

Nov. 5, 1968

D. A. JONES

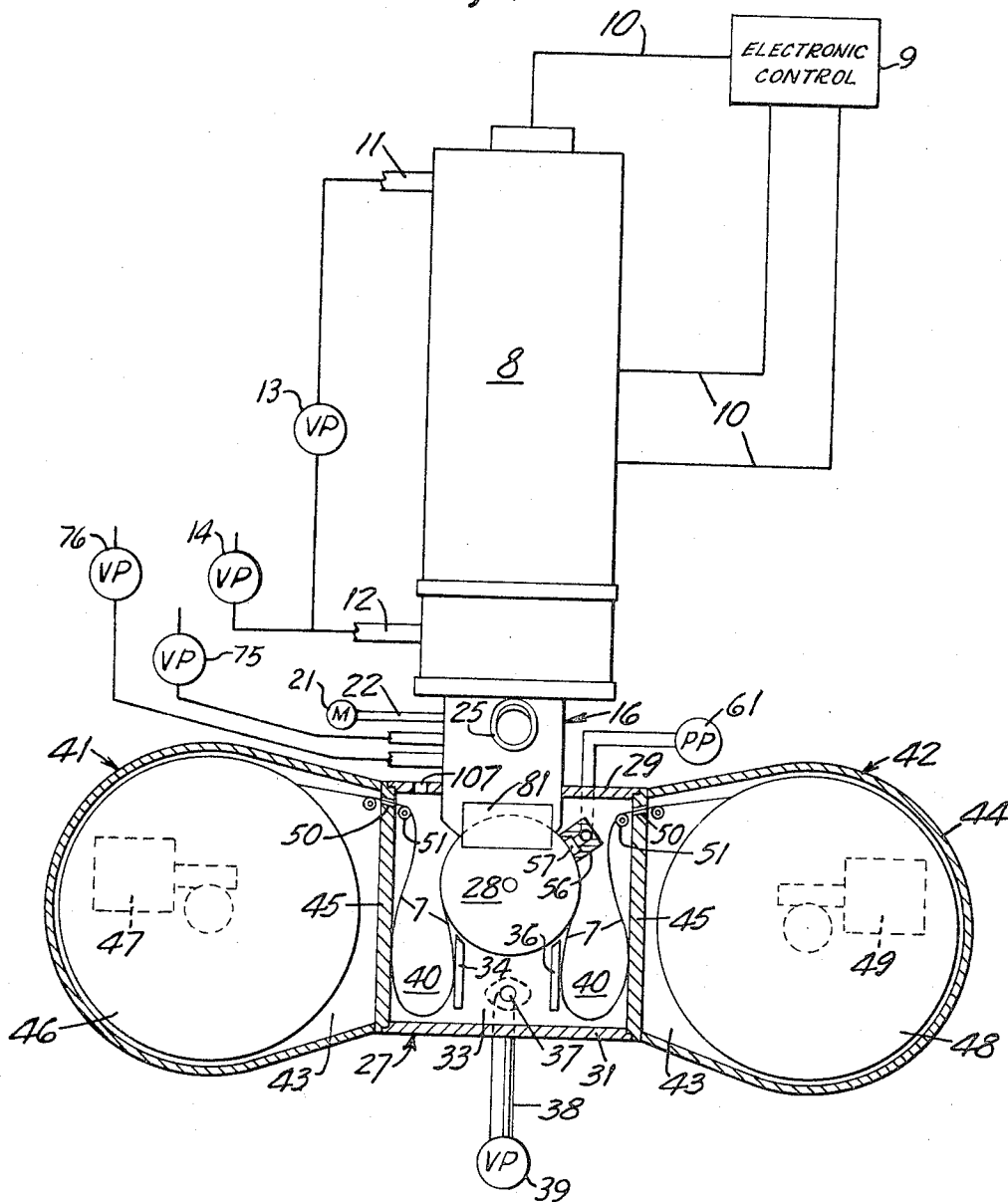
3,409,906

ELECTRON BEAM RECORDER WITH VACUUM SEAL SYSTEM

Original Filed Dec. 20, 1965

4 Sheets-Sheet 1

FIG. 1



INVENTOR.

DERRICK A. JONES

BY

Carpenter, Kinney & Boulter
ATTORNEYS

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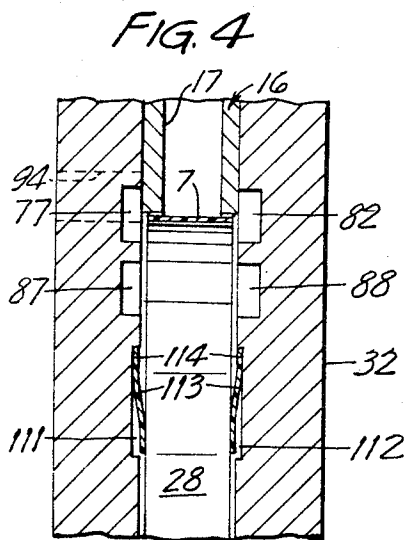
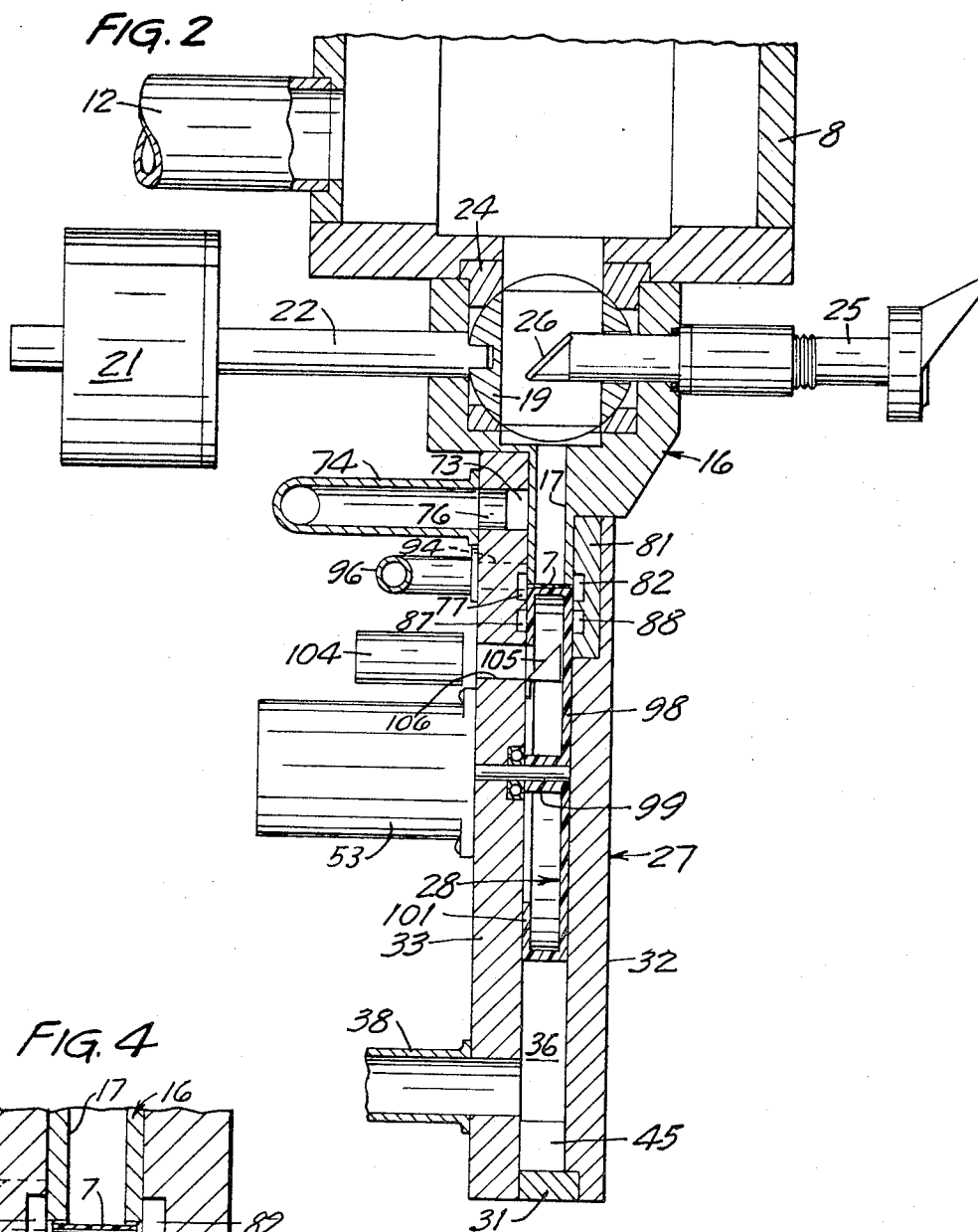
D. A. JONES

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INVENTOR
DERRICK A. JONES
 BY
Carpenter, Kinney & Boulter
 ATTORNEYS

Nov. 5, 1968

D. A. JONES

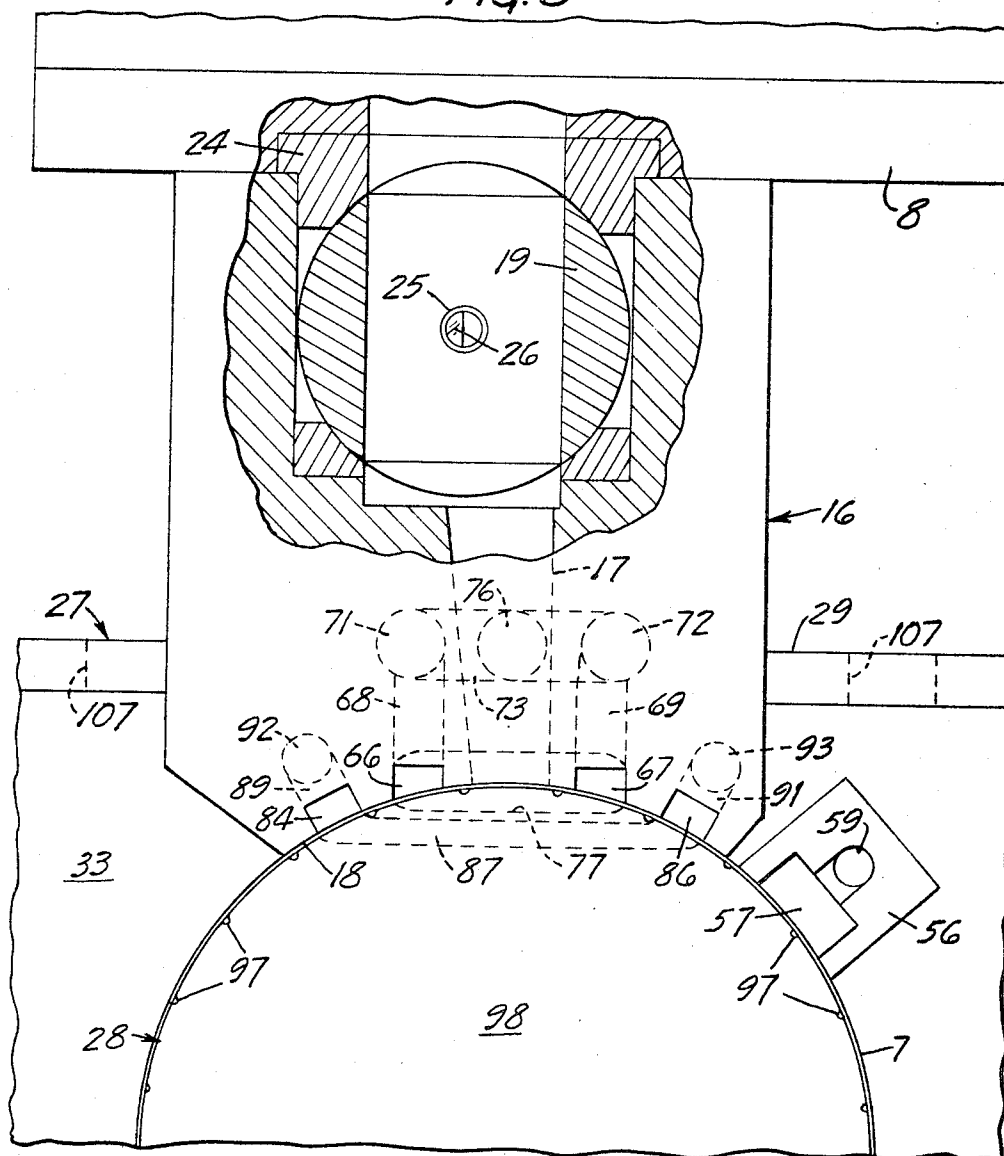
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ELECTRON BEAM RECORDER WITH VACUUM SEAL SYSTEM

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FIG. 3



INVENTOR
DERRICK A. JONES
BY
Carpenter, Kinney & Boulter
ATTORNEYS

Nov. 5, 1968

D. A. JONES

3,409,906

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FIG. 5

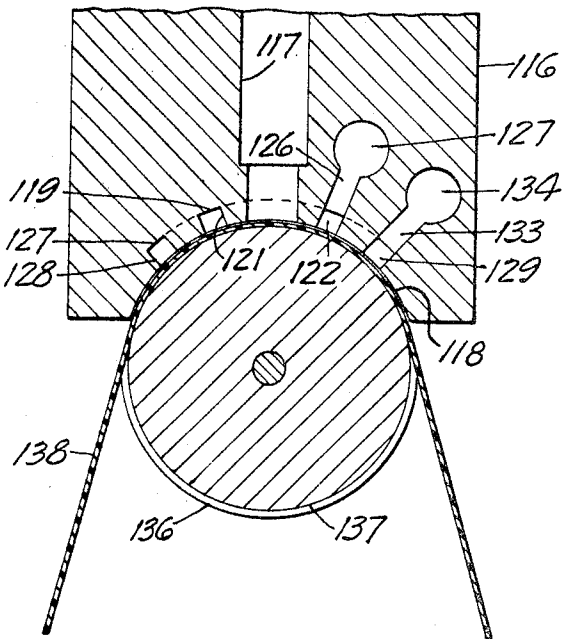


FIG. 6

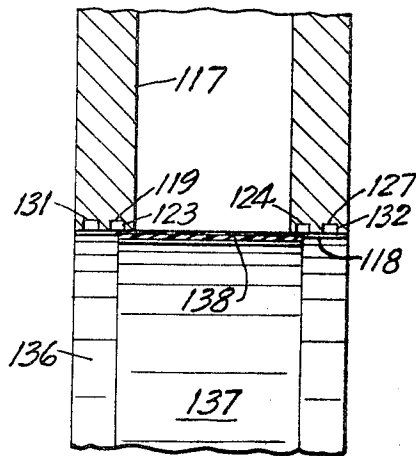


FIG. 7

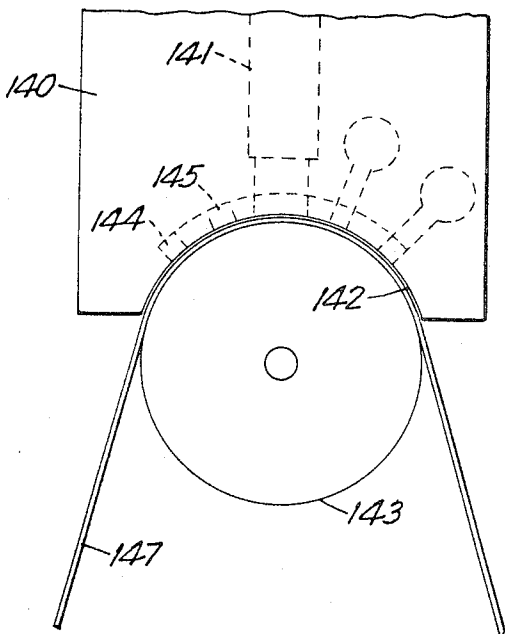
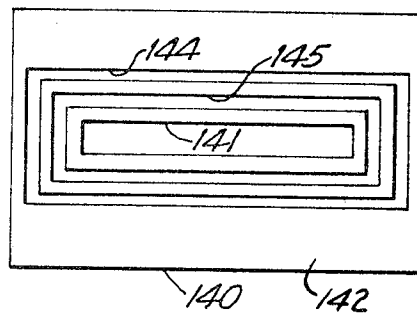


FIG. 8



INVENTOR.

DERRICK A. JONES

BY

Carpenter, Kinney & Boulter
ATTORNEYS

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3,409,906

ELECTRON BEAM RECORDER WITH VACUUM SEAL SYSTEM

Derrick A. Jones, Woodbury Township, Washington
County, Minn., assignor to Minnesota Mining and
Manufacturing Company, St. Paul, Minn., a cor-
poration of Delaware

Continuation of application Ser. No. 515,049, Dec. 20,
1965. This application June 30, 1967, Ser. No. 667,016
16 Claims. (Cl. 346—110)

ABSTRACT OF THE DISCLOSURE

An apparatus for treating a medium in the presence of at least a partial vacuum which apparatus includes a seal for an evacuated treating chamber, which seal is formed by an arcuate face having a treatment aperture leading directly to said chamber, on each side of which are at least partially evacuated cells, and means affording movement of a medium past said aperture on a support member along a path spaced from the arcuate face and concentric thereto.

Cross-reference

This application is a continuation of my earlier application, Serial No. 515,049, filed December 20, 1965, and now abandoned.

Specification

This invention relates generally to apparatus for treating a medium in the presence of at least a partial vacuum and in one aspect to the treating of a progressively moving media by directly bombarding the same with a corpuscular beam to record or readout information on said media.

There have been previous systems utilized for recording by the means of an electron beam. These systems have been of various types, for example, systems have utilized means for photographically recording the image from a phosphor screen such as illustrated in U.S. Patent No. 2,727,466; systems have utilized the Lenard Window in the face of a tube as described in U.S. Patents Nos. 1,943,109 and 2,716,048; systems have utilized devices known as "pin tubes" i.e., a series of fine electrically conductive wires formed in an end wall of a cathode ray tube as disclosed in U.S. Patent No. 3,040,124; or systems have utilized direct contact of the beam with the medium such as disclosed in U.S. Patents Nos. 1,736,456 and 2,630,484. The first three mentioned systems have inherent disadvantages such as restricted resolution and speed. The latter mentioned systems have been generally unsuccessful because a considerable array of hardware was required to provide proper seals for the gun chamber into and from which the recording actually took place and on many such devices the supply reel and take-up reel for the web on which the recording was effected were disposed within an evacuated chamber. This caused problems because of the gases trapped in the wound web. A simplified apparatus for direct imaging is described in applicant's prior application Serial No. 343,862, now Patent No. 3,222,678. In this latter apparatus an improved seal is described and the recording media used therewith is drawn over the smooth surface of the chamber and the media affords a sealing for the chamber. Where the medium used, however, has a sensitized coated surface which is easily abraded or disfigured, problems develop which decrease the resolution and quality of the recorded image if the same is drawn over a rigid surface.

An apparatus formed in accordance with the present invention provides the advantages of direct treatment of

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a medium to record or readout information thereon, change its physical characteristic or the like and removes the detrimental aspects of previously known treatment systems utilizing an evacuated atmosphere.

The present invention has an advantage in that it does not require the supply and take-up spools for the medium to be disposed in evacuated chambers.

The apparatus of the present invention affords controlled treatment of a web by direct bombardment with a high energy corpuscular beam, such as an electron beam, with a greatly reduced amount of hardware.

The apparatus of the present invention has the advantage in that the surface of the medium, be it a tape, polymeric web, film, treated paper, foil or the like, upon which the focused corpuscular beam impinges is not subjected to physical contact with a rigid member during movement of said surface to or from the evacuated treatment chamber which could cause abrasion or damage to the surface.

Further, the present invention provides a novel apparatus wherein the medium transport mechanism physically forms part of the means for maintaining the evacuated condition within the chamber housing the structure for generating and focusing a corpuscular beam which is directed through an aperture in the chamber to impinge directly upon the medium. This transport mechanism comprises a rotatable drum having a circular cross-section and a medium supporting surface which is concentric with an arcuate face of the member enclosing or housing the beam generating and focusing structure, in which said face the aperture is formed and through which the beam is directed to treat a medium supported by the drum. In the apparatus of the present invention the drum supporting surface and the arcuate face of the gun enclosure member are adjacent one another to place the surface of the medium to be bombarded by the beam close to said face.

Additionally the apparatus of the present invention includes a novel web handling system to place a web conveniently in contact with a portion of the peripheral medium supporting surface of a drum which carries the web past the treating head.

These and other objects and advantages of the present invention will become more apparent after reading the following detailed description which refers to the accompanying drawing, wherein:

FIGURE 1 is a diagrammatic front elevation of one embodiment of an apparatus, with certain parts removed, formed in accordance with the present invention;

FIGURE 2 is a vertical cross-sectional view taken through the center of the apparatus of FIGURE 1;

FIGURE 3 is an enlarged fragmentary front elevation view of the apparatus of FIGURE 1 with parts removed for purposes of clarity;

FIGURE 4 is an enlarged fragmentary vertical section showing a modification of the apparatus of FIGURES 1, 2 and 3;

FIGURE 5 is a fragmentary longitudinal sectional view of a second embodiment of an apparatus formed in accordance with the present invention;

FIGURE 6 is a fragmentary vertical cross-section view of the apparatus of FIGURE 5;

FIGURE 7 is a fragmentary front elevational view of a further embodiment of an apparatus formed in accordance with the present invention; and

FIGURE 8 is a bottom view of the treatment chamber illustrated in FIGURE 7.

FIGURE 1 illustrates an apparatus for treating a web in the presence of an evacuated atmosphere to record and/or reproduce intelligence in the form of images and electrical signals, respectively, on the web by means of a controlled corpuscular beam impinging directly on the

web. The apparatus includes an enclosure member in the form of a tube 8 housing a beam generating means and suitable electrostatic or electromagnetic deflecting and focusing means for control of the beam as is conventional in charged particle beam generating equipment. The beam generating means can be a simple three element electron gun having a tungsten wire filament, a control grid and an anode or accelerating electrode. Suitable electronic control means 9 are provided for receiving signals and for impressing signals on the beam generating and focusing means, and said control 9 is suitably connected to the gun by the leads such as illustrated at 10. The interior of the tube 8 forms a chamber which is evacuable through conduits 11 and 12 leading from ports in the side walls of the tube 8. The conduit 11 is connected to a molecular pump 13, such as an oil diffusion pump, which is in turn connected to a source of low pressure such as the vacuum pump 14. Conduit 12 is also connected to the vacuum pump 14 as illustrated in FIGURE 1. Shut-off valves may be placed in the conduits as desired.

A head 16 is connected on the lower or remote terminal end portion of the tube 8 and forms part of the enclosure member. The head 16 is formed with a generally rectangular passageway or aperture 17 which is axially aligned with the tube 8 (see FIGURES 2 and 3). The lower end of the aperture 17 is formed in a lower concave surface portion or face 18 of the head and openly communicates at its upper end with the interior of the chamber defined by the tube 8. In the apparatus of FIGURES 1, 2 and 3, the aperture 17 at the face 18 has a dimension to correspond or be slightly larger than the frame or section of the web to be imaged. This aperture has a dimension such that the ratio of length to width (length being in the direction of film movement) is not greater than 1 to 8 and which is typically 1 to 1. The lower face 18 of the head 16 is of equal radius, providing in the lengthwise direction of web movement a concave face which has a straight dimension in the widthwise direction of the web, and the widthwise dimension is substantially equal to the width of the web 7. The head 16 has a ball valve 19 positioned therein intermediate the ends of the aperture 17 to close said aperture, as desired to permit threading of the web when changing reels, etc. without disturbing the evacuated condition of the chamber. The ball valve 19 has an aperture therein corresponding to the aperture 17 and is operated between an open and closed position by suitable means such as a motor 21 and associated driven shaft 22. The valve 19 is supported within a sealed housing 24 fitted in the head 16.

A hollow tube 25 supporting a semicircular mirror 26 at its inner end and having a sealed eyepiece on its outer end affords the operator a view of the imaging plane. The tube 25 is suitably hermetically sealed relative to the head 16 and the valve 19 is rotatable relative to the tube 25 to close the aperture 17 without disturbing the tube.

The head 16 of the gun tube 8 is fitted in the upper edge wall of a box-like structure or case generally designated 27. The box-like case 27 positions a web supporting and transport means, in the form of a rotatable drum 28 which drum has a circular cross-section and an outer peripheral web supporting surface concentric to the face 18 of the head 16. The peripheral web supporting surface of the drum 28 is disposed in adjacent relation to the face of the head 16 and preferably closely spaced therefrom as will hereinafter be defined.

The box-like case 27 has a top edge wall 29, a bottom edge wall 31 and transversely spaced front and rear side walls 32 and 33, respectively. The front side wall 32 has been removed from FIGURES 1 and 3 for purposes of clarity. Disposed within the box-like case 27 and beneath the drum 28 are transversely extending partitions 34 and 36 which serve to divide the box-like casing into two interconnected loop chambers 40 disposed one on each side of the drum 28. The partitions 34 and 36 extend

vertically between the side walls 32 and 33 from positions closely adjacent the peripheral surface of the drum 28 to a position spaced from the bottom wall 31. Suitable bevels are formed in the upper ends of the partitions to mate the peripheral surface of the drum. Disposed between the partitions 34 and 36 is a port 37 connected by means of a conduit 38 to means for reducing the pressure within the loop chamber, which means may be a fan or a vacuum pump 39. The partitions 34 and 36 are directly below the drum such that the web 7 will contact a major portion of the drum in moving from one loop chamber 40 around the drum to the other.

Supported adjacent the right and left ends of the box-like casing are film cartridges 41 and 42. Each of these film cartridges are formed with front and rear side walls 43 (only the rear side walls of which are shown) and peripherally extending edge wall means 44. The cartridges 41 and 42 are generally circular in elevational view having one truncated edge which defines a planar edge wall portion 45. The planar edge wall 45 is adapted to fit between the top and bottom wall of the box-like casing in snug sealing engagement with said top and bottom walls and with the front and rear walls to enclose the open ends of the casing 27. The planar edge walls 45 of the cartridges thus form one side wall of each loop chamber 40. Suitable clamping means are provided to hold the cartridges to the case 27.

A reel 46 is rotatably supported in the left-hand cartridge 41 and is rotatably supported between the front and the rear side walls 43 thereof. The reel 46 serves to supply the web 7 to the apparatus and is supported and positioned to have a driving connection with a motor 47 and suitable gearing to rotate reel 46 in a controlled unwinding direction. The right-hand cartridge 42 rotatably supports between its front and rear side walls 43 a reel 48 which rewinds the web 7. The reel 48 is supported and positioned to have a driving connection with a motor 49 and suitable gearing.

Each of the planar edge walls 45 of the cartridges is formed with a narrow slit-like passage 50 allowing passage of the web 7 into or out of the cartridge. Supported on the side wall 33 of the box-like case 27 and positioned adjacent the passage 50 of each cartridge is a rotatable film guide spool 51. The guide spools 51 direct the web 7 to or from the passages 50 in the cartridges. A suitable seal, for example opposed felt pads, may be provided in each cartridge adjacent the passage 50 to block the entry of light into the cartridge and yet afford entry or removal of the web therefrom.

In the illustrated embodiment, the web 7 is advanced or transported past the treatment aperture 17 in the head 16 by means of the drum 28 which is rotatably supported by suitable bearings in the wall 33 of the casing 27 and is driven by a drive motor 53 controlled from the control means 9 to progressively move the web past the aperture 17. In a record and/or readout apparatus the motor 53 may be a stepping motor operative upon receiving pulses to rotate a predetermined extent. Upon receiving a given electrical pulse or number of pulses the motor 53 rotates drum 28 in increments to dispose sequentially successive frame sections or areas of the web in registry with the aperture 17 to afford the scanning of the entire area by the beam before subsequent movement of the drum to expose the next section for imaging or readout.

In the apparatus illustrated in FIGURES 1 to 3, pressure means are provided adjacent the outer peripheral surface of the drum 28 to press the web 7 into frictional-contact driving engagement with the drum, and comprises a high pressure air chamber defined by a block 56 having a cavity 57 which opens toward the drum. The cavity 57 is connected by a port 59 to a source of compressed air or a pressure pump 61. The force of the air in the chamber 57 holds the web tightly against the drum 28 affording a positive drive without a rigid member contacting the coated or sensitive surface of the web if such is the case.

Means are provided to reduce the air flow between the ambient atmosphere and the treatment chamber defined by the tube 8 and head 16. In the illustrated apparatus a first and a second evacuable cell or chamber are formed in the path of the web, which chambers collectively reduce the air flow so that the necessary vacuum can be maintained in the treatment chamber.

Referring now to FIGURES 2 and 3, the structure of the evacuable chambers will now be described. The chambers are formed by slots and recesses in the head 16 and casing 27. Transversely extending slots 66 and 67 are spaced ahead and behind the treatment aperture 17 with reference to the path or direction of movement of the web. A pair of borings 68 and 69, the axes of which are generally parallel with the axis of the treatment aperture 17, are formed in the head 16 and communicate at one end with the upper walls defining the slots 66 and 67. Communicating with the upper ends of borings 68 and 69 and extending transversely of the head are borings 71 and 72 which communicate with the rear surface of the head. The head 16 is positioned in close sealing engagement with the rear wall 33 of the box-like case 27. The rear wall 33 of the casing 27 has a longitudinally extending recess 73 which communicates with the transverse borings 71 and 72 and with a conduit 74, through a port 76, leading to a vacuum pump 75. Additionally, the rear wall 33 is provided with a second recess 77 on the inner side thereof which extends between the two transverse slots 66 and 67 formed in the head 16 and has a width to extend above and below the peripheral edge of the drum and the face 18, along the side of the rearward wall of the head defining the treatment aperture. A small plate 81 is sealingly fitted on the front side of the head 16 opposite the wall 33 and together with the rear wall 33 and the concave face 18 define a crescent-like cylindrical-concave groove in the terminal end of the tube 8. The plate 81 is formed with a recess 82 on the inner side thereof similar to the recess 77 and parallel thereto which communicates with each of the transverse slots 66 and 67. The slots 66 and 67 and the two longitudinal recesses 77 and 82 thus form the first evacuable chamber surrounding the walls of the head defining the treatment aperture. The pressure in this first chamber is pumped during operation to between 50 and 500 microns of mercury and reduces the pressure difference between the evacuated treatment chamber and the ambient atmosphere or the second chamber to reduce the flow of air to the evacuated treatment chamber and the treatment aperture 17 during operation, which pressure in the treatment chamber is typically at 0.1 to 2 microns of mercury.

A second pair of transversely extending slots 84 and 86, parallel to and spaced from the first slots 66 and 67, are formed in the face 18 of the head 16. These slots, 84 and 86, communicate with a recess 87 formed in the rear wall 33 and with a similar recess 88 formed in the plate 81 to define the second evacuable chamber in the head 16 which surrounds the treatment aperture 17. This second chamber is evacuated through vertically extending borings 89 and 91 which communicate with the slots 84 and 86 and with a pair of transverse borings 92 and 93, the latter being formed in the head 16 to register with corresponding borings 94 in wall 33 which are joined to a source of vacuum or a vacuum pump 76 by conduits 96 (only one of which is shown in FIGURE 2). The conduits 96 are connected to wall 33 over the borings 94 therein and are joined together to a common conduit from the vacuum pump 76. This second chamber aids in maintaining the desired evacuated condition in the treatment aperture and in the tube 8 and is continually pumped to between 2 and 5 centimeters of mercury which reduces the pressure difference between the atmosphere and the first evacuable chamber to reduce the flow of air to said first chamber as the web is advanced by the drum 28 toward the treatment aperture.

Axially extending and minute grooves 97 are formed

in the outer peripheral edge of the drum in a predetermined circumferential spaced relation, i.e., in the illustrated apparatus they are spaced 10°, to afford areas, in a drum having a diameter of about 5 inches, corresponding to the size of 16 mm. frame sections on the web. These axial grooves 97, as they move through the evacuable chambers defined by the slots 66, 67, 84 and 86, etc., are also evacuated and serve to equalize the pressure across the web 7.

The outer peripheral surface of the drum and the face 18 of the head are spaced apart about 0.006 inch (0.152 millimeter) when a web 7 having a thickness of 0.005 inch (0.127 millimeter) is used as the recording or information bearing medium.

When used only for the purpose of recording images onto a film, the drum 28 of the apparatus need not be of any special construction except it must be gas impervious and light in weight to afford a very low inertia. In a record and/or readout device however, the drum is preferably a hollow cylinder and formed with only one solid end wall 98 connecting the cylindrical wall portion to a hub 99 and a partial end wall 101 extending from the cylindrical wall portion toward the hub as shown most clearly in FIGURE 2. Such a drum would be formed of a light transmissive gas impervious material.

The recording media useable with the apparatus of this invention is any known material which may be imaged by a corpuscular beam such as an electron beam. The media useable for recording and reproducing a signal would contain both an imaging material and a fluorescent material. The imaging material and the fluorescent material are preferably in layered form adjacent one another and are usually supported by a backing member. Examples of imaging materials include silver halide emulsion, diazo materials, thermographic materials and the like. Examples of fluorescent materials include scintillators and phosphors. Examples of backing materials include plastics such as cellulose, polyetser, polypropylene and the like. Some media may contain a conductive layer such as vapor depositable metals.

The fluorescent material in a medium construction is distributed so as to be uniformly emissive of its characteristic photon energy output relative to one face of the medium. The imaging material in a medium construction is capable of being selectively altered in its capacity to transmit such characteristic photon energy output of the fluorescent material as a result of a recording operation. Hence, when a prerecorded medium is being readout in accordance with this invention, an electron beam striking the medium causes differential photon energy to be emitted. One suitable class of media is disclosed in British Patent No. 989,526.

The differential output from prerecorded medium will be received by a photomultiplier 104. In the illustrated device, see FIGURE 2, a reflective device such as mirror 105 is fixed on the wall 33 and disposed within the cylindrical drum 28. The mirror 105 will receive and reflect the energy output from the medium to the photomultiplier 104. An opening 106 in the wall 33 affords passage of the output from the mirror 105 to the photomultiplier 104. The photomultiplier 104 will thus emit electrical signals corresponding to the energy received and such signals will be of a type similar to the incoming video signals used in recording.

In operation, the web 7 is threaded from the supply reel 46 out the slotted passage 50 of the cartridge 41, over a first of the guide spools 51 and then down along the planar edge wall 45 of the cartridge to define a loop in the first loop chamber 40. The film 7 is then threaded around the peripheral supporting surface of the drum 28 and past the treatment aperture 17 in the lower terminal end of the tube 8. A second loop is formed in the other loop chamber 40 and is drawn over the other guide spool 51, through the slotted passage 50, into the cartridge 42

and onto the take-up reel 48. The loops formed in the box-like casing are maintained by the single source of vacuum from the pump 39. These loops, due to the presence of atmospheric pressure on the upper sensitive side of the web and reduced pressure on the under side, maintain a uniform tension in the web as the same passes over the upper outer peripheral surface of the drum. Conventional means are provided in the casing 27 for sensing the position of the two loops of film and to control the motors 47 and 49 to maintain the desired loop on each side of the drum. Atmospheric pressure enters the casing 27 through openings 107 in top edge wall 29.

Referring now to FIGURE 4, a modified form of the apparatus of FIGURES 1 to 3 is illustrated, which view corresponds generally to FIGURE 2 and similar elements have the same reference characters as the elements of FIGURES 1 to 3. In this apparatus the recesses 82 and 88 are formed in the front side wall 32 which is similar to the rear wall 33, thus eliminating the separate plate 81. This modification includes additional sealing means on each end of the drum 28. The front and rear side walls 32 and 33 are formed with shallow longitudinally extending channel-shaped recesses 111 and 112 positioned in opposed relation and below recesses 87 and 88. The recesses 111 and 112 extend across the ends of the drum 28 and a thin ribbon 113 of flexible polymeric material such as polyester is placed in each recess and secured along the upper edge of one side to the walls 32 and 33 by an adhesive substance 114. The differential pressures above and below the recesses 111 and 112 draw the lower portions of ribbons 113 against the end walls of the drum 28 to aid in decreasing gas flow toward the treatment aperture 17. This is especially true where a drum 28 does not fit very close to the walls 32 and 33.

Referring now to the embodiment of FIGURES 5 and 6, there is illustrated a lower terminal end of a closure member 116 which defines an evacuable chamber for treating apparatus such as a high energy beam, which beam is directed through an aperture 117, openly communicating between said chamber and an outer cylindrically concave face 118. The aperture 117 is rectangular, opening generally centrally in said face 118, which face also has a pair of separate evacuable cells 119 and 127 formed therein by recesses or slots rectangular in cross-section. Each cell is defined by four slots forming four sides to a cell which are spaced from and surround the treatment aperture 117. The first cell 119 is formed by a pair of transverse slots 121 and 122, i.e., extending axially of the face, which slots 121 and 122 communicate with arcuately extending recesses or slots 123 and 124 disposed in transversely spaced relation with respect to the aperture 117 as shown in FIGURE 6. The slots 121, 122, 123 and 124 openly communicate together and are evacuated through a generally vertically extending boring 126 connected with an upper transverse bore 127. The bore 127 will be connected to a suitable source of vacuum such as a vacuum pump. The second cell 127 is formed by transversely extending slots 128 and 129 and arcuately extending recess or slots 131 and 132. The slots 128 and 129 are spaced circumferentially from the slots 121 and 122, and the slots 131 and 132 are spaced transversely from the arcuate slots 123 and 124. Slots 128, 129, 131 and 132 openly communicate together and are evacuated through a boring 133 connected with a transverse bore 134. Again, the transverse bore 134 is connected to a suitable vacuum pump.

A drum 136 is rotatably supported adjacent the enclosure member 116 and has a recessed concentric outer peripheral web supporting surface 137. The web supporting surface 137 is concentrically recessed relative to the end flanges of the drum by an amount only slightly greater than the thickness of a web 138. In this embodiment the drum 136 is journaled to dispose the flanged end portions of the drum 136 in mating, journaled relation to the face 118.

In this embodiment as the web 138 is directed past the treatment aperture 117 by the drum 136, the same may be treated by a bombardment of one surface by a corpuscular beam directed through aperture 117. The aperture 117 and treatment chamber housing the generating and focusing means for the beam will be pumped during operation to maintain a pressure therein of between 0.1 to 2 microns of mercury. The first cell 119 will be evacuated during operation to a pressure of between 50 and 500 microns of mercury and the second cell 127 will be evacuated to a pressure between 2 and 5 centimeters of mercury. The continual pumping on the cells 119 and 127 reduce the pressure difference between the atmosphere surrounding the enclosure member 116 and the inner treatment chamber to reduce the flow of air to said treatment chamber as a web is advanced over the drum surface 137. The spacing between the web 138 and the face 118 during operation is preferably not greater than 0.001 inch (0.025 millimeter).

Referring now to the embodiment shown in FIGURES 7 and 8 there is illustrated an enclosure member 140 which defines a treatment chamber enclosing a treating device such as an electron gun. The enclosure member 140 is formed with an aperture 141 directly communicating with an outer cylindrical concave face 142 of the enclosure member. A cylindrical drum 143 is rotatably supported relative to said enclosure member 140 to dispose its outer peripheral surface in adjacent concentric relation with respect to the face 142. The face 142 is formed with a pair of independent evacuable cells 144 and 145 which surround the treatment aperture 141. These cells 144 and 145 are formed similarly to the cells 119 and 127 of FIGURES 5 and 6, and as shown in FIGURE 8, surround the open end of the treatment aperture 141. In this embodiment a web 147 to be treated should correspond substantially in width to the axial length of of drum 143 to be disposed across the transversely spaced slots or recesses defining cell 144. In this embodiment the treatment aperture has a ratio of length to width of 1 to 8 affording an elongate rectangular aperture through which the beam may pass to scan and treat a wide portion of the web. The drum is suitably bearinged to carry the web 147 through the cells 144 and 145 and to the treatment aperture 141 in closely spaced relation to the face, the spacing being preferably not over 0.001 inch (0.025 millimeter). Here again the treatment aperture, the recesses 144 and 145 are suitably evacuated to reduce the air leakage into the treatment aperture which would reduce its evacuated condition. A web about 9 inches (23 centimeters) wide may be transported by this apparatus and 8 inches (20 centimeters) thereof subjected to direct bombardment by the beam.

The present invention provides an apparatus permitting the beam to impinge directly on a beam sensitive media thus avoiding scattering and attenuation of the beam energy by interposed films or membranes as present in prior art systems. This will therefore result in improved resolution of the recorded images, permits high information packing density, and greater recording speeds.

What I claim is:

1. An apparatus for treating a medium by a corpuscular beam in the presence of at least a partial vacuum, said apparatus comprising:

- a drum having a circular cross-section and an outer peripheral medium supporting surface,
- enclosure means having wall surfaces defining an evacuable treatment chamber, an outer concave face having a predetermined arcuate extent concentric with the outer peripheral surface of said drum, and a treatment aperture in said face which openly communicates with said treatment chamber,
- means defining at least one evacuable cell which cell surrounds the wall surfaces of said enclosure means defining said aperture and includes a pair of slots formed in said face extending in an axial direction

relative to said drum and positioned in spaced relation to each side of said treatment aperture with respect to the direction of drum rotation and recesses connecting adjacent ends of said slots,

means for rotatably supporting said drum to move the outer peripheral surface of the drum past said slots and said treatment aperture in adjacent relation to said face to afford treatment of a said medium as the same is moved with said drum past said treatment aperture, and

means for at least partially evacuating said treatment chamber and said evacuable cell, whereby said drum and said cell reduce gas flow from the ambient atmosphere of said enclosure means to said treatment aperture to maintain the evacuated condition of said treatment chamber.

2. An apparatus as defined in claim 1 wherein said outer concave face is generally cylindrical and the outer peripheral surface of said drum is cylindrical.

3. An apparatus as defined in claim 2 wherein end walls are formed adjacent each axially spaced end of said cylindrical concave face, and said means defining said evacuable cell includes wall surfaces forming slots extending axially across said face and that said recesses are formed in each of said end walls, and means are formed in said enclosure defining passageways communicating with said slots to evacuate said cell.

4. An apparatus as described in claim 2 wherein means are provided adjacent the web supporting surface of said drum to press a said web into contact driving engagement with said drum, said last mentioned means comprising means defining a pressure chamber opening toward the periphery of the drum and means for supplying air under pressure to said pressure chamber.

5. An apparatus as defined in claim 1 wherein said treatment aperture is rectangular and has a length to width ratio not greater than 1 to 8.

6. An apparatus as defined in claim 1 wherein said means defining at least one evacuable cell defines a pair of independent evacuable cells in said face which extend in spaced symmetrical relation around said treatment aperture.

7. An apparatus as described in claim 6 wherein said outer peripheral medium supporting surface of said drum is a concentric recessed cylindrical-center portion of a cylindrical drum.

8. An apparatus as defined in claim 6 wherein there are means for evacuating said cells to provide different pressure in each cell.

9. An apparatus for recording and/or reproducing information on a carrier web comprising:

means for generating and focusing a corpuscular beam, enclosure means defining an evacuable chamber in which said beam generating and focusing means is disposed, said enclosure means having a terminal end toward which a said beam is directed and an outer concave face on said end,

means defining an aperture in said face openly communicating with said chamber,

a rotatable drum having an outer peripheral web supporting surface adapted to support and guide a said web, said peripheral surface of said drum being concentric with said concave face such that rotation of said drum will move portions of said peripheral surface progressively along said concave face and past said portion of said surface defining said aperture, means rotatably supporting said drum with a portion of said outer peripheral surface disposed in adjacent relation with respect to said concave surface portion of said head,

means including slots in said face affording a pair of independent evacuable cells surrounding said aperture,

means for at least partially evacuating independently

said evacuable chamber and each of said evacuable cells, and

drive means for rotating said drum.

10. An apparatus as defined in claim 9 wherein a casing having side walls and end walls enclosing said concave face and said drum, partition means in said casing defining a loop chamber on each side of said drum into which a said web is looped, means for producing a pressure differential on opposite surfaces of a said web while a said web is positioned in said loop chambers to place a said web in tension over at least the portion of the peripheral surface of the drum disposed adjacent said face.

11. An apparatus as defined in claim 9 wherein means are provided to form a loop chamber on each side of said drum aligned with said web supporting surface into which a said web is looped, means connected to said loop chambers for producing a uniform pressure on the web looped in each said loop chamber, said loop chambers being positioned generally parallel to each other and having at least a portion of said chambers disposed directly below the web supporting surface of said drum such that the web will contact more than half the peripheral surface of said drum in moving from one loop chamber to the other.

12. An apparatus as defined in claim 10 wherein said outer peripheral surface of said drum is provided with axially extending grooves spaced circumferentially on the periphery of said drum.

13. An apparatus for recording and/or reproducing information on a carrier web comprising:

means for generating and focusing a corpuscular beam, enclosure means defining an evacuable chamber housing said means for generating and focusing a beam, said enclosure means having a terminal end toward which a said beam is directed,

means defining a head at said terminal end which head has a cylindrical-concave outer face and which concave surface is formed with an aperture openly communicating with said chamber,

a rotatable drum having a cylindrical outer peripheral surface adapted to engage and support a web across the transverse width of said web, said peripheral surface of said drum being concentric to said cylindrical-concave face such that rotation of said drum will move portions of said peripheral surface progressively along said concave face and past said aperture,

a casing, said casing comprising parallel spaced side walls fitted to said head at axially opposite sides of said face, said drum being positioned between said side walls and mounted for rotation relative thereto with said outer peripheral surface disposed in adjacent relation with respect to said concave face of said head,

means defining an evacuable cell surrounding said aperture and comprising axially extending slots formed in said face which communicate with recesses in said side walls, which recesses extend along each end of said drum adjacent the peripheral surface of said drum disposed adjacent said face near the aperture to reduce the pressure around said aperture and restrict the flow of gas surrounding said head from reaching said aperture and increasing the pressure within said aperture and evacuable chamber,

means for independently evacuating said evacuable chamber and said evacuable cell, and

drive means for said drum to progressively move a said web through said cell and past said aperture to position successive areas in register with said aperture to expose said areas to direct bombardment by a beam.

14. An apparatus as defined in claim 13 wherein said drum is formed of transparent material, and said apparatus further comprises means supported relative to said drum for receiving radiation emitted from a said web as

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the same is bombarded by a said beam to change said radiation into electrical signals.

15. An apparatus as defined in claim 13 wherein said means for receiving radiation includes reflecting means positioned within the peripheral surface of said drum and a photomultiplier positioned relative to said reflecting means to receive radiation reflected therefrom.

16. An apparatus for treating a web by a corpuscular beam in the presence of at least a partial vacuum, said apparatus comprising:

enclosure means defining an evacuable chamber for enclosing beam generating and focusing means, said enclosure means having a terminal end,

means defining a head at said terminal end which head has a cylindrical-concave outer face and which concave surface is formed with an aperture openly communicating with said chamber at said terminal end,

a rotatable drum having a cylindrical outer peripheral surface adapted to engage and support a web across the transverse width of said web and having axially spaced end portions, said drum being positioned with the peripheral surface of said drum concentric to said cylindrical-concave face such that rotation of said drum will move portions of said peripheral surface progressively along in close proximity to said concave face and past said aperture,

a casing, said casing comprising spaced side walls fitted to said head and positioned in close proximity to said axially spaced end portions of said drum,

means defining a pair of evacuable cells one of which cells surrounds said aperture and the other of which also surrounds an outer portion of said drum, said cells each comprising two axially extending slots

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formed in said face on opposite sides of said aperture which slots communicate at their ends with opposed recesses formed one on each of said side walls, the opposed recesses of said one of said cells extend along each end of said drum adjacent the outer peripheral drum surface disposed adjacent the aperture to reduce the pressure around said aperture, and the opposed recesses of the other of said cells being formed in parallel radially spaced relation to said recesses of said one of said cells and disposed along the end portions of said drum, said cells serving to restrict gas flow to said aperture,

means for independently evacuating said evacuable chamber, and each of said evacuable cells to afford different pressures therein, and

means for rotatably mounting and for driving said drum to progressively move a said web supported on the surface thereof along said face and past one slot of each cell to said aperture and away from said aperture past one slot of each cell to expose said web directly through said aperture to treatment from said chamber.

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RICHARD B. WILKINSON, *Primary Examiner*.

J. W. HARTARY, *Assistant Examiner*.