# United States Patent

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**Continuation of application Ser. No. 746,444, July, 1968, now abandoned.**


[54] **REINFORCING STRIP FOR PLASTIC ARTICLES AND METHOD AND APPARATUS FOR MAKING SAME**
**2 Claims, 10 Drawing Figs.**


[52] **U.S. Cl.** ..... **113/116,** 52/716, 72/325
[51] **Int. Cl.** ..... **B21d 28/00**
[50] **Field of Search** ..... 113/116 A, 116 Y, 118 R, 116; 72/324, 325, 326, 186, 187, 188, 196, 197; 29/413; 52/716, 98



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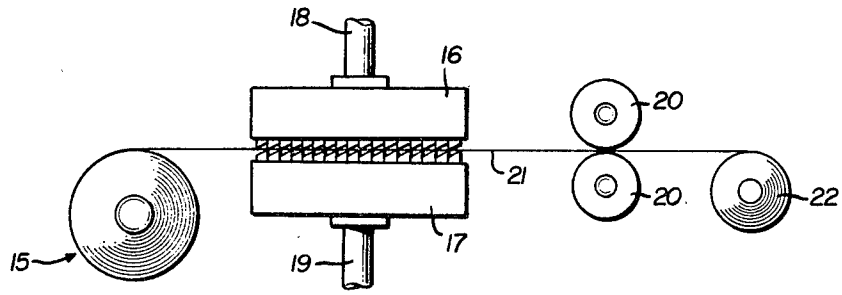
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**ABSTRACT:** The present disclosure relates to a method of and apparatus for making a reinforcing strip for plastic articles and to such a strip. The strip comprises a series of individual slats projecting to either side of a medial joining portion securing the slats together in accurately spaced relationship, the medial portion being of reduced thickness and being previously stretched to provide a frangible connection. The strip is manufactured by slitting the strip from opposite edges toward the medial portion to form the slats, deflecting the slats to lie parallel with one another and at an angle to the plane of the initial strip while stretching and coining the medial joining portion. The angularly deflected slats are then reformed to a single plane, so the slats are spaced apart throughout the distance to which the medial joining portions have been stretched. The apparatus is primarily a pair of cooperable dies having cooperative slitting edges and deflecting surfaces for deflecting the slit slats and medial stretching and coining portions at which the medial portion of the strip is formed, together with a final straightening device for deflecting the slats back to their planar alignment.

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SHEET 1 OF 2

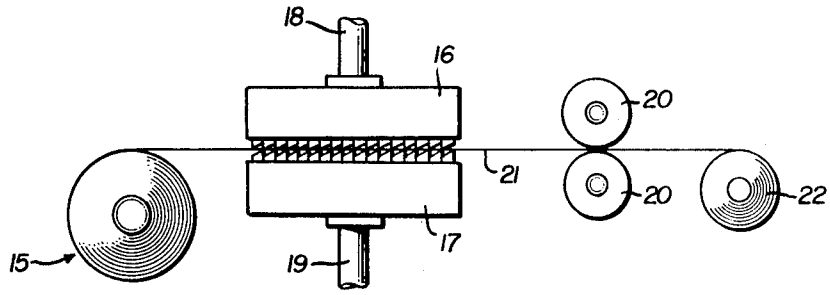



FIG. 1

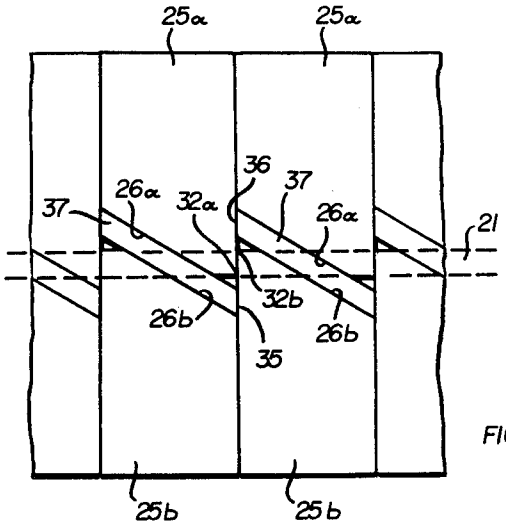



FIG. 3

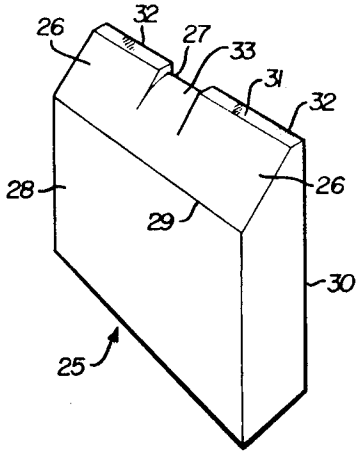



FIG. 2

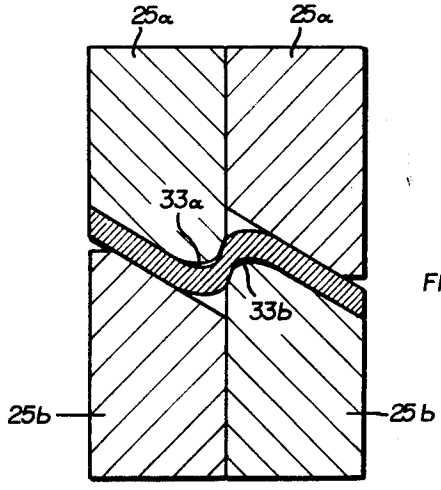



FIG. 4

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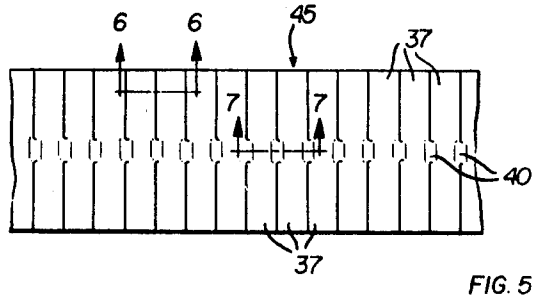



FIG. 5

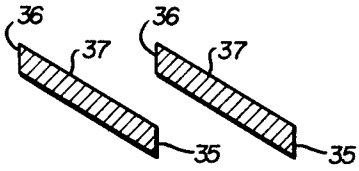



FIG. 6

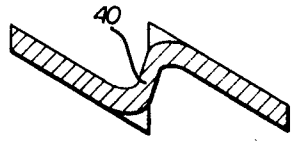



FIG. 7

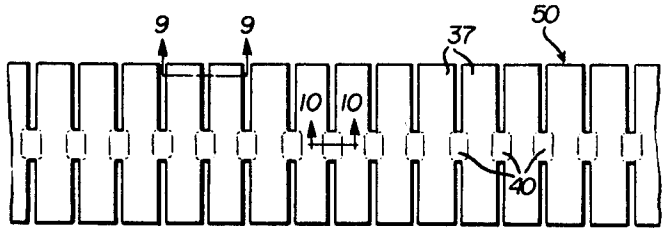



FIG. 8

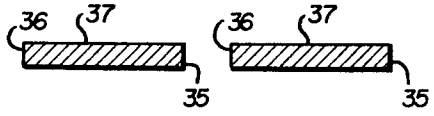



FIG. 9




FIG. 10

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# REINFORCING STRIP FOR PLASTIC ARTICLES AND METHOD AND APPARATUS FOR MAKING SAME

This application is a continuation of Ser. No. 746,444 filed July 22, 1968, now abandoned.

## BACKGROUND OF THE INVENTION

In the manufacture of certain plastic articles, for example interior trim strips or the like for automobiles, it is common to entrude a plastic envelope about a metallic reinforcing strip. This strip heretofore has typically been formed by passing a metal strip through a notching die which serves to remove from the opposite edges of the strip triangular- or rectangular-shaped pieces joined by a central spine which is normally untouched in the die. The notches or slots are removed from the strip to allow the plastic, during extrusion or molding, to flow through the notches, so that the strip becomes completely embedded in the plastic final composite article. The strip then is generally rolled to a nonplanar cross section generally conforming to the extrusion to be formed and is passed through an extrusion die at which time molten plastic is flowed about this strip and through the removed portions thereof so that the strip is firmly embedded therein.

Particularly where the composite article is to be used as a trim strip in an automobile, the backing or spine of the strip must be broken so that the composite strip can conform to curvature of the automobile component to which it is applied. The frangability of the metal strip can be accomplished in many different ways, e.g. by making the spine portion of the strip extremely thin in cross section, by piercing or otherwise interrupting the spine surface, or by making the entire strip out of a metal material which is readily frangible.

All of these prior methods suffer from various deficiencies, in that considerable scrap is generated and material losses are incurred by notching, cutting or otherwise removing portions of the initial strip to accommodate the flow of plastic material therethrough, and further material losses are incurred in rendering the spine readily frangible. The alternative use of low strength metals means a considerable loss in physical properties of the final composite strip.

All in all, it would be desirable to provide a method of making a strip for reinforcing a plastic article which reduced the metal losses previously incurred, which would provide a strip of enhanced physical properties while at the same time providing a strip which would be readily frangible for conformation to the curved surfaces to which it must be fitted during the assembly of an automobile or the like.

## SUMMARY OF THE INVENTION

The present invention now provides such a strip together with a method of an apparatus for making the strip.

More specifically, the strip of the present invention includes a series of separate and distinct laterally projecting parallel slats which are joined to one another in parallel array by tabs of reduced thickness located medially of the parallel edges of the slats. The tabs, which are formed integrally with the parallel edges of the adjacent slats, are cold worked or "coined" so as to be readily frangible after assembly of the reinforcing strip into the composite metal-plastic article. The slats are spaced from one another by the tabs which are elongated during the manufacture of the reinforcing strip, the spacing of the slats being accomplished by stretching the metal forming the tab as will be hereafter explained in greater detail.

Generally, the method of the present invention includes the performance of the simultaneous steps of slitting to form the slats, deflecting the slats and deflecting and stretching the tab portions. More particularly, the slitting step is carried out by passing a metallic strip through a die which first slits the strip inwardly from each of the longitudinal edges and stopping short of the complete width of the strip, so that separate slats are formed which are joined by a medial longitudinal portion of the strip. Substantially simultaneously with the slitting, the slats are angularly deflected relative to one another and from the plane of the strip, the slats being parallel to one another and having a medial plane which is roughly the longitudinal plane of the initial strip. The third and substantially simultaneous step is preformed by deforming the nonslit medial portions of the strip in a second and different direction to that in which the slats were deformed while at the same time stretching these longitudinal portions to reduce the thickness thereof and to bridge the gap between the adjacent slats. This stretching and coining operation cold works the nonslit portions of the strip, so as to make these portions more readily frangible in the final composite article. The coined, reduced thickness joining portions actually form tabs which are integral with and join the adjacent slats, so that the integrity of the strip is not disturbed.

Finally, the slitted and deflected strip is flattened back to a planar configuration corresponding to the planar configuration of the original strip. However, due to the stretching of the tab portions during their earlier deflection, the tab portions, when flattened, are elongated and serve to space the slats from one another through a distance which generally is 0.010 inch or greater to accommodate the flow of molten plastic material between the adjacent slats, so that the final article can become fully integrated into the final composite article.

Of course, the slitted, deflected and flattened strip can be subsequently formed, as by a rolling technique, to any desired cross-sectional configuration which adapts itself to the final composite article.

The apparatus of the present invention comprises a single die set having cooperable slitting edges, deflecting surfaces, and deflecting and stretching portions for forming the coined tabs joining the adjacent slats.

It is, therefore, an important object of the present invention to provide a new and improved metallic reinforcing strip adapted to be embedded in a plastic article.

Another important object of this invention is the provision of a metallic reinforcing strip for a plastic article or the like wherein plastic-receiving slits are provided without the removal of any scrap metal and the final strip is readily frangible so that the composite article can conform to a curved surface or the like.

It is a further object of this invention to provide a method of making a metallic reinforcing strip and wherein the edges of an initial metal strip are slit along spaced parallel locations toward a medial nonslit portion to form individual slats joined by the medial portion and the medial portion is stretched to join the slats to one another in space relationship to accommodate the flow of molten plastic between adjacent slats.

Yet another, and no less important, object of the present invention is the provision of an apparatus for the manufacture of a metallic reinforcing strip to be embedded in a plastic article and including die means having slitting edges joined by a central stretching portion for forming tabs integral with slit portions of the metallic strip which are stretched to space the slit portions of the strip from one another.

## AS SHOWN ON THE DRAWINGS

FIG. 1 is a schematic illustration of an apparatus of the present invention for carrying out the method of the present invention for carrying out the method of the present invention to provide the reinforcing strip of the present invention;

FIG. 2 is an enlarged perspective view illustrating, in elevation, a die element of the apparatus of FIG. 1;

FIG. 3 is a side elevational view illustrating a set of die elements as illustrated in FIG. 2 in operation, the die elements being viewed in elevation as shown in FIG. 1;

FIG. 4 is a view similar to FIG. 3, but illustrating the die elements of FIG. 3 at a medial portion of the strip being formed;

FIG. 5 is a plan view of the strip as initially formed by the apparatus of FIGS. 3 and 4;

FIG. 6 is an enlarged sectional view taken along the plane 6–6 of FIG. 5;

FIG. 7 is an enlarged sectional view taken along the plane 7–7 of FIG. 5;

FIG. 8 is a view of the finished strip;

FIG. 9 is a sectional view taken along the plate 9–9 of FIG. 8; and

FIG. 10 is a sectional view taken along the plane 10–10 of FIG. 8.

## AS SHOWN IN THE DRAWINGS

The apparatus of the present invention is utilized to form a reinforcing strip from a strip of metallic material, such as steel, indicated generally at 15. The strip 15 is fed between a set of dies indicated generally at 16 and 17 fitted to a press and adapted to be actuated by suitable means, as by actuating rods 18, 19, respectively, for reciprocation toward and away from one another. A pair of flattening rolls 20 are provided to receive the initially formed strip 21 from the dies 16, 17 and formed strip is then rerolled, as at 22, for subsequent use. Of course, the apparatus schematically illustrated in FIG. 1 of the drawings includes a feed means, (not shown) for intermittently advancing the strip between the dies 16, 17 and other conventional apparatus normally incorporated in such dies, e.g. vertical guide means guiding the reciprocation of the dies 16, 17, power drive means for the coiled strip 22 and the like.

As best shown in FIG. 2 of the drawings, the dies 16, 17 consist of a series of relatively vertically movable die elements, indicated generally at 25. These die elements are generally rectangular in configuration and have beveled deflecting surfaces 26 which are transversely spaced to lie on either side of a central notch 27. The bevel surfaces 26 each join one side face 28 of the element 25 at a sharp edge 29. The other side face 30 of the element 25 is connected to the spaced beveled surfaces 26 by means of a flat surface 31 defining sharp, right angular shearing edges 32 on either side of the notch 27. The notch 27 is formed between the two inclined deflecting surfaces 26 by means of a rounded surface 33 depressed beneath the level of the shearing edges 32 for a purpose to be hereafter more fully described.

As illustrated in FIG. 3 of the drawings, the strip fed between the dies 16, 17 is engaged throughout its entire transverse extent by the series of die elements 25. For ease of reference, the upper elements and portions thereof illustrated in FIG. 3 are identified by the suffix *a*, while the lower elements of FIG. 3 are indicated by the suffix *b*.

It will be seen that the strip 21 occupies a medial plane initially as indicated by the dotted lines 21 in FIG. 3 of the drawings. Upon closure of the dies 16, 17, the upper surface of the strip 21 is engaged by the upper die 25*a*, the lower surface of the strip 21 being simultaneously engaged by the die element 25*b*. As each strip portion between the die elements 16, 17 is engaged the shearing edges 32*a* of the upper element 25*a* cooperates with the shearing edges 32*b* of the next lower die element 25*b* to sever engaged transversely spaced portions of the strip from the remainder of the strip, thereby forming sheared edges 35 and 36 (see FIG. 6.). After the initial contact with the shearing edges 32*a* and 32*b*, the sheared strip portions 37 are next engaged by the respective die element inclined surfaces 26*a* and 26*b*, the inclination of these surfaces deflecting the sheared strip portions or "slats" 37 at inclined directions with respect to the plane of the original strip 21. These slats are illustrated in FIG. 6 of the drawings.

As illustrated in FIG. 4 of the drawings, the shearing edges 32 simply do not exist in the area of the notch 27, rather the rounded edge 33*b* of each lower die element 25*b* is spaced from the rounded edge 33*a* of the next successive upper die element 25*a* through a dimension which is somewhat less than the thickness of the initial strip 21. The engagement of the rounded edges 33*a* and 33*b* with the opposing, longitudinally spaced surfaces of the strip 21 results in wiping and stretching of the strip about the edges 33*b*, 33*a* to effect a juncture between the transversely spaced sets of inclined slats 37. This is clearly shown in FIG. 7 of the drawings, wherein the resultant stretched joining portions 40 are clearly illustrated. These stretched joining portions occur medially between the separate sets of slats 37, as best shown in the plan view of FIG. 5.

Of course, as seen by a comparison of FIGS. 3 and 6 with FIGS. 4 and 7, the sheared edges 35, 36 of the slats 37 are necessarily vertically aligned because the slats have merely been sheared by the shearing edges 32*a*, 32*b* and tilted by means of the deflecting surfaces 26*a*, 26*b*, whereas the joining portions 40 have been stretched and cold worked to form the juncture between the separate sets of slats 37.

Finally, the deformed strip 45 of FIG. 5 is passed through the straightening rolls 20 at which the inclined slats 37 are flattened into horizontal alignment, i.e. from their inclined parallel arrangement of FIG. 6. As illustrated in FIG. 8, this results in flattening the curved or arcuate joining portions 40 and the fact that the joining portions 40 are of greater longitudinal dimension than the distance between the edges 35, 36 causes the edges 35, 36 to be spaced from one another in parallel horizontal orientation, as best illustrated in FIGS. 8 and 9.

As illustrated in FIG. 10 of the drawings, the joining portions 40 are somewhat thinner in cross section than are the slats 37. Further, the portions 40 having been stretched and wiped over the arcuate notch surfaces 33 will be cold worked and weakened relative to the slats 37. As a result, the medial or joining portions 40 are readily frangible and the strip can be readily broken or separated at the areas 40.

The final strip 50 of FIG. 8 can be deformed to any desired cross section suitable to the extrusion within which it is to be embedded, and the formed strip passed through the cross head of an extruder to invest the strip completely in extruded plastic material. The plastic-strip composite structure is greatly enhanced by the accurate spacing of the edges 35, 36 of adjacent slats 37 from one another to accommodate the entry of extruded material therebetween as earlier explained. Further, the separate slats 37 are movable relative to one another after the medial joining portions 40 have been broken and, as a result the composite strip will readily adapt itself to a curved surface or to an irregular surface, also as heretofore explained.

I now claim:

1. In a method of making a metallic reinforcing strip to be embedded in a plastic article, the steps of slitting a planar metal strip from each longitudinal edge toward a medial longitudinal portion of the strip to form separate generally rectangular slats joined to one another only at said nonslitted longitudinal portion, tilting each such slat from the plane of the strip and on either side of said plane and stretching each of the medial longitudinal portions of said strips between the slats to join each slat to the next adjacent slat through an integral tab of reduced thickness metal, and finally returning the slats and tabs to the plane of said strip, thereby spacing the slats from one another through a dimension equivalent to the amount by which the intervening tab has been stretched.

2. In a method of making a metallic reinforcing strip to be embedded in a plastic article, the steps of simultaneously (1) forming a plurality of parallel slits from each longitudinal edge of a planar metal strip toward a medial longitudinal portion of the strip to form separate slats joined at said nonslitted medial longitudinal portion, (2) angularly deflecting each such slat from the plane of the strip to lie at an angle relative thereto and extending in a first common direction, and (3) deflecting and stretching the medial longitudinal portions of said strips bridging each such slit and immediately adjacent thereto in a second and different direction to join each slat to the next adjacent slat through an integral tab of reduced thickness coined metal, and finally flattening the slitted and deflected strip to space the slats from one another through a dimension equivalent to the amount by which the intervening tab has been stretched.