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Device for Supporting a Ribbon of Glass



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The invention relates to a device for supporting a ribbon of glass, having at least one roller arranged in the area of the underside of the ribbon of glass.

A widely used method for producing flat glass is the float method. In the course of this, molten glass is poured on a bath of liquid tin, spreads on it and solidifies while being pulled out of the tin bath in an area of reduced temperatures. Fire-polished surfaces are created on the top and underside in the process, which do not require further finishing.

The ribbon of glass is lifted off the surface of the bath at the cold end of the tin bath and is transported over a series of rollers to a cooling furnace, in which the glass is cooled to room temperature in a controlled manner and the tension is relieved in the process.

In a customary manner, lifting the ribbon of glass off the tin bath is also performed by rollers. In the course of the ongoing operation, these rollers are intended to lift the ribbon of glass gently off the tin bath, while the advancement force for the ribbon is provided by the rollers of the cooling furnace. However, at the start of production, or in case of an interruption which leads to the ribbon of glass being snapped off, the first rollers downstream of the tin bath have to provide this advancement force.

The first roller downstream of the tin bath in particular is subjected to relatively high temperatures, moreover, soiling of this roller by particles from the tin bath dragged along is the most extensive. Because of the high temperatures, some of these particles adhere to the surface of the roller, which results in damage to the underside of the newly formed ribbon of glass.

The replacement of the first rollers after the shaping by an air cushion table is described for example in USP 3,615,315 and USP 4,081,260. By means of this it is possible to prevent damage to the surface, since the ribbon of glass is guided over a surface without having contact with it. However, a grave disadvantage of this method resides in that no drawing force can be exerted by this air cushion table.

As long as an intact ribbon of glass exists, the lack of drawing force from the rollers can be replaced by the drawing effect of the connected cooling furnace. At the start of production, or in case the ribbon of glass snaps off, the process can only be started with an extraordinary effort, since the new start of the ribbon of glass must be manually transported into the depth of the cooling furnace until a drawing effect is again achieved.

The snapping off of the ribbon of glass is an undesirable state which, however, does occur regularly and which must be controlled by process technology.

It is the object of the invention to create a device of the type mentioned at the outset, by means of which the ribbon of glass can be transported without damage to the underside of the ribbon of glass, and which transmits an advancement force to the ribbon of glass, in particular at the start of production, or after the ribbon of glass has snapped off.

This object is attained in that at least one support device is assigned to the roller, that by means of an actuating device the roller or the support device can selectively be brought in contact with the underside of the ribbon of glass, wherein the support device is in contact, at least in some areas, with the underside of the ribbon of glass via a gas cushion.

The device in accordance with the invention can always be employed when a ribbon of glass must be transported in the course of a process, such as is required for example when rolling flat glass or in the course of the float method.

During the normal course of production the ribbon of glass can be conducted contactless, or substantially contactless, by means of the support devices. In this way damage to the underside of the ribbon of glass is prevented. In order to be able to transmit an advancement force to the ribbon of glass when taking up production or production is started, the rollers can be brought into contact with the underside of the ribbon of glass by means of the actuating device. Then the ribbon of glass is transported with the aid of the rollers.

Particularly in connection with the float process, the ribbon of glass can be transported by the action of the rollers in case the ribbon of glass snaps off until it has been introduced far enough into the cooling furnace. Then the cooling furnace can again take up the drawing function. Once introduced, transport can then be transferred to the support device. It has also been shown to be advantageous that the rollers can be produced more cost-effectively than before, since they are only needed at the start of production and in case the ribbon of glass snaps off, and do not affect the production quality in this time.

In accordance with a preferred embodiment variation of the invention it is provided that at least two rollers are arranged in the transport direction of the ribbon of glass downstream of a glass production or glass processing unit, and that at least one support device is arranged in the transport direction upstream of the first roller, as well as between the rollers. The first support device, arranged in the transport direction directly after the glass processing unit, lifts the ribbon of glass out. The glass processing unit can be a float tank, for example. Because the lift-out process

from the float tank takes place in a contactless manner, the ribbon of glass is not negatively affected mechanically in this delicate phase. An advantage of this construction is also that the support devices have such dimensions that it is possible, if desired, to retrofit already existing installations.

A possible variation of the invention is distinguished in that in its area facing the underside of the ribbon of glass the support device has a gas-permeable layer, and that the gas-permeable layer is connected to a pressure generator. In this case it can be provided in particular that the gas-permeable layer has bores and/or slits for the gas to escape, or that the gas-permeable layer is made of porous sinter metal, a porous ceramic material or graphite. If required, it is also possible to apply gas-permeable coatings of a precious metal to the gas-permeable layer, as well as other anti-adhesion or similar surface protection coatings.

In accordance with the invention it can also be provided that moist air, an inert gas, a reducing gas or gas mixture, or an SO₂-containing gas is supplied to the gas-permeable layer for creating the gas cushion.

In connection with the use in the float process in particular, it can be advantageous for the support device connected directly downstream of the float tank if an inert gas or a reducing gas is used there in order to prevent the oxidation of the tin contained in the float tank.

Preferably the contact width on the top of the support devices, which extends in the transport direction and through which the gas flows, should be greater than 20 mm, because with too narrow a width comparatively large gas flows are necessary.

In accordance with a preferred variation of the invention it can be provided that a heat exchanger is assigned to the support devices, or that they have a heat exchanger. It is possible by

means of this to prevent overheating of the support devices, and at the same time the supplied gas flow can be cooled.

A possible alternative of the invention is such that the actuating device adjusts the rollers in respect to the support devices, or the support devices in respect to the rollers, wherein the direction of actuation provides an offset opposite the direction of gravity.

If the rollers are only needed at the start-up or in case of outages, it can also be provided that the rollers have a rough surface, at least in some areas.

By means of this a good transfer of force to the ribbon of glass is assured during roller operation. A structuring of the surface of the rollers can also be used as the roughness.

In order to achieve a floating effect already at comparatively low gas circulation, in accordance with the present invention the upper surfaces of the support devices on which the gas film is formed are designed to be level, or slightly curved in accordance with the ribbon of glass resting on it.

The support devices usefully have a triangular or wedge-shaped cross section in order to utilize the space available between the rollers as effectively as possible and to achieve as great as possible a width of the contact surfaces in the drawing direction along with the shortest possible distance between the rollers.

The invention will be described in greater detail in what follows by means of an exemplary embodiment represented in the drawings.

Shown are in:

Fig. 1, a lateral view and schematic representation of a device for supporting a ribbon of glass, and

Fig. 2, a representation in accordance with Fig. 1 in a changed operational position.

A part of a glass processing unit, namely a float tank, of a flat glass production installation, is represented in Fig. 1. The float tank 10 contains a tin bath 11. An outlet edge 12 is arranged in the area of the end of the long side of the float tank 10. Liquid glass is poured on the tin bath 11 for producing float glass. It is fed in in the area of the outlet edge 12 and is continuously cooled in the process, so that a solidified ribbon 13 of glass results. This must be lifted out of the float tank 10 over the outlet edge 10. In the prior art, rollers 30, which are also called lift-out rollers, are used for this in the customary way. The ribbon 13 of glass runs up on these in such a way that a contact of the underside of the ribbon of glass with the outlet edge is prevented. As Fig. 2 shows, the ribbon 13 of glass is transported off over the rollers 30 and is conveyed into the area of a connected cooling furnace, not represented in the drawings. In accordance with the invention, support devices 20 are now employed in addition to the rollers 30. A first support device 20 is arranged directly following the outlet edge 12. Moreover, support devices 20 are also arranged between respective adjoining rollers 30. As shown in the drawings, these are embodied to be in the form of triangles or wedges. Because of this geometric design it is possible to arrange the support devices 20 in a space-saving manner, and to line up the rollers 30 closely next to each other.

The support devices 20 have a gas-permeable layer 20 in their area facing the underside of the ribbon of glass. The latter constitutes an inflow side and a pressure buildup side facing the ribbon 13 of glass. The pressure buildup side can be embodied to be level or slightly curved, corresponding to the bending of the ribbon of glass. The pressure buildup side is arranged within the support devices 20 and is connected to a pressure generator via a distribution chamber.

Gas can be conveyed into the area of the pressure buildup side by means of the pressure generator. It then forms a gas cushion between the gas-permeable layer and the underside of the ribbon 13 of glass. As can be seen in Fig. 1, the gas cushion supports the ribbon 13 of glass.

Different operational states are represented in Figs. 1 and 2. The arrangement during the normal production state is shown in Fig. 1. But Fig. 2 shows the setting which is employed at the start of production or after the ribbon of glass has snapped off. A switch between the two operational states can be made by means of an actuating device. In the process, the actuating device performs a relative displacement between the rollers 30 and the support devices 20. In the course of this the support devices 20 (Fig. 1), or the rollers 30 (Fig. 2) can be selectively brought into contact with the underside of the ribbon of glass.

Claims

1. A device for supporting a ribbon of glass, having at least one roller arranged in the area of the underside of the ribbon of glass,

characterized in that

at least one support device (20) is assigned to the roller (30), that by means of an actuating device the roller (30) or the support device (20) can selectively be brought in contact with the underside of the ribbon of glass, wherein the support device (20) is in contact, at least in some areas, with the underside of the ribbon of glass via a gas cushion.

2. The device in accordance with claim 1,

characterized in that

at least two rollers (30) are arranged in the transport direction of the ribbon (13) of glass downstream of a glass production or glass processing unit, and

at least one support device (20) is arranged in the transport direction upstream of the first roller, as well as between the rollers (30).

3. The device in accordance with claim 1 or 2,

characterized in that

in its area facing the underside of the ribbon of glass the support device (20) has a gas-permeable layer (21), and

the gas-permeable layer (21) is connected to a pressure generator.

4. The device in accordance with claim 3,
characterized in that
the gas-permeable layer (21) has bores and/or slits for the gas to escape.

5. The device in accordance with claim 4,
characterized in that
the gas-permeable layer (21) is made of porous sinter metal, a porous ceramic material or porous graphite.

6. The device in accordance with one of claims 3 to 5,
characterized in that
moist air, an inert gas, a reducing gas or gas mixture, or an SO₂-containing gas is supplied to the gas-permeable layer (21) for creating the gas cushion.

7. The device in accordance with one of claims 1 to 6,
characterized in that
a heat exchanger is assigned to the support devices (20), or that they have a heat exchanger.

8. The device in accordance with one of claims 1 to 7,
characterized in that

the actuating device adjusts the rollers (30) in respect to the support devices (20), or
the support devices (20) in respect to the rollers (30), wherein the direction of actuation provides an
offset opposite the direction of gravity.

9. The device in accordance with one of claims 1 to 8,
characterized in that

the rollers (30) have a rough surface, at least in some areas.

10. The device in accordance with one of claims 1 to 9,
characterized in that

the support device (20) arranged between two adjoining rollers (30) is embodied in
the shape of a triangle or a wedge in cross section.

11. The device in accordance with one of claims 1 to 10,
characterized in that

on its outside facing the ribbon (13) of glass, the gas- permeable layer (21) has a
curved surface geometry.

12. The device in accordance with one of claims 1 to 11,
characterized in that

the contact width on the top of the contact segments, through which gas flows and
which extends in the transport direction of the ribbon (13) of glass is greater than 20 mm.