

EP-A-0 238 014 describes thermoplastic synthetic films which have on at least one side solidified hot-melt adhesive dots applied by the paste dot printing process. The films are intended to be connected to other substrates, for example to textile material webs, with the aid of the re-activated adhesive dots.

The known thermoplastic films are produced by printing onto the films in the manner of a grid hot-melt adhesive dots of a thermoplastic and/or thermoset material by the paste dot printing process, in particular in the form of an aqueous dispersion paste. After printing on, the paste dispersion of the adhesive dots is dried by the action of heat and then the synthetic component of the adhesive dots is sintered or gelled by the action of elevated temperature on the film. Thereafter, cooling is carried out so that a film having solidified adhesive dots which adhere to the film is produced.

It has been found that as a result of the action of moisture from the paste dispersion and/or heat on the film the film tends to curl and/or shrink and/or distort or the like. In the cited publication, process measures are mentioned by means of which the negative influence of water and elevated temperature is successfully compensated with thermoplastic films, in particular with membrane films. Shortly after printing on the paste dispersion dots, hot air is blown both onto the upper side and onto the underside of the film in the region of the edges, using nozzles, so that an equilibrium in the moisture content of both sides of the film is very rapidly established. The supply of hot air is regulable. Moreover, it is provided for the film to be mounted pinned down during sintering or gelling of the synthetic material of the adhesive dots and to be transported continuously without tensile stress in the direction of transport.

However, the known means are not sufficiently variable with respect to material.

DE-A-2 301 938 discloses a process and an apparatus for hot-air

drying a wet-treated material web. In accordance with this, it is proposed that hot air be blown onto both sides of the web in a downstream drying zone to increase the shrinkage of the material web. Since, as a result of this measure, the material web lies on an air-permeable support at a substantially smaller pressure, it has the opportunity to shrink freely.

US-A-4 698 914 discloses a process for laying/drying a flexible material web coating. Here, it is provided for the material web to be guided through a drying apparatus by means of blowing onto it and applying suction successively in a defined undulating movement. The effect of this is supposed to be that the coating on the material web dries onto the surface of the material web in defect-free manner.

The object of the invention is to provide a process and an apparatus by means of which, on printing on and solidifying the adhesive dots applied by the paste dot printing process in the manner of a grid in the form of an aqueous dispersion, the film can be acted upon using simple means in a manner related to the material such that the finished cooled film product has no shrinkage, corrugations, distortion or the like.

This object is achieved by the features of Claims 1 and 16. The invention is explained below in more detail with reference to the drawings, in which:

Fig. 1 shows diagrammatically a side view of an apparatus according to the invention;

Fig. 2 shows, in perspective, a view inside part of a drier of the apparatus according to the invention.

An apparatus according to the invention for producing, in particular, the thermoplastic films described in EP-A-0 238 014 having adhesive dots printed onto the films in the manner of a grid by the paste dot printing process and sintered or gelled

from an aqueous dispersion has a conventional unwinding means 1 by which the film web 1a is drawn off from the film roll in the direction of the arrow 1b.

In accordance with the invention, the film web 1a, following the unwinding means 1 and before printing on the paste dots, is stretched in fold-free manner on both sides by means of a widthwise stretching roller 2 which is known per se, preferably an adjustable-curve widthwise stretching roller, a so-called cord stretcher, so that a fold-free widthwise stretching of the film web 1a is effected over the entire film width and the stretched film is transported further under appropriate tension. According to the invention, a fold-free stretching of the film is also effected in the longitudinal direction, preferably at the same time, by a transporting tensile stress by means of lower pressing roller 4 and upper pressing roller 3 downstream of the widthwise stretching roller 2. Stretching synthetic films in this manner is known and does not need to be explained in more detail.

The apparatus according to the invention has, directly behind the transport rollers 3, 4, the paste dot printing means with the rubber printing roller 5 and the screen printing roller 6, the lower pressing roller 4 being arranged such that it presses the film web 1a against the rubber printing roller 5 in a linear shape, while the upper pressing roller 3 is arranged such that it clamps the film web against the screen 6 so that an adequate wrapping angle for the film web 1a is ensured, which - as illustrated - is drawn through between the rubber printing roller 5 and the screen printing roller 6 in contact with both rollers for printing. During this the adhesive dispersion paste dots are applied.

According to the invention, the paste dots are applied in a quantity and distribution which is sufficient to maintain the stretched shape of the film web until it runs into the downstream drier 8, in which the water of the paste dots is expelled and preferably the synthetic material of the paste dots is also

gelled or sintered.

For the purposes of the invention, the drier 8 has a particular construction. It comprises a machine frame 21 on which, in the transverse direction to the direction of transport 1b of the film web 1a, there are arranged closely next to one another air suction-removal channels 22 whereof the top walls 23 form a planar horizontal running track 24. The channels 22 are conveniently constructed to be cuboidal in cross-section and have, as well as the top wall 23, the side walls 25 and the base wall 26. On the end side, the channels 22 are attached to air supply or air outlet openings (not illustrated). Perforations 27, preferably in the form of rows of perforations, are made in the top walls 23.

An endlessly guided driven air-permeable conveyor belt 28 lies on the running track 24 and can for example comprise a Teflon-coated glass fibre cloth. The conveyor belt 28 is guided, in a manner known per se, by way of deflection rollers 29 in front of and behind the drier 8 to drive means (not illustrated) down into the machine frame 21. It is driven at the same speed and in the same direction as the film web 1a.

The essential point is that the running track 24 is wider than the conveyor belt 28, so that a lateral overhang 30 remains on either side of the conveyor belt 28, with at least one row of perforations 31 remaining free in the longitudinal direction of the running track 24. Moreover, the conveyor belt 28 is preferably wider than the dot-coated film web 1a, so that the conveyor belt 28 for its part has a lateral overhang 32 on either side of the film web 1a.

The means, described below, of the machine upper part 33 arranged above the machine frame 21 cooperate with these means of the machine frame 21.

The machine upper part 33 has on its underside 35 supply air

channels 34 which are arranged spaced and transversely with respect to the direction of transport 1b of the film web 1a. Preferably, the spacing is the width of a supply air channel. The supply air channels 34 are conveniently constructed exactly like the air suction-removal channels 22 and have the same dimensions; however, with the perforation row wall 36 having the perforations 37, they are arranged directed towards the film web 1a. In the intermediate space between the supply air channels 34 there are air deflection channels 38 which have approximately the same dimensions as the supply air channels 34. In their wall 39 facing the conveyor track 24, however, there are made suction-removal slots 40 extending transversely to the direction of transport 1b. Consequently, the channels 24 and 38 are arranged alternately.

Supplied to the supply air channels 34, in the direction of the arrow 42, is warm air which emerges in the direction of the arrow 41 from the perforations 36 of the supply air channels 34, is deflected onto the film web and from there is sucked in the direction 43 of the curved arrow and in the direction 44 of the upward arrow - e.g. charged with water of drying - into the air deflection channels 38, from which it is removed by suction in the direction of the arrow 45 to, for example, an air heater (not illustrated). There is thus produced, in each case by the cooperation of a channel 34 with a channel 38, an air roller above the film web 1a which has the effect of a particularly gentle brushing over the film web and thus a drying of the paste of the paste dots on the film web which is particularly easy on the film, without the film altering its spatial shape because of the action of heat. Because of the plurality of cooperating channel systems 34, 38, air flows of different temperature and having different quantities of air can be guided onto the film surface, which makes simple adaptation to the type of film and the composition or quantity of the paste possible. The film web 1a is pressed onto the conveyor belt 28 by the air rollers. Moreover, because of the free rows 31 of perforations and the air-permeable conveyor belt 28, and because of an underpressure

applied to the channels 22, which can be different from one channel to the next, a partial quantity of the supply air from the channels 34 is sucked in the direction of the arrow 46 through the perforations 27 into the channels 22 and is removed from the channels 22 by suction in the direction of the arrow 47. As a result of these measures, a snug bearing and thus shape maintenance of the film web 1a during drying on the conveyor belt 28, and in particular the removal of the moisture coming from the paste of the paste dots, is achieved, so that this moisture cannot exert any damaging effect on the film.

In accordance with a particular embodiment of the invention, after the water has been expelled in the drier 8 the synthetic material of the paste dots is sintered or gelled. To this end, at least one of the channels 22 is a contraflow air channel 22a which is attached to an air supply means (not illustrated) which supplies contraflow air on the end side in the direction of the arrow 48, it being possible for this contraflow air to escape upwards in the direction of the arrow 49 through the perforations 27 of the contraflow air channel 22a. By this means, it is possible successfully to blow against the film web 1a from below such that it curves upwards in the region above the channel 22a in a curve 50, because it is pressed in front of and behind the channel 22a by the supply air from above (direction of the arrow 41) and by the underpressure of the suction removal in the direction of the arrow 46 against the conveyor belt 24.

The purpose of forming the curve or bulge 50 is to be able to act on the paste dots with an air roller acting from above (direction of the arrows 41, 43, 44) which has air of elevated temperature by comparison with the temperature of adjacent air rollers, which would be damaging to the film material of the film web 1a but which is necessary to gel or sinter the synthetic material of the paste dots. So that the high temperature of the air roller above the channel 22a does not damage the film, cooler air is blown against the film web 1a from below in the direction of the arrow 49, so that the film web 1a curves and is raised away from the

conveyor belt 28 or is cooled from below, floating freely. Thus, despite a gelling or sintering temperature which cannot be tolerated by the film, the film can successfully be kept cool such that the high gelling or sintering temperature does not exert any damaging influence on the film material.

Since the air supply quantities, the air suction-removal quantities, the contraflow air quantities, the temperature of the air flows and the throughput rates of the film web 1a can be regulated by simple means, the bearing according to the invention on the respective materials to be treated, of the film of the film web 1a and/or of the constituents of the paste dispersion of the adhesive dots, can be adjusted and moved. If necessary, a plurality of contraflow air channels 22a can be provided next to one another and/or alternately with air suction-removal channels 22.

In the direction of transport 1b behind the drier 8 there is a cooling roller 13 via which the film web 1a is guided and which is cooled from the inside with water at a temperature of for example 8 to 14°C so that the casing of the cooling roller 13 cools the film 1a preferably to 14 to 20°C. Conveniently, the casing surface of the metal casing of the cooling roller 13 is coated with a textile material web or a textile cloth which preferably has an outwardly projecting nap. This textile material prevents a damaging shock-type cooling of the film web 1a. The use of a velvet or a velvet-like material as the textile material web for the surface of the cooling roller 13 is particularly advantageous. Moreover, the textile material web ensures that there is also a good adhesion of the film web 1a on the roller surface and thus good entraining of the material web.

Below the cooling roller 13 there is a small deflection roller 12 which, in the direction of transport, is followed by a further deflection roller 16, downstream of which, in accordance with the invention, is arranged a further widthwise stretching roller 19, which is preferably a cord stretcher. The cord stretcher

stretches the film web in a manner known per se for winding on, which takes place in the downstream winding-on means 7 using the ascending loading rollers 19, 20.

According to the invention, for film material and/or dispersion paste material which cannot be adequately treated in the drier 8, a gelling or sintering station 9 is arranged downstream of the cooling roller 13, with a deflection roller 14 adjoining the cooling roller 13 and a widthwise stretching roller 15 which is arranged spaced above the deflection roller 14 and is preferably a cord stretcher. Arranged above the cord stretcher 15 is a bearing roller 9a which is cooled from the inside with water, preferably at a temperature of 8 to 14°C, and which has a metal casing over which the film web 1c is guided in the direction of the arrow 1d at an angle of deflection of conveniently approximately 270°. A sintering radiation means 10, for example an IR radiation means, which radiates heat in the direction of the casing surface of the bearing roller 9a, extends above a peripheral part region of the surface and spaced therefrom. Between the bearing roller 9a and the deflection roller 16 there is arranged a so-called banana roller 17 by means of which the film web 1c is guided from the bearing roller 9a to the deflection roller 16. The banana roller 17 has a curved spatial shape and consequently acts as a widthwise stretcher, approximately in the manner of a cord stretcher. From the deflection roller 16, the film web 1c passes, in the same way as the film web 1a, to the winding-on means 7 having the component parts 17, 18 and 20.

In the sintering station, the film material of the film web 1c is cooled from the underside, while heat is radiated onto the paste dots from the upper side, during which sintering or gelling of the synthetic material of the dried paste dots is effected. The sintering or gelling temperature which normally has a damaging effect on the thermoplastic material of the synthetic film 1c is kept away from the film by the cooling of the film during sintering or gelling, as is effected in a similar way in

the drier 8 by the channel 22a.

Because of the cooling on the cooling roller 13, shrinkage tensions occur in the film web. For this reason, the film is stretched before winding on by the widthwise stretching roller 19 or before gelling by the widthwise stretching roller 15 and then before winding on by the banana roller 17 and the widthwise stretching roller 19, so that there is available wound on a fold-free end product.

In accordance with a particular embodiment of the invention, the surface of the counter-roller or rubber roller 5 is equipped with a relatively soft rubber or synthetic material. Using a spray arrangement (not illustrated), a thin film of water is sprayed onto the surface of the rubber printing roller 5 so that the film web 1a comes into contact with the film of water or that a film of water is arranged between the surface of the rubber printing roller 5 and the underside of the film web 1a. This measure promotes in a surprising manner defect-free printing on of the paste dots and results in good adhesion of the paste dots on the surface of the film web 1a. This measure has the result that the quantity of paste is successfully applied to the surface of the film web in homogeneously distributed manner, so that an even application of paste can be ensured.



Claims

1. Process for producing thermoplastic synthetic films having adhesive dots printed on in the manner of a grid, hot-melt adhesive dots of a thermoplastic and/or thermoset material being printed in the form of an aqueous dispersion paste onto the films in the manner of a grid by the paste dot printing process, the paste dispersion of the adhesive dots being dried after printing on by the action of heat and then the synthetic component of the adhesive dots being sintered or gelled by the action of elevated temperature, after which the film is cooled so that a film having solidified adhesive dots which adhere to the film and can be activated by heat is produced, characterized in that during the action of elevated temperature on the adhesive dots for sintering or gelling the synthetic component the film is cooled.
2. Process according to Claim 1, characterized in that air is blown against the underside of the film, on which there are no adhesive dots.
3. Process according to Claim 2, characterized in that the film is held in a manner floating freely as a result of air being blown against it.
4. Process according to Claim 1, characterized in that the film is borne on a casing-cooled roller during the action of elevated temperature.
5. Process according to one or more of Claims 1 to 4, characterized in that the film is stretched before printing, so that the film is held at a defined material tension before printing.
6. Process according to Claim 5, characterized in that the film is stretched widthwise.
7. Process according to Claim 5 and/or 6, characterized in that



the film is stretched in the longitudinal direction.

8. Process according to one or more of Claims 1 to 7, characterized in that during drying of the dispersion paste dots the film is pressed against an air-permeable conveyor belt by means of air and/or underpressure.

9. Process according to Claim 8, characterized in that the drying is performed by means of a plurality of air rollers arranged one behind the other.

10. Process according to one or more of Claims 1 to 9, characterized in that the film is stretched widthwise after drying and before sintering or gelling the dried dispersion paste dots.

11. Process according to one or more of Claims 1 to 9, characterized in that the film is stretched widthwise after sintering or gelling the dispersion paste dots.

12. Process according to one or more of Claims 1 to 11, characterized in that the film is borne on a film of water during printing.

13. Process according to one or more of Claims 1 to 12, characterized in that gelling or sintering is carried out using air at an appropriate temperature.

14. Process according to one or more of Claims 1 to 12, characterized in that sintering or gelling is carried out using IR radiation.

15. Process according to one or more of Claims 1 to 14, characterized in that the film is cooled to 14 to 20°C during sintering or gelling.

16. Apparatus for carrying out the process according to one or



more of Claims 1 to 15, having an unwinding means (1); and a dispersion paste dot printing means which is arranged downstream in the direction of film transport (1b) and has at least transport rollers (3, 4) and a rubber printing roller (5) and a screen printing roller (6); a drier (8); a sintering or gelling means; and a winding-on means (7), characterized in that the drier (8) has a planar horizontal running track (24) which is formed by perforated top walls (23) of air suction-removal channels (22) which are arranged one behind the other and extend transversely with respect to the direction of transport (1b) and to which end-side air suction means are attached.

17. Apparatus according to Claim 16, characterized in that the film web (1a) is guided through in a manner floating freely between the two stations (33-14; 22a).

18. Apparatus according to Claim 16 or 17, characterized in that the drier (8) has a sintering or gelling station (33-14) which is arranged above a cooling station (22a), the film web (1a) being guided through between these two stations.

19. Apparatus according to Claim 18, characterized in that at least one contraflow air channel (22a) is arranged in the group of air suction-removal channels (22) and lies with its perforated top wall (23) in the running track (24) and, for formation of the cooling station, is attached at the end side to a cool-air supply means.

20. Apparatus according to Claim 18 or 19, characterized in that perforations (27) in the form of rows of perforations are made in the top walls (23).

21. Apparatus according to one or more of Claims 18 to 20, characterized in that an endlessly guided driven air-permeable conveyor belt (28) lies on the running track (24).

22. Apparatus according to Claim 21, characterized in that the



conveyor belt (28) comprises a Teflon-coated glass fibre cloth.

23. Apparatus according to Claim 21 or 22, characterized in that the running track (24) is wider than the conveyor belt (28), so that a lateral overhang (30) remains on either side of the conveyor belt (28), with at least one respective row of perforations (31) remaining free in the longitudinal direction of the running track (24).

24. Apparatus according to Claim 23, characterized in that the conveyor belt (28) is wider than the dot-coated film web (1a), so that the conveyor belt (28) for its part has a lateral overhang (32) on either side of the film web (1a).

25. Apparatus according to one or more of Claims 18 to 24, characterized in that supply air channels (34) extending above the running track (24) spaced from one another and transversely with respect to the direction of transport (1b) are provided.

26. Apparatus according to Claim 25, characterized in that the supply air channels (34) are constructed exactly like the air suction-removal channels (22) and, with the perforation row wall (36) having the perforations (37), are arranged directed perpendicular to the running track (24).

27. Apparatus according to Claim 25 or 26, characterized in that there are arranged in the intermediate space between the supply air channels (34) air deflection channels (38) which have approximately the same dimensions as the supply air channels and which have in their wall (39) facing the running track (24) suction-removal slots (40) extending transversely to the direction of transport (1b), the supply air channels (34) being attached at the end side to air supply means and the air deflection channels (38) being attached at the end side to air suction-removal means.

28. Apparatus according to one or more of Claims 16 to 27,



characterized by a widthwise stretching apparatus (2) between the unwinding means (1) and the printing means.

29. Apparatus according to one or more of Claims 16 to 28, characterized by a spray apparatus for spraying water onto the surface of the rubber printing roller (5).

30. Apparatus according to one or more of Claims 16 to 29, characterized by a sintering or gelling station (9) downstream of the drier (8).

31. Apparatus according to one or more of Claims 16 to 30, characterized in that a cooling roller (13) is arranged behind the drier (8).

32. Apparatus according to one or more of Claims 16 to 31, characterized in that a widthwise stretching means (15) is arranged in front of the sintering or gelling station (9).

33. Apparatus according to one or more of Claims 16 to 31, characterized in that a widthwise stretching means (17) is arranged downstream of the sintering or gelling station (9).

34. Apparatus according to one or more of Claims 16 to 32, characterized in that a widthwise stretching means (19) is arranged in front of the winding-on station (7).

35. Apparatus according to one or more of Claims 16 to 34, characterized in that the widthwise stretching means (2, 15 and 19) are cord stretchers.

36. Apparatus according to one or more of Claims 16 to 35, characterized in that the widthwise stretching means (17) is a banana roller.

37. Apparatus according to one or more of Claims 16 to 36, characterized in that the sintering or gelling station (9) has



a casing-cooled cooling roller (9a) above which an IR radiation means (10) is arranged.

38. Apparatus according to Claim 37, characterized in that the sintering or gelling station (9) is arranged between the cooling roller (13) and the winding-on means (7).

39. Apparatus according to one or more of Claims 16 to 38, characterized in that the cooling roller (13) is a casing-cooled cooling roller on the surface of which there is arranged a textile material web having a nap, preferably a velvet.

40. Apparatus according to one or more of Claims 16 to 39, characterized in that the casing of the cooling roller (9a) is of metal.