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(54) PROCESS AND APPLIANCE FOR MELTING AND APPLYING FUSION ADHESIVE, PARTICULARLY FOR EDGE-GLUING MACHINES

(71) We, KARL M. REICH MASCHINENFABRIK, GmbH, a German Company, of 7440 Nurtingen, Postfach 1740, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a process and an apparatus for melting and supplying fusion adhesive to an application device of an edge-gluing machine.

At present in an edge-gluing machine a specific amount of fusion adhesive in the form of granules is melted in a melting vessel. The molten fusion adhesive is supplied to an application device by means of a feed screw or a supply piston. The application device can be designed either as a heatable application roller or as a heatable wedge-shaped nozzle element; the surplus fusion adhesive which is not applied to the surfaces which are to be bonded has to be returned to the melting vessel again.

A disadvantage of this known arrangement is that when starting up the edge-gluing machine with this known process, all of the fusion adhesive which is located in the melting vessel first has to be melted, so that a relatively long heating-up time has to be taken into account. Also, if the production process requires that the type of fusion adhesive is to be changed, for example, when a different quality of colour of fusion adhesive is involved, then a long preparation period is required to change the fusion adhesive.

A further disadvantage with the known process is the cracking of the fusion adhesive by over-heating, which naturally has a bad effect on the quality of the bond. In addition, gas bubbles and vapour can form in the melting vessel, which are unpleasant for the operator and, under certain circumstances, may be detrimental to the health of the operator.

According to the present invention there is provided a process for melting and supplying fusion adhesive to an application device of an edge-gluing machine comprising supplying fusion adhesive in units from a magazine to a melting chamber, pressing an adhesive unit in the direction of a heatable wall so that only that area of the unit which is pressed against the melting wall is melted and supplying the melted adhesive, under pressure, to the application device responsive to sensor means actuated by a workpiece and operable to initiate or terminate the supply of melted adhesive.

The invention makes it possible to melt only the amount of fusion adhesive required for bonding in the shortest possible time, and allows rapid changing of the type of fusion adhesive. Therefore the production costs of the appliance required for the process and also the cost of the energy required for melting are substantially reduced.

Preferably a fusion adhesive unit is pressed by a power-operated feed piston in the direction of a heatable melting wall so that only that area of the unit which is pressed against the melting wall is melted.

This affords the advantage that only as much fusion adhesive as is required for satisfactory function of the application device is melted at any one time. Due to the short melting time thus made possible when the edge-gluing machine is started up, a reduction in production times and thus an important financial saving can be achieved. These advantages are also obtained when changing the type of fusion adhesive, since only the fusion adhesive unit located in the melting chamber needs to be changed over.

The melting of a relatively small amount of fusion adhesive prevents the cracking of the fusion adhesive, so that satisfactory bonding is ensured. Equally, the formation of gases and vapours and thus annoyance to

the operator is greatly reduced, and the process according to the invention is therefore environmentally acceptable.

The amount of molten fusion adhesive to be supplied under pressure to the application device may be adjusted by altering the pressure exerted on the units with the advantage that at any given time only the amount of fusion adhesive which is absolutely essential is melted. When the type of fusion adhesive is changed, naturally the units of fusion adhesive in the magazine can also be changed over.

The invention also includes apparatus for melting and supplying fusion adhesive to an application device of an edge-gluing machine comprising a melting chamber for a fusion adhesive unit having a heatable melting wall, an outlet for the molten fusion adhesive in the melting wall, pressure means for forcing the unit against the heatable melting wall so only that area of the unit which is pressed against the melting wall is melted and for forcing molten fusion adhesive from the melting chamber out through the outlet to the application device, and sensor means, actuable by a workpiece, operable to initiate or terminate the supply of melted adhesive.

This apparatus is simple and cheap to produce and, as no driven feed screw is required, an electromotor is not needed. A further saving is made in the amount of energy required for melting a specific amount of fusion adhesive, since only the melting wall has to be heated.

Preferably the melting chamber is cylindrical and the cylindrical wall is made at least in part of a material with low thermal conductivity so that it is ensured that the heat from the melting wall only acts on the area of the fusion adhesive which rests directly on it, and not on the areas lying further away. These areas of the unit therefore remain in the solid state. Furthermore, provision can be made for the cylinder wall of the melting chamber to have a coating of non-stick material in the vicinity of the melting wall so that it is ensured that molten fusion adhesive does not adhere to the cylinder wall so that the fusion adhesive can be removed easily from the melting chamber when the type of fusion adhesive is changed.

The invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a partial rear view of an edge-gluing machine with a melting appliance;

Figure 2 is a section along line II—II in Figure 1;

Figure 3 is a section along line III—II in Figure 2, and

Figure 4 shows a melting appliance with application roller, in partial section.

In Figure 1 a plate-shaped workpiece 1 in a known manner is advanced by means of a conveyor chain 2 to a wedge-shaped nozzle element 3. At the nozzle element 3 the workpiece 1 is provided with liquid fusion adhesive along one lateral narrow face, and is then stuck by an edge lip, which is not shown. From Figure 2 it will be seen that the wedge-shaped nozzle element 3 is equipped with an adhesive duct 4 and with nozzle holes 5 through which the adhesive is applied to the lateral narrow face of the workpiece 1. A rotary slide valve 6 is mounted rotatably in the adhesive duct 4 to control the flow of adhesive and is actuated by a cylinder-piston unit 7. The latter is controlled by a first sensor valve 8 which is influenced by the leading edge 10 and the trailing edge 11 of the workpiece 1.

The nozzle element 3 is attached to a bracket 12 which is mounted pivotably on the frame of the edge-gluing machine. Heating elements 13 in the nozzle element 3 heat this up to a specific set temperature, so that the fusion adhesive in the adhesive duct 4 is always molten. On the bracket 12, between a side face 14 of the nozzle element 3 and a transverse wall 15, there is a melting chamber 16, the cylinder wall 17 of which is made, at least in the vicinity of the side face 14, from a material with low thermal conductivity, such as asbestos cement for example. The inner surface of the cylinder wall 17 is preferably partially covered with a coating 18 of a non-stick material, such a fluorocarbon resin for example.

As Figures 2 and 3 show, in the region of the melting chamber 16 the side face 14 of the nozzle element 3 has concentric annular grooves 19 which interconnect via radial grooves 20. These annular grooves 19, together with the annular ribs 21 lying between them, form a melting wall 22, which is connected thermally conductively with the heatable nozzle element 3. Outlet holes 23 lead from the space inside the melting chamber 16 through the melting wall 22 into the adhesive duct 4.

The cylinder 24 of a feed unit 25 operate by compressed air is fixed to the transverse wall 15, and the associated piston 26 is mounted movably in the melting chamber 16. The cylinder 24 is connected via ducts 27 to the first sensor valve 8 and a second sensor valve 9 (see Figure 1).

A magazine 28 is also attached to the bracket 12, to accommodate individual cylindrical units 29 of fusion adhesive, which are passed to the melting chamber 16 through a supply aperture 30. Due to the vertical arrangement of the magazine 28 in the present embodiment, supply of the fusion adhesive units 29 is achieved by gravity; however, it is understood that the magazine may be arranged in any other position relative to the melting chamber 16 and the

fusion adhesive units 29 supplied to the melting chamber 16 by means of an external force, such as a spring for example. The supply aperture 30 is shut off by a slide plate 31 connected to the supply piston 26 during the forward stroke of the supply piston 26. On its free end the slide plate 31 has a cam 32 which co-acts with a third sensor valve 33 which also serves to control the feed unit 25.

In operation the appliance in accordance with the invention works as follows. The magazine 28 is filled with fusion adhesive units 29 and, since the supply piston 26 is in the rest position shown in dashes in Figure 2, a first fusion adhesive unit 29 can reach the melting chamber 16 via the supply aperture 30. As soon as a leading edge 10 of a workpiece 1 actuates the second sensor valve 9, the feed unit is started and the supply piston 26 moves forward so that the fusion adhesive unit 29 located in the melting chamber 16 is pressed against the heated melting wall 22. At the same time the heating elements 13 are switched to a higher working temperature by the second sensor valve 9, so that the amount of fusion adhesive required for the application process is positively melted. Both the rest temperature and the working temperature are controlled and held at the desired level by adjustable temperature sensors (not shown). The part of the fusion adhesive unit 29 which is pressed against the melting wall 22 is melted, and the supply piston 26 forces the melted fusion adhesive into the adhesive duct 4 through outlets 23.

When the leading edge 10 of the workpiece 1 reaches the first sensor valve 8 the cylinder-piston unit 7 is actuated causing the rotary slide valve 6 to open the nozzle holes 5 so that the molten fusion adhesive reaches the lateral narrow face of the workpiece 1. Simultaneously with the actuation of the unit 7 the first sensor valve 8 also causes the loading of the feed unit 25 with compressed air to be maintained, thereby maintaining the pressure on the supply piston 26 in the direction of the melting wall 22.

When the trailing edge 11 of the workpiece 1 clears the second sensor valve 9, this switches the heating elements 13 back again to their rest temperature. When this trailing edge 11 subsequently clears the first sensor valve 8, this terminates the forward stroke of the supply piston 26 which, however, remains in the stroke position it has reached, but not loaded with compressed air. At the same time, the rotary slide valve 6 is swung back into its closed position so that the nozzle holes 5 are closed again.

This process is repeated every time a workpiece 1 actuates the first and second sensor valves. When a fusion adhesive unit 29 is approximately half consumed, cam 32 actuates the third sensor valve 33. This third sensor valve effects the return stroke of the supply piston 26, which is not released, however, until after the trailing edge 11 of the workpiece 1 has cleared the first sensor valve 8. This ensures that the return stroke of the supply piston 26 does not take place until there is no workpiece 1 in the vicinity of the nozzle holes 5. The slide plate 31 connected to the supply piston 26 now moves away from the supply aperture 30 allowing the next fusion adhesive unit 29 to enter the melting chamber 16.

In order to ensure that in fact only that part of the fusion adhesive unit 29 in the vicinity of the melting wall 22 is melted, the cylinder wall 17 can be provided, in an area which adjoins the melting zone in the proximity of the melting wall 22, with an annular duct which can be loaded with small amounts of compressed air so that the rest of the fusion adhesive unit 29 remains cool. Also, by using a material with low thermal conductivity for the cylinder wall 17 it is ensured that no heat can reach the parts of the fusion unit 29 which lie at a distance from the melting wall 22, via the cylinder wall 17. For this purpose it is naturally sufficient for the cylinder wall 17 to be made of a material with low thermal conductivity only in the proximity of the melting wall 22. The rest of the cylinder wall 17 can be made out of any kind of suitable material.

The coating 18 of non-stick material with which the inner surface of the cylinder wall 17 can be covered, prevents the molten fusion adhesive from sticking to the cylinder wall 17. Therefore, if the type of fusion adhesive is to be changed, it is quite simple to take out the remainder of the fusion adhesive unit 29.

In order to prevent the fusion adhesive unit 29 from being melted unnecessarily during long breaks in operation, a time relay can also be provided, to switch the heating elements 13 off after they have been in the rest condition for a specific period of time. These then have to be switched on again by the operator before insertion of the next workpiece 1.

The consumption of fusion adhesive may be adjusted by varying the force of the piston 26 acting on the fusion adhesive unit 29 or by selecting different diameter fusion adhesive units 29.

If desired the process according to the invention and the appliance as well may alternatively be used in conjunction with an application device which has an application roller 34 for applying fusion adhesive (see figure 4). In this embodiment the melting chamber 35, together with the melting wall 36 is connected to an application device 37 which can be heated by heating elements 38. A supply duct 40 leads from the outlet hole 39 in the melting wall 36 to the application

roller 34.

It is understood that, although the application device and melting chamber have been specifically described as adjacent one another, the melting appliance according to the invention can be arranged separate from the application device, the melting chamber together with the heatable melting wall forming a unit and the molten fusion adhesive being supplied to the application device via a heatable supply duct.

WHAT WE CLAIM IS:—

1. A process for melting and supplying fusion adhesive to an application device of an edge-gluing machine comprising supplying fusion adhesive in units from a magazine to a melting chamber, pressing an adhesive unit in the direction of a heatable wall so that only that area of the unit which is pressed against the melting wall is melted, and supplying the melted adhesive, under pressure, to the application device responsive to sensor means actuated by a workpiece and operable to initiate or terminate the supply of melted adhesive.

2. A process according to claim 1 wherein the sensor means comprises a first and a second sensor, a leading edge of a workpiece initiating the forward stroke of a power-operated feed piston pressing the adhesive towards the melting wall by actuation of the second sensor, this forward stroke being maintained by actuation of the first sensor by the leading edge, and the forward stroke being terminated when the trailing edge of the workpiece clears the first sensor.

3. A process according to claim 2 wherein a third sensor actuated by the feed piston initiates the return stroke of the feed piston after the first sensor has been cleared.

4. A process according to claim 2 or 3 wherein after actuation of the second sensor, heating elements which heat up the melting wall are switched from a rest temperature to a higher working temperature, and then back to their rest temperature again after clearance of the second sensor.

5. Apparatus for melting and supplying fusion adhesive to an application device of an edge-gluing machine comprising a melting chamber for a fusion adhesive unit having a heatable melting wall, an outlet for the molten fusion adhesive in the melting wall, pressure means for forcing the unit against the heatable melting wall so only that area of the unit which is pressed against the melting wall is melted and for forcing molten fusion adhesive from the melting chamber out through the outlet to the application device, and sensor means, actuable by a workpiece, operable to initiate or terminate the supply of melted adhesive.

6. Apparatus according to claim 5 wherein the melting chamber is cylindrical having the melting wall at one end, the cylindrical wall being made at least in part from a material with low thermal conductivity.

7. Apparatus according to claim 6 wherein the cylindrical wall of the melting chamber is provided at least in the vicinity of the melting wall with a coating of non-stick material.

8. Apparatus according to any one of the claims 5 to 7 wherein the melting wall, on the side facing into the melting chamber, has interconnecting recesses in which the outlet commences.

9. Apparatus according to claim 8 wherein the melting wall has concentric annular grooves which are interconnected via radial grooves.

10. Apparatus according to any one of claims 5 to 9 wherein the melting chamber has a supply aperture for a fusion adhesive unit, a magazine for holding fusion adhesive units connected to the melting chamber being disposed adjacent the aperture to supply units to the melting chamber.

11. Apparatus according to Claim 10 wherein the pressure means is a piston of a piston/cylinder assembly and connected to the piston is a cover plate which shuts off the supply aperture during the advance stroke.

12. Apparatus according to any one of Claims 5 to 11 wherein the melting wall is connected thermally conductively to the application device.

13. Apparatus for supplying fusion adhesive to an application device substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

14. An edge-gluing machine including an application device and apparatus for melting and supplying fusion adhesive according to any one of claims 5 to 13.

15. A process for supplying fusion adhesive to an application device substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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1595357 COMPLETE SPECIFICATION
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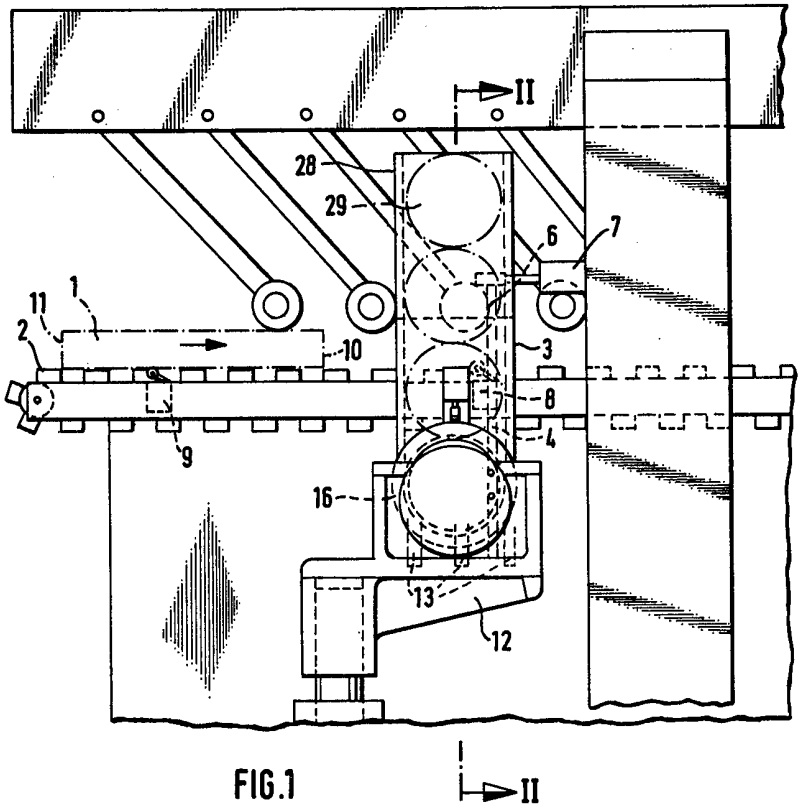

FIG.1

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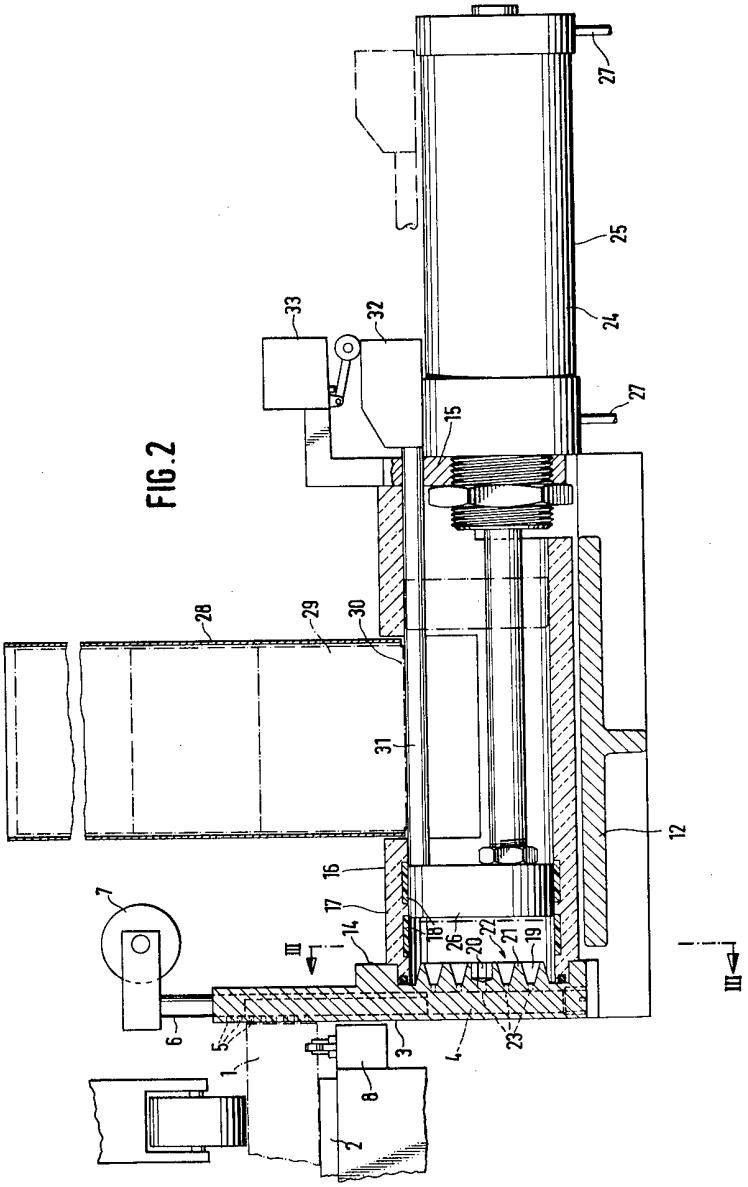
Sheet 2

FIG.2



1595357 COMPLETE SPECIFICATION
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Sheet 3

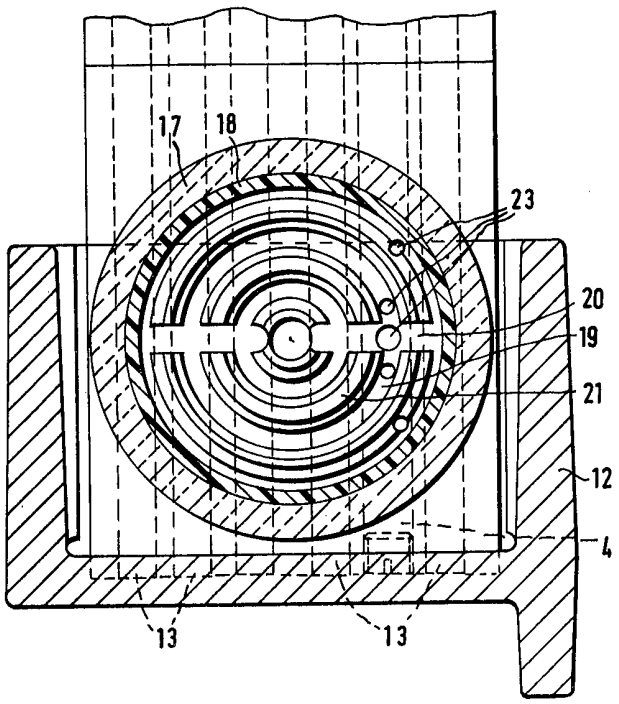

FIG. 3

1595357 COMPLETE SPECIFICATION
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Sheet 4

FIG.4