PATENT SPECIFICATION (11) 1 587 926

1 587 926

(21) Application No. 51300/77 (22) Filed 9 Dec 1977

(31) Convention Application No. 2656758 (32) Filed 15 Dec 1976 in

(33) Fed. Rep. of Germany (DE)

(44) Complete Specification Published 15 Apr 1981

(51) INT. CL.³ B21D 51/02

(52) Index at Acceptance
B3Q 2A1 2A3 2G 3 5
B3A 83A11 83A1 83A6 83B4 83BX
B3W 10L20U 10LY 22

(19)

(54) A MULTISTAGE METHOD OF MOULDING ELONGATE RECESSES OR CUPS OF VARYING CROSS-SECTION

(71) I, GUENTHER KAUPERT, of Thueringer Strasse 1, 5927 Erndtebrueck, Westfalen, Federal Republic of Germany; a German national, 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:—

The present invention relates to a method and an apparatus for the multistage moulding of recesses or cups in an intermittently advanced sheet material and having a varying cross-section by means of a plurality of dies acting in follow step sequential stages.

The processing of thin sheet strips into shaped packagings susceptible to tearing or cracking is known from the German Patent Specifications 1 162 316, 1 198 314 and 1 217 911, wherein the main aim is the careful moulding with continuous and sufficient material feed so that cracks are avoided. In order to have sufficient material in reserve, a pre-gathering of the sheet strip before deformation is proposed among other things. This, however, requires a relatively high material consumption. Because of the irregular shape of the cups, the strip also tends to deviate in an undesired manner from the rectilinear direction of feed when traversing the deformation stages.

It is an object of the invention to provide an improved method and an apparatus of the aforesaid kind so that - taking fully into account the susceptibility to cracking of the strip - the material consumption may be reduced as far as possible, and with the attaining of a satisfactory rectilinear passage of the strip through the deformation stages.

According to the present invention there is provided a multistage method of moulding elongate recesses or cups of varying cup cross-section along the length of cup in an intermittently advanced thin metal strip by means of a plurality of upper and lower dies acting in sequential stages, wherein a larger cup is first moulded in a preliminary moulding stage by stamping dies and then the smaller, final shape of the cup subsequently stamped by crease stamping in at least one subsequent stamping stage with material from the pre-shaped cup, characterised by the feature than an undulation extending at right angles to the direction of feed is first moulded in the strip, with the height of undulation corresponding to the maximum depth of cup base in its final shape, whereupon the undulation is moulded by stamping into the preliminary shape which, seen in plan, projects beyond the outline of the cup in its final shape, and that in at least one subsequent stamping stage, the material of the auxiliary moulding is then pressed against the subsequent stamping male die or dies corresponding to the final shape of the cup.

Preferably in a preliminary moulding stage strip relieving slots extending at right angles to the material stress are let in in the region of cross-sectional constrictions outside the outline of the cup tension. The strip is preferably located opposite the male die in the individual deformation stages before initiating the preliminary mouldings.

Also according to the present invention there is provided apparatus for the stepwise forming into a metal strip of a series of elongate recesses or cups of varying cross-section along its length comprising a plurality of stationary preliminary and subsequent stamping dies, a plurality of displaceable dies associated therewith and adapted to be actuated in succession and perpendicular to the direction of feed of the strip, a projection for forming an undulation in the strip being provided at right angles to the direction of feed of the strip with a height corresponding to the maximum depth of the cup base to be formed in its final shape by the subsequent dies, a first set of stationary and displaceable preliminary dies downstream with respect to the normal direction of travel of the strip, being adapted to form by stamping a larger cup plan shape in the preliminary moulding stage, and at least one subsequent set of stationary and displaceable subsequent crease stamping dies for forming the cup in its final shape; said dies forming the preliminary shape, seen in plan, projecting beyond the outline of

the subsequent cup forming dies and the end face of said dies forming the preliminary shape are substantially of the same size.

Preferably one or more cutting blades are mounted on the underside of the preliminary moulding die at the edge region of its indentation and blades after slitting the strip engage in apertures of the lower part of the male die. Furthermore, leading and resiliently mounted holding down members are guided for securing the strip between themselves and the lower dies. Still further and preferably the subsequent stamping die has grooves at the radiused drawing edges merging into the edge region of the indentation and which grooves regarded from below, extend substantially at right angles to the outline of the edge region. Furthermore, the first preliminary moulding die is a nose-shaped projection of constant cross-section extending at right angles to the direction of feed. The apparatus preferably has several identical rows of male dies located at right angles to the direction of feed and associated die indentations and is characterised by the feature that fingers are mounted at the end faces of the female dies facing the strip inlet (arrow A) for initiating the stamping of the strip and extend opposite to the direction of feed whereby forming nose-shaped projections and the male dies having receiving slots associated with the fingers. The cross-sectional differences of the cups are compensated by the auxiliary moulding so that the strip passes rectilinearly through the deformation stage, whereby the material consumption may be reduced to a minimum through an optimal dimensioning corresponding to the given shape of cup of the auxiliary mouldings.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic longitudinal section through a stamping tool in the open position and along a line through the tool corresponding to the position of the line I - I of Figure 2;

Figure 2 is a plan view of a metal strip positioned in the stamping tool of Figure 1 and showing the individual stamping stages;

Figure 3 is a schematic longitudinal section through the stamping tool in the open position and taken along a line through the tool corresponding to the line III - III of Figure 2;

Figure 4 is a cross-section taken on the line IV - IV of Figure 1 of the stamping tool in the preliminary stamping stage, and wherein the tool is closed;

Figure 5 is a cross-section taken on the line V - V of Figure 1 of the tool in the subsequent stamping stage and wherein the tool is closed;

Figure 6 is an enlarged fragmentary detail of the tool in the position of Figure 5;

Figure 7 is a partial plan view from below of the die of the detail of Figure 6;

Figure 8 is a longitudinal section taken on the line VIII - VIII of Figure 9 through the stamping tool in an open position for crease-stamping cups in several rows, and

Figure 9 is a plan view from below of the die of Figure 8.

A stamping tool is shown in Figure 1 comprising a lower part 20 having a projection 21, and supporting a preliminary stamping projecting or male die 22 and two subsequent stamping male dies 23; and an upper part 24 having a preliminary stamping die 6 and a subsequent stamping die 7. A thin metal strip 1, e.g. an aluminium sheet, is located between the two parts 20 and 24 and intermittently displaced therepast whereby crease or fold stamping occurs between the stages. In operation of this embodiment the die 7 is pressed by means of a driving ram or shaft 25 against the associated subsequent lower dies 23, whereby drawn cups 2 are given their final shape. At the same time the end-face moulding surface 26 of die 7 presses the strip 1 against the side of the preliminary stamping male die 22, located at the mouth relative to the direction of feed (arrow A). Then the pre-forming die 6, which is slidingly guided by shaft 25, is forced onto the pre-forming member 22 so as to generate preliminary shape 27. At the same time the strip 1 is drawn over nose-shaped projection 21 whereby an undulation 28 is formed extending over the width of the strip. After these stampings, the dies 6, 7 are drawn upwardly and the strip progressively moved by a stage. The drives for the dies and the strip are not shown for reasons of clarity. As is especially evident from Figure 2 a preliminary shape 27 is formed in the preliminary moulding stage (i.e. pressing together of the die 22 and recessed or female die 6 together with moulding surface 26 of the die 7) which both in its length and width is somewhat larger than the final shape of the cup 2. Moreover, the preliminary shape 27 is provided with material demanding auxiliary recesses 8 which, regardless of the varying cross-sections 5 and varying deformation depths 3 along the lowest point line 4 (Figure 5) for the final stage of the cup 2 first of all cause a uniform material consumption over the length of the preliminary moulding 27. This is particularly evident from the section level with the peaks of the cups in accordance with Figure 3 and from Figure 4, according to which the end faces 22*a* and 22*b* are substantially of the same size. In the subsequent stamping stage (female die 7 and male die 23) some of the superfluous material of the auxiliary mouldings or deformations 8 is reduced by pleating or crease-stamping 9 which is reduced in its visible surface and adapted to the final shape of the cup 2. In the embodiment shown, an end extending into a point and a constriction in the centre of the cup 2 is affected thereby. As is evident further from Figure 1 and 2, the substantially central constriction on the left-hand side of the cup is already initiated by the preliminary moulding surface 26 of the subsequent stamping die 7. In order in this case also to conform to the requirement of minimum material consumption whilst at the same time

keeping the material tension within permissible limits (especially to prevent the formation of cracks in the region of the moulding) tension relieving slots 16 are cut into the strip outside the area of cup moulding 27 and such slots extend at right angles to the material tension. For this purpose a cutting blade 15 is provided on the underside of the preliminary stamping die 6 and extends normal to the direction of feed and, an aperture 29 is provided in the lower part 20 for accommodating the blade during the slitting operation.

Frequently the foil or metal strips have a print diagram applied thereon so that it is necessary to adapt printed diagram and cup outline to each other in the region of the auxiliary mouldings. For this purpose, for example, for an imprint of letters, the strip is clamped before initiating the deformation in the individual moulding stages between the upper and lower die and thereby fixed at certain positions 10. This may be carried out in a simple manner in that in the dies 6 and 7 are axially guided by means of springs 30 resilient biassed pin-shaped holding down members 11 (Figure 4 and 5).

In the subsequent stamping stage, the tension edges 13 in the region of small radii 14 especially have to be structurally so formed that creasing is already initiated during the downward movement of the die 7 in the required direction and that herein no cracks or fissures occur. For this purpose, the radiused edges 13 of the die 7 merge from the depression in the edge region and have grooves 12 for controlling the crease-stamping which - see from below - are substantially at right angles on the boundary line 31 of the edge region (Figures 6 and 7).

The method in accordance with the invention may also be used to simultaneously mould or stamp several parallel rows of recesses or cups into the strip. A suitable device for this is shown in Figure 8 and 9. Two parallel rows of indentations 32 are let into the subsequent die 17 and point towards each other with their tips. The preliminary stamping die 36 also has two indentations 33 which, in comparison with the indentations 32 on the level of the tips of the indentations, are provided with enlargements 34 acting as auxiliary deformations. These indentations have corresponding pairs of projecting or male dies 35, 37 and 38 associated therewith. At the end faces of the dies 17, 36 facing the strip feed (arrow A) fingers 18 and 39 are mounted opposed to the direction of feed and which fingers engage between the rows thereby initiating the stamping of the two preliminary stamping stages (dies 37 and 38) at the sides of the rows of cups facing each other. Thus, the necessary material for the auxiliary deformations is prepared in this case and only then is the actual stamping of the cups within the rows carried out. Recesses 40, 41 are inset into the moulding die 38 and in the preliminary stamping die 36 and the fingers 18, 39 engage therein during stamping.

WHAT I CLAIM IS:—

1. A multistage method of moulding elongate recesses or cups of varying cup cross-section along the length of cup in an intermittently advanced thin metal strip by means of a plurality of upper and lower dies acting in sequential stages, wherein a larger cup is first moulded in a preliminary moulding stage by stamping dies and then the smaller, final shape of the cup subsequently stamped by crease-stamping in at least one subsequent stamping stage with material from the pre-shaped cup, characterised by the feature that an undulation extending at right angles to the direction of feed is first moulded in the strip with the height of undulation corresponding to the maximum depth of cup base in its final shape, whereupon the undulation is moulded by stamping into the preliminary shape which, seen in plan, projects beyond the outline of the cup in its final shape, and that in at least one subsequent stamping stage, the material of the auxiliary moulding is then pressed against the subsequent stamping male die or dies corresponding to the final shape of the cup.

2. A method as claimed in Claim 1, in which in a preliminary moulding stage strip relieving slots extending at right angles to the material stress are let in in the region of cross-sectional constrictions outside the outline of the cup tension.

3. A method as claimed in Claim 1 or 2 in which in the individual deformation stages before initiating the preliminary moulding, the strip is located opposite the relevant male die.

4. Apparatus for the stepwise forming into a metal strip of a series of elongate recesses or cups of varying cross-section along its length by the method as claimed in any of Claims 1 to 3, said apparatus comprising a plurality of stationary preliminary and subsequent stamping dies, a plurality of displaceable dies associated therewith and adapted to be actuated in succession and perpendicular to the direction of feed of the strip, a projection for forming an undulation in the strip being provided at right angles to the direction of feed of the strip with a height corresponding to the maximum depth of the cup base to be formed in its final stage by the subsequent dies, a first set of stationary and displaceable preliminary dies downstream with respect to the normal direction of travel of the strip, being adapted to form by stamping a larger cup plan shape in the preliminary moulding stage, and at least one subsequent set of stationary and displaceable subsequent crease-stamping dies for forming the cup in its final shape; said dies forming the preliminary shape, seen in plan, projecting beyond the outline of the subsequent cup forming dies, and the end faces of said dies forming the preliminary shape are substantially of the same size.

5. Apparatus as claimed in Claim 4, in which one or more cutting blades are mounted on the underside of the preliminary moulding die at the edge region of its indentation and which blades after slitting the strip engage in apertures of the

lower part of the male die.

6. Apparatus as claimed in Claims 4 or 5, in which leading and resiliently mounted holding down members are guided in the dies for securing the strip between themselves and the lower dies.

7. Apparatus as claimed in any of Claims 4 to 6, in which the subsequent stamping die has grooves at the radiused drawing edges merging into the edge region of the indentation and which grooves regarded from below, extend substantially at right angles to the outline of the edge region.

8. Apparatus as claimed in any of Claims 4 to 7 in which the first preliminary moulding die is a nose-shaped projection of constant cross-section extending at right angles to the direction of feed.

9. Apparatus as claimed in Claim 8 having several identical rows of male dies located at right angles to the direction of feed and associated die indentations, and characterised by the feature that fingers are mounted at the end faces of the female dies facing the strip inlet (arrow A) for initiating the stamping of the strip and extend opposite to the direction of feed whereby forming nose-shaped projections and the male dies have receiving slots associated with the fingers.

10. Apparatus for multistage moulding constructed and arranged to operate substantially as herein described with reference to and as illustrated in the accompanying drawings.

11. A cup drawn sheet whenever produced from the method claimed in Claim 1 or with the apparatus claimed in Claim 4.

POTTS, KERR & CO.,
Chartered Patent Agents,
27, Sheet Street,
Windsor,
Berkshire, SL4 1BY.

Printed for Her Majesty's Stationery Office by MULTIPLEX techniques ltd., St. Mary Cray, Kent. 1981. Published at the Patent Office, 25 Southampton Buildings, London WC2 1AY, from which copies may be obtained.

1587926 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

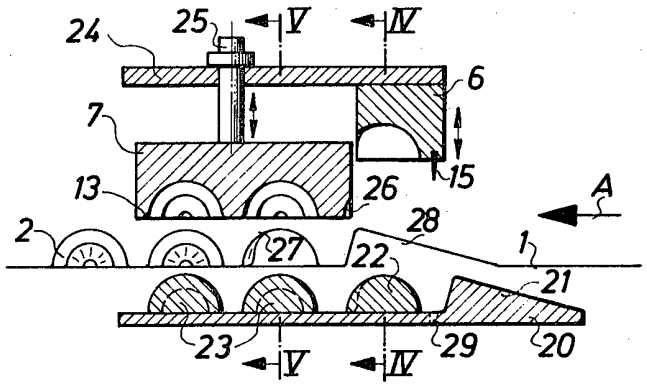

Fig.1

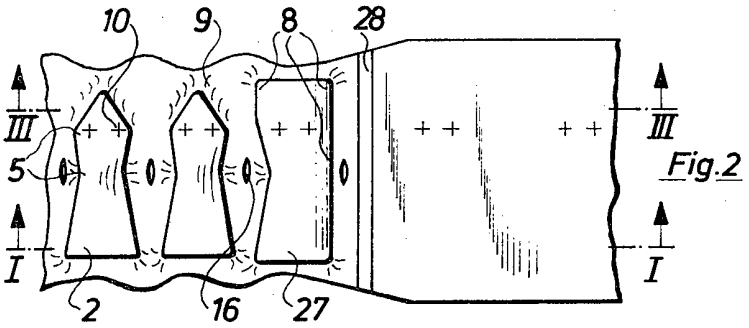

Fig.2

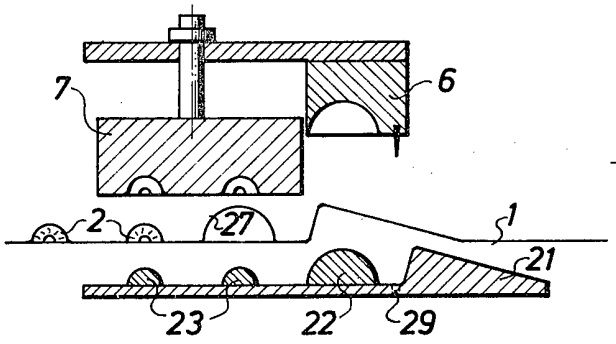

Fig.3

1587926 COMPLETE SPECIFICATION
3 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 2

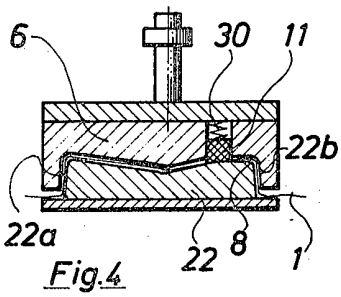

Fig.4

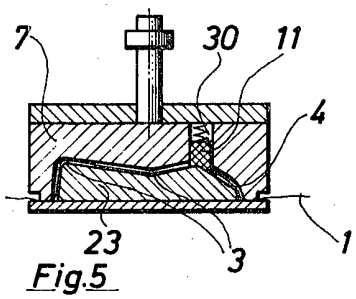

Fig.5

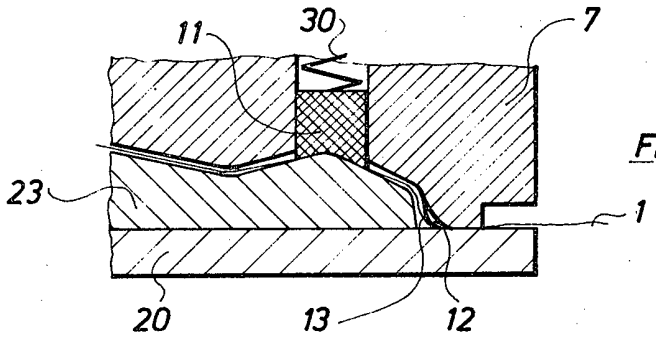

Fig.6

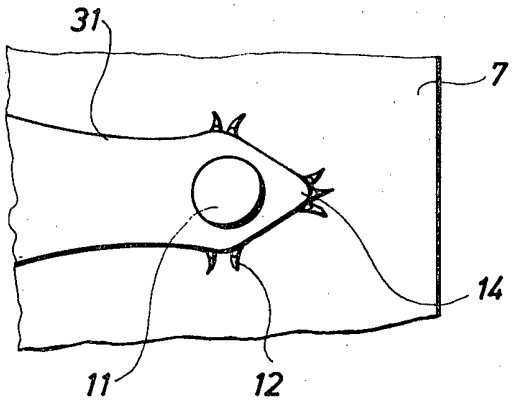

Fig.7

1587926 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 3

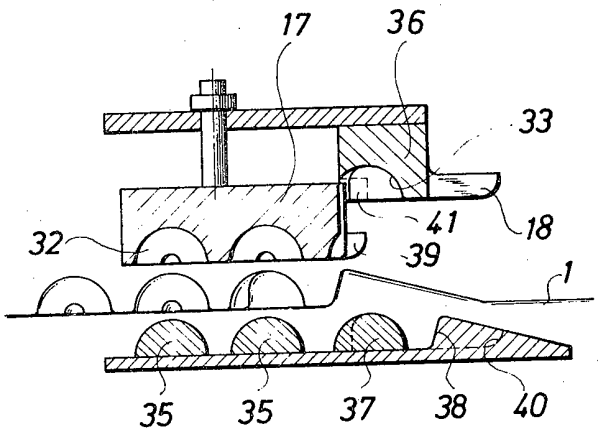

Fig. 8

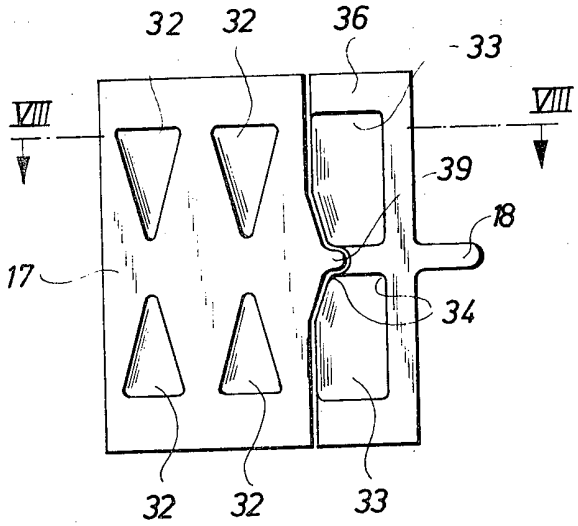

Fig. 9