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(54) FLEXIBLE NON-SKID STRIP AND PROCESS FOR PRODUCTION THEREOF

(71) I, HIROMITSU NAKA, a citizen of Japan, of No. 39, Oaza Sinnachi, Yashio-city, Saitama Prefecture, Japan, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to flexible non-skid strips to be installed on stairs and a process for continuously producing the strips.

There have been proposed and practically employed a variety of stair edgings for protecting the edges of stairs against damage and also for protecting persons who walk on the stairs.

According to the present invention, there is provided a flexible non-skid strip comprising a main body portion extending along the length of said strip and adapted to be secured to the tread portion of a stair, a forward edge anchoring portion co-extending with said main body parallel to and spaced from said main body and adapted to be secured to the riser of said stair, and a connection portion of arcuate cross-section and formed integrally with and interconnecting said main body and anchoring portions, said connection portion projecting above the upper surface of the body and anchoring portions and being capable of being bent about the stair edge of said stair so as to cover the stair edge, the anchoring portion of the strip having

a smooth upper surface, and at least a portion of the upper surface of said main body portion having projections and/or indentations providing a non-skid surface.

The strip may have a reinforcing web secured to the underside of the main body portion and anchoring portion, the strip being formed from a bendable material. The invention also provides a process for continuously producing such a strip comprising the steps of continuously heating a continuous length of strip material having a plurality of spaced holes in the longitudinal direction thereof and being of a material selected from the group consisting of aluminium, copper, steel and stainless steel, which strip constitutes the reinforcing web, moving the continuous length of strip material through an extrusion die and extruding a plastics material in a plastic condition onto the upper surface of said strip material in said extrusion die for forming said main body portion including a non-skid top surface portion, said forward edge anchoring portion and said connection portion for producing a flexible non-skid strip with a reinforcing web bonded thereto, and cooling the resulting product.

The invention will now be described in more detail with reference to the accompanying drawings in which:

Figure 1A is a perspective view of a preferred embodiment of flexible non-skid strip of the invention;

Figure 1B is a perspective view of said

strip of Figure 1A in a rolled state;

Figure 2 is a perspective view of said strip of Figure 1 installed on a concrete stair;

- 5 Fig. 3 is a perspective view of a further embodiment of flexible non-skid strip of the invention with a portion thereof cut away;

- 10 Figs. 4A, 4B, 5A and 5B are cross-sectional views of further modified embodiments of flexible non-skid strip of the invention;

- 15 Fig. 6 is a perspective view of a further embodiment of flexible non-skid strip of the invention with a portion thereof cut away showing the strip as being installed on a wooden stair;

- 20 Figs. 7A, 7B and 7E are cross-sectional views of further embodiments of flexible non-skid strip of the invention;

Fig. 7C is a cross-sectional view on an enlarged scale of the fluorescent layer as shown in Fig. 7B;

- 25 Fig. 7D is a sectional view taken substantially along the line 11D-11D of Fig. 11B;

- 30 Fig. 8 is a perspective view of a further embodiment of flexible non-skid strip of the invention with a portion thereof cut away;

Figs. 9A and 9B are cross-sectional views of further embodiments of flexible non-skid strip of the invention;

- 35 Figs. 10A, 10B, 10C and 10D are perspective views of further embodiments of flexible non-skid strip of the invention with a portion thereof in section and a portion thereof cut away;

- 40 Figs. 11A, 11B and 12 are cross-sectional views of further embodiments of flexible non-skid strip of the invention;

- 45 Fig. 13 is a schematic view of one embodiment of apparatus continuously producing a flexible non-skid strip according to the present invention;

Fig. 14 is a plan view of said apparatus as shown in Fig. 13;

- 50 Fig. 15 is a longitudinally sectional view on an enlarged scale of the metal mold of the apparatus as shown in Figs. 13 and 14;

- 55 Fig. 16 is a schematic view in side elevation of an embodiment of apparatus for continuously producing flexible non-skid strips according to the present invention;

Fig. 17 is a plan view of said apparatus of Fig. 16;

- 60 Fig. 18 is a side elevational view on an enlarged scale of the forming roll unit employed in the apparatus useful in both the apparatus of Figs. 16 and 17;

Fig. 19 is a front elevational view on an enlarged scale of said forming roll unit of Fig. 18;

- 65 Fig. 20 is a perspective view of a strip

material after the material has been shaped by the forming roll unit as shown in Figs. 18 and 19;

Fig. 21 is a longitudinally sectional view on an enlarged scale of the metal mold useful in the apparatus as shown in Figs. 18 and 19; and

Fig. 22 is a schematic view in side elevation of further modified embodiment of apparatus for continuously producing flexible non-skid strips according to the present invention.

Referring to the accompanying drawings and more particularly, to Figs. 1, 2A and 2B thereof, a preferred embodiment of flexible non-skid strip according to the present invention is generally shown in its flat form at 10. The strip 10 includes an elongate main body or rear portion 11, a forward edge anchoring portion 12 extending parallel to and spaced from the main body and a connection portion 13 interposed between the main body 11 and edge portion 12 to integrally connect them together. The connection portion projects above the upper surfaces of the main body portion 11 and the anchoring portion 12.

The main body 11 is formed on the upper surface with any suitable non-skid top surface portion such as serrations 14 extending along the entire length of the body and the connection portion 13 is designed to have a thickness smaller than the main body 11 and forward edge portion 12. For the purpose, the bottom of the connection portion 13 is formed with a semi-circular groove 15 opening downwardly and extending along the entire length of the portion 13. The forward edge portion 12 has the upper surface sloping downwardly and forwardly or smoothly decreases its thickness toward its extreme forward edge thereof. The strip 10 having the construction as mentioned above may be produced by integrally extruding any suitable one selected from thermoplastic synthetic resins such as polyvinylchloride polyolefins, celluloses and synthetic rubber.

The flexible non-skid strip 10 is installed on a concrete stair 230 as shown in Fig. 2. In the installation of the strip, a suitable adhesive 16 is first applied on fixing areas 233 and 234 of the tread 231 and riser 232 of the stair which are connected together by the edge 235 at right angles to each other and the strip 10 is then applied on the stair 230 with the main body 11 positioned on the adhesive-applied area 233 and the groove 15 positioned over the edge 235.

Thereafter, the forward edge portion 12 is bent downwardly at the junction between the forward edge portion 12 and the connection portion 13. The bending of the forward edge portion 130

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12 is assisted by the presence of the groove 15. Finally, a suitable pressure is applied on the main body 11 and forward edge portion 12 so as to cause the parts of the strip to adhere to the tread 231 and riser 232 of the stair 230, respectively, whereby the strip 10 is held in position on the stair 230. A pressure sensitive adhesive tape having a release paper may be applied to the bottom of the strip 10 covering the main body 11, connection portion 13 and edge portion 12 to provide a pressure sensitive adhesive layer and in such a case, the application of the adhesive 16 to the stair 230 can be eliminated.

As mentioned hereinabove, since the strip 10 is initially flat in the transverse direction and includes the thin connection portion 13, prior to the use of the strip 10, the strip can be rolled for easy storage and transportation as shown in Fig. 1B. In use, when it is assumed that the forward edge portion 12 is bent downwardly and the adhesive 16 is applied to the stair, the strip neither requires any specific curing jig, nor a long curing time. Thus, the installation operation of the strip 10 can be carried out in a brief period of time. Especially, when the strip 10 itself includes the pressure sensitive adhesive tape, the steps of application of the adhesive 16 to the stair 10 and of curing the adhesive 16 after the installation of the strip so as to cause the strip to adhere firmly to the stair can be eliminated. Furthermore, the possibility of application of the adhesive 16 at areas other than the portions 233 and 234 of the stair tread and riser 231 and 232 which may occur during the application of the adhesive to the portions 233 and 234 can be prevented.

Furthermore, since the connection portion 13 includes the groove 15 which is positioned over the edge 235 of the stair 230 when the strip 10 is held in position, the connection portion 13 which is adapted to subjected to higher treading impact than the other parts of the strip has imparted thereto an impact absorption capability whereby wear on the strip itself can be reduced and the strip can enjoy a prolonged service life and has a comfortable treading feel.

Furthermore, since the strip 10 is adapted to be directly adhered to the stair 230, the installation of the strip can be quite easily effected and the strip can be installed on a wide variety of structures such as stairs in ships, floors, sloped passages, station platforms and general houses' wooden stairs as well as concrete, stone and steel stairs where the strips are generally installed. And the installation of the strip 10 can be easily effected by any unskilled persons.

Furthermore, when the strip 10 is produced in an indefinite length and rolled, the rolled strip is conveniently stored and transported. Then, a desired section can be cut off the rolled strip in conformity with the width of a stair on which the strip is installed.

The strip 70 of Fig. 3 has a connection portion 71 of arcuate cross-section and an adhesive layer comprising a pressure sensitive tape 72 having a release paper 73 is applied on the entire bottom surface of the strip 70.

The strip 70 also includes the main body 11 having the non-skid top surface portion or serrations 14 and forward portion 12 connected to the main body by the connection portion 71. The centre part of the connection portion 71 projects above the upper surface of the main body 11 and forward edge portion 12 and the thickness of the connection portion 71 is smaller than that of the main body and forward edge portion 12.

In the installation of the strip 70, first, the release paper 73 is removed from the strip 70 and then, the main body 11 is placed onto a portion of the tread of a stair with the concaved side of the arcuate cross-section connection portion 71 positioned over the edge of the stair. Since the succeeding steps in the installation of the strip 70 are substantially similar to that described in connection with the strip 10, description of such similar steps are omitted. As mentioned hereinabove, since the connection portion 71 projects above the main body 11 and forward edge portion 11, the arcuate connection portion 71 can be employed as the reference against the stair edge when the strip 70 is positioned on the stair.

The strips 80a and 80b of Figs. 4A and 4B have connection portions differing from the corresponding part of the strip 70 of Fig. 3 and the remaining parts of this embodiment are substantially similar to the corresponding parts of the embodiment of Fig. 3. Therefore, the similar parts of the embodiment of Figs. 8A and 8B are shown by the same numerals and description of them are omitted.

The connection portions of the strips 80a and 80b of Figs. 8A and 8B have different cross-section configurations from that of the corresponding part of the embodiment of Fig. 3 and in these Figures, the pressure-sensitive adhesive layer is not shown.

In the strip 80a of Fig. 44, the connection portion 81a which has an arcuate upper portion 82a is of an arcuate cross-section having a thin thickness and the bottom of the arcuate connection portion 81a is defined by a pair of thin flanges 83a

and 84 extending from the opposite lower edges of the main body 11 and forward edge portion 12 into the semi-circular cross-section cavity defined by the arcuate configuration of the connection portion 81a.

In the strip 80b of Fig. 4B, the connection portion 81b which has an arcuate upper portion 82b defines an arcuate cross-section cavity therein and the bottom of the cavity is closed by a thin sheet-like cross piece 85.

With the provision of the thin flanges 83, 84 and sheet-like cross piece 85 in the strips 80a and 80b, respectively, after the installation of the strip on a stair, the strip is prevented from being displaced at the connection portion with respect to the stair when the strip is subjected to treading pressure.

The strips 90a and 90b of Figs. 5A and 5B are modifications of the strip 70 of Fig. 3. The strips 90a and 90b are shown with the pressure sensitive adhesive layer removed therefrom. The installation manner of the strips 90a and 90b is similar to that for the embodiment of Fig. 3 and description of the installation manner of these modified strips are omitted.

The strip 90a of Fig. 5A further includes the main body 11 having the non-skid top surface portion or serrations 14 and the forward edge portion 12 connected to the main body by the connection portion 71 of arcuate cross-section similar to the corresponding part of the strip in Fig. 3. The top surface portion 14 and arcuate cross-section connection portion 71 are formed of a high wear-resistance synthetic resin such as polyurethane or polyamid, for example, to provide an upper layer 91 and the remaining portion of the main body 11 and the forward edge portion 12 are formed of a flexible synthetic resin such as non-rigid polyvinyl chloride. The upper layer 91, the main body 11 and forward edge portion 12 are secured together into a unitary structure.

If the surface layer 91 has a different color from the color of the remaining portion of the main body 11 and forward edge portion 12, wear on the surface layer is visible if any and accordingly, the time when the strip 90a should be replaced can be determined. The multicolored strip has an aesthetically pleasing appearance.

The strip 90b of Fig. 5B includes the main body 11 having the non-skid top surface portion or serrations 14 and forward edge portion 12 connected to the main body by the connection portion 71 of arcuate cross-section as in the embodiment of Fig. 5A, but has an integrally formed laminated construction, that is, the strip of Fig. 5B including the serrations 14 and the upper layer 92 formed of a high wear-resistance

synthetic resin such as polyurethane or polyamid and the lower layer 93 constituting the remaining lower portions of the main body, forward edge portion and connection portion 11, 12 and 71 and formed of a flexible synthetic resin such as non-rigid polyvinyl chloride. The upper and lower layers may different colors so that the strip 90b provides the same visual effects as the strip 90a does.

Fig. 6 shows a further modification of the strip 70 of Fig. 3. The strip 100 includes the main body 11, forward edge portion 12 and connection portion 71 of arcuate cross-section connecting between the main body and forward edge portion. The main body 11 has two sets of longitudinally extending serrations 14 thereon in a spaced relationship to each other and a plurality of longitudinally extending fluorescent layers 102 and 103 in the form of a strip are embedded in the upper surface of the main body and forward edge portion, respectively with the upper surface exposed.

In the installation of the strip 100, first, a suitable adhesive 16 is applied on the underside of the strip 100 and then, the strip is placed on the tread 231 of a stair 230 with the connection portion 71 positioned over the edge 235 of the stair 230. The succeeding steps of the installation are the same as described in connection with the installation of the strip 10 of Fig. 1 and description of such steps is omitted.

Since the strip 100 includes the fluorescent layers 102 and 103 embedded in the upper surface, when the strip 100 is held in position on the stair 230, even if power supply is stopped in case of emergency such as fire occurrence and power stoppage at night, the width of the stairs and/or the distance between adjacent stairs can be discerned and therefore, the strip 100 provides safety characteristics. Although the fluorescent layers are shown as being positioned at the rear edge of the main body 11 and at the forward edge portion 12, it may be sufficient to provide the fluorescent layer 102 or 103 either at the main body or forward edge portion as desired.

Figs. 7A, 7B, 7C, 7D and 7E show modifications of the strip 100 of Fig. 6 and in the embodiments of these Figures, the position and construction of the fluorescent layers are modified. The remaining parts of the strips 110a, 110b, 110e are shown by the same numerals as those used for the corresponding parts of the embodiment of Fig. 6, and the manner in which the strips 110a, 110b and 110e are installed is similar to that for the strip 100 of Fig. 6. Therefore, description of the corresponding parts and the installation manner of these strips are omitted.

The strip 110a of Fig. 7A has fluorescent

layers 113 and 114 embedded in the rear edge 111 of the main body 11 and in the extreme forward edge 112 of the forward edge portion 11, respectively.

5 The strip 110b of Fig. 7B has fluorescent elements 115, 115 integrally formed in the main body 11 at the rear edge 111 thereof and forward edge portion 12, respectively and the upper surface of the elements 115 is exposed to the upper surface of the main body 11 and forward edge portion 12.

Each of the fluorescent elements 115 comprises (see Figures 7C and 7D) an elongate channel 116 of U-shaped cross-section, 15 a fluorescent material strip 117 received in the channel and a transparent covering strip 118 positioned over and secured to the fluorescent material strip.

The elongate channel 116 is formed of 20 a flexible synthetic resin having a pigment such as titanium dioxide and/or white lead blended therewith, the fluorescent material strip 117 is formed of a transparent synthetic resin sheet having a fluorescent pigment blended therewith and the transparent covering strip 118 is formed of a transparent synthetic resin having a ultra-violet ray absorption agent blended therewith.

Therefore, the fluorescent material strips 30 117 of the fluorescent layers 115, 115 are protected against the staining by mud and dirt from the footwear of persons who walk on stairs where the strips are installed and also prevented from being removed from the main body 11. Furthermore, since the fluorescent material strips 117 are received in the channels 116, ultraviolet rays are prevented from passing through the fluorescent material strips 117.

40 The strip 110e of Fig. 7E is substantially similar to the strip 100 of Fig. 6 except for that the main body has three longitudinally extending fluorescent layers 102, that is, the main body further has one fluorescent layer 45 102 between the arcuate connection portion 71 and the adjacent non-skid top surface portion or serrations 14 and another fluorescent layer 102 between the two non-skid top surface portions or serrations 14. The two additional fluorescent layers 102 are adhered to the upper surface of the main body 11. Therefore, the fluorescent layers 102 are prevented from being directly contacted by the footwear of persons who walk on stairs where the strips are installed, are subject to less wear due to treading pressure and can enjoy a longer service life.

Fig. 8 shows a further modification of the strip 70 of Fig. 3 and is shown by numeral 120. The strip 120 includes the main body 11 formed of a flexible synthetic resin, forward edge portion 12 and connection portion 71 of arcuate cross-section connecting between the main body 11 and 65 forward edge portion 12.

The main body 11 has the non-skid top surface portion or serrations 14 on the upper surface thereof and a web sheet 121 which may be formed of rigid synthetic resin, cloth or metal and has an area containing the main body 11, forward edge portion 12 and connection portion 71 is integrally formed with the under surface of the strip 120.

The web sheet 121 serves to impart rigidity to the strip against the elongation and contraction of the strip whereby the retention of the strip on a stair is improved. Metals of which the web sheet may be formed include aluminium, copper, steel and stainless steel. Furthermore, a pressure sensitive tape 122 including a release paper 123 is applied on the underside of the web sheet 122.

The strip 120 can be formed into a roll 85 and the installation of the strip 120 is the same as that described in connection with the strips 10 and 70 of Figs. 1 and 3 and description of the installation manner of the strip 120 is omitted.

90 The strips 170a, 170b, 170c and 170d of Figs. 10A to 10D are modifications of the strip 120 of Fig. 8 and the pressure-sensitive adhesive layer of these strips is not shown in these Figures. Since the strips 95 170a, 170b, 170c and 170d are installed in the same manner as that for the strip 120 of Fig. 8, the installation manner for these modified strips is omitted.

Each of the strips 170a, 170b, 170c and 100 170d includes the main body 11, forward edge anchoring portion 12 and arcuate connection portion 171 connecting between the main body and forward edge portion together. The main body 11 has two spaced 105 sets of non-skid top surface portions or serrations 14 formed on the upper surface and extending in the length of the strip and two holes 172 of rectangular cross-section positioned below the serrations 14 110 extending in the length of the strip.

Furthermore, in order to prevent the strip and web sheet from separating from each other, in the strip 170a of Fig. 10A, the opposite longitudinal edges 174 and 175 115 of the reinforcing web sheet 173 are bent upwardly above the plane of the rest of the sheet and embedded in the main body and forward edge portion, respectively. In the strip 170b of Fig. 10B, the web sheet 120 173b has a plurality of spaced engaging projections 176 of angular shape which serve to provide through-holes 177. The projections 176 are formed by a press. In the strip 170c of Fig. 10C, the web sheet 125 173c has a plurality of spaced rows of holes 178 adjacent to the opposite edges. In the strip 170d of Fig. 10D, the web sheet 173d has the opposite edges 174d, 175d embedded in the main body 11 and forward edge 130

portion 12, respectively. The web sheet 173d for the strip 170d of Fig. 10D has on the upper surface an upward projection 179 extending in the longitudinal direction of the strip so as to engage in the cavity defined by the connection portion 171 whereby in the installation of the strip, the positioning of the strip with respect to the tread of a stair and the bending of the forward edge portion are assisted.

Furthermore, the shape, arrangement and number of the above-mentioned engaging projections and engaging holes can be varied and the combination of the projections and holes can also be varied within the scope of the invention.

In each of the strips 180b and 190b shown in Figs. 11A and 11B, in order to impart rigidity to the strip, each of the web sheets 181b, and 191b is entirely embedded in the associated strip. The web sheet 191b for the strip 190b shown in Fig. 11B comprises a plurality of web sheet elements 192b.

The strip 200 shown in Fig. 12 employs a web sheet 201 having a center upwardly bent and horizontally extending portion 202 embedded in the strip and extending in the longitudinal direction of the strip.

The remaining parts of the strips 180b, 190b and 200 are shown by the same numerals as those used for the corresponding parts of the strips of Figs. 1, 3 and 10B. The manner in which the strip 200 is installed is the same as that for the strips shown in Figs. 1, 3 and 10B and description of the installation manner is omitted.

As to the materials of which the above-mentioned strips are formed, the main body, forward edge portion and connection portion are preferably formed of flexible thermoplastic synthetic resins such as non-rigid polyvinyl, chlorides, polyolefines or celluloses. The non-skid top surface portion and web sheet are preferably formed of any one selected from high wear-resistance synthetic resins such as polyurethane and polyamid if the parts are desired to have a high wear-resistance property. The web sheet is preferably formed of hard synthetic resin, cloth, aluminium, copper, steel or stainless steel, but may be formed of a porous sheet metal, foraminous steel sheet or expanded metal.

The width of the body of the strip may be designed to be equal to the width of the tread of a stair and the upper surface of the main body may be formed with ridges to provide a non-skid surface. Since the main body has a width substantially corresponding to that of the stair tread where the strip is installed, when held in position, the whole area of the stair tread has imparted to it a non-skid property. When the upper surface of the main body is pat-

terned with a particular design, the strip not only produces an aesthetic effect, but can eliminate the use of a carpet as well as a finish on the stair tread. The installation of such a strip on a stair is the same as that for the strip 10.

Figs. 13 to 15 illustrate a process and apparatus for continuously extruding an indefinite length of flexible non-skid strip 300 from which required lengths are sheared. The flexible non-skid strip 300 comprises a continuous length of flexible lower layer 301 formed of a continuous length of web sheet material which can be formed into a roll and a synthetic resin flexible non-skid upper layer 303 including the main body, forward edge portion and connection portion of each strip. The upper layer is formed by continuously and integrally extruding a synthetic resin onto the moving lower layer.

In carrying out the process of the invention on the illustrated apparatus of the invention, first of all, a rolled web sheet 301 formed of rigid synthetic resin or cloth is continuously paid out from a supply roll 310 and passed over heating means 331 positioned below the path of the sheet. After having passed over the heating means 311, the sheet 301 advances to and through the inlet 328 of a split die 325 mounted on a cross-head 324 in an extruder 320.

The heating means 311 is adapted to pre-heat the flexible lower layer 301 so that the upper layer 303 which is adapted to be secured to the lower layer can be prevented from displacing relative to the lower layer. The split die 325 comprises an upper mould 325a and a lower mould 325b defining a sheet passage 329 therein and having an inlet 328. An upper layer application passage 330 is in communication with the inner end of the passage 329 and has an outlet 331.

A granular non-rigid vinyl chloride having plasticizer, stabilizer, lubricant and filler blended therewith is supplied at a hopper 321 into a heating cylinder 322 of the extruder 320. The non-rigid vinyl chloride is advanced through the cylinder 322 by a rotating screw 323 within the cylinder 322. As the vinyl chloride is advanced through the cylinder, the material is fused and the ingredients of the material are kneaded together. The fused and kneaded material is passed to and through a manifold 326 formed in the upper mould 325a of the die 325. The fused material then passes to and through a downwardly inclined passage 327 extending from the manifold 326 and terminating at the upper layer application passage 330 and enters the passage where the fused material is applied on the moving sheet 302 under pressure.

The cross-sectional configuration of the application passage 330 and outlet 331 is determined depending upon the cross-sectional configuration of the flexible non-skid strip 300 to be produced. After having issued through the outlet 331, the hot laminated strip 300 passes to and through a cooling tank 332 containing water where the strip is cooled. After having passed through the cooling tank 332, the laminated strip 300 passes between haul-off rolls 333 and 334 of a haul-off gear to be guided thereby to coating means 340 where the underside of the strip 300 is continuously coated with a pressure sensitive adhesive agent. After having been coated with the adhesive agent, the strip is advanced to release paper application means where the underside of the coating adhesive agent is continuously applied thereon a release paper 304 supplied from release paper supply means 350 by means of press rollers 351 and 352. Thereafter, the strip 300 is advanced to a take-up reel 353 to be rolled thereabout. The above-mentioned coating means 340 includes a dipping tank 341 containing pressure-sensitive adhesive agent, a supply roll 342 and a spreading roll 343.

Figs. 16-21 show a modified process and apparatus for continuously extruding a laminated flexible non-skid strip 360 according to the present invention. First of all, a continuous length of web sheet 362 formed of aluminium, copper, steel or stainless steel and constituting the lower layer of the laminated flexible non-skid strip is continuously paid out from a supply roll 310 and passed between upper and lower forming rolls 370 and 371 which form angular projections 305 on the upper surface of the sheet in two rows extending in the longitudinal direction. If a web sheet 380 as shown in Fig. 18 is desired, forming rolls useful for the purpose may be selected as desired.

The formed sheet 362 is then passed over heating means 311 and further advanced to and through the inlet 328 of a split die 325 supported on a crosshead 324 of an extruder 320. The extruder 320 is charged through a hopper 321 with a granular non-rigid vinyl chloride having plasticizer, stabilizer, lubricant and filler blended therewith. The non-rigid vinyl chloride is advanced from the hopper 321 into a heating cylinder 322. As the vinyl chloride is advanced through the cylinder 322 by a screw 323 positioned within the cylinder, the vinyl chloride is fused and the ingredients of the material are kneaded together. The fused vinyl chloride is passed to and through a manifold 326 formed in the upper mould 325a of the die 325 under pressure.

The fused material is then passed through a passage 327 extending from the

manifold 326 and terminating at the inner end of a sheet passage 329 having the inlet 328 into an upper layer application passage 330 which has the outlet 331 and is in communication with the inner ends of the passages 327 and 329. In the application passage 330, the fused vinyl chloride is applied onto the moving sheet 362 from the passage under pressure to thereby form the flexible non-skid upper layer 363 on the sheet 362 to produce the strip 360. After having issued from the outlet 331, the hot laminated strip 360 is passed through a cooling tank 332 to be cooled thereby and then passed to and between haul-off rolls 333 and 334 to be advanced to tape supply means to be continuously supplied with a pressure sensitive adhesive-backed tape 306 having a release paper adhered thereto. Thereafter, the laminated strip is advanced to tape application means where the strip passes in contact with press rollers 35 which press the tape 306 against the strip 360. Finally, the strip 360 is continuously taken up by a take-up reel 353 to be wound thereabout. The pressure and rotational speed of the haul-off rolls 333 and 334 of the above-mentioned pulling means can be adjusted in accordance with the pressure at the outlet 331. When the upper layer 363 of the flexible non-skid strip 360 comprises two laminae of different materials, two extruders are employed with each extruder extruding one type of material and the two different materials are extruded onto the sheet 326 into two laminae.

Fig. 22 shows a further modified process and an apparatus for continuously and intermittently producing a length of flexible non-skid strip 390. An extruder 320 is positioned in a substantially center point of the passage of each strip 390 and pairs of upper and lower feed and guide rolls 400-401, 402-403, 404-405, 406-407, 408-409, 410-411, 412-413, 414-415, 416-417, 418-419, 420-421 are positioned along the passage of the strip upstream of the extruder 320 and a pair of haul-off rolls 440 and 441 are disposed along the strip passage downstream of the extruder. These rolls are continuously driven at a constant speed to advance the sheet 392. The feed rolls 400 and 401 feed successive sheets at a spaced relationship to the rolls 404 and 405 which in turn feed the sheet to and through the nip between the forming rolls 430 and 431. After having passed through the forming rolls 430 and 431, each sheet is passed through the pairs of rolls 406-407 and 402-403 in the order to heating means 311. From the heating means 311, the sheet is passed to and through an extruder 320 where the sheet 392 is applied thereon fused synthetic resin to form the upper non-

skid layer 393 on the sheet to thereby form a laminated flexible non-skid strip 390. The hot strip 390 is passed through haul-off rolls 440-441 and guide rolls 410-411 in succession to a cooling tank 332. From the cooling tank 332, the strip 390 is passed to and through shearing means where actuated cutters 450 and 451 shear a section of a predetermined length from the remaining laminated strip material to obtain a desired flexible non-skid strip 390.

While various embodiments of the invention have been shown and described in detail, it will be understood that these are for the purpose of illustration purpose only and is not to be taken as a definition of the scope of the invention, reference being had for this purpose to the appended claims.

The foregoing description includes matter which is described and claimed in the complete specification of our Patent Application No. 53183/76 (Serial No. 1 481 532).

WHAT I CLAIM IS:—

1. A flexible non-skid strip comprising a main body portion extending along the length of said strip and adapted to be secured to the tread portion of a stair, forward edge anchoring portion coextending with said main body parallel to and spaced from said main body and adapted to be secured to the riser of said stair, and a connection portion of arcuate cross-section and formed integrally with and inter-connecting said main body and anchoring portions, said connection portion projecting above the upper surfaces of the body and anchoring portions and being capable of being bent about the stair edge of said stair so as to cover the stair edge, the anchoring portion of the strip having a smooth upper surface, and at least a portion of the upper surface of said main body portion having projections and/or indentations providing a non-skid surface.

2. A flexible non-skid strip as claimed in claim 1, in which a pair of thin flanges extend toward each other from the lower edges of said main body portion and said anchoring portion respectively.

3. A flexible non-skid strip as claimed in claim 1, in which a thin flange extends from the lower edge of said main body portion to the lower edge of said anchoring portion, below the connection portion.

4. A flexible non-skid strip as claimed in any one of claims 1 to 3, in which said non-skid top surface portion and said connection portions are formed of wear-resistant synthetic resin.

5. A flexible non-skid strip as claimed in any one of claims 1 to 4, in which a layer of fluorescent material is embedded

in the upper surface of said main body and/or of the forward edge anchoring portions.

6. A flexible non-skid strip as claimed in any one of claims 1 to 4, in which a fluorescent element is embedded and comprises an elongate channel element embedded in at least one of said portions and extending in the longitudinal direction of said portion, a layer of fluorescent material in said channel element, and a transparent covering element covering said fluorescent material.

7. A flexible non-skid strip as claimed in claim 5, in which said layer of fluorescent material comprises a flexible synthetic resin layer having a white pigment therein, and a covering layer of a transparent flexible synthetic resin having an ultraviolet ray absorption agent therein.

8. A flexible non-skid strip as claimed in claim 1, further comprising a reinforcing web secured to the underside of the main body portion and anchoring portion and formed of a bendable material.

9. A flexible non-skid strip as claimed in claim 8, in which said web has a plurality of projections on the upper surface thereof.

10. A flexible non-skid strip as claimed in claim 8, in which said web has opposite longitudinal edges thereof bent upwardly above the level of the underside of said strip and embedded in said main body portion and anchoring portion respectively.

11. A flexible non-skid strip as claimed in claim 8, in which said web has opposite longitudinal edges thereof surrounded by said main body portion and anchoring portion.

12. A flexible non-skid strip as claimed in claim 8, wherein said reinforcing web has a ridge thereon extending in the longitudinal direction of the strip on the upper surface of the web and disposed in the concavity beneath the connection portion.

13. A flexible non-skid strip as claimed in claim 12, in which said ridge is convexly curved and is secured to the under-surface of the connection portion.

14. A flexible non-skid strip as claimed in any one of claims 8 to 13, in which said web has a plurality of holes therein.

15. A flexible non-skid strip as claimed in claim 14, in which the reinforcing web provides on its upper side arcuate projections extending above the surface of said upper side and respectively bridging said holes.

16. A flexible non-skid strip as claimed in claim 8, in which said web has a plurality of spaced holes adjacent opposite side edge thereof, said side edges being turned upwardly and embedded in said main body portion and forward edge anchor-



skid layer 393 on the sheet to thereby form a laminated flexible non-skid strip 390. The hot strip 390 is passed through haul-off rolls 440-441 and guide rolls 410-411 in succession to a cooling tank 332. From the cooling tank 332, the strip 390 is passed to and through shearing means where actuated cutters 450 and 451 shear a section of a predetermined length from the remaining laminated strip material to obtain a desired flexible non-skid strip 390.

While various embodiments of the invention have been shown and described in detail, it will be understood that these are for the purpose of illustration purpose only and is not to be taken as a definition of the scope of the invention, reference being had for this purpose to the appended claims.

The foregoing description includes matter which is described and claimed in the complete specification of our Patent Application No. 53183/76 (Serial No. 1 481 532).

WHAT I CLAIM IS:—

1. A flexible non-skid strip comprising a main body portion extending along the length of said strip and adapted to be secured to the tread portion of a stair, forward edge anchoring portion coextending with said main body parallel to and spaced from said main body and adapted to be secured to the riser of said stair, and a connection portion of arcuate cross-section and formed integrally with and inter-connecting said main body and anchoring portions, said connection portion projecting above the upper surfaces of the body and anchoring portions and being capable of being bent about the stair edge of said stair so as to cover the stair edge, the anchoring portion of the strip having a smooth upper surface, and at least a portion of the upper surface of said main body portion having projections and/or indentations providing a non-skid surface.

2. A flexible non-skid strip as claimed in claim 1, in which a pair of thin flanges extend toward each other from the lower edges of said main body portion and said anchoring portion respectively.

3. A flexible non-skid strip as claimed in claim 1, in which a thin flange extends from the lower edge of said main body portion to the lower edge of said anchoring portion, below the connection portion.

4. A flexible non-skid strip as claimed in any one of claims 1 to 3, in which said non-skid top surface portion and said connection portions are formed of wear-resistant synthetic resin.

5. A flexible non-skid strip as claimed in any one of claims 1 to 4, in which a layer of fluorescent material is embedded

in the upper surface of said main body and/or of the forward edge anchoring portions.

6. A flexible non-skid strip as claimed in any one of claims 1 to 4, in which a fluorescent element is embedded and comprises an elongate channel element embedded in at least one of said portions and extending in the longitudinal direction of said portion, a layer of fluorescent material in said channel element, and a transparent covering element covering said fluorescent material.

7. A flexible non-skid strip as claimed in claim 5, in which said layer of fluorescent material comprises a flexible synthetic resin layer having a white pigment therein, and a covering layer of a transparent flexible synthetic resin having an ultraviolet ray absorption agent therein.

8. A flexible non-skid strip as claimed in claim 1, further comprising a reinforcing web secured to the underside of the main body portion and anchoring portion and formed of a bendable material.

9. A flexible non-skid strip as claimed in claim 8, in which said web has a plurality of projections on the upper surface thereof.

10. A flexible non-skid strip as claimed in claim 8, in which said web has opposite longitudinal edges thereof bent upwardly above the level of the underside of said strip and embedded in said main body portion and anchoring portion respectively.

11. A flexible non-skid strip as claimed in claim 8, in which said web has opposite longitudinal edges thereof surrounded by said main body portion and anchoring portion.

12. A flexible non-skid strip as claimed in claim 8, wherein said reinforcing web has a ridge thereon extending in the longitudinal direction of the strip on the upper surface of the web and disposed in the concavity beneath the connection portion.

13. A flexible non-skid strip as claimed in claim 12, in which said ridge is convexly curved and is secured to the underside of the connection portion.

14. A flexible non-skid strip as claimed in any one of claims 8 to 13, in which said web has a plurality of holes therein.

15. A flexible non-skid strip as claimed in claim 14, in which the reinforcing web provides on its upper side arcuate projections extending above the surface of said upper side and respectively bridging said holes.

16. A flexible non-skid strip as claimed in claim 8, in which said web has a plurality of spaced holes adjacent opposite side edge thereof, said side edges being turned upwardly and embedded in said main body portion and forward edge anchor-



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ing portion, and said web having a plurality of spaced projections thereon embedded in said main body portion and a ridge extending in the longitudinal direction of the strip on the upper surface of the web and engaged in the concavity beneath the connection portion.

17. A flexible non-skid strip as claimed in claim 8, in which said web comprises a mesh.

18. The flexible non-skid strip as claimed in any one of the preceding claims, in which said strip has on its underside a pressure sensitive adhesive layer having a release paper on the exposed surface of the layer.

19. The flexible non-skid strip as claimed in claim 8, in which said web is embedded in said strip.

20. The flexible non-skid strip as claimed in claim 8, in which said web is divided into a plurality of pieces in the transverse direction of said strip.

21. A process for continuously producing a flexible non-skid strip according to any one of claims 8, 9, 12 to 15 or 17 comprising the steps of continuously heating a continuous length of strip material having a plurality of spaced holes in the longitudinal direction thereof and being of a material selected from the group consisting of aluminium, copper, steel and stainless steel, which strip constitutes the reinforcing web, moving the continuous length of strip material through an extrusion die and extruding a plastics material in a plastic condition onto the upper surface of said strip material in said extrusion die for

forming said main body portion including a non-skid top surface portion, said forward edge anchoring portion and said connection portion for producing a flexible non-skid strip with a reinforcing web bonded thereto, and cooling the resulting product.

22. A process according to claim 21, further including the steps of continuously hauling-off the cooled product and forming the cooled product into a roll.

23. A process according to claim 22 further including, between the steps of hauling-off and forming the strip into a roll, the steps of coating the underside of said product with a pressure-sensitive adhesive layer, and covering the exposed surface of said adhesive layer with a release paper strip.

24. A process according to claim 22 further including, between the steps of hauling-off and forming the strip into a roll, the step of applying a pressure-sensitive tape on the underside of said laminated product.

25. A process according to claim 21, further including the step of cutting the cooled product into predetermined lengths.

26. A flexible non-skid strip substantially as hereinbefore described with reference to and as illustrated in Figures 1, 1A and 2, or any of Figures 3 to 12 of the accompanying drawings.

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