

# **A THERMOCOMPRESSSION BONDING APPARATUS DISPLAY BRACKET**

## **FIELD OF THE INVENTION**

- 5 The present invention relates to a thermocompression bonding apparatus display bracket.

## **BACKGROUND**

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There are various problems with the placement of displays for monitoring bonding process in existing thermocompression bonding apparatuses. The bonding process herein referred to may, for instance, be the process of bonding a Liquid Crystal Display (LCD) to a Flexible Printed Circuit. Examples of existing thermocompression  
15 bonding apparatuses are the Cherusal™ tab bonding machine (model number TM-300PR-MKIII), Cherusal™ Pulse heat machine (model numbers TM101PR-MKIII and TM101P-MKIII), Cherusal™ ACF Pre-attachment machine (model numbers TM-90-MKIII and TM-90-MKIII-R) and Cherusal™ FOG Automatic Bonding machine (model number TM-388P).

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It is common for existing thermocompression bonding apparatuses to have two displays for displaying different camera views of the bonding process. When viewed from the front of a bonding apparatus facing the area where the bonding process is carried out, one of the displays is located on the left side of the bonding apparatus  
25 and the other display is located on the right side. In some bonding apparatus, a compression actuator for controlling the movement and speed of movement of the thermode assembly sits in between the two displays. One of the reasons for spacing the two displays apart is to avoid blocking access to the compression actuator.

30 During operation, an operator stands or sits in between the two displays to work on the bonding apparatus. The arrangement of the two displays undesirably forces the operator to swing his/her head as he/she alternates his/her vision between the two displays. When large quantities of products are bonded, the number of head swinging movements can be quite substantial. Furthermore, as it is necessary for the  
35 operator to maintain good visual concentration when monitoring the displays, the continuous head swinging movements can be very tiring for the operator.

In some bonding apparatuses, the displays are mounted in a rather bulky rectangular casing at the top of the bonding machine. Other than having an unsightly "top heavy" look and taking up more space, the rectangular casing also requires more resources to construct and more time and skill to replace or assemble with the bonding apparatus. Moreover, as the rectangular casing is at the top, the operator would have to look upwards when monitoring the bonding process. Continuous upward head movements will tire the operator.

Some bonding apparatuses are built with a lower position of the rectangular casing to bringing the displays mounted in the casing closer to the eye level of the operator. However, as a result, the adjustment mechanism of the bonding apparatuses located at the centre of the bonding apparatus would be blocked by the casing entirely or become difficult for the operator to access. Additional electromechanical components may need to be used to link the compression actuator to a location that is more accessible to the operator.

In large bonding apparatuses, displays could be mounted on an arm containing one or more joints. The arm could be pivoted into various configurations convenient for an operator to view the displays. However, the arm takes up much space and requires much resource to build.

## **SUMMARY**

According to a first aspect of the present invention, there is provided a thermocompression bonding apparatus display bracket having a display portion for mounting a display, the display bracket being arranged, when installed on the thermocompression bonding apparatus, for the display portion to be movable between a first position in which the display portion is disposed between an operator position and a portion of the thermocompression bonding apparatus whereby operator access to the portion of the thermocompression bonding apparatus is restricted; and a second position allowing operator access to the portion of the thermocompression bonding apparatus.

The display portion may be arranged for mounting two displays adjacent to each other.

The display bracket may comprise an intermediate portion and a mounting portion for mounting to the thermocompression bonding apparatus, wherein the intermediate portion links the display portion to the mounting portion and displaces the display portion from front of the thermocompression bonding apparatus.

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The display bracket may comprise a grip for moving said display portion between the first position and the second position, the grip being an extension from the intermediate portion.

- 10 The display bracket may be arranged as a removable attachment to the thermocompression bonding apparatus.

The display bracket may be arranged for pivoting relative to a top surface of the thermocompression bonding apparatus to move the display portion between the first  
15 location and the second location.

The display bracket may be arranged for pivoting relative to a side surface of the thermocompression bonding apparatus to move the display portion between the first  
location and the second location.

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The thermocompression bonding apparatus display bracket may be made by a method, the method comprising: folding a metal sheet to form the display portion and a mounting portion for mounting the display bracket to the thermocompression bonding apparatus.

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The method may comprise folding the metal sheet to form an intermediate portion linking the display portion to the mounting portion.

## 30 **BRIEF DESCRIPTION OF THE DRAWINGS**

Embodiments of the invention will be better understood and readily apparent to one of ordinary skill in the art from the following written description, by way of example only and in conjunction with the drawings, in which:

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Figure 1 is a perspective view of a bracket.

Figure 2 is an exploded view of the bracket.

Figure 3 is a perspective view illustrating a first orientation of the bracket on a thermocompression bonding apparatus.

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Figure 4 is a perspective view illustrating a second orientation of the bracket on a thermocompression bonding apparatus.

Figure 5 is a perspective view of a bracket.

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## **DETAILED DESCRIPTION**

In Figure 1, there is a thermocompression bonding apparatus display bracket 100 (not shown). The display bracket 100 has a display portion 120. The display portion 120 in Figure 1 is arranged for mounting two displays 102 and 104 adjacent to each other. The display 102 is located to the left hand side of the display 104 for monitoring left hand views of the bonding process. The display 104 is located to the right hand side of the display 102 for monitoring right hand views of the bonding process. Placing the displays 102 and 104 adjacent to each other means disposed touching or near each other such that operators viewing the displays 102 and 204 do not have to swing their heads as much, if required at all, when they alternate their vision between the two displays. This makes the bonding process monitoring task less tiring.

It is appreciated that there could be just one display instead of having the two displays 102 and 104. In this case, the left and right hand views of the bonding process could be made to be viewed on the same display. It is further appreciated that having more than two displays mounted on the display portion 120 is possible.

The display bracket 100 is arranged such that when it is installed on the thermocompression bonding apparatus, the display portion 120 is movable between a first position (illustrated in Figure 1) and a second position (illustrated in Figure 4). In the first position, the display portion 120 is disposed between an operator position 122 and a portion of the thermocompression bonding apparatus 124. The operator position 122 is a position whereby an operator would normally stand or sit to operate the thermocompression bonding apparatus 124 and be able to view the displays 102 and 104. In Figure 1, the position of the portion of the thermocompression bonding

apparatus 124 is located behind the displays 102 and 104. In the second position of the display portion 120, an operator is allowed access to the portion of the thermocompression bonding machine 124.

5 The portion of the thermocompression bonding apparatus 124 is typically the location of a compression actuator (not shown in Figures 1 and 2), which is controllable to move a thermode assembly (not shown in the Figures 1 and 2) towards and away from an article (not shown in all the Figures) to be bonded at an appropriate time during a bonding process. The compression actuator typically  
10 operates based on pneumatic and/or hydraulic principles. Advantageously, valves for pressure control of the compression actuator are made accessible to the operator in the second position of the display portion 120.

Each of the displays 102 and 104 in Figure 1 has an LCD (Liquid Crystal Display)  
15 monitor 132 facing the operator. For referencing purposes, the surfaces of the display bracket 100 facing and revealed to the operator is referred to as the front of the display bracket 100. The surfaces of the display bracket 100 facing the thermocompression bonding apparatus are referred to as the rear of the display bracket 100.

20 The display bracket 100 is formed by folding a metal sheet. The folds are made at an angle such that breakage to the metal sheet would not occur. It is envisaged that the display bracket 100 could be formed by welding metal sheets together as well. The metal used for the display bracket 100 may be made of, for instance, aluminium,  
25 stainless steel, mild steel and the like. In this example, the display bracket 100 has three substantially planar portions, namely, a display portion 120, an intermediate portion 110 and a mounting portion 128. The intermediate portion 110 links the display portion 120 to the mounting portion 128.

30 In the display bracket 100 of Figure 1, the plane of the display portion 120 is at an angle of about 110 degrees with respect to the plane of the intermediate portion 110. The plane of the intermediate portion 110 is at an angle of about 160 degrees with respect to the plane of the mounting portion 128. The plane of the display portion  
35 110 is at an angle of about 90 degrees with respect to the plane of the mounting portion 128. It is appreciated that the specific angles between the display portion 120, the intermediate portion 110 and the mounting portion 128 stated herein are not to

be regarded as exhaustive. Other suitable angles may be selected as the viewing angles of the display portion 120 where appropriate.

5 The mounting portion 128 is for mounting the display bracket 100 to the thermocompression bonding apparatus. The intermediate portion 126 helps to position the display portion 120 closer to the operator position 122 for viewing by the operator. The intermediate portion 126 also displaces the display bracket 100 from front of the thermocompression bonding machine. In the first position of the display portion 120, the display portion 120 covers the portion of the thermocompression  
10 bonding apparatus that is accessible to the operator in the second position of the display portion 120.

It is appreciated that the intermediate portion 126 could be omitted in the construction of the display bracket 100 by having a larger mounting portion 128  
15 and/or a larger display portion 120, and by arranging the plane of the mounting portion 128 at an appropriate angle with respect to the plane of the display portion 120.

If there is no intermediate portion 126, the method for making the display bracket  
20 100 by folding a metal sheet is to fold the metal sheet to form just the display portion 120 and the mounting portion 128. If the intermediate portion 126 is required, an additional fold is made to the metal sheet to form an intermediate portion 110 linking the display portion 120 to the mounting portion 128.

25 The display portion 120 and the mounting portion 128 are substantially rectangular in shape. The display portion 120 has larger area than the area of the mounting portion 128. In this example, the display portion 120 has twice the width of the mounting portion 128 and the same length as the plane of the intermediate portion 126. The area of the display portion 120 is sufficiently sized to allow mounting of the two  
30 displays 102 and 104, mounting of labels such as a label 114 and display of logos or Trademarks such as Trademark 118.

With reference to Figures 1 and 2, the label 114 and Trademark 118 are disposed above the two displays 102 and 104. The label 114 is a number plate for indicating a  
35 model number of the thermocompression bonding apparatus. The label 114 is mounted to the display portion 120 via two threaded fasteners 116. The two

fasteners 116 are put through holes 218 in the label 114 and twisted into threaded openings 220 disposed on the display portion 120.

5 The two displays 102 and 104 are each mounted to the display bracket 100 via a pair of threaded fasteners 210. Each of the threaded fasteners 210 are put through a washer 212 followed by a hole 224 in the display portion 120 from the rear of the display bracket 100. There are two mounting brackets 202 arranged to be attached to rear sides of the displays 102 and 104. The mounting brackets 202 have holes which the threaded fasteners 210 are put through after they are put through the  
10 holes 224 in the display portion 120. There are threaded openings (not shown in the Figures) located on the rear of the displays 102 and 104. After the threaded fasteners 210 are put through the holes in the mounting bracket 202, the displays 102 and 104 are fixed to the display portion 120 by tightening the threaded fasteners 210 into the threaded openings (not shown in the Figures) located on the rear of the  
15 displays 102 and 104.

The mounting portion 128 has a length longer than the length of the display portion 120 but it has a shorter width compared to the width of the display portion 120. The longer length of the mounting portion 128 enables the display bracket 100 to be  
20 hinged more securely to the thermocompression bonding apparatus (Not shown in Figures 1 and 2). It is more secure because more hinge components can be disposed along the longer length for hinging the display bracket 100 to the thermocompression bonding apparatus.

25 The intermediate portion 126 has a substantially rectangular main planar area, a width similar to the width of the mounting portion 128, and a length similar to the length of the display portion 120. The intermediate portion 126 has an elongate first extension 130 extending from it. The first extension 130 is substantially rectangular shaped. One of the length sides of the first extension 130 is joined to the mounting  
30 portion 128. The first extension 130 extends in a direction away from the main planar area of the intermediate portion 126 for up to the length of the mounting portion 128.

A second extension 106 that is substantially planar and rectangular shaped extends from the first extension 130. The second extension 106 has the same length as the  
35 first extension 130. The plane of the second extension 106 is sufficiently angled with respect to the main planar area of the first extension 130. The second extension 106 has the function to avoid an otherwise straight and flat edge of the first extension 130,

which is regarded as sharp and may cause harm to users when the display bracket 100 is being handled. The second extension 106 also acts as a cover over non-presentable parts of the thermocompression bonding apparatus to improve the aesthetic appearance of the invention. An example of a non-presentable part of the thermocompression bonding apparatus is screw heads located at edges of the thermocompression bonding apparatus that are used to join parts of the the apparatus together.

In Figure 1, the width of the first extension 130 is substantially smaller than the main planar surface area of the intermediate portion 126. In the example, the first extension 120 has a width of about a fraction of one over seven of the width of the main planar surface area of the intermediate portion 126. However, this is not to be regarded as a limitation on the dimension of the width of the first extension 130. The dimension of the width of the first extension 130 could be sized accordingly to provide convenience to an operator to access the second extension 106 and at the same time to avoid the display bracket 100 from blocking parts of the thermocompression bonding apparatus (Not shown in Figures 1 and 2) that should be accessible to the operator.

Although in this example the display portion 120 and the mounting portion 128 are substantially perpendicular to each another in Figure 1. It is appreciated that they may be at other angles with respect to each other as long as the angles still allow the mounting portion 128 to be hinged to the thermocompression bonding apparatus (Not shown in Figures 1 and 2) and allow the displays 102, 104 to be conveniently viewed by an operator at the operator position 122 when the display portion 120 assume the first position.

With reference to Figures 1 and 2, an elongate pivoting bar 108 is mounted along the length of the mounting portion 128 and close to an edge of the mounting portion 128 furthest from the display portion 120. The elongate pivoting bar 108 is generally shape in the form of a cuboid. The pivoting bar 108 is mounted via four screws 112 evenly spaced along the length of the pivoting bar 108. The mounting portion 128 has four corresponding openings 214 for receiving the four screws 112. The pivoting bar 108 is located on the surface of the mounting portion 128 that would face the thermocompression bonding apparatus (Not shown in Figures 1 and 2). The pivoting bar 108 has four threaded openings 208 for receiving the four screws 112. When mounting the pivoting bar 108 to the thermocompression bonding apparatus, the four

screws 112 are firstly put through four corresponding washers 206 respectively. Thereafter, the four screws 112 are put through the four respective openings 214 of the mounting portion 128 and then twisted and tightened to the four threaded openings 208 respectively.

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Furthermore, the elongate pivoting bar 108 has two openings 216 (one of which is not shown in Figure 2) used in mounting the elongate pivoting bar 108, and thus the display bracket 100, to the thermocompression bonding apparatus. The two openings 216 are each located at the centre of a side of the elongate pivoting bar 108. The two respective sides of the elongate pivoting bar 108 on which each of the openings 216 is located are facing away from each other and they are the sides of the elongate pivoting bar 108 having the least surface area. Each of the two openings 216 allows a pin (not shown in Figures 1 and 2) to be inserted and secured to it. The pin is put through a hole in the thermocompression bonding apparatus before insertion into each of the openings 216. In this manner, a hinge for pivoting the display bracket 100 relative to the thermocompression bonding apparatus is formed.

Figure 3 shows the display bracket 100 described previously with reference to Figures 1 and 2 mounted on a top surface 318 of a thermocompression bonding apparatus 300. The plane of the mounting portion 128 of the display bracket 100 is disposed over a top surface 318 of the thermocompression bonding apparatus 300. The display bracket 100 is pivotable about a longitudinal axis 314 of the elongate pivoting bar (108 in Figures 1 and 2) located through the centre and along the length of the elongate pivoting bar (108 in Figures 1 and 2). Pin 308 in Figure 3 is one of said pin that is put through a hole 316 in the thermocompression bonding apparatus before insertion into each of the openings (216 in Figure 2) located on the elongate pivoting bar (108 in Figures 1 and 2).

The thermocompression bonding apparatus 300 has a thermode assembly 312 and a compression actuator 302 for moving the thermode assembly 312 towards and away from an article (not shown in Figures 3 and 4) to be bonded at the appropriate time during a bonding process. The compression actuator 302 is a linear motion actuator for actuating movement of the thermo assembly 312 in a vertical axis of the thermocompression bonding apparatus 300. The article is placed on a working platform 310 during the bonding process. The thermode assembly 312 has a heating element (not shown in Figure 3) and the heating element is typically in the form of a

metal strip or a metal block. During the bonding process, the heating element of the thermode assembly 312 is brought into contact or close contact with the article to bond the article by heat.

- 5 The thermocompression bonding apparatus 300 in Figure 3 includes other components such as a control panel 304 for controlling components/parameters associated with the bonding process. The thermocompression bonding apparatus 300 also includes a pair of cameras 306 for capturing images of the bonding process. One of the cameras 306 captures the left hand view of the bonding process and the  
10 other camera captures the right hand view of the bonding process. The captured images from the left hand view are transmitted to the display 102 for viewing and the captured images from the right hand view are transmitted to the other display 104 for viewing.
- 15 Figure 3 illustrates that the displays 102 and 104 on the display portion 120 are located adjacent to each other and arranged to be above ground level, at about the height of the average eye level of an operator. Advantageously, this allows simultaneous viewing of the displays 102 and 104, and helps to reduce time taken by the operator during the bonding process, especially during a manual operation where  
20 an operator would manually align an article under the thermode assembly 312 for bonding. Furthermore, the operator will be less tired as he/she does not have to swing his/her head much, if required at all, to view the displays 102 and 104, which are just side by side. Overall, since the operator's task is more convenient and less tiring, yield of the number of units bonded in a given time, quality of the bond and  
25 cycle time of the bonding process are improved.

The portion of the thermocompression bonding machine that an operator would gain access to when the display portion 120 is in the second position is the compression actuator 302.

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- Figure 4 shows the display portion 120 being moved to the second position to reveal a front perspective view of the compression actuator 302 that is described with reference to Figure 3. The display bracket 100 has been flipped away from the top surface of the thermocompression bonding apparatus 300 that is pivoted about the  
35 longitudinal axis 314 of the elongate pivoting bar 108. The pins 308 join two side plates 408 and 410 of the thermocompression bonding apparatus 300 to the elongate pivoting bar 108 at a location close to the top surface 318 of the

thermocompression bonding apparatus 300 and keep the elongate pivoting bar 108 in place.

The thermocompression bonding apparatus 300 in Figure 4 is a "stripped down" version for illustrating the compression actuator 302 and some connectors and switches 406 that are located behind the display portion 120 in Figure 3. The connectors and switches 406 are utilized for various functions related to the thermocompression bonding apparatus 300.

10 The compression actuator 302 in Figures 3 and 4 is pneumatic based. It is appreciated that the compression actuator 302 could be pneumatic, electric (with use of solenoids) and/or hydraulic based so long as it could move the thermode assembly (312 in Figure 3; not shown in Figure 4). In Figure 3, the compression actuator 302 has two switches 402 and 404. One of the switches 402 and 404 is for  
15 extending the compression actuator 302 to move the thermode assembly (312 in Figure 3) towards an article placed on the working platform 310 and the other switch is for retracting the compression actuator 302 to move the thermode assembly (312 in Figure 3) away from the article placed on the working platform 310. It does not matter which of the switches 402 and 404 is for retracting or extending the  
20 compression actuator 302 so long as one of them is configured for retracting and the other is configured for extending. It is appreciated that just one switch could be implemented to activate both retraction and extension of the compression actuator 302. By moving the display portion 120 to the second position, an operator can now gain access to the switches 402 and 404. It is further appreciated that the switches  
25 402 and 404 or switch (if only one switch is implemented) could also be configured to control speed of movement of the thermode assembly (312 in Figure 3).

Figure 5 shows a display bracket 500 that is similar to the display bracket 100 described with reference to Figure 1. The only difference between the display  
30 bracket 500 in Figure 5 and the display bracket 100 in Figure 1 is that the label 114 is printed via, for instance, silkscreen printing methods, onto the display bracket 500. instead of being mounted to the display bracket 100 via two threaded fasteners 116.

It is appreciated that the display bracket 100 described with reference to the figures  
35 could be retrofitted to existing thermocompression bonding apparatuses that do not already have displays installed. In this case, modifications to the existing

thermocompression bonding apparatuses are required to enable the display bracket 100 to be hinged in the manner as described with reference to Figures 1 to 4.

5 It is further appreciated that the display bracket 100 described with reference to the figures could may also be implemented such that it pivots relative to a side surface of the front of the thermocompression bonding apparatus 300 instead of relative to the top surface 318 of the thermocompression bonding apparatus 300 as described with reference to Figures 3 and 4.

10 Also, the display bracket 100 described with reference to the figures may be arranged as a removable attachment to the thermocompression bonding apparatus instead of being permanently fixed to the thermocompression bonding apparatus as illustrated in Figures 3 and 4.

15 Many modifications and other embodiments can be made to the thermocompression bonding apparatus display bracket by those skilled in the art having the understanding of the above described disclosure together with the drawings. Therefore, it is to be understood that the thermocompression bonding apparatus display bracket is not to be limited to the above description contained herein only,  
20 and that possible modifications are to be included in the claims of the disclosure.

## CLAIMS

1. A thermocompression bonding apparatus display bracket having a display portion for mounting a display, the display bracket being arranged, when installed on the thermocompression bonding apparatus, for the display portion to be movable between  
5 a first position in which the display portion is disposed between an operator position and a portion of the thermocompression bonding apparatus whereby operator access to the portion of the thermocompression bonding apparatus is restricted; and  
10 a second position allowing operator access to the portion of the thermocompression bonding apparatus.
2. The display bracket as claimed in claim 1, the display portion being  
15 arranged for mounting two displays adjacent to each other.
3. The display bracket as claimed in claims 1 or 2, the display bracket comprising an intermediate portion and a mounting portion for mounting to the thermocompression bonding apparatus, wherein the intermediate portion  
20 links the display portion to the mounting portion and displaces the display portion from front of the thermocompression bonding apparatus.
4. The display bracket as claimed in claim 3, the display bracket comprising a grip for moving said display portion between the first position  
25 and the second position, the grip being an extension from the intermediate portion.
5. The display bracket as claimed in any one of the preceding claims, the display bracket being arranged as a removable attachment to the  
30 thermocompression bonding apparatus.
6. The display bracket as claimed in any one of the preceding claims, the display bracket being arranged for pivoting relative to a top surface of the thermocompression bonding apparatus to move the display portion between  
35 the first location and the second location.

7. The display bracket as claimed in any one of the preceding claims, the display bracket being arranged for pivoting relative to a side surface of the thermocompression bonding apparatus to move the display portion between the first location and the second location.

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8. A method for making a thermocompression bonding apparatus display bracket as claimed in any one of the preceding claims, the method comprising:

10 folding a metal sheet to form the display portion and a mounting portion for mounting the display bracket to the thermocompression bonding apparatus.

9. The method as claimed in claim 8, the method comprising:

15 folding the metal sheet to form an intermediate portion linking the display portion to the mounting portion.