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⑤④ **Apparatus for setting a wire in a plastic film.**

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Description

The present invention relates to an apparatus for setting a wire in a plastic film, which is particularly useful in the production of heatable laminated glass, wherein a plastic film or an intermediate film, fitted with waveformed wires, is typically laminated between glass sheets, the assembly being intended for use e.g. as a motor vehicle wind screen.

An apparatus as cited in the preamble of claim 1 is disclosed in US-A-3,795,472. This publication describes a heat treatment method for the plastic film with the wire embedded therein, wherein the plastic film is made to shrink in order to let the wires assume a wrinkled waveform in a random orientation. Among else, the apparatus comprises a collapsible drum member to permit decreasing the drum circumference. This configuration is rather complicated.

Methods for setting a wire in a plastic film used particularly as an intermediate film in laminated glass are prior disclosed e.g. publications GB 1,392,736 and US 3,522,651. In the method described in publication GB 1,392,736, the simultaneous heat-assisted setting of a plurality of wires on a plastic film travelling horizontally on a base structure is carried out by means of an eccentric-controlled guide rod, which is in a transverse reciprocating motion relative to the plastic film advancing direction. During said reciprocating motion, the guide rod creates a waveform in the wires running through a set of grooves formed in the guide rod. Setting the wires in a desired waveform on the surface of a plastic film is effected by means of a press roll, located downstream of the guide rod in the plastic film advancing direction and having the same width as the plastic film. In order to set the wires permanently in a plastic film, the cited publication further discloses a number of different heating variations either for wires, a press roll or a plastic film. The publication US 3,522,651 discloses a method, wherein a rotating frame assembly is fitted with resistance wires adjacent to each other. At the following stage of the method, the wires carried by said frame assembly are all waved in a single operation by means of a cylindrical toothed roller. At the following separate operating stage, the waved wires removed from said frame assembly are secured to a glass surface by means of a sprayable chemical.

A useful wire is characterized by being thin and prone to breaking as well as inconvenient to handle. Therefore, in a method disclosed in the publication GB 1,392,736, the simultaneous handling of a plurality of wires leads to a number of practical problems. For example, breaking of an individual wire or its running out on a particular supply reel is difficult to notice. The wires must be synchronized and arranged according to the width and/or desired resistance characteristics of a plastic film in each individual production series. Thus, the application of the above-described

method requires considerable preliminary work and continuous monitoring during the manufacturing process. An apparatus used in the method disclosed in the publication US 3,522,651 requires a lot of space particularly due to independent stages of operation. It is of course obvious that production involving several stages of operation is not efficient. The manufacture of high-quality laminated glasses with the technique described in the cited publication is very tedious and inconvenient. Particularly due to the spraying of a chemical agent, the method also involves environmental hazards and, thus, application of the method requires labour protective measures.

An object of this invention is to provide a decisive improvement on the above drawbacks and, thus, to advance the available prior art. In order to achieve this object, an apparatus of the invention is defined in claim 1.

The most important benefits gained by an apparatus of the invention include simplicity and operating reliability since a wire is set in a plastic film in a single operation, the progress of which can be readily monitored. An apparatus for the application of this method requires very little space indeed, and yet the obtainable productive capacity is of the same order or even better than what is achieved by the prior art methods.

By using an apparatus of the invention it is possible in a simple and reliable manner to set a wire in a waveform in contact with a plastic film, said plastic film being particularly intended for use as an intermediate film in laminated glass.

The non-independent claims directed to an apparatus disclose preferred embodiments for an apparatus of the invention.

The invention will be described in detail in the following specification with reference made to the accompanying drawing which is a schematic perspective view of one embodiment of the apparatus.

An apparatus of the invention includes a base block 1, set on a fixed supporting structure, such as a floor, and provided with guides or the like elements 2 on top of it for carrying a wire supply frame 3 during the application of this method in the longitudinal direction of guides 2. The apparatus further includes a cylindrical drum or a cylinder 4 which is carried by support brackets 5 or the like elements upon axle stubs or the like 6 projecting from the ends of the drum 4, said brackets being mounted adjacent to base block 1 e.g. on a fixed supporting structure, such as a floor. The drum has a circular cross-section and axle stubs 6 are located centrally relative to the cross-section, said drum 4 rotating around the centre axis 6' of axle stubs 6 extending in the direction of guides 2 and, thus, in the traveling direction of supply frame 3 (arrow 7). In order to rotate said drum 4, the base block 1 is provided e.g. with belt drive 8 or a like driving mechanism to operate at the end of at least one of the axle stubs 6.

The external surface of drum 4 is provided with a plastic film 9 e.g. by using suitable fastening arrangements, such as providing the drum with a perforation for creating a vacuum effect to adhere plastic film 9 to the external surface of drum 4. The vacuum system is not shown in the drawing as it is obvious to a skilled man. Naturally, it is also possible to use adhesive fastening.

In the illustrated embodiment, a supply frame 3 travels continuously in the direction of an arrow 10 from left to right as seen in the drawing, whereby a waveformed wire 11 coming from the supply frame is set in contact with plastic film 9 on top of said drum 4.

In the illustrated embodiment, the supply frame 3 is provided with a carrier arm 12 or a like, which is fitted with elements 17, 19 for giving said wire 11 a waveform and for setting it in contact with plastic film 9. The carrier arm 12 is preferably adapted to be movable in vertical direction whereby, e.g. especially during the replacement of drum 4, it can be turned out of the way and the drum already provided with wires 11 can be picked up from its position on top of support brackets 5 and another drum 4 to be provided with wires 11 can be placed along with its plastic film 9 to rest upon support brackets 5 and, if necessary, said supply frame 3 can be carried to a starting position at either end of drum 4.

The supply frame 3 is provided with a wire spool 13 or a like wire supply from which wire is passed by means of a guiding element 14 mounted on carrier arm 12 to said elements 17 giving the wire a waveform. In the drawing, said elements 17 for creating a waveform include a gear system carried by an auxiliary frame 16 fitted in connection with carrier arm 12, said system comprising two mutually meshed gears, e.g. bevel gears, the line of contact therebetween being substantially perpendicular to the surface of drum 4, whereby the waveformed wire emerges from between the gears in a manner that the waveform extend in the direction of the surface of drum 4. Gears 17a, 17b receive their driving power e.g. from a driving mechanism 18, which is common to both gears and mounted in contact with auxiliary frame 16. A particularly preferred arrangement is that the gears receive a driving power directly from the rotating motion of drum 4, the toothings of at least one of the gears 17a, 17b being in a direct contact with plastic film 9 on the external surface of drum 4. The element for setting a wire in contact with plastic film 9 comprises a press roller or a like 19 receiving its driving force from the rotating motion of drum 4, said roller being located in alignment with the waveform wire whereby, upon rotating around its axle 20, said roller presses waveformed wire 11 into contact with plastic film 9. Press roller 19 is mounted on carrier arm 12 by means of an auxiliary link 21.

Furthermore, the drawing illustrates schemati-

cally an electrical system for heating a resistance wire especially between gear assembly 17 and press roller 19, the setting of a resistance wire on a plastic film being effected by the application of thermal effect and assisted by press roller 19. Conductor wires 22 and 23 are connected on the one hand to the gear assembly and on the other hand to the press roller, both elements being made of an electrically conducting material. By way of carrier arm 12 said conductors are connected to a current source, e.g. a directcurrent source included in supply frame 3, which creates a potential difference between elements 17 and 19 to effect the heating of waveformed wire 11 as it travels between said elements 17 and 19 whereby, immediately after passing said zone, it will arrive within the range of action of press roller 19 and at this time at least said wire adheres to plastic film 9. In practice, e.g. one 17a of the gears can be made of a metal or a like electrically conductive material and conductor wire 22 can be connected to said gear 17a.

The invention can be subjected to major modifications. Firstly, one and the same drum 4 can be simultaneously provided with two or more wires in other words a plurality of carrier arms 12 can be used in parallel or one carrier arm can be fitted with a plurality of elements for supplying the wire, creating the waveform and securing the wire to a plastic film. On the other hand, the base structure carrying said plastic film 9 can be in the shape of an endless belt or a like web structure supported by two or more cylinders (e.g. similar to drum 4) adapted to be rotatable around an axle assembly comprising two or more parallel axles. Thus, in the annexed claims, the element upon which a plastic film 9 is laid has been defined as an endless surface. In addition, the method and apparatus offer extensive possibilities for variations in view of adjusting the wire density upon a plastic film 9. A relative adjustment of the traveling speeds of endless belt 4 and supply frame 3 makes it possible to have desired distances from a wire laid in spiral form on endless surface 4 to the adjacent spirals in a direction perpendicular to the traveling direction of endless surface 9. It is also obvious that elements 17 and 19 can be located in fixed positions relative to base block 1 of the apparatus and to adapt said endless surface 4 movable in the longitudinal direction of axle assembly 6 during the course of setting a wire. The above alternatives can also be used simultaneously. By reversing the traveling direction of endless surface 4 it is possible to carry out a reciprocating setting of a wire. It is obvious that a wire can also be set on endless surface in the longitudinal direction of an axle assembly, said surface 4 being indexed forward in a manner that a new section of a plastic film to be provided with a wire is located in alignment with elements 17 and 19.

When wire 11 has been laid on an endless surface, a plastic film 9 is ready for use in a laminating

operation after being removed. It is obvious that the replacement of endless surface 4, particularly when using a drum, can be automated in a simple manner to carry on the operation continuously as far as setting and removal of plastic film 9 is concerned.

Claims

1. Apparatus for setting a wire in contact with a plastic film, particularly for setting a resistance in contact with a plastic film, said plastic film being especially intended for use in a laminated glass manufacturing process as an intermediate film for laminated glass, said apparatus comprising along with a base block (1):
 - a base structure arranged as an endless surface (4), upon which is laid a plastic film (9) to be provided with a wire and which is adapted to be rotatable around the centre axis (6') of an axle assembly (6),
 - elements (17) particularly for creating a waveform of a gearing in the wire (11) by working the wire mechanically,
 - elements (2, 3, 12) for shifting the wire to be set in the plastic film and said endless surface (4) in relation to each other substantially in the longitudinal direction of said axle assembly (6) substantially on the width that is to be provided with the wire (11),
 characterized in that the apparatus comprises further
 - an element (19), in contact with the endless surface (4) for setting the wire (11) in wave form in contact with the plastic film (9), wherein
 - an electric potential difference is provided between elements (17) and (19) particularly for heating the section of wire between said elements (17) and (19).
2. Apparatus according to claim 1, characterized in that the potential difference is achieved by using a conductor assembly (22, 23), said conductor assembly (22, 23) being preferably connected to a current source fitted inside a supply frame (3).
3. Apparatus according to claim 1 or 2, characterized in that upon a base block (1) is laid a supply frame (3), adapted to be movable preferably on guides (2) or the like and comprising a carrier arm (12) or a like member which is fitted with elements (17) for producing a wave form as well as elements (19) for setting a wire on a plastic film (9), said carrier arm (12) being preferably adapted to be movable relative to the supply frame (3).

Patentansprüche

1. Vorrichtung zum Anbringen eines Drahtes auf einer Kunststoffolie insbesondere eines Widerstanddrahtes, wobei die genannte Folie Anwendung findet als Zwischenschicht bei der Herstellung von Verbundglas und wobei die Vorrichtung neben einem Fundament-Block (1) folgende Elemente aufweist:
 - eine Basisstruktur (4) mit endloser Oberfläche, welche eine Kunststoffolie (9), die mit einem Draht bestückt werden soll, trägt und um die zentrale Achse (6') einer Welle (6) drehbar ist, sowie
 - Elemente (17), welche dem Draht (11) beim Durchlauf zwischen Zahnrädern auf mechanische Weise eine Wellenform geben und ferner
 - Elemente (2,3,12), welche den auf die Kunststoffolie anzubringenden Draht relativ zur Längsrichtung der Achse (6') verschieben entsprechend dem vorgesehenen Abstand zwischen den Windungen des Drahtes (11),
 dadurch gekennzeichnet, dass die Vorrichtung
 - mit einem Element (19) versehen ist, welches in Verbindung mit der endlosen Oberfläche steht und den wellenförmigen Draht (11) auf die Kunststoffolie (9) drückt und dass
 - für eine elektrische Potentialdifferenz zwischen den Elementen (17) und (19) gesorgt ist, welche den Drahtabschnitt zwischen den Elementen (17) und (19) aufheizt.
2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, dass die Potentialdifferenz von den Zuleitungen (22,23) aufrechterhalten wird, wozu diese vorzugsweise mit einer Stromquelle verbunden sind, die im Schlitten (3) untergebracht ist.
3. Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass auf dem Fundament-Block (1) ein Schlitten (3) angebracht ist, der vorzugsweise entlang Schienen (2) verschiebbar ist, und dass der Schlitten mit einem Auslegerarm (12) ausgerüstet ist, welcher sowohl die Elemente (17), die dem Draht eine Wellenform geben, als auch die Elemente (19) trägt, die den Draht auf die Kunststoffolie (9) aufbringen, und dass dieser Auslegerarm vorzugsweise relativ zum Schlitten (3) bewegt werden kann.

Revendications

1. Appareil destiné à mettre un fil en contact avec

un film en matière plastique, en particulier destiné à mettre une résistance en contact avec un film en matière plastique, ledit film en matière plastique étant spécialement prévu pour être utilisé dans un processus de fabrication de verre feuilleté en tant que film intermédiaire pour le verre feuilleté, ledit appareil comportant, avec un bloc de base (1) :

- une structure de base prévue sous la forme d'une surface sans fin (4), sur laquelle est posée un film de matière plastique (9) devant être pourvu d'un fil et qui est prévue pour pouvoir tourner autour de l'axe central (6') d'un ensemble d'axe (6), 10
- des éléments (17) destinés particulièrement à créer une forme d'onde d'un engrenage dans le fil (11) en travaillant mécaniquement le fil, 15
- des éléments (2, 3, 12) destinés à déplacer le fil devant être mis dans le film en matière plastique et ladite surface sans fin (4) l'un par rapport à l'autre sensiblement dans la direction longitudinale dudit ensemble d'axe (6) sensiblement sur la largeur qui doit être pourvue du fil (11), 20 25

caractérisé en ce que l'appareil comporte en outre

- un élément (19), en contact avec la surface sans fin (4) afin de mettre le fil (11) en forme d'onde en contact avec le film en matière plastique (9), 30
- une différence de potentiel électrique étant prévue entre les éléments (17) et (19) en particulier afin de chauffer la section de fil entre lesdits éléments (17) et (19). 35

2. Appareil selon la revendication 1, caractérisé en ce que la différence de potentiel est obtenue en utilisant un ensemble conducteur (22, 23), ledit ensemble conducteur (22, 23) étant de préférence relié à une source de courant prévue à l'intérieur d'un bâti d'alimentation (3). 40

3. Appareil selon la revendication 1 ou 2, caractérisé en ce que, sur le bloc de base (1), est posé un bâti d'alimentation (3), prévu pour être mobile de préférence sur des guides (2) ou équivalent et comportant un bras de support (12) ou un élément équivalent qui est équipé d'éléments (17) destinés à produire une forme d'onde ainsi que d'éléments (19) destinés à mettre un fil (11) sur un film en matière plastique (9), ledit bras de support (12) étant de préférence prévu pour être mobile par rapport au bâti d'alimentation (3). 45 50 55

