, however, the air enclosed in the cathode space 23 flows into the tube on opening of the front closure, thus partly relieving the vacuum. To ensure that the original vacuum is restored within a very short period of time by extracting the air (by a vacuum pump) the ratio of the volume of the tube body to the cathode space is made high: at a ratio of about 10,000:1 the service vacuum is regained in roughly half a minute. This means that the total time taken to change a cathode (outage time) is less than 1 minute.

The system described not only means a saving in time, however, but offers several other advantages: operation is simple and virtually excludes incorrect actions, the cathode is always accurately centered and the equipment requires hardly any maintenance since the sealing rings are not exposed to wear or the ingress of dirt.

I claim:

1. An electron-gun system including a housing having a pair of openings between which extends a space for receiving a cathode, one of said openings serving to allow insertion of said cathode into said space and the other of said openings allowing passage of electrons emitted by said cathode; and a vacuum lock for preventing airflow simultaneously through said openings, said vacuum lock comprising first and second closure means adjacent said one and said other opening and operable to close off said one and said other opening respec-

tively and means interlocking said first and second closure means to prevent both closure means being simultaneously open, and said first closure means 30 comprising a sealing ring disposed about said one opening, an apertured member cooperable with said sealing ring to close off said one opening, means mounting said member to have linear movement toward and away from said sealing ring to engage and disengage said member therewith and therefrom respectively so as to close off and open respectively said one opening, said mounting means further allowing rotation of said member, in said disengaged position only, between first and second angular positions in which said aperture therein is in and out of alignment with said one opening respectively, and said mounting means being such as to allow said linear movement of said member only when in said second angular position, said first angular position allowing access to said space through said aperture in said member.

2. An electron-gun system as 16 and 15 claimed in claim 1 wherein said second closure means 16 and 15 comprises a sealing ring disposed about said other opening, a first apertured plate engageable with said sealing ring, a second apertured plate, means mounting said first and second plates for pivotal movement about a common axis, resilient means urging said first plate toward said second plate, first and second recesses in facing surfaces of said first and second plates respectively, a ball engageable in said first and second recesses to couple said plates for common pivotal movement, means coacting with said second plate to cause pivotal movement thereof from a first position in which said apertures in said plates are in alignment with said other opening to allow passage of electrons therethrough to a second position in which said aperture in said first plate is out of alignment with said other opening, a stop engageable by said first plate prior to said second plate reaching said second position to prevent further pivotal movement of said first plate such that said ball is forced out of one of said recesses and displaces said first plate into engagement with said sealing ring to close off said other opening.

3. An electron-gun system as claimed in claim 1, wherein said member of said first closure means comprises a plate containing said aperture and said mounting means therefor comprises a radially apertured ring, a plurality of balls located in the apertures of said apertured ring, means secured to said housing and defining at least one helical race exterior of said apertured ring and in which said balls run to cause said apertured ring to move linearly toward and away from said sealing ring upon turning said apertured ring one way and the other respectively, means carried by said plate and defining at least one race interior of said ring and in which said balls engage whereby said plate is rotatable relative to said apertured ring and is linearly movable therewith toward and away from said sealing ring; and further comprising a first locking arrangement acting between said plate and said housing to prevent rotation of said plate except when said plate is disengaged from said sealing ring, and a second locking arrangement acting between said housing and said apertured ring to prevent rotation of the latter except when said plate is in said second angular position.

4. An electron-gun system as claimed in claim 3 further comprising spring-loaded contacts carried by said plate on the side thereof facing said one opening for contacting conductive members of a cathode when located in said space, and connections to said spring-loaded contacts brought out through the plate in a hermetically sealed manner.

5. An electron-gun system as claimed in claim 3 wherein said first locking arrangement comprises first and second parts mounted to said housing and said plate respectively, one of said parts comprising a pin and the other of said parts comprising a member apertured to receive the pin in the aperture thereof as said plate moves toward said sealing ring from its disengaged position.

6. An electron-gun system as claimed in claim 3 wherein said second locking arrangement comprises a leaf spring

mounted to said housing, a recess in said apertured ring engageable by the leaf spring, and means carried by said plate to engage the leaf spring and lift it out of engagement in said apertured ring recess as said plate is turned to said second angular position.

7. An electron-gun system as claimed in claim 3 wherein said interlocking means comprises a rotatable actuator for said second closure means, said actuator being asymmetric about its axis of rotation and being located adjacent said apertured ring, said apertured ring having a recessed portion into which a portion of said actuator enters when said first closure means is closed and said second closure means is open whereby opening of said first closure means is prevented unless said actuator is turned to close said second closure means and withdraw said actuator portion from said recessed portion of said apertured ring.

8. An electron-gun system as claimed in claim 7 wherein said actuator is in the form of a disc having a cutaway disposed so that when said second closure means is in its closed position said apertured ring is linearly displaceable through said cutaway.

9. An electron-gun system as claimed in claim 2 wherein said second plate has an arcuate toothed edge and said means coaxing with said second plate to cause pivotal movement thereof comprises a spindle supported in said housing and a gearwheel fixedly mounted to said spindle and engaging the teeth of said second plate.

10. An electron-gun system as claimed in claim 9 wherein said member of said first closure means comprises a third plate containing said aperture providing access to said space and said mounting means comprises a radially apertured ring and a plurality of balls located in the apertures thereof, means secured to said housing and defining at least one helical race exterior of said apertured ring and in which said balls run to cause said apertured ring to be moved linearly toward and away from said sealing ring about said one opening upon turning said apertured ring one way and the other respectively, means carried by said third plate and defining at least one race interior of said apertured ring and in which said balls engage whereby said third plate is rotatable relative to said apertured ring and is linearly movable therewith; and further comprising a first locking arrangement acting between said third plate and said housing to prevent rotation of said third plate except when said third plate is disengaged from said sealing ring, and a second locking arrangement acting between said housing and said apertured ring to prevent rotation of said apertured ring except when said third plate is in said second angular position; and wherein said spindle projects outwardly from said housing adjacent said apertured ring, an actuator being

mounted on said spindle for turning same to turn said gearwheel, said actuator being asymmetric about the axis of said spindle and being located adjacent said apertured ring, said apertured ring having a recessed portion into which a portion of said actuator enters when said first closure means is closed and said second closure means is open whereby opening of said first closure means is prevented unless said actuator is turned to close said second closure means and withdraw said actuator portion from said recessed portion of said apertured ring.

11. An electron-gun system as claimed in claim 10 wherein said actuator is in the form of a disc having a cutaway disposed so that when said second closure means is in its closed position said apertured ring is linearly displaceable through said cutaway.

12. An electron-gun system as claimed in claim 1 comprising a replaceable cathode structure disposed within said space in said housing.

13. A cathode-ray device comprising a body portion defining an interior volume; a housing portion for a replaceable cathode fitted to said body, said housing having a pair of openings between which extends a space for receiving a cathode, one of said openings serving to allow insertion of said cathode into said space and the other of said openings allowing passage of electrons emitted by said cathode into said body portion, said body portion having a volume of the order of 10,000 times that of said cathode receiving space; and a vacuum lock for preventing airflow simultaneously through said openings, said vacuum lock comprising first and second closure means adjacent said one and said other opening and operable to close off said one and said other opening respectively and means interlocking said first and second closure means to prevent both closure means being simultaneously open, and said first closure means comprising a sealing ring disposed about said one opening, an apertured member cooperable with said sealing ring to close off said one opening, means mounting said member to have linear movement toward and away from said sealing ring to engage and disengage said member therewith and therefrom respectively so as to close off and open respectively said one opening, said mounting means further allowing rotation of said member, in said disengaged position only, between first and second angular position in which said aperture therein is in and out of alignment with said one opening respectively, and said mounting means being such as to allow said linear movement of said member only when in said second angular position, said first angular position allowing access to said space through said aperture in said member.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,588,574 Dated June 28, 1971

Inventor(x) Heinrich Hogg

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

Claim 1, line 12 cancel "30"

Claim 2, line 1 cancel "16 and 15"

Claim 2, line 2 cancel "16 and 15"

Signed and sealed this 18th day of January 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents