

PATENT SPECIFICATION (11)

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(54) METHOD AND APPARATUS FORMAKING EXPANDED METAL SHEETS

(71) We, JOHN LYSAGHT (AUSTRALIA) LIMITED, a Company incorporated under the laws of the State of New South Wales, Commonwealth of Australia, of 50 Young Street, Sydney, in the State of New South Wales, Commonwealth of Australia, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the manufacture of expanded metal sheets.

Hitherto such sheets have been made by successively stamping edge margins of a plain metal sheet to convert each edge margin into an undulating strip united at spaced apart locations to the immediately previously stamped strip along one edge and to the body of the plain sheet along its other edge. Between each stamping operation the stamping die is shifted laterally of the plain sheet (that is to say longitudinally of the edge margin to be stamped) by a distance equal to say, a half-pitch of the undulations in the strip, thus ensuring that the troughs of the undulations of each stamped strip are united to the crests of the undulations of the immediately previously stamped strip.

The production of expanded metal sheets as briefly described above is well known. The sheets produced by such known processes are necessarily uniform in pattern throughout the sheet because each strip is stamped by the same die and because of the need for uniformity of the undulation pitch to suit the distance of lateral movement of the die between each stamping operation.

An object of the present invention is to enable greater variation in pattern, either by variation in the undulous configuration of adjacent strips or by variation of the undulation pitch at different positions along the expanded metal strip or by both.

The invention achieves that object by providing a method of making an expanded metal sheet comprising the steps of stamping successive adjacent strips of a plain metal sheet simultaneously to sever each strip from

the plain sheet except at a plurality of spaced apart positions and to deform the metal of the strip intermediate those positions, characterised in that a separate die is utilised for each of any two consecutive steps, the dies having mutually different profiles.

The invention also consists in apparatus for effecting the above described method comprising at least two dies each adapted to stamp a strip of said sheet to sever the strip from the sheet except at a plurality of spaced apart positions, means to feed a metal sheet intermittently to said dies and to deform the metal of the strip intermediate those positions and means to operate said dies to cause each to stamp a predetermined selection of said strips; the arrangement being such that no one die operates on two adjacent strips, the dies having mutually different profiles.

According to some embodiments of the apparatus of the invention there are as many stamping stations as there are dies and the dies are respectively associated with the stamping stations.

In preferred embodiments of the invention all of the dies operate at a single stamping station and the apparatus includes means to shift the dies into and out of the stamping station in a predetermined sequence.

By way of example, an embodiment of the invention is described hereinafter with reference to the accompanying drawings.

Figure 1 is a diagrammatic elevation of the punching die of a conventional expanded metal sheet stamping apparatus.

Figure 2 is a diagrammatic sectional view taken on line 2—2 of Figure 1.

Figure 3 is a diagrammatic sectional view taken on line 3—3 of Figure 4 of an apparatus according to the invention.

Figure 5 is a non-diagrammatic sectional view similar to Figure 3.

Figures 1 and 2 illustrate a conventional apparatus comprising fixed die 7 and a single punching die 8. The punching die 8 rises and falls through return and working strokes respectively and at the top of each return stroke is oscillated endwisely so that

it is positioned as shown by full lines (Figure 1) during each alternate working stroke and as shown by broken lines during each of the other working strokes. Thus, a workpiece 9 fed intermittently across the fixed die 7 is formed into a conventional expanded metal sheet 10.

Such an expanded sheet is uniform in pattern throughout.

Figures 3 and 4 illustrate apparatus according to the invention comprising a fixed die 11 and two punching dies 12 and 13. The dies 12 and 13 rise and fall but instead of a translational oscillation they are caused to oscillate rotationally to bring each die 12 or 13 alternately into the vertical plane during each working stroke.

Punching dies 12 and 13 are of mutually different profile as shown clearly in Figure 4 so that a non-uniform pattern is produced in the finished expanded sheet 10a. Figure 5 illustrates the apparatus shown in Figures 3 and 4 in more detail. The apparatus comprises a work sheet supporting table 16 with a blade-like fixed bottom die 17 or anvil set in its edge, a work-sheet hold-down clamp 18 adapted to clamp a work-sheet 19 against an upper face of the bottom die 17, means to advance the work-sheet 19 (not shown) and a reciprocating ram 20 above and out-board of said edge all of substantially conventional character. The operating mechanism of the apparatus is conventional insofar as it synchronises the operation of the ram 20, hold-down clamp 18 and sheet feed mechanisms to obtrude a fresh strip of the work-sheet 19 beyond the edge of the bottom die 17 during each up-stroke of the ram 20 in preparation for a stamping operation thereon during the next down-stroke of the ram 20.

In conventional apparatus an upper blade-like die is mounted on the ram so as to extend downwardly there from in the manner of a shear blade adapted to co-act with the bottom die. The upper die is mounted on the ram in a manner permitting longitudinal translatory reciprocation of the upper die.

In accordance with the illustrated embodiment of the invention, however, a die holder 21 is secured to the under-face of the ram 20 by means which permit the die holder to be swung about an axis extending longitudinally of the holder. To that end, the die holder 21 may be attached to a fulcrum shaft 22 of which an upper part is homed in a part-cylindrical groove formed in the bottom end of the ram 20. The fulcrum shaft 22 may be held in place by two or more hook shaped retainers 23.

The die holder 21 provides locations for two blade-like punching dies 24 and 25 respectively of mutually different profile and means are provided to swing the die holder 21 about the axis of its fulcrum shaft 22

to bring the dies 24 and 25 alternately into an operative position relative to the bottom die 17.

The die holder 21 may be swung to and fro to bring the dies 24 and 25 into and out of their operative position by means, for example, of a toggle arm 26 projecting from a toggle shaft 27, mounted on a bracket 28 projecting from the ram 20, and with its free end connected by a toggle link 29 to the die holder 21. The toggle arm 26 may be rocked to and fro by means of a cam follower rod 30 pivoted to the free end of a lever arm 31 projecting from the toggle shaft 27 and extending to the cam in the operating mechanism of the apparatus which in conventional apparatus is similarly utilised to effect longitudinal reciprocation of the upper die.

The two operative positions of the die holder 21 may be determined on one hand by a screw adjustable stop 32 and on the other hand by virtue of the full straightening of the toggle.

If necessary, the hold-down clamp 18 may be shaped (as shown) so as not to foul the die holder 21 or the die 25 as they swing to and fro.

WHAT WE CLAIM IS:—

1. A method of making an expanded metal sheet comprising the steps of stamping successive adjacent strips of a plain metal sheet simultaneously to sever each strip from the plain sheet except at a plurality of spaced apart positions and to deform the metal of the strip intermediate those positions characterised in that a separate die is utilised for each of any two consecutive steps, the dies having mutually different profiles.

2. A method according to claim 1 wherein two dies are used alternately.

3. Apparatus for effecting the method of either of the preceding claims comprising at least two dies of mutually different profiles each adapted to stamp a strip of said sheet to sever the strip from the sheet except at a plurality of spaced apart positions and to deform the metal of the strip intermediate those positions, means to feed a metal sheet intermittently to said dies and means to operate said dies to cause each to stamp a predetermined selection of said strips; the arrangement being such that no one die operates on two adjacent strips.

4. Apparatus according to claim 3 wherein all of the dies operate at a single stamping station, and which includes die selector means to shift the dies into and out of the stamping station in a predetermined sequence.

5. Apparatus according to claim 4 wherein two dies are attached to a single die holder and wherein said die selector means cause rotary oscillation of said die holder.



it is positioned as shown by full lines (Figure 1) during each alternate working stroke and as shown by broken lines during each of the other working strokes. Thus, a workpiece 9 fed intermittently across the fixed die 7 is formed into a conventional expanded metal sheet 10.

Such an expanded sheet is uniform in pattern throughout.

Figures 3 and 4 illustrate apparatus according to the invention comprising a fixed die 11 and two punching dies 12 and 13. The dies 12 and 13 rise and fall but instead of a translational oscillation they are caused to oscillate rotationally to bring each die 12 or 13 alternately into the vertical plane during each working stroke.

Punching dies 12 and 13 are of mutually different profile as shown clearly in Figure 4 so that a non-uniform pattern is produced in the finished expanded sheet 10a. Figure 5 illustrates the apparatus shown in Figures 3 and 4 in more detail. The apparatus comprises a work sheet supporting table 16 with a blade-like fixed bottom die 17 or anvil set in its edge, a work-sheet hold-down clamp 18 adapted to clamp a work-sheet 19 against an upper face of the bottom die 17, means to advance the work-sheet 19 (not shown) and a reciprocating ram 20 above and out-board of said edge all of substantially conventional character. The operating mechanism of the apparatus is conventional insofar as it synchronises the operation of the ram 20, hold-down clamp 18 and sheet feed mechanisms to obtrude a fresh strip of the work-sheet 19 beyond the edge of the bottom die 17 during each up-stroke of the ram 20 in preparation for a stamping operation thereon during the next down-stroke of the ram 20.

In conventional apparatus an upper blade-like die is mounted on the ram so as to extend downwardly there from in the manner of a shear blade adapted to co-act with the bottom die. The upper die is mounted on the ram in a manner permitting longitudinal translatory reciprocation of the upper die.

In accordance with the illustrated embodiment of the invention, however, a die holder 21 is secured to the under-face of the ram 20 by means which permit the die holder to be swung about an axis extending longitudinally of the holder. To that end, the die holder 21 may be attached to a fulcrum shaft 22 of which an upper part is homed in a part-cylindrical groove formed in the bottom end of the ram 20. The fulcrum shaft 22 may be held in place by two or more hook shaped retainers 23.

The die holder 21 provides locations for two blade-like punching dies 24 and 25 respectively of mutually different profile and means are provided to swing the die holder 21 about the axis of its fulcrum shaft 22

to bring the dies 24 and 25 alternately into an operative position relative to the bottom die 17.

The die holder 21 may be swung to and fro to bring the dies 24 and 25 into and out of their operative position by means, for example, of a toggle arm 26 projecting from a toggle shaft 27, mounted on a bracket 28 projecting from the ram 20, and with its free end connected by a toggle link 29 to the die holder 21. The toggle arm 26 may be rocked to and fro by means of a cam follower rod 30 pivoted to the free end of a lever arm 31 projecting from the toggle shaft 27 and extending to the cam in the operating mechanism of the apparatus which in conventional apparatus is similarly utilised to effect longitudinal reciprocation of the upper die.

The two operative positions of the die holder 21 may be determined on one hand by a screw adjustable stop 32 and on the other hand by virtue of the full straightening of the toggle.

If necessary, the hold-down clamp 18 may be shaped (as shown) so as not to foul the die holder 21 or the die 25 as they swing to and fro.

WHAT WE CLAIM IS:—

1. A method of making an expanded metal sheet comprising the steps of stamping successive adjacent strips of a plain metal sheet simultaneously to sever each strip from the plain sheet except at a plurality of spaced apart positions and to deform the metal of the strip intermediate those positions characterised in that a separate die is utilised for each of any two consecutive steps, the dies having mutually different profiles.

2. A method according to claim 1 wherein two dies are used alternately.

3. Apparatus for effecting the method of either of the preceding claims comprising at least two dies of mutually different profiles each adapted to stamp a strip of said sheet to sever the strip from the sheet except at a plurality of spaced apart positions and to deform the metal of the strip intermediate those positions, means to feed a metal sheet intermittently to said dies and means to operate said dies to cause each to stamp a predetermined selection of said strips; the arrangement being such that no one die operates on two adjacent strips.

4. Apparatus according to claim 3 wherein all of the dies operate at a single stamping station, and which includes die selector means to shift the dies into and out of the stamping station in a predetermined sequence.

5. Apparatus according to claim 4 wherein two dies are attached to a single die holder and wherein said die selector means cause rotary oscillation of said die holder.



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6. Apparatus for producing an expanded metal sheet substantially as described herein with reference to Figures 3, 4 and 5 of the accompanying drawings.

5 7. An expanded metal sheet when made by a method according to claim 1.

For the Applicants:
F. J. CLEVELAND & COMPANY,
Chartered Patent Agents,
Lincoln's Inn Chambers,
40—43 Chancery Lane,
London, W.C.2.

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