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(54) **PROFILE FOR MANUFACTURING A SLAT FOR A SWIMMING POOL COVER AND USE OF A PLASTIC COMPOSITION IN A SWIMMING POOL COVER**

(57) Profile (1) for manufacturing a slat for a swimming pool cover, wherein the profile (1) is made of plastic, wherein the profile (1) comprises one or more internal channels (8), wherein the profile (1) comprises a first top wall (5) located above the one or more channels (8), wherein the first top wall (5) has a first relative light transmittance for infrared light and a second relative light transmittance for visible light, wherein the ratio (1 - the second relative light transmittance)/(1 - the first relative light transmittance) is at least 1.10. The invention further concerns the use of a plastic composition in a swimming pool cover, said plastic composition being adapted to transmit infrared light better than visible light.

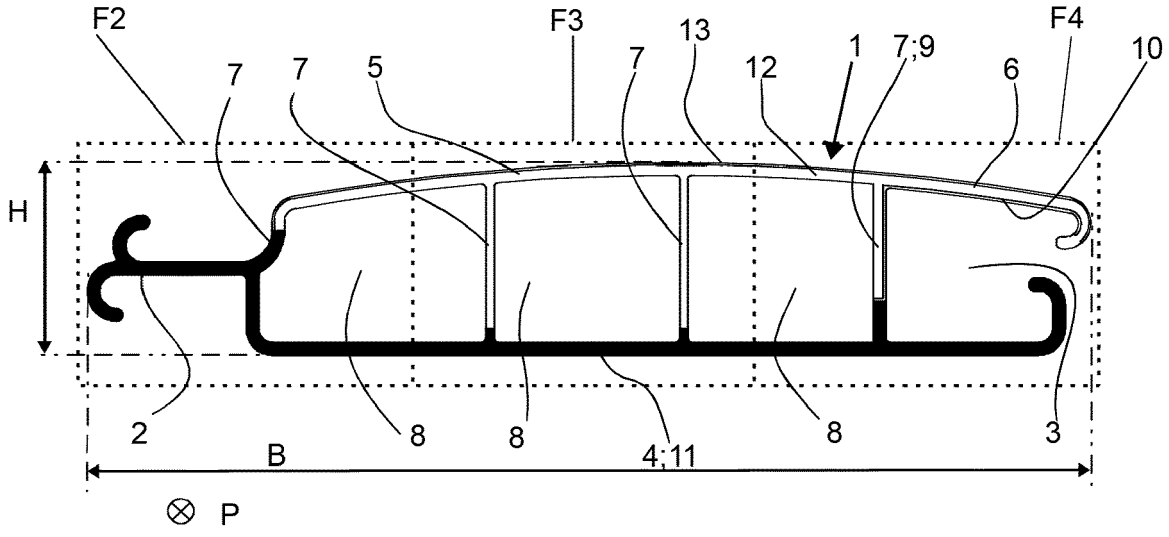

Fig. 1

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Description

[0001] The present invention relates to a profile for manufacturing a slat for a swimming pool cover, in particular a rollable swimming pool cover, and a swimming pool cover, more particularly a rollable swimming pool cover, that is made from such profiles. The invention also relates to the use of a plastic composition in a swimming pool cover.

[0002] It is known to make rollable swimming pool covers from slats made from plastic profiles which are provided on their ends with closing caps. These profiles are hingedly mutually coupled with their sides by means of a lateral hook that forms part of the profile and that fits into a lateral groove that forms part of an identical adjacent profile.

[0003] Such profiles and swimming pool covers are known from, for example, AU-A-21669/95, FR2761711A1, DE29604839U1 and FR2719622A1.

[0004] It has a particular advantage if the underside of the profiles is black and the upper side is transparent, such that overheating of the upper side is avoided, but sunlight is maximally absorbed by the underside of the profiles, whereby this heat can be released again to the swimming pool water to thereby heat up the swimming pool water. Beause of the black underside this also limits algae growth in the swimming pool and/or this algae growth is not visible. Such profiles are also called 'Solar' profiles.

[0005] Such profiles and swimming pool covers are known from, for example, DE3044949A1 and DE4101727A1.

[0006] However, it has been found that relatively stagnant water with a high temperature is formed in the lateral groove, as a result of which in such profiles, more precisely in the groove, a considerable algae growth takes place.

[0007] Therefore, profiles have been developed wherein the top walls and optionally the side wall of the groove are opaque, such that little or no sunlight can enter the groove and algae development is limited and avoided. Also, because of this, contaminations in the grooves, such as leaves and dead insects, are hidden from view.

[0008] Such profiles and swimming pool covers are known from, for example, DE19646117C1, DE10103204A1 and EP2295676B1.

[0009] However, these profiles have the disadvantage that, when they are assembled into a swimming pool cover, the upper side of this swimming pool cover does not look homogeneous, but rather striped. This is the case because the top wall of the profile at the location of the groove is black or because at the location of the groove a black wall lies close below a transparent top wall, while at other locations than the groove the black bottom wall is located at a much larger distance from the transparent top wall. This means that the black colour at the location of the groove is much more explicitly visible than in other locations, resulting in a striped, zebra-like pattern.

[0010] Such profiles thereby cause an unattractive striped pattern on the swimming pool cover, although they are technically satisfactory as far as the heating of the swimming pool water and the prevention of algae growth are concerned.

[0011] The known profiles with a transparent top wall also have the disadvantage that condensation droplets on the inside of the profiles are clearly visible. Such droplets of condensation water may form on the inside of the profiles due to condensation of water vapor, especially due to cooling at night, and are unattractive.

[0012] With the aim of reducing or avoiding the above and other disadvantages, the present invention concerns a profile for manufacturing a slat for a rollable swimming pool cover, wherein the profile is made of plastic, wherein the profile comprises one or more internal hollow channels extending in the profile direction, wherein the profile comprises a first top wall located above the one or more hollow channels, wherein the first top wall has a first relative light transmittance for infrared light and a second relative light transmittance for visible light, wherein the ratio (one minus the second relative light transmittance)/(one minus the first relative light transmittance) is at least 1.10.

[0013] The values (1 - the first relative light transmittance) and (1 - the second relative light transmittance) indicate which fraction of the light in the respective wavelength range is absorbed or reflected by the first top wall.

[0014] Herein, the first and second relative light transmittance are expressed as fractions.

[0015] Obviously, numerical values of the first and second relative light transmittance, when expressed as percentage, should first be divided by 100 to obtain the first and second relative light transmittance expressed as fraction.

[0016] Obviously, these values are dependent on the composition and thickness of the first top wall, and in particular on the concentration of intentionally added chemical compounds and other products present therein that absorb or reflect visible light better than infrared light. These values are also dependent on other components in the first top wall that can also absorb or reflect light over the entire spectrum or over a portion thereof. This concerns in particular the plastic itself of which the top wall is made.

[0017] For the sake of completeness, it is noted that in the technical literature different wavelengths are used for the transition between infrared light and visible light. For the avoidance of doubt and possible edge effects in a transition range, it is noted that in this document infrared means the wavelength range between 800 nm and 1400 nm, which approximately corresponds to what is called the near infrared band, and that visible light means the wavelength range between 400 nm and 700 nm.

[0018] Preferably, the ratio (1 - the second relative light transmittance)/(1 - the first relative light transmittance) is at least 1.4, and more preferably at least 1.8, and even

more preferably at least 2.5.

[0019] Hereby, it is noted that the profile direction is the direction in which a cross section of the profile remains the same.

[0020] For completeness it is noted that the first relative light transmittance and the second relative light transmittance concern the same part of the first top wall, in other words the same position on the first top wall.

[0021] Such a profile has the advantage that the first top wall appears dark, due to its low second relative light transmittance, such that the striped, zebra-like pattern is less noticeable.

[0022] Also, occurring condensation droplets will be completely or partially hidden from view.

[0023] At the same time, such a first top wall still transmits a significant portion of the energy in sunlight, namely a relatively large portion of the infrared light supplemented with a smaller, but not necessarily negligible portion of the visible light. As a result, the bottom wall of such a profile can still absorb a significant portion of the energy in sunlight and deliver it to the swimming pool water to heat it up.

[0024] The basis of the invention is the insight that a significant portion of the energy in sunlight is located in the infrared portion of the spectrum, such that the transmittance of the top wall for visible light only determines to a limited extent how much energy from sunlight such a profile can absorb in order to transfer it to the pool water. This in contrast to the already known disclosures in which only the visible portion of the spectrum is considered.

[0025] Obviously, the properties of the first top wall, in particular the concentration of an additive that selectively blocks visible light but transmits infrared light and the layer thickness of a plastic layer in which it is present, can be chosen such that virtually no visible light is transmitted. Therefor, in practice, the first layer of plastic can be completely black, such that the striped pattern and condensation droplets cannot be seen at all.

[0026] With other words, the degree to which, by means of the invention, the undesired striped pattern is visually suppressed, can be selected taking into account other desirable characteristics such as total light transmittance and colour intensity.

[0027] In a preferred embodiment, the profile on a first side is provided with a groove for receiving a coupling member, wherein the groove has a second top wall on its top side, the second top wall having a third relative light transmittance to infrared light and a fourth relative light transmittance for visible light, wherein the ratio (one minus the fourth relative light transmittance) divided by (one minus the third relative light transmittance) is at least 1.10.

[0028] As a result, the second top wall also transmits said significant portion of the energy in sunlight such that a larger portion of the energy that irradiates the total surface of a swimming pool cover can be used for heating up the water.

[0029] In this case, visible light is completely or partially blocked, such that algae growth in the groove is limited. Also, any contaminations in the groove, including possibly some limited algae growth, is not visible from above.

[0030] This advantage exists independently, such that according to another aspect the invention concerns: a profile for manufacturing a slat for a rollable swimming pool cover, wherein the profile is made of plastic, wherein the profile on a first side is provided with a groove for receiving a coupling member, wherein the groove has a second top wall at its top side, the second top wall having a third relative light transmittance for infrared light and a fourth relative light transmittance for visible light, wherein the ratio (one minus the fourth relative light transmittance) divided by (one min the third relative light transmittance) is at least 1.10.

[0031] Preferably, the ratio (one minus the fourth relative light transmittance) divided by (one minus the third relative light transmittance) is at least 1.4, and more preferably at least 1.8, and even more preferably at least 2.0.

[0032] In a preferred embodiment the first relative light transmittance is at least 0.40, and preferably at least 0.65. For the sake of completeness, it is noted that a first relative light transmittance of 0.40 means that 40 % of the infrared light is transmitted and 60 % is not transmitted but is absorbed or reflected. This allows a large portion of the energy-rich infrared light to irradiate through the top wall to heat up the pool water.

[0033] In a preferred embodiment, the second relative light transmittance is a maximum of 0.65, and preferably a maximum of 0.50. This means that a maximum of 65 %, and preferably a maximum of 50 % of the visible light is transmitted, such that the first top wall is sufficiently dark.

[0034] In a preferred embodiment, the profile has a bottom wall below the one or more hollow channels, the bottom wall being opaque to both infrared light and visible light, and preferably black. This allows the sunlight to be well absorbed by the bottom wall of the profile to optimally heat up the pool water.

[0035] In a preferred embodiment, the profile has a groove on a first side for receiving a coupling member, wherein the groove has a second top wall on its top side, wherein the second top wall comprises a first layer of plastic that is opaque.

[0036] This prevents light from entering the groove and stimulating algae growth in there.

[0037] In a preferred embodiment, the profile is provided on a second side with a coupling member which is adapted to be inserted into the groove of another identical profile in order to thereby couple two profiles hingedly laterally to each other.

[0038] In that case, the coupling member is preferably opaque and preferably made of the same plastic composition as the bottom wall, such that the possibilities for light to enter the groove are even further limited.

[0039] In a preferred embodiment the first layer of plastic and the bottom wall have a different colour. Hereby,

the colour of the first plastic layer can be adapted to the apparent colour obtained by the combination of the first top wall and the bottom wall, in order to avoid to an even greater extent a striped zebra-like pattern.

[0040] In a preferred embodiment, the first top wall comprises one or more layers of plastic, wherein said one or more layers of plastic, optionally with a mutually different thickness, are also located above said first layer of plastic of the second top wall, wherein said one or more layers of plastic are located in the second top wall or are located in another wall, said other wall being located above the second top wall.

[0041] By the use of one or more layers of plastic, which are the same as the first top wall above the first layer of plastic, the formation of a striped pattern can be prevented even better.

[0042] The invention further relates to a swimming pool cover comprising two or more mutually coupled slats, wherein the slats comprise a profile according to the invention.

[0043] The invention also relates to the use of a plastic composition in a swimming pool cover, wherein the plastic composition is adapted to transmit infrared light better than visible light.

[0044] The plastic composition has a first specific extinction for infrared light and a second specific extinction for visible light, whereby the ratio between the second specific extinction and the first specific extinction is at least 1.1. The extinction includes both reflection and absorption.

[0045] According to Beer-Lambert's law, the relative light transmittance $I_1/I_0 = 10^{-\varepsilon cd}$.

[0046] Herein, I_1 is the emerging light intensity, i.e. the light intensity at the bottom side of the first top wall, I_0 the incident light intensity, i.e. the light intensity at the top side of the first top wall, ε the extinction coefficient of the light-absorbing compound or compounds, c the concentration of the light-absorbing compound or compounds and d the thickness of the first top wall.

[0047] The product of c and ε is the specific extinction, and it is a material property of the various layers of the first top wall.

[0048] Preferably, the ratio between the second specific extinction and the first specific extinction is at least 1.4, and more preferably at least 1.8.

[0049] Such a plastic composition is eminently suitable for making a profile according to the invention.

[0050] Preferably, the plastic composition is used in a wall, in particular a top wall, of a slat forming part of the swimming pool cover. Preferably, the slat is made from a profile according to the invention.

[0051] Preferably, the profile is an extruded profile that is made of polycarbonate.

[0052] In a preferred embodiment, the groove has an opaque side wall on the side facing the one or more internal hollow channels, such that obliquely incident light is prevented from reaching into the groove via this side wall where it may stimulate algae growth.

[0053] In this embodiment, the top wall is minimally partially transparent in the visible range, but also coloured, and the first colour is chosen such that it does not differ much from the top wall colour, in order to avoid the zebra effect.

[0054] The invention also relates to a rollable swimming pool cover comprising two or more profiles laterally coupled to each other according to the invention.

[0055] In order to clarify the invention, a preferred embodiment of a profile according to the invention is described below, with reference to the following figures, wherein

Figure 1 represents a cross-section of a profile according to the invention;
Figures 2, 3 and 4 represent the parts of the profile of Figure 1 indicated by F2, F3 and F4 on a larger scale;
Figure 5 represents a cross-section of another profile according to the invention;
Figure 6 represents the relative light transmittance of a used material;
Figure 7 represents the relative light transmittance of a part of the profile of Figure 1; and
Figure 8 represents the relative light transmittance of a part of the profile of Figure 5.

[0056] The profile 1 shown in the Figures 1 to 4 has a total width B of 73 mm and a total height H of 14 mm. The relative dimensions of the various parts of the profile 1 are correctly shown in the figures. The profile 1 extends in a profile direction P.

[0057] On a side, the profile 1 is provided with a coupling member 2 with a double hook shape. On the opposite side, the profile 1 is provided with a groove 3 which can receive such a coupling member 2, such that such profiles 1 can be laterally mutually coupled to form a swimming pool cover and are then hingedly coupled to each other.

[0058] The profile 1 comprises a bottom wall 4 and a first top wall 5 and a second top wall 6. The first top wall 5 is connected to the bottom wall 4 by means of four connecting walls 7 which define three closed hollow channels 8 between the bottom wall 4 and the first top wall 5. One of the connecting walls 7, in this example the rightmost connecting wall, also forms the side wall 9 of the groove 3. The second top wall 6 is located above the groove 3 and is the top wall of this groove 3.

[0059] The first top wall 5 and the second top wall 6 together form a slightly curved common top wall without kink or angle at the junction between the first top wall 5 and the second top wall 6.

[0060] The bottom wall 4 extends in this example under both the hollow channels 8 and under the groove 3.

[0061] The profile 1 is, in this example, but not necessarily, made of polycarbonate, and is made by means of coextrusion of four plastic compositions.

[0062] The second top wall 6 consists of three layers

of plastic and the first top wall 5 consists of two layers of plastic.

[0063] The bottom layer of the second top wall 6, hereinafter referred to as the first layer 10 of plastic, is made of opaque polycarbonate with added colorants to obtain the anthracite grey RAL colour 7016-P. This first layer of plastic is opaque, that is to say that it does not transmit light.

[0064] The bottom wall 4 consists of one layer of plastic, hereinafter referred to as the second layer 11 of plastic, and it is made of polycarbonate with 0.5 % carbon black added thereto. This second layer 11 of plastic is opaque and black.

[0065] The bottom layer of the first top wall 5, hereinafter referred to as the third layer 12 of plastic, is made of a coloured polycarbonate Makrolon 3113, coloured with colour 450601, supplied by the company Covestro. This coloured polycarbonate is mixed in a ratio of 1 to 4 with transparent Makrolon 3113 to produce the third layer 12.

[0066] This colour 450601 has been developed to allow infrared light selectively to pass through and to block visible light partially or completely by reflection or absorption. Such dyes are available from a variety of suppliers, wherein the skilled person is able to easily determine the concentration themself depending on the desired visible light transmittance.

[0067] The relative light transmittance according to the manufacturer of said coloured polycarbonate Makrolon 3113, of layers 1 mm thick is shown in Figure 6, wherein the horizontal axis represents the wavelength in nanometres and the vertical axis represents the relative light transmittance in %.

[0068] This third layer of plastic 12 continues into the second top wall 6, wherein said third layer 12 of plastic forms the middle layer of the second top wall 6. This third layer 12 of plastic is tinted dark grey with a slightly purple hue, but is transparent, approximately like sunglasses.

[0069] The top layer of the first top wall 5, hereinafter referred to as the fourth layer 13 of plastic, is made of transparent polycarbonate with an additive that blocks UV light.

[0070] The fourth layer 13 of plastic continues into the second top wall 6 and forms the top layer of the second top wall 6.

[0071] The coupling member 2 is made of the same material as the bottom wall 4.

[0072] The upper part of the side wall 9 of the groove 3 consists of two layers, more specifically a layer of plastic which is located on the side of the hollow channels 8 and which is made of the same material as the third layer 12 of plastic and which adjoins the third layer 12 plastic, and a layer of plastic which is located on the side of the groove 3 and which has the same composition as the first layer 10 of plastic.

[0073] The bottom part of the side wall 9 of the groove 3 is made of the same material as the bottom wall 4.

[0074] This makes the entire side wall of the groove 3 opaque.

[0075] The total wall thickness of the first top wall 5, the second top wall 6 and the bottom wall 4 is approximately 0.9 mm.

[0076] The relative light transmittance of the first top wall 5 is measured with a Cary 500 UV-VS NIR spectrophotometer. The results are shown in Figure 7, wherein the horizontal axis represents the wavelength in nanometres and the vertical axis the relative light transmittance in %.

[0077] In the range 400-700 nm, i.e. the visible portion of the spectrum, the first top wall 5 has an average relative light transmittance of 24.1 %, i.e. 0.241.

[0078] In the range 800-1400 nm, i.e. the near-infrared portion of the spectrum, the first top wall 5 has an average relative light transmittance of 87.0 %, i.e. 0.87.

[0079] This means that the first top wall 5 transmits a significant portion of the energy of sunlight, seen over the entire spectrum.

[0080] Due to this significant light transmittance of the first top wall 5 and the black colour of the bottom wall 4, when used in a swimming pool cover of profiles 1 coupled together, a large portion of the light falling on the profiles 1 is absorbed by the bottom wall 4. This energy is then delivered to the pool water, resulting into heating up.

[0081] At the same time, no sunlight can get into the groove 3 because the second top wall 6 and side wall 9 of the groove 3 are opaque. This prevents algae growth in stagnant water in the groove 3, and any contamination is hidden from view.

[0082] Due to the dark grey colour of the top wall, in particular of the fourth layer 13 of plastic, the underlying parts of the profile 1 are hardly visible, such that this already largely avoids the creation of a zebra-like pattern of dark lines and light lines if a swimming pool cover is made with these profiles 1.

[0083] Because the first layer 10 is designed in a slightly lighter colour than the bottom wall 4, the formation of a striped pattern is suppressed even further.

[0084] The alternative profile 1 of Figure 5 differs from the profile 1 of Figures 1 to 4 in that the fourth layer of plastic and the first layer of plastic are absent, wherein the third layer 12 of plastic has been designed correspondingly thicker. Furthermore, the composition of the third layer 12 of plastic is different, namely because it is made by mixing the aforementioned coloured polycarbonate Makrolon 3113, coloured with colour 450601, in a ratio of 1 to 1 with transparent Makrolon 3113.

[0085] Therefore, the first top wall 5 and second top wall 6 have a very dark grey colour.

[0086] The relative light transmittance of the first top wall 5 and the second top wall 6 was measured with a Cary 500 UV-VS NIR spectrophotometer. The results are shown in Figure 8, wherein the horizontal axis represents the wavelength in nanometres and the vertical axis the relative light transmittance in %.

[0087] In the range 400-700 nm, i.e. the visible portion of the spectrum, the first top wall 5 has an average relative

light transmittance of 3.4 %, that is 0.034.

[0088] In the range 800-1400 nm, i.e. the near infrared portion of the spectrum, the first top wall 5 has an average relative light transmittance of 86.0 %, i.e. 0.860.

[0089] This means that the first top wall 5 transmits a significant portion of the energy of sunlight, seen over the entire spectrum, such that still a significant heating will take place. In contrast to the second top wall 6 of the first profile 1, the second top wall 6 also transmits a significant portion of the energy of sunlight. This energy can therefore also be used for heating up the swimming pool water.

[0090] Because the first top wall 5 and second top wall 6 allow virtually no visible light to pass through, firstly, algae growth in the groove will only occur to a very limited extent, because no visible sunlight can enter the groove 3. By exchanging water between the groove 3 and the rest of the swimming pool, a build-up of algae in the groove 3 is avoided. This exchange of water is very limited, but sufficient.

[0091] Second, any algae growth that might occur due to the very low transmittance of visible light of the second top wall 6, is not visible.

[0092] For the sake of completeness, it is noted that, although in the above examples the third layer 12 and the fourth layer 13 of plastic are arranged in the second top wall 6, it is also possible that above the groove the top wall of the profile is located at some distance from the top wall of the groove, as is the case, for example, in the profile of Figure 5 of AU-A-21669/95 and Figure 1 of EP2295676B1, such that in that case the third layer 12 and fourth layer 13 of plastic can also be arranged in a wall above the second top wall, i.e. in the top wall of the profile, which is located above the top wall of the groove.

Claims

1. Profile (1) for manufacturing a slat for a swimming pool cover, wherein the profile (1) is made of plastic,

   wherein the profile (1) comprises one or more internal channels (8),
   wherein the profile (1) comprises a first top wall (5) located above the one or more channels (8),
   wherein the first top wall (5) has a first relative light transmittance for infrared light and a second relative light transmittance for visible light,
   wherein the ratio (1 - the second relative light transmittance)/(1 - the first relative light transmittance) is at least 1.10.

2. Profile (1) according to claim 1, **characterized in that** the ratio (1 - the second relative light transmittance)/(1 - the first relative light transmittance) is at least 1.40, and preferably at least 1.80.

3. Profile (1) according to any one of the preceding claims, **characterized in that** the first relative light transmittance is at least 0.40, and preferably at least 0.65.

4. Profile (1) according to any one of the preceding claims, **characterized in that** the second relative light transmittance is a maximum of 0.65, and preferably a maximum of 0.55.

5. Profile (1) according to any one of the preceding claims, **characterized in that** the profile (1) is provided on a first side with a groove (3) for receiving a coupling member (2), wherein the groove (3) has a second top wall (6) at its top side, the second top wall (5) having a third relative light transmittance for infrared light and a fourth relative light transmittance for visible light, wherein the ratio (1 - the fourth relative light transmittance)/(1 - the third relative light transmittance) is at least 1.10.

6. Profile (1) according to any one of the preceding claims, **characterized in that** the profile (1) has a bottom wall under the one or more channels (8), wherein the bottom wall (4) is opaque and preferably black.

7. Profile (1) according to any one of the preceding claims, **characterized in that** the profile (1) is provided on a first side with a groove (3) for receiving a coupling member (2), wherein the groove (3) has a second top wall (6) at its top, the second top wall (6) comprising a first layer (10) of plastic that is opaque.

8. Profile (1) according to claims 6 and 7, **characterized in that** the first layer (10) of plastic and the bottom wall (4) have a mutually different colour.

9. Profile (1) according to claim 7 or 8, **characterized in that** the first top wall (5) comprises one or more layers of plastic, wherein said one or more layers of plastic are also located above said first layer (10) of plastic of the second top wall (6), said one or more layers of plastic being located in the second top wall (6) or being located in another wall, said other wall being located above the second top wall (6).

10. Swimming pool cover comprising two or more mutually coupled slats, wherein the slats comprise a profile (1) according to any one of the preceding claims.

11. Use of a plastic composition in a swimming pool cover, **characterized in that** the plastic composition is adapted to transmit infrared light better than visible light.

12. Use according to claim 11, **characterized in that** the plastic composition is used in a slat forming part

of the swimming pool cover and comprising a profile (1) according to any of claims 1 to 9, whereby the swimming pool cover is a rollable swimming pool cover.

13. Use according to claims 11 or 12, **characterized in that** the plastic composition is used in a slat of the swimming pool cover has a first specific extinction for infrared light and a second specific extinction for visible light, wherein the ratio between the second specific extinction and the first specific extinction is at least 1.1

14. Use according to claim 13, **characterized in that** the ratio between the second specific extinction and the first specific extinction is at least 1.4, and preferably at least 1.8.

15. Use according to any one of claims 11 to 14, **characterized in that** the plastic composition is used in an top wall of a slat of the swimming pool cover.

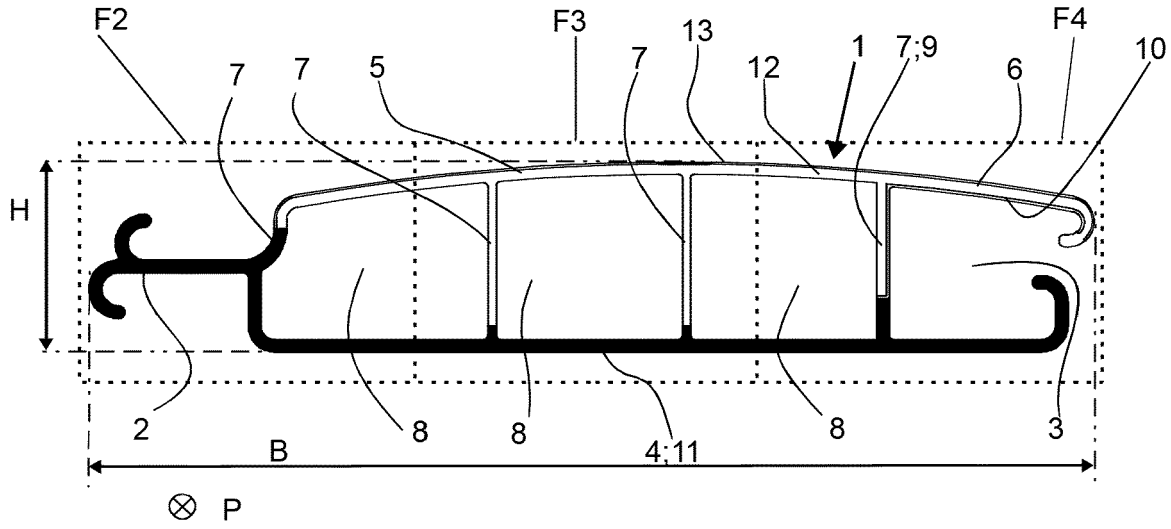


Fig. 1

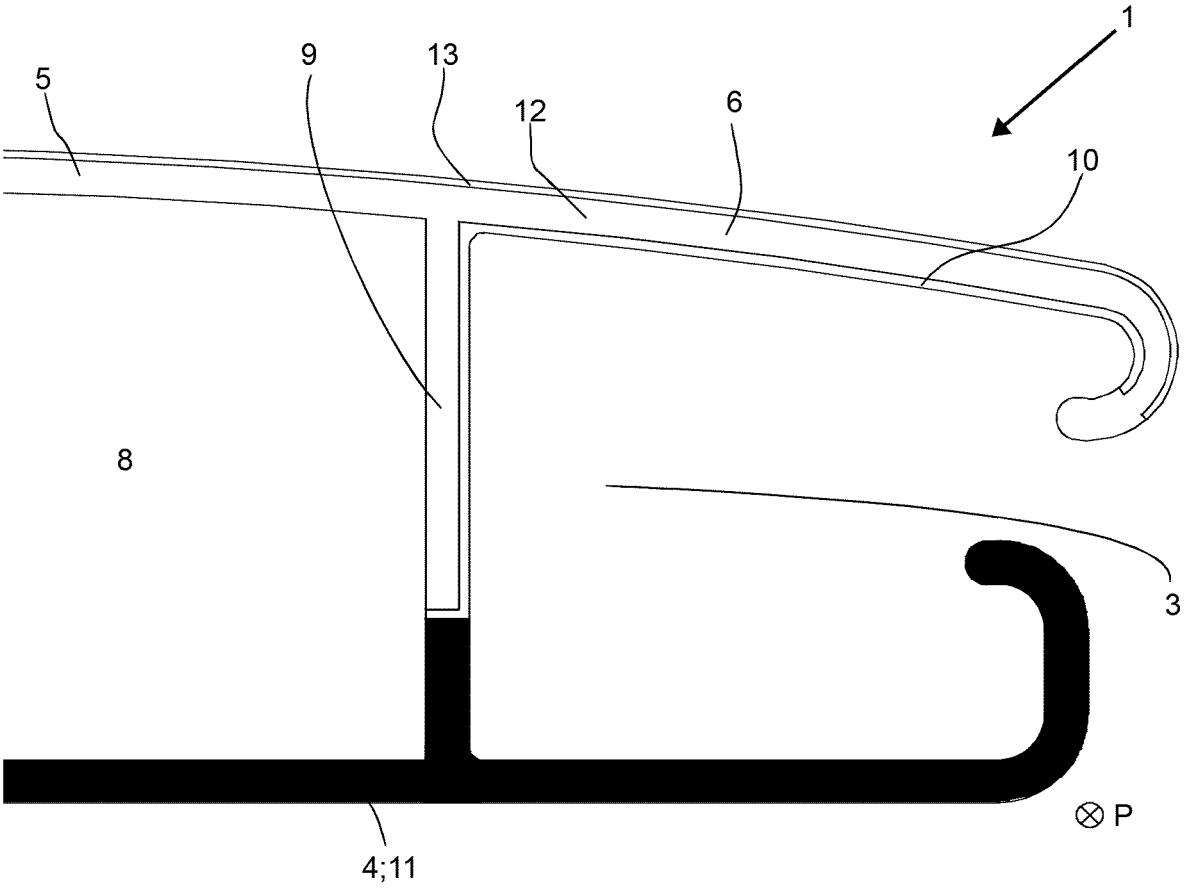


Fig. 2

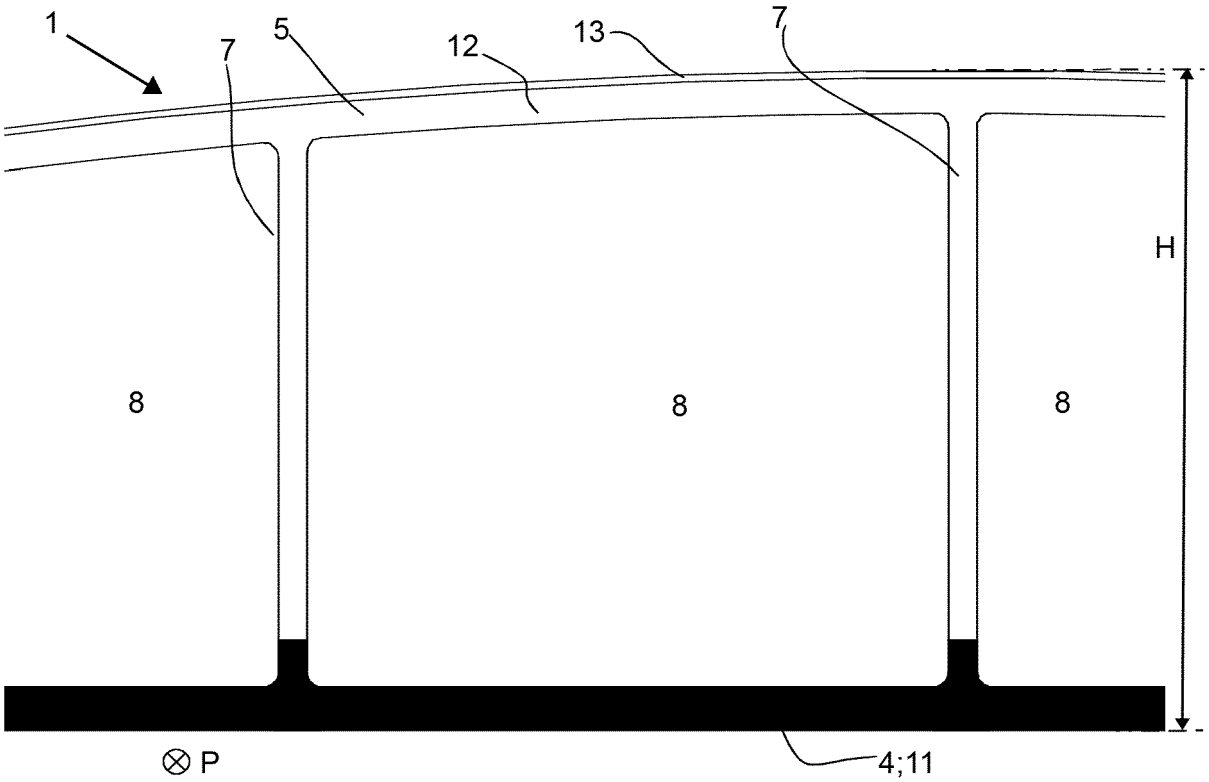


Fig. 3

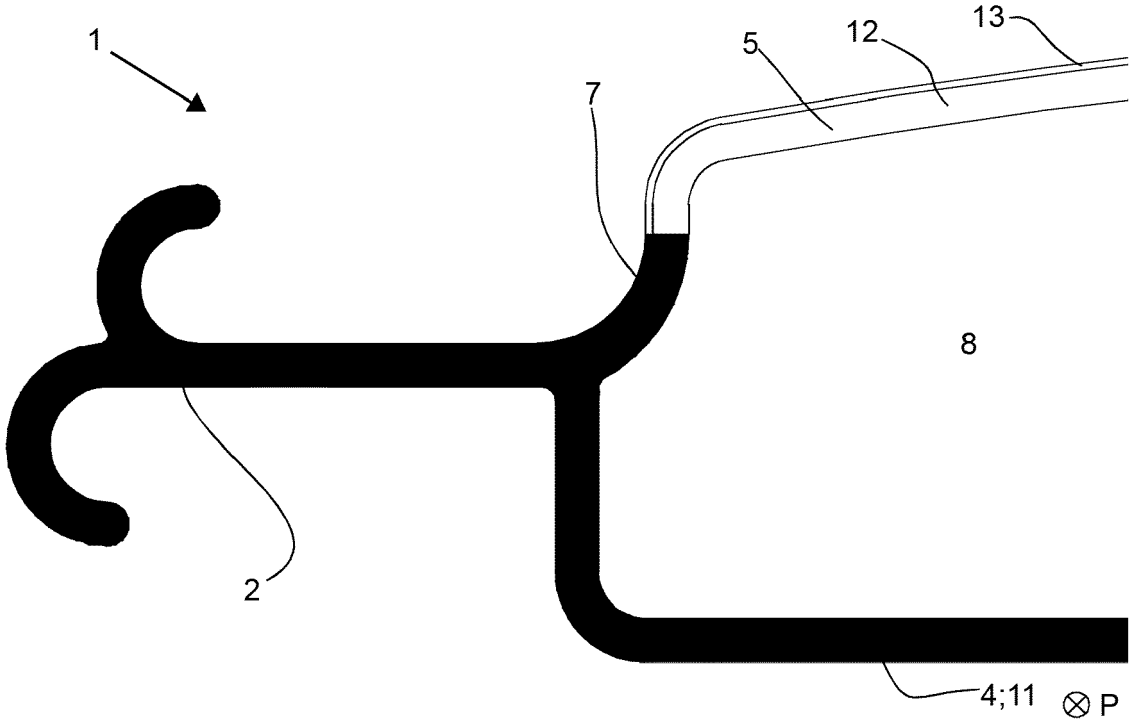


Fig. 4

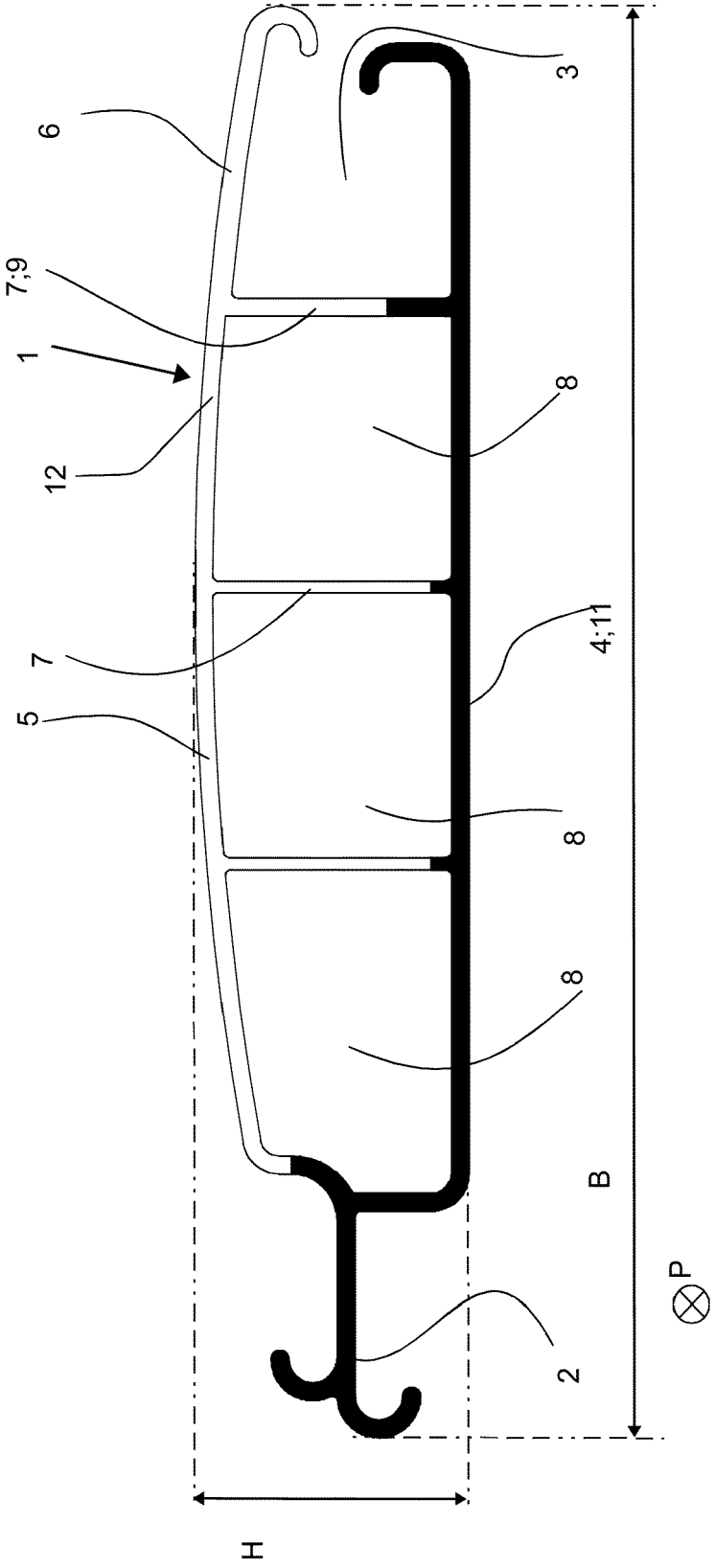


Fig. 5

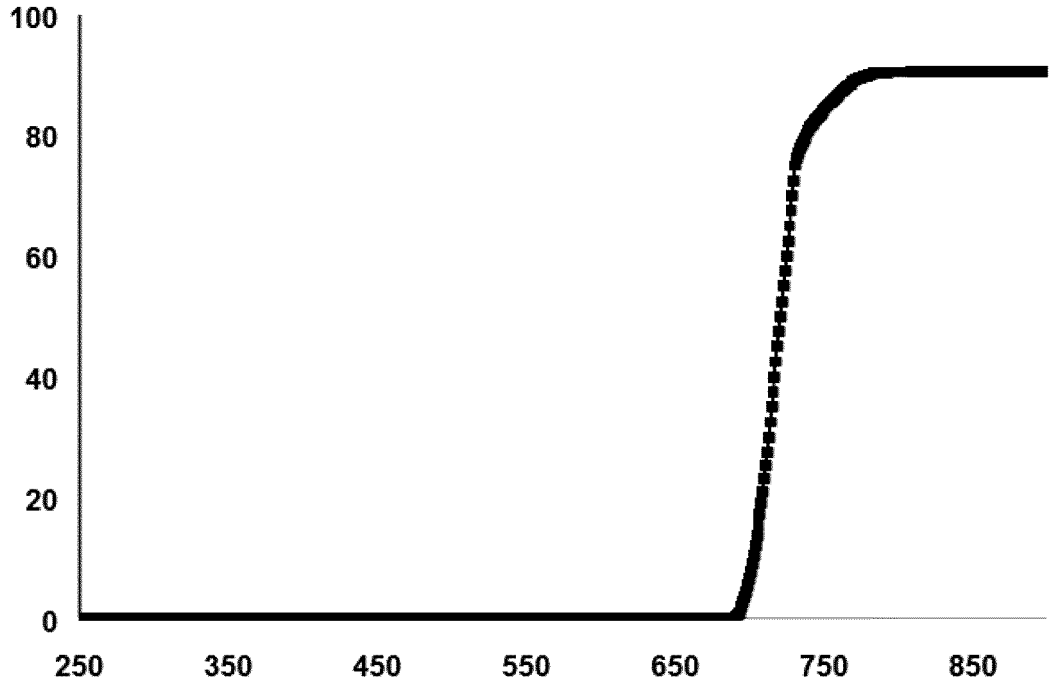
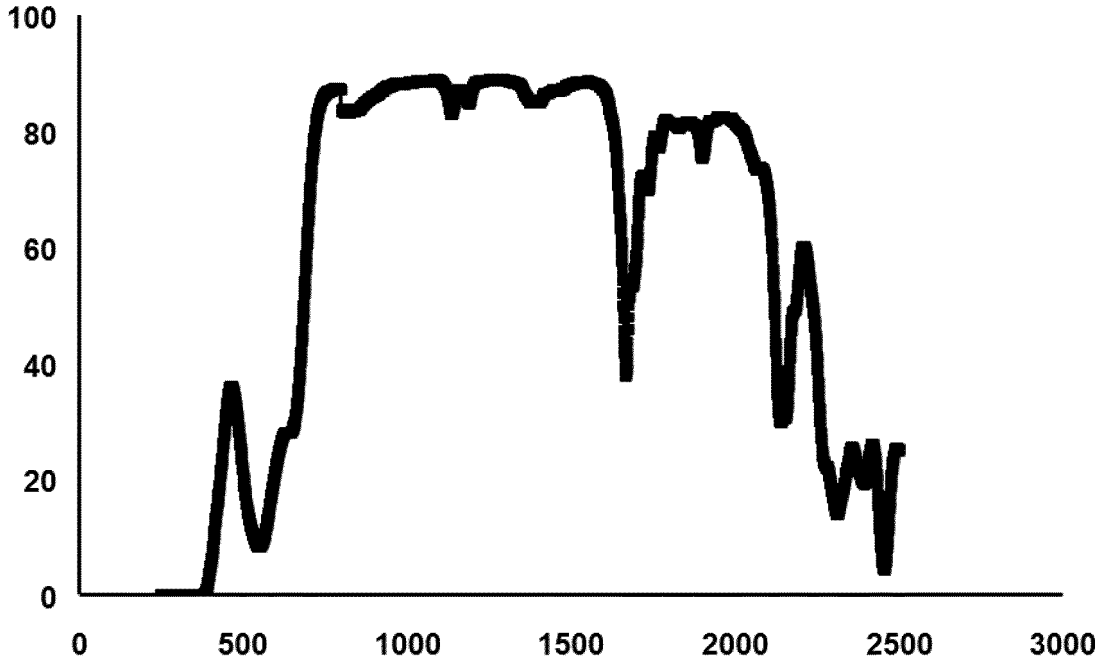

100
80
60
40
20
0
250
350
450
550
650
750
850

Fig. 6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80
60
40
20
0
0
500
1000
1500
2000
2500
3000

Fig. 7

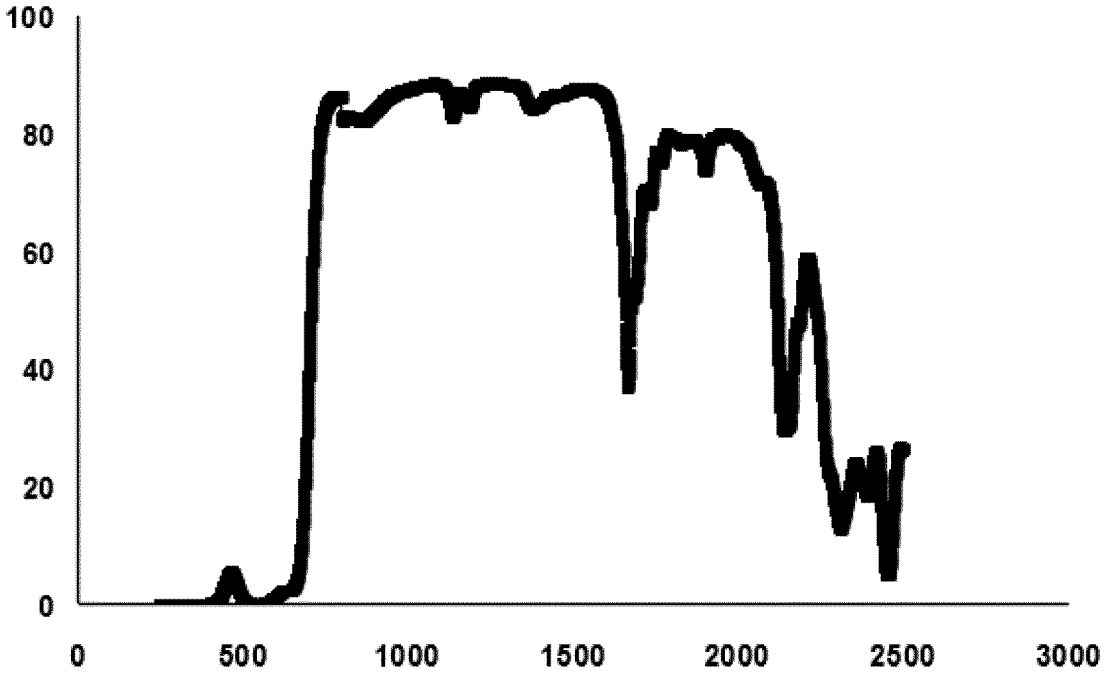

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
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Place of search	Date of completion of the search	Examiner
Munich	3 February 2022	Schnedler, Marlon

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