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Patent Application

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Method to Manufacture a Laminar Composite

This invention relates to a method to manufacture a laminar composite out of at least two foil sheets in which recurrent punching structures are applied into the foil sheets in a punching device in equal distances and in which the foil sheets are glued together after applying the punching structures in such a way that the punching structures of the foil sheets glued together have a predetermined position towards each other.

Furthermore, this invention relates to a device to manufacture a laminar composite.

Such a device is, for example, known from DE 29 39 014. The glueing of a metal foil sheet and of a plastic foil sheet is described in this publication. Before glueing the two foil sheets together, both foil sheets run independently from each other through punches in which different punching structures are punched into the respective foil sheets. To avoid and/or reduce a

mismatch of the two foil sheets against each other occurring due to different expansion coefficients of the material of the foil sheets, a relatively costly control system is installed, by means of which the speed of the foil sheets can be changed.

Furthermore, it is known from WO-92/15118 to place two foil sheets, which have punching markings, on top of each other in such a way that the punching markings of the one foil sheet are arranged at the same position on the foil composite as the punching markings of the second foil sheet. For this, the position of the punching markings is controlled and a possible mismatch between the two punching markings is compensated in that the size of this mismatch is measured and the different temperatures are applied to the two foil sheets according to the mismatch before they are put together, in order to compensate for the mismatch caused by the different expansions of the two foil sheets. Additionally, tensile stress can be applied to one of the foil sheets so that the so effected extension of this foil sheet contributes to the compensation of the mismatch. Such a method requires a high equipment expenditure in order to realize the different temperature applications of the two foil sheets and to guarantee that the required temperature changes can take place within a very short time in order to keep the section of the foil composite with the mismatch as small as possible.

In both cases a costly and relatively complicated control is required which is usually also less active. A possible mismatch cannot be removed immediately; before correcting the feed, and thus before removing

the mismatch a longer sheet of foil composite with mismatch is regularly manufactured. This piece, however, cannot be used for further processing, for example for chip cards manufacturing.

Derived from the above described prior art the task of the present invention is to provide a method with which several foil sheets can be glued together to realize a laminar composite in a way as simple as possible and with an exact fit. It is furthermore the task of the present invention to provide a device to carry out this method.

According to the invention the task of the above characterized method is solved in that the foil sheets are fed into the punching device one after the other, identical position markings being punched into the foil sheets in a first part of the punching device and, after that, characteristic foil structures being punched into the foil sheets of each respective foil sheet in a second replaceable part of the punching device, the second part of the punching device being replaced after each run of a foil sheet through the punching device. The device to manufacture a laminar composite out of several foils according to the invention has a punching device and a laminar device and is characterized in that the punching device has two punching tools which are arranged independently from each other in a set distance. The foil sheets which are fed into the punching device are usually unwound from transport spools. The foil sheets can be rolled up on another spool for intermediate storage after having left the punching device in which periodically recurrent punching structures have been punched in. The foil sheets, either coming from these

spools or directly from the punching device, will be fed into the glueing device lying upon each other and here, they can be adjusted in such a way that the punching structures have a predetermined position to each other. This step of glueing can be done in the known method, the foil sheets being adjusted for example by guiding mandrels which are arranged at a feeding device of the laminar device and which lock into the position markings of the foil sheets. For this, besides the feeding device and the guiding mandrels the laminar device has a device to apply tack points at the foil sheets and a device to glue the foil sheets together as a whole. Due to this method that the foil sheets to be glued together run through the same punching device and that they do not have to be exposed to different heat or tensile stress a possible mismatch of the punching structures of the foil sheets is negligible and does not occur in the form of a sum error.

In a special embodiment of the method according to the invention one metal foil sheet and one plastic foil sheet are punched and glued together or one metal foil sheet and at least two plastic foil sheets are punched and glued together, the metal foil sheet being glued together with a plastic foil sheet and then the second plastic foil sheet being glued on the metal foil sheet or on the first plastic foil sheet. For exact adjustment of the foil sheets before and/or during glueing of the foil sheets guiding mandrels which are arranged at a feeding device can lock into the position markings, which are lying upon each other, of the foil sheets to be glued together.

The invention is described in detail by means of an embodiment and a drawing. The device according to the invention is shown in this drawing.

A plastic foil sheet 1, a metal foil sheet 2 and another plastic foil sheet 3 run one after the other through a punching device 4 which has a punching tool 5 and 6. These punching tools 5 and 6 are arranged on a common support 7. The punching tool 5 provides a punching stamp to punch out the position markings 8 which are equally punched into all three foil sheets 1; 2; 3. The punching tool 6 is replaceable and provides punching stamps which are developed according to the foil structures 9; 10 to be applied to each respective foil sheet 1; 2; 3. To simplify matters, the foil structures of the metal foil sheet 2 are not shown in the drawing. These foil structures 9; 10 are characteristic for each respective foil sheet 1; 2; 3. The foil sheets 1; 2; 3 run through the punching device 4 one after the other, punching tool 6 being replaced after each run of a foil sheet. After the run of the foil sheets 1; 2; 3 through the punching device 4 the foil sheets 1; 2; 3 will be in the first place rolled up. Afterwards, the plastic foil sheet 1, which is out of a glass-fibre reinforced plastic, and the metal foil sheet 2 are put together at their beginning and fed into the laminar device 11. Here, the position markings 8 are placed manually upon each other in such a way that they are seized by the guiding mandrels which are arranged at a transport device (similar to DE 43 40 996 C1). These guiding mandrels as well as the transport unit are well known and can, in principal, be set up in a similar way as a camera film transport system. The punching structures 8; 10 of the foil sheets running through the laminar device 11 are not shown in the

drawing. The guiding mandrels lock into the foil sheets 1; 2 in a first part 12 of the laminar device 11 and transport the two foil sheets 1; 2 through a tack station 14 and a glueing station 13. A sum error caused by the different heat expansions when glueing the foil sheets 1 and 2 together is avoided by applying tack points between the foil sheets in the tack station 14. In the glueing station 13 the two foil sheets 1; 2 are then glued together as a whole, the foil sheets 1; 2 being exposed to a temperature of approximately  $180^{\circ}$  for approximately 30 seconds.

Afterwards, continuing roll lamination through a roller pair 15 according to the prior art is performed.

The laminar composite created in such a way can then be put together with the second plastic foil 3 and fed into the laminar device 11 in the same way as described above. This creates a laminar composite out of three foils in which the metal foil 2 is arranged in the middle. It may also be possible to place the two plastic foils 1; 3 directly upon each other or to build the laminar composite only out of a plastic foil sheet 1 and a metal foil sheet 2.

Such a laminar composite shows no mismatch as the individual foil sheets 1; 2; 3 show no mismatch over the whole length of the foil sheet due to the constant arrangement of the different punching tools 5; 6 towards each other. Since the foil sheets are fixed by means of tack points in their position towards each other when being fed into the laminar device 11, here, too, a mismatch adding up over the length of the foil sheets cannot occur.



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## Patent Claims

1. A method to manufacture a laminar composite out of at least two foil sheets in which recurrent punching structures are applied into the foil sheets in a punching device in equal distances and in which the foil sheets are glued together after applying the punching structures in such a way that the punching structures of the foil sheets glued together have a predetermined position towards each other characterized in that, the foil sheets (1; 2; 3) are fed into the punching device one after the other, identical position markings (8) being punched into the foil sheets (1; 2; 3) in the first part (5) of the punching device (4) and, after that, characteristic foil structures (9; 10) being punched into the foil sheets (1; 2; 3) of each respective foil sheet (1; 2; 3) in a second, independent and replaceable part (6), arranged in a set distance to the first part (5), of the punching device (4), the second part (6) of the punching device (4)

