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(54) **ANGLED MOUNTING ASSEMBLY FOR AN LED CLUSTER**

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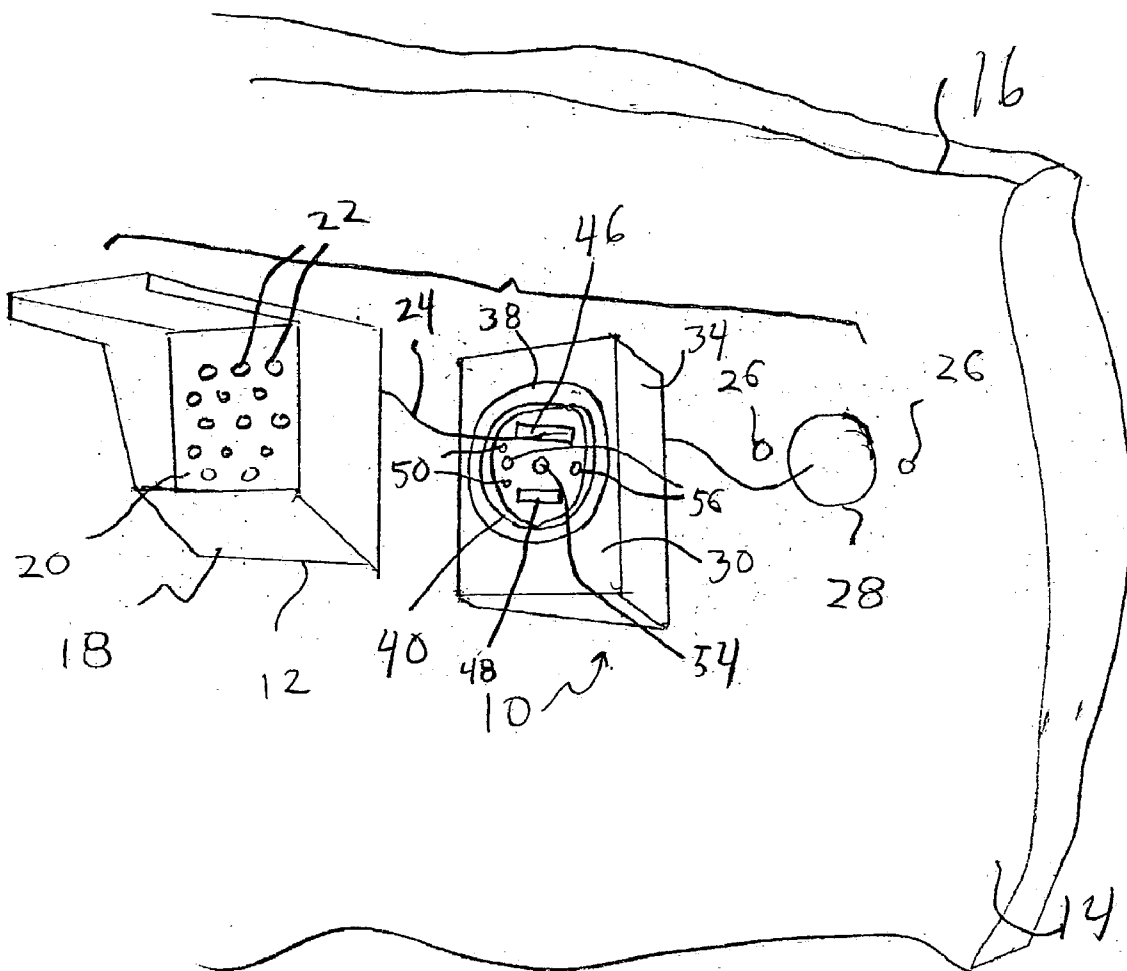
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(57) **ABSTRACT**

An assembly is provided for mounting an LED cluster to the front panel of an electronic sign cabinet. The assembly includes a forward section for connecting to and supporting the housing of the LED cluster. A rearward section is connected to the forward section and is selectively attachable to the sign such that an inner face of the rearward section is substantially flushly interengaged with the front panel of the sign. The forward and rearward sections include at least one conduit for communicating with corresponding openings in the cluster housing and the sign. The conduit accommodates wiring of the LED cluster. The forward and rearward sections are angularly oriented relative to one another such that when the forward section is connected to the cluster housing and the rearward section is connected to the sign, each pixel of the LED cluster is directed along an axis that extends at an acute angle relative to the front panel of the sign.



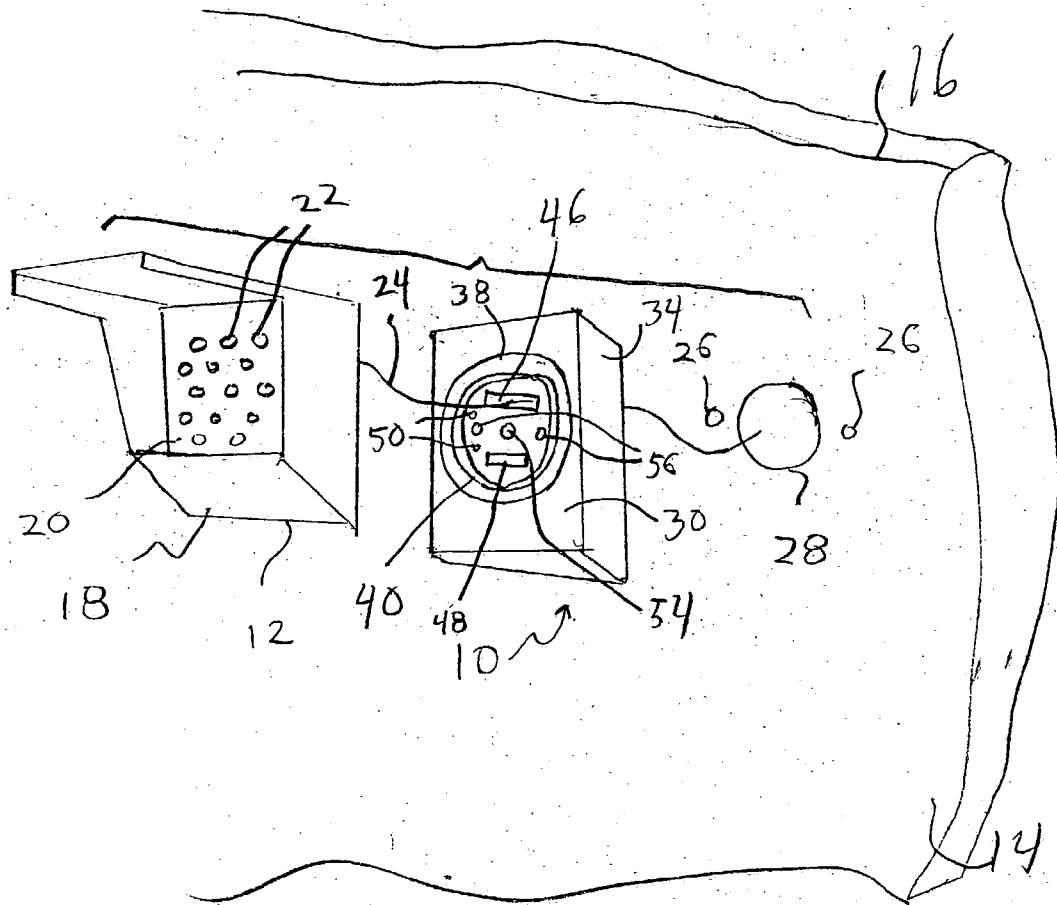
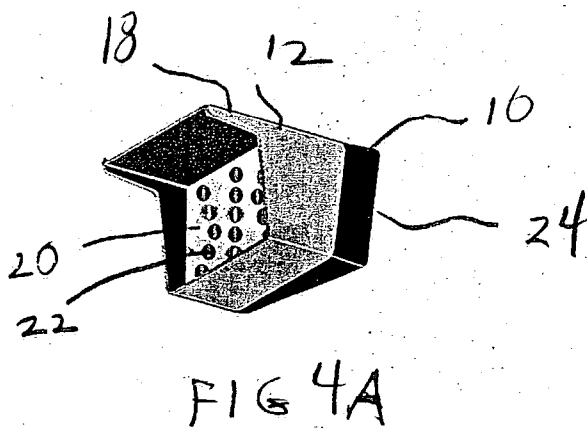
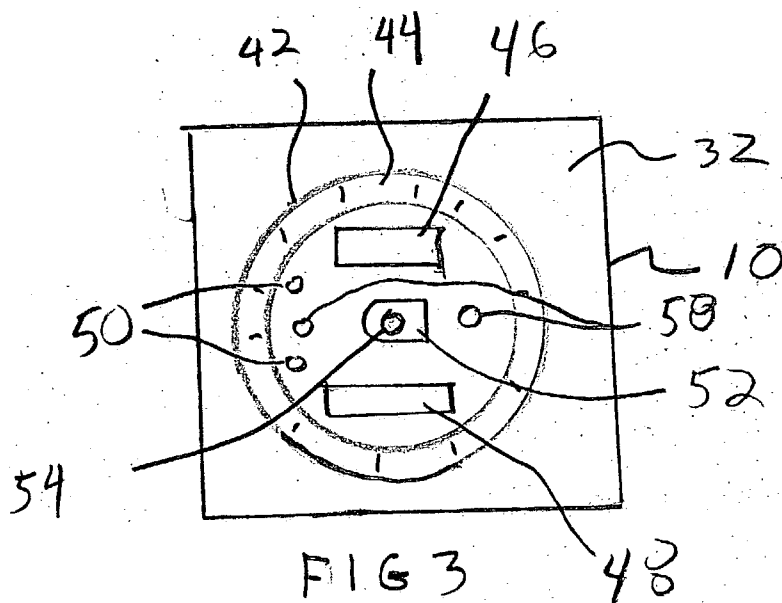
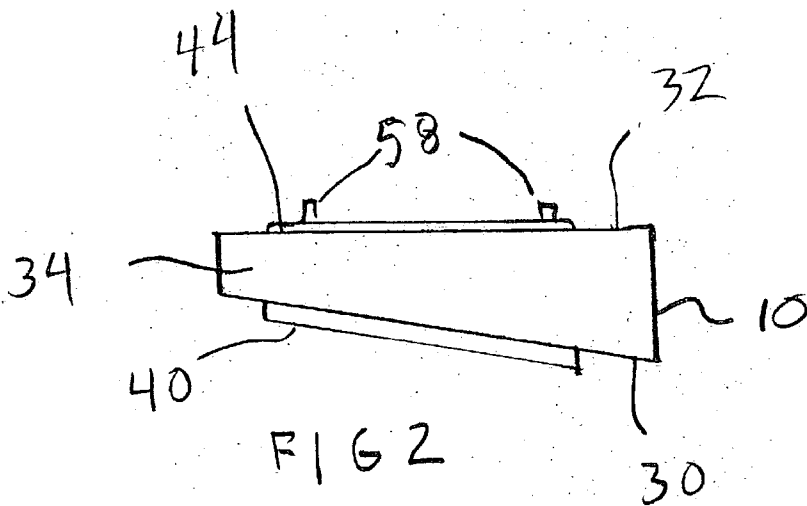


FIG 1



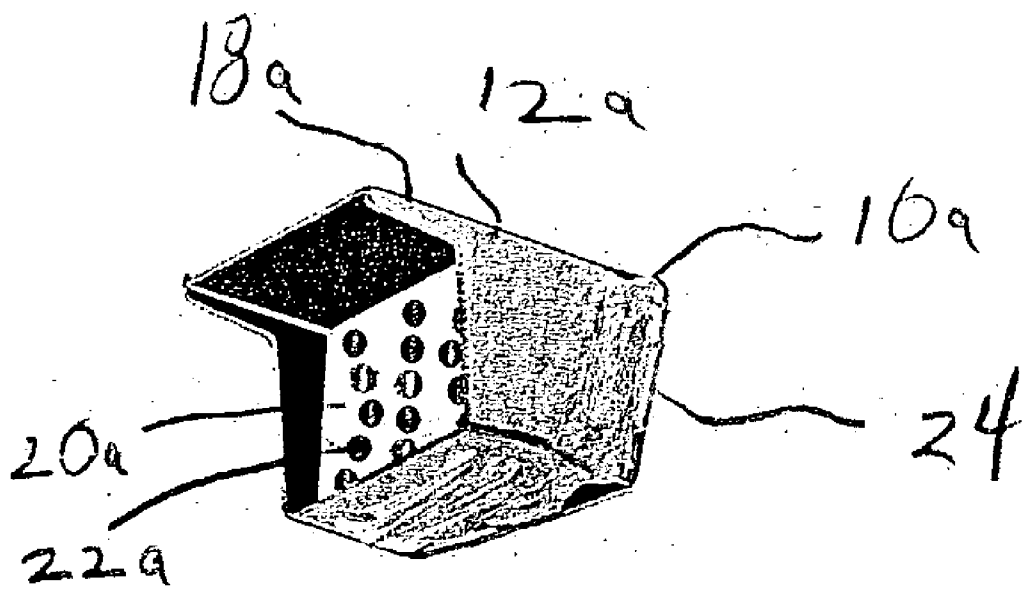
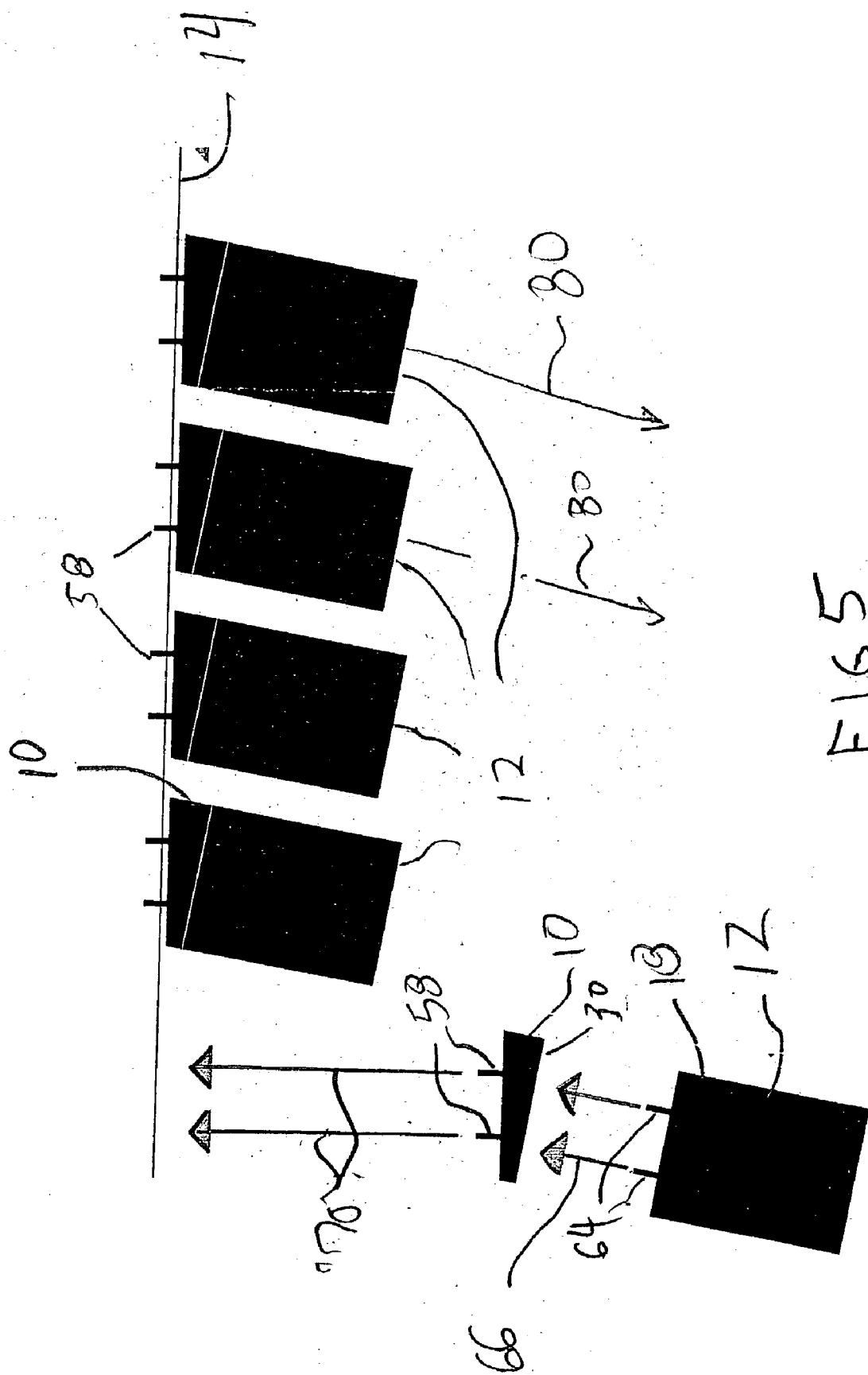


FIG 4B



F165

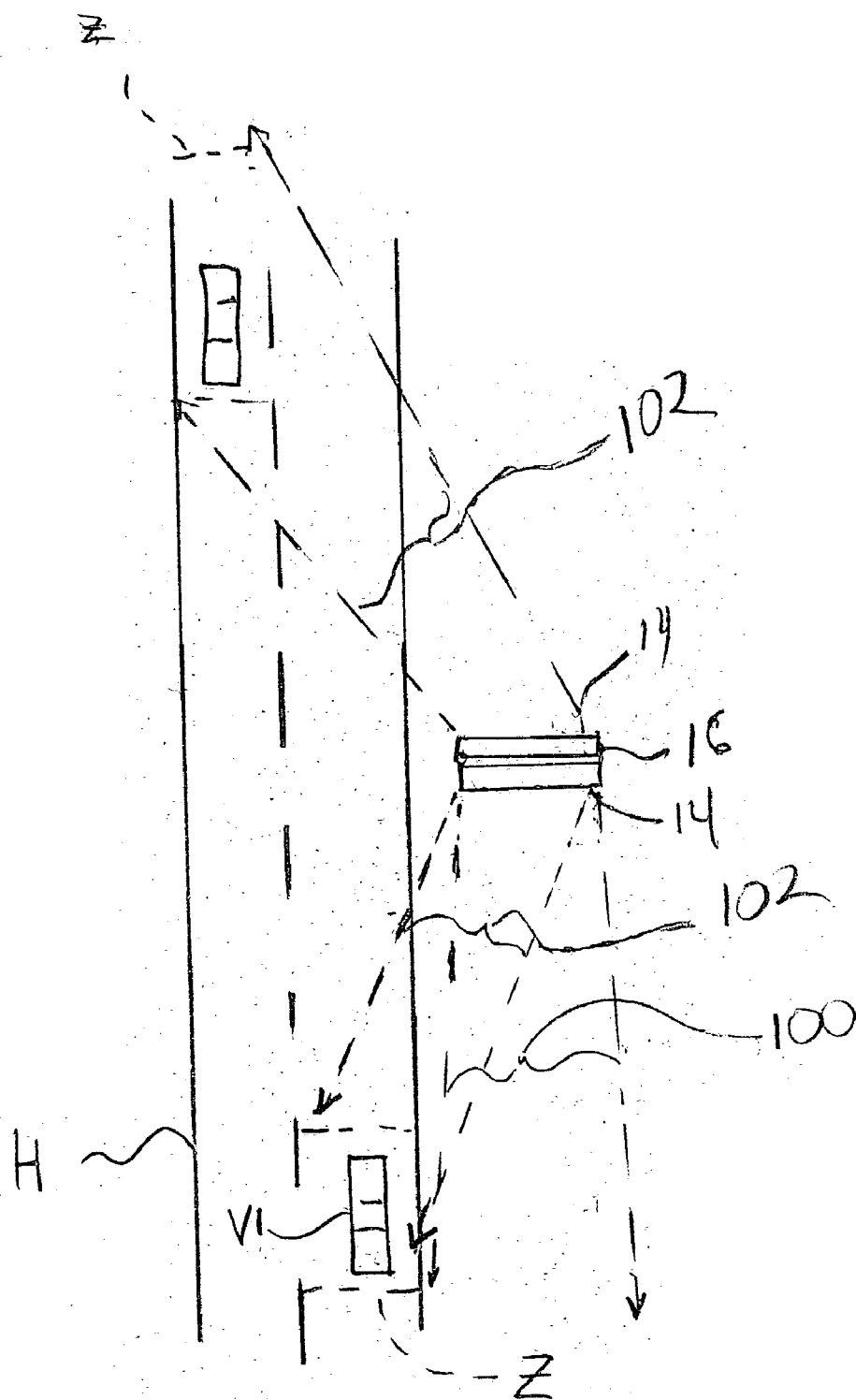


FIG 6

ANGLED MOUNTING ASSEMBLY FOR AN LED CLUSTER

FIELD OF THE INVENTION

[0001] This invention relates to an angled mounting assembly for an LED cluster and, in particular, to an assembly for operably mounting an LED cluster and associated wiring to the cabinet of an electronic sign or message board such that the LED pixels are directed at an acute angle relative to the front panel of the sign.

BACKGROUND OF THE INVENTION

[0002] Illuminated display signs are presently in wide-spread use. Examples of such products include highway and roadway signs, stadium message boards, commercial signage and advertising billboards. Illuminated signs typically employ text and/or graphics.

[0003] Traditionally, illuminated signs utilized incandescent bulbs. More recently however, this type of signage has been replaced in many cases by electronic signs and displays. Such products require significantly less energy and are far less costly to operate than incandescently illuminated signage. For example, a display sign which costs \$1,000 per month to operate using incandescent lighting may cost only about \$40 per month if LED (light emitting diode) bulbs are substituted. LED bulbs also tend to burn out and require replacement far less frequently than incandescent lights.

[0004] Most known electronic signs utilize a plurality of electronically controlled LED clusters. Each cluster features a plurality of LED pixels mounted in a cluster housing. The housing is fastened to a generally front panel of the sign's cabinet. The pixels are interconnected to the electronic controls by appropriate wiring that is connected to the cluster through an opening at the front panel of the panel. Electronic signs and message boards of this type are presently used in many varied applications by federal, state and municipal governments, as well as by private businesses.

[0005] Although they are fairly cost efficient to operate, known electronic signs, displays and message boards exhibit certain shortcomings. Quite often, the existing cabinet of an incandescent sign is retrofitted to accommodate multiple LED clusters. This presents a particular problem for existing roadside signs, which are often oriented so that the front panel of the cabinet is substantially perpendicular to the direction of the roadway. When a conventional LED cluster is mounted to such a cabinet, the LED pixels extend outwardly in a generally straight or perpendicular direction from the front panel of the cabinet. As a result, the light is projected from the electronic sign in a fairly narrow conical pattern that generally parallels the roadway. Such signs tend to provide oncoming drivers with a relatively narrow and optically inferior viewing angle. The driver may have only a relatively short distance and period of time to adequately view and read the sign. Optimal viewing is achieved only when the driver views the LED clusters more or less directly. However, because the conventional LED clusters are directed more or less parallel to the highway, it becomes difficult, if not impossible, for the driver to obtain a direct view of the sign, particularly as he or she approaches the sign and arrives at a convenient viewing distance (e.g. 2-3 blocks from the illuminated sign). At this point, the LED

clusters usually must be observed peripherally and an inadequate viewing quality is provided.

[0006] The foregoing problem is further complicated because governmental rules and regulations often prevent the electronic sign from being angled toward the roadway or otherwise modified to provide drivers with a more direct view of the LED clusters. Even where retrofitting of the existing cabinet is permitted, many jurisdictions prohibit reconstruction or reconfiguration of the cabinet. In other situations, it is either logistically, structurally or economically infeasible to modify or otherwise reposition the sign to provide more direct and optically effective viewing. Even where structural modifications are permitted, it can be unduly complex and expensive to reposition an existing cabinet or to install an entirely new sign. LED clusters that provide wider viewing angles are currently available. However, such products tend to provide for rather poor viewing quality when observed from straight ahead. A significant need exists for a less expensive and yet more optically effective means for installing electronic signs and for retrofitting existing signage to accommodate LED clusters.

SUMMARY OF THE INVENTION

[0007] It is therefore an object of the present invention to provide an assembly for mounting an LED cluster to an electronic sign so that the cluster may be positioned on the sign as needed to provide for more direct and thereby significantly improved viewing as the sign is approached at a convenient distance.

[0008] It is a further object of the invention to provide an assembly for quickly and conveniently mounting LED clusters to an electronic sign cabinet and orienting such clusters at a selected angle to provide for improved optical quality and more effective viewing of the sign.

[0009] It is the further object of this invention to provide an assembly for mounting LED clusters to an electronic sign in an angled manner so that an ideal view is achieved at a preferred, predetermined distance from the sign.

[0010] It is the further object of this invention to provide an assembly for quickly and conveniently retrofitting existing illuminated sign cabinets with LED clusters.

[0011] It is the further object of this invention to provide an assembly for mounting LED clusters to existing incandescent sign cabinets, which permits such cabinets to be effectively retrofitted according to applicable governmental rules and regulations.

[0012] It is the further object of this invention to provide an assembly which permits LED clusters to be quickly and conveniently replaced as required on the panel of an illuminated display sign.

[0013] It is the further object of this invention to provide an assembly for mounting LED clusters in an electronic sign, which may be used in virtually all electronic signage applications.

[0014] It is the further object of this invention to provide a mounting assembly for an LED cluster, which may be utilized effectively to provide an angled LED orientation in either a new electronic sign or in a retrofit sign cabinet.

[0015] This invention results from a realization that improved viewing of an electronic sign may be achieved by

angling the LED clusters relative to the sign cabinet as needed to improve the optical quality of the sign as the viewer approaches the sign. This invention features an assembly for mounting an LED cluster to the front panel of an electronic sign cabinet. The LED cluster, which is known, includes a housing that supports a plurality of LED pixels directed outwardly from a forward face of the housing along respective axes substantially perpendicular to the forward face and one or more associated conductors (wires) electrically connected to the pixels. The mounting assembly includes a forward section for connecting to and supporting the cluster housing. There is a rearward section connected to the forward section. The rearward section is selectively attachable to the sign such that an inner face of the rearward section is substantially flushly interengaged with the front panel of the sign cabinet. The forward and rearward sections include at least one conduit for communicating with corresponding openings in the cluster housing and the sign cabinet and for accommodating the one or more associated conductors of the pixels. The forward and rearward sections are angularly oriented relative to one another, such that when the forward section is connected to the cluster housing and the rearward section is connected to the sign cabinet, each LED pixel is directed along an axis that extends at an acute angle relative to the front panel of the sign.

[0016] In a preferred embodiment, the forward section includes an outer face that is flushly interengagable with a rearward face of the cluster housing. The outer face may include a connector that is selectively interengagable with a complementary connector carried by the rearward face of the cluster housing to attach the forward section to the cluster housing. The connector and the complementary connector may include at least one interengagable pin and receptacle. The forward section may include a threaded hole that is alignable with a corresponding threaded hole in the cluster housing for receiving a threaded component to attach the forward section to the cluster housing. Alternatively, the forward section may be permanently and unitarily attached to the cluster housing.

[0017] The outer face of the forward section may be oriented at an acute angle relative to the inner face of the rearward section, which angle may correspond to the angle between the axis along which each pixel is directed and the front panel of the sign cabinet. A sealing component may be interposed between the interengaged inner face of the rearward section and front panel of the sign cabinet. A recess may be formed in the inner face for receiving the sealing component. The inner face may include a connector that is selectively engagable with a corresponding connector carried by the front panel of the sign to connect the rearward section to the sign. The connector and the complementary connector may again include at least one interengagable pin and receptacle. Typically, the acute angle is at least 1 and not greater than 45°.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0018] Other objects, features and advantages will occur from the following description of a preferred embodiment and the accompanying drawings, in which:

[0019] **FIG. 1** a perspective view of a preferred mounting assembly in accordance with this invention, which is inter-

posed between a respective LED cluster and a corresponding opening in the front panel of an illuminated electronic sign cabinet;

[0020] **FIG. 2** is a top plan view of the mounting assembly of **FIG. 1**;

[0021] **FIG. 3** is a front elevational view of the mounting assembly;

[0022] **FIG. 4A** is a perspective view illustrating the mounting assembly operably interengaged with an associated LED cluster;

[0023] **FIG. 4B** is a perspective view of an LED cluster that includes a mounting assembly in accordance with this invention permanently and unnaturally interconnected to the cluster housing;

[0024] **FIG. 5** is a top, partly schematic view of a plurality of LED clusters that are mounted to the front panel of an electronic sign and oriented at a desired angle through the use of the mounting assembly of this invention; and

[0025] **FIG. 6** is a schematic view illustrating an electronic sign featuring the mounting assemblies of this invention, which orient the LED clusters of the sign to direct light at an optimal viewing angle to an adjacent roadway.

[0026] There is shown in **FIG. 1** a wedged-shaped mounting assembly or adapter **10** for supporting an LED (light emitting diode) cluster **12** on the front panel **14** of an electronic sign cabinet **16**. It should be understood that LED cluster **12** panel **14** and cabinet **16** are conventional items, which will be well-known to persons skilled in the art. In particular, cluster **12** includes a plastic housing **18** having a forward face **20** through which project a plurality of LED pixels **22**. The pixels are mounted such that they extend generally perpendicularly outwardly from front face **20**. Various numbers and arrangements of pixels **22** may be utilized. The pixels are electrically connected to conventional conductive wiring **24**. According to the prior art, a plurality of LED clusters **12** are mounted directly to the front panel **14** of sign cabinet **16**. In particular, the reverse side of housing **18** of LED cluster **12** (obscured in **FIG. 1**) carries a pair of mounting pins (see pins **64** in **FIG. 5**) which are received in corresponding slots or receptacles **26** (**FIG. 1**) of panel **14**. Wiring **24** extends through panel opening **28** and is connected to the electronic power source and controls of the sign in a known manner. As with the LED cluster, panel **14** and sign cabinet **16** are conventional components that are presently available in various electronic and incandescent display signs. In electronic signage applications, an appropriate electronic power source and controller are utilized to operate the LED clusters.

[0027] The present invention modifies the existing and commercially available electronic signs by utilizing a wedge-shaped adapter or mounting assembly **10**, which enables cluster **12** to be mounted to the cabinet and directed or pointed at a desired angle. Assembly **10**, which is shown alone in **FIGS. 2 and 3**, preferably features a plastic construction, which is the same or analogous to that utilized by housing **18** of LED cluster **12**. Typically, assembly **10** features a one piece molded construction. In particular, assembly **10** includes a forward section comprising a generally planar outer face **30** and an oppositely facing rearward section comprising a generally planar inner face **32**. An

intermediate body portion 34 extends unitarily between the inner and outer faces. As best shown in FIG. 2, outer and inner faces 30 and 32 are oriented at an acute angle relative to one another. This angle is preferably at least 1° and no greater than 45°. The angle is selected to position the LED cluster at a corresponding angle relative to the sign panel. This is explained and described more fully below.

[0028] Outer face 30 includes a shallow annular groove 38 (FIG. 1) that surrounds a concentric annular flange 40. As best shown in FIG. 3, the opposite, inner face 32 includes an annular recess 42 that accommodates an elastomeric “O” ring or seal 44. A plurality of openings are formed through the intermediate body portion 34 between outer face 30 and inner face 32. In particular, upper and lower rectangular openings 46 and 48 extend fully through the mounting assembly from the outer face to the inner face. Likewise, a smaller pair of circular openings 50 extend completely through the mounting assembly. Inner face 32 includes a central pocket 52. A central orifice 54 is formed in the bottom of pocket 52. As shown in FIG. 1, orifice 54 extends from the bottom of the pocket through outer face 30. The function of these openings is explained more fully below.

[0029] A pair of receptacles 56 (FIG. 1) are formed in outer face 30. Again, these receptacles are formed interiorly of annular flange 40. These openings are designed to be interengaged by the standard pins carried by the back of housing 18 of LED cluster 12 (See pins 64 in FIG. 5). This operation is likewise described more fully below.

[0030] As best shown in FIG. 3, a pair of positioning and mounting pins 58 extend unitarily from inner face 32 of mounting assembly 10. These pins are positioned to engage respective receptacles 26 (FIG. 1) in sign panel 14. This enables the mounting assembly and attached LED cluster to be properly positioned and mounted on the front panel of the electronic sign cabinet.

[0031] Wedged-shaped mounting assembly 10 is attached to LED cluster 12 in the manner best shown in FIG. 4A. Outer face 30 of assembly 10 has a configuration that generally matches the rearward profile of housing 18 of LED cluster 12. The outer face 30 of mounting assembly 10 is juxtaposed against the back surface of the LED cluster housing in the manner best shown in FIG. 5. The standard rearward extending connector pins 64 of cluster 12 are inserted, as indicated by arrows 66, into respective slots 56 of assembly 10. The mounting assembly and LED cluster are then pushed together and joined as shown in FIG. 4A. When the outer face 30 of mounting assembly 10 interengages the rearward face of LED cluster housing 18, the standard “O” ring carried by the LED cluster surrounds flange 40 and effectively seats in narrow groove 38 of outer face 30. As a result, the mounting assembly sealably interengages the rearward face of the LED cluster. Wiring 24 (FIG. 1) is disposed through one of the openings 46, 48 and 50 formed through mounting assembly 10. It should be noted that the openings formed through the mounting assembly may vary in number, size and position so that the wiring and conductor arrangements of various known LED clusters may be conveniently accommodated. Wiring 24 thereby extends outwardly from the inner surface 32 of mounting assembly 10 and is introduced into cabinet 16 through opening 28. An appropriate electrical connection is made with the electronic controls and power source of the sign in a known manner.

[0032] After mounting assembly 10 is joined to LED cluster 12 in the foregoing manner, the assembled product, shown in FIG. 4A, is attached to the front panel 14 of sign cabinet 16 in the manner best shown in FIG. 5. Specifically, the rearwardly extending pins 58 are engaged in the direction of arrows 70 against the front panel 14. The inwardly extending pins 58 of each other assembly 10 are similarly inserted into respective mounting/positioning slots 26 (FIG. 1) formed in front panel 14 of sign 16. When the inner surface 32 of mounting assembly 10 is engaged against panel 14, “O” ring 44 sealably interengages the front panel. This prevents moisture and heat from the sign from entering the cabinet and interfering with operation of the sign. As shown in FIG. 5, an array of any number of LED clusters 12 are secured in an analogous manner to the front panel of the sign. In each case, the attached mounting assembly 10 supports the LED cluster at a predetermined or selected acute angle relative to front panel 14. This angle corresponds to the previously described acute angle formed between outer face 30 and inner face 32 of assembly 10. Each LED pixel is thereby directed along a respective axis 80 that forms the selected acute angle with front panel 14 of sign 16. The LED clusters, which are connected through conductive wiring 24 to the electronic power source controls of the sign, are then operated in a known manner to provide the desired textural and/or graphic display. The LED clusters may be arranged and powered in any manner required to relay a selected message or graphic display.

[0033] Because the LED pixels direct their light along angled axes 80, the electronic sign provides for significantly improved optical viewing. This advantage is best exhibited in FIG. 6. Therein, electronic sign cabinet 16 includes a pair of opposing front panels 14 that face in opposite directions adjacent to a highway H. When LED clusters are mounted in a manner according to the prior art, a viewing cone or region 100 is generated. This provides an undesirable viewing angle as the driver approaches the sign. The sharpest, straight-ahead view of the sign is unavailable from the roadway, at least at the optimally proximate zone Z of vehicle V1 approaching the sign. Moreover, due to commonplace governmental regulations, the existing sign 16 cannot be reconfigured to angle panel 14 toward zone Z for optimal viewing. Accordingly, a significantly viewing angle is achieved by utilizing the mounting assembly described above. Assemblies 10 angle and redirect the LED pixels so that they project the light through optimal viewing regions 102 in opposing directions along the roadway. The angle at which the light is redirected may be adjusted by selecting mounting assemblies having a corresponding acute angle so that the optimal viewing region 102 is entered by a driver within a reasonable and convenient distance from sign 16 (i.e. within zone Z). The angle can be selected as needed for any particular application and highway environment. The range of angles may vary from at least 1° to preferable not greater than 45°. It has been determined that this provides for optimal viewing characteristics at a distance of about 2-3 city blocks from the sign. At the same time, the structure and orientation of underlying sign cabinet 16 and panels 14 do not have to be altered.

[0034] In the alternative embodiment of this invention shown in FIG. 4B, a wedge-shaped mounting assembly is formed integrally and unitarily with housing 18a of LED cluster 12a. In this version, the inner face of the LED cluster is simply formed at a selected acute angle relative to the

forward face **20a** of the cluster. The previously described interconnection between the mounting assembly and the housing of the LED cluster is eliminated. Instead, the housing of the LED cluster effectively includes a wedge-shaped inner or rearward section that directly engages the front panel of the cabinet in the previously described manner so that the LED pixels are supported at an acute angle. This angle is equivalent to the angle formed between the rearward face of the LED housing and the forward face of the LED cluster. The openings formed through the rearward section of LED housing **18a** (i.e. through the unitary mounting assembly **10a**) are similar or identical to those shown in the previously described embodiment. In this version, only a single seal is utilized. The rearward face of the LED housing effectively resembles the inner face of the preferred mounting assembly **10** shown in **FIG. 3**. In this embodiment, only a single sealing element is utilized. The complexity and additional structure required for releasably innerconnecting the mounting assembly to the LED housing are eliminated. This version allows selectively angled LED housings to be installed or retrofit into electronic display panels. The version of **FIGS. 1-5** allows conventional, non-angled LED clusters to be attached to the panel in an angled manner.

[0035] From the foregoing it may be seen that the apparatus of this invention provides for an assembly for mounting an LED cluster to the cabinet of an electronic sign at a selected angle. While this detailed description has set forth particularly preferred embodiments of the apparatus of this invention, numerous modifications and variations of the structure of this invention, all within the scope of the invention, will readily occur to those skilled in the art. Accordingly, it is understood that this description is illustrative only of the principles of the invention and is not limitative thereof.

[0036] Although specific features of the invention are shown in some of the drawings and not others, this is for convenience only, as each feature may be combined with any and all of the other features in accordance with this invention.

What is claimed is:

1. An assembly for mounting an LED cluster to the front panel of an electronic sign cabinet, which LED cluster includes a housing that supports a plurality of LED pixels directed outwardly from a forward face of the housing along respective axes substantially perpendicular to the forward face and one or more associated conductors electrically connected to the pixels, said mounting assembly comprising:

a forward section for connecting to and supporting the cluster housing; and

a rearward section connected to said forward section and being selectively attachable to the sign such that an inner face of said rearward section is substantially flushly interengaged with the front panel of the sign cabinet;

said forward and rearward sections including at least one conduit extending therethrough for communicating with corresponding openings in the cluster housing and the front panel of the sign cabinet and for accommodating the one or more associated conductors of the pixels, said forward and rearward sections being angularly oriented relative to one another such that when

said forward section is connected to the cluster housing and said rearward section is connected to the sign, each LED pixel is directed along axis that extends at an acute angle from the front panel of the sign cabinet.

2. The assembly of claim 1 in which said forward section includes an outer face that is flushly interengagable with a rearward face of the cluster housing.

3. The assembly of claim 2 in which said outer face includes a connector that is selectively interengagable with a complementary connector carried by the rearward face of the cluster housing to attach said forward section to the cluster housing.

4. The assembly of claim 3 in which said connector and the complementary connector comprise at least one interengagable pin and receptacle.

5. The assembly of claim 2 in which said forward section includes a threaded hole that is alignable with a corresponding threaded hole in the cluster housing for receiving a threaded component to attach said forward section to the cluster housing.

6. The assembly of claim 1 in which said forward section is permanently and unitarily attached to the cluster housing.

7. The assembly of claim 2 in which said outer face of said forward section is orientated at an acute angle relative to said inner face of said rearward section, which angle corresponds to the angle formed between the axis along which each pixel is directed and the front panel of the sign cabinet.

8. The assembly of claim 1 further including a sealing component carried by said rearward section for interposing between said inner face of said rearward section and the front panel of the sign cabinet.

9. The assembly of claim 8 further including a recess formed in said inner face for receiving said sealing component.

10. The assembly of claim 1 in which said inner face includes a connector that is selectively engagable with a complementary connector carried by the front panel of the sign cabinet to connect said rearward section to the sign.

11. The assembly of claim 10 in which said connector and the complementary connector comprise at least one interengagable pin and receptacle.

12. The assembly of claim 7 in which said acute angle is at least 1° and no greater than 45° .

13. An angled adapter assembly for mounting an LED cluster to the front panel of an electronic sign cabinet, which LED cluster includes a housing that supports a plurality of LED pixels directed outwardly from a forward face of the housing along respective axes substantially perpendicular to the forward face and one or more associated conductors electrically connected to the pixels, said angled adapter assembly comprising:

an outer face section for substantially flushly interengaging a rearward face of the cluster housing, said outer face having a connector for releasably interengaging a complementary connector carried by the rearward face of the cluster housing to attach said outer face to the cluster housing;

an inner face section that is substantially flushly interengagable with the front panel of the sign cabinet, said inner face section including a connector that is releasably interengagable with a complementary connector carried by the front panel of the sign to interconnect said inner face section to the sign; and

an intermediate section interconnecting said outer face section and said inner section and including at least one conduit extending therethrough from said outer face section to said inner face section for communicating with corresponding openings in the cluster housing and the front panel of the sign cabinet to accommodate the one or more associated conductors of the LED pixels, said outer and inner face sections being oriented angularly at an acute angle relative to one another such that when said outer face section is interengaged with the cluster housing and the inner face section is interengaged with the front panel of the sign cabinet, each LED pixel is directed along an axis that extends at said acute angle to the front panel of the sign.

14. The assembly of claim 13 in which said front face section and the cluster housing include at least one interengagable pin and receptacle for releasably connecting the outer face section to the cluster housing.

15. The assembly in claim 13 in which said inner face section and the front panel of the sign include at least one interengagable pin and receptacle for releasably connecting the inner face section to the front panel of the sign.

16. The assembly in claim 13 in which said acute angle is at least 1° and not greater than 45° .

17. The assembly of claim 13 further including a sealing component carried by said inner face section for interposing between the inner face section and the front panel of the sign cabinet when the inner face section is interengaged with the front panel.

18. The assembly of claim 16 further including a recess formed in said inner face section for receiving said sealing component.

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