March 12, 1940. E. PENKALA 2,193,737

METHOD OF ROLLING PROFILED SECTIONS FROM SHEET METAL

Filed June 19, 1937

Fig. 1.

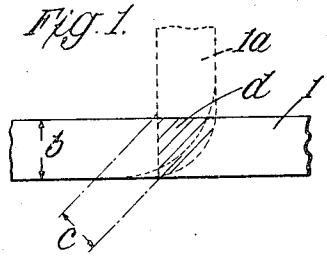


Fig. 2.

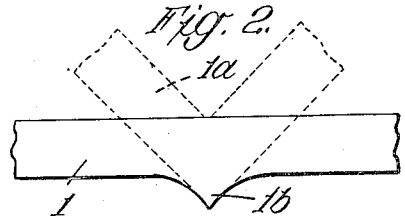


Fig. 3.

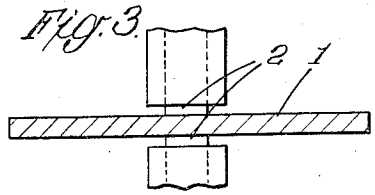


Fig. 7.

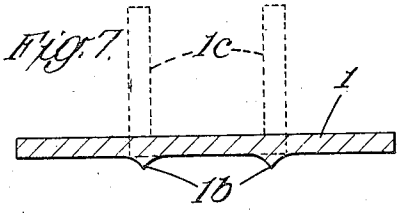


Fig. 4.

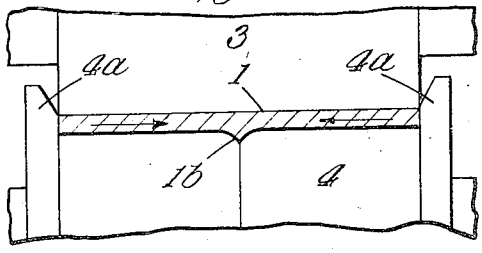


Fig. 8.

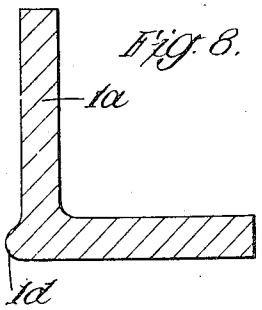


Fig. 5.

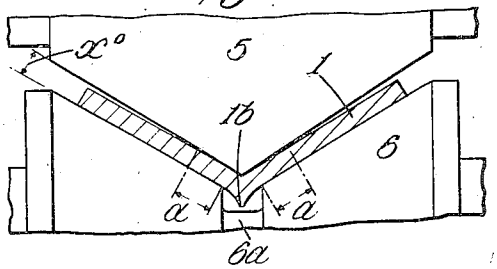


Fig. 9.

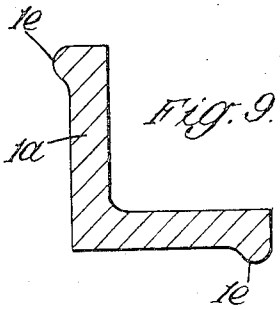
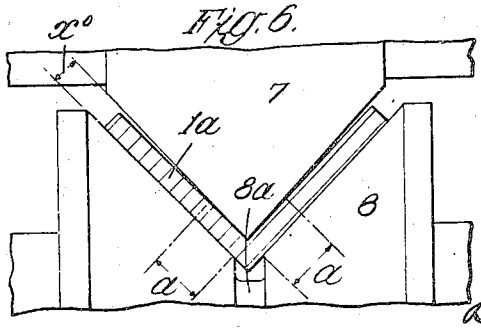


Fig. 6.



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UNITED STATES PATENT OFFICE

2,193,737

METHOD OF ROLLING PROFILED SECTIONS FROM SHEET METAL

Emil Penkala, London, England, assignor of one-half to Metal Trim Limited, London, England, a British company

Application June 19, 1937, Serial No. 149,220
In Great Britain January 26, 1937

1 Claim. (Cl. 80—60)

This invention relates to an improved method and apparatus for the production of profiled sections by rolling from sheet metal.

Usually the bend or corner is the weakest part of a profiled section formed from sheet metal by rolling owing to the fact that the lateral stretching of the metal at the bend, which stretching is communicated to some extent to the adjacent walls or flanks of the section, results in substantial thinning of the metal at the bend and consequently the section is of unequal thickness and is naturally weakest at the bend.

Furthermore, in bending up an L or U or similar section longitudinal stretching of the edges of the metal strip is liable to occur in the methods heretofore employed and it is obvious that any pressure applied at or near the edges of the strip will tend to increase this longitudinal stretching action.

The present invention has for its object to enable profiled sections to be produced wherein the bend or corner of the section is at least as strong as the remainder of the section, and, if desired, may be made of greater strength than the remainder of the section, without applying pressure on parts of the section which have been stretched or are subject to stretching in a lateral or longitudinal direction during the profiling operation.

The invention also has for its object to enable profiled sections to be produced with bends or corners which are sharp or angular externally or with bends, corners and/or edges reinforced by flanges, beads or other forms.

According to the present invention, the improved method of forming a profiled section by rolling from sheet metal includes the step of upsetting the metal in a lateral direction or directions to form a part or parts of increased thickness and of any desired shape whereby the profile produced by subsequent bending of the material may be modified and reinforced. Thus, prior to a bending operation of, for example, an L or U section, the parts at which the metal is to be bent may be thickened up or reinforced in such manner that when bent up the corner of the section is of sharp angular form externally, or other desired shape. Furthermore, the marginal edges of the section may be beaded, flanged or otherwise provided with enlargements.

More specifically, the invention includes a method of producing profiled sections by rolling from sheet metal wherein, prior to the formation, or to a stage in the formation, of a bend or corner in the section, the metal thereof is upset so as to flow towards the position of the bend or corner while passing between rollers shaped to produce a rib or angular or other projection or thickening at the position of the bend or corner. The extent of the upsetting action and the shape and size of the projection or thickening thereby produced may be such that when the section is bent to its final shape the bend is of true angular formation externally without any reduction in thickness of the section at any point or points, with the result that the bend actually will be the strongest part of the section. Obviously other forms of reinforcement may be provided, for instance, the bend may be formed with an external reinforcing rib or even with an externally projecting flange.

In the case of comparatively soft metals, the step of upsetting the metal may be effected in the cold, but in the case of steel, the invention includes the step of local heating of the strip material at and/or adjacent the parts to be upset, such heating preferably being effected immediately prior to the upsetting operation, it being understood that the material passes continuously from the upsetting rollers to the profiling rollers.

In some cases two or more upsetting operations, if necessary in conjunction with two or more heating operations, may take place at various stages in the production of a profiled section.

The formation of the part or parts of increased thickness may be effected by the use of rollers adapted to exert an upsetting pressure on the appropriate parts of the metal while confining the edges of the same so that the metal is constrained to flow towards a position or positions at which at least one of the rollers is grooved or relieved to allow of the formation of a rib or other projection or thickening for the purpose described.

The invention is hereinafter described by way of example with reference to the accompanying diagrammatic drawing, in which—

Figure 1 is a diagram illustrating the inherent tendency to thinning of the metal where a bend is formed;

Figure 2 is a similar view illustrating the manner in which a sharp angled section is produced according to the invention;

Figures 3 to 6 are cross-sectional views illustrating the method according to the invention as applied to the production of a sharp angled L section;

Figure 7 is a cross-sectional view illustrating the manner in which a sharp angled U section may be formed; and

Figures 8 and 9 are cross-sectional views showing examples of modified sections capable of being produced according to the invention.

When the metal strip 1 is bent up to form an angle section 1*a*, as shown in Figure 1, there is a tendency for a thinning of the metal to occur at the bend so that the thickness indicated at *c* will be less than the initial thickness *b* of the strip. This thinning tendency is due to the fact that the cross-sectional area indicated by the cross-hatching at *d* has to be made up by flow of the metal in the walls of the section towards the bend during the profiling operation. Thus, in order to avoid any substantial thinning of the metal at the bend it is usually necessary to effect the profiling operation under considerable pressure sufficient to cause a flow of the metal towards the bend.

In accordance with the present invention and as shown in Figure 2, the metal strip 1 is first formed with a suitably shaped projection portion 1*b* so that when the strip is bent up to form the angle 1*a* the thickness of the metal at the bend actually is greater than the thickness of the wall of the section and obviously the projection 1*b* may be shaped to secure a sharp external angle, as shown. Inasmuch as the preliminary formation of the projection 1*b* may be of such cross-sectional area as to obviate any necessity for effecting a flow of the metal of the section walls towards the position of the bend, it is clear that the profiling operation may be effected under considerably less rolling pressure than heretofore.

Referring more especially to Figures 3 to 6, the improved method according to the invention consists in first subjecting the metal strip 1 to an upsetting operation, preferably with the prior application of localised heating so as to form the projecting rib 1*b*, and thereafter passing the strip between profiling rollers by which it is bent up to the desired profiled form, the profiling operation preferably being carried out in accordance with my copending application Serial No. 149,217, filed June 19, 1937, so as to avoid any stretching of the edges of the strip and also to localise the application of the rolling pressure to the parts of the section which are not stretched or subject to stretching either in a lateral or longitudinal direction during the profiling operation.

In one embodiment and in the application of the invention to the production of a sharp angled L section, the strip 1 is first passed between electrodes 2 or other heating means whereby the portion of the strip at which the bend is to be formed is locally heated to facilitate the upsetting operation which, as shown in Figure 4, may be effected by passing the strip 1 between rollers 3 and 4 arranged to exert an upsetting pressure, the roller 4 having flanges 4*a* serving to confine the edges of the strip whereby the metal is caused to flow in the direction of the arrows and thereby upset the locally heated metal at the centre to form the projecting rib 1*b*. Thereafter the strip 1 is passed between profiling rollers 5, 6 and 7, 8 which preferably are profiled according to the teaching of said copending application so that the rolling pressure is localised at the parts *a* at which there is no lateral or longitudinal stretching tendency. For this purpose the upper rollers 5 and 7 are profiled so that the outer parts thereof diverge outwardly in relation to the corresponding profiled faces of the respective lower rollers 6 and 8 so as to form an angle of *x* degrees therewith, while the lower rollers 6 and 8 are formed with centrally disposed circumferential recesses 6*a*, 8*a* respectively. If necessary the profiled section may be finished by passing between calibrating rollers the profiles of which correspond exactly to the profiles of the finished section.

By upsetting the metal to form the projection 1*b* before the profiling operation takes place, it is unnecessary to confine the edges or marginal portions of the strip during the profiling operation and thus, the whole of the profiling may be effected by the use of rollers as described adapted to avoid the application of any pressure on stretched parts or parts liable to stretching and consequent thinning.

As illustrated in Figure 7, a U section may be produced in a similar manner by first forming two projecting ribs 1*b* and then profiling the strip in the manner before described. Obviously, any other profiled section may be produced in accordance with the invention. Furthermore, the projecting rib 1*b* may be otherwise shaped, for example, to produce a bulbous enlargement, such as shown at 1*d* in Figure 8. Furthermore, the invention is applicable for the production of sections having beadings or flanges 1*e* at the edges, as shown in Figure 9, or at any other positions.

If required for the production of more complicated sections, two or more upsetting operations, with or without preliminary local heating, may take place simultaneously or in series.

It will be understood that the invention is not limited to the particular embodiments hereinbefore described and that sections of any desired profile reinforced at the bend or bends or other positions may be produced.

Although the invention is of general application for the production of profiled sections by rolling from sheet metal, it is particularly applicable for use in connection with the method and apparatus according to my further copending applications, Serial Numbers 149,216 and 149,218, both filed June 19, 1937. Furthermore, the rollers utilised for carrying the invention into effect may be constructed according to my copending application, Serial No. 149,219, filed June 19, 1937.

What I claim and desire to secure by Letters Patent is:

A method of preventing metal strips of substantially uniform thickness from having undesirably weak zones when rolled from substantially flat material into structural members of altered cross-sectional shape, comprising the steps of locally heating the strip in a longitudinal zone where the corner, enlargement or re-enforcement is to be formed, and immediately subjecting the strip to rolling while exerting pressure on the unheated portions of the strip towards the locally heated zone whereby the material of said locally heated zone is upset.

EMIL PENKALA.