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Dickson

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[54] **MANUALLY OPERABLE MECHANIC AND ELECTRICAL CONNECTOR**

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[52] **U.S. Cl.** ..... **354/81, 346/110 R**

[51] **Int. Cl.** **G03b 29/00**

[58] **Field of Search** ..... 95/12, 86; 346/110 R; 355/20; 178/7.8; 200/61.62, 61.7, 61.76, 61.81, 61.58

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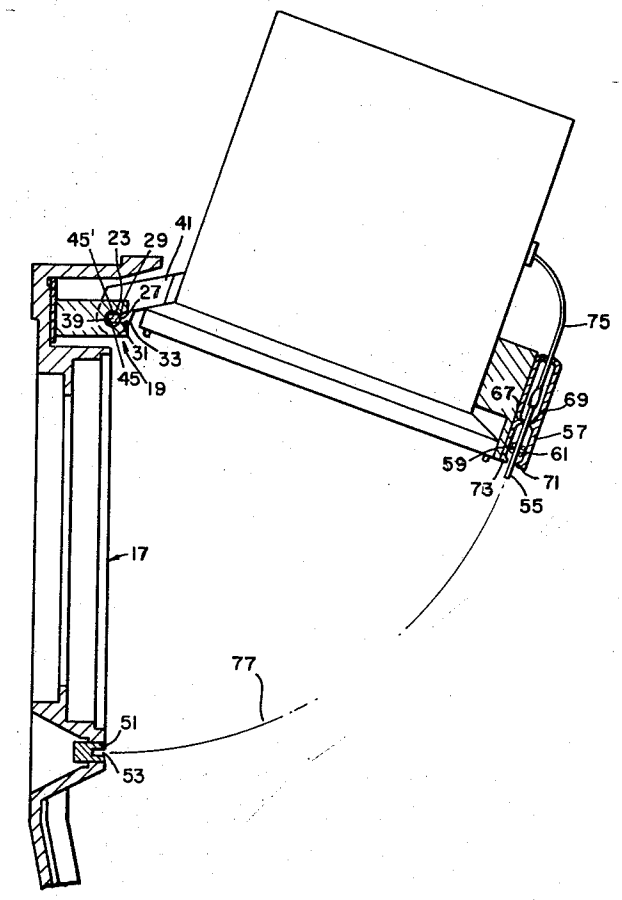
[57] **ABSTRACT**

Apparatus for mechanically and electrically interconnecting two devices, such as an electronic visual display device an a photographic camera attachment assembly. A hinge pivot bar attached to one of the devices has a circular bore extending along its length and an elongated slot opening the bore to the outside. A pivot shaft attached to the other of the devices is circular of a diameter to fit within the circular bore of the hinge pivot bar and further includes a pair of parallel surfaces permitting the pivot shaft to be inserted through the slot of the hinge pivot bar thereby forming the mechanical connection. Mating electrical connector elements are provided on the two devices for electrical interconnection therebetween as the mechanical connection is being effected.

12 Claims, 4 Drawing Figures



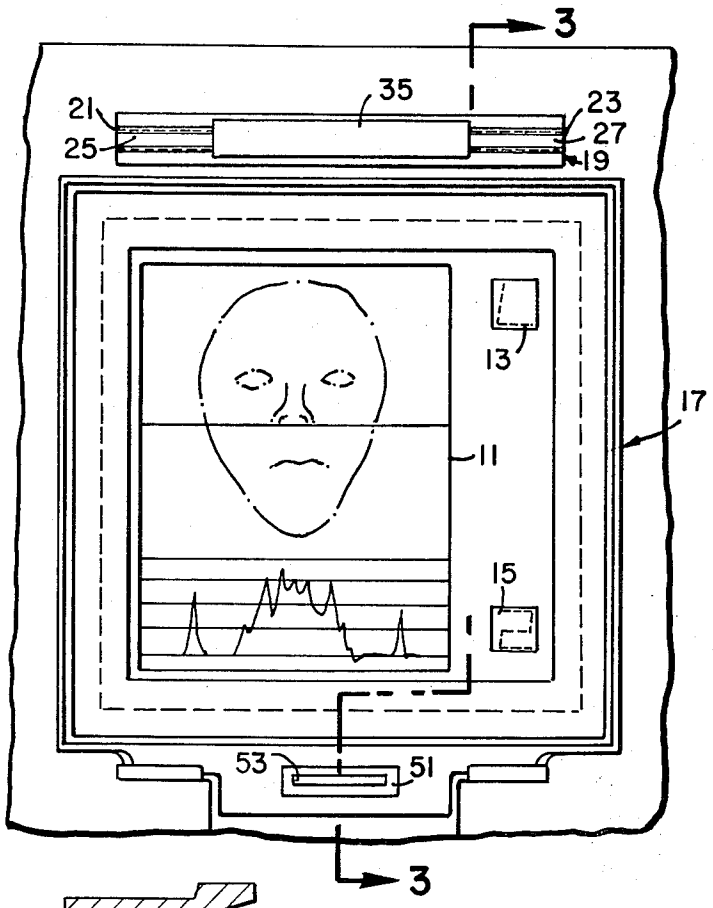

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FIG_1

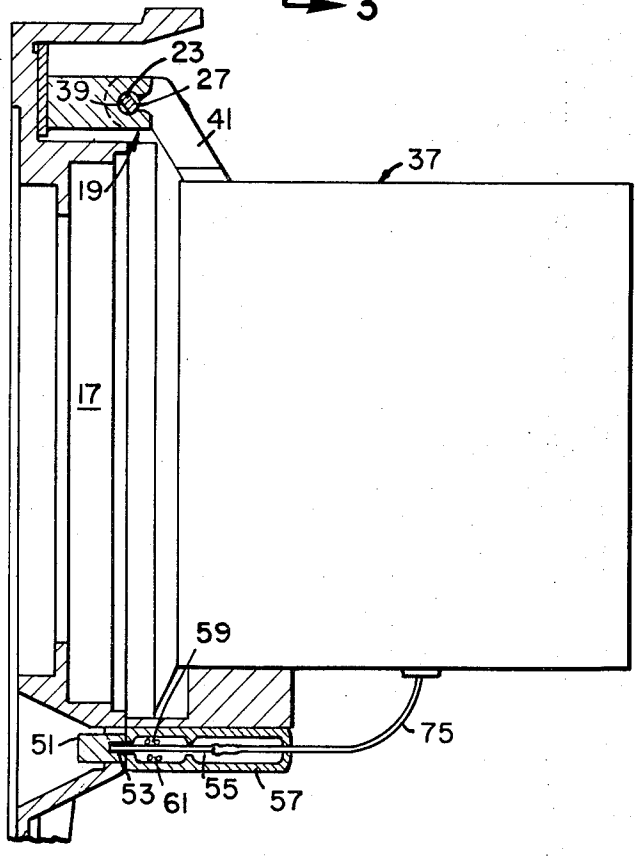
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FIG_4

FIG_3

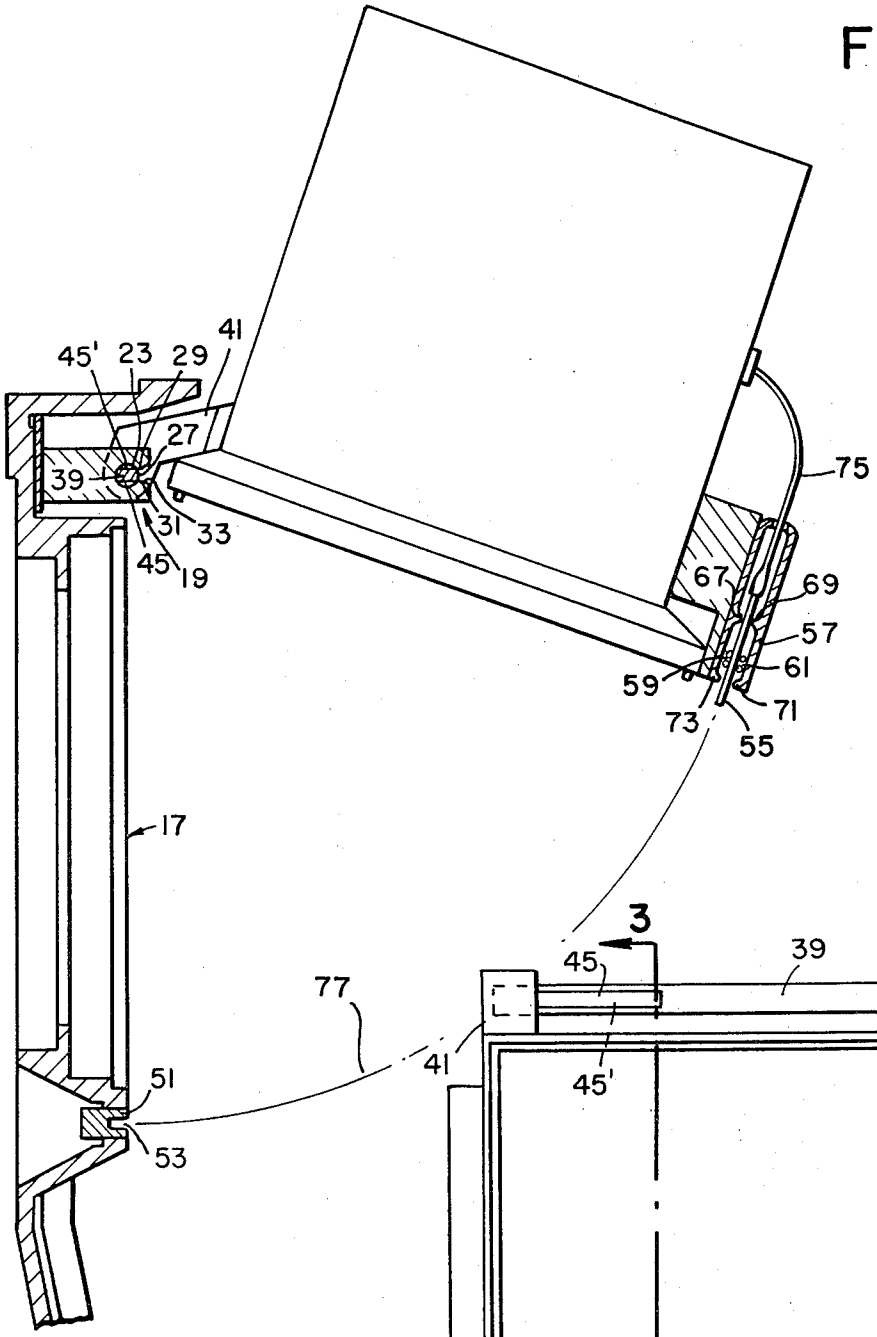
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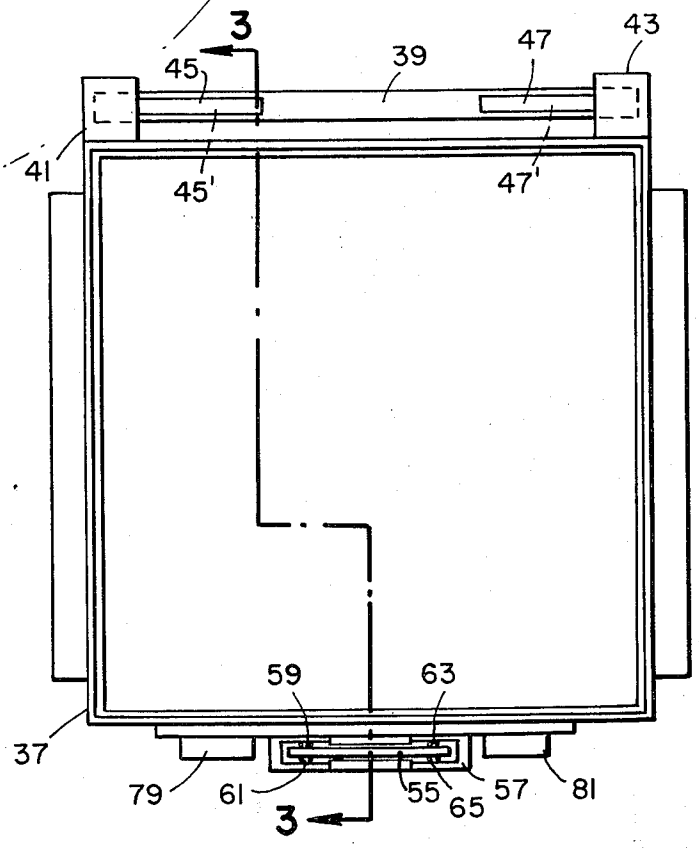
FIG_2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MANUALLY OPERABLE MECHANIC AND ELECTRICAL CONNECTOR

BACKGROUND OF THE INVENTION

The present invention relates generally to a mechanical connector and more specifically to a means for joining two devices both mechanically and electrically.

There are numerous existing applications for a mechanical latching assembly that may be easily and positively operated by hand to connect and disconnect two separate devices. In many of these applications, there is the further requirement that electrical connections be made and broken between the two devices as they are mechanically joined and separated, respectively. Therefore, it is a primary object of the present invention to provide a mechanical latch that is sure and easy in manual operation and which permits the establishment and disconnection of an electrical circuit as part of the same simple hand operation.

A specific example of an application of such a device is for the mechanical and electrical interconnection of a photographic camera assembly with an oscilloscope. In laboratory operation of an oscilloscope, it is sometimes desirable to photograph the display on the face of its cathode ray tube while at other times the oscilloscope is used without the camera in position. The camera is typically electrically interconnected with the oscilloscope so that its shutter operates in synchronism with the cathode ray tube display. Present camera attachment devices rely on separate mechanical and electrical connectors which require two separate operations when a connection or disconnection is desired to be effected. Such a two-connector approach is inconvenient and further has a possibility of damaging the electrical interconnection if the camera assembly is attempted to be removed without first properly disconnecting the electrical connector.

Besides general laboratory oscilloscopes, there are other applications where a cathode ray tube display is desirably photographed by a camera attachment. One of these applications is with a thermograph that displays in the optical domain on the face of a cathode ray tube an image of a human patient or other object as viewed in the infrared domain. In one specific thermograph, the opening of the shutter of the photographic camera attachment initiates action within the thermograph which leads to presentation of a picture on the cathode ray tube face. Thus, an electrical connection between the thermograph and the photographic camera attachment is desirable. Furthermore, since a thermograph of this type may be used by persons having little familiarity with precision laboratory equipment, it is desirable that the mechanical and electrical interconnection between the thermograph and the camera attachment be as simple to operate as possible. Accomplishing this goal is a further object of the present invention.

SUMMARY OF THE INVENTION

These and additional objects are accomplished by the present invention wherein a hinge pivot bar is attached to one of the devices to be interconnected and a pivot shaft for mating therewith is attached to the other device. The hinge pivot bar is constructed to receive the pivot shaft in one rotatable position with respect thereto and then for the pivot shaft to be rotated to form a positive mechanical interconnection of the two devices. Each of the devices also contains a part of an electrical connector for establishing an electrical circuit between the two devices as they are rotated with respect to each other about the mechanical latch.

Although the mechanical and electrical latching mechanisms of the present invention have general application to a wide variety of types of devices, it is especially useful when one of those devices is an oscilloscope type of instrument, such as a laboratory oscilloscope or a thermograph, and the other of the two devices is a photographic camera attachment. The camera is attached on the oscilloscope instrument whenever its cathode ray tube display is desired to be photographed. In a specific form described hereinafter, the hinge bar is attached to the oscilloscope instrument adjacent a top edge of the cathode ray tube. An electrical receptacle is carried by the oscilloscope instrument adjacent a bottom edge of the cathode ray tube display. Mating mechanical and electrical elements are spaced on the camera assembly for interconnection with their associated elements on the oscilloscope device. In effecting a mechanical connection of the camera assembly onto the oscilloscope instrument, an operator establishes an electrical connection without a separate operation. When the camera is mechanically detached, the electrical connection is broken without any damage to the wires or connectors.

Additional objects, features and advantages of the present invention will become apparent from the following description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a view of an electronic display instrument showing the mechanical and electrical connectors thereon;

FIG. **2** is a view of one end of a camera assembly with mechanical and electrical connectors for interconnecting with the connectors of the electronic instrument of FIG. **1**;

FIG. **3** is a cross-sectional view of FIGS. **1** and **2** at line **3—3** showing the camera assembly being attached to the electronic display device; and

FIG. **4** is a sectional view of FIGS. **1** and **2** across line **3—3** showing the camera assembly fully connected onto the electronic display device.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1**, an electronic display is shown that at times is desirably photographed. This display includes a face **11** of a cathode ray tube and two light emitting diode displays **13** and **15**. These elements are surrounded by a frame **17** that is a part of the instrument case. The particular electronic instrument portion of FIG. **1** shows a display of a thermograph instrument. The cathode ray tube is shown to be displaying an image of a human face as seen by infrared radiation with a graph therebelow showing the intensity of infrared radiation across a line of the patient's face. The light emitting diodes **13** and **15** display information as to the patient's position and a video gain setting of the thermograph instrument, respectively, for recordation on photographic film by a photographic camera attachment assembly. Although the mechanical and electrical fastening elements of the present invention have particular advantage when applied to such an electronic in-

strument and camera attachment therefor, it will be understood that the techniques of the present invention also have a much wider application generally to mechanical and electrical fastening applications.

Referring to FIG. 1, a hinge pivot bar 19 is attached to the instrument case in a manner to lie horizontal and parallel to the upper edge of the electronic display to be photographed. The hinge pivot bar 19 is in the vicinity of and adjacent to the upper edge of the visual display as formed by the frame 17. The hinge pivot bar 19 is of a finite length having abrupt ends. Adjacent the opposing ends are circular bores 21 and 23, respectively, and associated narrow horizontal slits 25 and 27.

The nature of the circular bore and slit can best be seen from FIG. 3 which shows the hinge pivot bar 19 in cross-section along a line 3—3 of FIG. 1. The slit 27 is formed of upper and lower parallel surfaces 29 and 31 which are spaced apart a distance that is less than the diameter of the circular bore 23. In order to aid the mechanical fastening operation, the slit 27 is flared outward at the forward edge of the hinge pivot bar 19 by the use of beveled surfaces adjacent the slit forming surfaces 31 and 29, such as the beveled surface 33. The bore 21 and its associated horizontal slit 25 appear to be the same in cross-section as the bore 23 and its slit 27. The circular bore and associated slit could alternatively extend completely between the two opposite abrupt ends of the hinge pivot bar 19 but the construction shown in FIG. 1 wherein the middle section 35 of the hinge pivot bar 19 is relieved is preferable. By minimizing the length of the circular bore and its associated access slit, precision machining of the hinge pivot bar 19 is minimized.

Referring to FIG. 2, an end view of the camera assembly is shown wherein a hollow box-like case 37 is to be attached to the frame 17 of the instrument casing shown in FIG. 1. On the top surface of the case 37, a pivot shaft 39 is firmly held with respect thereto by a pair of pivot blocks 41 and 43 at either end of the pivot shaft 39. The pivot blocks 41 and 43 are separated by a distance that is substantially the same as but only slightly greater than the length of the hinge pivot bar 19 of FIG. 1. Adjacent each pivot block 41 and 43 are flat surfaces 45 and 47 formed in the pivot shaft 39. The pivot shaft 39 is of a circular cross-section with a diameter slightly less than the diameter of the circular bores 21 and 23 of the hinge pivot bar 19 of FIG. 1. The flat surfaces 45 and 47 have opposing flat surfaces 45′ and 47′ on the opposite sides of the pivot shaft 39. The flat surfaces 45 and 45′ are carefully constructed to be parallel to one another and separated a distance substantially equal to but slightly less than the distance between the parallel surfaces 29 and 31 that form the slit 27 of the pivot bar 19.

FIG. 3 shows a cross-sectional view of the pivot shaft 39 as positioned within the circular bore 23 of the hinge pivot bar 19. The opposing planar surfaces 47 and 47′ are constructed in a manner similar to that described for the surfaces 45 and 45′. The flat surfaces of the pivot shaft 39 are limited since it is only necessary for them to extend in length as far as the length of the circular bores 21 and 23 of the hinge pivot bar 19.

Referring again to FIG. 3, a cross-sectional view of the pivot shaft 39 on the camera frame 37 is shown in place within the circular bore 23 of the hinge pivot bar 19. The camera case 37, and thus the pivot shaft 39, has previously been tilted to the angle shown and the shaft 39 pushed through the slot 27 of the hinge pivot bar 19 in order to reach the position shown in FIG. 3. As the camera housing 37 is allowed to fall downward and against the instrument frame 17, the pivot shaft 39 will rotate with respect to the hinge pivot bar 19 to a position shown in FIG. 4. In the position shown in FIG. 4, the pivot shaft 39 is rotated to a locked position wherein it cannot be pulled outward through the slot 27 since the diameter of the pivot shaft 39 is larger than the width of the slit opening 27. The front of the camera housing 37 and the frame 17 of the electronic instrument are cooperatively shaped to engage one another when the camera housing 37 is in the position shown in FIG. 4 in order to minimize light leaks from the outside into the camera housing 37. A camera of any convenient standard design (not shown) is attached to the camera housing at its end opposite that end which contacts the frame 17. The camera housing 37 is positioned accurately in a lateral direction because the distance between the hinge blocks 41 and 43 on the camera housing 37 is about the same distance as the length of the hinge pivot bar 19. When the camera housing 37 is mounted on the electronic instrument, the hinge blocks 41 and 43 contact the ends of the hinge pivot bar 19 to prevent axial play of the pivot shaft 39.

Referring again to FIG. 1, an electrical receptacle 51 is positioned on the electronic instrument adjacent the lower edge of the visual display to be photographed. The electrical receptacle 51 includes an elongated slot 53 for receiving an electrical plug of the camera assembly. The plug receiving slit 53 is parallel with the axial bores 21 and 23 of the hinge pivot bar 19. A cross-sectional view of the receptacle 51 can best be seen from FIG. 3.

Referring to FIGS. 2 and 3, the electrical plug assembly that is attached to the camera housing 37 may best be illustrated. The plug itself is a flat piece of insulating material 55 upon which the various circuit conductors are formed by printed circuit techniques. Matching conductive connectors are provided, of course, in the interior portion of the slit 53 to make the required electrical connection between the camera attachment and the electronic instrument. The printed circuit connector 55 is suspended in the middle of a plug housing 57 by four spring and spacer combinations 59, 61, 63 and 65. These springs are held under compression between the printed circuit board 55 and the interior surfaces of the plug housing 57. The plug housing 57 is attached to the camera housing 37 in a position so that the extreme end of the printed circuit connector 55 is inserted into the slot 53 of the receptacle 51 as the camera is installed by its mechanical latching mechanism previously described onto the electronic display instrument. The printed circuit connector 55 is allowed to float on its four supporting springs within the connector housing 57 within the limits defined by stops 67, 69, 71 and 73. A rear end of the printed circuit connector 55 has its conductive strips connected to wire 75, which is electrically connected with the camera in an appropriate manner. The printed circuit connector 55 preferably has a plurality of parallel conductive strips extending from connection with the wire 75 to the end of the connector 55 that is received by the slit 53 of the receptacle 51.

Referring to FIG. 3, it can be seen that as the camera housing 37 is fastened onto the instrument by the me-

chanical latching mechanism, the protruding end of the printed circuit connector **55** travels along an arc something like the dashed line **77** and into engagement with the receptacle **51.** Its engaged position is shown in FIG. **4.** The spring mounting of the printed circuit board **55** allows it to move up and down in order to properly seat within the slot **53** of the receptacle **51** as the camera assembly is installed on the instrument. This ability of the printed circuit connector **55** to move slightly compensates for the fact that the slot **53** is a straight one rather than following the circular arc **77** that has a center at the central axis of the pivot shaft **39.**

After the camera assembly is installed in a manner as shown in FIG. **4,** a pair of simple plastic latches **79** and **81** (FIG. **2**) on the camera housing **37** on either side of the electrical connector and at its bottom are snapped onto mating connector elements on either side of the receptacle **51** on the electronic display instrument. This latching is desirable to hold the camera housing in the position shown in FIG. **4** without the printed circuit connector **55** becoming disengaged from the receptacle slot **53** on the instrument. When it is desired to remove the camera attachment from the instrument, these latches are simply disengaged and the camera housing rotated back from the position shown in FIG. **4** to the position shown in FIG. **3.** The camera housing **37** is then pulled away from the electronic instrument to remove the pivot shaft **39** from within the circular bores of the hinge pivot bar **19** through the slots **25** and **27.**

It can be seen from the structure of the latch and its associated electrical connector, that the camera assembly may be easily attached and disengaged from an electronic display instrument without the necessity of tightening screws or performing other manipulations while the heavy camera attachment must be held. The electrical construction is made without any separate manipulations being required.

The various aspects of the present invention have been described with respect to its preferred embodiments, but it will be understood that the invention is entitled to protection within the full scope of the appended claims.

I claim:

1. Apparatus for attaching a photographic camera assembly to an electronic visual display instrument, comprising:

an electronic visual display instrument,

a hinge pivot bar attached to said electronic visual display instrument,

a photographic camera assembly,

a pivot shaft attached to said camera assembly, said pivot shaft being cooperatively shaped to be received by said hinge pivot bar and rotated with respect thereto about an axis of rotation,

an electrical receptacle positioned a distance away from said hinge pivot bar on said electronic visual display instrument, said receptacle having an elongated plug receiving slot that is substantially parallel with said axis of rotation, and

an electrical connecting plug held by said camera assembly for insertion into said receptacle slot as said pivot shaft is rotated within said hinge pivot bar about said axis of rotation, said plug being resiliently suspended on said camera assembly in a manner that it can move in a direction toward and away from said pivot shaft as the camera assembly is positioned on the instrument and the plug is inserted in said receptacle slot.

2. Connectable apparatus, comprising:

an electronic device containing a visual display,

an elongated hinge pivot bar connected to said electronic device adjacent one edge of said visual display,

a circular bore within said hinge pivot bar and extending in a direction along its length, said circular bore having a surface with a uniform diameter therealong,

an elongated slot extending along the length of said hinge pivot bar in a manner to provide an opening into said circular bore, said slot including a pair of parallel plane surfaces intersecting said circular bore surface, said parallel plane surfaces being spaced apart a distance that is less than said circular bore uniform diameter,

a photographic camera assembly,

a pivot shaft having a uniform diameter that is slightly less than the diameter of said circular bore but significantly greater than the distance between the parallel surfaces of said slot, said pivot shaft being rigidly connected to said photographic camera assembly,

at least one pair of parallel plane surfaces on opposite sides of said pivot shaft along at least a portion of its length, the distance between said shaft parallel plane surfaces being slightly less than the distance between the parallel surfaces of the slot of said hinge pivot bar,

an electrical receptacle held by said electronic visual display device along an edge of said display that is opposite to the edge along which said hinge pivot bar is connected and a certain distance therefrom, and

a plug held by said camera assembly said certain distance from the pivot shaft and having a shape cooperating with that of the receptacle to be received thereby as said camera assembly is pivoted about its pivot shaft within said hinge pivot bar.

3. A connectable apparatus according to claim **2** wherein said electronic visual display device includes a cathode ray tube whose display is desired to be recorded by a camera on said camera assembly.

4. A connectable apparatus according to claim **3** wherein said hinge pivot bar extends across a top edge of said cathode ray tube.

5. A connectable apparatus according to claim **4** wherein said pivot shaft is oriented on said camera assembly so that its parallel plane surfaces slide into the slot on said hinge pivot bar with the camera assembly rotated to form an acute angle with said electronic visual display device, whereby said camera assembly is rotated relative to said hinge pivot bar once the pivot shaft is engaged within said circular bore thereof.

6. A connectable apparatus according to claim **2** wherein said hinge pivot bar extends outward of said electronic instrument and further wherein said pivot shaft is rigidly attached at its ends to a pair of hinge blocks on said camera assembly, said hinge blocks being spaced a distance apart that is slightly greater than the length of said hinge pivot bar, whereby lateral motion of said camera assembly relative to said electronic visual display device is restrained when the pivot shaft is engaged within the hinge pivot bar.

7. A connectable apparatus according to claim 6 wherein said circular bore extends within the hinge pivot bar for only a portion of its length, said portion including segments adjacent each of its said abrupt ends, the middle of said hinge pivot bar between said segments being relieved.

8. A connectable apparatus according to claim 2 wherein said plug is movable a small amount with respect to said camera assembly in a direction toward and away from said pivot shaft so that the plug may engage said receptacle as said camera assembly is being rotated about said hinge pivot bar for movement into engagement with said receptacle.

9. A connectable apparatus according to claim 2 wherein said hinge pivot bar is connected across a top edge of said display portion of the electronic display device and wherein said electrical receptacle is held along a bottom edge of said display portion.

10. Apparatus according to claim 2 wherein said plug is a thin printed circuit board having strips as conductors for contacting associated contacts within said receptacle.

11. Apparatus according to claim 10 wherein said plug is held in a manner to be movable in a direction toward and away from the part of the mechanical connector on the same device a certain fixed amount for proper alignment and engagement with said socket as the two devices are rotated with respect to each other.

12. Apparatus according to claim 11 wherein said printed circuit board plug is held by at least a pair of springs on either side thereof which under compression push toward said plug in a direction toward and away from the part of the mechanical connector on the same device, whereby said plug is movable against said springs as it engages said socket.

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