US011821593B1

(12) **United States Patent**
Weatherman

(10) **Patent No.: US 11,821,593 B1**
(45) **Date of Patent: Nov. 21, 2023**

(54) **PRACTICAL LIGHTING APPARATUS AND METHOD FOR USE**

(71) Applicant: **Kenneth Casey Weatherman**, Roswell, GA (US)

(72) Inventor: **Kenneth Casey Weatherman**, Roswell, GA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **18/098,763**

(22) Filed: **Jan. 19, 2023**

Related U.S. Application Data

(60) Provisional application No. 63/312,165, filed on Feb. 21, 2022.

(51) **Int. Cl.**

F21K 9/275	(2016.01)
F21V 21/096	(2006.01)
F21K 9/272	(2016.01)
F21Y 103/10	(2016.01)
F21W 131/406	(2006.01)
F21Y 115/10	(2016.01)

(52) **U.S. Cl.**
CPC ***F21K 9/275*** (2016.08); ***F21K 9/272*** (2016.08); ***F21V 21/096*** (2013.01); *F21W 2131/406* (2013.01); *F21Y 2103/10* (2016.08); *F21Y 2115/10* (2016.08)

(58) **Field of Classification Search**
CPC F21K 9/272; F21K 9/275; F21V 21/096
See application file for complete search history.

(56) **References Cited**

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Rainbow tube by Quasar Science—accessed and printed as screenshot May 9, 2023—https://www.quasarscience.com/collections/lights/products/rainbow-2-ex-demo.

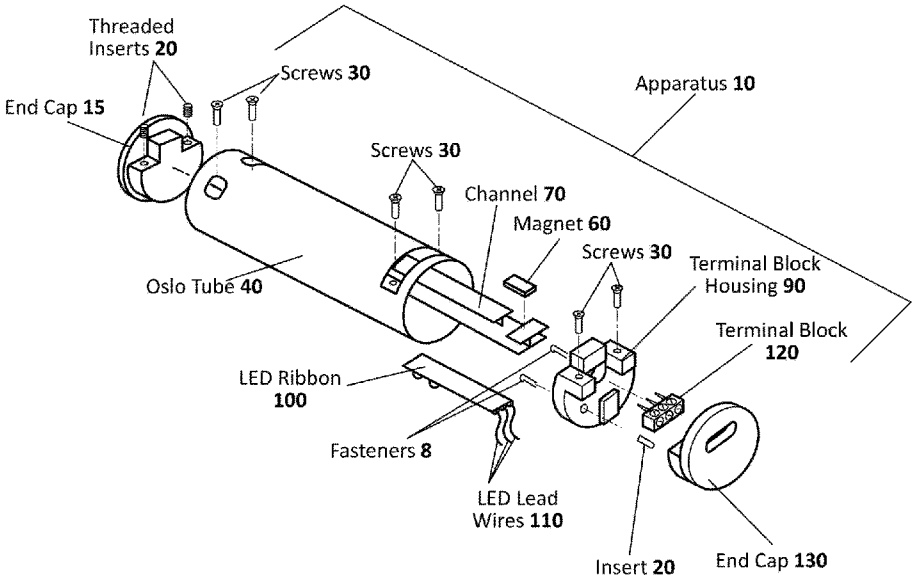
(Continued)

Primary Examiner — William N Harris
(74) *Attorney, Agent, or Firm* — GRONHOLM PATENT SERVICES

(57) **ABSTRACT**

Practical lighting is the technique of using light sources that are seen within the frame of a shot. Apparatus **10** and **10**A is a lightweight, magnetically mounted, light diffusing housing for LED ribbon which is designed to look like a standard fluorescent tube when used as practical lighting. Control wires can be easily and repeatedly removed via screwed terminal housings (**10**) or connected via industry standard phoenix receptacle (**10**A) housed discreetly one of its two end caps, providing a solderless connection with either apparatus. The magnets internally installed adhere the apparatus to standard metal fluorescent housings without damage to the installed fixture negating the need of additional mounting rigging hardware.

20 Claims, 41 Drawing Sheets



Exploded view of Apparatus **10**

(56) **References Cited**

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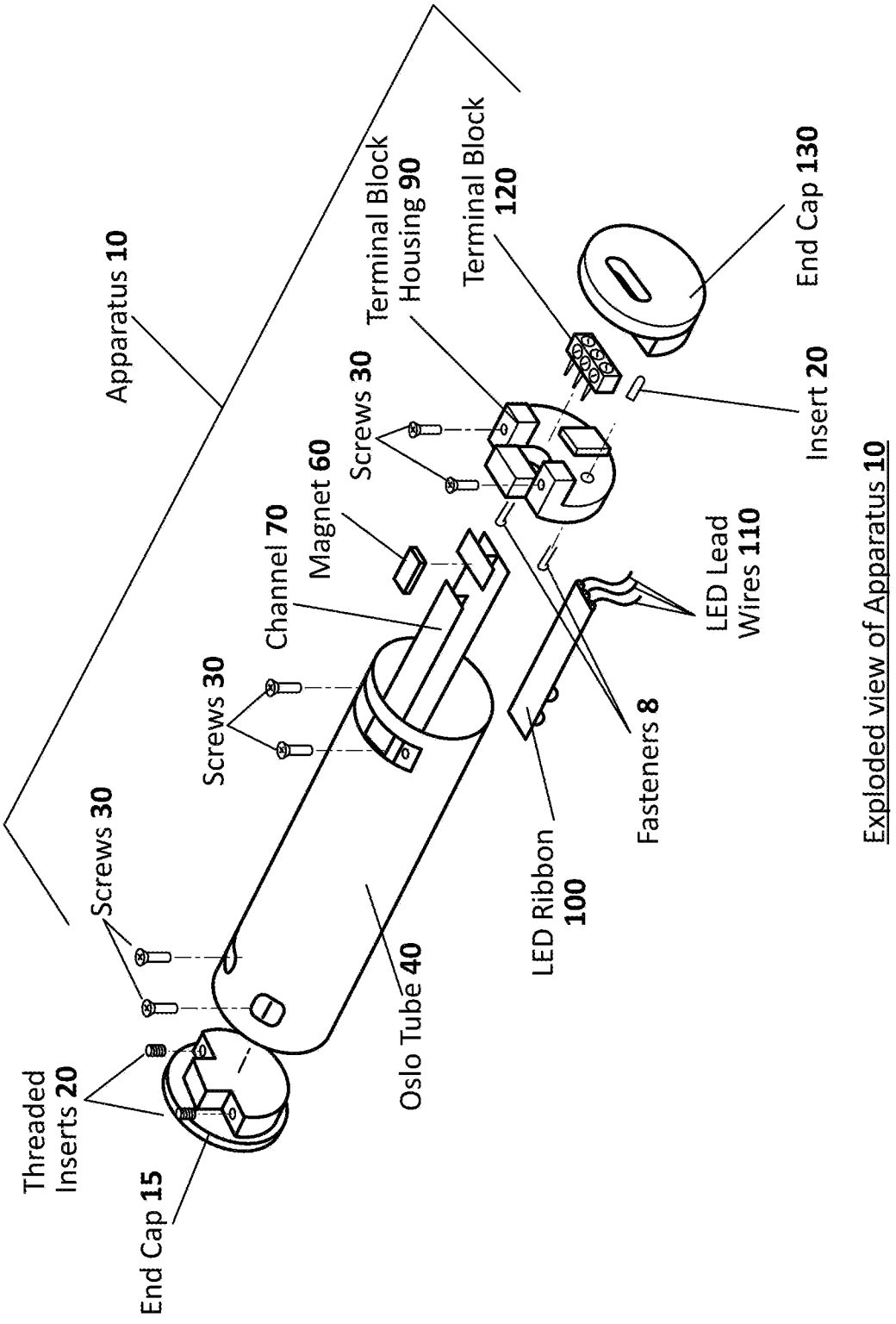
Q-Ion by Quasar Science—accessed and printed as screenshot May 9, 2023—https://www.quasarscience.com/collections/lights/products/q-lion-us-charger.

FreeStyle by Kino Flo—accessed and printed as screenshot May 9, 2023—https://kinoflo.com/freestyle-t41-t21-led/.

Color Corrected Fluorescent tubes by Kino Flo—accessed and printed as screenshot May 9, 2023—https://www.filmandvideolighting.com/4fttubesbulbs.html.

The Ultimate LED Tube by Astera—Titan Tube—Downloaded May 9, 2023 From https://astera-led.com/products/titan/—Titan Tube is the ultimate LED tube for filmmakers, studios, event technician and any creative person. It emits powerful, tunable whites with ultra-high color rendering as well as colored light which can be applied to individual pixels or the whole tube. The tube offers unlimited range of usage; indoor or outdoor, AC-powered or on battery, on the go with the AsteraApp, with wired or wireless DMX.

* cited by examiner



Exploded view of Apparatus 10

FIG. 1

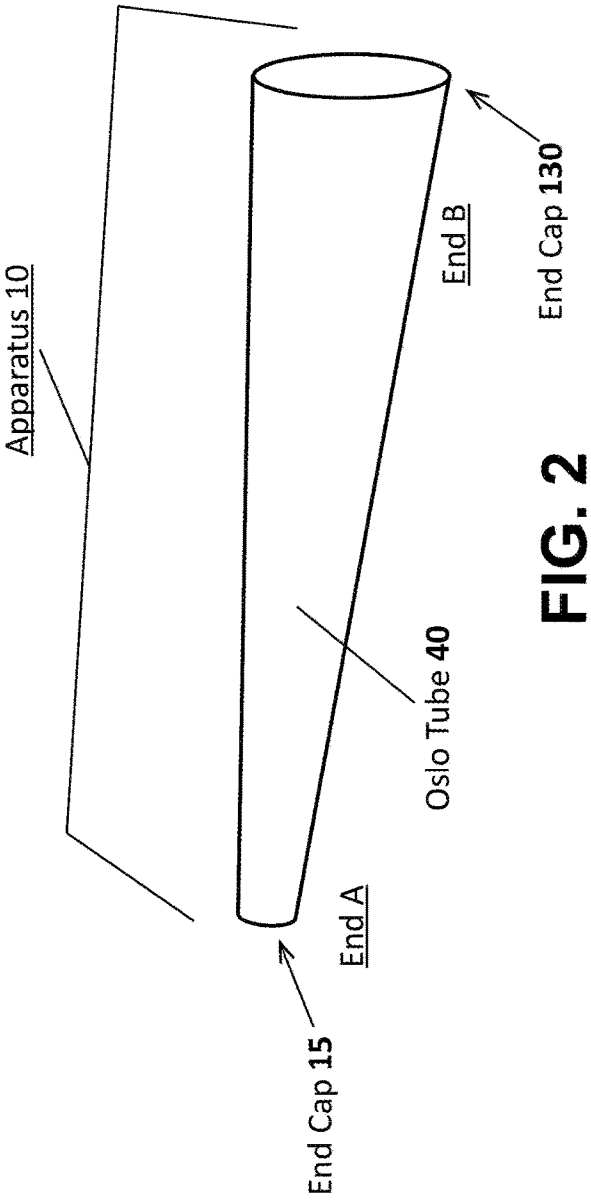

Apparatus 10
End B
End Cap 130
Oslo Tube 40
End A
End Cap 15

FIG. 2

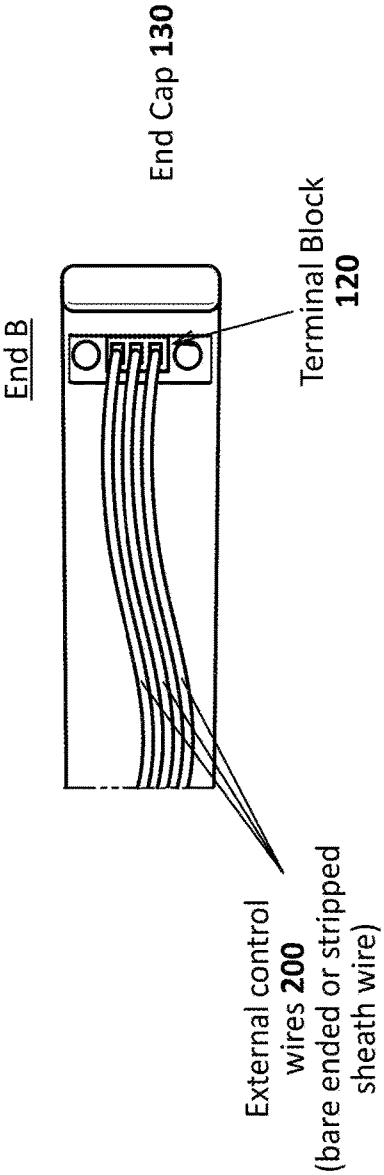

End Cap 130
End B
Terminal Block 120
External control wires 200 (bare ended or stripped sheath wire)

FIG. 3

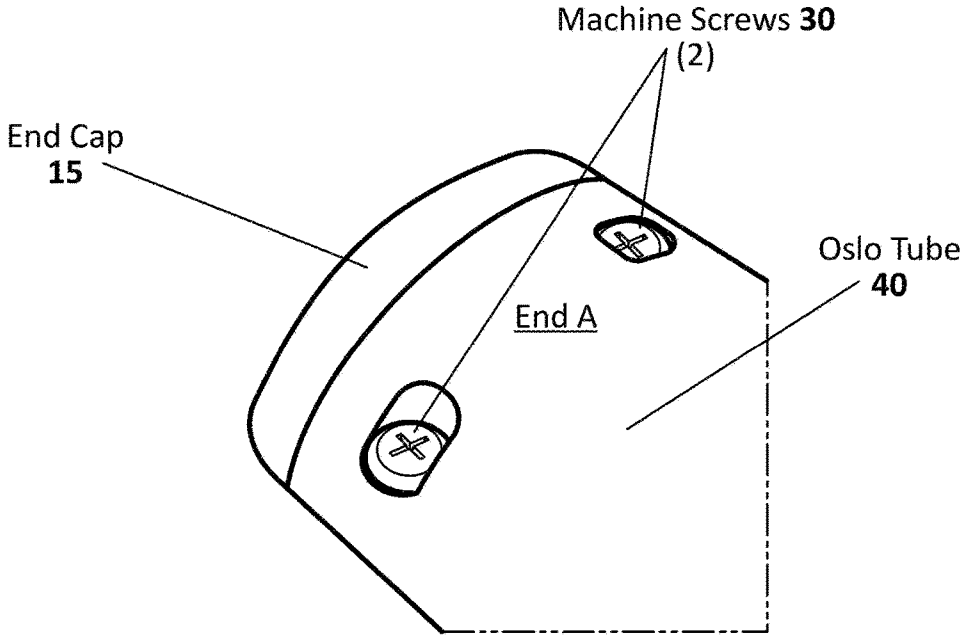

Machine Screws 30
(2)
End Cap
15
Oslo Tube
40
End A

FIG. 4

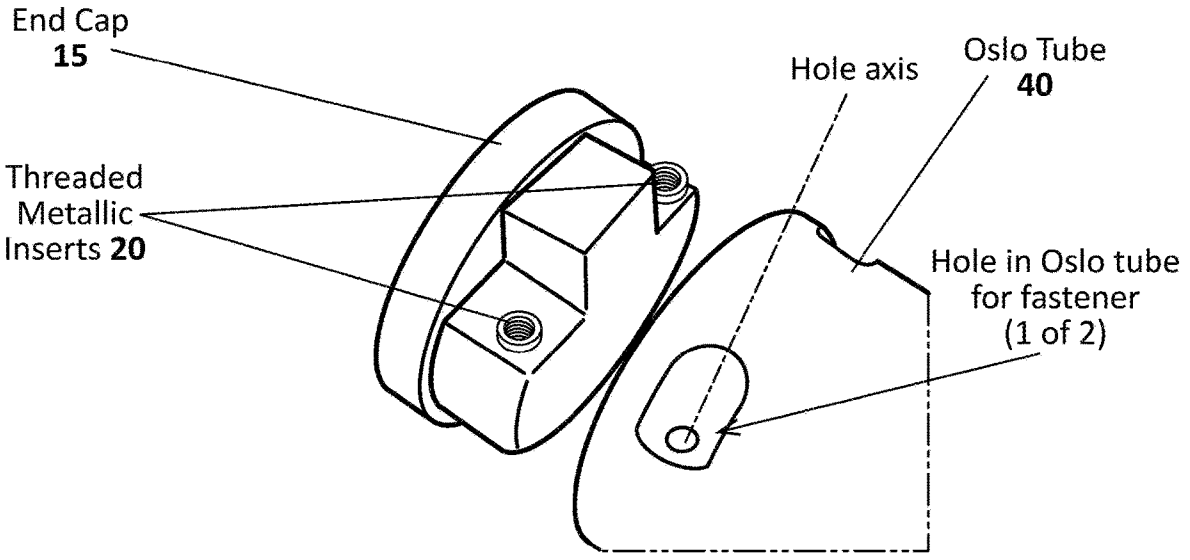

End Cap
15
Hole axis
Oslo Tube
40
Threaded
Metallic
Inserts 20
Hole in Oslo tube
for fastener
(1 of 2)

FIG. 5

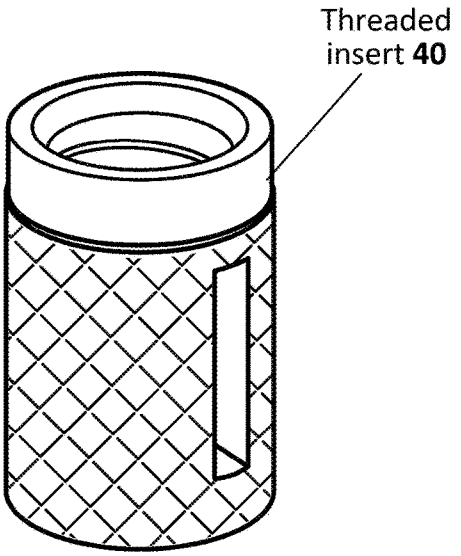


FIG. 6

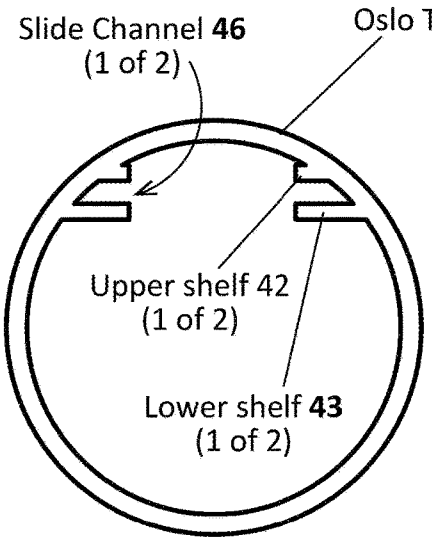


FIG. 7A

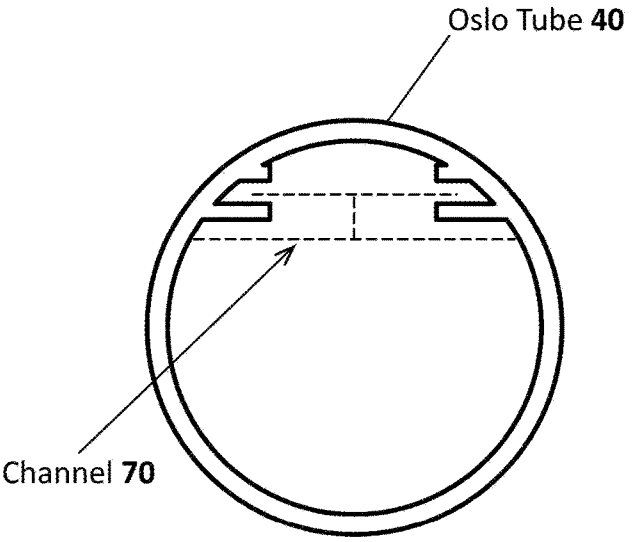


FIG. 7B

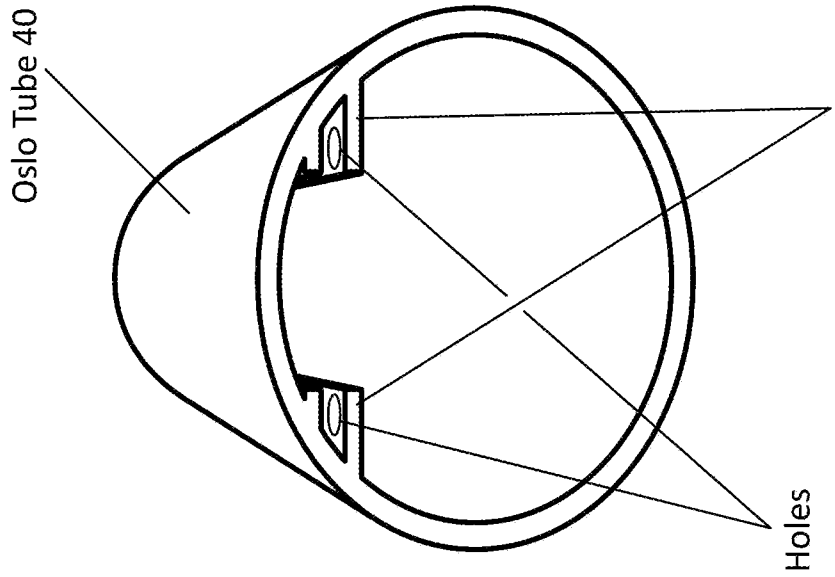

Oslo Tube 40
Shelves
Holes

FIG. 9

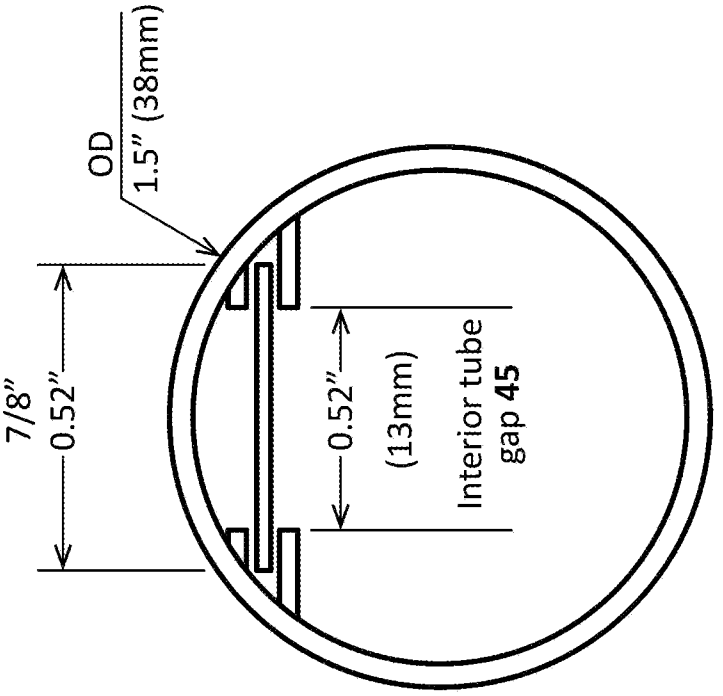
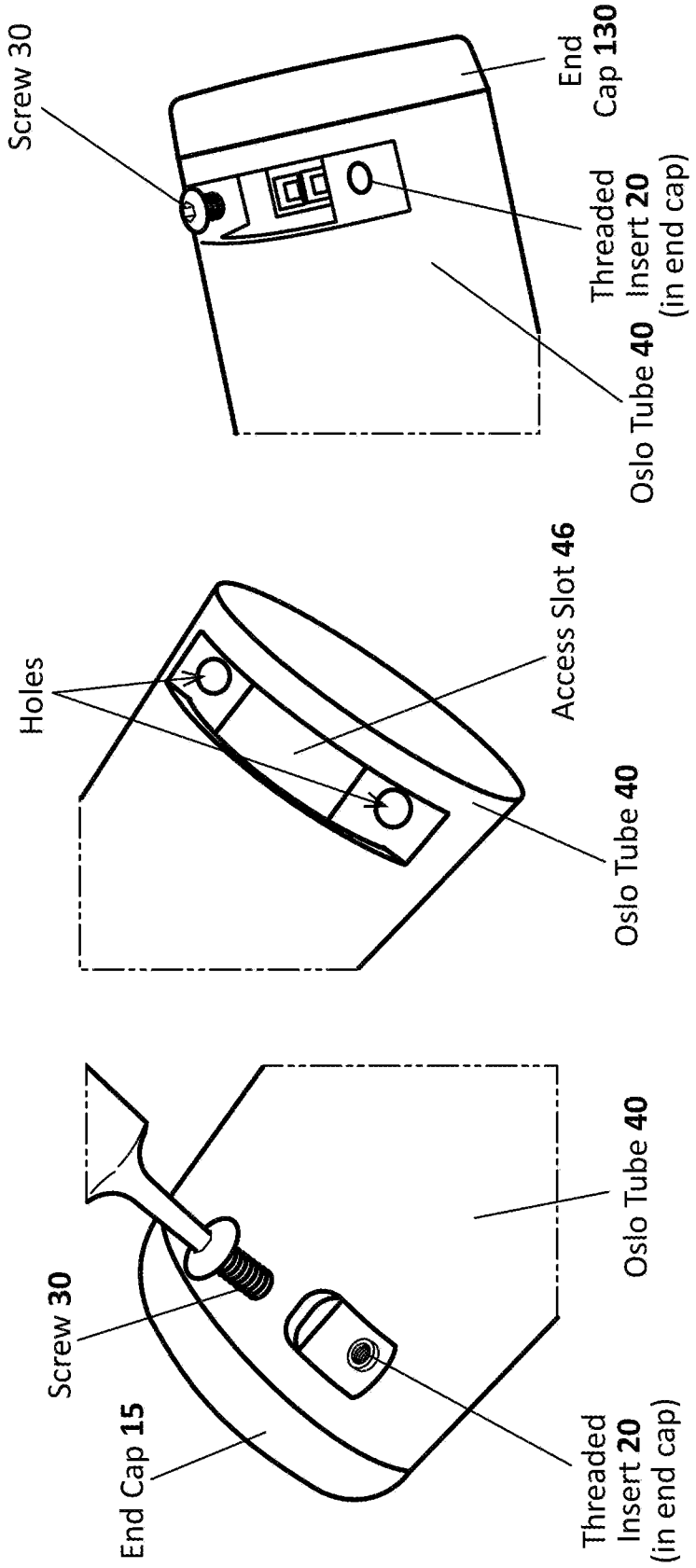

OD
1.5" (38mm)
7/8"
0.52"
0.52"
(13mm)
Interior tube
gap 45

FIG. 8



End B of Apparatus 10

FIG. 10C

End B of Apparatus 10

FIG. 10B

End A of Apparatus 10

FIG. 10A

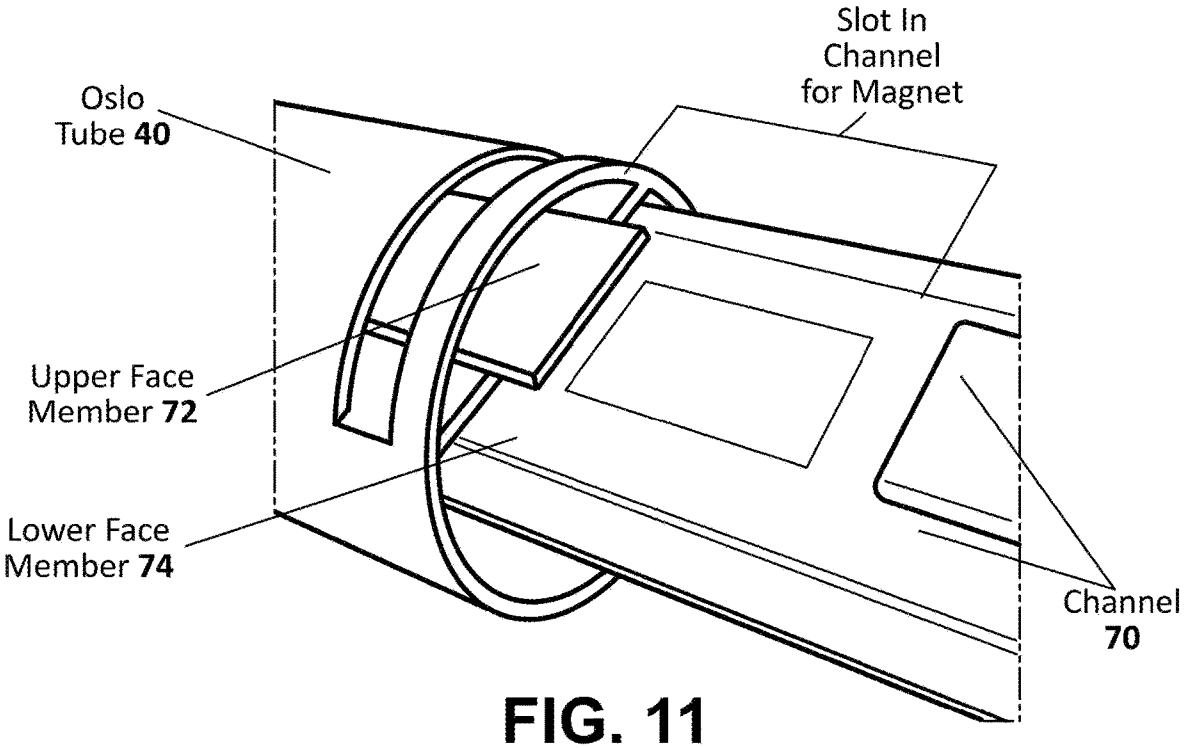

Slot In
Channel
for Magnet
Oslo
Tube 40
Upper Face
Member 72
Lower Face
Member 74
Channel
70

FIG. 11

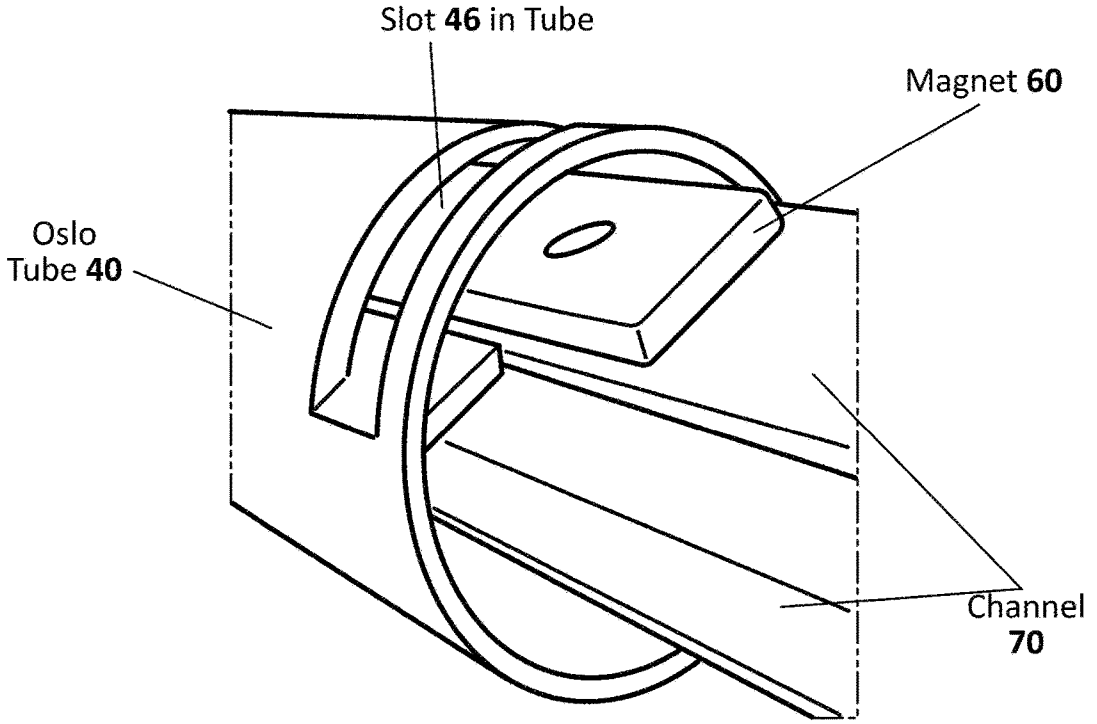

Slot 46 in Tube
Magnet 60
Oslo
Tube 40
Channel
70

FIG. 12

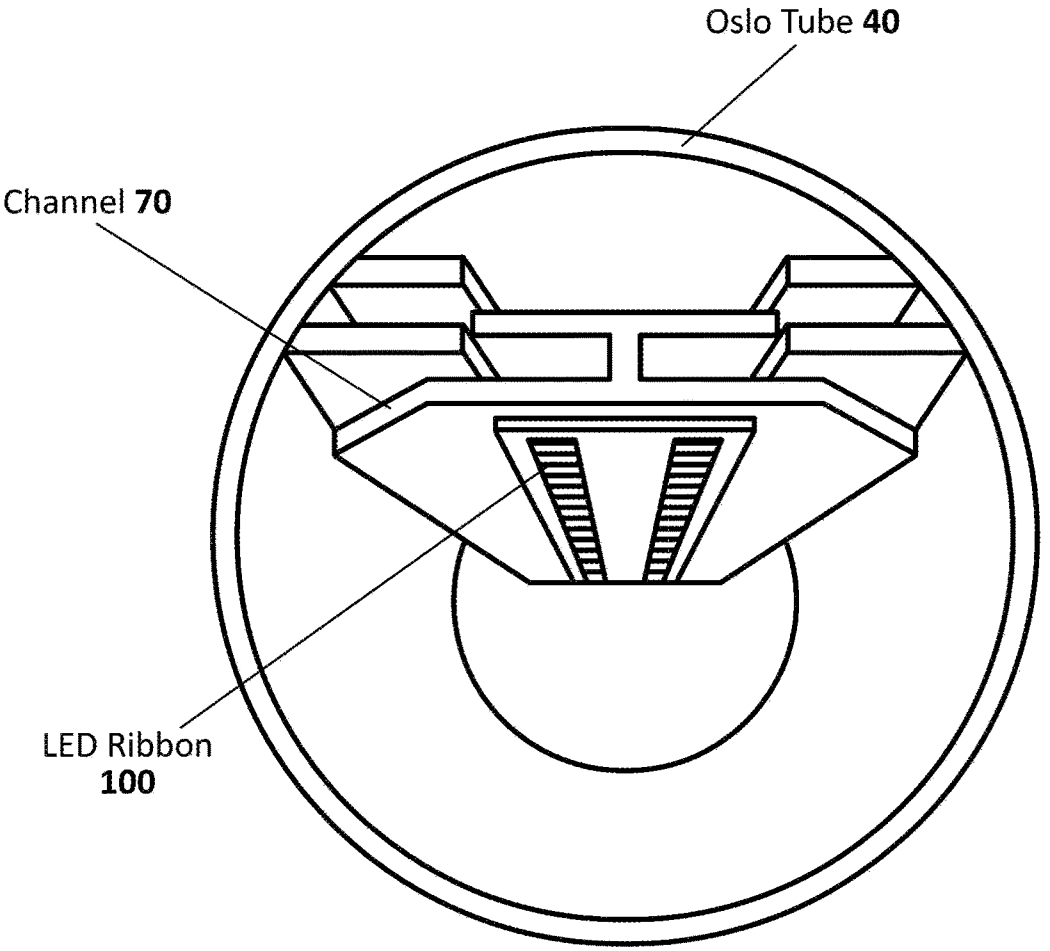

Oslo Tube 40
Channel 70
LED Ribbon
100

FIG. 13

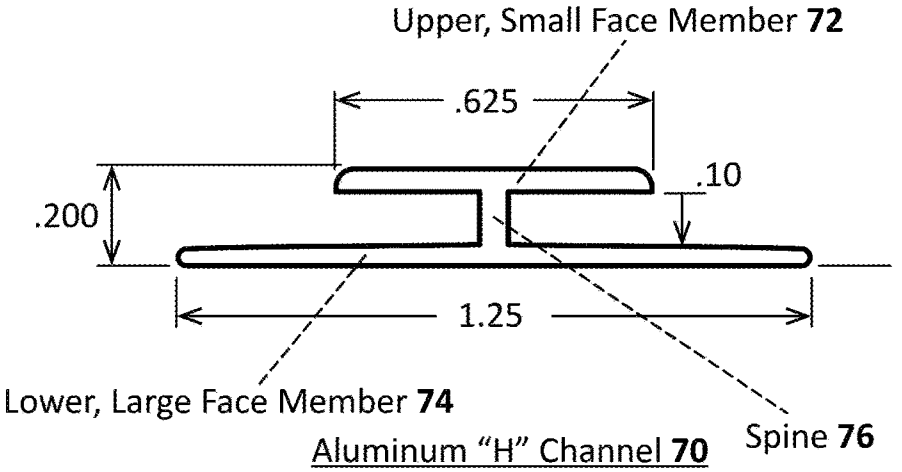

Upper, Small Face Member 72
.625
.10
.200
1.25
Lower, Large Face Member 74
Spine 76
Aluminum "H" Channel 70

FIG. 14

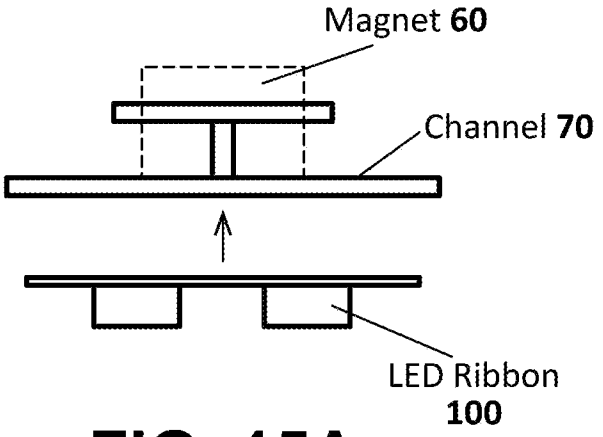


FIG. 15A

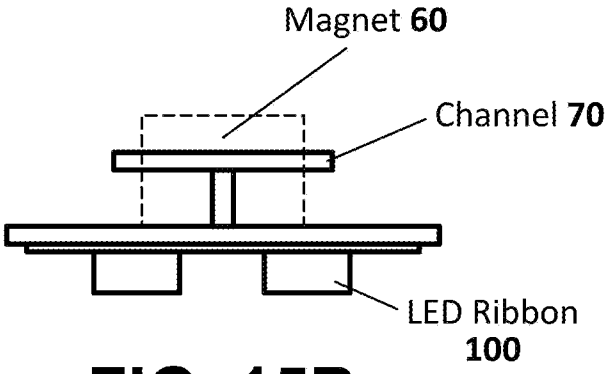


FIG. 15B

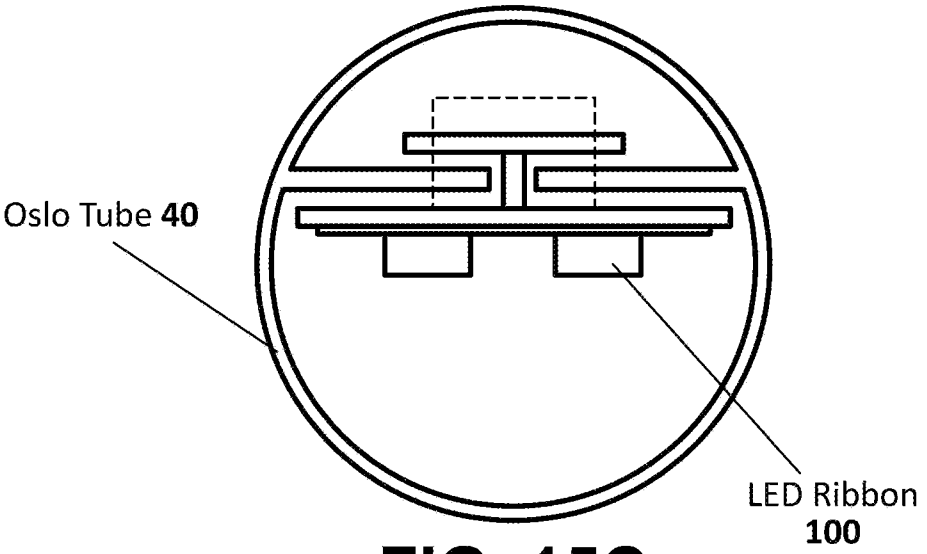


FIG. 15C

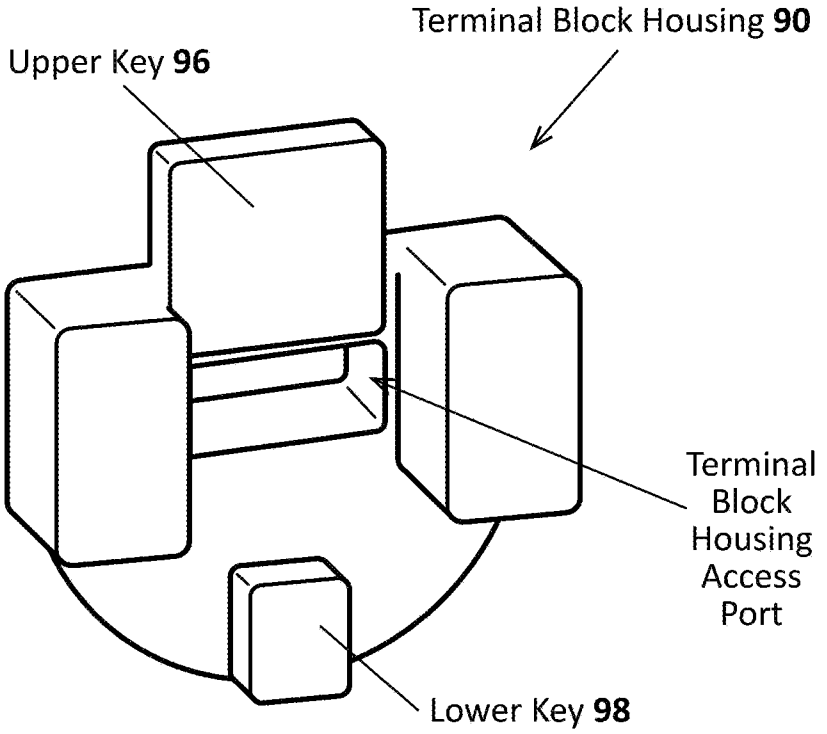

Terminal Block Housing 90
Upper Key 96
Terminal Block Housing Access Port
Lower Key 98

FIG. 16

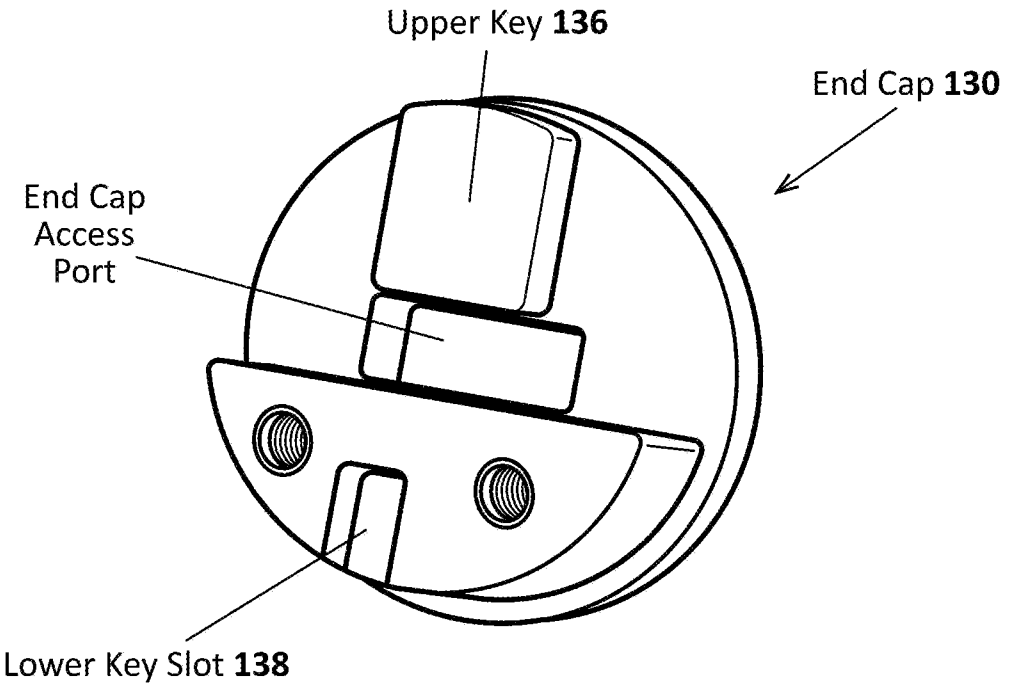

Upper Key 136
End Cap 130
End Cap Access Port
Lower Key Slot 138

FIG. 17

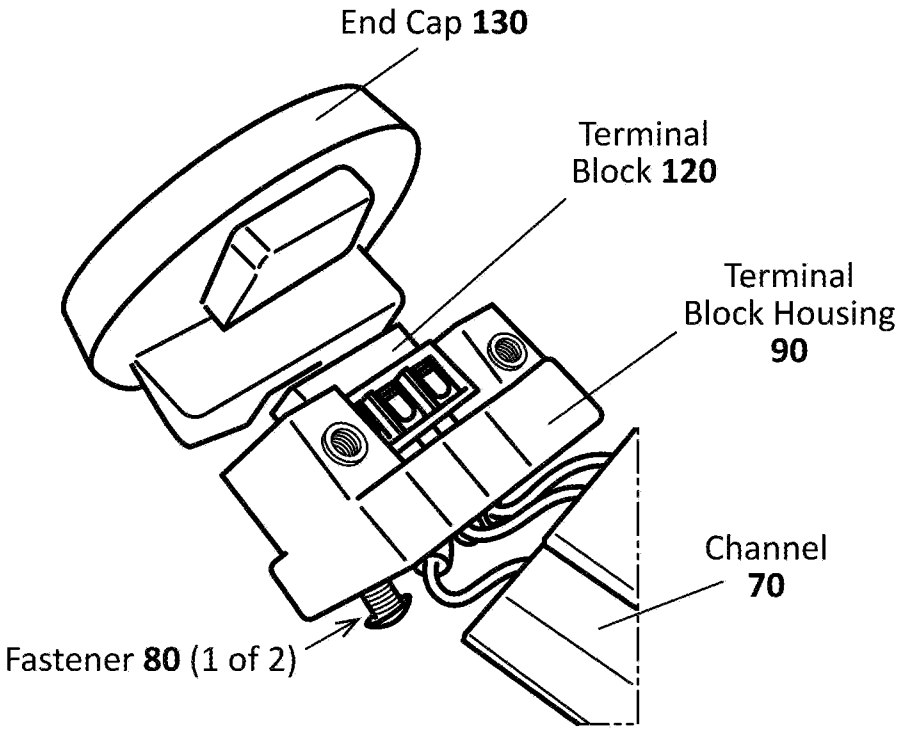


FIG. 18A

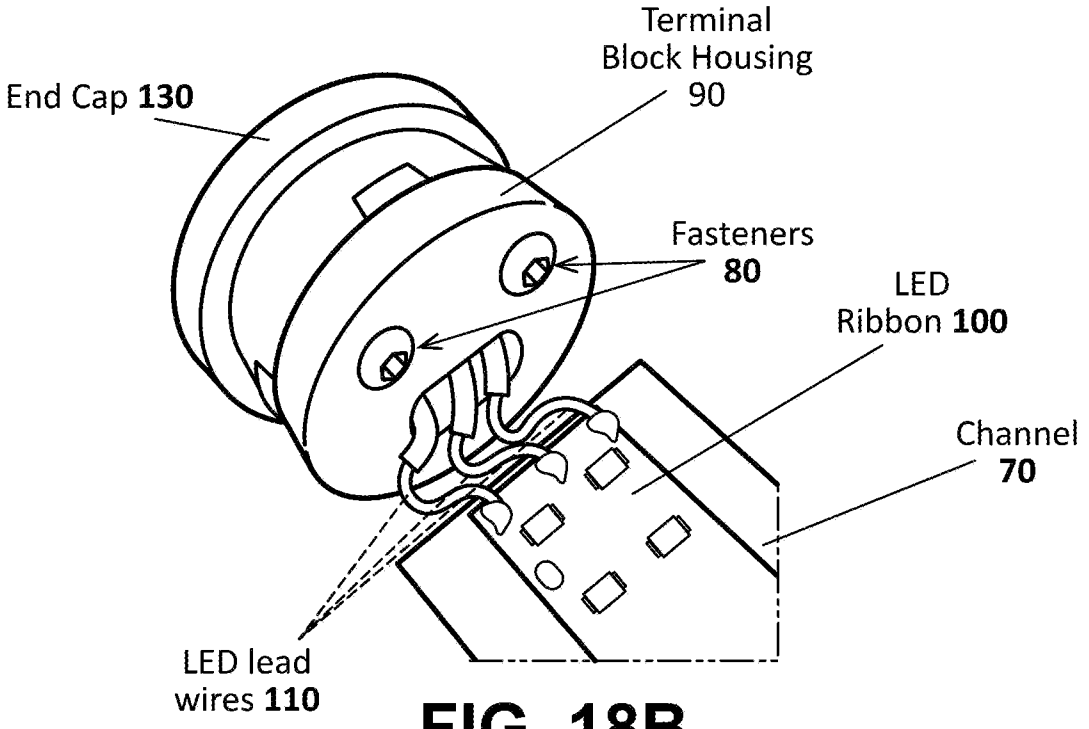


FIG. 18B

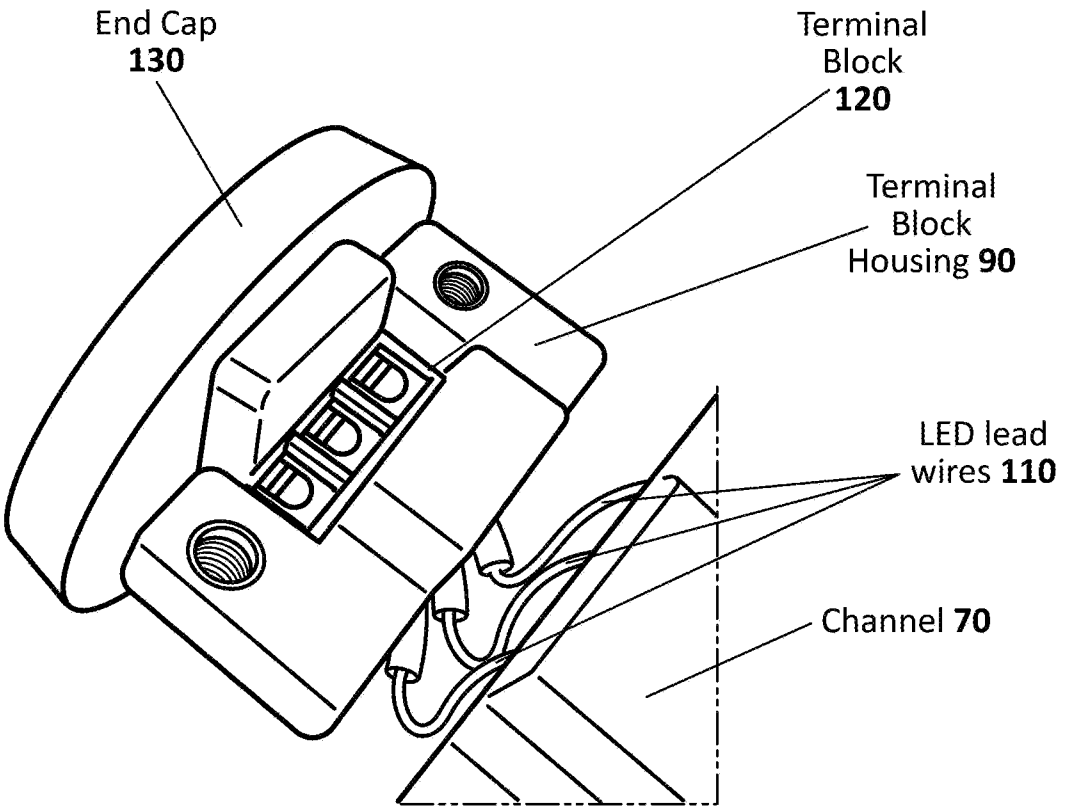

End Cap
130
Terminal
Block
120
Terminal
Block
Housing 90
LED lead
wires 110
Channel 70

FIG. 19

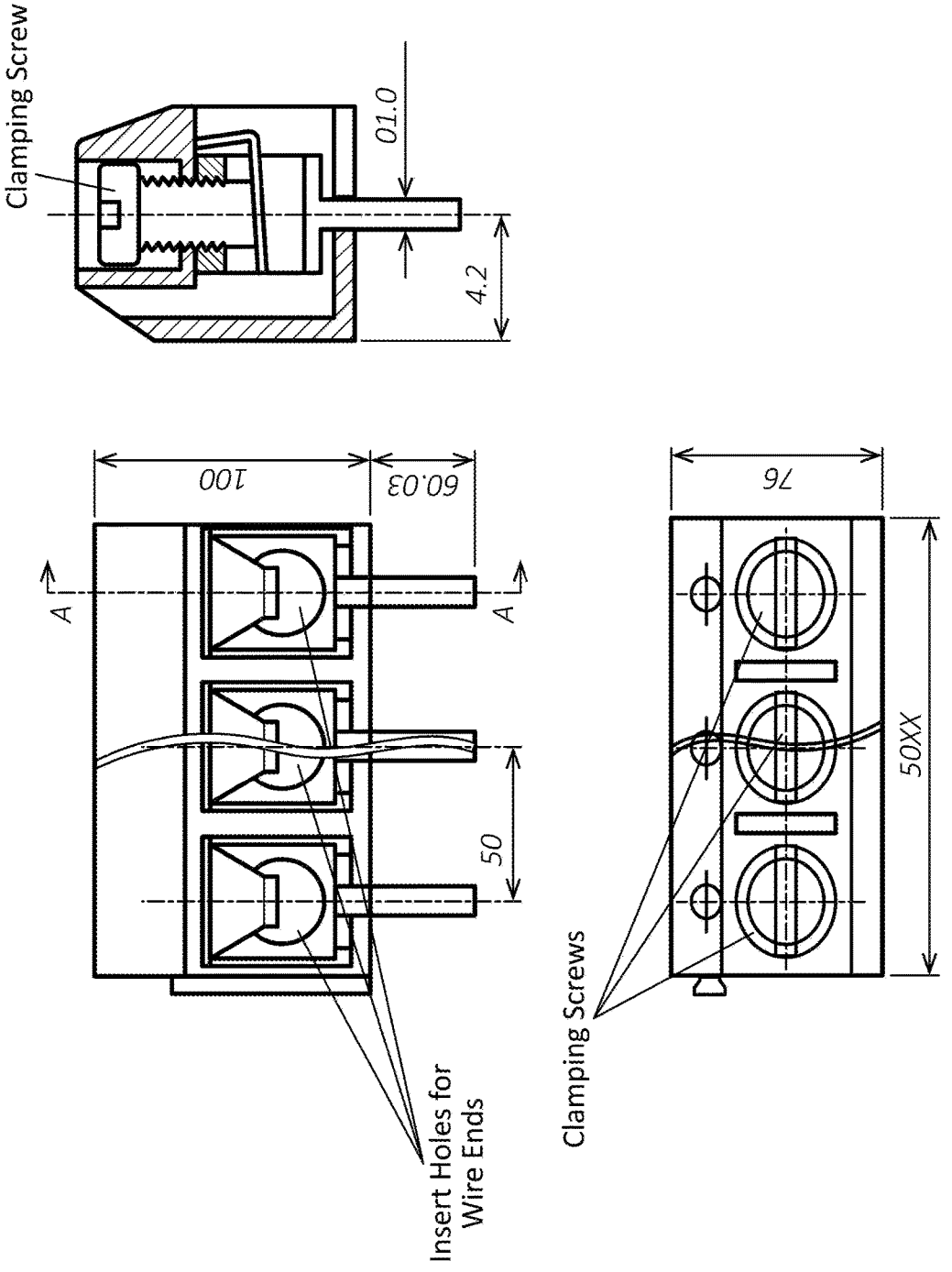

Clamping Screw
01.0
4.2
100
60.03
A
A
50
Insert Holes for
Wire Ends
76
50XX
Clamping Screws
Terminal block

FIG. 20

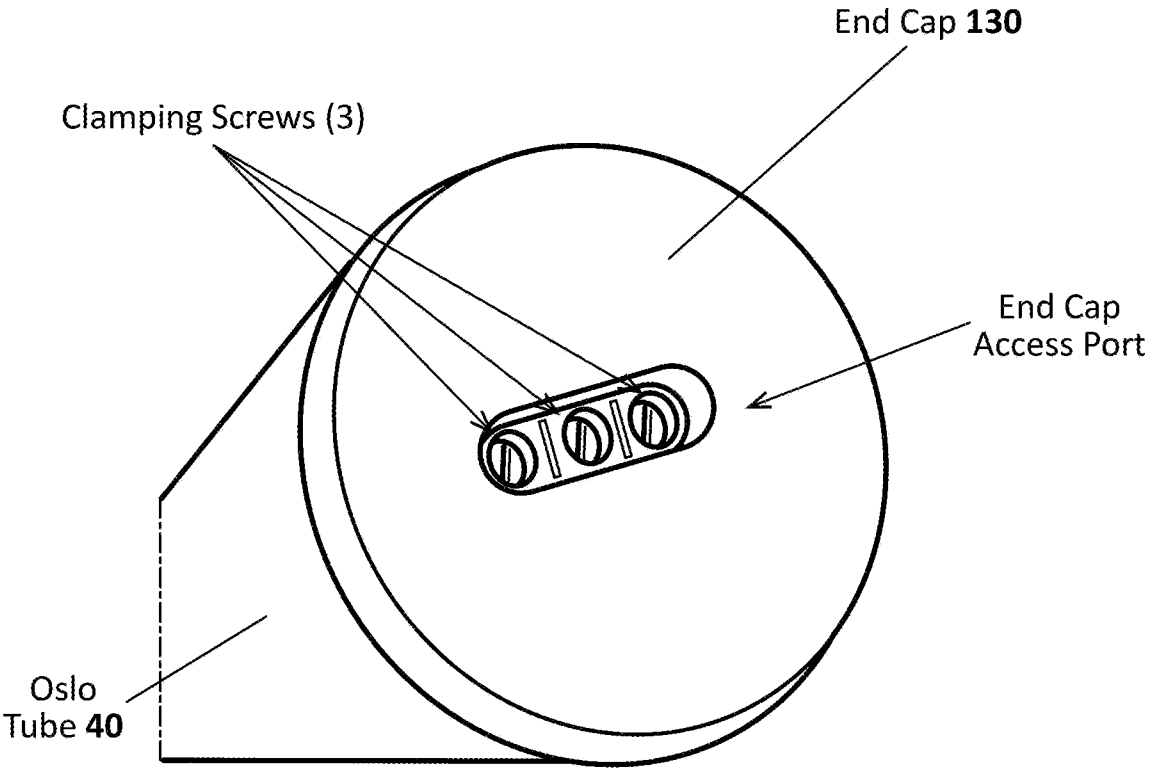

End Cap 130
Clamping Screws (3)
End Cap
Access Port
Oslo
Tube 40

FIG. 21

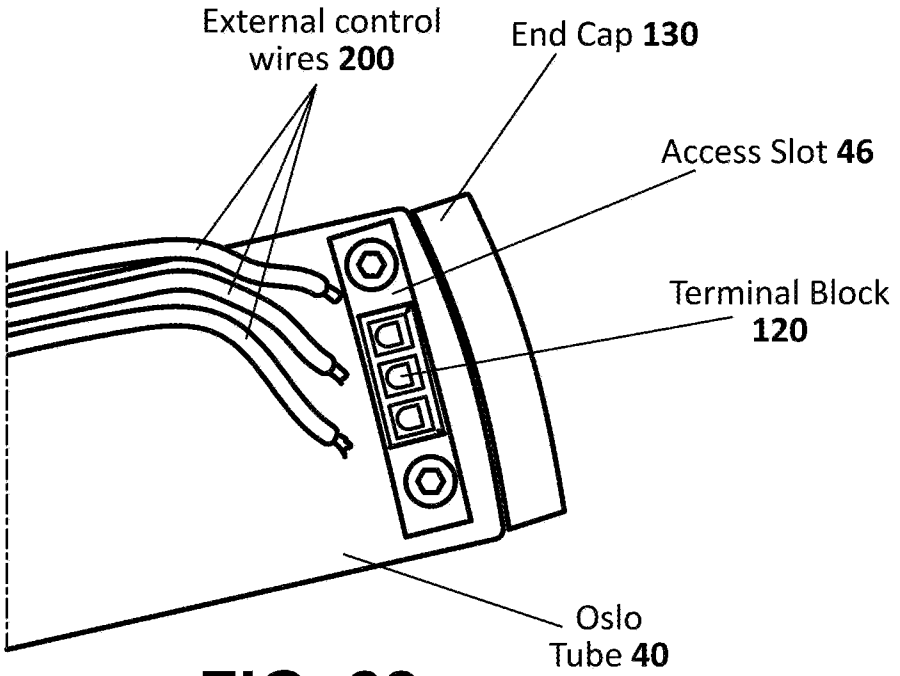

External control
wires 200
End Cap 130
Access Slot 46
Terminal Block
120
Oslo
Tube 40

FIG. 22

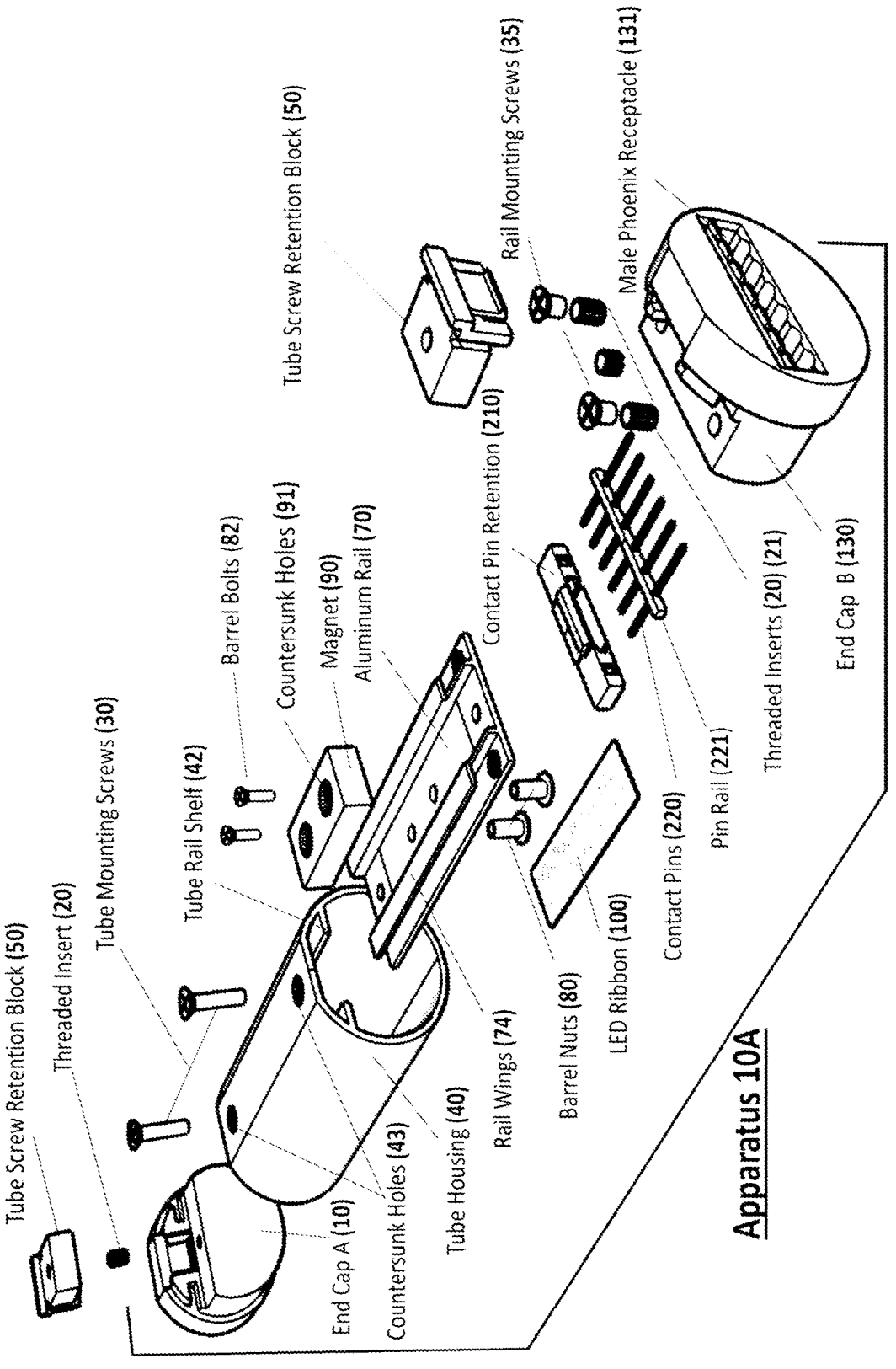
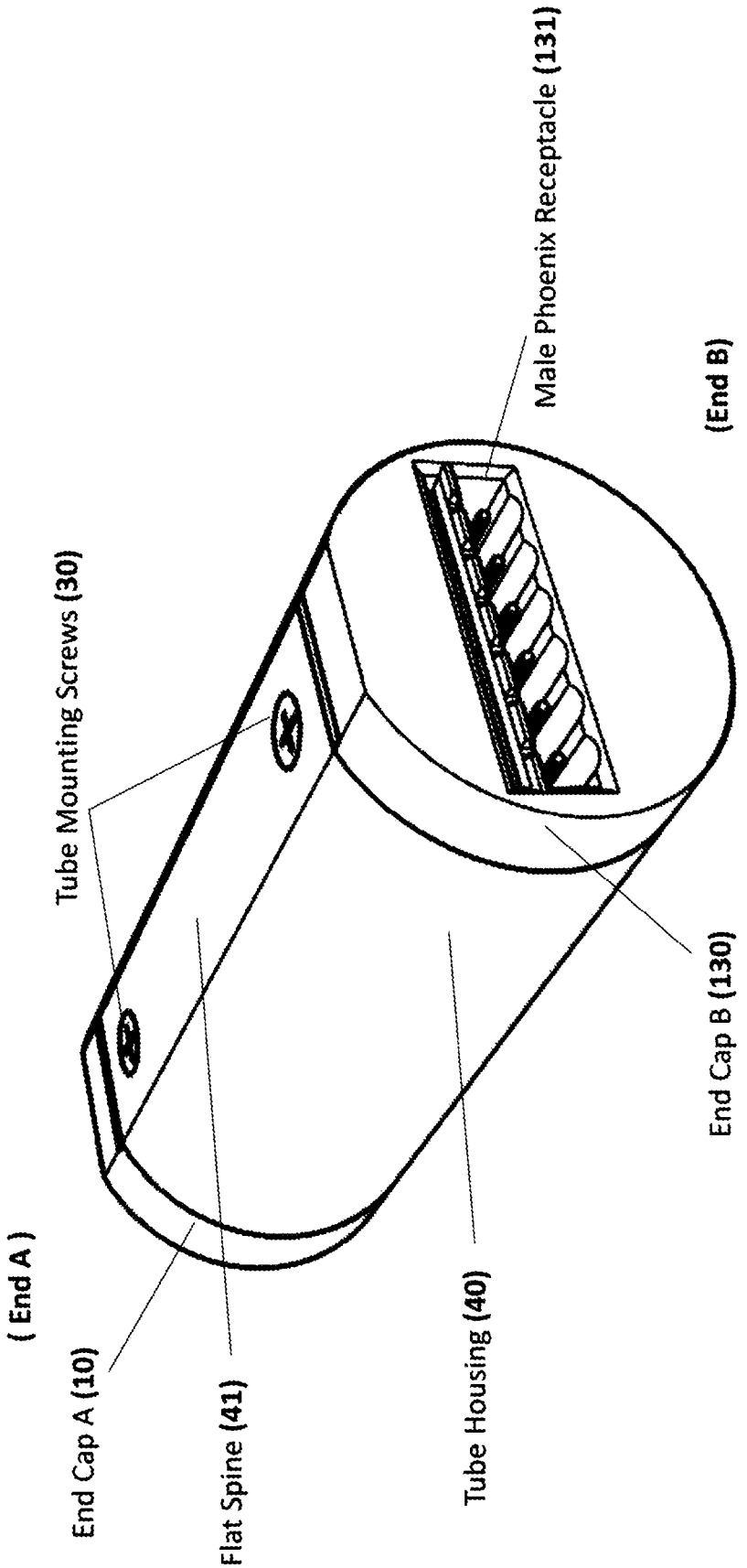
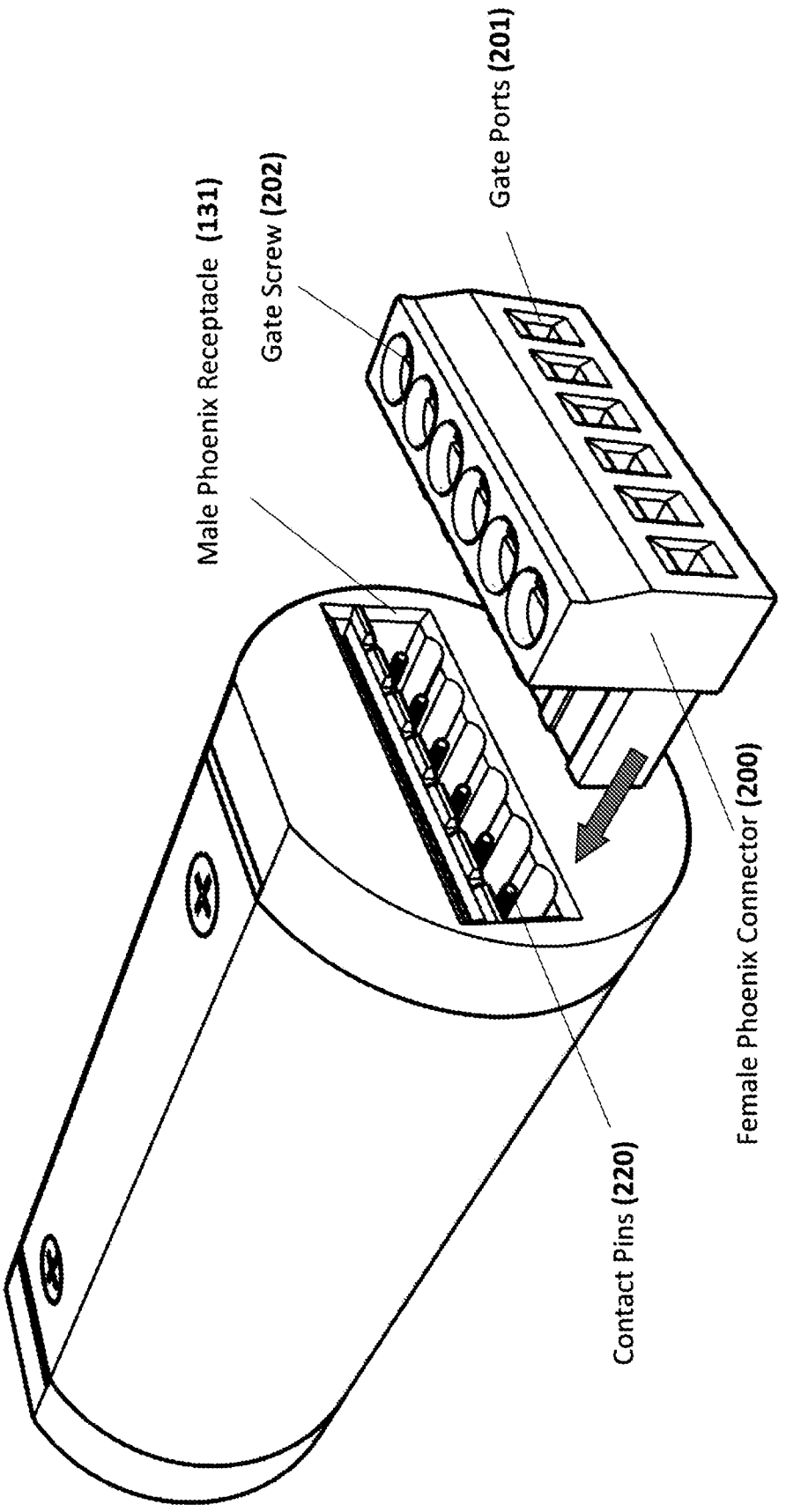

Tube Screw Retention Block (50)
Threaded Insert (20)
Tube Mounting Screws (30)
Tube Rail Shelf (42)
Barrel Bolts (82)
Countersunk Holes (91)
Magnet (90)
Aluminum Rail (70)
Tube Screw Retention Block (50)
Rail Mounting Screws (35)
Male Phoenix Receptacle (131)
Contact Pin Retention (210)
End Cap A (10)
Countersunk Holes (43)
Tube Housing (40)
Rail Wings (74)
Barrel Nuts (80)
LED Ribbon (100)
Contact Pins (220)
Pin Rail (221)
Threaded Inserts (20) (21)
End Cap B (130)
Apparatus 10A
Apparatus 10A Exploded View

FIG. 23



Apparatus 10A

FIG. 24



Apparatus 10A,
Female Phoenix Connector(200)

FIG. 25

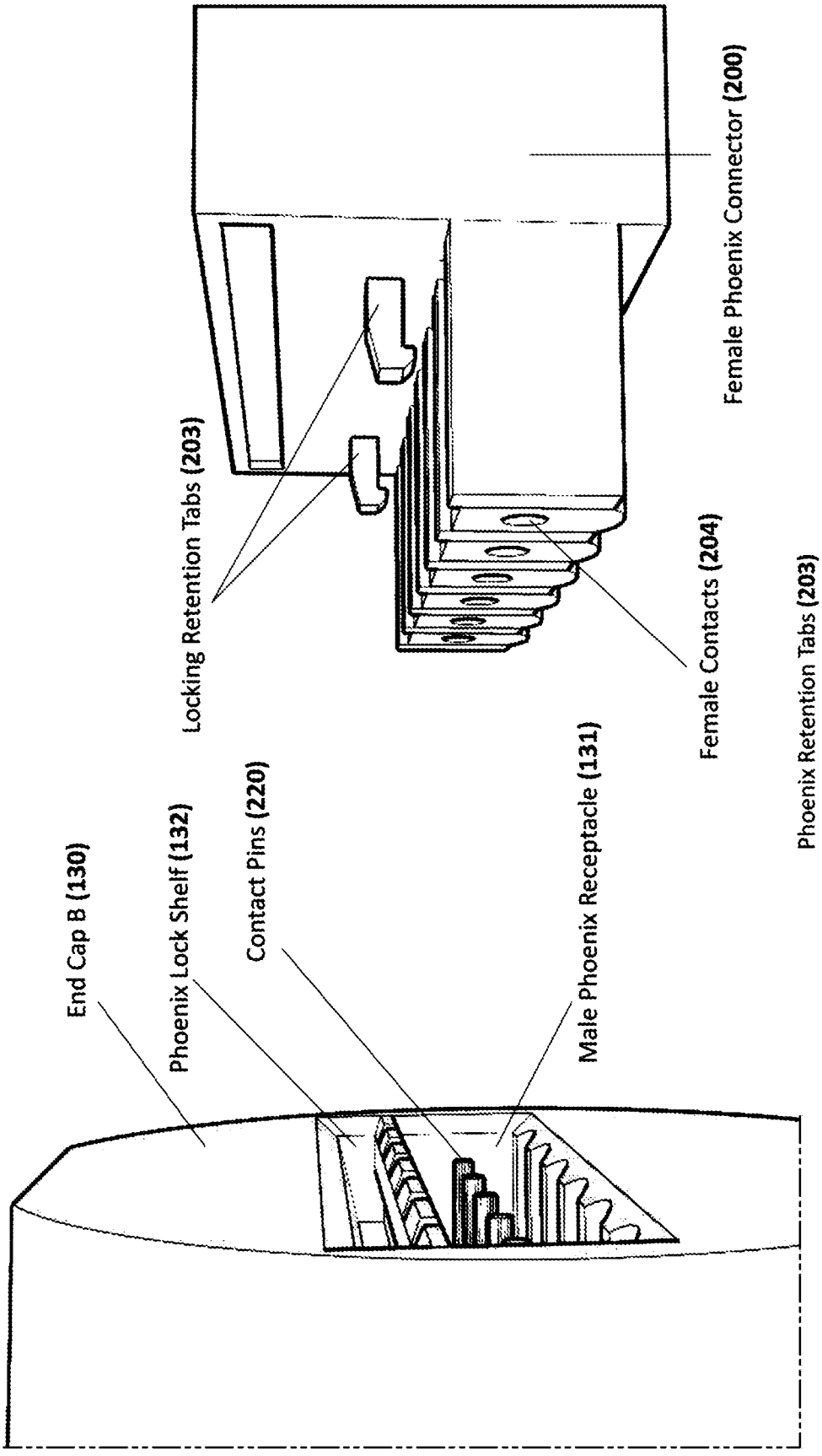
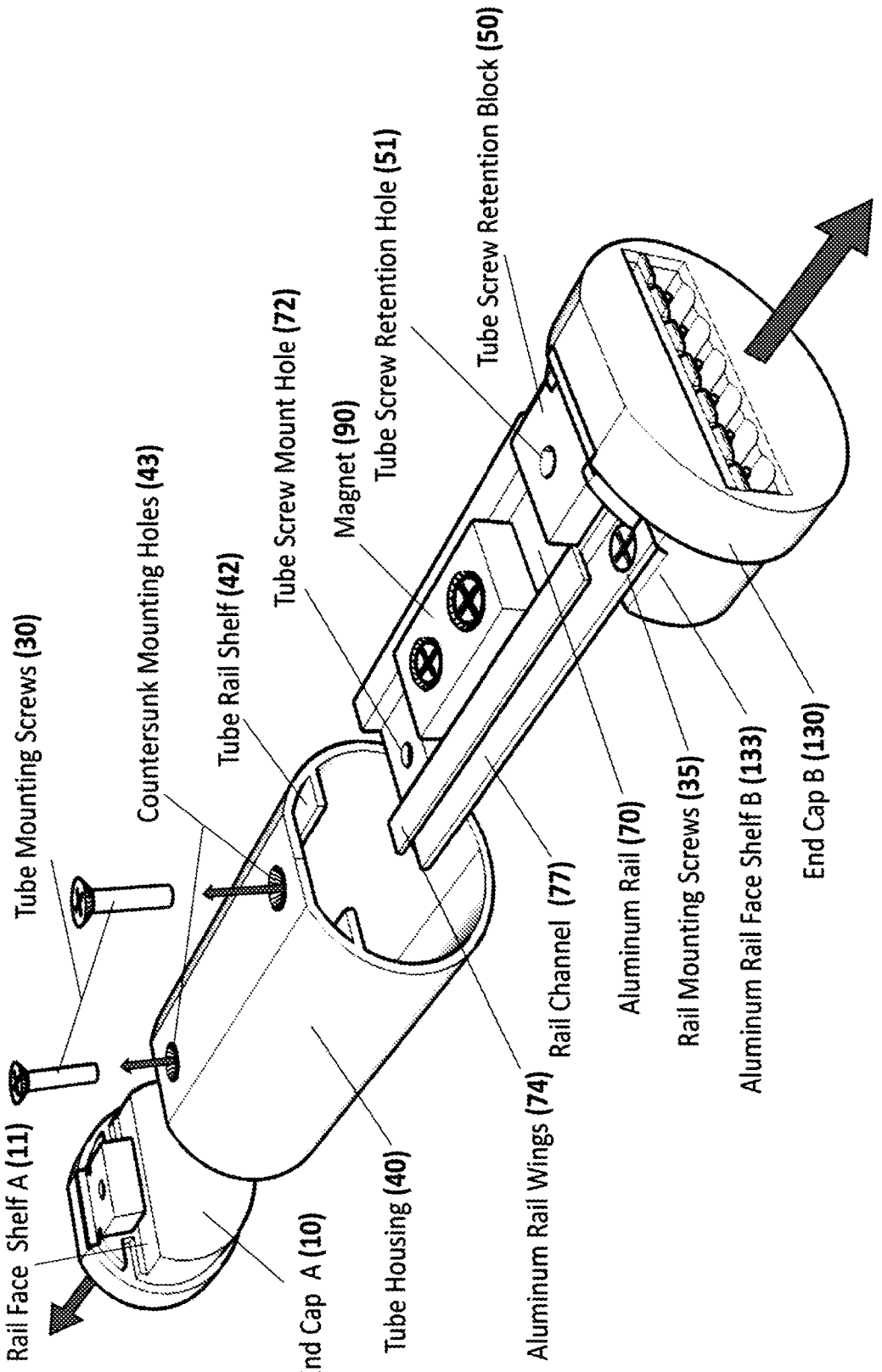

Female Phoenix Connector (200)
Locking Retention Tabs (203)
Female Contacts (204)
Phoenix Retention Tabs (203)
and Locking Shelf (132)
End Cap B (130)
Phoenix Lock Shelf (132)
Contact Pins (220)
Male Phoenix Receptacle (131)

FIG. 26



Apparatus **10A** Opened

FIG. 27

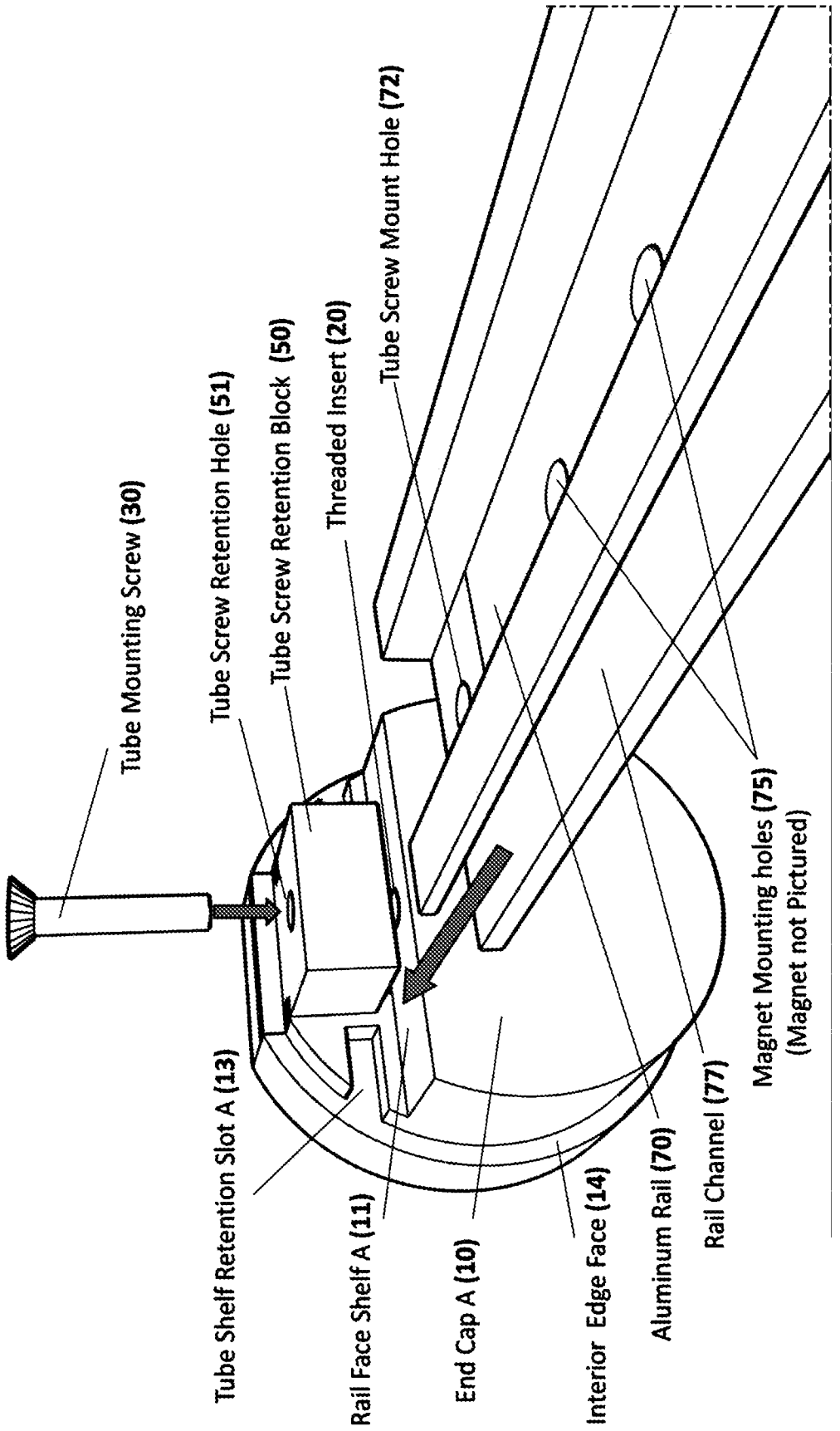

Tube Mounting Screw (30)
Tube Screw Retention Hole (51)
Tube Screw Retention Block (50)
Threaded Insert (20)
Tube Screw Mount Hole (72)
Tube Shelf Retention Slot A (13)
Rail Face Shelf A (11)
End Cap A (10)
Interior Edge Face (14)
Aluminum Rail (70)
Rail Channel (77)
Magnet Mounting holes (75)
(Magnet not Pictured)
End Cap A 10, Tube Screw 30
Aluminum Rail Channel 70

FIG. 28A

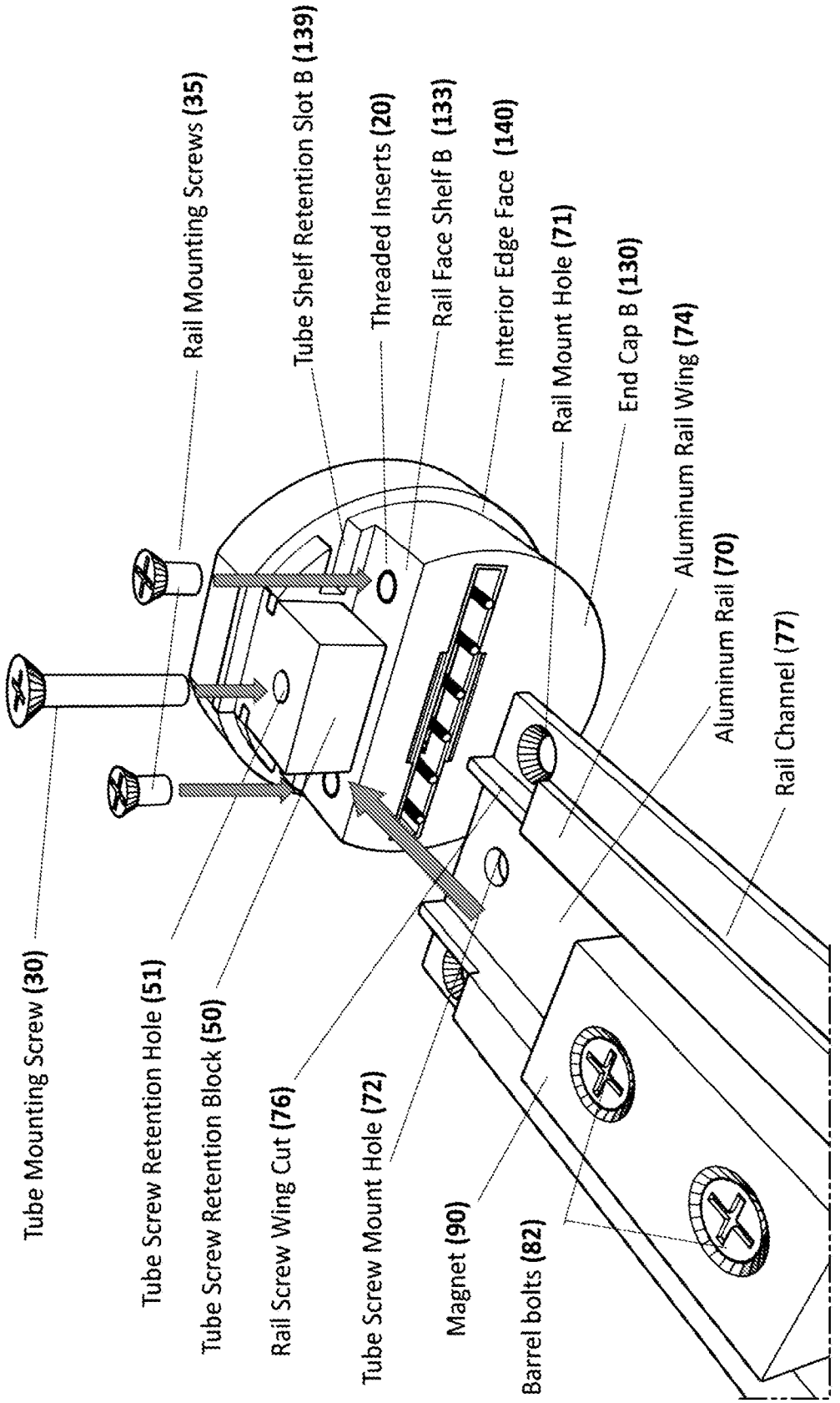
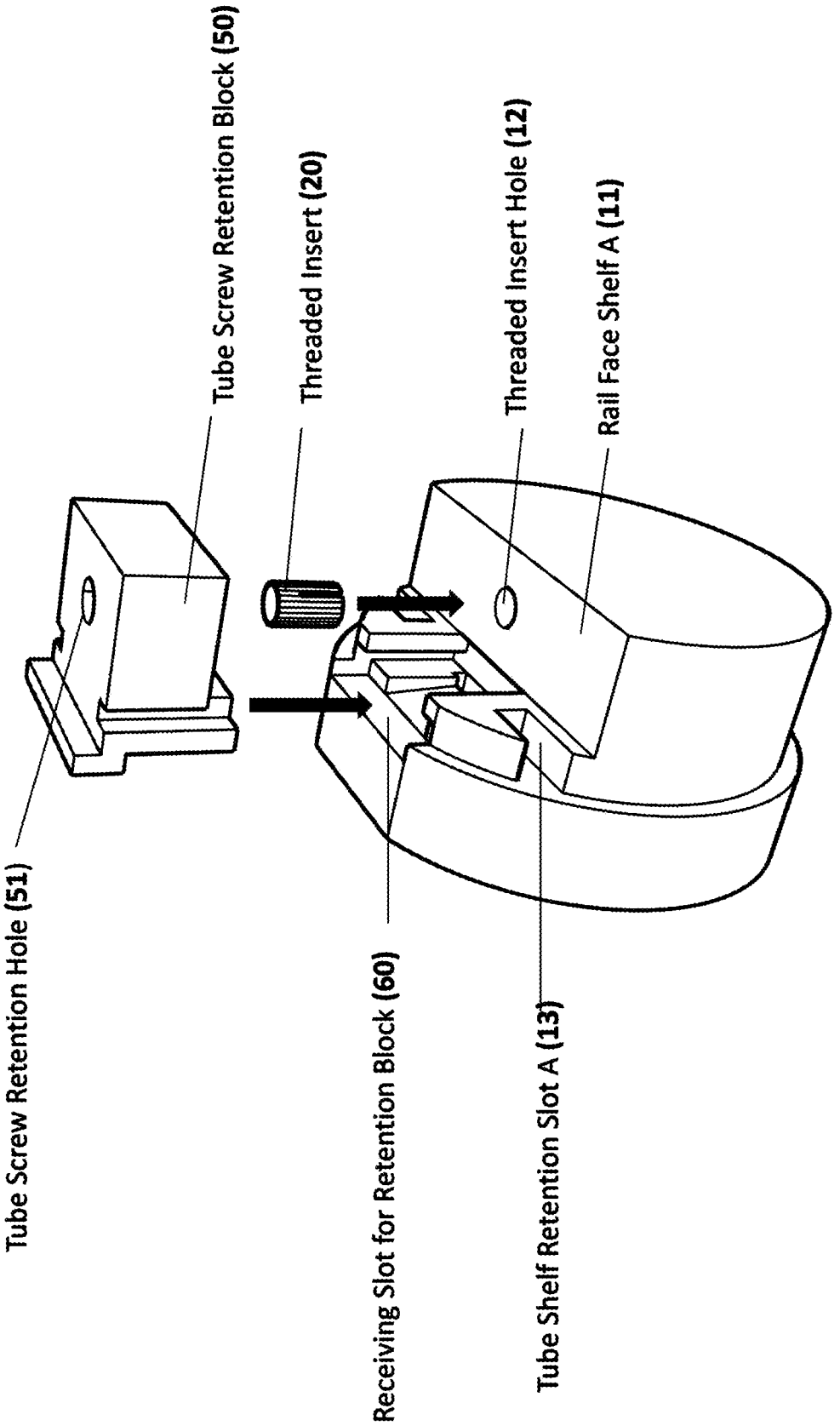
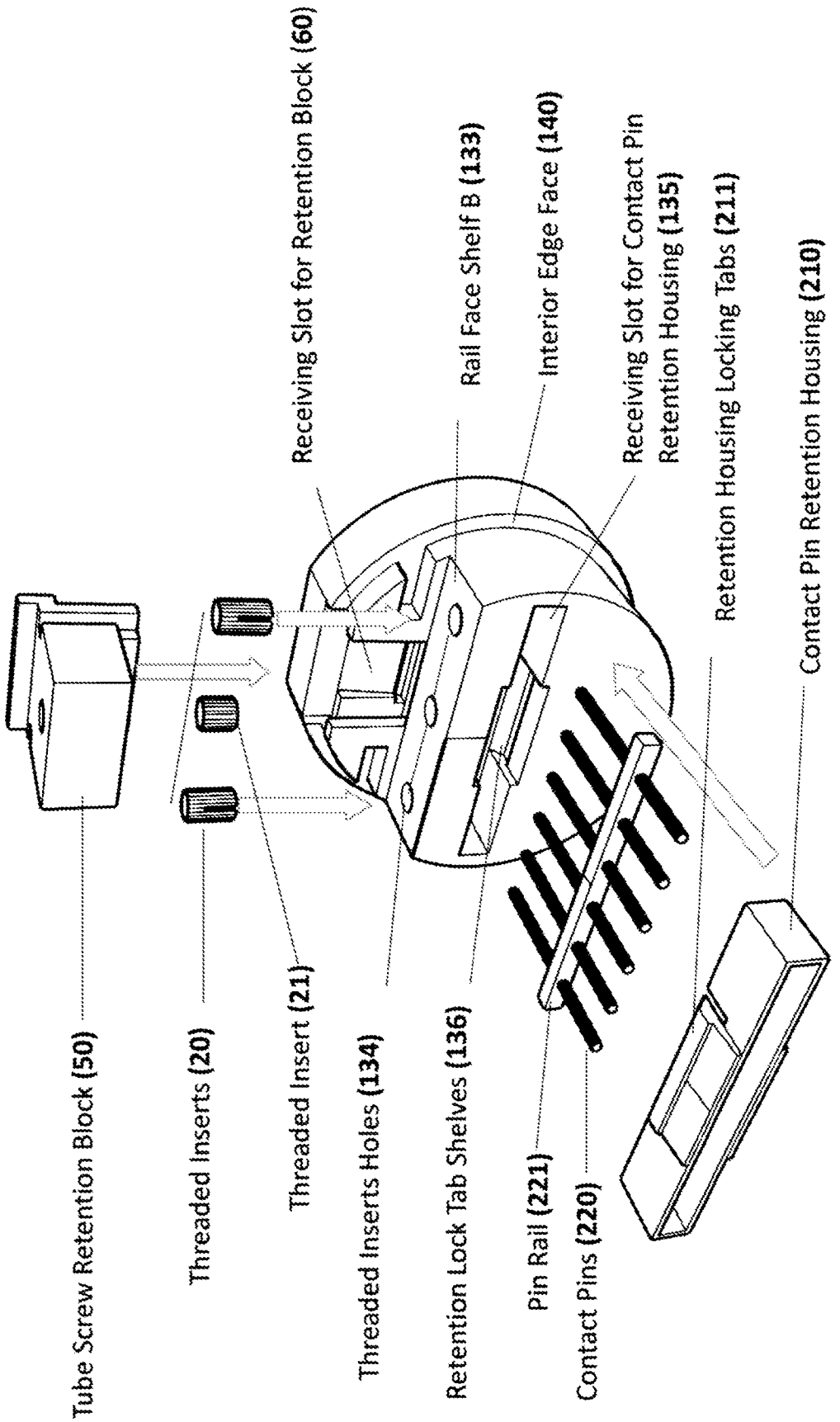

Tube Mounting Screw (30)
Tube Screw Retention Hole (51)
Tube Screw Retention Block (50)
Rail Screw Wing Cut (76)
Tube Screw Mount Hole (72)
Magnet (90)
Barrel bolts (82)
Rail Mounting Screws (35)
Tube Shelf Retention Slot B (139)
Threaded Inserts (20)
Rail Face Shelf B (133)
Interior Edge Face (140)
Rail Mount Hole (71)
End Cap B (130)
Aluminum Rail Wing (74)
Aluminum Rail (70)
Rail Channel (77)
End Cap B 130,
Tube Screw 30, Rail Screws 35

FIG. 28B



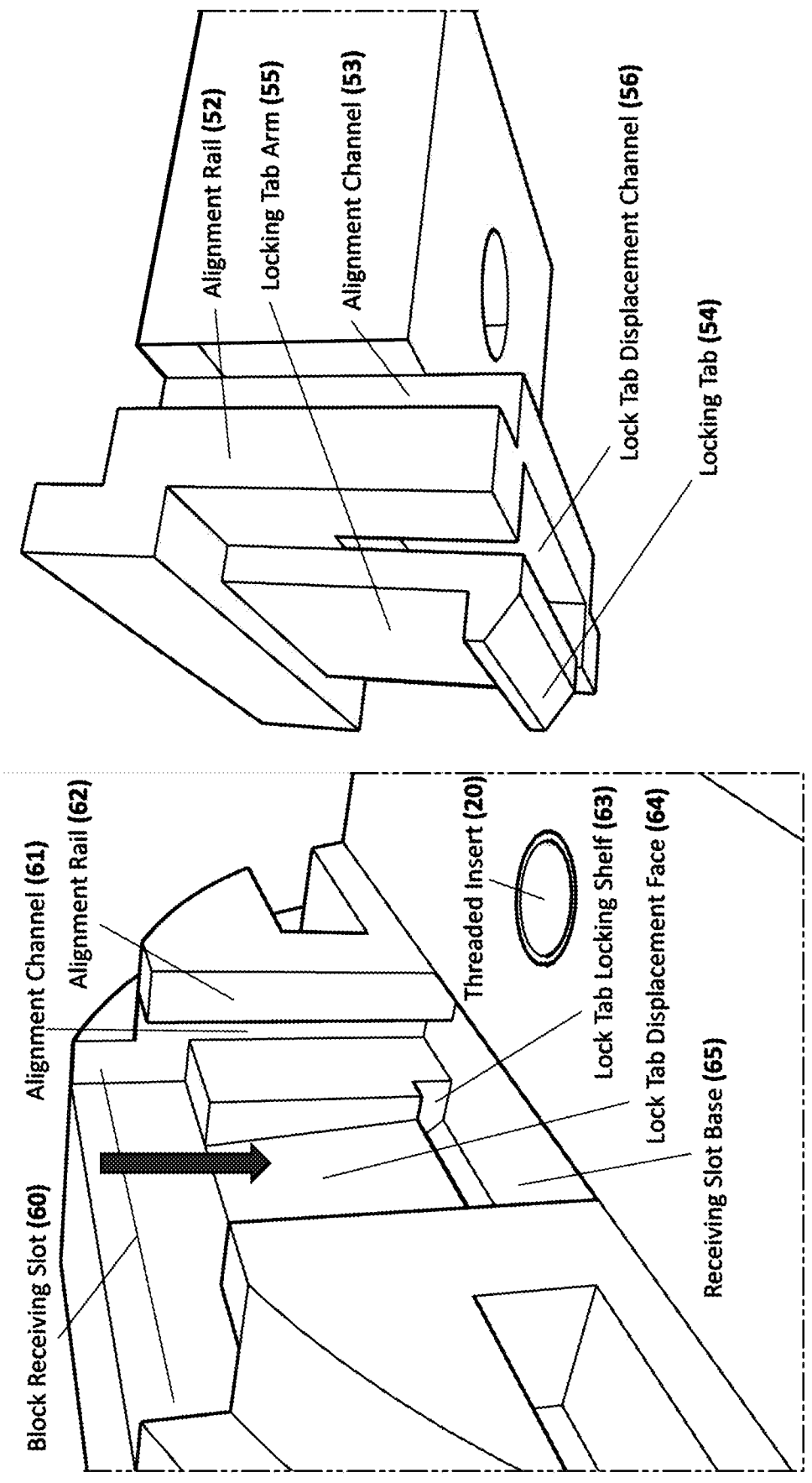
End Cap A **10** Exploded View

FIG. 29A



End Cap B **130** Exploded View

FIG. 29B



Receiving Slot **60** Detail
Retention Block Slide Lock **50**

FIG. 30

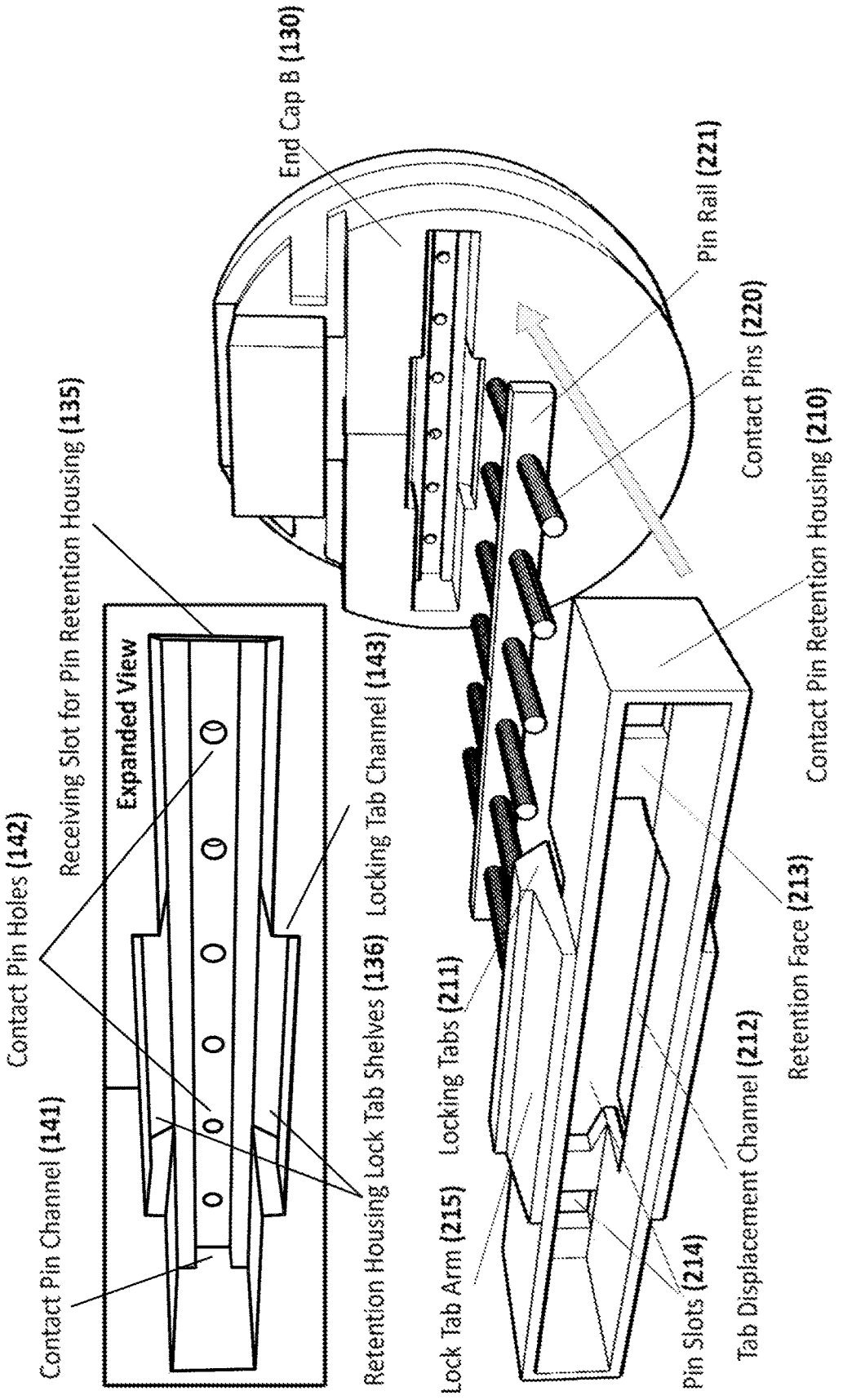
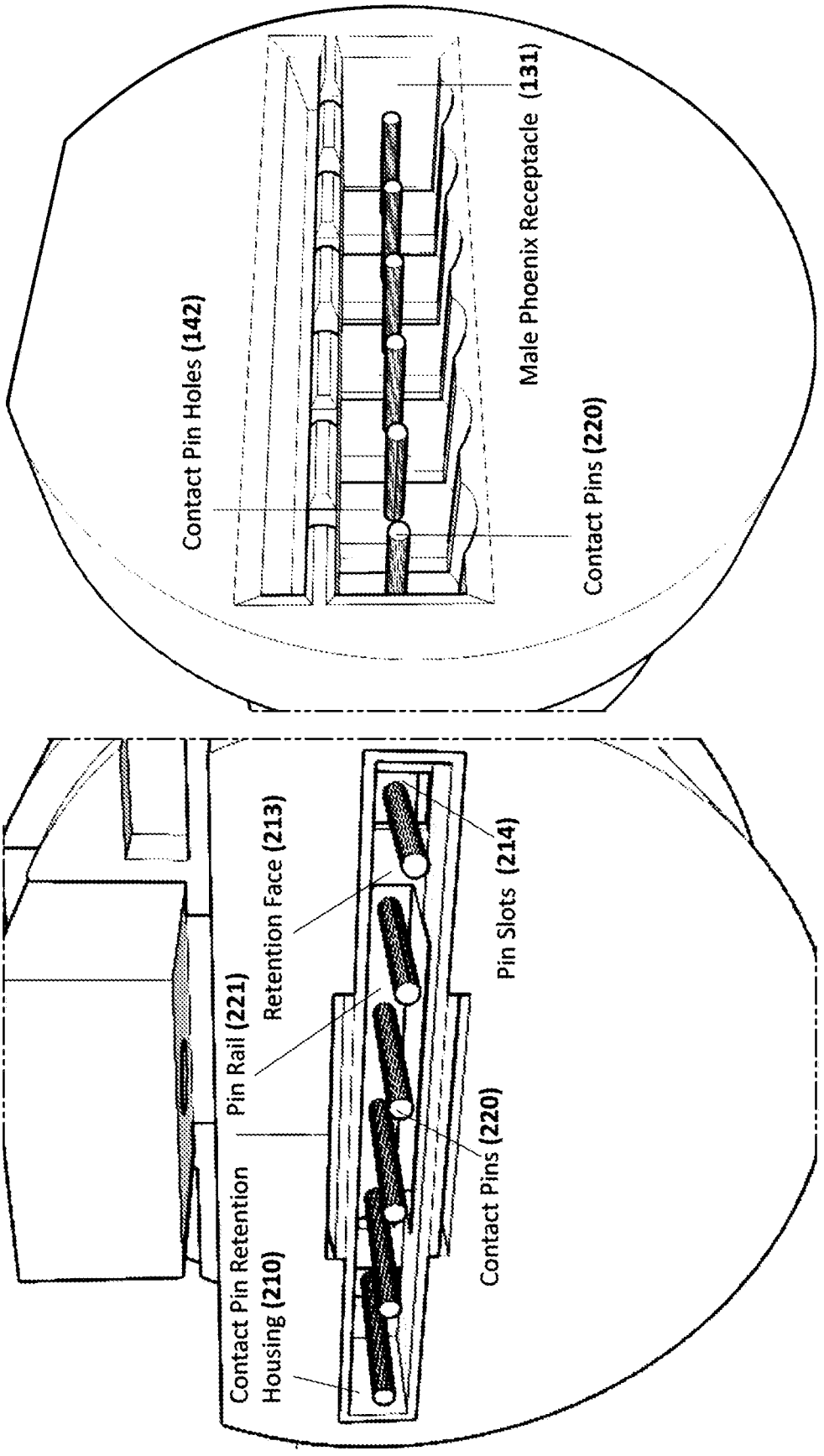
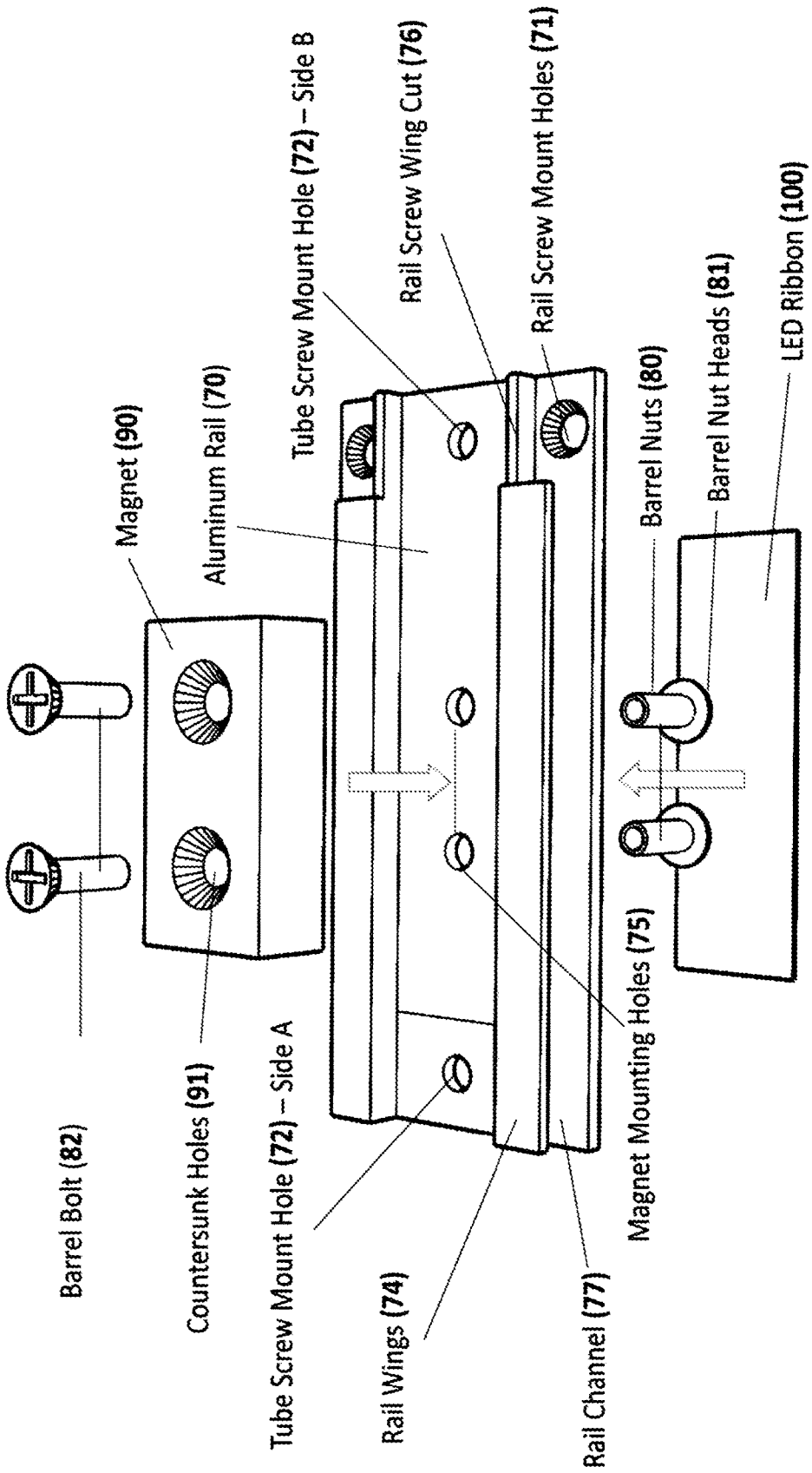

End Cap B (130)
Pin Rail (221)
Contact Pins (220)
Contact Pin Retention Housing (210)
Pin Retention Housing 135
Contact Pin Housing 210
Retention Face (213)
Tab Displacement Channel (212)
Pin Slots (214)
Lock Tab Arm (215)
Locking Tabs (211)
Retention Housing Lock Tab Shelves (136)
Locking Tab Channel (143)
Receiving Slot for Pin Retention Housing (135)
Contact Pin Holes (142)
Contact Pin Channel (141)
Expanded View

FIG. 31A



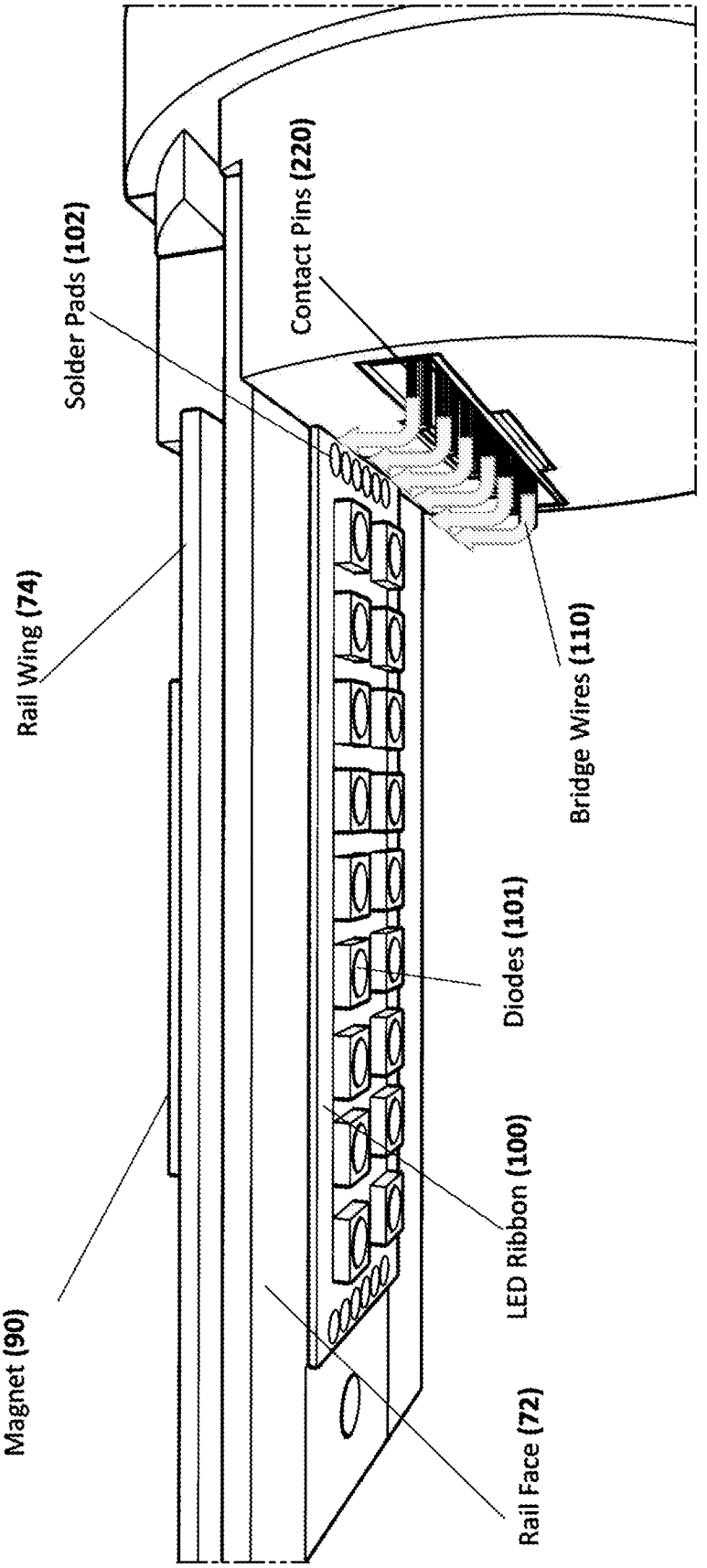
Contact Pin Housing **210**
Installed in End Cap B **130**

FIG. 31B



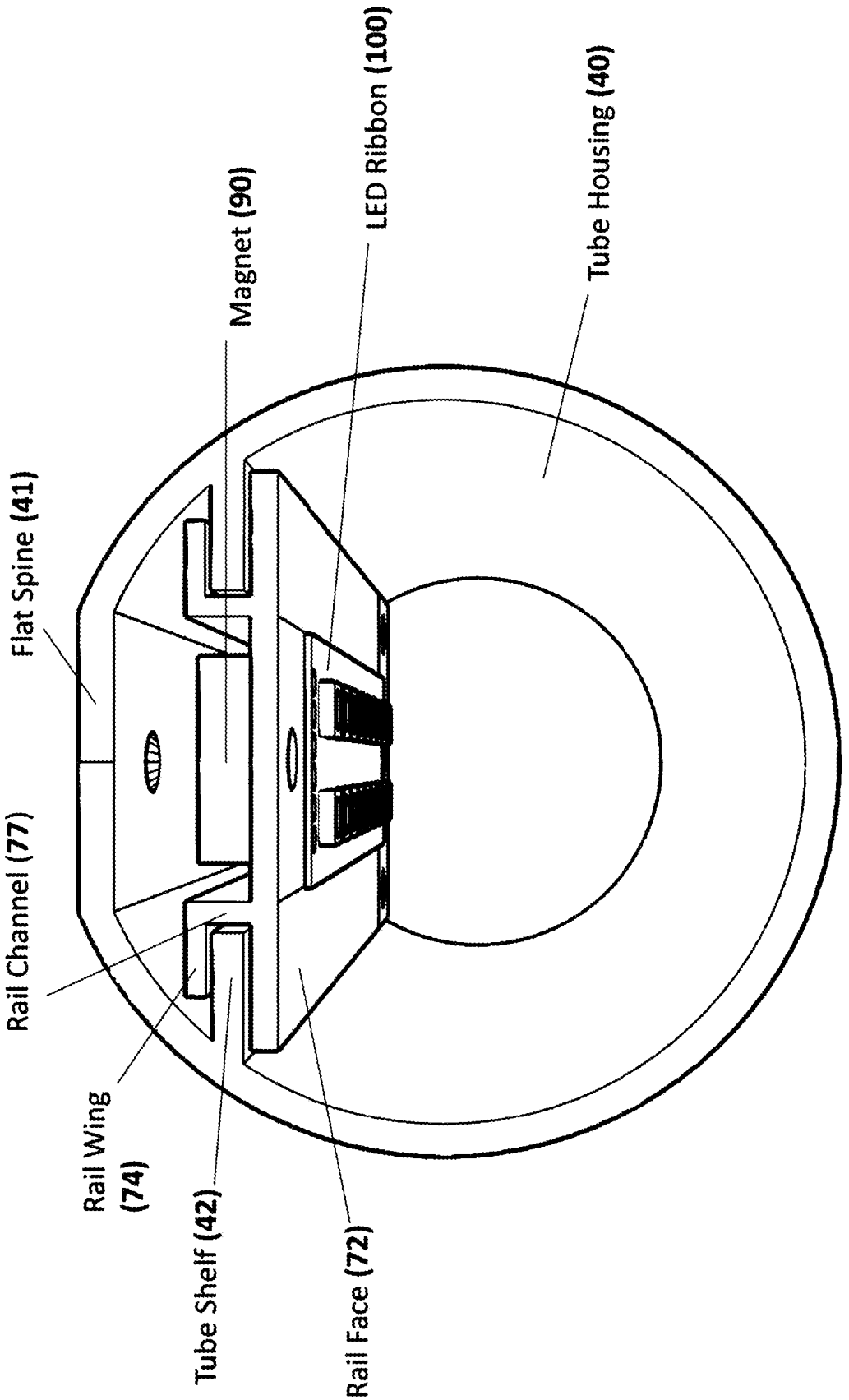
Aluminum Rail 70
Magnet 90 and LED 100

FIG. 32



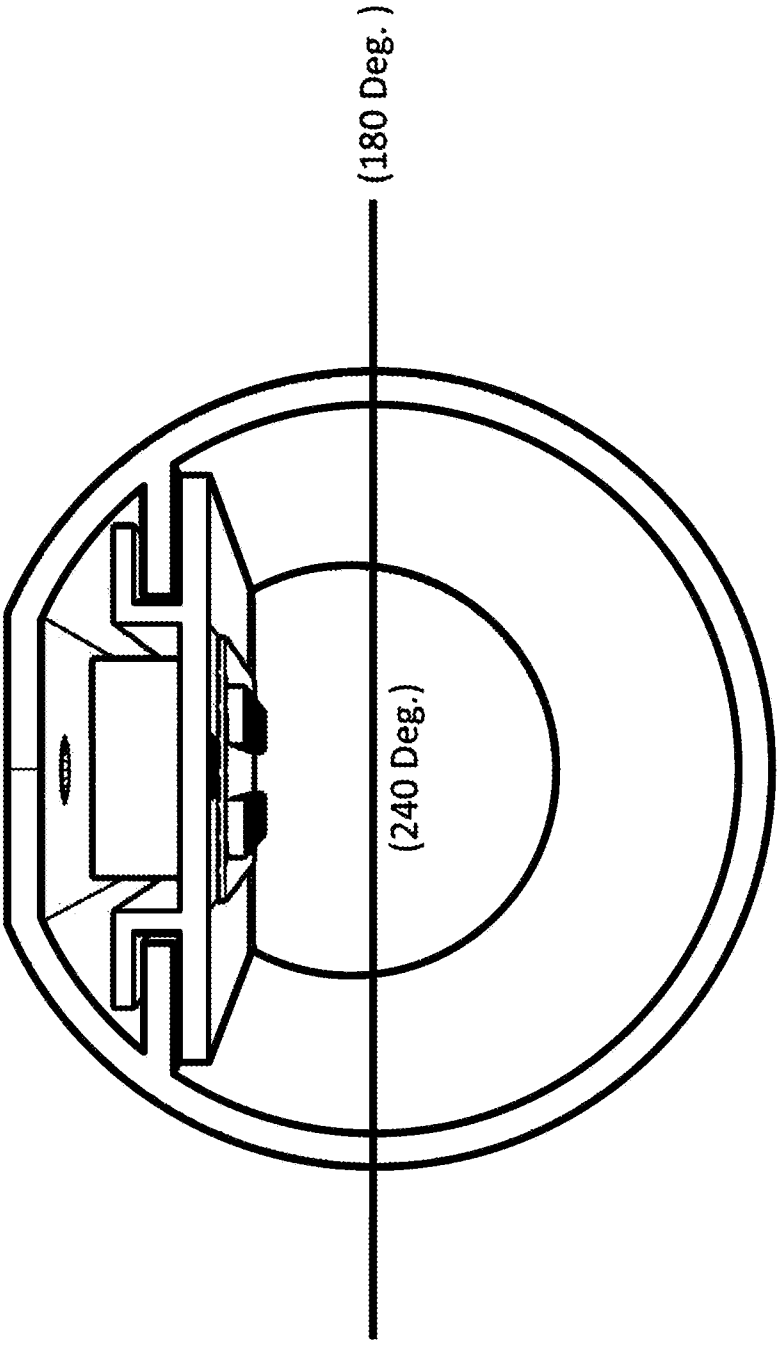
Aluminum Rail 70
End Cap B 130 and LED 100

FIG. 33A



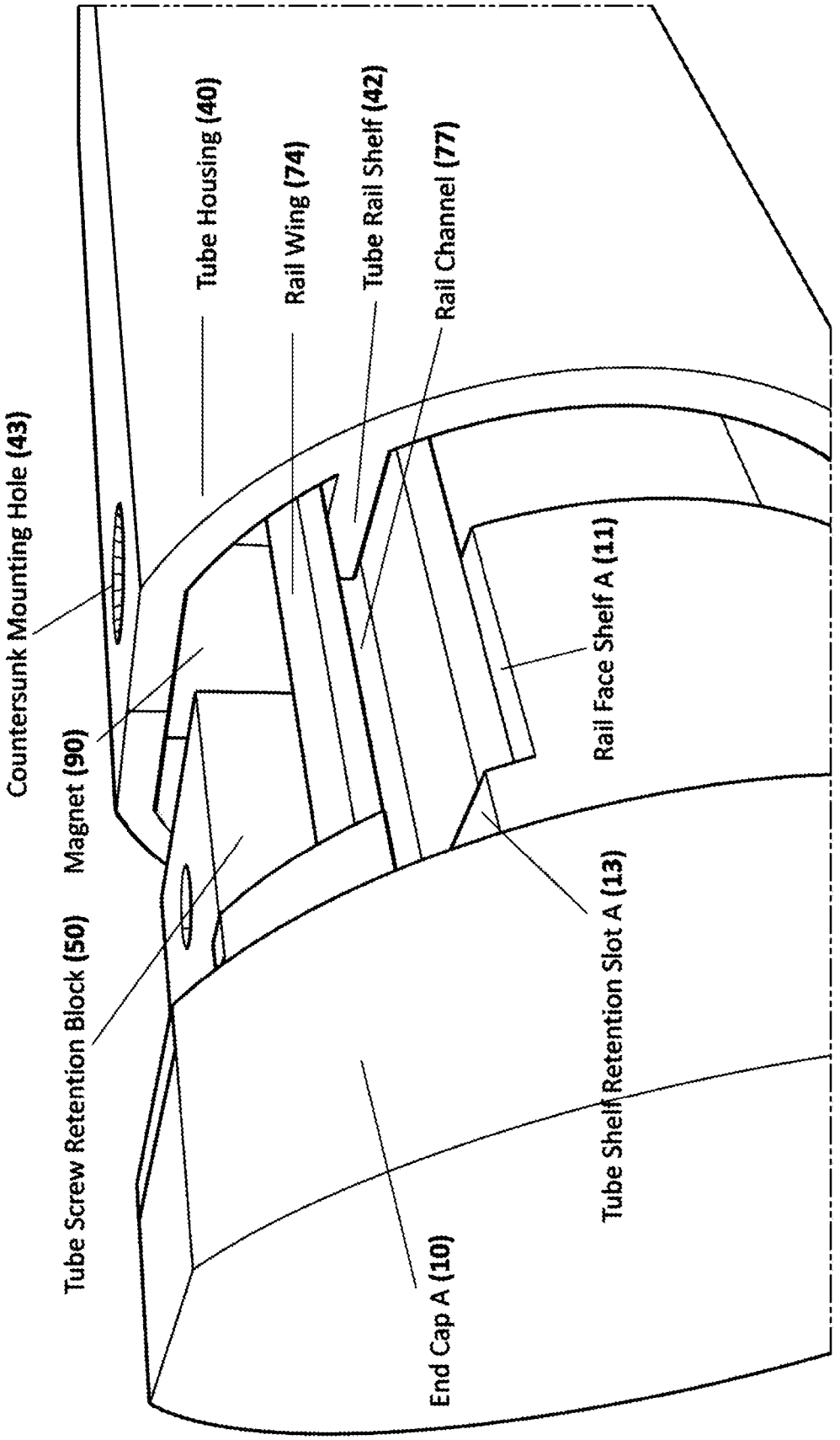
Aluminum Rail **70**
Tube Housing **40** and LED **100**

FIG. 33B



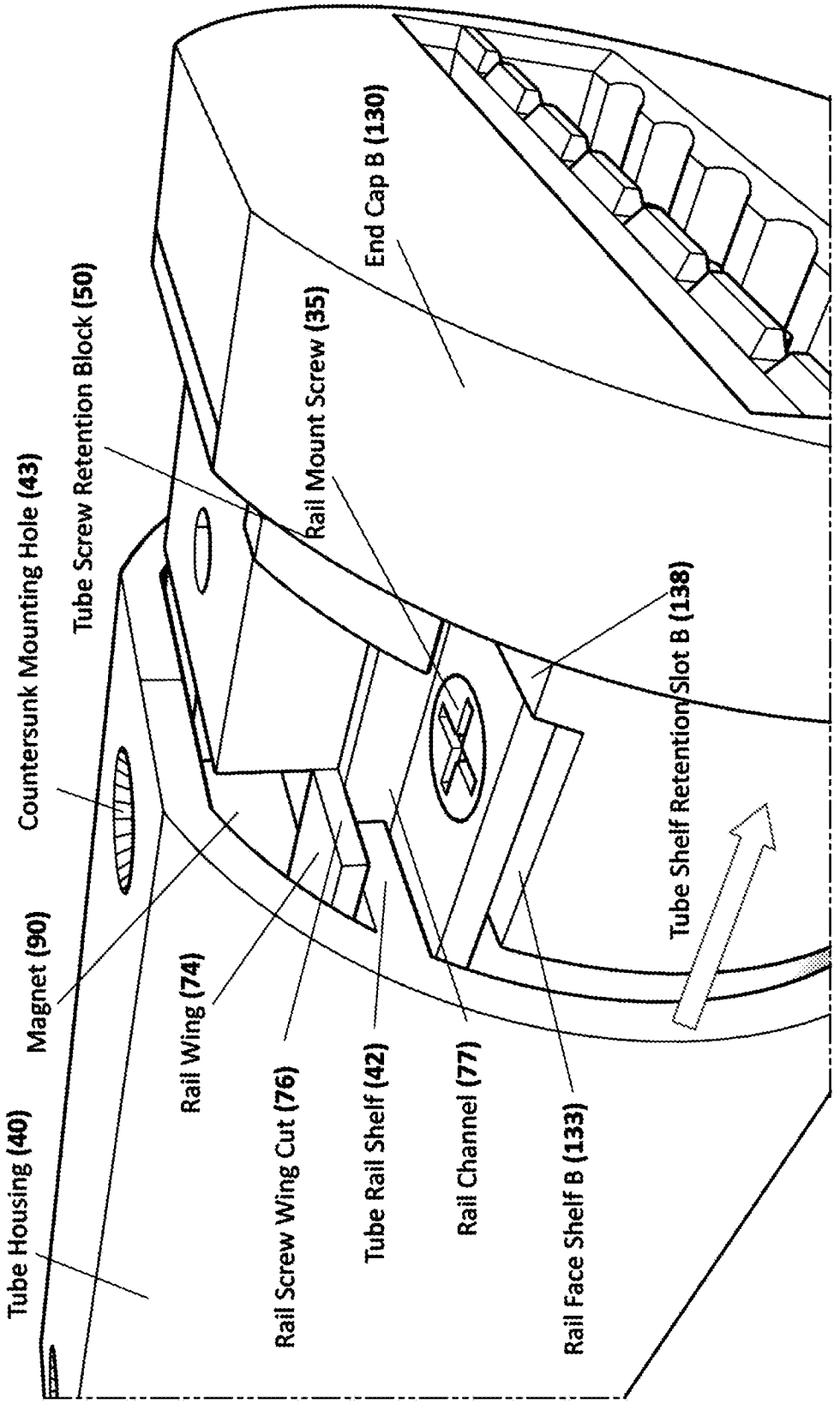
Angle of Light Emission from Tube Housing **40** and LED **100**

FIG. 33C



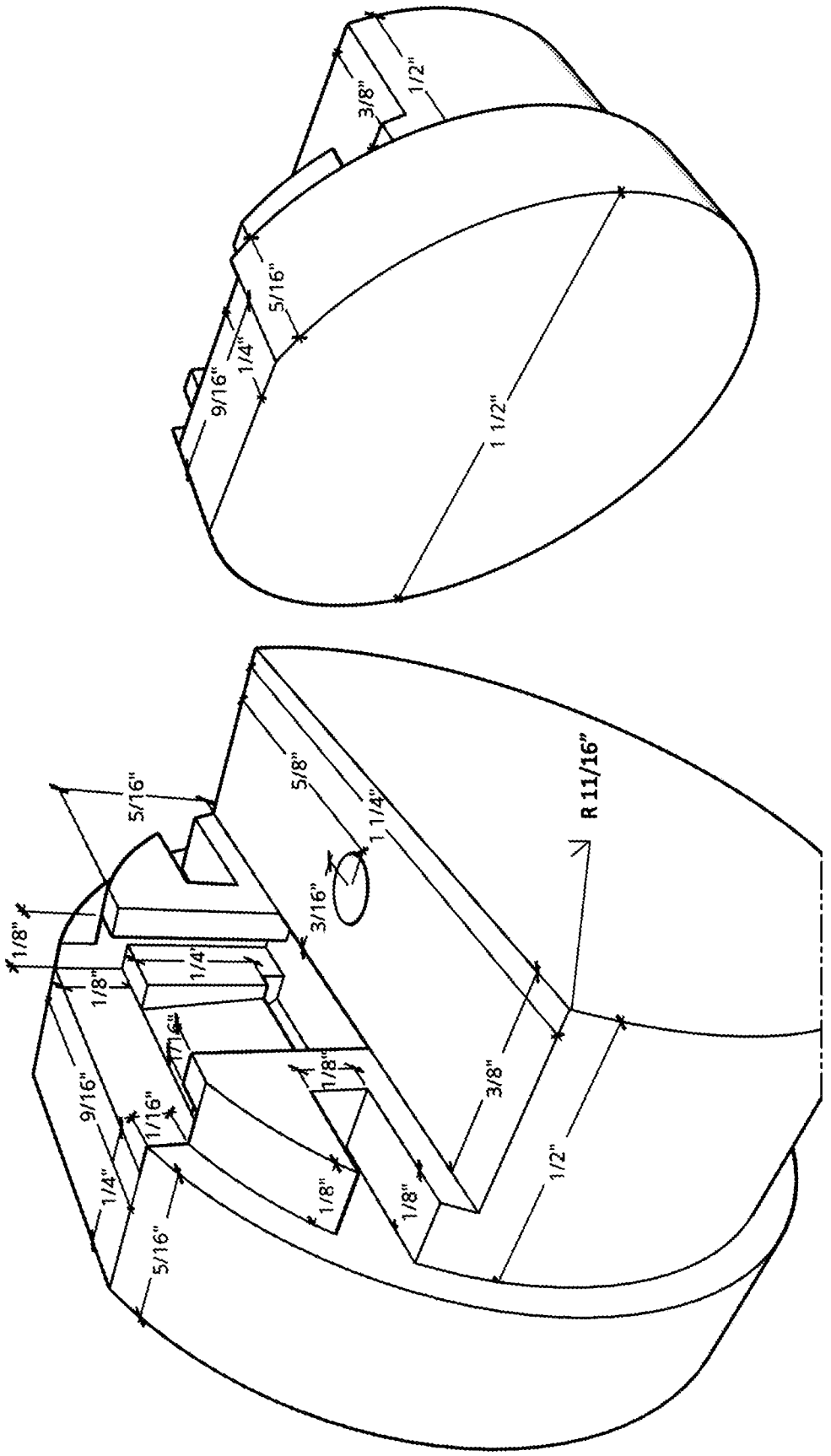
Tube Housing **40**,
End Cap A **10** Connection

FIG. 34A



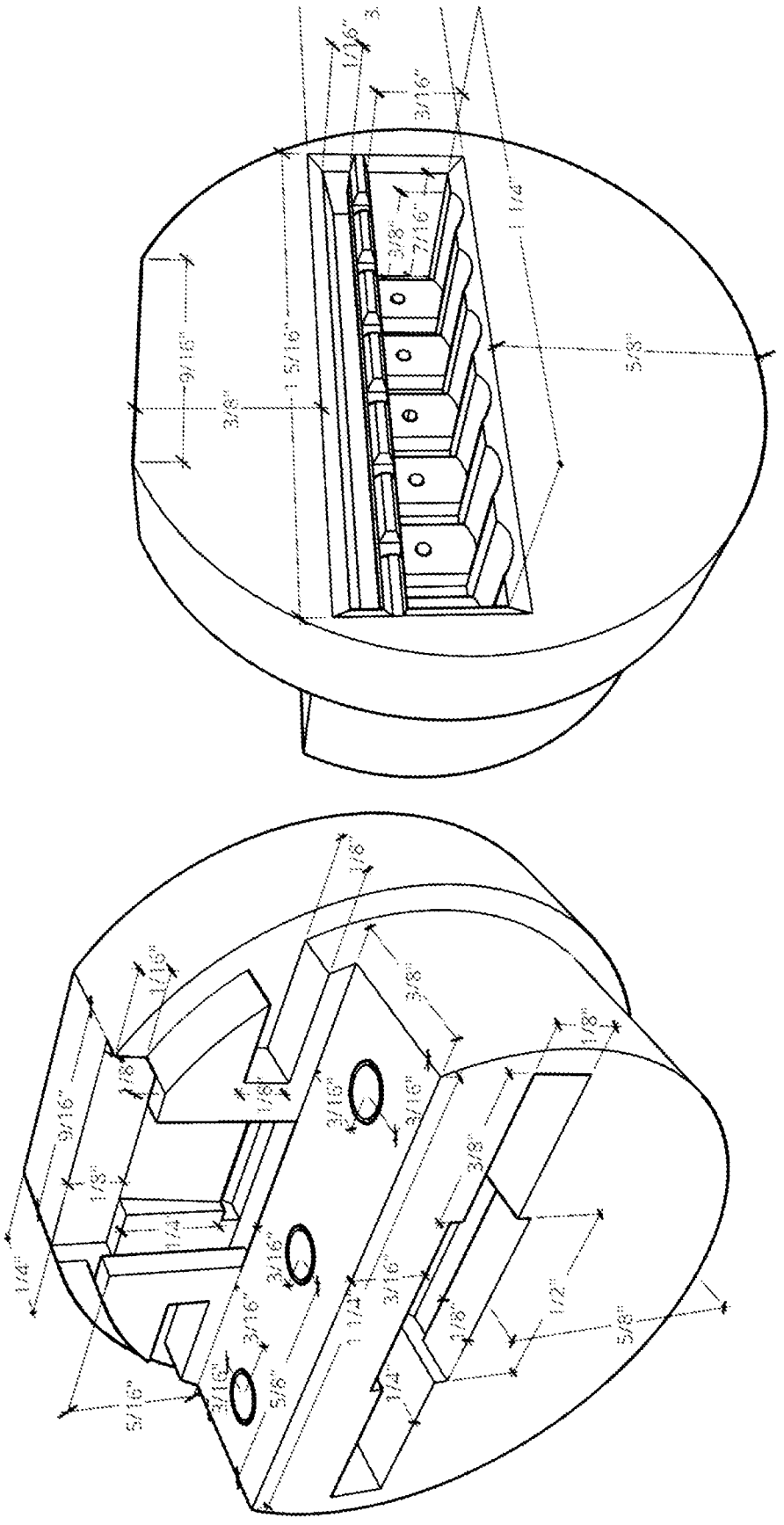
Tube Housing **40**,
End Cap B **130** Connection

FIG. 34B



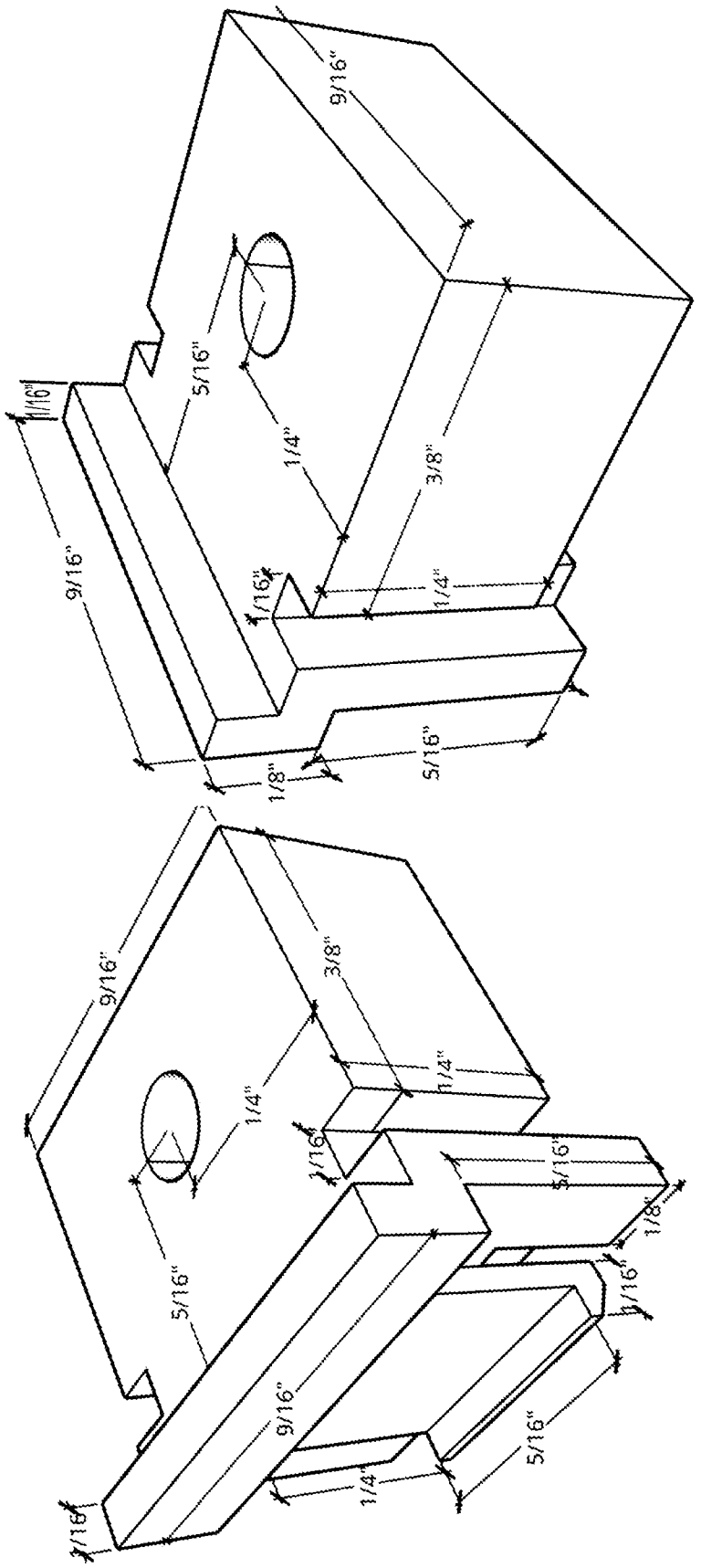
End Cap A 10, Dimensions

FIG. 35



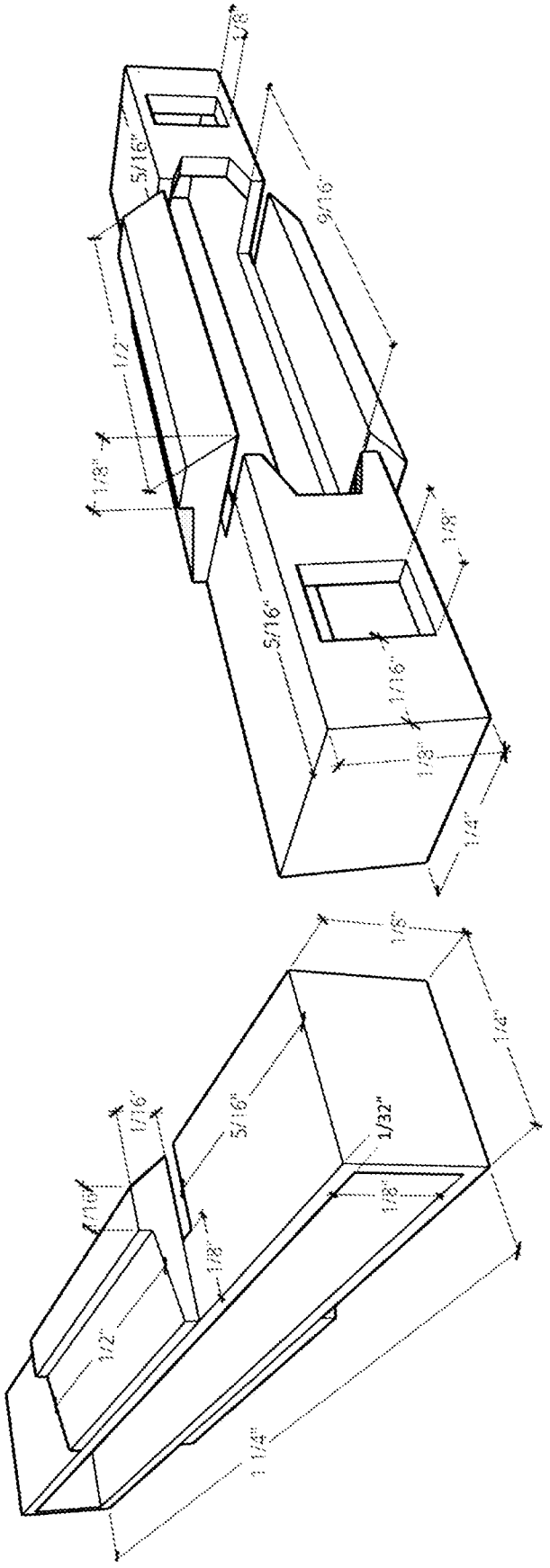
End Cap B **130**, Dimensions

FIG. 36



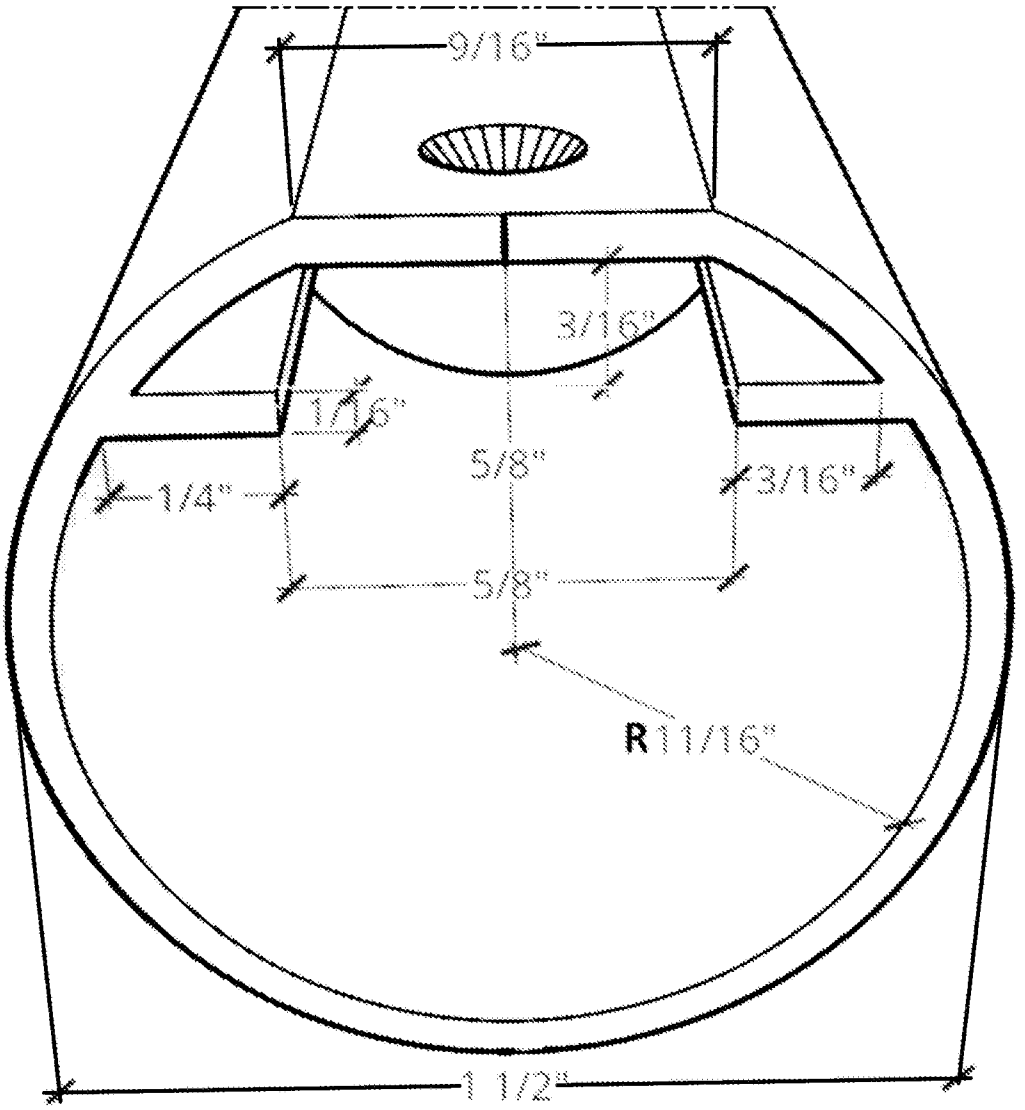
Tube Screw Retention
Block **50** Dimensions

FIG. 37



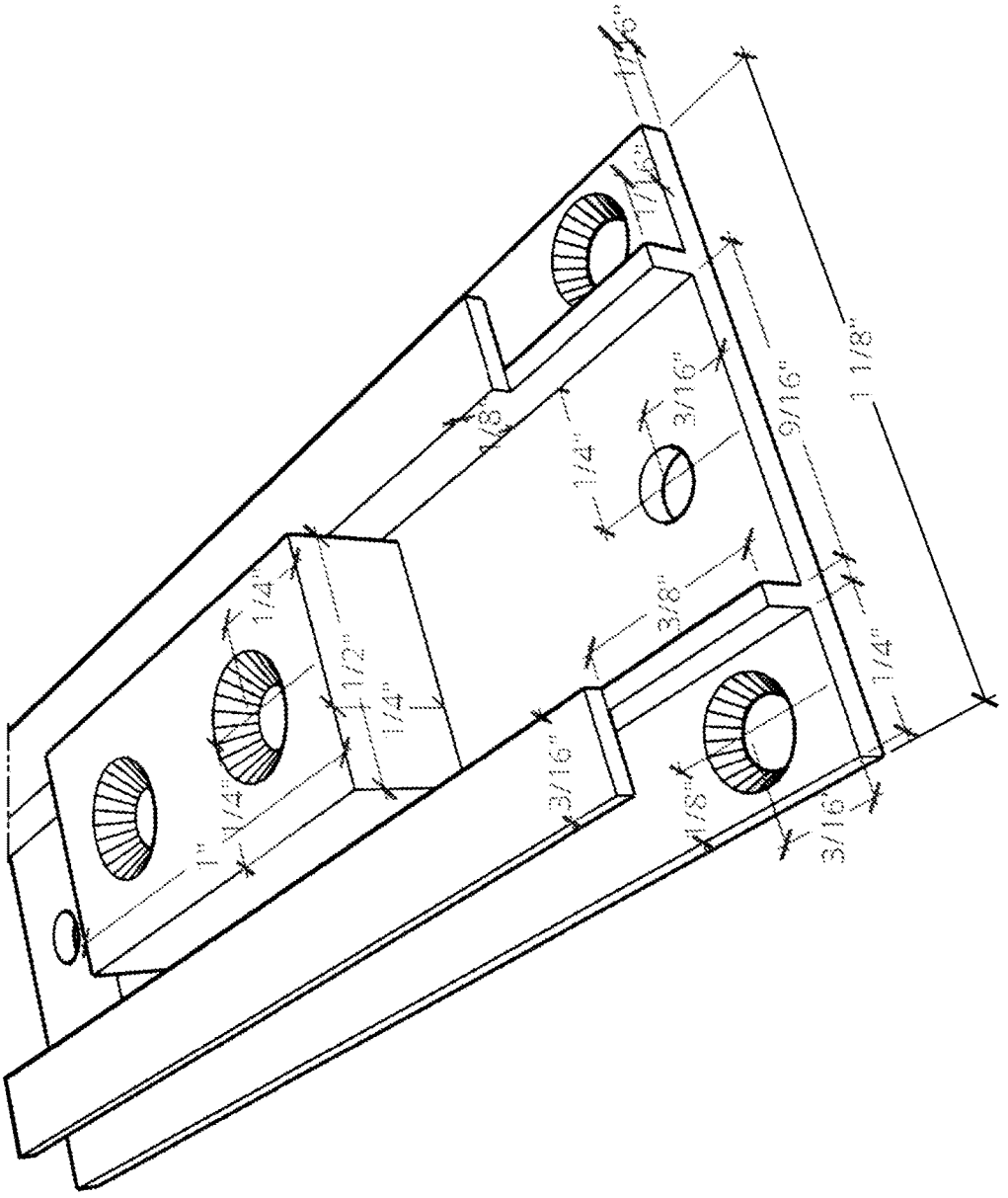
Contact Pin Retention
Housing **210** Dimensions

FIG. 38



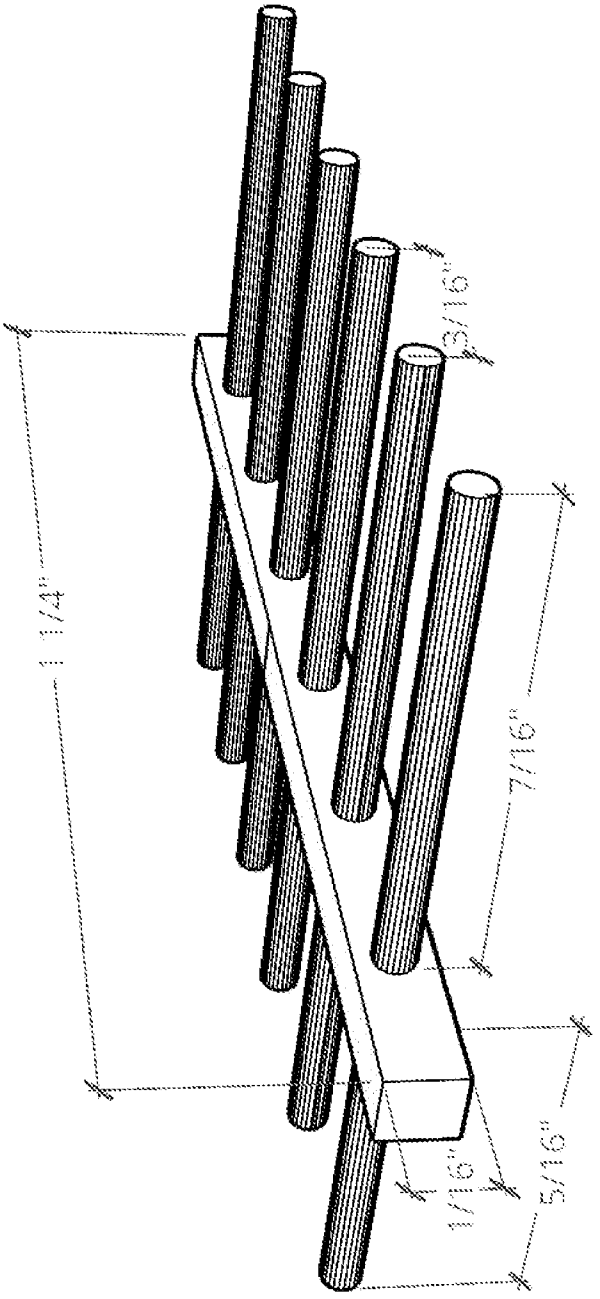
Tube Housing **40**
Dimensions

FIG. 39



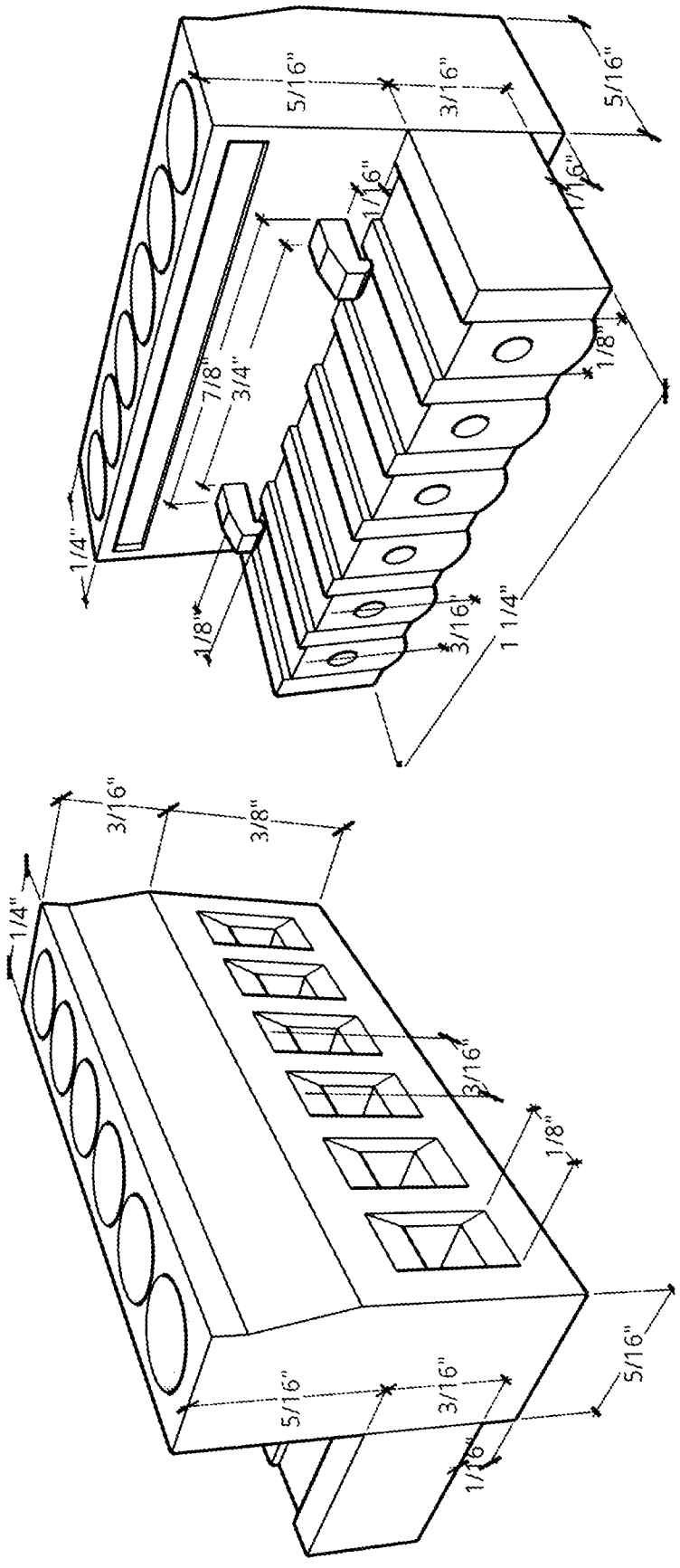
Aluminum Rail **70** and Magnet **90**
Dimensions

FIG. 40



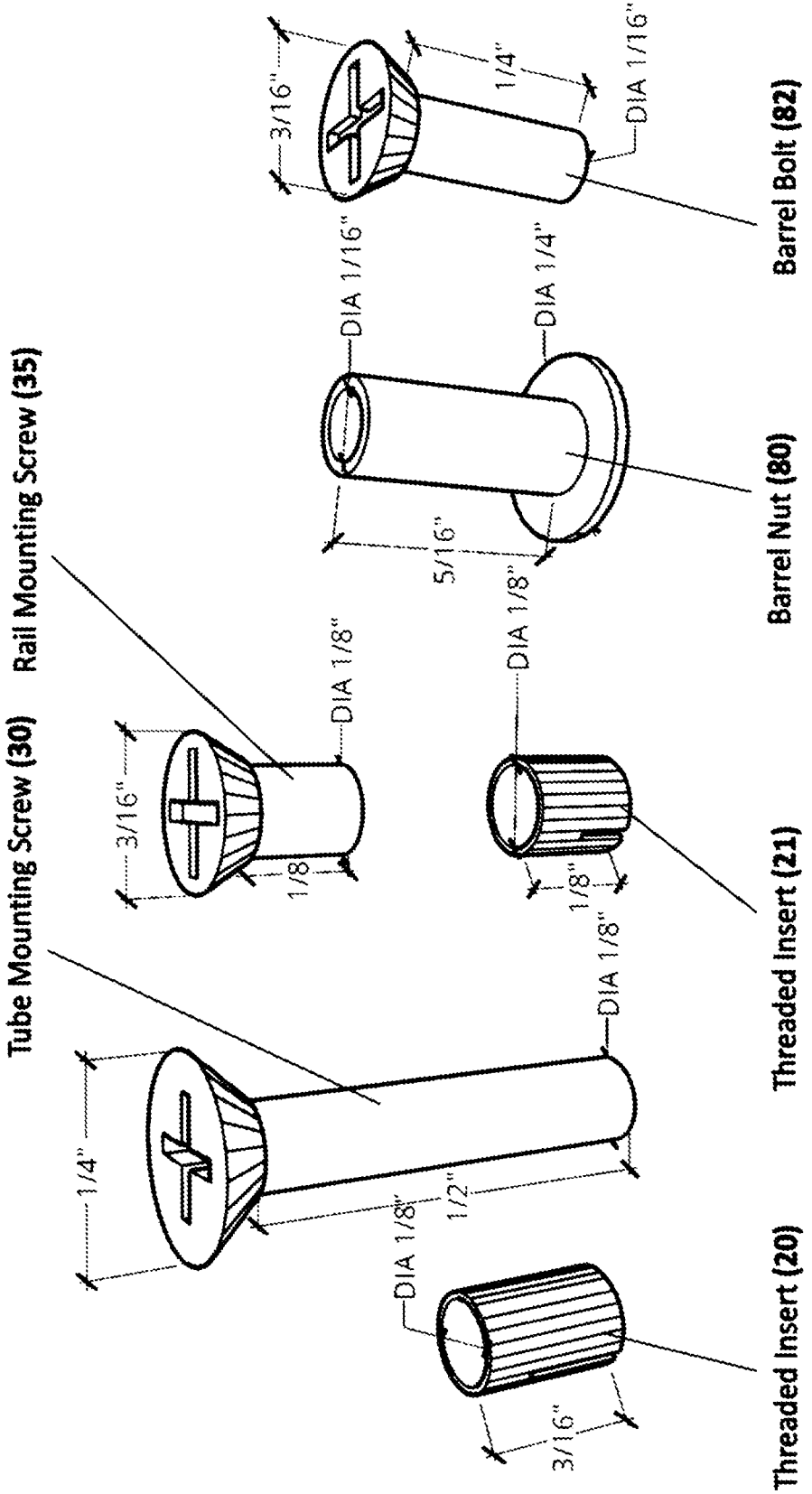
Contact Pins **220** and Rail **221**
Dimensions

FIG. 41



Phoenix Connector **200**
Dimensions

FIG. 42



Screws, Inserts and Bolt Dimensions

FIG. 43

PRACTICAL LIGHTING APPARATUS AND METHOD FOR USE

FIELD

This disclosure relates generally to lighting in video production environments, particularly lighting which may be in view of the video camera during filming (aka on camera "practical lighting", or "practicals").

SUMMARY

The present application is directed towards a system, method, and apparatus for the use in film practical lighting. Providing a lightweight, light diffusing housing for LED ribbon, designed to look like a standard fluorescent tube, which mounts into metal fixtures primarily via magnetic force without the aid of additional rigging hardware.

An aspect of the present invention includes a film lighting apparatus simulating the appearance of a fluorescent tube and configured to be attached relative to an overhead member having a downwardly facing flat horizontal surface being attracted to a magnet, said lighting apparatus configured for selective electrical power connection with an external electrical power supply, said lighting apparatus itself comprising: A) an elongate generally tubular housing, said housing defining an elongate internal cavity and at least one end opening, and having an elongate tubular housing portion being comprised of a surrounding wall surrounding said elongate internal cavity, said surrounding wall having a substantially consistent wall thickness; B) an elongate internal rail configured to detachably fit within said elongate internal cavity of said tubular housing, said internal rail including an upwardly facing portion and an opposing, downwardly facing portion; C) at least one light source configured to be attached relative to said downwardly facing portion of said internal rail; D) at least one magnet including an upwardly facing portion and an opposing, downwardly facing portion, said downwardly facing portion of said magnet configured to be attached relative to said upwardly facing portion of said internal rail; E) at least one detachable end cap configured to fit within said end opening of said tubular housing, said end cap including internally and externally facing terminal connection ports, said externally facing ports configured for selective electrical connection with said external electrical power supply; and F) an internal wiring assembly configured to fit within said elongate internal cavity of said tubular housing, said wiring assembly providing electrical connection between said internally facing terminal connection ports of said detachable end cap and said light source, such that an electrical connection is provided between said external power supply and said light source, such that said magnet attracts said overhead member sufficient to cause said film lighting apparatus to be detachably fixed relative to said overhead member.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said magnet is a first magnet, and further comprising a second magnet attached relative to said upwardly facing portion of said internal rail, such that said first and second magnets provide the primary means of connecting said film lighting apparatus to said overhead member.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said externally facing terminal connection ports in said end cap are provided at least in part by a Phoenix connector.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said internal rail is metal, and provides a heat sink for heat generated by said light source.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said detachable end cap is a first detachable end cap, wherein said end opening is a first end opening, and further comprising a second detachable end cap configured to fit within a second end opening of said tubular housing, said second end opening facing opposite to said first end opening.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said internal rail has elongate opposing long sides which fit within corresponding cofacing channels defined by said tubular housing, such that a sliding and guiding action is provided by said cofacing channels to said opposing long sides, such that said internal rail may slide in and out of place during installation and removal, respectively, while being guided by said cofacing channels.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said tubular housing is comprised of a generally tubular plastic having translucent properties through its walls to provide a diffusion of light from said light source when passing therethrough.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said light source is an LED ribbon.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said lower surface of said rail is above the height midpoint of said tubular housing, and above the central circumferential axis, and wherein said tubular housing is translucent, thus allowing for light emitted from said LED ribbon attached to said rail to pass through said translucent housing to illuminate approximately 240 degrees of said housing's circumference.

An aspect of the present invention includes a film lighting apparatus simulating the appearance of a fluorescent tube and configured to be attached relative to an overhead member having a downwardly facing flat horizontal surface being attracted to a magnet, said lighting apparatus configured for selective electrical power connection with an external electrical power supply, said lighting apparatus itself comprising: A) an elongate generally tubular housing, said housing defining an elongate internal cavity and at least one end opening, and having a surrounding wall surrounding said elongate internal cavity, said surrounding wall having a substantially consistent wall thickness, said surrounding wall defining a cylindrical shape with the exception of a flat wall section in its otherwise tubular cylindrical wall shape, said flat section having parallel outer and inner wall surfaces, each of said flat section outer and inner wall surfaces lying in a plane being generally parallel to each other and with said longitudinal axis of said elongate generally tubular housing; B) an elongate internal rail configured to detachably fit within said elongate internal cavity of said tubular housing, said internal rail including an upwardly facing portion and an opposing, downwardly facing portion; C) at least one light source configured to be attached relative to said downwardly facing portion of said internal rail; D) at least one magnet including an upwardly facing portion and an opposing, downwardly facing portion, said downwardly facing portion of said magnet configured to be attached relative to said upwardly facing portion of said internal rail such that said upwardly facing portion of said magnet is in substantial contact with said underside surface of said flat wall section of said tubular housing; E) at least one detach-

able end cap configured to fit within said end opening of said tubular housing, said end cap including internally and externally facing terminal connection ports, said externally facing ports configured for selective electrical connection with said external electrical power supply; and F) an internal wiring assembly configured to fit within said elongate internal cavity of said tubular housing, said wiring assembly providing electrical connection between said internally facing terminal connection ports of said detachable end cap and said light source, such that electrical connection is provided between said external power supply and said light source, such that said magnet attracts said overhead member sufficient to cause said film lighting apparatus to be detachably fixed relative to said overhead member with said magnet urging said flat section of said tubular housing into planar contact with and against said downwardly facing flat horizontal surface of said overhead member.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said magnet is a first magnet, and further comprising a second magnet attached relative to said upwardly facing portion of said internal rail, such that said first and second magnets provide the primary means of connecting said film lighting apparatus to said overhead member.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said externally facing terminal connection ports in said end cap are provided at least in part by a Phoenix connector.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said internal rail is metal, and provides a heat sink for heat generated by said light source.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said detachable end cap is a first detachable end cap, wherein said end opening is a first end opening, and further comprising a second detachable end cap configured to fit within a second end opening of said tubular housing, said second end opening facing opposite to said first end opening.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said internal rail has elongate opposing long sides which fit within corresponding cofacing channels defined by said tubular housing, such that a sliding and guiding action is provided by said cofacing channels to said opposing long sides, such that said internal rail may slide in and out of place during installation and removal, respectively, while being guided by said cofacing channels.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said tubular housing is comprised of a generally tubular plastic having translucent properties through its walls to provide a diffusion of light from said light source when passing therethrough.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said light source is an LED ribbon.

Another aspect of the present invention includes a film light apparatus as noted above, wherein said lower surface of said rail is above the height midpoint of said tubular housing, and above the central circumferential axis, and wherein said tubular housing is translucent, thus allowing for light emitted from said LED ribbon attached to said rail to pass through said translucent housing to illuminate approximately 240 degrees of said housing's circumference.

An aspect of the present invention includes a method of replacing a light source in a film lighting apparatus simulating the appearance of a fluorescent tube and configured to be attached relative to an overhead member having a downwardly facing flat horizontal surface being attracted to a magnet, said apparatus configured for selective electrical power connection with an external electrical power supply, said method including the following steps: A) providing a lighting apparatus itself comprising: 1) an elongate generally tubular housing, said housing defining an elongate internal cavity and at least one end opening, and having a tubular housing portion being comprised of a surrounding wall surrounding said elongate internal cavity, said surrounding wall having a substantially consistent wall thickness; 2) an elongate internal rail configured to detachably fit within said elongate internal cavity of said tubular housing, said internal rail including an upwardly facing portion and an opposing, downwardly facing portion; 3) at least one first light source configured to be attached relative to said downwardly facing portion of said internal rail; 4) at least one magnet including an upwardly facing portion and an opposing, downwardly facing portion, said downwardly facing portion of said magnet configured to be attached relative to said upwardly facing portion of said internal rail; 5) at least one detachable end cap configured to fit within said end opening of said tubular housing, said end cap including internally and externally facing terminal connection ports, said externally facing ports configured for selective electrical connection with said external electrical power supply; and 6) an internal wiring assembly configured to fit within said elongate internal cavity of said tubular housing, said wiring assembly providing electrical connection between said internally facing terminal connection ports of said detachable end cap and said light source, such that electrical connection is provided between said external power supply and said light source, such that said magnet attracts said overhead member sufficient to cause said film lighting apparatus to be detachably fixed relative to said overhead member; and B) replacing said first light source by performing the following sub-steps: 1) detaching said selective electrical connection between said externally facing ports of said end cap and said external electrical power supply; 2) removing said end cap from said elongate generally tubular housing; 3) removing said elongate internal rail by sliding it out of place from within said elongate internal cavity of said tubular housing; 4) detaching said first light source from said downwardly facing portion of said internal rail; 5) attaching a second light source to said downwardly facing portion of said internal rail; 6) replacing said elongate internal rail by sliding it into place from within said elongate internal cavity of said tubular housing; 7) replacing said end cap on said elongate generally tubular housing; and 8) reattaching said selective electrical connection between said externally facing ports of said end cap and said external electrical power supply.

Another aspect of the present invention includes a method as noted above, wherein said light source is an LED ribbon.

BRIEF DESCRIPTION OF THE DRAWINGS

The figures presented correspond to two variations of an apparatus contained within. Apparatus **10** and apparatus **10**A. FIG. **1** through FIG. **22** illustrates apparatus **10**. Whereas figures FIG. **23** through FIG. **43** illustrate apparatus **10**A.

Apparatus **10** Figures

Elements listed for apparatus **10** Figures are exclusive to apparatus **10** and found in the Apparatus **10** Elements List located within.

FIG. **1** is an exploded view of apparatus **10**, showing its multiple components.

FIG. **2** is a pictorial view of Apparatus **10**, showing its two ends A and B. Proximate each of said ends A and B are corresponding end caps **15** and **130**. End cap **130** is the cap including wiring shown also in FIG. **3**. End cap **15** at end B does not include wiring.

FIG. **3** is a partial view of Apparatus **10**, showing the "upper" side of its end B, which shows where the external control wires **200** connect to the apparatus **10** via the terminal block **120**.

FIG. **4** is a partial view of Apparatus **10**, showing the "upper" side of its end A, showing the two screws **30** which attach the end cap to the Oslo tube **40** as well as the end cap **15**, as described in further detail below.

FIG. **5** is a view similar to that of FIG. **4**, except that the end cap **15** has been removed from the main assembly **10**, by removing the machine screws **30** and pulling out the end cap **15**. Shown installed are two threaded inserts **20** which accept the machine screws **30** and are configured to frictionally engage holes drilled in the end cap **15**, such that the end cap may be selectively attached in place by the screws **30** (not shown in FIG. **5**). The axis of one of the two holes is shown by a dotted line.

FIG. **6** is an isolated view of a threaded insert **20**.

FIGS. **7**A and **7**B are illustrative transverse cross sections of the Oslo tube **40**. FIG. **7**A shows the Oslo tube **40** with its interior upper shelves **42** and interior lower shelves **43**. Each of these interior shelves runs the length of the tube **40** (with the exception of certain parts cut out along the length as discussed elsewhere). The upper and lower shelves **42**, **43** combine to create two elongated slide channels **44**, each of which is configured to accept an elongate side edge of the upper face member **72** of the channel **70**, as shown in FIG. **7**B.

FIG. **8** shows some typical dimensions of the Oslo tube **40**, but these should not be limiting. Note that the "interior tube gap **45**" which is shown as 13 mm in drawing is the gap into which the upper key **96** of the terminal block housing **90** fits when installed. This same gap **45** is the gap into which the upper key **136** of the terminal block housing **130** fits when installed.

FIG. **9** shows the Oslo tube **40**, with holes and shelves as discussed elsewhere.

FIGS. **10**A-C are various views showing the way end caps are attached. FIG. **10**A shows End A of the apparatus **10**, showing the end cap **15** in place, with a screw **30** being prepared to be installed into a threaded insert **20** in the end cap **15** securing end cap **15** relative to the Oslo tube **40**. FIG. **10**B shows End B of the apparatus **10**, showing the Oslo tube in isolation, with access slot **46** cut therein to enable the drilling of holes in the lower interior shelf of the Oslo tube **40**. FIG. **10**C shows End B of the apparatus **10**, showing the end cap **130** installed, and showing a screw **30** being installed into a threaded insert **20** (press fit in a hole in the end cap **130**). It should be understood that the screw **30** in this configuration may be of a different length than the one in FIG. **10**A, depending on the application).

FIG. **11** is a view showing an Oslo tube **40** having channel **70** installed in its interior. This figure also shows the upper small face member **72** and the lower larger face member **72**. Also shown here is a transverse slot which has been cut into channel **70**, such that a magnet **60** can be installed into the slot in the channel.

FIG. **12** is a view similar to that of FIG. **11**, except that a magnet **60** has been installed therein.

FIG. **13** is an illustrative view of the Oslo tube **40**, showing the LED ribbon **100** installed on the typically downwardly facing lower surface of channel **70**.

FIG. **14** shows channel **70**, which includes a large lower face member **74** having a one 1.25" wide face side and a smaller 0.625" upper face member **72** separated by a 0.10" spine **76** down the middle. These dimensions are exemplary only and should not be considered exclusive or limiting.

FIGS. **15**A-C are sequential illustrative views of the assembly of the LED Ribbon **100**, channel **70**, and magnet **60**. FIG. **15**A shows the LED Ribbon **100** being attached to the underside of channel **70**, and the magnet **60** (shown in dotted line) in place atop the channel **70**.

FIG. **15**B shows the LED Ribbon **100** attached to the underside of channel **70**, and the magnet **60** in place atop channel **70**. FIG. **15**C shows the assembly shown in FIG. **15**B installed within the interior of Oslo tube **40**. This can also be seen in FIG. **13**. However, FIG. **15**C shows the magnets relation to the slide channel **46** and lower shelf **43** discussed elsewhere.

FIG. **16** is a view of the terminal block housing **90**, showing the terminal block housing access port, and the upper key **96**, which locates between the "interior tube gap **45**" which is between the two opposing interior channels of the Oslo tube **40**. Also shown is the lower key **98** which mates with the lower key slot **138** defined by the end cap **130**.

FIG. **17** is a view of the end cap **130**, showing the end cap access port as well as the upper key **96** which locates between the "interior tube gap **45**" which is between the two opposing interior channels of the Oslo tube **40**. FIG. **8** shows some typical dimensions of the Oslo tube **40**, but these should not be limiting. Note that the "interior tube gap **45**" which is shown as 13 mm in drawing is the gap into which the upper key **96** of the terminal block housing **90** fits when installed. This same gap is the gap into which the upper key **136** of the terminal block housing **130** fits when installed.

Also shown is the lower key slot **138** which accepts the lower key **98** of the terminal block housing **90** when the elements **90**, **130** are fastened together.

FIGS. **18**A-B are sequential assembly views showing the attachment of the end cap **130** to the terminal block housing **90**, in the process capturing the terminal block therebetween. FIG. **18**A shows the terminal block in position before the end cap **130** is attached to the terminal block housing. This figure shows one screw **80** which will eventually have its free end engaging the end cap **130**, thus fastening the end cap **130** to the terminal block housing **90**. FIG. **18**A shows the configuration "turned over" in an upside-down configuration in order to show the two screws **80** which will eventually have their free ends engaging the end cap **130**, thus fastening the end cap **130** to the terminal block housing **90**. In this configuration the terminal block is captured by the end cap **130** and the terminal block housing **90**.

FIG. **19** shows the elements of FIG. **18**B in their generally upright configuration, with the end cap **130** attached to the terminal block housing **90**. In this configuration the terminal block **120** is captured by the end cap **130** and the terminal block housing **90**.

FIG. **20** is a drawing of terminal block **120** in one embodiment.

FIG. **21** is a view of End B of assembly **10**, showing the end cap **130** attached to the Oslo tube **40**. Also shown is the end cap access port in the end cap **130**. This end cap access port allows for the manipulation of clamping screws in the terminal block **120**, such that the screws can be screwed in or out in order to secure or release external control wires **200** relative to the apparatus **10**. In one embodiment, these control wires are bare end or stripped end.

FIG. **22** is a view of End B of the assembly **10**, showing the end cap **130** attached to the Oslo tube **40**. Also shown is terminal block **120**, viewable though a slot provided in the Oslo tube **40**. This slot allows for external control wires **200** to be connected to the terminal block **120**, such that its clamping screws can be screwed in or out to fix or release the external control wires **200** (bare ended or stripped sheath wire) relative to the apparatus **10**.

APPARATUS **10**A FIGURES

Elements listed for apparatus **10**A Figures are exclusive to apparatus **10**A and found in the Apparatus **10**A Elements List located within.

FIG. **23** is an exploded pictorial view of apparatus **10**A, showing its multiple components. Length of apparatus **10**A will be manufactured for a variety of typical fluorescent tube lengths. 2 Ft, 4 Ft or 8 Ft length are standard fluorescent sizes. However, these dimensions are exemplary only and should not be considered exclusive or limiting. Representations shown in the following figures will be in a condensed fashion for illustration purposes.

FIG. **24** is a condensed length, pictorial view of apparatus **10**A when fully assembled, showing its two ends A and B. Proximate each of said ends A and B are corresponding end caps A **10** and B **130**. End cap B **130** includes the male phoenix receptacle **131**. End cap A **10** at end A does not include this receptacle.

FIG. **25** full view of apparatus **10**A, showing End B, which depicts where the premanufactured, external, female control wire connecter, known as a phoenix connector **200**, connects to the apparatus **10**A via the male phoenix receptacle **131** embedded in end cap B **130**.

FIG. **26** is a close-up, side view, of end B with end cap B **130** and female phoenix connector **200**. Detailing the lock shelf **130** and the locking retention tabs **203**.

FIG. **27** Shows a view of components that are released once the tube mounting screws **30** are removed from the tube housing **40**. Depicts the end user's disassembly procedure.

FIG. **28**A looks at the mounting mechanism for components of End A.

FIG. **28**B looks at the mounting mechanism for components of End B.

FIG. **29**A shows an exploded view of components that insert into end cap A **10**.

FIG. **29**B shows an exploded view of components that insert into end cap B **130**.

FIG. **30** shows the permanent locking mechanism of the tube screw retention blocks **50** when pressed into the receiving slot **60** of each corresponding end cap. The mechanism is the same for both end caps A **10** and B **130** but is only shown in detail in FIG. **30**.

FIG. **31**A details the components and installation of the contact pins **220** and the contact pin retention housing **210** into the retention housing receiving slot **135** of end cap B **130**. An expanded view window shows details of the retention housing receiving slot **135** and its components.

FIG. **31**B shows both interior face and exterior face of end cap B **130** when all components are installed. Contact pins **220** are retained by the contact pin housing **210**.

FIG. **32** is an exploded view of components which mount to the aluminum rail **70**.

FIG. **33**A shows LED ribbon **100** attached to the rail face **72** of the aluminum rail **70** with end cap B **130** attached. Details the connection of the contact pins **220** to the solder pads **102** of the LED ribbon **100**, via soldered bridge wires **110**. (Similar bridge wires can also be seen in Apparatus **10** FIG. **18**B.)

FIG. **33**B shows the A side of the aluminum rail **70** installed into the tube housing **40** with the tube shelf **42** mating with the rail channel **77** and rail wing **74**.

FIG. **33**C is the same view as FIG. **33**B. However, blue diagrams illustrate the angle of light emissions from the tube when LED **100** is illuminated.

FIG. **34**A is a partial view of side A of apparatus **10**A detailing the connections of the tube rail shelf **42**, mated with the rail channel **77** and the rail wing **74** when end cap A **10** is installed.

FIG. **34**B is a similar view to FIG. **34**A but showing the B side of apparatus **10**A, detailing the connections of the tube rail shelf **42**, mated with the rail channel **77** and the rail wing **74** when end cap B **130** is installed.

FIG. **35** details the dimensions of end cap A **10**.

FIG. **36** details the dimensions of end cap B **130**.

FIG. **37** details the dimensions of the tube screw retention block **50**.

FIG. **38** details the dimensions of the contact pin retention housing **210**.

FIG. **39** details the dimensions of the tube housing **40**. One line is a measurement reference for the distance between the flat spine **41** and the tube rail shelves **42**. The flat spine **41** may also be referenced as a flat wall section having a wall thickness.

FIG. **40** details the dimensions of the aluminum rail **70** and magnet **90**.

FIG. **41** details the dimensions of the contact pins **220**.

FIG. **42** details the dimensions of the female phoenix connector **200**.

FIG. **43** detail the dimensions of screws (**30**, **35**) inserts (**20**, **21**) barrel nuts **80**, and barrel bolt **82**.

DETAILED DESCRIPTION

Introduction

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments of the inventions are shown. This invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

Reference is now made to FIGS. **1** through **22**, in which like elements indicate like elements throughout the several views of apparatus **10**.

ELEMENT LIST: APPARATUS **10**

10. Apparatus **10**
15. End Cap A (w/o connections)
20. Inserts
30. Screws
40. Oslo Tube Housing
  42 Upper Shelf
  43 Lower Shelf
  44. Slide Channel
  45. Interior Tube Gap
  46 Slot
50. Mounting Locations
60. Magnets
70. Prefabricated Aluminum H Channel

72 Small Upper Face Member
74 Large Lower Face Member
76 Spine
80. Fasteners
90. Terminal Block Housing
100. LED Ribbon
110. LED Bridge Wires
120. Terminal Block
130. End Cap B (w/connections)
200. External control wires (bare ended or stripped sheath wire)

Reference is now made to FIGS. **23** through **43**, in which like elements indicate like elements throughout the several views of apparatus **10**A.

ELEMENT LIST: APPARATUS **10**A

1. Lighting Apparatus **10**A
10. End Cap A
11. Aluminum Rail Face Shelf
12. Threaded Insert Hole
13. Tube Shelf Retention Slot
14. Interior Cap Edge Face
20. Threaded Inserts Long
21. Threaded Inserts Short
30. Tube Mounting Screws
35. Rail Mounting Screws
40. Tube Housing
41. Flat Spine (aka flat wall section in otherwise cylindrical enclosure)
42. Tube Rail Shelf
43 Countersunk Mounting Holes
50. Tube Screw Retention Block
51. Tube Screw Retention Hole
52. Alignment Rails
53. Alignment Channel
54. Locking Tab
55. Locking Tab Arm
56. Locking Tab Displacement Channel
60. Receiving Slot for Tube Screw Retention Block
61. Alignment Channels
62. Alignment Rail
63. Lock Tab Locking Shelf
64. Lock Tab Displacement Face
65. Receiving Slot Base
70. Aluminum Rail
71. Rail Screw Mount Holes
72. Tube Screw Mount Holes
72. Rail Face
74. Rail Wings
75. Magnet Mounting Holes
76. Rail Screw Wing Cut
77. Rail Channel
80. Barrel Nuts
81. Barrel Nut Head
82. Barrel Bolt
90. Neodymium Magnet
91. Countersunk Holes
100. LED Ribbon
101. Diodes
102. Solder Pads
110. LED Bridge Wires
130. End Cap B
131. Male Phoenix Receptacle
132. Phoenix Lock Tab Shelf
133. Aluminum Rail Face Shelf
134. Threaded Insert Holes
135. Receiving Slot for Contact Pin Retention Housing
136. Retention Housing Lock Tab Shelves (top and bottom)
137. Contact Pin Channel
137. Receiving Slot for Tube Screw Retention Block
138. Retention Block Lock Tab Shelf
139. Tube Shelf Retention Slot
140. Interior Edge Face
141. Contact Pin Channel
142. Contact Pin Holes
143. Locking Tab Channel
200. Female Phoenix Connector
201. Gate Port
202. Gate Screw
203. Locking Retention Tab
204. Female Contacts
210. Contact Pin Retention Housing
211. Retention Housing Locking Tabs (top and bottom)
212. Tab Displacement Channel
213. Retention Face
214. Pin Slots
215. Lock Tab Arm
220. Contact Pins
221. Pin Rail

DETAILED DISCUSSION

Intro and Background

Practical lighting is a term in film making which utilizes light sources that are seen within the frame of any given shot to light sets or actors. These light sources that are seen within the frame are called "practical lights" or "practical's." Typical examples include things like desk lamps and wall sconces. However, any light source which is established in a set or installed on location which is seen on screen is considered a "practical". Practical's are effective at establishing motivated light sources in a scene and creating a sense of realism for the audience.

Most film lighting tools are not seen on camera and are generally used to light the actors/action from off screen, we refer to these lights as film lights or set lighting, that is, lights that are off screen which shine into frame to light the actors or sets.

Film crews are broken up by many departments, most notable are camera, make up, wardrobe etc. However, we will focus on two main distinctions which do encompass many departments. The shooting crew, film crew or 1st unit are all descriptions of the crew that is actually doing the work of filming any given scene of action with the actors, either on location or in sets built on sound stages. The rigging crew are the people who do all the prep work for the shooting crew to film, which includes construction, lighting, creating wardrobe etc. The rigging electric crew is the prep crew that sets up and tests all the lighting gear that the shooting crew will use on the day of filming. When the shooting crew finishes filming the rigging crew then comes the day after to break down the set and rig the next one. Leap frogging every set for the shooting crew. Future discussions will focus mainly on the lighting dept known as rigging electric however some overlap is understood and won't be specified.

The Kelvin color scale is used for describing color tones which create white light in film making and will be used in this discussion. Generally, the lower the number in the scale the "warmer" or redder the color of light will be. 3200 degrees Kelvin, or 3200K, is commonly called "tungsten" and is based on the color temperature of light the element

tungsten, the filament used in traditional light bulbs, will emit when electrified. The higher the number value in the Kelvin scale the "cooler" or more blue the color will be. 5600K is called "daylight" and is similar to the light emitted by the sun which reaches Earth (diffused though our atmosphere measured at high noon or when the light is parallel to the surface). Light from the sun, diffusing through more atmosphere tends to loose color value and turn reddish orange around 2900 k or so, as what happens a sunset or sunrise, typically referred to as "magic hour" in the film industry. Historically, film lights were specifically designed to create one of these color tones, either by using tungsten lamps (3200K) or HMI lamps (5600K). Early LED products also started with these two distinctions as well, technicians would have to choose LED fixtures that were either 3200K or 5600K. Next generation of LEDs could mix between the two giving technicians more options in a single package. Current LED fixtures and ribbon can mix between the two as well as add Red Green and Blue (RGB) to any color mix which can create thousands of color possibilities and new LED products are being invented every day. LED ribbon has many of these functions as well as being able to stick to surfaces via adhesive backing and rolled out like tape. Soldering end points allow for many customizable options to install into many different situations.

Lighting for film and television has become a huge market. New tools and practices always try to become more efficient, brighter and with more control over the output, specifically with regards to color temperature and dimmability. Most film lighting tools are not seen on camera. However more film crews are relying on using on set practicals, that is lights within the frame of the camera, to light the set or location as well as the actors. Every Gaffer, the head of the lighting department, or their boss the Director of Photography wants the ability to "dial in" every light on set. They want the ability to change its brightness, color, and if possible, its light quality (softness or hardness of shadows cast from the source).

With modern technology and the advent of LED lights most film lights have full control over color and brightness, especially when linked to the lighting control network DMX512 (digital multiplex) code. When lights are connected to this network, with a push of a button from a lighting control board, the board operator can send a signal to any fixture on a film set controlling its intensity, color, program lighting effects or strobes, flicker and so forth. This saves time for the shooting crew. But takes extra time and care by the rigging crew to install.

Fluorescent tubes have been around since the early 1900's and have been in film just about as long. These practical lights have long been in films, but film makers have always had to deal with the challenges they produce. Further discussion will focus on these challenges the film makers have had to overcome in the past.

Historical Issues with Traditional Fluorescent Tubes

Color of fluorescent tubes are a particular challenge to film crews. Color issues need to be solved before a film crew can shoot with traditional fluorescent lights in a scene. Standard fluorescent bulbs, to the naked eye, emits a nice soft cool white light in the 4100K color range. However, to the camera, when not corrected, they also emit a ghoulish green color. This can be corrected by the time-consuming process of "gelling" the tubes with a Magenta tinted transparent plastic film which wraps around the tube and corrects the color of the green hue, bringing it back to a neutral white color. Or they could replace the tube with a tube developed with gas specially formulated which creates either the 3200 k or 5600 k industry standard white color. Once this color is chosen the shooting crew has no option to change it on set without the time-consuming job of changing physically changing the gel or tube again.

Flicker is another issue facing film crews with traditional fluorescent tubes. In a fluorescent tube fixture, a ballast takes a standard 120 AC voltage and transforms it to a higher AC voltage (usually 240-700 volts). The igniter pins on either end of the fluorescent tube fire with a frequency (on and off) usually 50-60 times a second. This ignition reacts with the gas inside the tube which glows to emit light. Flickering occurs due to a mismatch of the tubes Frequency or Hertz to the camera's frame rate, which is the rate a film or video camera opens a internal mechanical gate to expose an image on a light reactive film or camera sensor. A camera's fame rate is typically 24 times a second. When the hertz of the ballast firing the tube and the camera's frame rate don't align a flicker or strobing effect is created on screen when played back at 24 frames a second. This is because different exposures levels are being received through the gate of the camera for every frame exposed. If the tube is in mid fire, so to speak and not being illuminated fully at the time the film or sensor is exposed, each frame will have a different exposure. Playing these different exposures back at 24 frames per second creates a flicker effect when in motion. The age of the ballast could also affect its frequency or voltage range limiting brightness or creating flicker.

Control is the next issue with fluorescents because the supply voltage from the ballast cannot be dimmed to change the light intensity as in typical tungsten filament bulbs as is the case with wall dimmer switches in residential applications. A fluorescent fixture and ballast cannot be connected into a dimmer switch or DMX network and thus the intensity of the lights output cannot be controlled or dimmed. Only a few options exist for achieving this goal, which is gelling the tube again with another film that cuts light intensity called Neutral Density (ND) or changing the tube out of its fixture for different desired wattage tube, lower wattage is lower light emission. This, however, creates a new problem as power supply ballast are typically rated for specific wattage bulbs. Most often is the case that a technician would have to change the ballast along with the tube wattage as to not damage the tube. Which means added cost for new ballasts and then re installing the old ballasts once production is finished with the shooting day. Which is why gelling is the preferred method for old school film makers. Still very time consuming and costly because gels, and the time of this writing are around 8 dollars a ft. However now the choice is to install LED tubes as a replacement. Residential and commercial LED fluorescent tube replacements are sold across the world and benefit from being ecofriendly, consuming less wattage and are longer lasting than fluorescent tubes, however the color balance needed for film lighting is so high, and the quality control of these tubes are so varied, these options are often a non-starter for film. These products are mostly non controllable or dimmable, however some are. Ballast replacements are needed to install these tubes and most require a constant voltage to work. Further discussion will focus only on LED tube style products made specifically for film lighting or event lighting which utilize DMX protocol for control, and their methods and uses in the industry.

Discussion of Existing Film Related LED Tube Style Light Fixtures

Many LED tube style products have been created for and utilized in the film industry over the previous decade. We will generally discuss the some of the pros and cons of the

features of these products and the challenges film crews face when installing or using these products. Prior art will show examples what is discussed.

Appearance and Size is one concern, most of these products have bulky end caps, power and data cable connections which are large and inhibiting (as seen in the prior art section) and most tubes are wider in diameter than standard fluorescent tubes. None of these products look exactly like the product they are replacing, apart from having a long tubular face side that emits light. Most only achieve 180 degrees of light emission from this face, and if looked at from the side, only half of this fixture is illuminated the rest houses other technology. Half of the tube structure is to house the technology components within, only allowing half the tube to be a light emitting source. The length of most of these products don't reflect true fluorescent sizes and usually the length is short by 3-4 inches on either end, and when installed they appear to be "floating" in a fixture as the ends do not come close to the tombstones (the mounting and power supply contacts of traditional fluorescent tubes). These products are also wider in diameter than fluorescent tubes making it hard to install into tightly closed housings designed to fit them. Often having to modify the fixtures to fit the desired LED tube, especially if the rigging hardware is needed which adds extra bulk.

Internal Batteries and Wireless DMX Control Receivers are installed in most LED tubes on the market, which does give the user the option not to run the bulky power cables, however the batteries in these units are heavy, making the fixture awkward to install even with mounted rigging hardware. Wireless DMX control is great in theory, being able to link the tube to a transmitter via radio signal from the control board and not having to install bulky wires for control or power. However, the battery run time of these tubes, at their highest output setting (the most draw on the battery), is only a few hours at best. This technology is great for getting a shot or two in a pinch. Say needing to add one last light far off in the background to make the shot perfect. The shooting crew just would just need to mount some rigging clips, install the tube, link to the control board, set the level and then shoot the shot. This is a great selling point for these products, and for this purpose nothing can beat it. However, when the film crew is planning an all-day shoot, they don't want to spend wasted time replacing tubes in the overhead fixtures of an office building with fresh batteries every few hours, or even worse, running the risk of losing a light when the actor is giving the best performance of a lifetime. Wireless works great when your fixture is unobstructed, within line of sight and within range of the transmitter. However, once the tube is enclosed in a metal housing (creating a Faraday Cage), or set behind the concrete pillar of an underpass, the signal to the transmitter is effectively lost or connection is weak at best. As a result, rigging crews are constantly asked to run power and control cables to every tube installed in a set or location, negating the usefulness of the battery and wireless capability that technology achieves. Wiring these systems has its own set of problems which we will discuss later.

Overheating of the LED tubes with wireless DMX control and internal batteries is another battle facing rigging crews, especially if they are rigged into airtight housings or set pieces with no air circulation. With all the technology installed in the tube housing itself, heat becomes a problem for sensitive computer chips. Most of these tubes will shut down to protect components, or lose data signal, or otherwise flicker or flash randomly if overheated.

Accessibility for trouble shooting. When problems arise, rigging crews must trouble shoot these issues, this is always part of the job. However, some products seem to add to the stress rather than alleviate it. When all the manual control elements of a fixture are built into the fixture itself, when things go wrong you need to get to that fixture to troubleshoot it. This means that when these tubes are built into a set piece, disassembly of set pieces must happen to gain access to the tube for inspection. When tubes are mounted to lighting rigs high above a set, and things go wrong, the technician must get into a lift and navigate their way up to the rig to inspect and diagnose the issue.

Rigging Hardware is usually screwed or bolted into whatever surface it's being rigged to, whether it is the metal housing of a lighting fixture, using self-taping screws or into premade set wall channels or other mounting surfaces. This hardware then friction holds or clamps to the outside of the LED tubes, holding them in place. Rigging hardware is often hard to conceal and is usually seen by camera when installed in open fixtures, not hidden by diffusion panels or lenses. Screwing and drilling into fixtures or walls of real locations will cause permanent damage and is costly to repair, plus reduces the willingness of the owner to allow film crews back into their property.

Proprietary Wiring of these systems makes customization difficult. As technicians scout a new location, being flexible is key to being a successful rig. What worked great for one location won't necessarily be the case for the next. Sometimes many tubes will be wired within feet of each other, in other, hundreds of feet could be separating them. Sometimes it would be nice to hide a controller up high controlling **4** tubes, while also rigging a different controller low with other 6 others 50 ft away in a back room. But with most of these systems you are limited with your reach and effectiveness to run separate spots based on what comes in a kit, forcing you to order many different kits accomplish the job of one. The LED systems used today each use their own proprietary cables and ports to connect their tubes to their charging/control stations/controllers. Each one has a maximum length they can run. Some only come with one control module for a set of 10 tubes from the rental house, and the length between those cables is only 50 linear feet. Some have power cables which also run data in the same line, some do not. Again, most have all their wireless DMX control components in the tubes and only need power run to them but then have power adapters that need to be installed to change the AC power to DC to run the tubes. Most of these tubes have been used for many years and the ports are wearing out, cables past their prime and not connecting to the ports they are meant to connect with. Thus, creating data connection issues, creating errors in the color, timing issues with lighting cues, or power drain and charging issues. In all these cases, there is nothing the technician can do to service these faulty tubes and cables except return faulty equipment to the rental house and wait for a new one to be delivered. Some older style tubes function with dimmable AC power and can be installed with ungrounded 18/2 AWG lamp cord commonly called "zip cord". This adds to the customization because you can cut cable runs to length and install quick on plugs to plug in your lights. However, when not installed properly, not paying attention to polarity, can result in flicker problems of the lights when dimmed and even shock or fire hazards. All these different restrictions come into play with little time to figure it out before the shooting crew arrives expecting everything lit up and ready to go.

Summary of Concepts

The goal of this invention was to address the challenges outlined in previous discussion regarding traditional fluorescent tubes and current LED fixtures on the market. The present concepts include apparatus **10** and **10**A both include a lightweight, magnetic, light diffusing housing for LED ribbon which is designed to look like a standard fluorescent tube in a practical lighting video filming application. A tube housing that is easily serviceable for the technician, who can install any LED ribbon of their choosing. A tube that mounts magnetically without any intrusive rigging hardware into most fluorescent housings, creating no damage to the existing fixture. A fixture that can be wired with any length of multiconductor wire of appropriate gauge relative to the amperage needs of the LED ribbon. Control wires can be easily and repeatedly removed or connected via either the discreet terminal block or an industry standard phoenix connection port, housed discreetly one of either apparatus two end caps. Utilizing external DMX control modules for ease of access and trouble shooting from the ground and the ability to customize installation of systems based on the needs of the rig.

Issues of Historical Fluorescents Addressed by Apparatus **10** and **10**A

Color is chosen and installed by the end user of apparatus **10** and **10**A. LED ribbon is manufactured in multiple sizes and voltages from various manufacturers.

Flicker is controlled by plugging apparatus **10** and **10**A into external DMX control modules which utilize a high frequency, constant current, PWM dimming system. (Pulse Width Modulation) This system ensures a dimming curve which seamlessly matches with any camera frame rate, with no flicker during playback.

Control by using external DMX control modules, linked to the lighting control board, the board operator has full control of color, brightness, and lighting effects.

Issues of Existing LED Fixtures Addressed by Apparatus **10** and **10**A

Appearance and Size Apparatus **10** and **10**A is designed to look like a traditional fluorescent tube. The length is just shy of standard tombstones in traditional housings, within one and a half inches between each end cap and tombstone without phoenix connector installed. Width is very similar to that of a fluorescent tube. End caps are slim and flush with the tube housing, and the connector port is discreetly molded into one end cap. The white diffused housing has the appearance of glass in a traditional fluorescent tube while being structurally strong and less fragile. As noted in FIG. **33**C, apparatus **10** and **10**A achieves a 240-degree angle of illumination whereas previous LED tubes only can manage 180 degrees of light output. This is due to apparatus **10** and **10**A having no internal batteries or onboard computers. The space taken up by these elements in previous LED style tubes is utilized in apparatus **10** and **10**A for light output. Yet again creating a more realistic, fluorescent tube replacement viewed from many angles of view.

Internal Batteries and Wireless DMX Control Receivers Apparatus **10** and **10**A has no internal batteries nor wireless DMX control technology in its housing. All control and power are external, which allows the housing to be lightweight and slender in appearance. Wireless control can still be achieved by connecting radio receivers to the DMX control module, completely external and separate from apparatus **10** and **10**A. Controllers with wireless receivers can be rigged within range of the board transmitter while apparatus **10** and **10**A rigged out of range but can still be connected via control wires to the control module.

Overheating Because the power and control are external, overheating of apparatus **10** and **10**A is not an issue. No computer components are installed in the apparatus, so heat retained inside its housing does not affect control. The aluminum rail inside the housing does act as a heat sink, dispersing any heat generated by the LED ribbon, as well as a rigging platform for the magnets inside. Temperatures on the exterior of the tube when testing various ribbons never exceeded 100 degrees Fahrenheit in open, ventilated fixtures.

Accessibility Since the DMX control modules and power supplies are external from the tube, any trouble shooting of the system control can be done without the need to access apparatus **10** and **10**A while rigged. Should the need arise to trouble shoot apparatus **10**A for example, unplugging the phoenix control wires and pulling the tube from the housing is very easy. Should the need also arise to service inside apparatus **10** or **10**A or change its ribbon within, this can easily be achieved by removing the mounting screws and pulling the components out from the housing. Other manufactured LED tubes are not serviceable and sealed units.

Rigging Hardware is not necessary for apparatus **10** and **10**A in most applications. Leaving the existing housing undamaged during and after installation. If the need does arise where apparatus **10** and **10**A needs to be rigged into nonmagnetic material, it fits in standardly utilized rigging hardware.

Proprietary Wiring is not the design choice of apparatus **10** and **10**A rather giving the end user the freedom of utilizing their own means of cable distribution. Apparatus **10** offers gated port terminals to which the user can attach multiconductor wiring for control. Apparatus **10**A implements the use of the phoenix connection system as the primary connection port, which is a widely used system for LED purposes in the film industry, these features make either apparatus very customizable and film friendly. Many crews already have these connectors in their tool kits. The phoenix terminal connection is reusable because of its screwed clamping gate port system. Bulk multiconductor wire known as Belden or security wire comes in many gauges and conductors and is sold in spools of 250 ft to 1000 ft. Technicians can decide its length, orientation, and application. Clamping the unsheathed wires into phoenix connectors or the terminal blocks allows for many different uses and applications, for example, creating wire harnesses for multiple fixtures fed by one control or "trunk line". Four apparatus in one fixture housing could easily be run from one main control multiconductor cable coming into the housing, jumped between the apparatuses in the fixture by wiring one to the other via the phoenix connection. Or all apparatus in the fixture could be individually cabled if the situation demands it, running a trunk line for each apparatus. Apparatus **10** and **10**A are designed to be used in a customizable system created by the end user or technician as the situation presents itself.

Basic Construction and Operation of Apparatus **10**

The present invention relates to a method and use of apparatus **10** for film and television lighting. The present concepts include apparatus **10** which includes a lightweight, magnetic, light diffusing housing for LED ribbon which is designed to look like a standard fluorescent tube in a practical lighting video filming application. A tube housing that is easily serviceable for the technician, who can install any LED ribbon of their choosing. A tube that mounts magnetically without any intrusive rigging hardware into

most fluorescent housings, creating no damage to the existing fixture, but also be able to use existing rigging hardware when needed.

The Apparatus **10** includes the following general components

10. Apparatus **10**
15. End Cap A (w/o connections)
20. Inserts
30. Screws
40. Oslo Tube
60. Magnets
70. Prefabricated Aluminum H Channel
80. Fasteners
90. Terminal Block Housing
100. LED Ribbon
110. LED Bridge Wires
120. Terminal Block
130. End Cap B (w/connections)

Generally described, apparatus **10** includes a tube housing **40** a 1/16th inch thick polycarbonate tube with opposing interior slide channels **46** in the interior which accept a portion of an aluminum H channel **70**. The channel includes magnets **60** adhered to its top side and LED ribbon adhered to its downwardly facing underside. Once the channel **70** is inserted into the tube **40** and the end caps **15**, **130** are installed, the apparatus **10** looks like a standard flourecent tube in a practical lighting video filming application. One end cap **130** houses a terminal block screwed gate system which allows the user to clamp in the externally connected control wires necessary (bare ended or stripped sheath wire) to light the tube apparatus easily and repeatedly with out damage to the ribbon inside.

More Detailed Construction and Operation of Apparatus **10**

Here follow more details of apparatus **10**. This will be done by describing the detail of the various elements of FIG. **1** through FIG. **22** as well describing their fit and function as they relate to the whole. A detailed listing of components will be referenced from the complete Apparatus **10** elements list.

FIG. **1** is an exploded view of apparatus **10**, showing its multiple components.

FIG. **2** is a pictorial view of Apparatus **10**, showing its two ends A and B. Proximate each of said ends A and B are corresponding end caps **15** and **130**. End cap **130** is the cap including wiring shown also in FIG. **3**. End cap **15** at end B does not include wiring.

FIG. **2** is a pictorial view of Apparatus **10**, showing its two ends A and B. Proximate each of said ends A and B are corresponding end caps **15** and **130**. End cap **130** is the cap including wiring shown also in FIG. **3**. End cap **15** at end B does not include wiring.

FIG. **4** is a partial view of Apparatus **10**, showing the "upper" side of its end A, showing the two screws **30** which attach the end cap to the Oslo tube **40** as well as the end cap **15**, as described in further detail below.

FIG. **5** is a view similar to that of FIG. **5** except that the end cap **15** has been removed from the main assembly **10**, by removing the machine screws **30** and pulling out the end cap **15**. Shown installed are two threaded inserts **20** which accept the machine screws **30**, and are configured to frictionally engage holes drilled in the end cap **15**, such that the end cap may be selectively attached in place by the screws **30** (not shown in FIG. **5**). The axis of one of the two holes is shown with a dotted line.

End Cap **15** is configured to attach to one end of the Oslo Tube **40**, and to close that end of the tube **40**. End cap **15** consists in one embodiment of a cured, opaque, two-part epoxy resin which is extracted from a silicone mold. Circular disk OD 1.5" diameter, with 1/8" lip forms the exterior, while an inner 3/8 "shelf and alignment key are inset by 1/16" from the diameter.

End cap **15** seats inside the Oslo tube **40** with its upper key **96** (see briefly FIG. **16**) aligning with the interior tube gap **45** of the Oslo tube **40** (see briefly FIG. **8**). Interior shelves on Side A the Oslo tube **40** have holes drilled therein which allow screws to extend therethrough to accept threaded Inserts **20** on either side of the upper key of the End Cap **15**. This allows the screws **30** to attach the end cap **15** to the Oslo tube **40**.

Threaded inserts **20** (see FIG. **6**) are press fit into the resin endcaps **15**, **130**, which allow engagement with threaded machine screws **30**. In one configuration they are M3×6 mm×0.5 threaded inserts.

Screws **30** are configured to engage the threaded inserts **20**. When assembled they are inserted through holes drilled into the Oslo Tube **40** shelf via the 1/4 Inch wide channel cut into the Oslo Tube **40**. The machine screws **20** are then screwed into the two inserts **20** press fitted into the resin end caps shelves, thus securing the end caps **15**, **130**, to their respective ends of the Oslo tube **40**. In one embodiment the screws **20** are M3×6 mm×0.5.

Oslo tube **40** is a generally tubular member which simulates the outside circumferential shape of a conventional elongate florescent light. FIGS. **7**A and **7**B are illustrative transverse cross sections of the Oslo tube **40**. FIG. **7**A shows the Oslo tube **40** with its interior upper shelves **42** and interior lower shelves **43**. Each of these interior shelves runs the length of the tube **40** (with the exception of certain parts cut out as discussed elsewhere). The upper and lower shelves combine to create two elongated slide channels **44**, each of which is configured to accept an elongate side edge of the upper face member **72** of the channel, as shown in FIG. **7**B.

FIG. **8** shows some typical dimensions of the Oslo tube **40**, but these should not be limiting. Note that the "interior tube gap **45**" which is shown as 13 mm in drawing is the gap into which the upper key **96** of the terminal block housing **90** fits when installed. This same gap **44** is the gap into which the upper key **136** of the terminal block housing **130** fits when installed.

FIG. **9** shows the Oslo tube **40**, with holes and shelves as discussed elsewhere.

FIGS. **10**A-C are various views showing how the end caps are attached. FIG. **10**A shows End A of the apparatus **10**, showing the end cap **15** in place, with a screw **30** being prepared to be installed into a threaded insert **20** in the end cap **15** to secure end cap **15** relative to the Oslo tube **40**. FIG. **10**B shows End B of the apparatus **10**, showing the Oslo tube in isolation, with an access slot **46** being cut therein in to enable the drilling of holes in the lower interior shelf of the Oslo tube **40**. FIG. **10**C shows End B of the apparatus **10**, showing the end cap **130** installed, and showing a screw **30** being installed into a threaded insert **20** (press fit in a hole in the end cap **130**). It should be understood that the screw **30** in this configuration may be of a different length than the one in FIG. **10**A, depending on the application).

On End (A) of the Oslo tube **40** two 1/4" holes are notched 1/8" from the end of Side A. Holes are dilled through the interior shelf on either side to align with the resin End Caps and their M3 inserts **20**. On End (B) of the Oslo tube **40** a 1/4" inch slot **46** (see FIGS. **10**B and **12**) is cut perpendicular to the interior tube gap **45** running the length of the Oslo tube **40**, 1/8" in from each end which exposes the rail shelf inside.

This interior tube gap **45** also allows wire access (bare ended or stripped sheath wire) to the ports on the terminal block housed in End Cap (B).

Magnets **60** are configured to provide an attachment of the overall apparatus **10** to an external ferrous element, such as the inside of a conventional florescent lighting housing.

FIG. **11** is a view showing an Oslo tube **40** having channel **70** installed in its interior. This figure also shows the upper small face member **72** and the lower larger face member **72**. Also shown here is a transverse slot which has been cut into channel **70**, such that a magnet **60** can be installed into the slot in the channel.

FIG. **12** is a view similar to that of FIG. **11**, except that a magnet **60** has been installed therein.

In one embodiment, three Neodymium magnets are glued to the channel via the transverse slots in the small face side of the channel **70**, are rated at a 20 lbs pull each, and have the dimensions 1"×½"×¼". Other embodiments could include securing the magnet with barrel nuts and bolds through counter sunk holes in the magnet.

FIG. **13** is an illustrative view of the Oslo tube **40**, showing the LED ribbon **100** installed on the typically downwardly facing lower surface of channel **70**.

Channel **70** is configured to support the LED ribbon **100** in a spaced apart relationship to the interior of the Oslo tube **40**. A detailed transverse cross section of Channel **70** is shown in FIG. **14**. FIG. **14** shows channel **70**, which includes a large lower face member **74** having a one 1.25" wide face side and a smaller 0.625" upper face member **72** separated by a 0.10" spine **76** down the middle. These dimensions are exemplary only and should not be considered exclusive or limiting.

The small face of elongate channel **70** mates with the interior elongate channel of the Oslo tube **40** and runs the length of the Oslo tube **40** between the two endcaps **15**, **130**. This rail dissipates heat, creates the structure which the LED Ribbon **100** adheres to the large face side, and houses the magnets **60** on the smaller face side. Three 1" long 0.10"" deep magnet slots are cut from its small face side, perpendicular to its length. One is centered on the length of the rail, the other two on each end 4" from the end of the rail. These magnet slots allow three (3) magnets to be glued per rail.

FIGS. **15**A-C are sequential illustrative views of the assembly of the LED Ribbon **100**, channel **70**, and magnet **60**. FIG. **15**A shows the LED Ribbon **100** being attached to the underside of channel **70**, and the magnet **60** (shown in dotted line) in place atop channel **70**. FIG. **15**B shows the LED Ribbon **100** attached to the underside of channel **70**, and the magnet **60** in place atop channel **70**. FIG. **15**C shows the assembly shown in FIG. **15**B installed within the interior of Oslo tube **40**.

Fasteners **80** are configured to fasten the terminal block housing **90** to end cap **130**, by screwing into M3 inserts pressed into the plastic housing **90**. In one embodiment, they are M3×12 mm×0.5 bolts.

Terminal Block Housing **90** is configured to support terminal block **120** relative to end cap **130**. The housing **90** mates to the interior side face of End Cap **130**, such that this mating connection is made within and is concealed by the Oslo tube **40**.

FIG. **16** is a view of the terminal block housing **90**, showing the terminal block housing access port, and the upper key **96**, which when installed locates itself between the "interior tube gap **45**" which is between the two opposing interior channels of the Oslo tube **40**. Also shown is the lower key **98** which mates with the lower key slot **138** defined by the end cap **130**.

FIG. **17** is a view of the end cap **130**, showing the end cap access port as well as the upper key **96** which when installed locates between the "interior tube gap **45**" which is between the two opposing interior channels of the Oslo tube **40**. FIG. **8** shows some typical dimensions of the Oslo tube **40**, but these should not be limiting. Note that the "interior tube gap" which is shown as 13 mm in drawing is the gap into which the upper key **96** of the terminal block housing **90** fits when installed. This same gap is the gap into which the upper key **136** of the terminal block housing **130** fits when installed.

Also shown is the lower key slot **138** which accepts the lower key **98** of the terminal block housing **90** when the elements **90**, **130** are fastened together.

FIGS. **18**A-B are sequential assembly views showing the attachment of the end cap **130** to the terminal block housing **90**, in the process capturing the terminal block therebetween. FIG. **18**A shows the terminal block in position before the end cap **130** is attached to the terminal block housing. This figure shows one screw **80** which will eventually have its free end engaging the end cap **130**, thus fastening the end cap **130** to the terminal block housing **90**. FIG. **18**A shows the configuration "turned over" in an upside-down configuration in order to show the two screws **80** which will eventually have their free ends engaging the end cap **130**, thus fastening the end cap **130** to the terminal block housing **90**. In this configuration the terminal block is captured by the end cap **130** and the terminal block housing **90**.

FIG. **19** shows the elements of FIG. **18**B in their generally upright configuration, with the end cap **130** attached to the terminal block housing **90**. In this configuration the terminal block **120** is captured by the end cap **130** and the terminal block housing **90**.

The semi-circle, flat faced side of the housing **90** is ¾" thick and 1¼" in diameter. Its upper alignment key **96** matches the interior tube gap **45** of the Oslo tube **40**. Two shelves, which house two M3 threaded inserts, extend ¼" out from the housings back flat face and mate with the back face of End Cap (B). Below these two shelves are a set of holes drilled perpendicular to the housings front face to allow an M3×12 mm bolt to pass thru and join the housing to the End Cap (B) Between the extended shelves is an access port through the face which allows access of pins from the terminal block to pass through. Below this access port is an lower alignment key **96** which extends from the back face of the housing that mates with the shelf of the End Cap (B). When joined with the End Cap (B) the housing cradles the Terminal Block within the End Cap allowing wires to be soldered to bridge the LED Ribbon **100** and the terminal block **120**.

The housing **90** consists of a fully cured, clear, two-part epoxy extracted from a silicone mold. Clear resin is required to limit the shadow created by this housing. Light bounces through and does not appear as dead space when illuminated.

LED Tape Ribbon **100** is configured to provide lighting withing the apparatus **10**. In one embodiment, ribbon **100** is premanufactured LED Tape Ribbon, including LED diodes circuited into linear ribbon. When installed via adhesive backing, the ribbon **100** is attached to the large face of the aluminum channel, which is typically facing downward when installed.

LED Bridge wires **110** (See FIG. **18**B) are wires which extend from the LED ribbon **100** to the terminal block **120**, providing electrical connection (including signaling) therebetween. In one embodiment they are 22 AWG Wires

soldered at one end to the LED Ribbon **100**, then soldered at their other ends to the terminal block **120** pins.

Terminal block **120** is configured to provide a detachable electrical connection between external wiring such as external wiring **200** and the LED tape ribbon **100**. 5 mm pitch Side Entry. Consisting of metal pins which extend from a bonded socket, each socket utilizes a gate which screws which clamp shut.

End Cap **130** is configured to attach to the one end of the Oslo tube **40** and close said end (End A, see FIG. **2**). It also combines with the terminal block housing **90** to capture and secure the terminal block **120** therebetween.

This cap **130** is attached to the terminal block housing via fasteners **80** (See FIG. **1**). M3 threaded inserts, and together rests inside the Oslo Tube Housing with the key aligning with the interior channel of the Oslo Tube.

FIG. **21** is a view of End B of assembly **10**, showing the end cap **130** attached to the Oslo tube **40**. Also shown is the end cap access port in the end cap **130**. This end cap access port allows for the manipulation of clamping screws in the terminal block **120**, such that the screws can be screwed in or out in order to secure or release external control wires **200** (bare ended or stripped sheath wire) relative to the apparatus **10**.

FIG. **22** is a view of End B of the assembly **10**, showing the end cap **130** attached to the Oslo tube **40**. Also shown is terminal block **120**, viewable though a slot provided in the Oslo tube **40**. This slot allows for external control wires **200** (bare ended or stripped sheath wire) to be connected to the terminal block **120**, such that its clamping screws can be screwed in or out in order to secure or release the external control wires **200** relative to the apparatus **10**.

As shown in FIG. **21**, an access port through the face of the cap **130** allows access to the gate clamping screws of terminal block **120**. The ports face towards the Oslo tube **40** interior. External control wires **200** (bare ended or stripped sheath wire) have access to the ports through the channel cut in the Oslo tube **40**. This allows for quick and secure wiring of tails to the unit. External control wires **200** then run to DMX Controllers and power supply to run the LEDs within. consisting of a cured opaque two-part epoxy resin, extracted from a silicone mold.

External control wires **200** (bare ended or stripped sheath wire) can be 18-22 AWG gauged wire to be inserted and clamped to make semi-permanent connection with each corresponding power and data channel on the LED ribbon. This allows 18-22 AWG gauged wire to be inserted and clamped to make semi-permanent connections with each corresponding power and data channel on the LED ribbon.

Basic Construction and Operation of Apparatus **10**A

The present invention relates to a method and use of apparatus **10**A for film and television lighting. The present concepts include apparatus **10**A which includes a lightweight, magnetic, light diffusing housing for LED ribbon which is designed to look like a standard fluorescent tube in a practical lighting video filming application. A tube housing that is easily serviceable for the technician, who can install any LED ribbon of their choosing. A tube that mounts magnetically without any intrusive rigging hardware into most fluorescent housings, creating no damage to the existing fixture, but also be able to use existing rigging hardware when needed.

The Apparatus **10**A includes the following general components:

1. Apparatus **10**A
10. End Cap A
20. Threaded Inserts
30. Tube Mounting Screws
35. Rail Mounting Screws
40. Tube Housing
50. Tube Screw Retention Block
60. Receiving Slot for Tube Screw Retention Block
70. Aluminum Rail
80. Barrel Nuts
90. Neodymium Magnet
100. LED Ribbon
110. LED Bridge Wires
130. End Cap B
200. Female Phoenix Connector
210. Contact Pin Retention Housing
220. Contact Pins

Generally described, apparatus **10**A includes a tube housing **40**, with a flat spine **41** (aka flat wall section), made from a $1/16^{th}$ inch thick white diffused, polycarbonate tube which includes opposing interior shelves **42** on the interior which accept a portion of an aluminum rail **70**. A channel of this rail **70** includes magnets **60** secured to its top side between rail wings **74**, and LED ribbon **100** of the end users choosing adhered to its downwardly facing, underside rail face **72**. Once the rail **70** is inserted into the tube housing **40** and the end caps A **10** and B **130** are installed, with tube mounting screws **30**, the apparatus **10**A looks like a standard flourecent tube in a practical lighting video filming application. End cap B **130** houses a male phoenix receptical **131** which mates to an industry standard female phoenix plug **200**. A standardized system which utalizes a screwed gate ported plug and mating receptacles to allow the user to clamp external control wires into a plug then insert them into the recptacle housings, easily and repeatedly with out damage to the ribbon inside. The apparatus **10**A is configured to be attached via magnetic attraction to a downwardly facing flat horizontal surface of an overhead member (not shown) which in practice is often the interior top panel of an existing florescent light assembly that has had its florescent light tubes removed, leaving a metal fixture enclosure behind. The interior of the enclosure includes a downwardly directed metal interior top panel wall which is attracted by the magnets of the apparatus **10**A.

More Detailed Construction and Operation for Apparatus **10**A

Here follow more details of apparatus **10**A. This will be done by describing the detail of the various elements of FIG. **23** through FIG. **43** and also describing their fit and function as they relate to the whole. A detailed listing of components will be referenced from the complete Apparatus **10**A elements list.

FIG. **23** is an exploded view of apparatus **10**A, showing its multiple components. Length of apparatus **10**A will be manufactured for a variety of typical fluorescent tube lengths. 2 Ft, 4 Ft or 8 Ft length are standard fluorescent sizes. However, these dimensions are exemplary only and should not be considered exclusive or limiting. Representations shown in all figures will be in a condensed fashion for illustration purposes.

FIG. **24** is a pictorial view of Apparatus **10**A, showing its two ends A and B. Proximate each of said ends A and B are corresponding end caps A **10** and B **130**. End cap B **130** is the cap including the male phoenix receptacle **131** shown also in FIG. **25**. End cap A **10** does not include this receptacle. Tube Housing **40** is a white diffused, translucent polycarbonate tube housing which allows light to emit through its surface while diffusing the LED source within while also concealing the "hot spots" or points of light of each diode embedded in the LED ribbon **100**. When illu-

minated, the tube emits a bright diffused source of light from its tube housing **40**. Tube mounting screws **30** are installed connecting both end caps A **10**, and B **130** through the flat spine **41** of the tube housing **40**. The flat spine **41** also provides a stable mounting platform with a large surface area for the magnetic adhesion of the magnets **60** within and prevents rolling of the tube once mounted in a downwardly facing flat horizontal surface of a light fixture.

FIG. **25** is a full view of Apparatus **10**A, focusing on End B, which shows where the premanufactured, external female control wire connecter, commonly known as a phoenix connector **200**, connects to the apparatus **10**A via the male phoenix receptacle **131**. The arrow shows the travel of connector during insertion. Once inserted into the male receptacle, unsheathed ends of external control wires (not shown) which are clamped inside gated ports **201** via the gate screw **202** of the female connector **200**, contact the male contact pins **220** of the male receptacle via the female contacts **204** (shown in FIG. **26**) This connection of the plug to the port creates the circuit for controlling the LED ribbon externally. The control wires connect to DMX controllers and power supplies which feed the tube its data and power. Control wires can be easily hidden behind set walls or in drop ceilings of location rigs. FIG. **33**A will show the internal connections made from the contact pins **220** to the LED ribbon **100**.

FIG. **26** is a close-up view of End B with end cap B **130** and female connector **200**. A locking shelf **132** is recessed just above the male receptacle **131** in end cap B **130** which allows the retention tab **203** of the female connector **200** to grab and retain itself to the end cap B **130** which also allows male contact pins **220** to insert into female contacts **204** thus contacting the external control wires. This creates a semi-permanent wire connection between the control wires and apparatus **10**A.

FIG. **27** Shows the components that are released once the tube mounting screws **30** are unthreaded from threaded inserts **20** and **21** and removed from countersunk mounting holes **43** in the flat spine **41** of tube housing **40**. Tube mounting screws **30** also release the following components once removed: retention holes **51** of each end caps tube screw retention block **50** and tube screw holes **72** in the A and B side of aluminum rail **70**. (Shown in more detail in FIG. **28**A and FIG. **28**B). Arrows show the motion of travel for each component when released. Once the tube mounting screws **30** are removed, end cap A **10** can be removed from the tube housing **40** and the aluminum rail **70** which mates with the rail face shelf **11** of end cap A **10**. End cap B **130** is attached to the aluminum rail **70** via rail mounting screws **35** which are threaded into the press fit threaded inserts **20** seated in threaded insert holes B **134** of end cap B's rail face shelf B **133**. (Shown in more detail in FIG. **29**B) Both cap and rail slide out from the tube housing along the tube rail shelf **42** of the tube housing **40** which mates to the rail channel **77** and rail wings **74**. (Shown in more detail in FIGS. **34**A and **34**B)

The process described in FIG. **27** is the extent and ease of which a technician would need to access the interior of the tube housing to change or modify the LED ribbon **100**. Just remove the two tube mounting screws **30**, remove end cap A **10** and slide out end cap B **130** with the attached rail **70** from the tube housing **40**. If needed the technician could remove rail **70** from end cap B **130**, however this is not necessary for intended use. Reinstalling the housing is just a reversal of this process. Further descriptions herein are for the manufacturing process and not intended for the end user. Better detail of the first step of reassembly is shown in (FIG. **34**B)

FIG. **28**A looks at the mounting mechanism for components of End A. Arrow indicates the mounting path of tube mounting screw **30** into end cap A **10** (tube housing **40** and magnet **90** are not pictured. Aluminum rail **70** is removed from the rail face shelf **11** for illustration purposes). The tube screw passes through the exterior of the tube housing **40** via countersunk mounting hole **43**, then through the retention block **50** via the tube screw retention hole **51**, through the drilled tube screw hole **72** of side A of the aluminum rail **70**, which mates to the end cap on the rail face shelf A **11** of end cap A **10**. Tube screw **30** threads into the threaded insert **20** which is friction pressed into the threaded insert hole **12** (shown in FIG. **7**A) centered on the rail face shelf A **11**. When installed, the screw connects end cap A **10** with rail **70** and tube housing **40**. Tube housing **40**, when installed, contacts end cap A **10** along its interior edge face **15** and the tube rail shelves **42** mates with corresponding tube shelf retention slots A **13**. (Shown in more detail in FIG. **34**A)

FIG. **28**B looks at the mounting mechanism for components of End B. Arrows indicate the mounting path of tube mounting screw **30** and rail mounting screws **35** into end cap B **130** (tube housing **40** not pictured and aluminum rail **70** is removed from the rail face shelf B **133** for illustration purposes). Tube screw **30** passes through the exterior of the tube housing **40** via countersunk hole **43**, through the retention block **50** via the tube screw retention hole **51** then through the tube screw hole **72** in the B side of the aluminum rail **70**, which mates to end cap B **130** mating with the rail face shelf **132**. The tube screw **30** threads into the threaded insert **21** which is friction pressed into end cap B **130** centered on the rail face shelf **131**. Threaded insert **21** is shorter than insert **20** to accommodate space for the contact pin housing slot **135**. (Shown in more detail in FIG. **29**B) When installed, the tube screw **30** connects end cap B **130** with the aluminum rail **70** and tube housing **40**. Rail mount screws **35**, pass through the counter sunk rail mount holes **71** of the B side of the aluminum rail **70**, to thread into the threaded inserts **20** which are friction pressed into threaded insert holes **134** (shown in FIG. **29**B) along the rail face shelf B **133**. Tube housing **40**, when installed, contacts the interior edge face **140**, tube rail shelves **42** mates with corresponding tube shelf retention slots **139** (Shown in more detail in FIG. **29**B). During the aluminum rail processing, a section of the aluminum rail wing **74** is cut create the rail screw wing cut **76**, to allow access for drilling the rail mount holes **71** on the back side of the rail face **72**. This allows access for the rail mount screws **35** to mount the aluminum rail **70** to the end cap B **130**. Magnet **90** is shown secured to the rail **70** via barrel bolts **82** which thread into female barrel nuts **80** (shown in more detail in FIG. **32**)

FIG. **29**A shows an exploded view of components that connect to end cap A **10**. Arrows show the motion of travel when installing components. Tube screw retention block **50** is designed to be permanently snapped into end cap A **10** via the receiving slot **60**. This operation is shown in more detail in (FIG. **30**). Installation of retention block **50** must be done after the threaded insert **20** is friction pressed into the threaded insert hole **12**, which is centered in the rail face shelf A **11**.

FIG. **29**B shows and exploded view of components that insert into end cap B **130**. Arrows show the motion of travel when installing components. Tube screw retention block **50** is designed to be permanently snapped into end cap B **130** via the receiving slot **60**. This installation must be done after

the threaded inserts **20** and **21** are friction pressed into the threaded insert holes **134** along the rail face shelf B **133**. Installation of retention block **50** is shown in more detail in (FIG. **30**). Premanufactured contact pins **220** are installed through the contact pin holes **142** (shown in more detail in FIG. **31**A and FIG. **31**B) pin rail **221** mates with the contact pin channel **141** on the rear face of the retention housing receiving slot **135**. The pins extend through the pin holes **142** and protrude into the male receptacle **131** side of end cap B **130**.

FIG. **30** Shows the permanent locking mechanism of the tube screw retention blocks **50** when pressed into the receiving slot **60** of each end cap. The mechanism is the same for both end caps A **10** and B **130** but is only shown in detail in FIG. **30**. Blue arrow shows the motion of travel for the tube screw retention block **50**. As stated in FIGS. **29**A and B, only after threaded inserts **20** and **21** are press fit into the insert holes **12** and **134** of cap A **10** and B **130** can the tube screw retention block **50**, be installed. Each component, the receiving slot **60** and tube screw retention block **50**, has alignment rails (**52**, **62**) and channels (**53**,**61**) for each other to mate with during the installation. Alignment rails **52** of the tube screw block **50**, align with the alignment channels **61** of the receiving slot **60**, as well as the alignment rails **62** of the receiving slot **60** in each end cap align with the corresponding alignment channel **53** of the tube screw block **50**. Once retention block **50** is placed above the receiving slot **60** and the channels and rails have made contact, downward force is applied to install. The locking tab displacement face **64** contacts the locking tab **54** at the beginning of its travel downwards, the alignment channels and rails retain the retention block **50** laterally and only allows vertical motion. The displacement face **64** is set at an angle from its top face along the alignment channel to the bottom at the locking tab shelf **63**. This angle, as the tube retention block **50** is pressed downward, laterally forces the locking tab **54** to recess into its lock tab displacement channel **56** bending the locking tab arm **55**. Once the screw retention block **50** reaches the end of its travel downwards resting on the receiving slot base **65**, the locking tab pushes beyond the displacement face **64** and the locking tab arm **55**, relieved of its lateral force, snaps back to its original orientation mating the locking tab **54** with the lock tab locking shelf **63**. Once mated the locking tab **54** prevents any vertical travel, locking the tube screw retention block **50** permanently to the end cap.

FIG. **31**A details the components and installation of the contact pin **220** and the contact pin retention housing **210** into the retention housing receiving slot **135** of end cap B **130**. Blue arrow denotes travel of components. An expanded view window shows details of the retention housing receiving slot **135** and its components. As stated before, premanufactured contact pins **220** are installed through the contact pin holes **142**, the pin rail **221** mates with the contact pin channel **141** on the rear face of the retention housing receiving slot **135**. The pins extend through the pin holes **142** and protrude into the male receptacle **131** side of end cap B **130**. (Shown in FIG. **31**B) The contact pin retention housing **210** mates with the receiving slot **135**. Both top and bottom locking tabs **211** of the retention housing **210** contact the locking tab channels **143** of the receiving slot **135**. When pressure is applied to the retention housing **210** the angle of the front face of the locking tabs **211** contacting the tab channel **143** causes the tab to recess into the tab displacement channels **212** bending the lock tab arm **215**. Once the retention housing **210** is seated against the back face of the receiving slot **135**, the locking tabs **211** push beyond the tab channel **143**, the tab arm **215** releases its tension returning to its original position. The locking tabs **211** mate with the lock tab shelves **136** permanently mating the retention housing **210** to end cap B **130** via the receiving slot **135**. When installed the retention face **213** of the retention housing **210** contacts and retains the pin rail **221** in the pin channel **137** permanently securing the contact pins **220** into end cap B **130**. Pin slots **214** in the retention face **213** allow the contact pins to protrude out the rear of the retention housing **210**.

FIG. **31**B shows both interior face and exterior face of end cap B **130** when all components are installed. Contact pins **220** are retained by the contact pin housing **210**. The retention face **213** holds pin rail **221** in the contact pin channel **137**. Pin slots **214** between the retention faces **213** allow the contact pins **220** to protrude out of the retention housing **210**. Contact pins **220** protrude out of the contact pin holes **142** of the male phoenix receptacle **131**.

FIG. **32** is an exploded view of the components which mount to the aluminum rail **70**. Arrows show the path of travel of the components to mount to rail **70**. High strength neodymium magnets **90** rest on rail **70** between the rail wings **74** and is secured when female threaded barrel nuts **80** are installed through magnet mounting holes **75** on rail **70**, flat head barrel bolts **82** thread into the barrel nuts **80** and mate with the countersunk holes **91** in magnet **90**. Only one magnet is shown in this figure, however 2-6 magnets will be installed on rail **70** for the various lengths described in description of FIG. **23**. After magnets **90** are installed with corresponding barrel nuts **80** and bolts **82**, Light Emitting Diode (LED) ribbon **100** can be installed on the rail face **72** and over the flush mounted barrel nut heads **81** via adhesive backing which is standard for most LED ribbon **100** (shown in more detail in Z-FIG. **11**A)

FIG. **33**A shows rail face **72** of the aluminum rail **70** with end cap B **130** attached. LED ribbon **100** can be seen adhered to the rail face **72** over the barrel nut heads **81** which mount the magnet **90** to the rail **70**. Bridge wires **110** (represented by arrows) solder to contact pins **220** and solder to corresponding solder pads **102** of the LED ribbon **100**. Diodes **101**, when electrified by the bridge wires **110**, emit light from the rail face **72** illuminating the tube housing **40** (not shown).

FIG. **33**B is a view of A side of the aluminum rail **70** installed into the tube housing **40** with the tube shelf **42** mating with the rail channel **77** and rail wing **74**. End cap a **10** and end cap B **130** are removed for illustration purposes. Magnet **90**, which is secured to the rail in between the rail wings **74**, clears just under the interior face of the tube housing **40** flat spine **41** when installed with rail **70**. LED ribbon **100** is shown adhered to the rail face **72** facing downward.

FIG. **33**C is the same view as FIG. **33**B. However, the curved and connected radial lines diagrams illustrate the angle of light emissions from the tube when LED **100** is illuminated. The properties of the tube housing **40**, allows light to pass through while also being diffused in the process. Tube housing **40** and its relation to the aluminum rail **70** creates 240 degrees of illuminated circumference of tube housing **40**. This creates a better illusion of a true fluorescent lamp. This is accomplished by the lower surface of the rail being above the height midpoint of said tube housing (in FIG. **33**C this is the solid horizontal line passing through the height midpoint of the tube housing). Said another way the lower surface of the rail is above the central circumferential axis. As the tube housing is translucent, this allows for light emitted from said LED ribbon attached to the rail to pass

through the translucent housing to illuminate approximately 240 degrees of the housing's circumference.

FIG. **34**A is a partial view of all the components on the A side of apparatus **10**A showing the connections made when installing end cap A **10**. (Please note during actual installation, rail **70** will already be fixed to end cap B **130** via rail mount screws **35** and will not be protruding as shown, this is for illustration purposes) This figure shows the detail of the tube rail shelf **42** mating with the rail channel **77** and the rail wing **74** as well as the tube shelf retention slot **13** of end cap A **10**. When the tube housing **40** contacts end cap A **10**'s interior edge face **140** (shown in FIG. **28**A) the tube rail shelf **42** seats with the tube shelf retention slot **13**.

FIG. **34** B is a similar view to FIG. **34**A but showing the B side of the apparatus **10**A connections, detailing the tube rail shelf **42**, mated with the rail channel **77** and the rail wing **74**. The arrow shows the path of travel for the tube housing **40** to connect with end cap B **130**. When tube housing **40** contacts to the interior edge face **140** of end cap B **130** (shown in FIG. **28**B) the tube rail shelf **42** mates with the tube shelf retention slot B **138** of end cap **130**.

The process described in FIG. **34**B is the first step in reassembly by the technician of apparatus **3**. The tube housing **40** would seat with the end cap B **130**, then the tube mounting screw **30** would be installed via countersunk mounting hole **43** joining all components of side B. The technician would then install end cap A **10** and install the tube mounting screw **30** joining all components of side A.

FIGS. **35** through **43** are dimensions of the apparatus **10**A components in their current embodiments. These dimensions are exemplary only and should not be considered exclusive or limiting.

FIG. **35** details the dimensions of end cap A **10**.

FIG. **36** details the dimensions of end cap B **130**.

FIG. **37** details the dimensions of the tube screw retention block **50**.

FIG. **38** details the dimensions of the contact pin retention housing **210**.

FIG. **39** details the dimensions of the tube housing **40**. Blue line is a measurement reference for the distance between the flat spine **41** and the tube rail shelves **42**.

FIG. **40** details the dimensions of the aluminum rail **70** and magnet **90**.

FIG. **41** details the dimensions of the contact pins **220**.

FIG. **42** details the dimensions of the female phoenix connector **200**.

FIG. **43** detail the dimensions of screws (**30**, **35**) inserts (**20**, **21**) barrel nuts **80**, and barrel bolt **82**.

Advantages and Features

Advantages and features of this system include many.

This system solves a few of the main issues discussed in previous articles of the known prior art while taking certain features and combining them into an easy to use, easy to rig as well as be good looking enough to pass for a real fluorescent tube on camera.

Apparatus **10** and **10**A is designed to look like a standard fluorescent tube and intended to be seen on camera with similar size and shape as the real thing. They mount into existing fluorescent fixtures seamlessly.

Magnetic attachments allow the user to click the tube into existing metal housing without the need for installing damaging mounting hardware.

Apparatus **10** and **10**A are light weight; a complete configuration can be just over 1 lbs. Whereas most others on the market are much heavier due to onboard batteries.

If an enclosed fixture housing is not metal or magnetic, apparatus **10** and **10**A will fit standard rigging hardware used by other products on the market.

Both apparatus **10** and **10**A allow for repeatable and customizable control wire connection and removal via the gated port terminals of apparatus **10** or via the industry standard phoenix connection in apparatus **10**A

Both apparatuses **10** and **10**A allow a DMX Control module and power supply to be separated from the apparatus yet connected by control wire. This reduces the chances of failure due to overheating and wireless connectivity issues when enclosed in overhead fixtures compared to prior systems having such elements enclosed in the tube housing. Also, these control systems can be mounted on or near the ground allowing for easy accessibility for trouble shooting versus being mounting in the air.

Apparatuses **10** and **10**A are serviceable by the technician or user. Unscrewing the tube mounting screws, removing the endcaps, and removing the rail quickly allows the user to gain access to the LED ribbon inside, for any maintenance or customization needs.

Apparatuses **10** and **10**A have a wide degree of illumination at 240 degrees. While prior technology typically only achieves 180 degrees. (See FIG. **33**C)

Apparatuses **10** and **10**A are customizable allowing multiple manufacturers of LED ribbon to be installed.

Variations

Various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention.

For example, the number of contact pins of apparatus '**10**A, within the phoenix receptacle, could be altered relative to the remainder of the apparatus, to allow more, or less control wires as demand changes. FIGS. **23**-**43** show 6 contact pins, one for power and 5 for corresponding colors or channels. Red, Green, Blue, Tungsten, and Daylight are currently standard. However new ribbon colors are invented all the time which could add channels and therefore add contact points. **7** ports could be needing in future embodiments.

Terminal block channels in apparatus **10** vary in the same manner. FIGS. **1**-**22** only feature **3** channels, where up to 7 channel ports could be included.

Pixel ribbon is another example where only 3-5 contacts are needed. One for power, one for data, and a negative are standard in this configuration, sometimes an additional contact for clock is used or two data contacts for redundancy. This ribbon is also directional, meaning one end cap will be an input with data and power running through the tube and needing an out point, which then will connect to the next tube via its input. This creates the need for both end caps to have a phoenix receptacle, one for input and one being the output. This would allow the tubes to be daisy chained together.

Length variations have been discussed for typical fluorescent tube sizes, however fluorescent desk lamp sizes could be created which would still be covered as variations of the same apparatus.

Variations to tube materials could be made, currently the polycarbonate material is best choice for strength, transparency, and durability. However, should the need arise to change it for better light transmission, longevity etc. doing so should not change the mechanics of the design.

CONCLUSION

Other various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention.

From the foregoing, it will be seen that this invention is one well adapted to obtain all the ends and objects herein set forth, together with other advantages which are obvious, and which are inherent to the method and structure.

It will be understood that certain features and sub combinations are of utility and may be employed without reference to other features and sub combinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention claimed is:

1. A film lighting apparatus simulating the appearance of a fluorescent tube and configured to be attached relative to an overhead member having a downwardly facing flat horizontal surface being attracted to a magnet, said lighting apparatus configured for selective electrical connection with an external electrical power supply and with at least one external control module, said lighting apparatus itself comprising:

A) an elongate generally tubular housing, said housing defining an elongate internal cavity and at least one end opening, and having an elongate tubular housing portion being comprised of a surrounding wall surrounding said elongate internal cavity, said surrounding wall having a substantially consistent wall thickness;

B) an elongate internal rail configured to detachably fit within said elongate internal cavity of said tubular housing, said internal rail including an upwardly facing portion and an opposing, downwardly facing portion;

C) at least one light source configured to be attached relative to said downwardly facing portion of said internal rail;

D) at least one magnet including an upwardly facing portion and an opposing, downwardly facing portion, said downwardly facing portion of said magnet configured to be attached relative to said upwardly facing portion of said internal rail;

E) at least one detachable end cap configured to fit within said end opening of said tubular housing, said end cap including internally and externally facing terminal connection ports, said externally facing ports configured for selective electrical connection with said external electrical power supply and at least said one control module; and

F) an internal wiring assembly configured to fit within said elongate internal cavity of said tubular housing, said wiring assembly providing electrical connection between said internally facing terminal connection ports of said detachable end cap and said light source,

such that an electrical connection is provided between said external power supply and said light source, and such that a connection is provided between said external control module and said light source so as to allow for external control of color or brightness or lighting effects of said lighting source,

such that said magnet attracts said overhead member sufficient to cause said film lighting apparatus to be detachably fixed relative to said overhead member.

2. The film lighting apparatus as claimed in claim **1**, wherein said magnet is a first magnet, and further comprising a second magnet attached relative to said upwardly facing portion of said internal rail, such that said first and second magnets provide the primary means of connecting said film lighting apparatus to said overhead member.

3. The film lighting apparatus as claimed in claim **1**, wherein said externally facing terminal connection ports in said end cap are provided at least in part by a Phoenix connector.

4. The film lighting apparatus as claimed in claim **1**, wherein said internal rail is metal, and provides a heat sink for heat generated by said light source.

5. The film lighting apparatus as claimed in claim **1**, wherein said detachable end cap is a first detachable end cap, wherein said end opening is a first end opening, and further comprising a second detachable end cap configured to fit within a second end opening of said tubular housing, said second end opening facing opposite to said first end opening.

6. The film lighting apparatus as claimed in claim **1**, wherein said internal rail has elongate opposing long sides which fit within corresponding cofacing channels defined by said tubular housing, such that a sliding and guiding action is provided by said cofacing channels to said opposing long sides, such that said internal rail may slide in and out of place during installation and removal, respectively, while being guided by said cofacing channels.

7. The film lighting apparatus as claimed in claim **1**, wherein said tubular housing is comprised of a generally tubular plastic having translucent properties through its walls to provide a diffusion of light from said light source when passing therethrough.

8. The film lighting apparatus as claimed in claim **1**, wherein said light source is an LED ribbon.

9. The film lighting apparatus as claimed in claim **8**, wherein said downwardly facing portion of said rail is above a height midpoint of said tubular housing, and above a central circumferential axis, and wherein said tubular housing is translucent, thus allowing for light emitted from said LED ribbon attached to said rail to pass through said translucent housing to illuminate approximately 240 degrees of said housing's circumference.

10. A film lighting apparatus simulating the appearance of a fluorescent tube and configured to be attached relative to an overhead member having a downwardly facing flat horizontal surface being attracted to a magnet, said lighting apparatus configured for selective electrical connection with an external electrical power supply and with at least one external control module, said lighting apparatus itself comprising:

A) an elongate generally tubular housing, said housing defining an elongate internal cavity and at least one end opening, and having a surrounding wall surrounding said elongate internal cavity, said surrounding wall having a substantially consistent wall thickness, said surrounding wall defining a cylindrical shape with the exception of a flat wall section in its otherwise tubular cylindrical wall shape, said flat section having parallel outer and inner wall surfaces, each of said flat section outer and inner wall surfaces lying in a plane being generally parallel to each other and with said longitudinal axis of said elongate generally tubular housing;

B) an elongate internal rail configured to detachably fit within said elongate internal cavity of said tubular housing, said internal rail including an upwardly facing portion and an opposing, downwardly facing portion;

C) at least one light source configured to be attached relative to said downwardly facing portion of said internal rail;

D) at least one magnet including an upwardly facing portion and an opposing, downwardly facing portion, said downwardly facing portion of said magnet configured to be attached relative to said upwardly facing

portion of said internal rail such that said upwardly facing portion of said magnet is in substantial contact with said inner wall surface of said flat wall section of said tubular housing;

E) at least one detachable end cap configured to fit within said end opening of said tubular housing, said end cap including internally and externally facing terminal connection ports, said externally facing ports configured for selective electrical connection with said external electrical power supply and at least said one control module; and

F) an internal wiring assembly configured to fit within said elongate internal cavity of said tubular housing, said wiring assembly providing electrical connection between said internally facing terminal connection ports of said detachable end cap and said light source,

such that an electrical connection is provided between said external power supply and said light source, and such that a connection is provided between said external control module and said light source so as to allow for external control of color or brightness or lighting effects of said lighting source,

such that said magnet attracts said overhead member sufficient to cause said film lighting apparatus to be detachably fixed relative to said overhead member with said magnet urging said flat section of said tubular housing into planar contact with and against said downwardly facing flat horizontal surface of said overhead member.

11. The film lighting apparatus as claimed in claim **10**, wherein said magnet is a first magnet, and further comprising a second magnet attached relative to said upwardly facing portion of said internal rail, such that said first and second magnets provide the primary means of connecting said film lighting apparatus to said overhead member.

12. The film lighting apparatus as claimed in claim **10**, wherein said externally facing terminal connection ports in said end cap are provided at least in part by a Phoenix connector.

13. The film lighting apparatus as claimed in claim **10**, wherein said internal rail is metal, and provides a heat sink for heat generated by said light source.

14. The film lighting apparatus as claimed in claim **10**, wherein said detachable end cap is a first detachable end cap, wherein said end opening is a first end opening, and further comprising a second detachable end cap configured to fit within a second end opening of said tubular housing, said second end opening facing opposite to said first end opening.

15. The film lighting apparatus as claimed in claim **10**, wherein said internal rail has elongate opposing long sides which fit within corresponding cofacing channels defined by said tubular housing, such that a sliding and guiding action is provided by said cofacing channels to said opposing long sides, such that said internal rail may slide in and out of place during installation and removal, respectively, while being guided by said cofacing channels.

16. The film lighting apparatus as claimed in claim **10**, wherein said tubular housing is comprised of a generally tubular plastic having translucent properties through its walls to provide a diffusion of light from said light source when passing therethrough.

17. The film lighting apparatus as claimed in claim **10**, wherein said light source is an LED ribbon.

18. The film lighting apparatus as claimed in claim **17**, wherein said downwardly facing portion of said rail is above a height midpoint of said tubular housing, and above a central circumferential axis, and wherein said tubular housing is translucent, thus allowing for light emitted from said LED ribbon attached to said rail to pass through said translucent housing to illuminate approximately 240 degrees of said housing's circumference.

19. A method of replacing a light source in a film lighting apparatus simulating the appearance of a fluorescent tube and configured to be attached relative to an overhead member having a downwardly facing flat horizontal surface being attracted to a magnet, said apparatus configured for selective electrical connection with an external electrical power supply and with at least one external control module, said method including the following steps:

A) providing a lighting apparatus itself comprising:

1) An elongate generally tubular housing, said housing defining an elongate internal cavity and at least one end opening, and having a tubular housing portion being comprised of a surrounding wall surrounding said elongate internal cavity, said surrounding wall having a substantially consistent wall thickness;

2) An elongate internal rail configured to detachably fit within said elongate internal cavity of said tubular housing, said internal rail including an upwardly facing portion and an opposing, downwardly facing portion;

3) At least one first light source configured to be attached relative to said downwardly facing portion of said internal rail;

4) At least one magnet including an upwardly facing portion and an opposing, downwardly facing portion, said downwardly facing portion of said magnet configured to be attached relative to said upwardly facing portion of said internal rail;

5) At least one detachable end cap configured to fit within said end opening of said tubular housing, said end cap including internally and externally facing terminal connection ports, said externally facing ports configured for selective electrical connection with said external electrical power supply and at least said one control module; and

6) An internal wiring assembly configured to fit within said elongate internal cavity of said tubular housing, said wiring assembly providing electrical connection between said internally facing terminal connection ports of said detachable end cap and said light source,

such that an electrical connection is provided between said external power supply and said light source, and such that a connection is provided between said external control module and said light source so as to allow for external control of color or brightness or lighting effects of said lighting source,

such that said magnet attracts said overhead member sufficient to cause said film lighting apparatus to be detachably fixed relative to said overhead member; and

B) replacing said first light source by performing the following sub-steps:

1) Detaching said selective electrical connection between said externally facing ports of said end cap and said external electrical power supply and said at least one control module;

2) Removing said end cap from said elongate generally tubular housing;

3) Removing said elongate internal rail by sliding it out of place from within said elongate internal cavity of said tubular housing;

4) Detaching said first light source from said downwardly facing portion of said internal rail;

5) Attaching a second light source to said downwardly facing portion of said internal rail;

6) Replacing said elongate internal rail by sliding it into place from within said elongate internal cavity of said tubular housing;

7) Replacing said end cap on said elongate generally tubular housing; and

8) reattaching said selective electrical connection between said externally facing ports of said end cap and said external electrical power supply and said at least one control module.

20. The method as claimed in claim **19**, wherein said light source is an LED ribbon.

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