(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 054 522**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 81830241.6

(22) Date of filing: 03.12.81

(51) Int. Cl.³: B 21 D 53/40
E 05 D 3/02

(30) Priority: 17.12.80 IT 6892280

(43) Date of publication of application:
23.06.82 Bulletin 82/25

(84) Designated Contracting States:
DE FR GB IT SE

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(54) Process for the manufacture of hinges, particularly for vehicle doors.

(57) A method for the manufacture of vehicle hinges produces, by blanking and cold-forming, hinges (11, 15) of the type comprising two flat rectangular plates (7, 9) each provided on one side with a flat projection (12, 16) of the same thickness as that of the plate (7, 9) terminating with a substantially cylindrical enlargement (13, 19) traversed by an axial hole (14, 18) for receiving the hinge pin of the hinge (11, 15). In particular, the method according to the invention is usable for the manufacture of hinges (11, 15) of the type in which the axis of the said hole (14, 18) is offset with respect to the plane of the associated plate (7, 9). The invention also relates to a press tool usable in a press to effect the cold-forming operation which constitutes a stage in the manufacturing method of the hinge.

FIG. 5

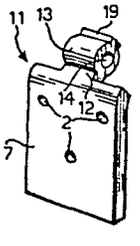
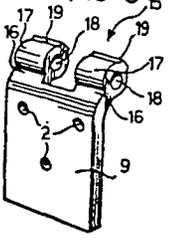


FIG. 6



EP 0 054 522 A2

Method for manufacture of vehicle door hinges

The present invention relates to hinges, particularly for vehicle doors, of the type comprising two rectangular plates provided with holes for the passage of screws for fixing it, respectively, to a door and to a support structure, each of the two plates being provided on one side with at least one flat projection which, being of the same thickness as the plate, has sides parallel to the two sides of the plate adjacent to the said side and terminates with a substantially cylindrical enlargement traversed by an axial hole intended to receive the hinge pin of the hinge, the axis of the said hole being offset with respect to the plane of the associated plate.

A method for the manufacture of hinges of the type indicated above has already been proposed comprising the following operations:

- forming, by means of a punching and blanking operation on sheet metal, two first blanks each constituted by a rectangular plate provided with respective holes for the fixing screws of the hinge and having its finished dimensions on three sides and, on the fourth side, at least one flat projection having a width substantially equal to that of the projection of the finished hinge and a volume at least equal to the sum of the volumes of the flat projection and the cylindrical enlargement which it is intended to obtain in the finished hinge;

- subjecting each projection of each of the said first blanks to an upsetting operation in a press in such a way as to obtain two second blanks in each of which each plate has a projection having a reduced length with respect to the corresponding projection of the first blank and terminating with a cylindrical enlargement, the said projection and the said cylindrical

enlargement having the desired final dimensions, and

- axially piercing the enlargements of the said second blanks.

This known method is usable for the manufacture of hinges of the type in which the axis of the hole of the cylindrical enlargement of each plate is contained in a median plane parallel to the major faces of the plate and equi-distant from such faces.

The object of the present invention is to provide a method usable for the manufacture of hinges in which the axis of the hole of the cylindrical enlargement of each projection of each plate is offset with respect to said median plane of the plate.

The principle characteristic of the method according to the invention lies in the fact that, before the upsetting operation in the press, each of the two first blanks are subjected to a bending operation about a line parallel to and adjacent the side of the plate which is provided with the flat projection, whereby to dispose said projection into a plane inclined with respect to the plane of the plate.

In the method for the manufacture of hinges which has already been proposed, the upsetting operation of each of the first blanks, which takes place in a press, comprises the following stages:

-providing a die set including a pair of dies able to clamp one of the said first blanks across its major faces each of the said dies having a recess which defines with the corresponding recess of the other die a cylindrical cavity which is diametrically traversed by the projection of the first blank when this latter is clamped between th dies of the die set, the said dies further defining between them an outwardly-opening channel communicating w said cylindrical cavity, into which projects the free

end of the said projection;

- providing containment means operable to oppose displacement of the sides of the first blank, and

- introducing a punch by pressing action into the said channel in such a way as to press the projection of the first blank axially and cause, by plastic deformation, a flow of material of the projection into the said cavity to give rise to the formation of the cylindrical enlargement.

In the method according to the present invention the said upsetting operation is also performed by the above-described stages. In this respect, however, the method according to the invention differs from the one which has already been proposed by the fact that the facing surfaces of the dies of the die set, intended to press the first blank between them in correspondence with its major faces, each have two flat sections inclined with respect to one another by an angle corresponding to the angle of the said bend in the first blank.

A further characteristic of the method according to the invention lies in the fact that, in order to perform the upsetting operation, there is provided a press utilising a pair of dies for each of the two first blanks respectively, whereby to allow the two elements of a hinge to be obtained at each operation of the press.

Preferably, moreover, the volume of the portion of the flat projection of the first blank which traverses the cylindrical cavity of the die set and projects into the said channel when the first blank is clamped between the two dies of the die set is greater than the volume of the said cylindrical cavity, so that the cylindrical enlargement obtained by the upsetting operation has an external longi-

tudinal tooth on the side thereof diametrically opposite the region of connection of the cylindrical enlargement with the plate.

The present invention also relates to a press tool usable in a press to perform the upsetting operation constituting a stage in the above-described method.

More precisely, the invention also relates to a press tool usable in a press for subjecting a blank, constituted by a rectangular plate provided on one side with at least one flat projection having a thickness equal to that of the plate and two sides parallel to the two sides of the plate adjacent to the said side, to an upsetting operation, for the purpose of obtaining a cylindrical enlargement at the free end of the said projection.

A press tool of the above-indicated type has already been proposed, this comprising a die set which includes:

- a support structure;
- a pair of dies which can be displaced towards one another along the support structure by the effect of the displacement of the movable members of a press, for clamping the blank across its major faces, the said dies being provided with facing surfaces each having a recess which defines, together with the recess of the corresponding surface of the other die, a cylindrical cavity which is diametrically traversed by the flat projection of the blank when this latter is clamped between the said facing surfaces of the dies of the die such facing surfaces further defining between them an outwardly open channel disposed about the prolongation of the flat projection traversing the cylindrical cavity and communicating with this latter;
- containment means operable to press against the

sides of the blank when this is clamped between the dies of the die set, and

-a punch slidably mounted in the said channel and displaceable towards the said cylindrical channel by the displacement of the movable members of the press during their working stroke.

A further object of the present invention is to provide a press tool of the type indicated above usable for blanks of the type in which each flat projection is disposed in a plane which is inclined with respect to the plane of the associated plate.

The main characteristic of the press tool according to the present invention lies in the fact that each of the said facing surfaces of the dies of the die set, intended to clamp the major faces of the blank between them, has two flat sections inclined with respect to one another by an angle corresponding to the angle of inclination of each projection of the blank with respect to the corresponding plate.

A further characteristic of the press tool according to the invention lies in the fact that the volume of the said cylindrical cavity is less than the volume of the portion of the flat projection of the blank which traverses the said cavity and which projects into the said channel when the blank is clamped between the dies of the die set.

According to a further preferred characteristic, the press tool according to the present invention includes two die sets respectively positioned to simultaneously subject two blanks to the said upsetting operation whereby to allow the two elements of a hinge to be obtained at each operation of the press.

In a first embodiment of the press tool according to the invention the two punches of the two die sets form-

ing part of the tool are slidable along the direction of movement of the movable members of the press and are directly controlled by these latter, whilst the two dies of each of the two die sets are movable, one with respect to the other, in a direction perpendicular to the direction of movement of the movable members of the press, the relative approach of the said dies being controlled by wedge means displaceable in the direction of movement of the movable members of the press.

In a second embodiment of the press tool according to the invention the two dies of each of the two die sets are movable with respect to one another in the direction of movement of the movable members of the press, the relative approach of the said dies being directly controlled by these movable members, whilst the two punches of the two die sets are each slidable in a direction perpendicular to the direction of movement of the movable members of the press and are controlled by wedge means displaceable in the direction of movement of the movable members of the press.

Further characteristics and advantages of the present invention will become apparent from the following description, with reference to the attached drawings provided by way of non-limitative example, in which:

Figure 1 is a plan view of a section of sheet metal strip after the first stage of the method according to the invention has been performed;

Figure 2 is an exploded perspective view of the two blanks obtained after the first stage of the method has been performed;

Figures 3 and 4 are perspective views of the two blanks of Figure 2 after the subsequent stage of the method according to the invention has been performed;

Figures 5 and 6 are perspective views of the two

elements of a hinge obtained by means of the method according to the present invention;

Figure 7 is a lateral section of a first embodiment of the press tool according to the invention;

Figure 8 is a section taken on the line VIII-VIII of Figure 7;

Figure 9 is a lateral section of a second embodiment of the press tool according to the present invention;

Figure 10 is a section taken on the line X-X of Figure 9, and

Figure 11 illustrates a detail of Figure 7 on an enlarged scale.

In Figure 1, a strip of sheet metal is indicated 1. This strip is subjected to a combined operation of punching, to form a plurality of holes 2, and fine blanking along the lines indicated 3 and 4, by means of a stepped fine blanking die.

After these operations the two blanks indicated 5 and 6, and illustrated on an enlarged scale in Figure 2, are obtained.

With reference to this Figure, the blank 5 is constituted by a rectangular plate 7 having on three sides the final dimensions of the hinge element which it is desired to obtain, and on the fourth side a flat projection 8 with a thickness which is equal to the thick-thickness of the plate 7 and sides parallel to the two sides of the plate 7 which are adjacent to the side provided with the projection 8.

The blank 6 is constituted by a rectangular plate 9 having, on three sides, the final dimensions of the hinge element which it is desired to obtain, and on the fourth side two flat projections 10 arranged in complementary positions with respect to the flat projection 8 of the blank 5. The projections 10 have a thickness equal to

the thickness of the plate and sides parallel to the sides of the plate which are adjacent to the side provided with the projections themselves.

The holes 2 with which each of the two blanks 6,7 is provided are intended to permit the fixing of the finished hinged elements to the door and to the body of a motor vehicle, respectively.

Figures 5 and 6 are perspective views of the two finished hinge elements obtainable starting from the sheet metal strip 1 by the method according to the present invention.

In Figure 5, the hinge element obtainable starting from the blank 5 is generally indicated 11. The finished hinge element 11 differs from the blank 5 in that the plate 7 is provided with a flat projection 12 the width of which corresponds to the width of the flat projection 8 of the blank 5 and of a reduced height with respect to the height of the projection 8. The projection 12 ends, moreover, with a cylindrical enlargement 13 having an axis parallel to the side of the plate which is provided with the projection 12. The enlargement 13 is traversed by an axial hole 14 intended to receive the hinge pin of the hinge.

Similarly, in Figure 6, a finished hinge element obtainable starting from the blank 6 illustrated in Figure 2 is generally indicated 15; the finished hinge element 15 differs from the blank 6 mainly by the fact that the plate 9 is provided with two projections 16 the width of which is equal to that of the projections 10 of the blank 6 whilst the height of which is less than that of the projections 10 of the blank 6. The flat projections 16 end with two cylindrical enlargements 17 having axes parallel to the side of the plate 9 which is provided with such projections. Each cylindrical en-

largement 17 is, moreover, traversed by an axial hole 18 which is intended to receive the hinge pin of the hinge.

Each of the cylindrical enlargements 13,17 of the finished hinge elements 11,15 has, moreover, an external longitudinal tooth 19 the function of which will be described below, this being disposed on the side diametrically opposite the corresponding projections 12,16.

The method according to the invention is usable to obtain hinge elements of the type illustrated in Figures 5 and 6, that is to say, hinge elements in which the axis of each of the cylindrical enlargements 13,17 is offset with respect to a plane parallel to the major faces of the respective plate and equi-distant from such major faces.

According to the invention, the two blanks 5,6 are subjected to a bending operation in such a way as to obtain the two blanks 20,21 illustrated in Figures 3,4. The bending of each of the two blanks 5,6 is effected along a line 22 adjacent to the side of the respective plate which is provided with the flat projection or projections. In this way, the blank 20 has a flat projection 8 lying in a plane which is inclined with respect to the plane of the corresponding plate 7, whilst the blank 21 has two flat projections 10 lying in a plane inclined with respect to the plane of the corresponding plate 9.

In the subsequent working stages, each of the two blanks 20,21 is subjected to a cold upsetting operation in a press to derive, in correspondence with each of the projections 8,10, the cylindrical enlargements 13 and 17 and the corresponding longitudinal teeth 19.

There will now be described, with reference to Figures 7 and 8, a first embodiment of press tool according to the invention usable to perform the said upsetting operation on the two blanks 20,21.

In Figures 7,8 and 11, a press tool is generally

indicated 23, this tool being usable in a single-acting press and including a pair of die sets 24 respectively usable for effecting the said upsetting operation on the two blanks 20,21. Thanks to this characteristic, two hinge elements are obtained at each stroke of the press. The working cycle is subsequently completed by forming the axial holes 14,18 in the cylindrical enlargements 13,17 formed by means of the upsetting operation.

In greater detail, the press tool 23 includes a fixed base structure 25 in which there are disposed two die sets 24. Each die set 24 includes a fixed die 26 and a movable die 27 mounted so as to be slidable in a direction perpendicular to the vertical direction of movement of the ram (not illustrated) of the press.

Each pair of dies 26,27 has two facing surfaces 26a, 27a (see Figure 11) intended to clamp the associated blank between them in correspondence with its major faces.

In the case illustrated, the pair of dies 26,27 shown on the left of Figure 7 are intended to clamp between them the blank 20, whilst the pair of dies 26,27 shown on the right of Figure 7 are intended to clamp between them the blank 21.

As illustrated in detail in Figure 11, each of the facing surfaces 26a,27a has two flat sections, respectively indicated 28,29 and 30,31, which are inclined with respect to one another by an angle corresponding to the angle by which the respective blank is bent.

The two flat sections 29,31 of the facing surfaces 26a,27a of the two dies 26,27 of each die set 24 have two recesses 32 which together define a cylindrical cavity.

Figure 11 illustrates the blank 20 clamped between

the two dies 26,27 of the die set 24 which is shown on the left in Figure 7. In this condition, the plate 7 of the blank 20 is clamped between the flat sections 28,30 of the facing surfaces of the dies, whilst the flat projection 8 is clamped between the flat sections 29,31 of the said facing surfaces. In particular, the flat projection 8 diametrically traverses the cylindrical cavity defined by the recesses 32 and projects into an open channel 33 disposed about the prolongation of the flat projection 8, which is defined between the facing surfaces of the two dies. Similarly, in the case of the die set 24 which is illustrated on the right in Figure 7, the blank 21 is clamped between the two dies 26,27 in such a way as to position it with the plate 9 between the sections 28 and 30 of the facing surfaces of the two dies and with the flat projections 10 between the sections 29,31 of the said facing surfaces.

With reference to Figures 7 and 8, in each channel 33 there is slidably mounted a punch 34 fixed to a support 35 which in turn is carried by a structure 36 movable with the ram of the press in which the press tool illustrated is intended to be utilised.

The structure 36 includes an upper thrust plate 37 to which there is fixed an hydraulic cylinder 38 for the control of the vertical displacement of a wedge 39 the inclined sides of which press with their corresponding inclined surfaces 40 against the two horizontally slidable elements 41 which are fixed respectively to the two movable dies 27. A spring 42, interposed between the free end of the wedge 39 and the fixed base structure 25 tends to bias the wedge 39 towards a raised end-of-stroke position.

Within the structure 36 there are also vertically slidably mounted, with the interposition of springs 43,

lateral containment members 44 able to press with their sides against the projections 8,10 of the two blanks 20, 21 during the performance of the said upsetting operation.

Between the support 35 and the fixed base structure 25 there are interposed springs 45, schematically illustrated in Figure 7, for biasing the structure 36 upwardly.

As has been desribed the press tool illustrated in Figures 7,8 and 11 is usable for simultaneously subjecting the blanks 20,21 illustrated in Figures 3 and 4 to the upsetting operation necessary to obtain the finished hinge elements 11,15 illustrated in Figures 5 and 6. This upsetting operation is performed in the following manner:

Initially, the structure 37 is located in a raised position with respect to the base structure 25, the wedge 39 is displaced from the surface 40 of the elements 41, and the dies 26,27 of each die set 24 are spaced from one another.

In this condition, two blanks 20,21 are introduced into the two die sets 24 by feeding them along a direction perpendicular to the plane of Figure 7.

A lowering of the structure 37 is then controlled, in such a way as to bring the containment members 44 to press with their sides against the projections 8,10 of the two blanks 20,21. The hydraulic cylinder 38, the extension of which is obtainable independently from the movement of the structure 36, is then controlled to bring the wedge 39 against the action of the spring 42 so as to press with its inclined surfaces 40 against the elements 41. The lowering of the wedge 39 causes separation of the two elements 41 from one another, thus pressing the two movable dies 27 against their respective fixed dies 26.

The blanks 20 are thus clamped between the two dies 26,27 in the manner illustrated in Figure 11 and the blank 21 is clamped between the corresponding dies in a similar manner.

At this point,a lowering of the press ram is controlled in such a way as to cause the punches 34 to slide within the channels 33,so as to cause plastic deformation of the flat projections 8,10 of the two blanks 20,21.

In this way,there is caused a flow of material of these projections into the cylindrical cavities defined by the recesses 32 formed in the facing surfaces of the dies 26,27 whereby to obtain the cylindrical enlargements 13,17 illustrated in Figures 5 and 6.

In Figures 7 and 8,the dies 26 and 27 are illustrated in a condition where they clamp the corresponding blanks and the movable members are illustrated in the condition corresponding to the lowermost ends of the stroke of the press ram.

When the press ram has reached the end of its stroke,the inner chamber of the hydraulic cylinder 38 is put into communication with a discharge reservoir whereby to allow raising of the wedge 39 under the action of the biasing spring 42. At this point,the structure 36 is raised causing disengagement of the punches 34 and the lateral containment members 44 from the finished hinge element which is ejected from the die set by displacing it in a direction perpendicular to the plane of Figure 7.

The manufacture of the hinge must be completed at this point with the operation necessary to form the axial holes 14,18 in the cylindrical enlargements 13,17.

The volume of the cylindrical cavity defined by the recesses 32 formed in the facing surfaces of each pair of dies 26,27 is less than the volume of the part

of the corresponding projection which diametrically traverses this cylindrical cavity and projects into the channel 33. In this way, once the upsetting operation has been effected, the cylindrical enlargement thus obtained has the above described longitudinal tooth 19 (See Figures 5 and 6) in correspondence with a region diametrically opposite to the region of connection of the cylindrical enlargement with the associated plate.

The teeth 19 of the two finished hinge elements 11, 15 serve the purpose of constituting a stop against the excessive opening of the door of the motor vehicle, during the manufacture of the motor vehicle itself, until it reaches the point in the production line at which the means for limiting the maximum opening of the door are assembled. During this manufacturing phase of the motor vehicle, an excessive opening of the door is prevented thanks to the engagement of the teeth 19 of the cylindrical enlargement of each element of the hinge against the end edge of the plate of the other hinge element.

Figures 9 and 10 illustrate a second embodiment of the press tool according to the invention usable in a double-acting press for performing the above-described upsetting operation.

In this case too, the press tool, which is generally indicated with the reference numeral 46, includes two die sets 24 for subjecting the two blanks 20,21 to an upsetting operation. In Figure 10, however, only one of these die sets is illustrated, the parts of the tool which are not visible being symmetrical to those illustrated across a vertical plane indicated with the line X-X.

The press tool 46 includes a fixed base structure 47 in which are slidably mounted the pressure columns 48

of the double-acting press. These pressure columns are connected in a known way at their lower end to the pneumatic cylinders acting as elastic bearings.

On the other end of the pressure columns 48 there is fixed, for each die set (indicated with the reference numeral 49), a die 50. The die 50 is intended to co-operate with a die 51 fixed to a structure 52 which is rigidly connected to an upper plate 53 movable with the ram (not illustrated) of the press.

The press tool illustrated in Figures 9 and 10 differs therefore from that illustrated in Figures 7 and 8 by the fact that the direction of relative movement of the two dies of each die set is parallel to the direction of the movement of the press ram.

The two dies 50,51 of each die set 49 have facing surfaces having an identical conformation to that of the surfaces 26a,27a of the dies 26,27 illustrated in Figure 11. Each of said surfaces therefore has two flat sections inclined with respect to one another and intended to come into contact, respectively, with the plate and with each projection of each blank, and are moreover provided with recesses to define the cylindrical cavities in which the cylindrical enlargements of the hinge elements are formed.

Another substantial difference between the press tool illustrated in Figures 9 and 10 and that illustrated in Figures 7 and 8 lies in the fact that the punch, indicated with the reference numeral 54, cooperating with each pair of dies 50,51 is displaced in a direction perpendicular to the direction of the movement of the press ram. The punch 54 is in fact rigidly connected to a support 55 which is horizontally slidably mounted on guides 52a (schematically illustrated in Figure 10) carried by the structure 52.

Each support 55 has, moreover, an inclined surface 56 which presses against the inclined sides of a wedge 57 rigidly connected to the base structure 47.

This base structure is moreover provided with a support 47a corresponding with each pair of dies 50,51 against which the dies press during the pressing operation.

In this case, too, the upper structure 52 is provided with lateral containment members 58 operable to press against the sides of the projections 8,10 of the two blanks during the pressing operation.

The containment members 58 are slidably mounted within supports 47b rigidly connected to the base structure 47, and their free ends are in contact with slidable elements 59 subjected to the action of springs 60.

Figures 9 and 10 illustrate the movable parts of the press tool in the positions which they assume at the end of the working stroke of the press ram. In the case of the use of the press tool illustrated in Figures 9 and 10, the upsetting operation necessary to obtain the two finished hinge elements 11,15 from the two blanks 20,21 is performed in the following manner:

Initially, the press ram is raised so that the upper die 51 is displaced from the lower die 50 and this latter has its upper surface lying substantially at the height of the upper surface 47c of the supports 47a, 47b rigidly connected to the base structure 47. In this condition, the containment members 58 are also raised and the slidable elements 59 are maintained by the springs 60 in a raised position in which their upper surfaces are flush with the surface 47c. These upper surfaces therefore form, with the surface 47c, a single horizontal plane onto which the blank intended to be

introduced into the die set can be fed.

Once each blank has been placed on the upper surface of the lower die 50 of the associated die set, the structure 53 is lowered until the clamping of the blanks 20,21 between the facing surfaces of the dies 50,51 of the two die sets takes place. In this way, the lateral containment members 58 press the slidable elements 59 downwardly against the action of the spring 60 and press against the sides of the projections 8,10 of the two blanks.

At this point, the lowering of the press ram is controlled. Such lowering causes a corresponding lowering of the supports 52 and a relative separation of the two supports 55 by the action of the engagement of the inclined surfaces 56 on the inclined sides of the wedge 57 rigidly connected to the fixed base structure 47.

The movement of the supports 55 causes sliding of the punches 54 in the corresponding channels formed between the dies 50,51 of the two die sets whereby to obtain the formation of the cylindrical enlargements 13,17 illustrated in Figures 5 and 6.

In this case, too, naturally, the manufacture of the hinge elements must be completed with the operation necessary to form the axial holes 14,18 in the cylindrical enlargements 13,17. Also, moreover, the volume of the cylindrical cavity defined by the two recesses formed in the facing surfaces of the dies 50,51 of each die set is less than the volume of that part of each projection which, before the execution of the upsetting, diametrically traverses the said cylindrical cavity to project into the channel in which the respective punch is slidable.

In this way, at the end of the upsetting operation,

there are obtained cylindrical enlargements having longitudinal teeth 19 of the type illustrated in Figures 5 and 6. The press tool illustrated in Figures 9 and 10 can be advantageously used when the two hinge elements to be made have a significant dimension in the direction perpendicular to the axis of the cylindrical enlargement.

Naturally, the principle of the invention remaining the same, the details of construction and the embodiments can be widely varied with respect to what has been described and illustrated by way of example, without by this departing from the scope of the present invention.

CLAIMS

1. A method for the manufacture of hinges, particularly for vehicle doors, of the type comprising two rectangular plates (7,9) provided with holes (2) for the passage of screws for fixing the plates respectively to a door and to a support structure, each of the two plates (7,9) being provided on one side with at least one flat projection (8;10), the thickness of which is equal to that of the plate (7;9), having sides parallel to the two sides of the plate (7;9) adjacent to the said side and terminating with a substantially cylindrical enlargement (13;17) traversed by an axial hole (14;18) intended to receive the hinge pin of the hinge, the axis of this hole (14;18) being offset with respect to the plane of the plate (7;9), the said method comprising the following operations:

- forming by means of a sheet metal punching and blanking operation two first blanks (5,6) each constituted by a rectangular plate (7;9) provided with respective holes (2) for the hinge fixing screws and having its final dimensions on three sides and, on the fourth side, at least one flat projection (8;10) having a width substantially equal to that of the projection (12;16) of the finished hinge and a volume at least equal to the sum of the volume of the flat projection (12;16) and of the cylindrical enlargement (13;17) which it is intended to obtain in the finished hinge;

- subjecting each projection (8;10) of each of the said first blanks (5;6) to an upsetting operation in a press in such a way as to form two second blanks in each of which each plate (7;9) has a projection (12;16) having a reduced length with respect to the corresponding projection (8;10) of the first blank (5;6) and terminating with a cylindrical enlargement (13;17), the said

projection (12;16) and the said cylindrical enlargement (13;17) having the desired final dimensions, and

- axially piercing the cylindrical enlargements (13,17) of the said second blanks,

characterised by the fact that, before the upsetting operation in the die set, each of the two first blanks (5;6) is subjected to a bending operation about a line (22) parallel to and adjacent the side of the plate (7;9) provided with the flat projection (8;10), whereby to dispose the projection (8;10) in a plane inclined with respect to the plane of the plate.

2. A method according to Claim 1, in which the operation of upsetting each of the first blanks (5;6) in a press comprises the steps of:

-providing a die set (24;49) including a pair of dies (26,27; 50,51) operable to clamp one of the said first blanks across its major faces, each of the said dies having a recess (32) which defines, with the corresponding recess (32) of the other die, a cylindrical cavity which is diametrically traversed by the projection (8;10) of the first blank when this latter is clamped between the dies of the die set, the said dies further defining between them a channel (33) which is outwardly open and communicates with the said cylindrical cavity into which the free end of the said projection extends;

-providing containment means (44,58) operable to press against the sides of the blanks, and

-introducing a punch (34;54) into the said channel (33) by means of a pressing action in such a way as to axially compress the projection (8;10) of the first blank and cause, by plastic deformation, a flow of material of this projection in the said cavity to give rise to the formation of the cylindrical enlargement,

characterised by the fact that the facing surfaces of the dies (26,27; 50,51) of the die set (24;49), in-

tended to press the blanks between them in correspondence with its major faces, each have two flat sections inclined to one another at an angle corresponding to the angle of the said bend in the blank.

3. A method according to Claim 2, characterised by the fact that to perform the upsetting operation there is provided a press utilising a pair of die sets (24;49) respectively positioned for two first blanks whereby to allow two hinge elements to be obtained with a single stroke of the press.

4. A method according to Claim 2, characterised by the fact that the volume of the portion of the flat projection (8;10) of the first blank, which traverses the cylindrical cavity of the die (24;49) and projects into the said channel (33) when the first blank is clamped between the two dies (26,27; 50,51) of the die set (24;49), is greater than the volume of the said cylindrical cavity so that the cylindrical enlargement (13;17) obtained with the said upsetting operation has an external longitudinal tooth (19) disposed on the sides diametrically opposite the region of connection of the cylindrical enlargement (13,17) with the respective plate (7,9).

5. A press tool usable in a press for subjecting a blank (20;21), constituted by a rectangular plate (7;9) provided on one side with at least one flat projection (8;10) having a thickness equal to that of the plate (7;9) and sides parallel to the two sides of the plate adjacent to the said side, to an upsetting operation for the purpose of obtaining a cylindrical enlargement (13;17) at the free end of each projection, each projection being disposed in a plane inclined with respect to the plane of the respective plate (7;9), the said press tool including:

-a support structure (25;47);

-a pair of dies (26,27; 50,51) displaceable with respect to one another in the support structure by the effect of the displacement of the movable members of a press to clamp the blanks in correspondence with their major faces, the said dies being provided with facing surfaces (26a,27a) each having a recess (32) which defines, together with the recess (32) of the corresponding surface of the other die , a cylindrical cavity which is diametrically traversed by the flat projection (8;10) of the blank when this latter is clamped between the facing surfaces of the dies of the die set, said facing surfaces moreover defining between them a channel (33) which is open outwardly and positioned about on the prolongation of the flat projection traversing the said cylindrical cavity and communicating with this latter;

-containment means (44,58) operable to press against the sides of the blank when this latter is clamped between the dies (26,27; 50,51) of the die set (24,49), and

-a punch (34,54) slidably mounted in the said channel (33) and displaceable in the direction of the said cylindrical cavity by the effect of the displacement of the movable members of the press during their working stroke,

characterised by the fact that each of the said facing surfaces (26a,27a) of the dies (26,27; 50,51) of the die set (24,29), for clamping therebetween the major faces of the blank , has two flat sections (28,29) 30,31) inclined to one another at an angle corresponding to the angle of inclination of the projection (8;10) of the blank with respect to the corresponding plate (7,9).

6. A press tool according to Claim 5, characterised by the fact that the volume of the said cylindrical cavity is less than the volume of the portion of the flat projection (8;10) of the blank which traverses this

cylindrical cavity and projects into the said channel (33) when the blank is clamped between the dies (26,27; 50,51) of the die set (24,49).

7. A press tool according to Claim 5, characterised by the fact that it includes two die sets (24;49) respectively positioned to subject two blanks to the said upsetting operation, these blanks having their flat projections (8;10) in complementary positions whereby to allow the two elements of a hinge to be obtained with a single stroke of the press.

8. A press tool according to Claim 7, characterised by the fact that the two punches (34) of the two die sets (24) are slidable in the direction of movement of the movable members of the press and are directly controlled by these latter, and by the fact that the two dies (26,27) of each of the two die sets (24) are movable with respect to one another in a direction perpendicular to the direction of movement of the movable members of the press, the relative approach of the said dies (26,27) being controlled by wedge means (39) displaceable in the direction of movement of the movable members of the press.

9. A press tool according to Claim 7, characterised by the fact that the two dies (50,51) of each of the two die sets (49) are movable with respect to one another in the direction of movement of the movable members of the press, the relative approach of the said dies (50, 51) being directly controlled by these movable members, and by the fact that the two punches (54) of the two die sets (49) are slidable in a direction perpendicular to the direction of movement of the movable members of the press and are controlled by wedge means (57) displaceable in the direction of movement of these movable members.

FIG. 1

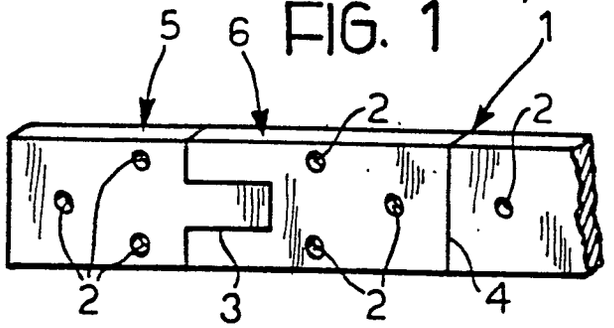


FIG. 3

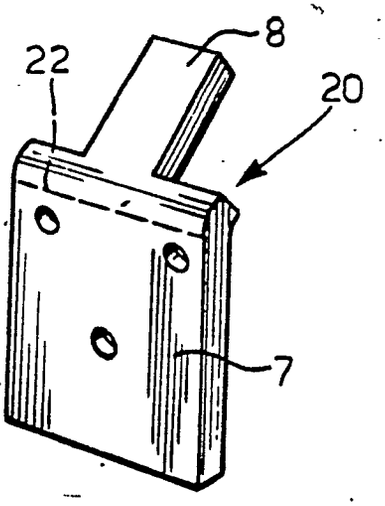


FIG. 2

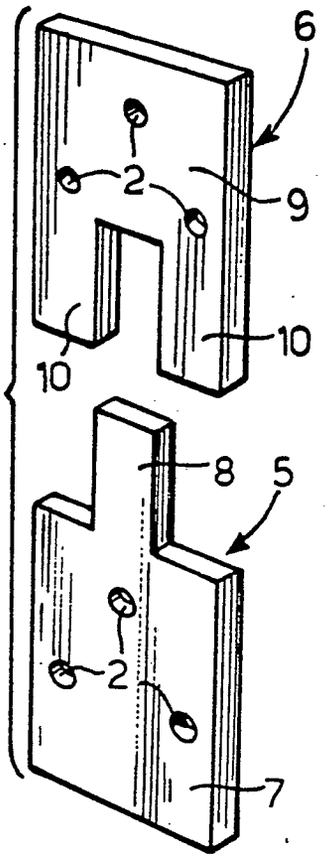


FIG. 4

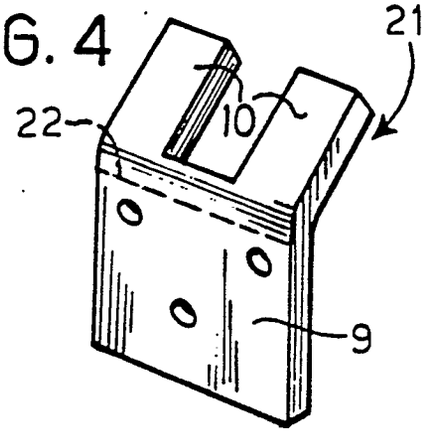


FIG. 5

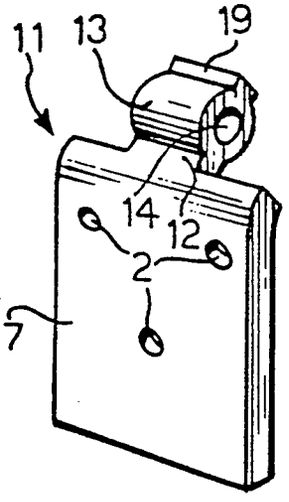


FIG. 6

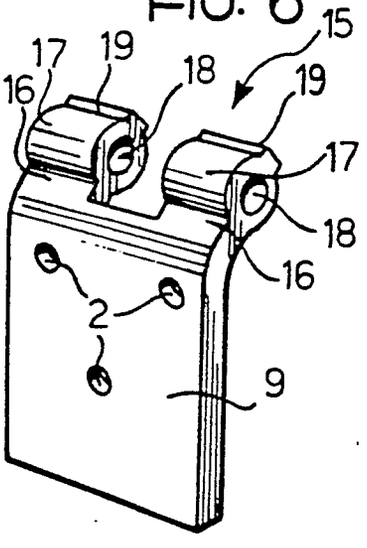


FIG. 11

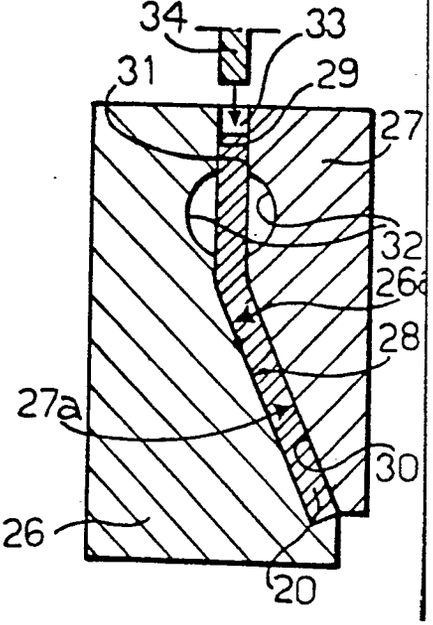
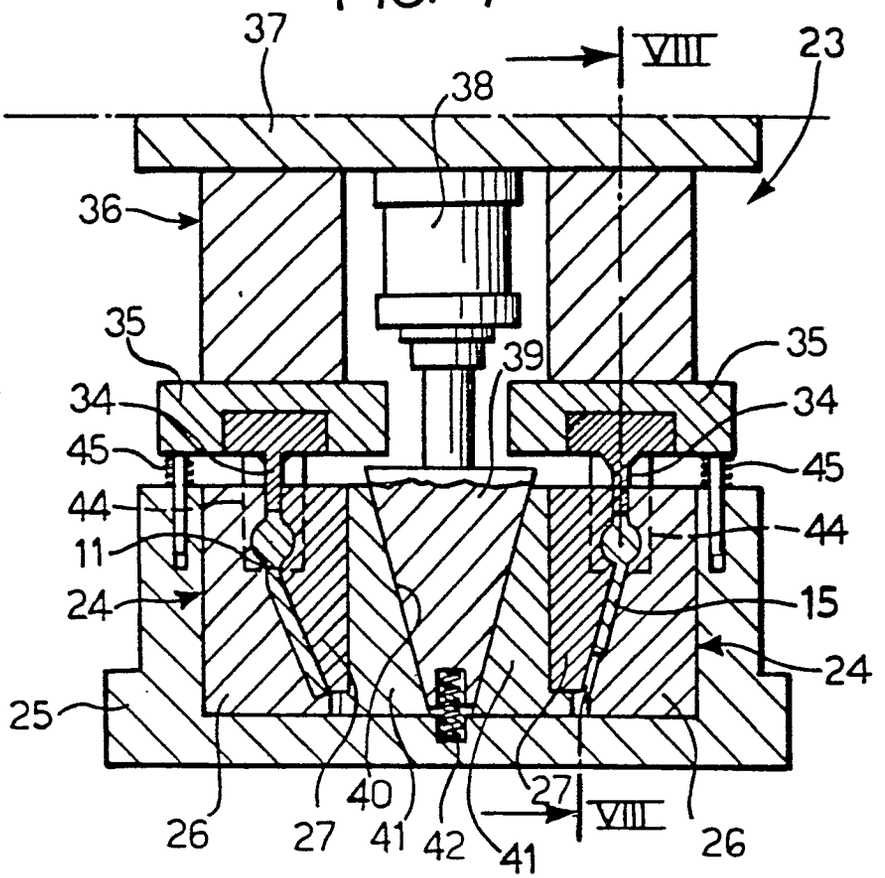


FIG. 7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VIII
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VIII
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FIG. 8

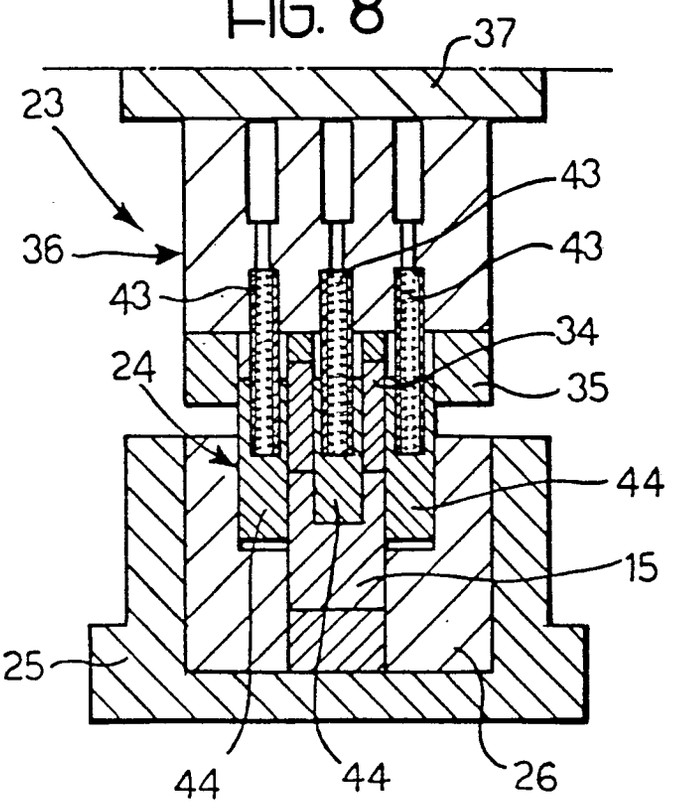
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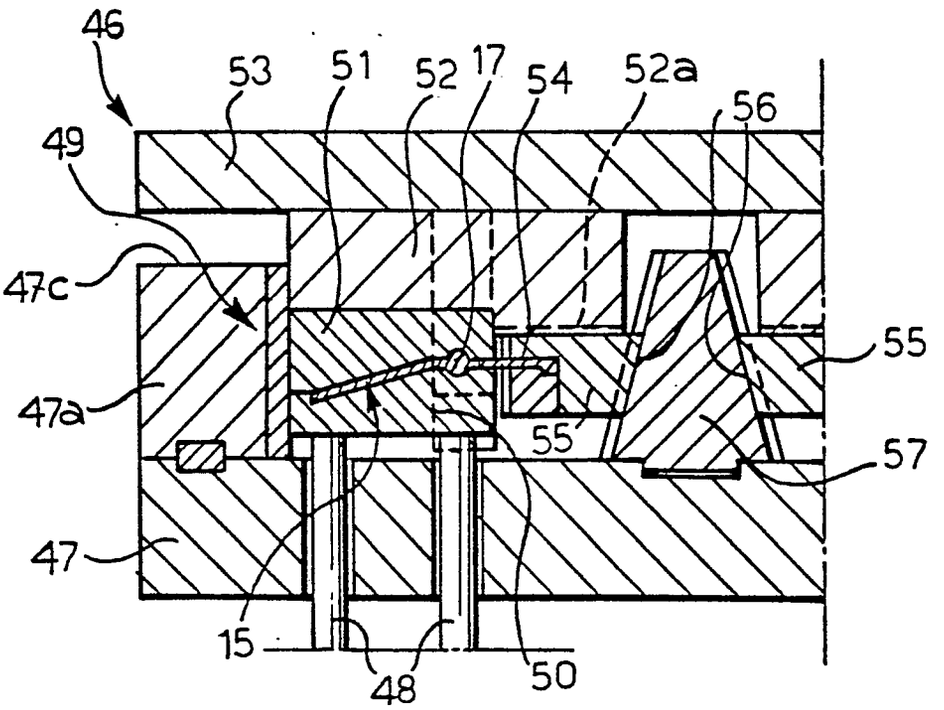
FIG. 10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47c
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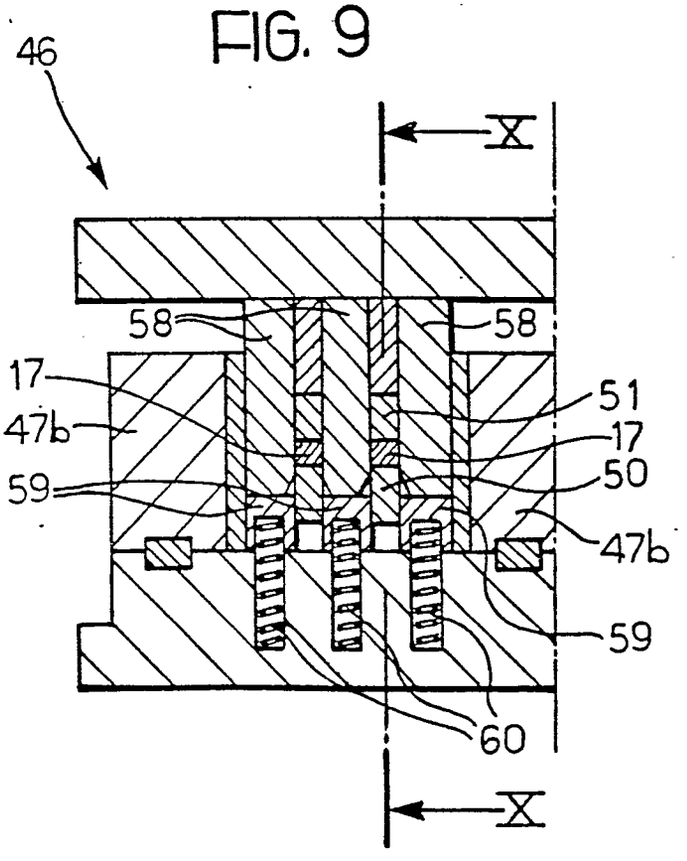
FIG. 9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47b
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