May 17, 1955 W. D. WILSON ET AL 2,708,511

RUNOUT TABLE GUIDE

Filed Aug. 5, 1949

3 Sheets-Sheet 1

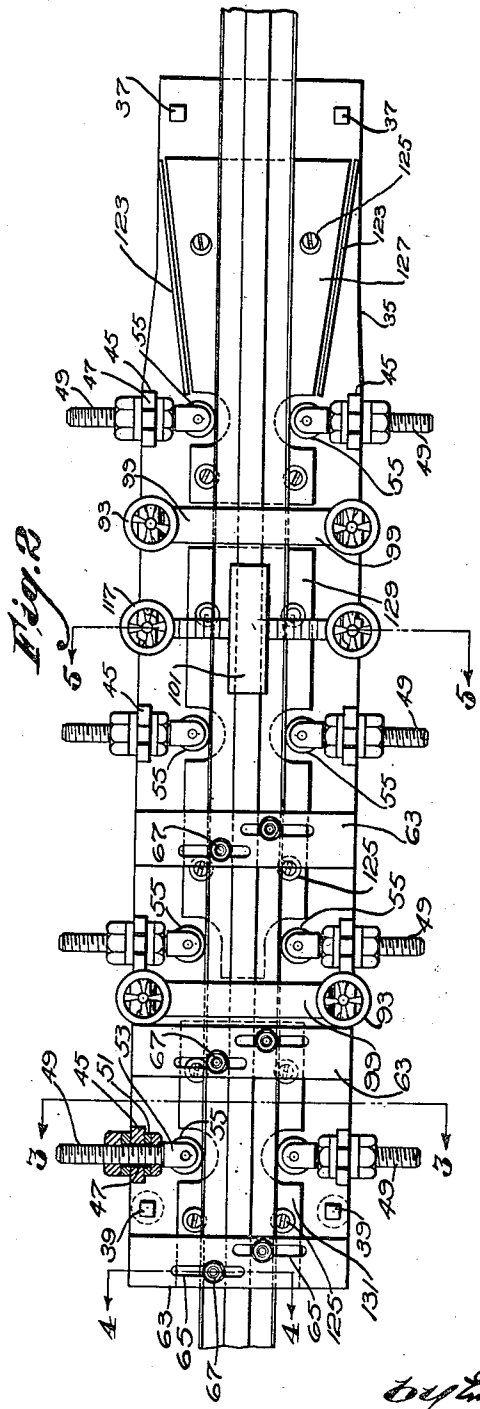

Fig. 2

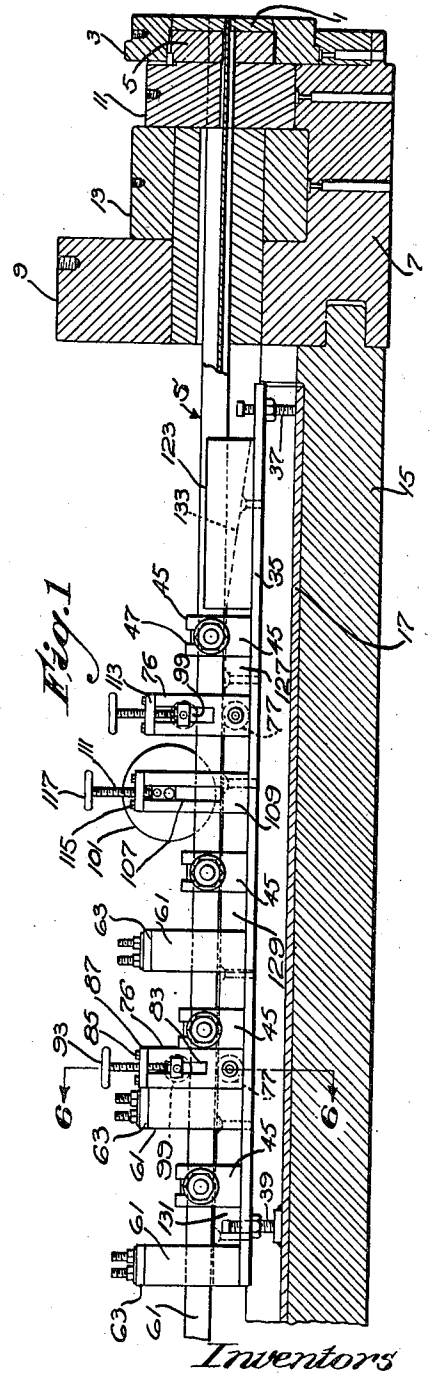

Fig. 1

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Fig. 3

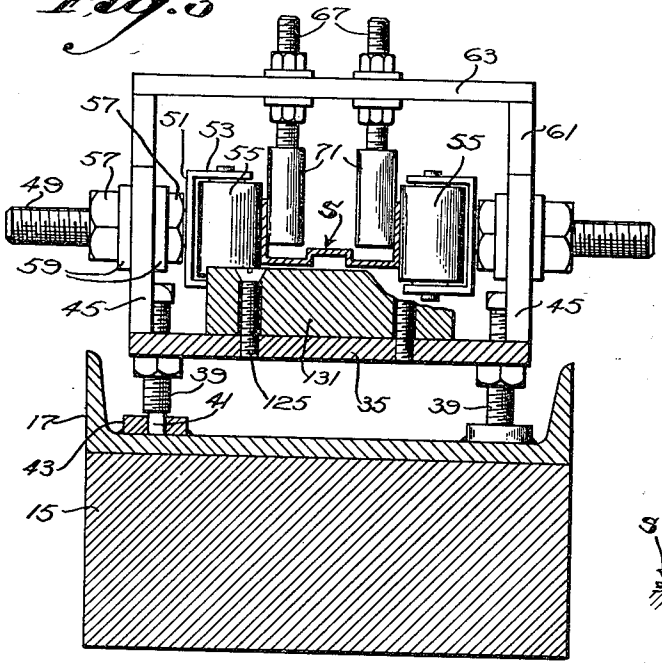

Fig. 4

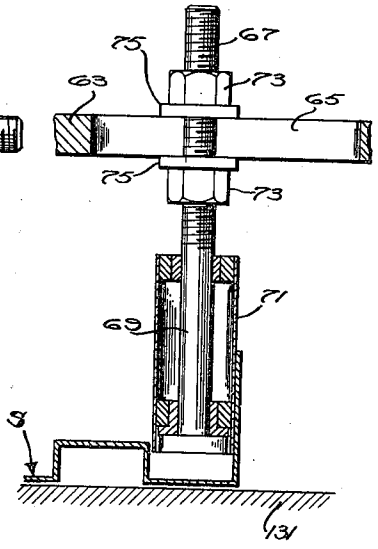

Fig. 5

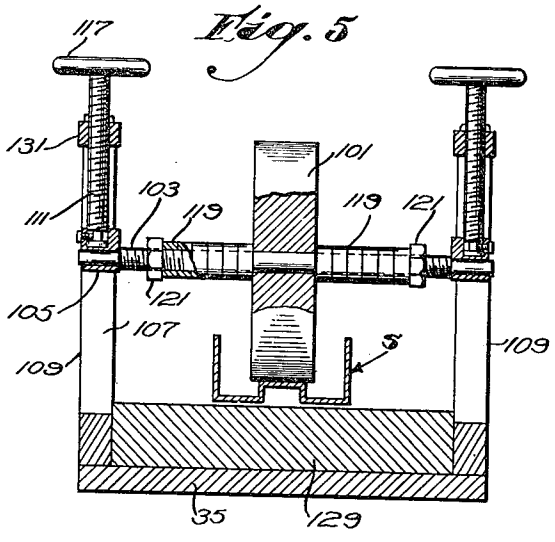

Fig. 6

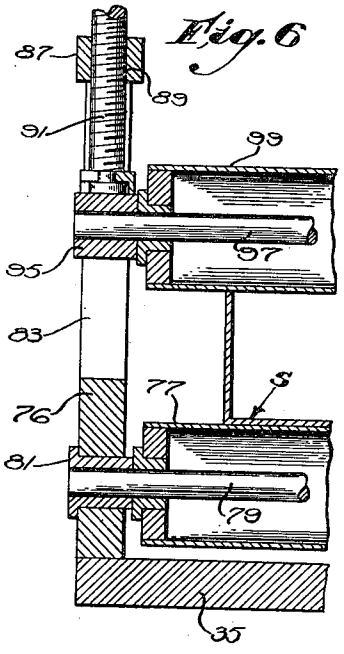

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Fig. 7

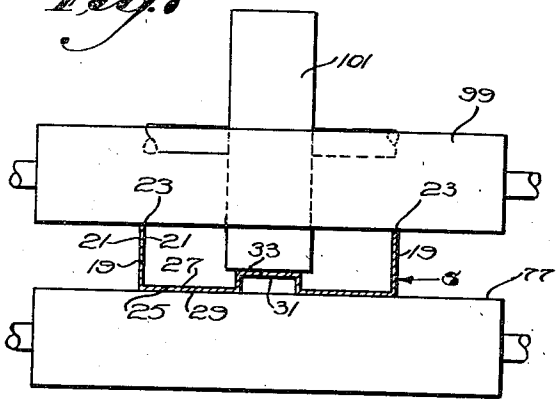


Fig. 10

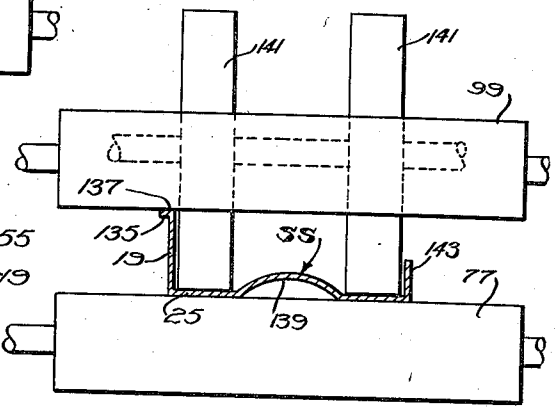


Fig. 8

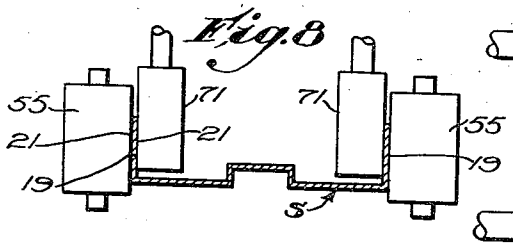


Fig. 11

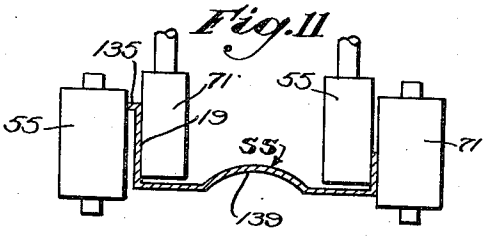


Fig. 9

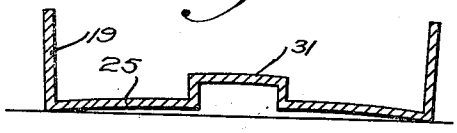


Fig. 13

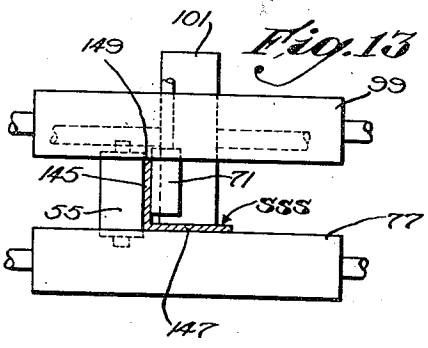
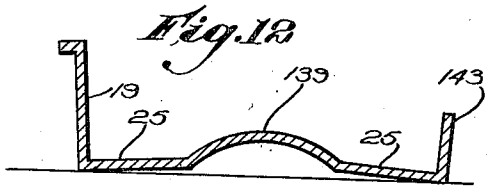


Fig. 12



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2,708,511

RUNOUT TABLE GUIDE

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Application August 5, 1949, Serial No. 108,784

2 Claims. (Cl. 207—2)

Our invention relates to methods of and apparatus for extruding metal shapes.

Heretofore great difficulty has been experienced in extruding readily flowably metals, such as aluminum, at anywhere near reasonable speed without serious distortion of the extruded shape, particularly where the latter is formed with flanges or is of similar irregular cross-section. This distortion, it has been found, is caused by variations in the rates of flow of the metal through different parts of the die opening, some parts of such opening being of relatively restricted cross-section and presenting more surface friction to the flowing metal, while the other parts are of relatively less restricted cross-section and present less surface friction to the flowing metal. The distortion is quite marked when it is attempted, for example, to extrude at high speeds shapes of the cross-sections of the ordinary structural angle-iron, channel-iron and the like, in which cases not only will the cross-section of the shape be distorted but the shape lengthwise thereof will be distorted transversely in all directions and will be twisted. Straightening of the shapes, even when possible, is an expensive time consuming operation, making it necessary heretofore in practice to extrude the shapes at slow speeds so as to reduce to a minimum the distortion and consequent necessity for a straightening operation.

The present invention has among its objects the overcoming of the above defects so as to enable shapes to be extruded at high speeds without distortion. The invention and other of its objects, however, will be best understood from the following description when read in the light of the accompanying drawings, while the scope of the invention will be more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is a longitudinal medial vertical section through part of an extrusion press according to the invention, with parts in elevation;

Fig. 2 is a plan of Fig. 1 on an enlarged scale, with parts omitted;

Figs. 3, 4 and 5 are, respectively, sections on the lines 3—3, 4—4 and 5—5 of Fig. 2 on an enlarged scale;

Fig. 6 is a section on the line 6—6 of Fig. 1 on an enlarged scale;

Figs. 7 and 8 are diagrams showing the application of the rolls of the construction shown by Figs. 1 to 6 to the shape shown in the last mentioned figures;

Fig. 9 is a diagram showing a cross-section of the shape according to Figs. 7 and 8 when distorted;

Figs. 10 and 11 are diagrams showing the application of the rolls of the construction shown by Figs. 1 to 6 to a modified form of shape;

Fig. 12 is a diagram showing a cross-section of the shape according to Figs. 10 and 11 when distorted; and

Fig. 13 is a diagram showing the application of the rolls of the construction shown by Figs. 1 to 6 to a further modified form of shape.

Referring to the drawings, the extrusion press is provided with a die 1 (Fig. 1) carried by a die holder 3. Abutting the right hand side of the die holder as viewed in Fig. 1, as will be understood by those skilled in the art, is a billet container (not shown) in which is a ram for forcing the metal of the billet through the die opening for extruding the elongated shape. As is usual in extrusion presses, the die holder carries a back-up block 5 for the die, the die holder being supported on a tool container 7 having the upstanding portion 9 between which latter and the die holder are positioned a die block 11 and adapter block 13. The press further comprises the elongated run-out table 15 the upper part of which is formed by a member 17 (Fig. 3) of channel-shaped cross-section.

The elongated shape S being extruded is shown in Figs. 1 to 8 as of channel-shaped transverse cross-section. It comprises the longitudinally extending flange-like parts 19 (see Fig. 7) each having opposite sides 21 and a free end surface 23. With respect to each flange-like part 19 the web 25 of the shape constitutes a second longitudinally extending flange-like part having the opposite sides 27 and 29, the latter being remote from the free end surfaces 23 of the flange-like parts 19. As shown, the web or flange-like part 25 has intermediate its width a raised portion 31 of channel-shaped cross-section, the upper side 33 of which may be considered as a continuation of the upper side 27 of the flange-like part 25.

Referring particularly to Figs. 1 to 6, carried by the run-out table is a flat plate 35 which may be adjusted vertically and levelled by the screws 37 and 39 which are screw-threaded through the plate and bear at their lower ends on the top of the run-out table. For preventing movement of the plate longitudinally of the run-out table, the screws 39 are provided at their lower ends with terminal portions 41 (Fig. 3) received in and rotatably fitting the central opening of a washer-like member 43 welded to the upper surface of the run-out table.

The plate 35 at spaced points lengthwise thereof is shown as carrying, adjacent its longitudinal edges, upwardly extending oppositely positioned posts 45, the posts at their lower ends being welded to the plate. These posts are shown as formed with slots 47 extending downward from their upper ends, and received in each of these slots is the shank 49 of a member having a U-shaped bracket the base 51 (Fig. 3) of which is formed integrally with the shank and the end flanges 53 of which rotatably support an idle roll 55. The shank may be adjusted longitudinally and vertically relative to the post by means of the nuts 57 screw-threaded on the shank at opposite sides of the post, washers 59 being interposed between these nuts and the adjacent sides of the post.

At other spaced points along the plate 35 adjacent its edges are other upwardly extending oppositely positioned posts 61 welded at their lower ends to the plate. Between these posts at their upper ends extend cross-bars 63 welded at opposite ends to the upper ends of the posts. Each cross-bar is shown as formed with a pair of longitudinally extending slots 65 (Figs. 2 and 4) through each of which vertically extends the screw-threaded upper end portion 67 of an arbor 69 rotatably carrying an idle roll 71. These arbors may be adjusted vertically and transversely relative to the cross-bars by means of the nuts 73 screw-threaded on the arbors at the upper and lower sides of the cross-bars, a washer 75 being positioned between each nut and the adjacent side of the cross-bar. The arrangement shown is such that adjacent each idle roll 71 is a post 45 carrying an idle roll 55. As illustrated, the two slots 65 of each cross-bar 63 are laterally offset relative to each other a distance which is very slightly greater than the diameter of a roll 71, the purpose of which is to permit the pair of rolls 71 carried by the cross-bar to be placed in a narrow space, for ex-

ample the space between the two flange-like parts **19** of the shape **S**, when that space is of less width than twice such diameter.

As further shown, at other spaced points along the plate **35** adjacent its opposite edges are other opposite posts **76** (Figs. 1 and 6) between which are positioned lower idle rolls **77** carried by arbors **79** supported at opposite ends in bearings **81** carried by the posts. The upper portions of the posts are shown as formed with vertical slots **83**, and on the upper ends of the posts are detachably secured, by means of bolts **85**, blocks **87** bridging these slots and provided with screw-threaded openings **89** (Fig. 6) which receive the screw-threaded shanks **91** adapted to be rotated by means of handwheels **93** (Figs. 1 and 2). Mounted for vertical sliding in the slots **83** are bearings **95** having a detachable swivel connection, of common construction, to the lower ends of the shanks **91** so that by rotating the latter the bearings may be adjusted vertically upward and downward. Mounted in the bearings **95** are the opposite ends of arbors **97** which support the upper idle rolls **99**.

As shown, two of the roll sets **77**, **99** are provided. Intermediate these sets is shown a roll **101** (Figs. 1, 2 and 5). This last mentioned roll is carried on an arbor **103** (Fig. 5), the central portion of which latter is screw-threaded and the end portions of which are received in bearings **105** slidably mounted in the vertically extending slots **107** of posts **109**, these posts being carried by the plate **35** adjacent its opposite edges, the lower ends of the posts being welded to the plate. For adjusting the arbor vertically relative to the posts the bearings are secured, by swivel joints of common construction, to the lower ends of screws **111**, these screws extending through the screw-threaded perforations of blocks **113** removably secured to the upper ends of the posts by bolts **115** (Fig. 1), the screws at their upper ends being provided with handwheels **117** for turning them. The roll **101** may be adjustably positioned longitudinally of the arbor by means of the removable spacers **119** positioned between the opposite sides of the roll and nuts **121** screw-threaded on the arbor.

As further shown, the plate **35** at its end adjacent the die carries a pair of vertically extending plate-like members **123** welded at their lower edges to the upper side of the plate **35**, these members **123** converging toward each other and serving to prevent undue deflection of the advancing free end of the shape as it leaves the die at the initial portion of the extrusion operation. Also secured to the plate at its upper side by means of screws **125** (Figs. 2 and 3) are shown blocks **127**, **129** and **131**, the block **127** having its upper surface **133** (Fig. 1) downwardly inclined toward the die. These blocks, which are preferably formed of graphite, so as to constitute anti-friction surfaces softer than the metal of the shape, serve to guide the advancing end of the shape into cooperation with the horizontal rolls at the initial part of the extrusion operation.

As best shown in Fig. 7, each upper horizontal roll **99** engages the free end surface **23** of each flange-like part **19** of the shape **S**, while each cooperating lower horizontal roll **77** engages that side **29** of the other flange-like part **25** which is remote from the free end surface **23**. The horizontal roll **101** engages the upper side **33** of the raised portion **31** of the shape, which side operatively forms part of the upper side **27** of the flange-like part **25**, so as to hold the flange-like part **25** against the lower roll **77**. As best shown by Fig. 8, the vertical rolls **55** and **71** engage the opposite sides **21**, respectively, of the flange-like parts **19**. As there are a plurality of sets of the horizontal rolls **77**, **99** operating on the shape at spaced points along its length, and a plurality of sets of vertical rolls **55**, **71** operating on the shape at spaced points along its length, the shape is effectively held against deflection and leaves the series of rolls exactly straight, these rolls acting to confine that portion of the length of the advancing

shape which is adjacent the die against deflection in all directions transverse thereto including twisting of the shape and deflection of its parts as viewed in transverse cross-section. If the rolls were not provided, and it were attempted to extrude the shape rapidly, the shape would be approximately of the transverse cross-section shown by Fig. 9, and further would be bent sinuously transversely both vertically and horizontally and would be twisted along its longitudinal axis, making it practically impossible to straighten it by a levelling operation. In practice it has been found that by use of the present invention the number of feet of the shape extruded per hour may be more than doubled as compared to prior methods, and without the necessity for a straightening operation.

It will be understood that the shape extruded may be of various cross-sections, and that the rolls will be adjusted to suit the cross-section of the particular shape being extruded. For example, the shape may be that shown at **SS** in Figs. 10 and 11. This shape **SS** is generally similar to that shown by Figs. 7 and 8 except that the flange-like part **19** is shown as formed with a short laterally extending flange **135** at its free edge, the upper surface **137** of this flange **135** constituting the free end surface of the flange-like part **19** with which the roll **99** contacts. Further, the central portion of the shape **SS** is shown as provided with a rounded raised portion **139**, instead of the flat raised portion **31** of the shape **S**, for which reason, instead of a single horizontal roll **101** being employed for holding the shape in contact with the lower horizontal roll **77**, a pair of vertical rolls **141** may be substituted for the roll **101**, each roll **141** engaging the web or flange-like part **25** of the shape at opposite sides of the raised portion **139**. In respect to the shape **SS**, the vertical roll **55** will be adjusted, as shown in Fig. 11, to engage the outer end of the flange **135** of the flange-like part **19**. The flange-like part **143** of the shape **SS** opposite the flange-like part **19** is shown as of less vertical height than the latter, and consequently cannot be engaged by the upper horizontal roll **99**. However, the flange-like part **143** being confined by the vertical rolls **55** and **57** as shown in Fig. 11, and a horizontal roll **141** being applied to the shape adjacent the flange-like part **143** for holding it in contact with the horizontal roll **77**, the deflection of the shape adjacent the flange-like part **143** is effectively prevented. In absence of the rolls the shape **SS**, if it were attempted to extrude it rapidly, would be distorted transversely as shown in Fig. 12, and besides would be sinuously deflected transversely, horizontally and vertically and would be twisted along its longitudinal axis, making it practically next to impossible to straighten the shape.

As shown in Fig. 13, the shape **SSS** is in the form of an angle-iron having the longitudinally extending flange-like parts **145** and **147**, the upper roll **99** being adjusted to engage the free end surface **149** of the flange-like part **145**, while the lower roll **77** engages the side of the flange-like part **147** remote from this free end surface. As before, the roll **101** engages the upper side of the flange-like part **147** to hold that part against the roll **77**, while the two rolls **55** and **71** engage the opposite sides of the flange-like part **145**.

It will be understood that within the scope of the appended claims wide deviations may be made from the form of the invention described without departing from the spirit of the invention.

We claim:

1. Apparatus for producing at high speed an elongated aluminum shape presenting in transverse cross-section pairs of longitudinally extending flange-like parts at approximately right angles to each other joined at a longitudinally extending corner of said shape, one of which parts has a free end surface in parallel relation to the other of said parts, which apparatus comprises an extrusion die formed with a die opening through which

the shape is adapted to be extruded from an aluminum billet, such die opening in transverse cross-section having portions identically complementary to said flange-like parts, free end surface and corner of said shape as viewed in transverse cross-section; means preventing distortion of said parts of the shaft caused by different speeds of flow of the aluminum through different parts of said portions of said die opening during the extrusion operation so as to produce a straight untwisted shape in which said parts, free end surface and corner in transverse cross-section are identical with said portions of said die opening viewed in transverse cross-section, said means comprising groups of closely adjacent cylindrical idle rolls rigidly supported for axial rotation adjacent the discharge side of said die opening, said rolls having their axes at right angles to the direction of the length of the shape adapted to be discharged from the die opening; said groups of rolls comprising laterally spaced pairs of operatively opposed rolls of which a roll of each pair is adapted to engage said free end surface of one of said flange-like parts and the other roll of each pair is adapted to engage the remote side of the other of said flange-like parts; said groups also comprising further laterally spaced pairs of operatively opposed rolls laterally spaced from and at right angles to the first mentioned pairs, the rolls of each of which further pairs are adapted to engage the opposite sides, respectively, of the flange-like part having said free end surface; the cylindrical surfaces of the rolls of said groups being adapted to contact said free end surface and sides of said flange-like parts along lines which lie in the same planes as the surfaces of said portions of said die opening which are complementary to said free end surface and sides, whereby said rolls in respect to said free end surface and sides form a rigid pass for the shape aligned with the rigid pass formed by such surfaces of said portions of the die opening.

2. Apparatus for producing at high speed an elongated aluminum shape presenting in transverse cross-section pairs of longitudinally extending flange-like parts at approximately right angles to each other joined at a longitudinally extending corner of said shape, one of which parts has a free end surface in parallel relation to the other of said parts, which apparatus comprises an extrusion die formed with a die opening through which the shape is adapted to be extruded from an aluminum billet, such die opening in transverse cross-section having portions identically complementary to said flange-like parts, free end surface and corner of said shape as viewed in transverse cross-section; means preventing distortion

of said parts of the shape caused by different speeds of flow of the aluminum through different parts of said portions of said die opening during the extrusion operation so as to produce a straight untwisted shape in which said parts, free end surface and corner in transverse cross-section are identical with said portions of said die opening viewed in transverse cross-section, said means comprising groups of closely adjacent cylindrical idle rolls rigidly supported for axial rotation adjacent the discharge side of said die opening, said rolls having their axes at right angles to the direction of the length of the shape adapted to be discharged from the die opening; said groups of rolls comprising laterally spaced pairs of operatively opposed rolls of which a roll of each pair is adapted to engage said free end surface of one of said flange-like parts and the other roll of each pair is adapted to engage the remote side of the other of said flange-like parts; said groups also comprising further laterally spaced pairs of operatively opposed rolls laterally spaced from and at right angles to the first mentioned pairs, the rolls of each of which further pairs are adapted to engage the opposite sides, respectively, of the flange-like part having said free end surface; and said groups further comprising a roll operatively opposed to the last mentioned rolls of the first mentioned laterally spaced pairs of rolls, which roll is adapted to engage the side of the flange-like part opposite that engaged by the said last mentioned rolls of said pairs; the cylindrical surfaces of the rolls of said groups being adapted to contact said free end surface and sides of said flange-like parts along lines which lie in the same planes as the surfaces of said portions of said die opening which are complementary to said free end surface and sides, whereby said rolls in respect to said free end surface and sides form a rigid pass for the shape aligned with the rigid pass formed by such surfaces of said portions of the die opening.

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