United States Patent [19]

Duepree

[11] **3,753,640**

[45] **Aug. 21, 1973**

[54] **APPARATUS FOR FORMING SYSTEM COMPONENTS OF EXTRUDED HOLLOW CHAMBER PROFILES**

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[21] Appl. No.: **177,666**

[52] **U.S. Cl.** **425/392,** 264/322

[51] **Int. Cl.** **B29c 23/00**

[58] **Field of Search** ..... 425/384, 385, 393; 18/19 TE; 264/320, 322; 72/392, 393

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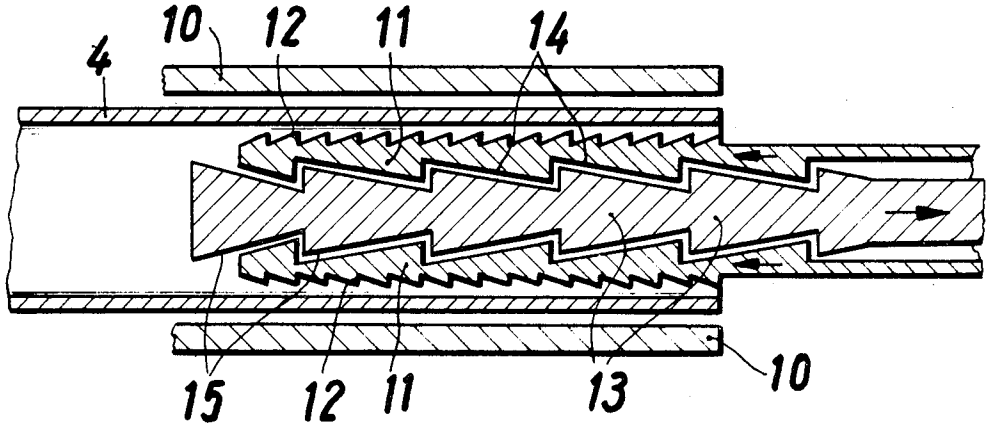
[57] **ABSTRACT**

This disclosure teaches a structural system with extruded plastic members having hollow (preferably rectangular) profiles with their ends open. Connecting plugs are provided for engagement into the open ends for attachment to the members. Embossed toothing at the open ends interfacing the plugs and the members secure their attachment. Embossing devices are used to emboss the toothing on the internal and external surfaces.

2 Claims, 16 Drawing Figures



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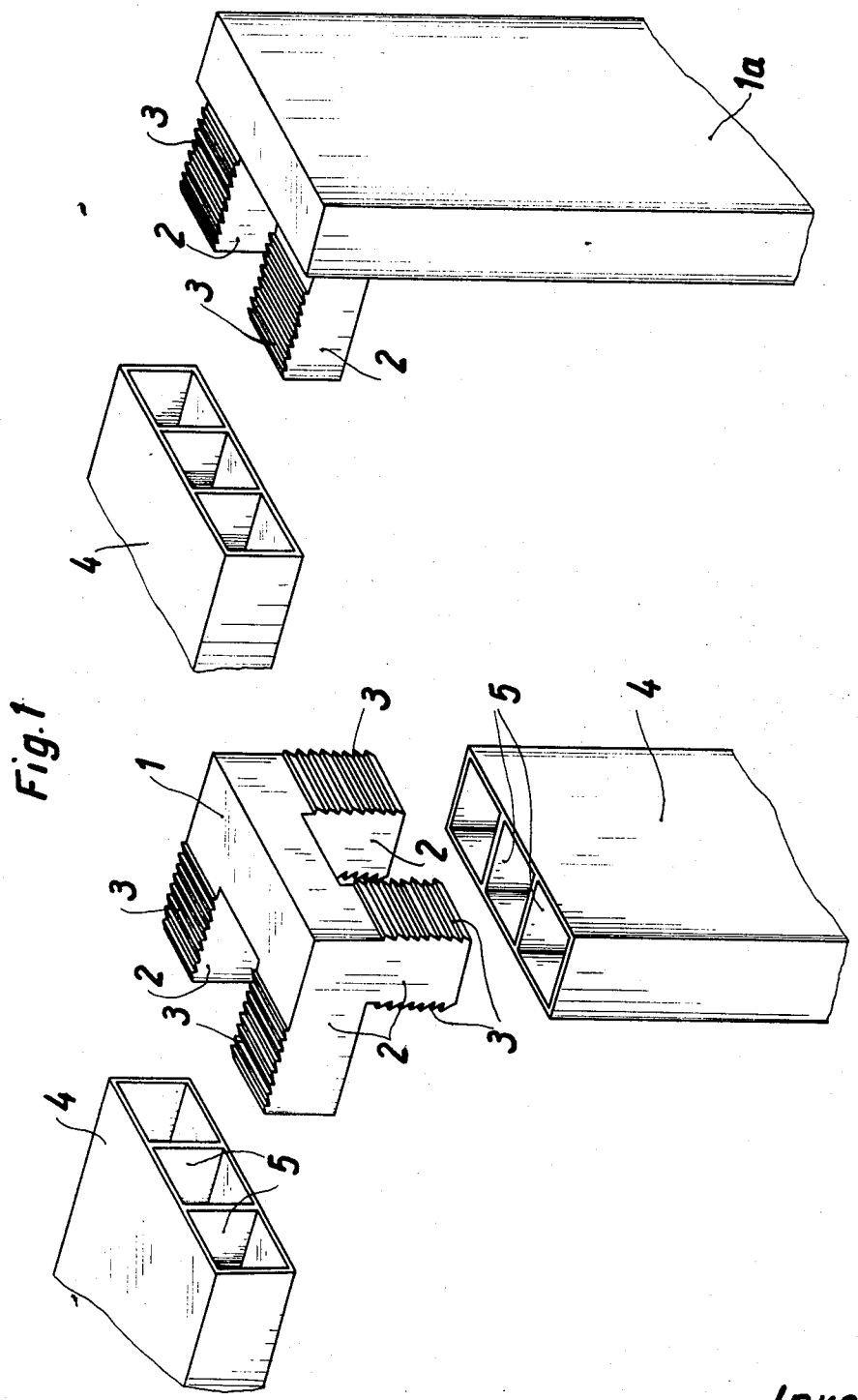

Fig. 1

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Fig. 2

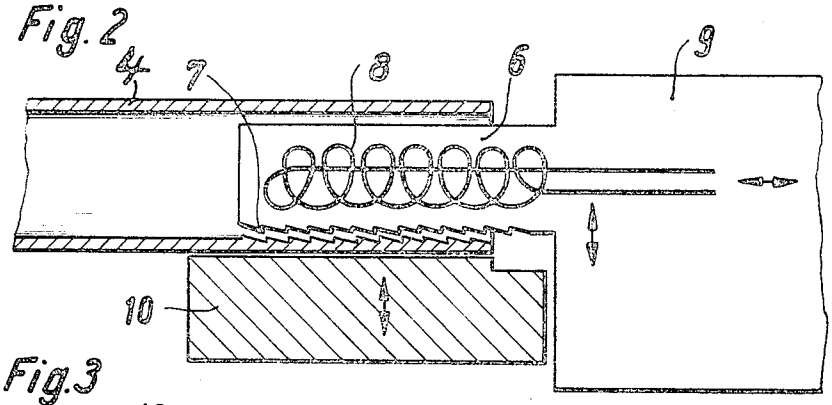


Fig. 3

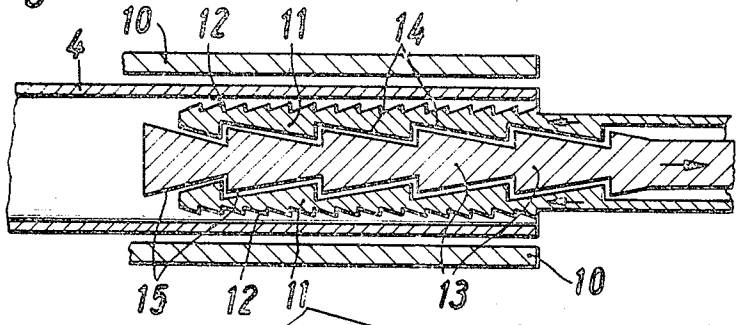
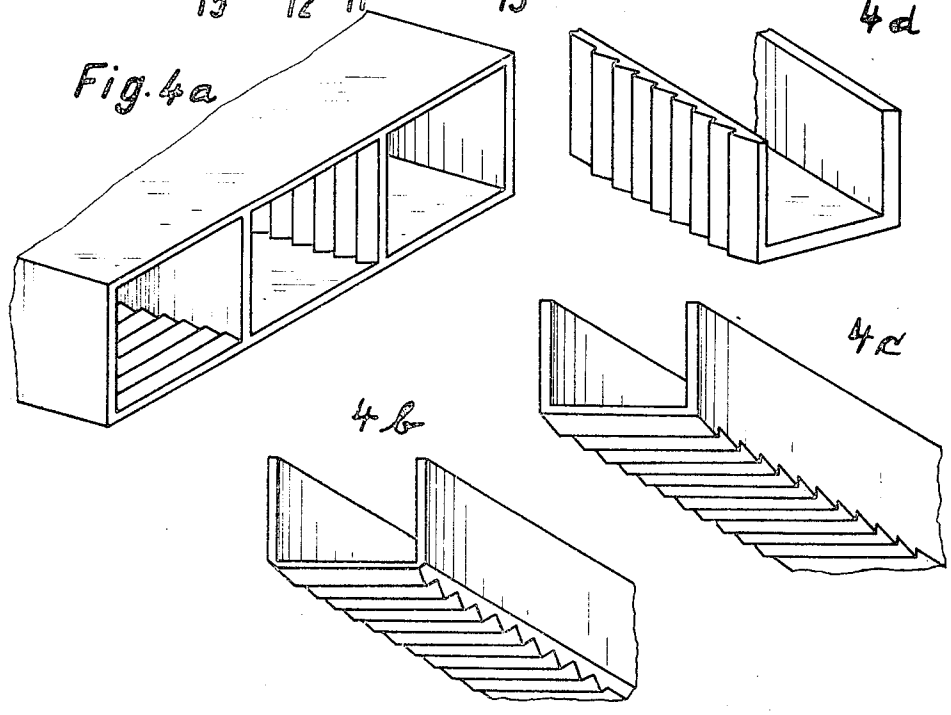


Fig. 4a



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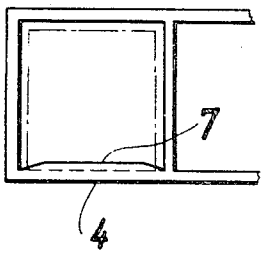

Fig. 5

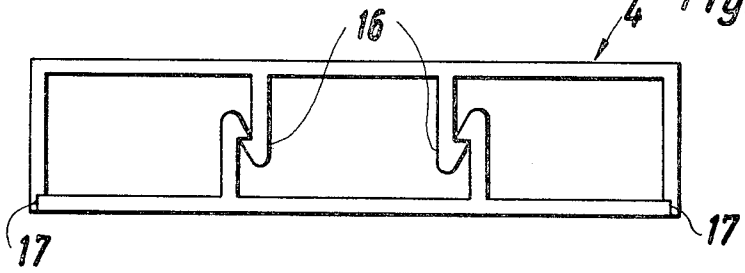

Fig.6

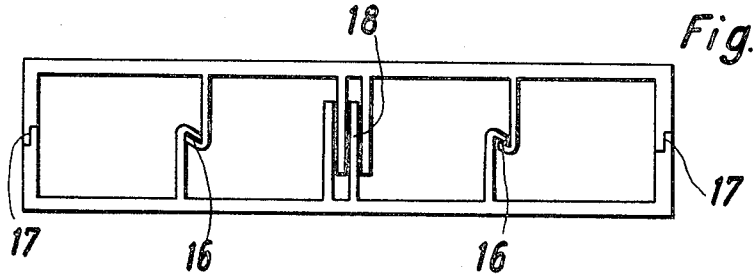

Fig. 7

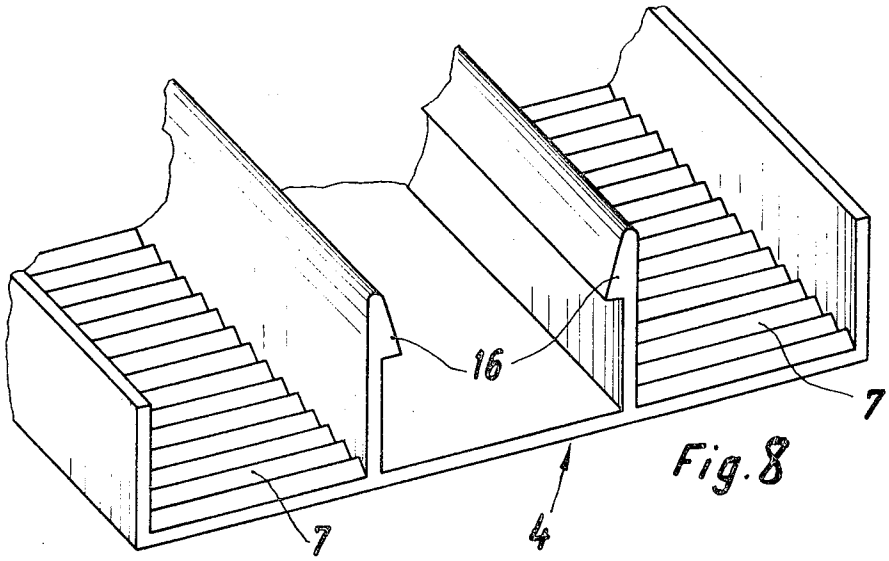

Fig. 8

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Fig. 9

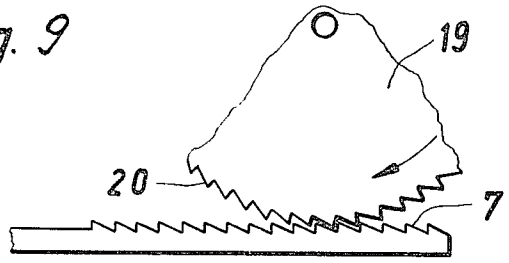


Fig. 10

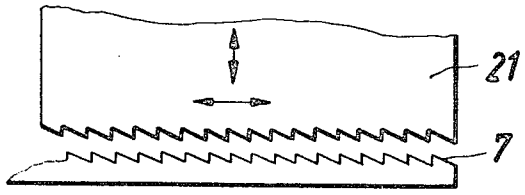
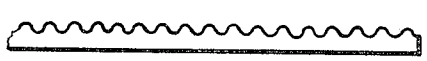


Fig. 11

a.

b.

c.



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APPARATUS FOR FORMING SYSTEM COMPONENTS OF EXTRUDED HOLLOW CHAMBER PROFILES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the processing of plastic materials and the manufacture of plastic articles and more particularly to an arrangement and a process of producing plastic system components in the form of hollow-chamber profiles which are produced from plastic by the extrusion process.

2. Description of the Prior Art

Hollow-chamber or box profiles of plastic materials produced by the extrusion process are of preferred use as system components for the manufacture of frames, boxes, cabinets, and the like due to the advantages in their manufacture. However, up to now considerable difficulties have been encountered with respect to a proper connection of the corners of hollow-chamber profiles made in this manner because in the case of these profiles it is not possible during their manufacture to produce recesses or protrusions which would permit a simple and rapid connection of the corners; for the extrusion process permits the production of shapes extending in longitudinal direction only. Therefore, in order to achieve proper corner connections in extruded hollow-chamber profiles, fins mutually engaging each other are inserted into the hollow chambers of the profile after providing a miter cut therein which, however, leaves the outer wall standing, and the profile is then bent together at the apex of the miter.

In accordance with another known arrangement, the extruded hollow-chamber profiles, cut to length, are connected to each other by plugs. The plugs are designed as angle members and are preferably of extruded plastic material. They are then provided in subsequent operations with special appendices of stamped or punched metal sheets. These metal sheets form, in the region of the plugs, protruding barbs which, after assembling the plug connection, rest against the inner walls of the hollow chambers and are anchored therein. Aside from the costly additional machining or finishing of the plugs, such connections are not very durable or firm. Of course, it has also been proposed to effect such connections by means of corner plugs in which, after joining the corner plugs and hollow chamber profiles, a transverse bore hole was produced into which a pin is inserted. Such connections, to be sure, hold firmly together, but in order to obtain a connection which is particularly resistant to twisting, the bore holes and transverse pins had to be arranged in a special manner, resulting in complications during manfuacture. It usually was necessary to effect additional attachment by means of an adhesive. As is known, bonding of plastics by means of an adhesive is not possible in all cases since there are scarcely any adhesives which adhere equally firmly, for instance, on the one hand to polyvinyl chloride and on the other hand to polystyrene; furthermore, such plastic adhesives are extremely expensive and cause substantial complications in the manufacturing process. Heretofore, all known or suggested connections of the corners of extruded plastic profiles up to the present time require considerable subsequent machining, additional measures and materials, as well as expensive manual labor it being not possible in many cases to obtain a connection which is easily produced but nevertheless firm, dependable, and particularly resistant to twisting.

SUMMARY OF THE INVENTION

It is one object of the present invention to provide a simple and highly effective method of firmly and satisfactorily joining extruded plastic articles at their end so as to form corners.

Another object of the present invention is to provide plastic parts or articles which are firmly joined and connected to form corners.

Other objects of the present invention and advantageous features thereof will become apparent as the description proceeds.

In principle the present invention of providing system components of extruded hollow chamber profiles of plastic material which can be connected to form corners by means of connecting plugs, is characterized by the feature that profile sections are provided with a toothing in the region of their ends on an inner surface of at least one chamber. Said toothing is preferably embossed therein. The embossed toothings can also be arranged at two opposite inner surfaces of at least one chamber. The hollow-chamber profiles can also be composed of two open profile parts assembled by means of a continuous hook-connection, the hooks engaging behind each other on longitudinal ribs. The plugs preferably have an open U-shaped profile and are provided with the toothing on the outer side of their base. The plugs in the form of an open U-shaped profile can also be provided with the toothing on the outer side of the arms of said profile. The plug walls are preferably of smaller thickness in the region of the toothing as a whole or towards its edges. The walls of the chamber profiles can advantageously be made of smaller thickness in the region of the toothing towards the edges.

One method producing hollow chamber profiles in accordance with the present invention is characterized by the feature that one or more embossing plugs are introduced endwise into one or more chambers of the hollow profile and are pressed on the softened corresponding inner surfaces in order to emboss thereon the toothing.

Another variant of the method of producing hollow chamber profiles is characterized by the feature that one or more embossing jaws which are arranged opposite each other and between spreading wedges are displaceably arranged, are introduced at the end into one or more chambers of the hollow profile and are pressed in while softening their inner surfaces, by displacing the spreading wedges so as to emboss the toothing. When pressing the embossing tools from the inside of the hollow chamber profile, the latter is stabilized by jaws applied in opposing direction, shaped, and, if required, cooled.

One method of producing hollow chamber profiles from open profiled bars is characterized by the feature that by means of an embossing wheel which acts against the inside of the profiled bars or by means of an embossing stamp which can be raised or lowered, they are provided with the toothing while softening the surface to be shaped.

As is evident toothing with a plurality of teeth lying one behind the other on connecting plugs and system component gives a connection which is extremely easy to produce in assembling, but which is nevertheless very strong, stable, and permanent. In this connection

many different forms of teeth can be employed; a barb-shaped toothing is particularly advantageous. To use such a connection for extruded hollow chamber profiles was not possible heretofore because said special molding process does not permit production of indentations extending transversely to the injection nozzle. In contrast thereto and in accordance with the present invention, such indentations arranged transversely to the direction of extrusion are embossed subsequently by a special molding tool after the hollow profiles have been cut to the desired length from their ends, whereby the inner surfaces are softened. Or, according to another embodiment of the present invention the hollow chamber profile is so divided up in length that it is composed of two halves. In this case the toothing can be formed by means of an embossing wheel or a moving embossing stamp during the continuous course of manufacture, i.e., directly after the extruded profile has left the injection nozzle or the calibrating nozzle and is still somewhat plastically deformable. The embossing wheel has its shaft supported in fixed position in a frame and rolls in contact therewith, while the extruded profile is moved over its surface. Thereby, the embossing stamp moves up and down on said profile and moves along with the extruded profile during the embossing process. Of course, the embossing of the open hollow chamber profiles can also be effected at a later time, provided care is taken that the inner surfaces are softened for embossing.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, advantages, and features of the present invention will be more fully understood in connection with the following description of certain preferred embodiments thereof, taken in conjunction with the accompanying drawings without, however, being limited thereto. In said drawings

FIG. 1 is a perspective view of two types of corner connections shown in the form of an exploded drawing;

FIG. 2 is a longitudinal section through a first embodiment of an embossing tool;

FIG. 3 is a longitudinal secton through another embodiment of an embossing tool;

FIGS. 4*a*–4*d* are perspective views of different embodiments of the toothings in a hollow chamber profile and on the plug corresponding thereto;

FIG. 5 is a cross section through a special embodiment of an extruded hollow chamber profile;

FIG. 6 is a cross section through a hollow chamber profile assembled from two halves;

FIG. 7 is a cross section through a hollow chamber profile assembled from two halves in accordance with another embodiment;

FIG. 8 is a perspective view of one half, corresponding to FIGS. 6 or 7, of the hollow chamber profile;

FIG. 9 is a longitudinal section through a toothing device for a profile in accordance with FIGS. 6 to 8;

FIG. 10 is a longitudinal section through a toothing device corresponding to FIG. 9 in another embodiment;

FIGS. 11, 11*b*, and 11*c* show different forms of teeth.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The perspective view of FIG. 1 shows the manner in which the hollow chamber profiles as system components are connected with each other by means of a plug connection, either by means of a special part connecting two hollow chamber profiles at their ends to form a corner. Said part consists of plugs arranged at an angle to each other. Or the plugs can form an integral part of one of the system components produced, for instance, by injection molding. According to FIG. 1 there are provided on corner connecting part 1 or on the system component 1*a* plugs 2 arranged at a right angle to each other or to system component 1*a*. Said plugs 2 have toothed outer surfaces 3 the teeth being constructed as hooks. The box profiles 4 are extruded profiles with flat reactangular cross section which have on their inside several transverse ribs or webs 5 which stiffen and strengthen the box profile, and particularly the extended outer surfaces thereof. On extruding said box profiles 4 it is not possible to provide the inner surfaces of the individual chambers of the profiles 4 with toothings into which the plugs 2 with their toothings can engage, since such toothings have to extend transversely to the directon of extrusion.

Therefore, after the continuously extruded box or hollow chamber profiles 4 have been cut to the desired length, they are provided by means of a special embossing tool such as shown in FIGS. 2 or 3, with the barb indentation.

The embossing tool of FIG. 2 consists of an embossing plug 6 of rectangular cross section, the lengths of its sides being smaller than the lengths of the sides of the inner cross section of a chamber of the hollow chamber profile 4. The embossing plug 6 is provided on one of its surfaces with an embossing toothing 7 which is coated with a release agent, for instance, with silicone or polytetrafluoroethylene, so as to prevent its adherence to the softened plastic after embossing. The embossing plug 6 is provided in its interior with a heating means 8 and a temperature detector. The embossing plug 6 is attached to a guide 9 which introduces it for embossing into the chamber 4. Plug 6 is then pressed against the wall to be embossed. After embossing, it is lifted off and is withdrawn, as shown by the arrows indicated on guide 9. On guide 9 there is furthermore displaceably arranged jaw 10 which is movable toward and from the direction of movement of plug 6. Said jaw 10 rests during embossing and softening of the chamber wall by heating means 8 on the surface opposed to the surface of said wall which will be embossed and, thereby, stabilizes and strengthens it when the heated embossing tool 6 acts on said surface. Stabilizing and strengthening jaw 10 can be cooled, if required.

The use of the stabilizing and strengthening jaw 10 produces an additional advantage when a toothing is embossed by means of the embossing tool 6 on the surface of one of the wall surfaces of the inner ribs 5 (FIG. 1) of the chamber profile 4. As is known, hollow chamber profiles, after extrusion, are brought to the proper dimensions by means of a calibrating nozzle. Thereby, however, it is not possible to precisely mold the ribs between the chambers. These ribs therefore are usually not of exact measurements; they frequently are bent, arched, or otherwise deformed. Such deformations are disadvantageous when the plug connections are introduced at the end. By the provision of stabilizing and strengthening jaw 10 it is possible to properly emboss the wall of an inner rib by placing the stabilizing and strengthening jaw 10 placed against the other side of said wall 5 opposed to the embossing plug 6, thus align-

ing the molding the rib 5 exactly to the desired dimensions, at least within the area where plug connection is effected, thereby eliminating any deformation. To achieve this result it is only necessary to suitably control the temperature so that during embossing the rib has softened to such an extent that it can be molded under the pressure exerted by the embossing tool 6 and the stabilizing and strengthening jaw 10.

It has also proven of advantage to somewhat increase the thickness of the wall of the hollow chamber profile 4 which is to be provided with the embossing, whereby, however, the thickness of the wall material preferably decreases towards the lateral longitudinal edges (as indicated in the cross sectional view of FIG. 5). Then the embossing tool 6 is merely of a width which corresponds to the thicker part of the wall. In this way two advantages are achieved. On the one hand, on embossing, the softened material which has been displaced at the apices of the teeth can give way towards the sides. On the other hand, due to the material being weakened in the vicinity of the longitudinal lateral edges, the result is achieved that this part of the wall has a greater elasticity which favors and facilitates introduction and locking of the toothing of the connecting plugs.

In accordance with another embodiment of the present invention as shown in FIG. 3, an embossing tool for embossing of toothings on opposite inner walls of the hollow chamber profile consists essentially of two embossing jaws 11 which are positioned opposite each other and the outer surfaces of which are shaped as hook toothing 12 to be embossed. Between these embossing jaws 11 there are displaceably arranged spreading wedges 13. These wedges 13 are constructed in the embodiment shown in FIG. 3 so that the opposite facing surfaces of the embossing jaws 11 have a plurality of inclined surfaces 14 arranged one behind the other and extending towards each other. Correspondingly obliquely inclined surfaces 15 on the spreading wedge 13 cooperate with the said oblique surfaces or wedge surfaces 14 of the embossing jaws 11 in such a manner that upon displacement of said embossing jaws 11 and said spreading wedges 13 with respect to each other in the direction indicated by the arrows, the embossing jaws 11 are pressed against the walls of the hollow chamber profile 4. The inner surfaces of said walls are softened for embossing. Softening can also be effected by heating the embossing jaws 11, before introducing them into the hollow chamber profile 4, to a predetermined temperature at which, with due consideration of the interim cooling effect, softening of said inner surfaces sufficient for embossing takes place. When using plastics which, due to their specific composition, have a wide temperature range within which they soften, the hollow chamber profile 4 as a whole can also be heated to the softening temperature prior to embossing. Another possible manner of softening consists in increasing the temperature to the softening temperature by exposure to high frequency current at the boundary surfaces between embossing stamp and plastic profile. It is advisable, during embossing and thus as long as the plastic profile is softened, to apply to it from the outside pressing jaws 10 which cause the outer shape of the profiles to be retained and which are cooled, if required.

Various possibilities of providing toothing in the hollow chamber profile are shown in FIG. 4, the correlation of the plugs to the toothings to form the hollow chambers being illustrated in partial perspective view. In an outer chamber a toothing is arranged in the hollow chamber profile on the inside of an outer wall at its bottom (FIG. 4*a*). Two different types of plug are shown for such a toothing, namely a lower plug embodiment in which the plug has a U-shaped profile and is provided with the toothing on the outside of the base surface. This toothing is bevelled towards the lateral longitudinal edges so that the wall of the plug is somewhat thinner in this region. At this place the material displaced in the hollow chamber upon embossing is taken up. In addition thereto the result is achieved that by so weakening the wall of the plug, a certain elasticity is created permitting simpler assembly of the plug and hollow chamber.

FIG. 4*c* shows a U-shaped plug in which the toothing extends from edge to edge.

FIG. 4 also shows a central chamber which is provided with a toothing on one of its side walls, i.e., on the inner surface of a rib. Corresponding to this side wall toothing FIG. 4*d* shows a plug of U-shaped cross section which bears the toothing on the outer surface of one of its arms.

A particularly advantageous and useful embodiment of the present invention consists in the feature that a complete hollow chamber profile is not produced directly upon the extrusion, but that first partial, for instance, half profiles are extruded which are subsequently assembled together to form a hollow chamber or box profile. FIGS. 6 to 8 illustrate such profile shapes. In FIG. 5 the hollow chamber profile 4 is composed of two open partial profiles. The center ribs are designed in the form of hook ribs 16 which engage behind each other and the narrow sides can be provided with an interengaging stepped toothing 17 in order to avoid formation of any substantial gap. When the hollow chamber profile of FIG. 6 is composed of two non-identical open profiles, it is advisable to arrange the stepped toothing 17 in such a manner that it lies at a longitudinal edge. It can easily be seen that the two open profile parts are assembled in a simple and rapid manner to form a closed hollow chamber profile by placing said parts upon each other and pressing them together so that the barbs of the opposing hook ribs 16 engage each other and hold the profile firmly and securely together. The stepped profiles 17 on the sides also engage each other.

While a hollow chamber profile assembled in accordance with FIG. 6 from two open profiles requires two different extrusion forms, a hollow chamber profile composed of two open profiles in accordance with FIG. 7 can be extruded from a single extrusion nozzle. The interengaging hook ribs 16 are in identical position in the embodiment of FIG. 6, i.e., the hooks of the upper profile part point towards the left and the hooks of the lower profile part point towards the right. Displacement of the two profile parts and thus disengagement and loosening of the interengaging hooks 16 is prevented by providing a corresponding opposite facing steps 17 in the narrow side walls of the profile parts. Displacement can also be prevented by providing additional corresponding ribs 18 which form a longitudinal wall of the hollow chamber profile and engage each other. Of course, it is possible, depending on the respective shape and dimension of the hollow chamber profile, to provide a large number of hook ribs 16 and interengaging ribs 18 within the profile. It is evident

that the profile shape of FIG. 7 consists of two identical profile parts which, however, are arranged opposite each other as mirror images.

Due to the simple division of a hollow chamber profile into two open extruded profile parts, it is readily possible in accordance with the present invention to continuously provide in said open profile parts during the course of their manufacture a barb toothing 7, as illustrated in particular in FIG. 8. Of course, thereby the desired longitudinal extention of the system components must be taken into consideration so that opposite barbed shapes are present at all times at each end of the profile length. The extrusion of the profile parts can be controlled in the manner that, upon leaving the extrusion die or the calibrating device, they are still so soft that the barbed shape can readily be embossed by means of a suitable embossing tool. It is also possible to heat the embossing tool in a suitable manner so that the surface to be embossed will be softened during embossing. It is also advisable to support the profile parts during embossing from the outside so that they retain their original shape. For continuously embossing the extruded open profile parts, there can be used an embossing wheel 19, such as shown in FIG. 9, which is provided on its cylindrical surface with barbed toothing 20. This embossing wheel, upon the advance of the extruded open profile part, rolls or hobs on the corresponding inner surfaces of said profile part and provides it thereby with the desired embossing. The circumference of the wheel and the embossing toothing on its cylindrical surface are so adapted to each other that the required barbed toothing is embossed each time at the ends of the longitudinal extension of the profile parts as desired in each case.

Another possibility of molding the barbed toothing on the extruded open profile is shown in FIG. 10. Here the barbed profile is pressed by means of an embossing stamp 21 against the inner surface of the open profile part and travels along with the extruded profile part with the speed of advance during the embossing process. After embossing, the stamp 21 is withdrawn and is returned to its starting position so that embossing can be repeated. The directions of movement of the stamp are indicated by arrows. Of course, two such embossing stamps can also be used alternately in order to emboss toothings which are opposed to each other.

In FIG. 11 there are shown various shapes of tooth profiles which can be used for the purpose of the present invention: FIG. 11*a* illustrates a barbed profile which can easily be placed together and assures excellent hold and firmness, but is not detachable. FIG. 11*b* illustrates a simple tooth profile with teeth having equilateral flanks. FIG. 11*c* illustrates an undulated profile. The last two profiles, suitably shaped, can be detached.

From the above description it can be noted that it is possible to apply to extruded profiles the particularly advantageous embodiment of connecting by means of barbed toothings hollow chamber profiles and plug profiles. In particular such connections can also be effected by the very advantageous and suitable step of dividing the hollow chamber profile into two open halves into which the barbed toothing can be embossed or molded already during the continuous extrusion of said halves.

I claim:

1. A device for embossing toothing onto an inner wall of an extruded plastic member having a hollow profile with an open end, the device comprising in combination:

spreading wedges insertable into the open end in contact with the wall,

means for heating the inner wall to soften it,

means for pressing the spreading wedges against the softened inner wall to emboss the toothing thereon, lifting means for lifting the spreading wedges from the inner wall,

means for removing the spreading wedges from the open end,

stabilizing means provided at the outside of the wall to be embossed, said stabilizing means movable toward and from the wall to be embossed and on contacting said wall reenforcing same to prevent bending thereof on embossing.

2. The device of claim 1, in which the stabilizing means are provided with cooling means.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,753,640 Dated August 21, 1973

Inventor(s) HANS-WERNER DUEPREE

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Claim 1 should read as follows:

1. A device for embossing toothing onto at least one inner wall of an extruded plastic member having a hollow profile with an open end, the device comprising in combination:

a spreadable embossing tool insertable into the open end of said member in contact with said one wall,

means for inserting said embossing tool into said open end,

means for heating said one wall to soften it,

wedge means for pressing said embossing tool against the softened inner wall to emboss the toothing thereon,

lifting means for lifting said embossing tool from the inner wall,

means for removing said embossing tool from the open end of said member, and

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,753,640 Dated August 21, 1973

Inventor(s) HANS-WERNER DUEPREE

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

stabilizing means provided at the outside of the wall to be embossed, said stabilizing means being movable toward and from the wall to be embossed and on contacting said wall reenforcing same to prevent bending thereof on embossing.

Signed and sealed this 21st day of May 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents