(54) Title: BLANK AND DRAW PRESS TOOL

(57) Abstract

A blank and draw press tool (11) for a press for blanking and drawing an article from sheet metal comprising a stationary first die part (13) which carries a cutting or blanking die (34) having a peripheral edge (15) corresponding in shape to the contour of the blank to be cut from the sheet metal, a movable second die part (14) including a cutting punch (37) which is adapted to be moved into a cutting relationship with edge (15) on the die (34) to produce a blank from a metal sheet placed between first (13) and second (14) die parts and a movable third die part (16) adapted to move axially through die (34) and to cooperate with a form punch (42) on the second die part (14) to draw the blank to the desired shape, the relative movements of the second (14) and third (16) die parts being actuated via electromagnetic means.
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BLANK AND DRAW PRESS TOOL

Technical Field

The present invention relates to an improved die set for the stamping and drawing of articles from sheet metal and to a press incorporating such a die set.

Background Art

Conventional die sets for stamping and drawing articles from sheet metal comprise a pair of die parts which are reciprocated relative to one another such that as the die parts approach one another a sheet of metal placed therebetween is stamped, i.e., a blank of a desired shape is cut out of the metal sheet and, as the die parts continue to move together, the blank is drawn into some desired shape by the die parts. Such die sets are effective and have been used for a long time, however, they are relatively slow. Attempts which have been made to increase the speed of operation of such die sets have proven costly and have shown only a limited improvement. The present invention is designed to provide an alternative form of die set capable of stamping and at least shallow drawing at a speed equal to or greater than the faster types of conventional die sets at a price which is advantageous compared with such die sets.

Disclosure of Invention

The present invention consists in a die set for a press, which die set is adapted to form stamped and drawn articles, such as can ends and lids, from sheet metal, the die set comprising a first die part having a through aperture having a peripheral edge corresponding in shape to the peripheral shape of the blank to be stamped from the sheet metal, a second die part including a cutting punch which is adapted to be moved relative to the first die part into a cutting relationship with the peripheral edge of the aperture in the first die part to stamp a blank from a metal sheet placed between the first and second die parts, and a third die part adapted to move relative to the first and second die parts through the aperture in the first die part and to cooperate
with the second die part to draw the blank to the desired shape.

In another aspect the present invention consists in a press comprising a frame, a first die part mounted on the frame and having a through aperture having a peripheral edge corresponding in shape to the peripheral shape of the blank to be stamped from sheet metal, a second die part mounted on the frame and adapted to be moved relative to the first die part into a cutting relationship with the peripheral edge of the aperture in the first die part by first actuating means such that a cutting punch on the second die part moves relatively into juxtaposition with the said peripheral edge of the aperture to stamp a blank from a metal sheet placed between the first and second die parts, and a third die part mounted on the frame and adapted to be moved relative to the first and second die parts through the aperture in the first die part by second actuating means and to cooperate with the second die part to draw the blank to the desired shape.

In yet another aspect the present invention consists in a process for stamping and drawing articles from metal sheet comprising the steps of placing the metal sheet between a first die part which has a through aperture having a peripheral edge corresponding in shape to the peripheral shape of the blank to be stamped from the metal sheet and a second, die part which is reciprocable relative to the first die part and has a cutting punch adapted to cooperate with the said peripheral edge of the first die part to stamp a blank from the metal sheet; moving the cutting punch of the second die part relatively into juxtaposition with the said peripheral edge of the first die part to stamp a blank from the metal sheet; and subsequently moving a third die part relative to the first and second die parts through the aperture in the first die part into close juxtaposition with the second die part to draw the blank into the desired shape between the second and third die parts.
While the die set according to the invention has particular applicability in the manufacture of ends and lids for cans such die sets can also be used for the manufacture of other stamped and drawn articles, particularly shallow drawn articles.

The arrangement according to the present invention allows the total linear movement of the die parts for producing any given stamped and drawn article to be significantly reduced as compared with conventional two part die sets. This reduction in travel of the die parts allows the die parts to be cycled more rapidly thereby improving the productivity of the press in which the die set is installed. Another advantage of the present arrangement is that the cutting ring of the second die part only needs to move into close juxtaposition with the peripheral edge of the aperture in the first die part to shear through the sheet metal stock as compared with a conventional two part die set where the cutting punch must move past the corresponding cutting edge on the other die part by a distance equal to the full drawing depth of the die set. This shallow cutting depth substantially reduces the possibility of the die parts being damaged during use due to a slight misalignment of the die parts and reduces wear on the cutting punch as it avoids the cutting punch having to move past the sheared sheet metal stock as is required in the prior art arrangement.

The die set according to this invention is preferably installed in a press actuated by a pair of opposed solenoids or electromagnets. In such a press one solenoid or electromagnet can be used to move the second die part up to the aperture in the first die part and the other solenoid or electromagnet can be used to move the third die part through the aperture in the first die part into juxtaposition with the second die part. The solenoids or electromagnets preferably comprise annular iron castings containing appropriate windings. A main solenoid or electromagnet is
preferably provided to move each of the second and third die parts towards the first die part while a smaller and subsidiary solenoid is preferably provided to reverse each of the second and third die parts away from the first die part. Each pair of main and subsidiary solenoids or electromagnets are preferably mounted in coaxial face to face relationship on either side of an iron disk or plate which is mounted on an actuating rod for the associated die part. Each subsidiary solenoid is preferably mounted such that the distance between the main and subsidiary solenoids may be varied in order to change the amount of travel of the associated die.

Sheet metal to be stamped and drawn may be introduced into the press according to this invention by any conventional means and in strip or coil form. The stamped and drawn article may be similarly removed by any suitable means such as an air blast.

While it is preferred that the second and third die parts of the die set according to this invention are actuated by solenoids this is not essential as they could for instance be actuated by cams or other like means.

Brief Description of Drawings:

Hereinafter given by way of example only is a preferred embodiment of this invention described with reference to the accompanying drawings in which:

Fig. 1 is a partly cut away side elevational view of a press according to this invention;

Fig. 2 is a cross sectional view on an enlarged scale of the press along II-II of Fig. 1;

Fig. 3 is a longitudinal sectional view along III-III of Fig. 2 on an enlarged scale showing the die set included in the press of Fig. 1;

Best Method of Carrying Out the Invention

The press 10 comprises a die set 11, adapted to stamp out a circular blank from sheet metal and to draw it into a
pressing lid actuated by two sets of electromagnets 12 constituting actuating means. The die set comprising a first stationary die assembly 13 having a through aperture 17, an edge 15 of which defines the peripheral shape of the blank, a second, movable, die assembly 14 which includes a cutting panel adapted to move into cutting relationship with the peripheral edge 15 of the first die assembly 13 to stamp out the blank, and a third, movable, die assembly 16 adapted to move through the aperture 17 into close juxtaposition with the second die assembly 14 to draw the blank positioned therebetween into the desired shape.

The die set 11 and the two sets of electromagnets 12 are mounted within a press frame 18. The press frame 18 defines three axially aligned enclosed spaces, a central space is occupied by the die set 11 and the end spaces are each occupied by a set of electromagnets 12. Each electromagnet set 12 comprises a principal electromagnet 19 which is annular and faces away from the die set 11. Facing the principal electromagnet 19 and coaxial with it is a supplementary electromagnet 21 which is also annular. The supplementary electromagnet is bolted to an externally threaded sleeve 22 which is screwed into a threaded bore 23 in the end wall of the frame 18, the sleeve 22 and the bore 23 are coaxial with the electromagnets 19 and 21. An annular resilient pad 24 is secured to the face of the supplementary magnet 21. An actuating rod 25 extends from an associated movable die assembly 14 or 16, through an aperture in the frame 18, through the annulus in the electromagnet 19, through the annulus of the electromagnet 21 and is secured at its end distal to the die set 11 in a resilient mounting 26. An annular iron plate 27 is secured to the rod 25 intermediate the principal electromagnet 19 and the supplementary electromagnet 21. The resilient mounting 26 comprises an annular mounting ring 28 secured to the frame and surrounding a ring 29 of a resilient rubber material
which in turn surrounds a further ring 31. The ring 31 is secured to an annular plate 32 which is connected to the rod 25 and has on its face proximal to the frame 18 a resilient facing 33.

In use the principal electromagnet 19 is actuated to draw the iron plate 27 into engagement with it, thereby moving the rod 25 and with it the associated movable die assembly 14 or 16 towards, or through, the fixed die assembly 13. This movement of the rod 25 will draw the facing 33 of the plate 32 into engagement with the frame 18. Upon actuation of the supplementary electromagnet 21 the iron plate 27 is drawn in the reverse direction until the plate 27 engages with the annular resilient pad 24 on the electromagnet 21.

The first die assembly 13 is provided with a cutting ring 34 forming the peripheral edge 15 of the aperture 17. Radially inwardly of the cutting ring is a pressure ring 35 reciprocally mounted in the first die assembly 13 and biased towards the second die assembly 14 by an "O" ring 36. The second die assembly 14 includes a cutting punch 37 movable with the second die assembly 14. Radially outwardly of the cutting punch 37 in a further pressure ring 38 biased towards the first die assembly 13 by an "O" ring 39, the pressure ring 38 serves to strip sheet metal stock from the cutting punch 37 after each press cycle. Radially inwardly of the cutting punch 34 is a knock out 41 which is spring mounted in the second die assembly 14. A form punch 42 is located centrally of the face of the second die assembly 14. The third die assembly 16 carries form punch 43 which moves reciprocably within the aperture 17 of the first die assembly 13 and draws, together with form punch 42, a blank cut out by the cutting punch 37 into a desired form.

The second die assembly 14 is mounted on a support block 44 by bolts 45. The support block 44 is formed with a frusto-conical bore 46 which surrounds a frusto-conical nut
47 which is screwed onto a threaded end of one of the rods 25. When the bolts 45 are tightened the die assembly 14 is drawn against the proximal face of support block 44 and simultaneously the nut 47 is jammed in place on the threaded end of rod 25. If the nuts are loosened the nut 47 may be rotated without removing the die assembly 14 from the frame 18 thereby allowing the position of die assembly 14 to be adjusted relative to the fixed die assembly 13. The third die assembly 16 is similarly mounted on die plate 48 which in turn is bolted by bolts 52 to support block 49 which surrounds a conical nut 51 which is screwed to the end of the other rod 25.

As is seen in Fig. 2 the support block 49 is formed with recesses 61 which receive the bolts 53. These recesses 61 open in oppositely facing tangential directions such that upon loosening bolts 53 and rotating the support block 49 through approximately 45° the attached die assembly 16 may be withdrawn from the frame 18. The support block 44 is similarly provided with open sided recesses to allow ready separation of die assembly 14, and bolts 45 from support block 44.

The fixed die assembly 13 is connected to the frame 18 through support blocks 53 which are forced into face to face engagement with pads 54 on the frame 18. The blocks 53 are each formed on their outer surface with a groove 55 into which fits a plate 56 (only one of which is shown) which extends through the slots 57 in the frame 18. Bolts (not shown) force the outer end of plates 56 in the direction of arrow A of Fig. 1 which forces the other end of the plate in the opposite direction and clamps the blocks 53 against pads 54. To remove the fixed die assembly 13 the bolts may be loosened, the plates 56 removed and the die assembly 13 may then be removed from the frame 18.

Four pillars 58 extend through the fixed die assembly 13 and are fixed relative thereto. The ends of the pillars 58
extend in cantilevered fashion from the faces of the fixed
die assembly 13 and through bushes 59 in the movable die
assemblies 14 and 16.

The actuation of the die assemblies is controlled by
solid state circuitry which does not form part of this
invention. In alternative embodiments of this invention cam
or hydraulic or pneumatic rams could be used to actuate the
die assemblies in place of the electromagnets hereinbefore
described.

While the invention has been described with reference to
movement of the second die assembly towards the first die
assembly and of movement of the third die assembly through
the aperture in the first die assembly it will be recognised
by persons skilled in the art that the absolute sense of the
movement is irrelevant as long as the appropriate relative
movement occurs between the die assemblies. It is therefore
within the ambit of this invention to maintain any one of the
die assemblies stationary and to move the other two die
assemblies relative to it.
The claims defining the invention are as follows:-

1. A die set for a press, which die set is adapted to form stamped and drawn articles, from sheet metal, the die set comprising a first die part having a through aperture having a peripheral edge corresponding in shape to the peripheral shape of the blank to be stamped from the sheet metal, a second die part including a cutting punch which is adapted to be moved relative to the first die part into a cutting relationship with the peripheral edge of the aperture in the first die part to stamp a blank from a metal sheet placed between the first and second die parts, and a third die part adapted to move relative to the first and second die parts through the aperture in the first die part and to cooperate with the second die part to draw the blank to the desired shape.

2. A press as claimed in Claim 1 in which the first die part is fixed and the second and third die parts are movable.

3. A press as claimed in Claim 1 in which the first die part is mounted in the frame of a press and in which the second and third die parts are mounted on pillars cantilevered from the first die part.

4. A press comprising a frame, a first die part mounted on the frame and having a through aperture having a peripheral edge corresponding in shape to the peripheral shape of the blank to be stamped from sheet metal, a second die part mounted on the frame and adapted to be moved relative to the first die part into a cutting relationship with the peripheral edge of the aperture in the first die part by first actuating means such that a cutting punch on the second die part moves relatively into juxtaposition with the said peripheral edge of the aperture to stamp a blank from a metal sheet placed between the first and second die parts, and a third die part mounted on the frame and adapted to be moved relative to the first and second die parts through the aperture in the first die part by second actuating means and
to cooperate with the second die part to draw the blank to the desired shape.

5. A press as claimed in Claim 4 in which the first and second actuating means each includes an electromagnet or solenoid.

6. A press as claimed in Claim 5 in which each of the first and second actuating means includes a pair of electromagnets arranged in opposition and between which is an iron plate connected to one of the die parts such that upon actuation of one of the electromagnets the iron plate is drawn to that magnet and thereby moves the said one of the die parts in one direction and actuation of the other of the electromagnets the iron plate, and the said one die part, are drawn in opposite directions.

7. A process for stamping and drawing articles from metal sheet comprising the steps of placing the metal sheet between a first die part which has a through aperture having a peripheral edge corresponding in shape to the peripheral shape of the blank to be stamped from the metal sheet and a second, die part which is reciprocable relative to the first die part and has a cutting punch adapted to cooperate with the said peripheral edge of the first die part to stamp a blank from the metal sheet; moving the cutting punch of the second die part relatively into juxtaposition with the said peripheral edge of the first die part to stamp a blank from the metal sheet; and subsequently moving a third die part relative to the first and second die parts through the aperture in the first die part into close juxtaposition with the second die part to draw the blank into the desired shape between the second and third die parts.

8. A process as claimed in Claim 7 in which the first die part is maintained in a stationary condition and the second and third die parts are reciprocated.
AMENDED CLAIMS
(received by the International Bureau on 26 May 1981 (26/05/81))

1. (amended) A die set for a press, which die set is adapted to form stamped and drawn articles from sheet metal, the die set comprising a first die part having a through aperture which has a peripheral edge corresponding in shape to the peripheral shape of the blank to be stamped from the sheet metal, a second die part including a cutting punch which is adapted to be moved relative to the first die part into a cutting relationship with the peripheral edge of the aperture in the first die part to stamp a blank from a metal sheet placed between the first and second die parts, stop means being provided to stop the cutting punch moving substantially past the peripheral edge of the first die part, and a third die part adapted to move relative to the first and second die parts through the aperture in the first die part from the end thereof distal to said peripheral edge and to cooperate with the second die part to draw the blank to the desired shape.

2. A press as claimed in Claim 1 in which the first die part is fixed and the second and third die parts are movable.

3. A press as claimed in Claim 1 in which the first die part is mounted in the frame of a press and in which the second and third die parts are mounted on pillars cantilevered from the first die part.

4. (Amended) A press comprising a frame, a first die part mounted on the frame and having a through aperture having a peripheral edge corresponding in shape to the peripheral shape of the blank to be stamped from sheet metal, a second die part mounted on the frame and adapted to be moved relative to the first die part into a cutting relationship with the peripheral edge of the aperture in the first die part by first actuating means such that a cutting punch on the second die part moves relatively into juxtaposition with, but not substantially beyond, the said peripheral edge of the aperture to stamp a blank from a metal sheet placed between the first and second die parts, and a third die part mounted on the frame and adapted to be moved relative
to the first and second die parts through the aperture in the
first die part from the end thereof distal to the said
peripheral edge by second actuating means and to cooperate with
the second die part to draw the blank to the desired shape.
5. A press as claimed in Claim 4 in which the first and second
actuating means each includes an electromagnet or solenoid.
6. (Amended) A press as claimed in Claim 5 in which each of the
first and second actuating means includes a pair of
electromagnets arranged in opposition and between which is an
iron plate connected to one of the die parts such that upon
actuation of one of the electromagnets the iron plate is drawn
to that magnet and thereby moves the said one of the die parts
in one direction and upon actuation of the other of the
electromagnets the iron plate and the said one die part are
drawn in an opposite direction.
7. (Amended) A process for stamping and drawing articles from
metal sheet comprising the steps of placing the metal sheet
between a first die part which has a through aperture having a
peripheral edge corresponding in shape to the peripheral shape
of the blank to be stamped from the metal sheet and a second,
die part which is reciprocable relative to the first die part
and has a cutting punch adapted to cooperate with, but not
substantially beyond the said peripheral edge of the first die
part to stamp a blank from the metal sheet; moving the cutting
punch of the second die part relatively into juxtaposition with
the said peripheral edge of the first die part to stamp a blank
from the metal sheet; and subsequently moving a third die part
relative to the first and second die parts through the aperture
in the first die part from the end thereof distal to the said
peripheral edge into close juxtaposition with the second die
part to draw the blank into the desired shape between the second
and third die parts.
8. A process as claimed in Claim 7 in which the first die part
is maintained in a stationary condition and the second and third
die parts are reciprocated.
## INTERNATIONAL SEARCH REPORT

**I. CLASSIFICATION OF SUBJECT MATTER**

According to International Patent Classification (IPC) or to both National Classification and IPC

| Int. Cl. B21D 51/10, 51/44, B30B 9/28 |

**II. FIELDS SEARCHED**

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**AU**: IPC as above; Australian Classification 73.83

**III. DOCUMENTS CONSIDERED TO BE RELEVANT**

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* Special categories of cited documents:
- **A**" document defining the general state of the art
- **E** earlier document but published on or after the international filing date
- **L**" document cited for special reason other than those referred to in the other categories
- **O" document referring to an oral disclosure, use, exhibition or other means
- **P** document published prior to the international filing date but on or after the priority date claimed
- **T** later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention
- **X" document of particular relevance

**IV. CERTIFICATION**

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**International Searching Authority**: Australian Patent Office

**Signature of Authorized Officer**: A.S. Moore

Form PCT/ISA/210 (second sheet) (October 1977)
FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET


VI. OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE ¹⁰

This international search report has not been established in respect of certain claims under Article 17(3)(a) for the following reasons:

1. Claim numbers ............. because they relate to subject matter ¹¹ not required to be searched by this Authority, namely:

2. Claim numbers ............. because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out ¹², specifically:

VI. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING ¹¹

This International Searching Authority found multiple inventions in this international application as follows:

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

Remark on Protest
☐ The additional search fees were accompanied by applicant’s protest.
☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (supplemental sheet 03) (October 1977)