

[54] **INDICATOR MODULE AND METHOD OF MANUFACTURING SAME**

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[52] U.S. Cl. **317/101 R, 317/101 F, 174/52 R**

[51] Int. Cl. **H05k 5/00**

[58] Field of Search..... 317/101 F, 101 R; 174/52 R; 340/381; 350/160; 200/307; 313/109.5

References Cited

UNITED STATES PATENTS

3,221,131	11/1965	Bury	200/307
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1,766,162	10/1969	Germany	317/101 F
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Attorney, Agent, or Firm—R. J. Steinmeyer

[57]

ABSTRACT

A gas discharge indicator module comprises a flexible strip printed circuit with a flat alphanumeric gas discharge indicator tube connected at one end, a multiple contact electrical connector fastened at the other end, and the electronic circuit components associated with the indicator tube connected to the flexible printed circuit strip between the indicator tube and the electrical connector with the appropriate circuit interconnections effected by the printed wiring. The flexible printed assembly is folded in accordian fashion with the flat indicator tube and the electrical connector at either end of the folded assembly and parallel to one another. The folded assembly is inserted into a case whereby the flat indicator tube is viewable at the front of the case and the electrical connector is disposed at the rear of the case for making electrical connection to the indicator module.

5 Claims, 3 Drawing Figures

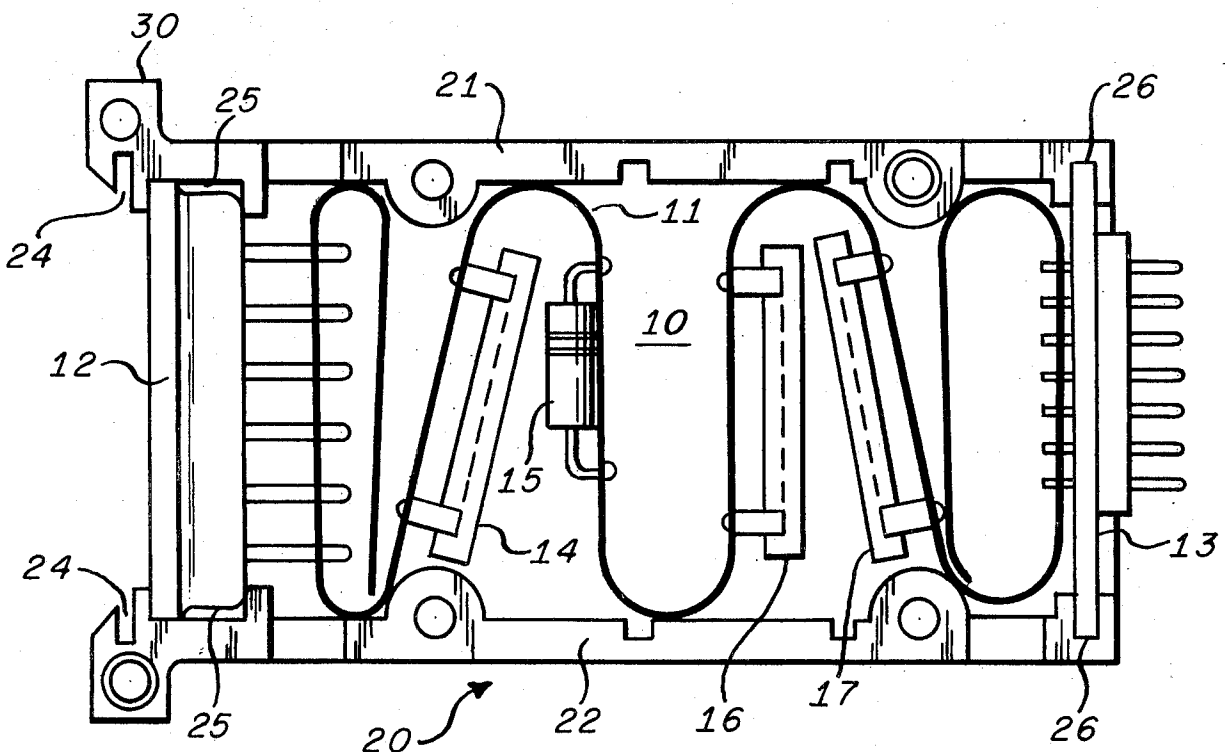


FIG. 1.

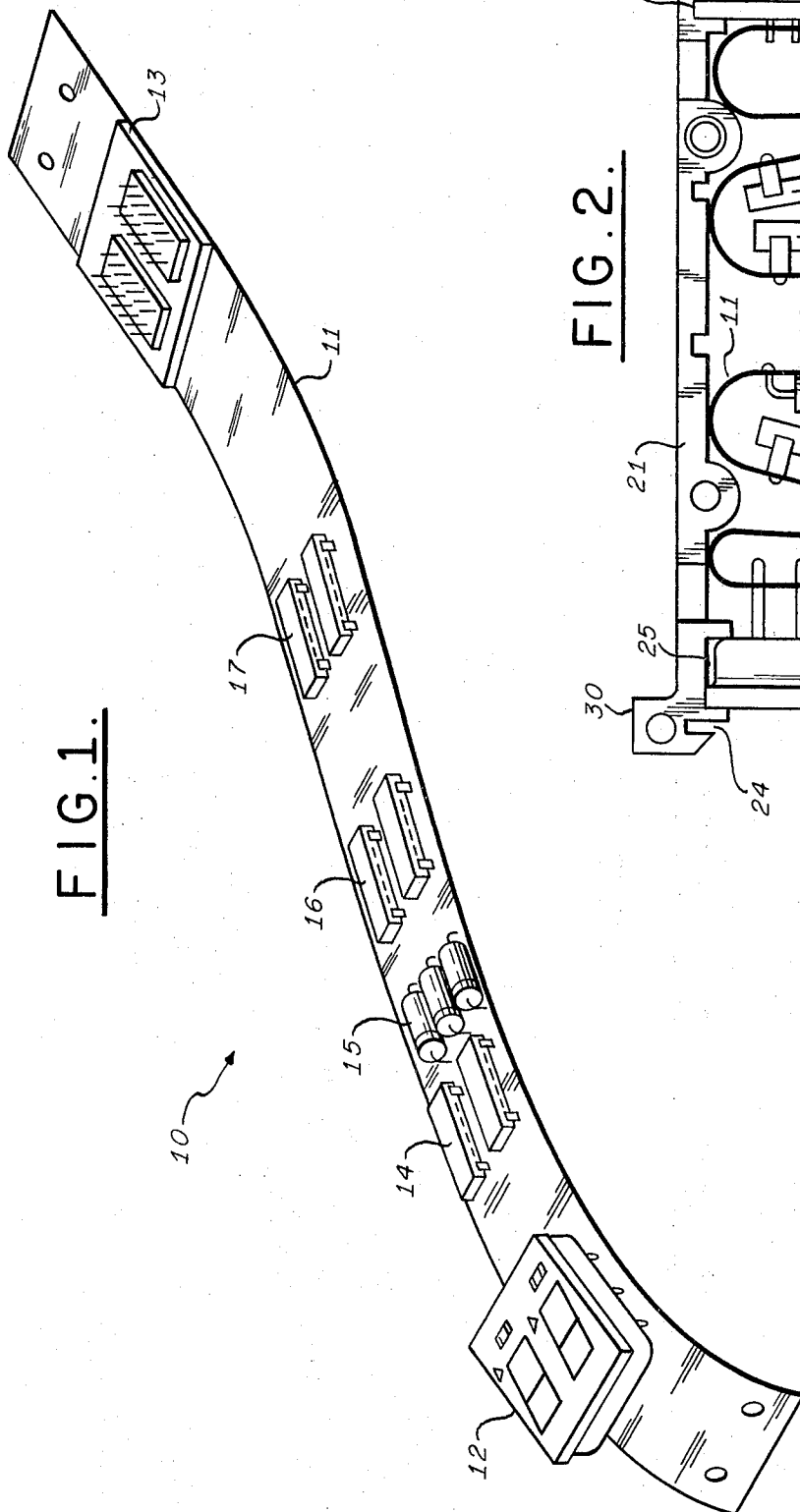
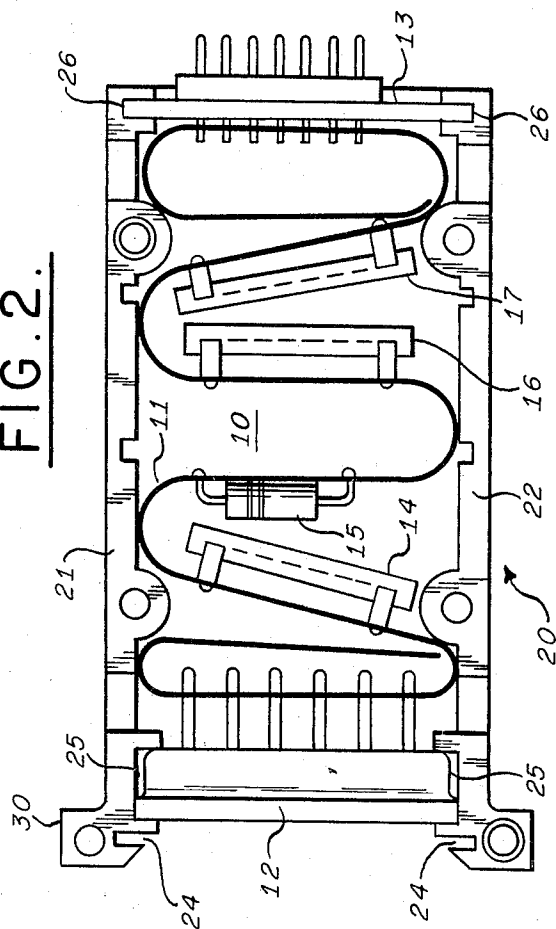


FIG. 2.



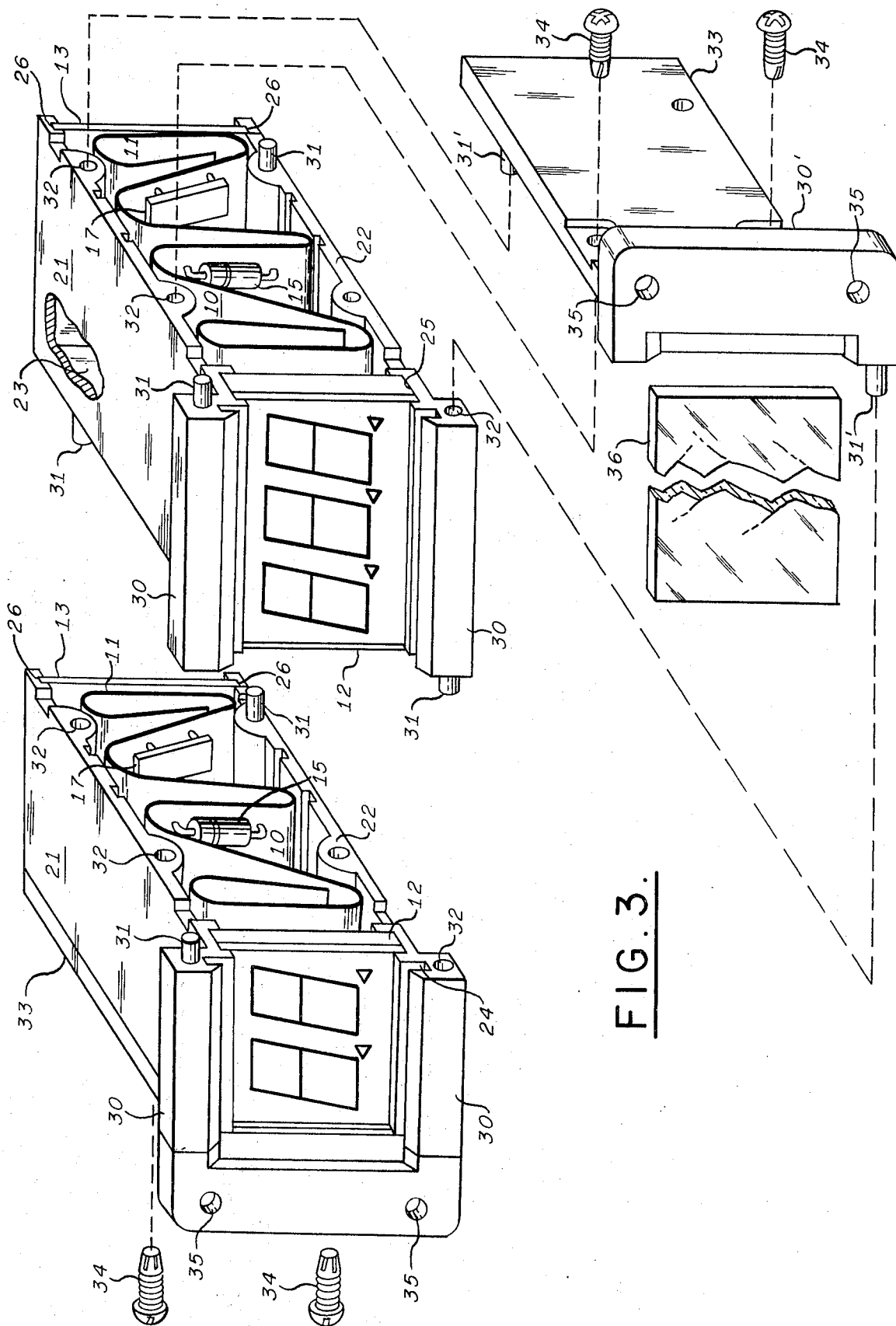


FIG. 3.

INDICATOR MODULE AND METHOD OF MANUFACTURING SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to indicator modules particularly with regard to a flat tube gas discharge indicator module.

2. Description of the Prior Art

In the prior art, alphanumeric gas discharge indicator displays were manufactured for specific applications in accordance with the number of digits required. For example, a manufacturer of electronic equipment may desire an eight digit front panel mounting display for a product line of instruments. The display would be designed with a rigid printed circuit board on which the tubes for displaying the eight digits are mounted along with the electronic components and electrical connectors for operating the display. This assembly would then be suitably encased and provided with the various required features such as a mounting bezel and filter provision. The completed indicator would be manufactured in quantity for the particular application for which it was designed. This approach tends to provide costly indicators since standardization of components is rendered difficult and displays of differing numbers of digits require individual custom designs. Additionally, these displays tend to be bulky because of the utilization of rigid circuit boards.

In an attempt to modularity and standardization of components, some prior art gas discharge indicator displays have been constructed with a single digit indicator tube and a rigid printed circuit board in a manner similar to that described above. This single digit assembly would be fully encased to provide an alphanumeric indicator module. These modules would then be stacked side-by-side to construct any arbitrary length display. This approach, however, often resulted in space between the digits on the order of the width of the digits themselves, hence providing an unsightly display that required excess panel mounting area.

SUMMARY OF THE INVENTION

The present invention obviates the above prior art disadvantages by providing an alphanumeric indicator module comprising a flexible printed circuit strip to either end of which is affixed an alphanumeric indicator tube and a multiple contact electrical connector, respectively. Intermediate the tube and connector are affixed the electronic components required for an operable digit display module. The flexible printed circuit assembly is folded in accordian fashion with the indicator tube and electrical connector at either end and substantially parallel to each other. The folded assembly is inserted into a case, through the front of which the indicator tube is viewable and at the back of which the electrical connector is available for receiving system power and digit selection signals. The sides of the module cases are provided with locating pins and holes to snap the modules together thereby forming displays of arbitrary numbers of digits. Side covers are provided with locating pins and holes to snap onto the outer sides of the assembled display modules. Integral with the module case is a bezel section and filter mounting provision whereby when the modules and side panels are snapped together a complete bezel and filter mounting is formed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a flexible printed circuit assembly for use in an indicator module;

FIG. 2 is a side elevation view of a flexible printed circuit assembly inserted into a case to form the indicator; and

FIG. 3 is an exploded perspective view of several indicator modules with side covers forming a complete indicator assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, a perspective view of a flexible printed circuit assembly 10 in accordance with the invention is illustrated. The assembly 10 comprises a flexible printed circuit 11 containing the printed wiring for the electronic drive circuitry for the indicator module. The flexible printed circuit 11 is preferably in the form of a relatively long strip. An alphanumeric gas discharge indicator tube 12 is connected at one end of the flexible printed circuit strip 11. The indicator tube 12 is preferably of the flat or planar variety such as that described in Applicant's assignee's U.S. Pat. No. 3,675,066 issued July 4, 1972 entitled "Planar Raised Cathode Alphanumeric Gas Discharge Indicator" by James B. Armstrong et al.

A multiple contact electrical connector 13 is fastened to the end of the printed circuit strip 11 opposite that on which the indicator is mounted. Intermediate the indicator 12 and the electrical connector 13, the electronic circuit components for the drive electronics for the tube 12 are connected. Typically, the drive electronics for an indicator tube of the type described may include decoder drivers 14, resistors 15, latches 16, and counters 17. The indicator tube 12, electrical connector 13 and electronic circuit components 14-17 are interconnected by the electrical wiring of the strip 11 to form an operable drive circuit to apply power to the elements of the tube 12 from the connector 13 and to selectively energize the elements of the tube 12 so as to display numeric or alphanumeric characters in response to appropriately coded data signals applied to the connector 13. The electrical design and operation of such indicator circuits are well known in the art and will not be belabored here for brevity.

The indicator tube 12, the electrical connector 13 and the components 14-17 may be electrically connected to the printed wiring of the strip 11 by any convenient technique such as wave or flow soldering or by any other conventional procedure.

Referring now to FIGS. 2 and 3 in which like reference numerals indicate like components with respect to FIG. 1, the flexible printed circuit 10 is folded in accordian fashion with the indicator tube 12 and the electrical connector 13 at either ends of the folded assembly respectively. The folded assembly is inserted into a case 20 which conveniently may be formed of molded plastic or any other suitable material by conventional means and techniques. Case 20 is constructed, for example, with a top wall 21, a bottom wall 22 and a side wall 23, which side wall is best seen in the cutout portion of FIG. 3. The top and bottom walls 21 and 22 are provided with grooves 24, 25 and 26 as illustrated. When the accordian folded flexible assembly 10 is inserted into the case 20, the indicator tube 12 is slid into the grooves 25 and the electrical connector 13 is slid

into the grooves 26 with the edges of the printed circuit strip 11, the tube 12 and the connector 13 abutting the side wall 23. It is thus appreciated that when assembled, the front of the indicator tube 12 is viewable through the front of the case 20 and the contacts of the electrical connector 13 are available at the rear of the case 20 for plugging into a suitable source of power and digit selection signals for the module.

Referring specifically now to FIG. 3, an exploded perspective view of a display utilizing the modules of the present invention is illustrated. A bezel section 30, in which the grooves 24 are disposed, is located at the front of the case 20. The sides of the case 20 and the bezel section 30 include locating pins 31 and locating holes 32 as illustrated.

In order to assemble a display of an arbitrary number of digits, a suitable number of modules are stacked in juxtaposed relation as illustrated in FIG. 3 and snapped together by means of the locating pins 31 and locating holes 32. In order to complete the display assembly, side covers 33 are provided, the fronts of which include bezel sections 30' and the sides of which include locating pins and holes, the locating pins 31' being illustrated. The side covers 33 may conveniently be fastened to the two exposed sides of the assembled modules by means of, for example, screws 34.

It will thus be appreciated that when assembled, the bezel sections 30 and 30' form a complete bezel assembly which may be utilized for front mounting the display assembly by means of, for example, mounting holes 35. It will further be appreciated that the grooves 24 and their continuations in the bezel sections 30' provide a mounting facility for a filter 36 such as a contrast filter. As is readily apparent, the filter may be positioned in the grooves 24 prior to the final positioning of one of the side covers 33.

It will be appreciated from the foregoing that because of the novel construction of the indicator module of the present invention as compared to the prior art designs discussed above, the following desirable features are obtained:

1. Exceedingly low manufacturing costs in both material and labor;
2. An enclosed display assembly container with filter provision;
3. In-line electrical interconnections at the rear of the display;
4. Side stackability to provide any number of digits in accordance with individual applications;
5. An exceedingly compact package; and
6. An integral front mounting bezel.

Although the above-described embodiment of the invention is explained in terms of a printed circuit strip, it will be appreciated that any suitable flexible circuit strip may be utilized. The invention was described in terms of the indicator tube 12 and the electrical connector 13 fastened on either end of the strip 11 and the strip then folded in accordian fashion with the indicator tube 12 and the electrical connector at either end of the folded assembly and substantially parallel to each other. It will be appreciated that although this arrangement is preferred, other configurations are possible in practicing the invention. For example, the tube 12 or the connector 13 may be fastened to an intermediate portion of the strip 11 with circuit components located along the strip on either side thereof. Similarly, the relative orientations of the tube 12 and the connector 13

need not necessarily be parallel. For example, the tube 12 may be located as described above but the connector 13 may be positioned at openings in either the upper wall 21 or the lower wall 22 for appropriate connection thereat. Additionally, although folding the printed circuit assembly in accordian fashion is considered to provide an optimum arrangement, other folding configurations may also be utilized including a rolled-up arrangement.

It is appreciated that although the above described embodiment of the invention is explained in terms of a module with an indicator tube, an electrical connector on a printed circuit strip; other configurations may include more than one indicator tube, more than one electrical connector or more than one strip or any combination of these elements singly or in plurality.

It will be appreciated from the foregoing that the flexible printed circuit construction of the present invention provides an additional advantage with regard to the aforementioned rigid printed circuit board construction of prior art devices. Because of this novel construction, the module of the present invention should be more resistant to shock and vibration than the rigid prior art arrangements thus facilitating packaging for shipment as well as increasing the resistance of the inventive devices to these adverse environments.

The invention has been described hereinabove and illustrated in the drawings in terms of a module utilizing a gas discharge indicator tube. It will be appreciated that the above-described novel construction is equally applicable to other indicator elements such as, for example, light emitting diode alphanumeric indicators and the like, to the same advantage.

While the invention has been described in its preferred embodiment, it is to be understood that the words which have been used are words of description rather than limitation and that changes within the purview of the appended claims may be made without departing from the true scope and spirit of the invention in its broader aspects.

I claim:

1. An indicator module comprising flexible circuit strip means having circuit wiring formed thereon, indicator element means, electrical contact connector means and circuit component means secured upon said strip means and electrically interconnected to said circuit wiring to form an indicator circuit,

said strip means being folded to form a folded assembly with said indicator element means and said electrical connector means at the periphery thereof,

and case means, said case means including a front portion having a first set of grooves formed therein, and a rear portion having a second set of grooves formed therein, said folded assembly being inserted into said case means with said indicator element means being inserted within said first set of grooves and said electrical connector means being inserted within said second set of grooves.

2. The module of claim 1 in which said case includes a first bezel section at the front thereof including a third set of grooves.

3. The module of claim 2 in which sides of said case include locating pins and holes.

4. A plurality of the modules of claim 3 oriented in juxtaposed relation with respect to each other and snapped together by means of said locating pins and

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holes to form a display assembly, said display assembly further including side covers in juxtaposed relation with respect to exposed sides of said display assembly and fastened thereto.

5. The display assembly of claim 4 in which each side

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cover includes a second bezel section including fourth grooves, said first and second bezel sections forming a complete bezel for said display assembly and said third and fourth grooves forming a filter mounting.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,873,889 Dated March 25, 1975

Inventor(s) Manuel R. Leyba

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

Claim 1, Line 50 -- Delete -- at the periphery --
and insert therefor "being disposed on
opposite ends"

Signed and sealed this 27th day of May 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks

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