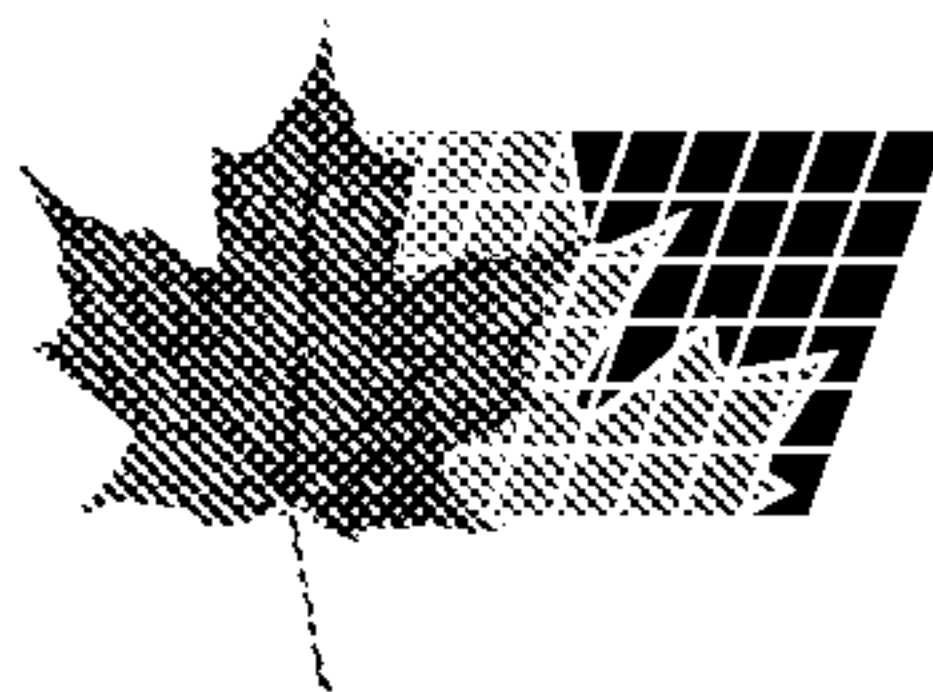




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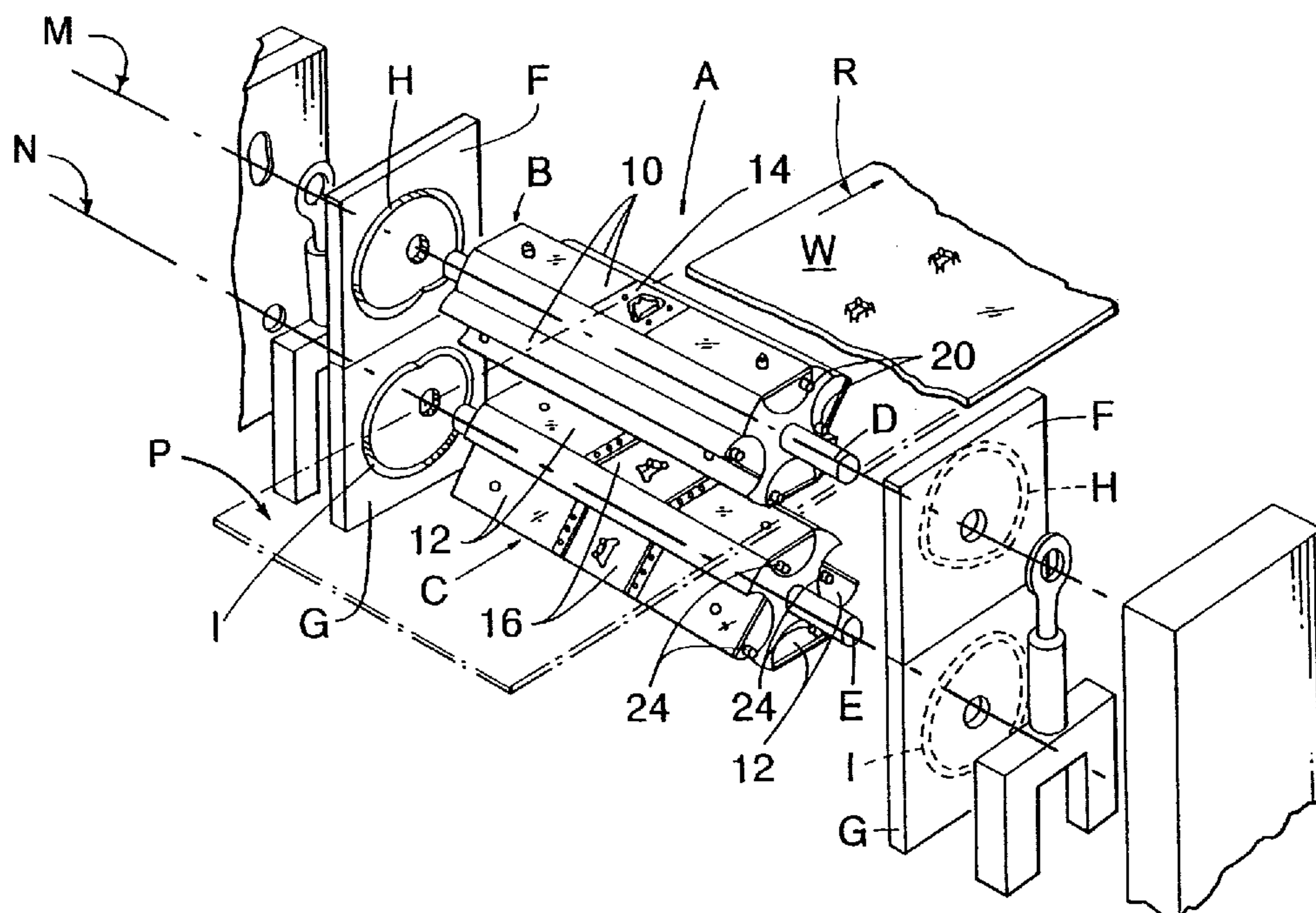
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(54) **MATRICE DE DECOUPAGE ET DE FORMAGE**

(54) **TWO STAGE DIE SET**



(57) A two stage die set for sequentially blanking an opening in a work piece, and thereafter forming edges of the work piece around the opening and having a male die assembly, having a male blanking die, a male forming die spaced from the male blanking die, and a recess therebetween, a female die assembly having a generally hollow female die sleeve, the die sleeves being shaped and dimensioned to correspond to the shape of the male blanking die and to receive it in telescopic relation, a moveable support plate located around the female die sleeve the moveable plate being biased so as to urge it into a first extended position, and the moveable plate yielding to the male forming die of the male die assembly, when the male and female dies are closed together, so that the male blanking die, in co-operation with the female die sleeve blanks out a portion of a work piece and forms an opening, and upon further relative movement between the male and female dies towards one another, the male forming die co-operates with moveable plate and the female die sleeve, to cause deformation of an edge portion of the work piece around the opening, ejector apparatus in the male blanking die being resiliently movable, so that it is withdrawn into blanking die, upon closure of the die on a work piece, and, after blanking of the portion of the work piece the ejector is extended from the male die, and displaces the blanked out slug portion, and, a passageway in the female die assembly communicating with the female die sleeve for receiving the slug which is then disposed of through the passageway.

ABSTRACT OF THE DISCLOSURE

A two stage die set for sequentially blanking an opening in a work piece, and thereafter forming edges of the work piece around the opening and having a male die assembly, having a male blanking die, a male forming die spaced from the male blanking die, and a recess therebetween, a female die assembly having a generally hollow female die sleeve, the die sleeves being shaped and dimensioned to correspond to the shape of the male blanking die and to receive it in telescopic relation, a moveable support plate located around the female die sleeve the moveable plate being biased so as to urge it into a first extended position, and the moveable plate yielding to the male forming die of the male die assembly, when the male and female dies are closed together, so that the male blanking die, in co-operation with the female die sleeve blanks out a portion of a work piece and forms an opening, and upon further relative movement between the male and female dies towards one another, the male forming die co-operates with moveable plate and the female die sleeve, to cause deformation of an edge portion of the work piece around the opening, ejector apparatus in the male blanking die being resiliently movable, so that it is withdrawn into blanking die, upon closure of the die on a work piece, and, after blanking of the portion of the work piece the ejector is

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extended from the male die, and displaces the blanked out slug portion, and, a passageway in the female die assembly communicating with the female die sleeve for receiving the slug which is then disposed of through the passageway.

FIELD OF THE INVENTION

The invention relates to a die set for processing a work piece, in two stages in a single die, and in particular to a die set for first of all blanking out an opening, and then forming edge formations in the work piece around the opening.

BACKGROUND OF THE INVENTION

10 In various work piece processing operations, and in particular in the processing of sheet metal, it is frequently desirable to form openings in a work piece, and then to form a variety of formations around the edge of the opening.

20 In the past, traditional engineering has generally dictated that these two steps be carried out in two separate dies sets. In certain cases progressive dies have been used, in which a series of dies treat the same work piece, and the work piece moves in an intermittent start stop fashion through the progressive dies. In other proposals, a work piece of a predetermined size is inserted into a die. In a first operation the edge of the work piece is trimmed, and then the die descends further and forms the rest of the work piece.

This process is relatively slow however and is unsuitable for many applications.

Still other proposals have been made in which a work piece is punched out of the sheet, and the punched out piece

is then worked in the same die. Again this is a relatively slow process.

It is desirable as far as possible to speed up the processing of a metal work piece, thereby reducing its cost.

This is particularly true in the case of a rotary apparatus for processing a work piece on a continuously moving line. Such rotary apparatus is disclosed in U.S. Letters Patent 5,040,397, inventor Ernest R. Bodnar.

10 In such an apparatus a plurality of dies are mounted on respective upper and lower die supports on respective upper and lower rollers. The sheet metal work piece passes between the two roller and is processed by the die set.

The operation of the dies on the work sheet metal must therefore be carried out at high speeds so that the line can be run at an economical speed.

20 A typical product manufactured on such a line is shown in U.S. Letters Patent 4,793,113, inventor Ernest R. Bodnar. It will be observed that the products illustrated in the second patent comprise a series of openings formed through a work piece, and flanges formed around the opening. Longitudinal bend formations are formed in the product, but these of course would be formed by conventional roll forming dies.

If old technology single stage dies were used on the rotary apparatus, to make this product, then it was necessary to provide two rotary stations, the first to form

the openings and the second to form the edge flanges. In practice, since the openings in the product of 4,793,113 were relatively close together it was necessary to have four such rotary stations.

This involved extra expense and also involved the necessity to carefully register the locations of the dies relative to one another by spacing the rotary units precisely, so as to ensure that the second die, forming the edge registered precisely with the opening formed by the first die.

While this was entirely feasible and was in fact done with some degree of commercial success, it was an expensive solution to the problem.

BRIEF SUMMARY OF THE INVENTION

With a view to overcoming the various disadvantages noted above, the invention comprises a two stage die set for sequentially blanking an opening in a work piece, and thereafter forming edge formations on said work piece around said opening and comprising a male die assembly, in turn comprising a male blanking die member defining a male blanking edge, a male forming die member spaced from said male blanking die member defining a male forming corner, recess means between said blanking die and said forming die, a female die assembly in turn comprising a generally hollow female die sleeve member, said female die sleeve member being shaped and dimensioned to correspond to said male

blanking die member and to receive the same in telescopic relation and defining inner and outer sides, blanking edge means on the inner side of said female die sleeve, forming corner means on the outer side of said female die sleeve, a moveable female support plate means located around said outer side of said female die sleeve member, and pressure means operable on said moveable female support plate means, whereby to urge the same into a first position, and said moveable plate means being adapted to yield to said male forming die member of said male die assembly, when said male and female dies are closed together, whereby said male blanking die co-operates with said female die sleeve of said female die assembly to blank out a portion of a work piece and form an opening therein, and whereby upon further relative movement between said male and female die assemblies towards one another, said male forming die sleeve will co-operate with said moveable support plate means and said female die sleeve, to cause deformation of an edge portion of said work piece around said opening, ejector means in said male blanking die member, said ejector means being resiliently movable, whereby the same may be withdrawn into said blanking die member, upon closure of said blanking die member on said work piece, and, after blanking of said portion of said work piece by said male and female die members, said ejector means being adapted to be extended from said male blanking die, whereby to displace said

blanked out portion, and, passageway means in said female die assembly communicating with the interior of said female die sleeve for receiving said blanked out portion of said work piece, whereby the same may be disposed of through said passageway means.

10 The invention further comprises such a two stage die set and wherein said female die assembly includes a movable support plate means is in the form of a generally rectangular plate, edge rib means on said plate, extending outwardly from opposite sides of said plate, and a pair of retaining rails, defining retaining ribs interengaging with said edge ribs, said retaining rails defining spaces enclosed by said retaining ribs, whereby said edge ribs may move relative thereto within said spaces.

20 The invention further comprises such a two stage die set and including die support means for supporting said male and female die assemblies, recess means in said die support means, and spring means extending between said recess means and said male die assembly and spring means extending from said recess means and said female die assembly, and means for securing respective said male and female die assemblies to respective said support means.

The invention further comprises such a two stage die set for use in a rotary apparatus, and having upper and lower rotary members, and having at least one generally semi-cylindrical die support member in each of said upper

and lower rotary members, and wherein said male die assembly is supported on said semi-cylindrical die support member of said upper rotary apparatus and wherein said female die assembly is supported on said semi-cylindrical die support member of said lower rotary apparatus, and including upper spring recess means in said upper semi-cylindrical die support member, and including lower spring recess means in said lower semi-cylindrical die support member.

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The invention further comprises such a two stage die set and including slug ejection opening means in said lower semi-cylindrical die support member for receiving a slug from said female die, and ejecting the same.

20

The invention further comprises such a two stage die set and wherein said female die sleeve includes a female hollow die sleeve, of regular section from top to bottom, and a female die base sleeve, defining ledge means engaging the lower end of said hollow die sleeve, and opening means in said die base member registering with said hollow female die sleeve, said die base member being attachable to said die support member, for supporting said hollow die sleeve in position, and securing means for securing said hollow die sleeve to said die base member.

The invention further comprises such a two stage die set wherein said female die sleeve defines in plan, a shape having at least some linear portions and having radiussed corners joining said linear portions, and wherein said

linear portions define a predetermined first width, and wherein said radiussed corners define a predetermined second width less than said first width.

The invention further comprises such a two stage die set wherein said female die sleeve defines a predetermined first height, and wherein said movable support plate means, in its said first position, defines a predetermined second height, greater than said first height, whereby upon closing of said male and female die assemblies, said work piece is
10 initially clamped between said male forming die member and said movable support plate means, just prior to blanking of said opening.

The invention further comprises such a two stage die set, and wherein said die base member defines a generally frustoconical shape, and wherein said movable plate means defines an interior generally frustoconical recess, shaped to substantially correspond to said frustoconical shape of said die base, whereby said mounting plate means may be moved over and around said die base means.

20 In another aspect of the invention there is a two stage die set for use in a rotary apparatus. The two stage die set has upper and lower rotary members and at least one generally semi-cylindrical die support member in each of the upper and lower rotary members, for sequentially blanking an opening in a work piece, and thereafter forming edge formations on the work piece around the opening. It is

characterized by a male forming die assembly, in turn comprising a male blanking die member defining a male blanking edge. A male forming die member is spaced from the male blanking die member to define a male forming corner. There is a recess means between the blanking die and the forming die. A female die assembly in turn comprises a generally hollow female die sleeve member, shaped and dimensioned to correspond to the male blanking die member and to receive the same in telescopic relation and defining
10 inner and outer sides. The male die assembly is supported on the semi-cylindrical die support member of the upper rotary apparatus and the female die assembly is supported on the semi-cylindrical die support member of the lower rotary apparatus. An upper spring recess means is in the upper semi-cylindrical die support member, and lower spring recess means is in the lower semi-cylindrical die support member. There is a blanking edge means on the inner side of the female die sleeve and a forming corner means on the outer side of the female die sleeve. A moveable female support
20 plate means is located around the outer side of the female die sleeve member. A pressure means is operable on the moveable female support plate means, whereby to urge the same into a first position. The moveable plate means is adapted to yield to the male forming die member of the male die assembly, when the male and female dies are closed together, whereby the male blanking die co-operates with the

female die sleeve of the female die assembly to blank out a portion of a work piece and form an opening therein. Upon further relative moveable between the male and female die assemblies towards one another, the male forming die sleeve will co-operate with the moveable support plate means and the female die sleeve, to cause deformation of an edge portion of the work piece around the opening. The female die sleeve defines a predetermined first height. The movable support plate means, in the first position, defines a
10 predetermined second height, greater than the first height, whereby upon closing of the male and female die assemblies the work piece is initially clamped between the male forming die member and the moveable support plate means, just prior to blanking of the opening, and the work piece is blanked prior to any deformation thereof. An ejector means is in the male blanking die member. The ejector means is resiliently moveable, whereby the same may be withdrawn into the blanking die member, upon closure of the blanking die member on the work piece, and, after blanking of the portion
20 of the work piece by the male and female die members. The ejector means is adapted to be extended from the male blanking die, whereby to displace the blanking outer portion. The passageway means in the female die assembly communicates with the interior of the female die sleeve for receiving the blanked out portion of the work piece, whereby the same may be disposed of through the passageway means.

In an additional feature of that aspect of the invention the female die assembly includes a movable support plate means in the form of a generally rectangular plate. An edge rib means on the plate extends outwardly from opposite sides of the plate, and a pair of retaining rails, defining retaining ribs interengaging with the edge ribs, the retaining rails defining spaces enclosed by the retaining ribs, whereby the edge ribs may move relative thereto within the spaces.

10 In another additional feature of that aspect of the invention the two stage die set includes the male and female die assemblies, recess means in the die support means and spring means extending between the recess means and the male die assembly. Spring means extends from the recess means and the female die assembly, and means for securing respective the male and female die assemblies to respective the support means.

In still another additional feature of that aspect of the invention the two stage die set includes slug ejection
20 opening means in the lower semi-cylindrical die support member for receiving a slug from the female die, and ejecting the same.

In a still further alternative feature of that aspect of the invention the female assembly includes a female hollow die sleeve, of regular section from top to bottom, and a female die base member, defining ledge means engaging

the lower end of the hollow die sleeve. The opening means in the die base member registers with the hollow female die sleeve. The die base member is attachable to the die support member, for supporting the hollow die sleeve in position, and securing means for securing the hollow die sleeve to the die base member.

In a yet further alternative feature of that aspect of the invention the die base member defines a generally frusto-conical shape and the movable plate means defines an
10 interior generally frusto-conical recess, shaped to substantially correspond to the frusto-conical shape of the die base. The mounting plate means may be moved over and around the die base means.

In a still further alternative feature of that aspect of the invention the female die sleeve defines, in plan, a shape having at least some linear portions and having radiused corners joining the linear portions. The linear portions define a predetermined first width, and the radiussed corners define a predetermined second width less
20 than the first width.

In a further aspect of the invention, there is a rotary apparatus having a two stage die set. The rotary apparatus has upper and lower rotary members, and has at least one generally semi-cylindrical die support member in each of the upper and lower rotary members. The two-stage die set has a male die assembly supported on the semi-cylindrical die

support member of the upper rotary apparatus and a female die assembly supported on the semi-cylindrical die support member of the lower rotary apparatus. Each of the die sets is characterized by a male die assembly, in turn comprising a male blanking die member defining a male blanking edge. A male forming die member spaced from the male blanking die member defines a male forming corner. There is a recess means between the blanking die and the forming die. A female die assembly in turn comprises a generally hollow female die sleeve member, shaped and dimensioned to correspond to the male blanking die member and to receive the same in telescopic relation and defines inner and outer sides. There is an upper spring recess means in the upper semi-cylindrical die support member, and a lower semi-cylindrical die support member. A blanking edge means is located on the inner side of the female die sleeve, and forming corner means on the outer side of the female die sleeve. A moveable female support plate means is located around the outer side of the female die sleeve member. A pressure means is operable on the moveable female support plate means, whereby to urge the same into a first position. The moveable plate means is adapted to yield to the male forming die member of the male die assembly, when the male and female dies are closed together, whereby the male blanking die co-operates with the female die sleeve of the female die assembly to blank out a portion of a work piece

and form an opening therein, and whereby upon further relative movement between the male and female die assemblies towards one another, the male forming die sleeve will co-operated with the moveable support plate means and the female die sleeve, to cause deformation of an edge portion of the work piece around the opening. The female die sleeve defines a predetermined first height, and the movable support plate means, in its first position, defines a predetermined second height, greater than the first height, 10 whereby upon closing of the male and female die assemblies, the work piece is initially clamped between the male forming die member and the moveable support plate means, just prior to blanking of the opening, and the work piece is blanked prior to any deformation thereof. The ejector means in the male blanking die member is resiliently moveable, whereby the same may be withdrawn into the blanking die member, upon closure of the blanking die member on the work piece, and, after blanking of the portion of the workpiece by the male and female die members, the ejector means is adapted to be 20 extended from the male blanking die, whereby to displace the blanked out portion. The passageway means in the female die assembly communicates with the interior of the female die sleeve for receiving the blanked out portion of the work piece, whereby the same may be disposed of through the passageway means.

In an additional feature of this aspect of the

invention the female die assembly includes a movable support plate means in the form of a generally rectangular plate, edge rib means on the plate, extending outwardly from opposite sides of the plate, and a pair of retaining rails, defining retaining ribs interengaging with the edge ribs. The retaining rails define spaces enclosed by the retaining ribs, whereby the edge ribs may move relative thereto within the spaces.

10 In another additional feature of this aspect of the invention the combination includes die support means for supporting the male and female die assemblies, recess means in the die support means, and spring means extending between the recess means and the male die assembly and spring means extending from the recess means and the female die assembly, and means for securing respective the male and female die assemblies to respective the support means.

20 In an additional feature of that aspect of the invention the combination includes a slug ejection opening means in the lower semi-cylindrical die support member for receiving a slug from the female die, and ejecting the same.

In still another additional feature of that aspect of the invention the female die assembly includes a female hollow die sleeve, of regular section from top to bottom, and a female die base member defining ledge means engaging the lower end of the hollow die sleeve, and opening means in the die base member registering with the hollow female die

sleeve the die base member being attachable to the die support member, for supporting the hollow die sleeve in position, and securing means for securing the hollow die sleeve to the die base member.

In yet another additional feature of that aspect of the invention the die base member defines a generally frusto-conical shape, wherein the movable plate means defines an interior generally frusto-conical recess, shaped to substantially correspond to the frusto-conical shape of the die base. The mounting plate means may be moved over and around the die base means.

In still another additional feature of that aspect of the invention the female die sleeve defines in plan, a shape having at least some linear portions and having radiused corners joining the linear portions. The linear portions define a predetermined first width, and the radiused corners define a predetermined second width less than the first width.

In still another aspect of the invention, there is a rotary press having a pair of, rotating assemblies mounted to counter-rotate in mutual co-operation to form a web work piece as it passes in a forming plane lying between the rotating assemblies. The web work piece moves in a work piece feed direction. Each of the assemblies has a first member mounted for rotation about a main rotor axis parallel to the forming plane, and perpendicular to the feed

direction. Each of the rotating assemblies has a die support member mounted to pivot relative to the first member, about an axis parallel to the main rotor axis. One member of a pair of mating dies is mounted to each of the die support members. The dies are moveable to engage the web work piece as the rotating assemblies rotate. The press has a governor for controlling the orientation of each of the mating dies relative to the other when the press is in motion. One of the pair of mating dies has a first element
10 and a second element. The first element is moveable relative to the second element under rotation of the one rotating assembly, while the die engages the web work piece.

In an additional feature of this aspect of the invention, one of the elements is resiliently mounted relative to the support member.

In another additional feature of this aspect of the invention, the first element is spring mounted relative to the support member and rotation of the first assembly causes the first element to engage the web work piece, the spring
20 to compress, and the first element to move relative to the second element in a direction perpendicular to the plane of the web work piece.

In yet another additional feature of this aspect of the invention, the first element is mounted for telescoping motion relative to the second element.

In still yet another additional feature of this aspect

of the invention, when viewed perpendicular to the plane of the web work piece, the second element is surrounded by the first element.

In a further additional feature of this aspect of the invention, the second element is a sleeve mounted within the first element.

In yet a further additional feature of this aspect of the invention, the other of the pair of dies has a blanking die portion and a forming die portion. The dies are
10 moveable relative to each other as the rotating assemblies counter-rotate to cut a blank from the web work piece, thereby defining an opening in the web work piece. The opening has an edge; and the dies are further moveable relative to each other to form the edge of the opening.

In still yet a further additional feature of this aspect of the invention, the other of the pair of dies has a forming portion and a blanking portion. The blanking portion has a blanking edge. The first element is a forming
20 plate for engaging the forming portion. The second element includes a blanking edge for co-operating with the blanking edge of the blanking portion. The dies are moveable to engage the forming plate and the forming portion on opposite faces of the web work piece. The blanking edges of the dies are moveable, under counter-rotation of the rotating assemblies, to cut a blank from the web work piece to define

an opening therein. The opening has an edge and the dies are operable to form the edge of the opening.

In another additional feature of this aspect of the invention, the other of the pair of dies has a forming portion and a blanking portion. The forming portion has a forming corner and the blanking portion has a blanking edge. The first element is a forming plate for engaging the forming portion. The second element is a die having a
10 blanking edge for co-operating with the blanking edge of the blanking portion and a forming edge for co-operation with the forming corner. The dies are moveable to engage the forming plate and the forming portion on opposite faces of the web work piece. The blanking edges of the dies are moveable relative to each other to cut a blank from the web work piece to define an opening therein and the opening has an edge. The forming edge is moveable relative to the forming plate and the forming corner to form dies are operable to form the edge of the opening out of the plane.

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In yet another additional feature of this aspect of the invention, the forming edge is operable to form the edge of the opening about the forming corner into a flange. In yet a further additional feature of this aspect of the invention, the dies are operable to cut a blank from the web work piece. One of the dies has a chamber for receiving the

blank cut from the work piece. The press includes a slug ejector mounted to one of the dies. The slug ejector is operable to eject the blank from the chamber.

In still yet a further additional feature of this aspect of the invention, the chamber is formed to receive an advancing portion of the other of the dies, and a passageway extends from the chamber to an exit from the press. The advancing portion includes the slug ejector, and the slug
10 ejector is operable to urge the blank from the chamber to the passageway. In still yet another additional feature of this aspect of the invention, the slug ejector is a spring loaded pin.

In still another aspect of the invention, there is a rotary press having a pair of rotating assemblies mounted to counter-rotate in mutual co-operation to perform a forming operation on a web work piece as it passes in a forming plane lying between the rotating assemblies. The web work
20 piece moves in a work piece feed direction. Each of the rotating assemblies has a first member mounted for rotation about a main rotor axis parallel to the forming plane and perpendicular to the feed direction. Each of the rotating assemblies has a die support member mounted to pivot relative to the first member, about an axis parallel to the main rotor axis. One die of a pair of mating dies is mounted

to each of the die support members. One of the pair is a female die set. The other of the pair is a male die set. The dies are moveable to engage the web work piece as the rotating assemblies rotate. The die support member is controlledly pivotable to present the die to the work piece at a controlled angular orientation. The female die set has a first element and a second element. The first element is moveable relative to the second element under rotation of the one rotating assembly, while the die engages the web
10 work piece.

In an additional feature of that aspect of the invention the male die set has a forming die and a blanking die, and, in plan view, the blanking die is surrounded by the forming die. The forming die has a forming corner on an edge thereof facing the blanking die. The blanking die has a blanking edge on an edge thereof facing the blanking die. A gap is defined between the forming corner and the blanking edge. The first element of the female die set is a forming
20 plate for co-operation with the forming die. The second element of the female die set is a female die having a blanking edge for co-operation with the blanking edge of the male die set, and a forming edge for co-operation with the forming corner of the forming die of the male die set. The female die is reciprocally moveable within the gap. The assemblies are rotatable to clamp the web work piece between

the forming plate and the forming die. The assemblies are rotatable to operate the blanking edges of the blanking die and the female die to cut a blank from the web work piece to define an opening having an edge. The assemblies are rotatable to move the forming edge of the female die relative to the forming corner of the forming die to form the edge into a flange.

10 In still yet another additional feature of that aspect of the invention the forming plate is resiliently mounted relative to the support member, and the female die is rigidly mounted to the support member. In yet a further additional feature of that aspect of the invention the female die is a sleeve and has a chamber defined therein for receiving the blank cut from the web work piece. The chamber has a passageway extending therefrom to an exit from the rotary press. The male blanking die has a slug ejector mounted thereto for urging the blank to leave the chamber.

20 The various features of novelty which characterize the invention are pointed out with more particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and

described preferred embodiments of the invention.

IN THE DRAWINGS

Figure 1 is a schematic perspective illustration of a pair of upper and lower die support members, showing the upper and lower male and female die assemblies of the die set in accordance with the invention;

Figure 2 is a section along the line 2-2 of the male and female die set, showing it in an open position just prior to closing on a work piece;

10 Figure 3 is a section corresponding to Figure 2, showing the die set in a first partially closed position, blanking out a slug from a work piece;

Figure 4 is a section corresponding to Figures 2 and 3 showing the die set in a third position, forming the edges of the work piece around the opening formed in Figure 3;

Figure 5 is a plan view of the female die assembly, showing various portions in phantom, and,

Figure 6 is a plan view of the male die assembly showing various portions thereof in phantom.

20 DESCRIPTION OF A SPECIFIC EMBODIMENT

Referring first of all to Figure 1, it will be seen that this illustrates, in isolation, a pair of upper and lower semi-cylindrical die support members. Such semi-cylindrical die support members are used in the rotary apparatus described in the U.S. patent 5,040,397 of E.R. Bodnar referred to above.

As will be well understood from studying the patent, such rotary die supports will close and open on a work piece at a relatively high rate of speed. For example, it is anticipated that the line speed of such a rotary forming line would be upwards of 300 feet per minute or more.

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Since the openings being formed in a work piece, moving at this speed, will in most cases be only fractions of an inch apart, in some cases it will be appreciated that the rotary apparatus will be rotating at a high rate of speed and the dies will be closing and opening with great rapidity.

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This however is merely mentioned by way of preliminary remarks. It will be appreciated that the invention described herein will be applicable to a great many situations both in rotary apparatus and also in other forms of reciprocating punch presses of conventional design. However, in such punch presses, the use of the invention will enable significant advantages both in the reduction of the number of operations required on a work piece and also in speeding up the production to a very significant degree. Thus, while the invention is described in general terms in relation to its use in a rotary apparatus as referred to above, the invention is not in any way to be considered as confined solely to use in a rotary apparatus, but will be of application in a wide variety of processing applications for processing a work piece where two operations are to be

performed sequentially at high speed, in a single die set whether on a conventional press, or on a rotary apparatus.

In addition, it will be appreciated that there are presses known as "flying dies" in which dies which are initially stationary are accelerated up to the speed of a moving work piece and are then closed and opened again, and are returned back to their at rest position, with this function being repeated over and over again as the work piece moves along. Dies sets of the type of the present
10 invention could also be applicable to such flying dies.

Consequently, it will be appreciated that the invention is related generally to dies performing a two stage operation at relatively high speed a single die set, whether such dies are in a conventional press, or a flying die, or in a rotary apparatus.

Furthermore, while reference has been made herein repeatedly to operations on sheet metal, it will be appreciated that such dies may be required to process a variety of different types of material, and therefore the
20 reference to sheet metal is merely by way of example, for the sake of explanation, and without limitation. Such dies may be utilized for many different applications on many different forms of material.

Referring to Figure 1, it will be seen that the rotary apparatus which is illustrated generally as A comprises

upper and lower roll units B and C, supported on shafts D and E in respective plates F and G. Roll units B and C rotate about the respective axes M and N of shafts D and E.

Upper and lower die supports 10 and 12 are of generally semi-cylindrical shape in section, and are supported in the upper and lower roll units so that they may partially rotate relative thereto as the upper and lower roll units rotate.

Guide pins 20 and 24, at opposite ends of the die supports 10 and 12 are guided in grooves H and I in end plates F and G.

The work piece is illustrated as W, and moves in the direction of the arrow R between the upper and lower roll units B and C. Work piece W is shown in a plane P extending between roll units B and C. It will be understood that the die sets of roll units B and C move at the same speed as work piece W (as noted below) in the direction of arrow R. As such, roll units B and C counter-rotate relative to each other. When viewed from the direction illustrated in Figure 1, roll unit B has a counter-clockwise direction of rotation, and roll unit C has a clockwise direction of rotation.

Turning to Figure 1A, it will be seen that the semi-cylindrical upper and lower die supports 10 and 12 are shown as supporting a die set

comprising respective male and female die assemblies 14 and 16. The die supports 10 and 12 are shown as being guided by respective guide pins 18-20 and 22-24. The function of such guide pins is described in the aforesaid U.S. Letters Patent, and further description is omitted from this application, since it is superfluous. Essentially the purpose of such guide pins is to ensure that the die supports, and die assemblies 14 and 16, are moved into a horizontal spaced apart parallel position just prior to closing, during closing and just after opening, so as to ensure that the die assemblies 14 and 16 register precisely with one another.

However, all of this is explained in the aforesaid U.S. Letters Patent, and no further description is given herein.

The registering of upper and lower die assemblies is well-known to be essential to the satisfactory operation of dies both in conventional presses, and in flying dies, and means for registration in those situations are well-known in the art.

Referring now to Figure 2, it will be seen this is sectioned along the line 2-2 of the die set 14-16 just prior to closing.

The die assemblies 14 and 16 are shown associated with die supports partially illustrated as 10 and 12. However, as explained above, this is purely by way of illustration and without limitation, since such die assemblies 14 and 16

could be used and supported otherwise than with the semi-cylindrical die supports 10 and 12.

Referring first of all to the male die assembly 14 it will be seen to comprise a central male blanking die member 30, and a male forming die member 32.

The shapes of the dies 30 and 32 are shown in Figure 6, and will depend on the shape of the opening to be blanked, and on the shape of the edge formations to be formed.

10 A space 34 is defined between the male blanking die member 30 and the male forming die member 32. One or more central openings 36 are provided in the blanking die 30 (see Figure 6). One or more ejector pins 38 are located in such openings 36. The ejector pins 38 have collars 40, and are adapted to slide in recesses 42. In this embodiment recesses 42 are formed in the die support 10, although clearly they could be formed in some other block or support (not shown) in another application.

20 Within the recesses 42 there are located springs 44, adapted to urge the ejector pins 38 outwardly for reasons to be described below.

The male forming die 32 is secured, in this case to the die support 10, by bolts 46. The male blanking die 30 is secured to the die support 10 by bolts 46 (Figure 6).

The blanking die 30 defines blanking edges 48-48. The forming die 32 defines radiussed forming corners 50-50.

Referring now to the lower or female die assembly 16,

this will be seen to comprise a female die sleeve 52, defining a hollow interior 53 supported on a base member 54. Base member 54 is secured by bolts 55 to support 12, and defines ledges 56 for engaging the lower end of the sleeve 52. The base member 54 defines an opening 58 which is of greater size than the hollow interior 53 defined by the sleeve member 52 for reasons to be described.

10 The sleeve member 52 defines a blanking edge 60, around its inner side, and defines a forming corner 62, around its outer side.

20 The blanking edge 60 co-operates with the blanking edge 48 of the male blanking die 30 of the male die assembly 14, to blank out a slug portion of a work piece and form an opening, the work piece being indicated generally as W, when the dies move towards one another (Figure 3). It will be appreciated that in the embodiment shown in Figure 1, the two die assemblies move towards one another essentially simultaneously from opposite sides of the work piece. However this will not always be the case, in many cases the female die assembly 16 will be in a fixed location and the male die assembly 14 will be in some form of movable press, so that the male die assembly will move relative to the female die assembly, while the female die assembly remains stationary.

 However, this does not affect the operation of the invention, and is merely mentioned here for the sake of

clarification.

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10 In order to form the edges of the work piece around the opening blanked out by the blanking edges 48 and 60, a movable female support plate 64 is located around the outside of the female die sleeve 52. Movable die support plate 64 comprises an upper generally planar surface 66, and a lower frustoconical shaped surface 70 adapted to accommodate the shape of the base 54. The outer periphery of the support plate 64 is generally of vertical shape, and defines edge ribs 72-72. Within the moveable support plate 64 there are defined a plurality of, in this case six, spring recesses 74-74. Springs 76-76 are received within recesses 74-74. Springs 76-76 are further received in recesses 78-78, located, in this case, in the semi-cylindrical die support 12.

20 It will be appreciated that the springs could be accommodated in recesses in other forms of support means (not shown) other than the semi-cylindrical supports 12, as described above, where such die sets are used in other forms of presses such as flying dies or conventional presses.

Springs 76 urge the plate 64 upwardly towards the male forming die 50 of the male die assembly 14.

In its extended position (Figure 2) the plate 64 is extended somewhat higher than the top of sleeve 52.

Upward movement is restricted by means of the side rails 80-80. Side rails 80-80 have retention ribs 82-82

engaging the edge ribs 72-72. Rails 80-80 define spaces below the ribs 82-82 within which the ribs 72-72 can move downwardly and upwardly in a manner described below.

Rails 80 are secured for example by means of bolts 84, to the semi-cylindrical die support 12.

The female die sleeve 52 is secured in the base 54 by means of a one or more set screws 86, so that the female die sleeve 52 is held securely in position.

10 A passageway 88 in support 12 communicates with the die base, to discharge the slug S to the exterior.

In operation, starting with Figure 2, a work piece W is assumed to be passing through the male and female die assemblies 14 and 16, and the male and female die assemblies 14 and 16 are assumed to be moving, at the same speed as the work piece W. It will of course be appreciated however that this is true only in the case of for example rotary apparatus, and flying die apparatus.

At this stage the movable forming support plate 64 is located above the female die sleeve 52.

20 In the case of a conventional press, the work piece W would not be moving but would simply be placed in position and would be stationary.

The male and female die sets 14 and 16 then move to close relative to one another. As explained they move together in the rotary apparatus. However, one of the die sets may move relative to the other while the other remains

stationary, in other presses.

The next stage is as shown in Figure 3, with the die sets partially closed. During this time the male forming die 32 of the male die assembly 14 will engage the work piece, on one side, and the moveable support plate 64 of the female die assembly 16 will engage it on the underside, thus securely gripping the work piece. This occurs before engagement of the male and female dies 30 and 52.

10 Subsequently it will be seen that the moveable support 64 moves downwardly and the edges 48 and 60 engage the work piece W in such a manner as to blank out a slug S of material. During this brief moment, the ejector pin 38 will be seen to have been retracted somewhat into the recess 42, against the pressure of spring 43.

Once the blanking out operation has taken place, which will take place in a fraction of a second, in most cases, then the ejector pin 38 will be urged downwardly by the spring 43 and will eject the slug, as shown in Figure 4.

20 Continued relative movement of the die assemblies will then cause the movable forming plate 64 to be retracted further against the pressure of the springs 76. The radiussed corners 50 and 62 of the respective forming die 32 female die sleeve 52 will then cause the edges of the work piece around the opening formed in the work piece, to be turned upwardly as at E in Figure 4.

The female die sleeve will be seen to be received in

the spacing 34 between the male blanking die 30 and the male forming die 32.

The slug S will be seen falling through the hollow interior 53 in the female die sleeve 52, and the ejector pin will be seen to be extended from the male die 14.

10

Continued relative movement of the male and female die sets 14 and 16 will cause them to open up. This will release the movable support plate 64 from the pressure of the male forming die 50, and springs 76 will urge the support plate 64 upwardly once more into the position shown in Figure 2. This will then cause the work piece W and edges E to be displaced upwardly from the female sleeve die member 52, thereby permitting the work piece W to move continuously, without interrupting the smooth flow of movement of the production line.

20

It will be appreciated that when engineering the design of a particular die set and, the space 34 between the male blanking die 30, and the male forming die 32, allowance must be made for the thickness of the work piece W, which will be turned upwardly between the forming corners 50-62 of the male forming die 52 and the female die sleeve 32 respectively. This will be understood readily by an examination of Figure 4. Thus the opening or spacing 34 will be slightly greater than the width of the female die sleeve 32 of the female die set 16.

As will be understood, the forming corners 50 and 62

will have a profile suitable to form the shape desired for the edge E, and a radius appropriate to the type of material being formed.

Referring to Figures 5 and 6, the male and female dies are shown in plan. Although not illustrated in the sectional drawings, the male die assembly 14 is shown having additional spacer plate means 90-90 on either side secured by bolts.

10 In the particular die illustrated in this description, the shape of the die is best shown in Figures 5 and 6.

Figure 5 illustrating the female die assembly shows the female die sleeve 52 as having linear portions 92-92-92 joined by curved or radiussed corners 94-94-94-94. It will be noted that the linear portions 92 define a predetermined first width, and that the radiussed corners define a predetermined second width less than said first width. This produces advantageous results in the particular product, such as that illustrated in the aforesaid U.S. Letters Patent. However, it will be appreciated that the design and
20 shaping of the female die will be dependant upon the engineering of the particular product being made, and this is illustrated here by way of example.

The foregoing is a description of a preferred embodiment of the invention which is given here by way of example only. The invention is not to be taken as limited to any of the specific features as described, but

comprehends all such variations thereof as come within the scope of the appended claims.

The embodiments of the invention in which an exclusive property or privileges claimed are defined as follows:

1. A two stage die set for sequentially blanking an opening in a work piece, and thereafter forming edge formations on said work piece around said opening and comprising;

a male die assembly, in turn comprising a male blanking die member defining a male blanking edge;

10 a male forming die member spaced from said male blanking die member defining a male forming corner;

recess means between said blanking die and said forming die;

a female die assembly in turn comprising a generally hollow female die sleeve member, said female die sleeve member being shaped and dimensioned to correspond to said male blanking die member and to receive the same in telescopic relation and defining inner and outer sides;

blanking edge means on the inner side of said female die sleeve;

20 forming corner means on the outer side of said female die sleeve;

a moveable female support plate means located around said outer side of said female die sleeve member, and pressure means operable on said moveable female support plate means, whereby to urge the same into a first position, and said moveable plate means being adapted to yield to said

male forming die member of said male die assembly, when said male and female dies are closed together, whereby said male blanking die co-operates with said female die sleeve of said female die assembly to blank out a portion of a work piece and form an opening therein, and whereby upon further relative movement between said male and female die assemblies towards one another, said male forming die sleeve will co-operate with said moveable support plate means and said female die sleeve, to cause deformation of an edge portion of said work piece around said opening;

10 ejector means in said male blanking die member, said ejector means being resiliently movable, whereby the same may be withdrawn into said blanking die member, upon closure of said blanking die member on said work piece, and, after blanking of said portion of said work piece by said male and female die members, said ejector means being adapted to be extended from said male blanking die, whereby to displace said blanked out portion, and,

20 passageway means in said female die assembly communicating with the interior of said female die sleeve for receiving said blanked out portion of said work piece, whereby the same may be disposed of through said passageway means.

2. A two stage die set as claimed in Claim 1 and wherein said female die assembly includes a movable support plate means is in the form of a generally rectangular plate, edge

rib means on said plate, extending outwardly from opposite sides of said plate, and a pair of retaining rails, defining retaining ribs interengaging with said edge ribs, said retaining rails defining spaces enclosed by said retaining ribs, whereby said edge ribs may move relative thereto within said spaces.

10 3. A two stage die set as claimed in claim 2 and including die support means for supporting said male and female die assemblies, recess means in said die support means, and spring means extending between said recess means and said male die assembly and spring means extending from said recess means and said female die assembly, and means for securing respective said male and female die assemblies to respective said support means.

20 4. A two stage die set as claimed in claim 1 for use in a rotary apparatus, and having upper and lower rotary members, and having at least one generally semi-cylindrical die support member in each of said upper and lower rotary members, and wherein said male die assembly is supported on said semi-cylindrical die support member of said upper rotary apparatus and wherein said female die assembly is supported on said semi-cylindrical die support member of said lower rotary apparatus, and including upper spring recess means in said upper semi-cylindrical die support member, and including lower spring recess means in said lower semi-cylindrical die support member.

5. A two stage die set as claimed in claim 4 and including slug ejection opening means in said lower semi-cylindrical die support member for receiving a slug from said female die, and ejecting the same.

6. A two stage die set as claimed in claim 5 and wherein said female die sleeve includes a female hollow die sleeve, of regular section from top to bottom, and a female die base sleeve, defining ledge means engaging the lower end of said hollow die sleeve, and opening means in said die base member registering with said hollow female die sleeve, said die base member being attachable to said die support member, for supporting said hollow die sleeve in position, and securing means for securing said hollow die sleeve to said die base member.

7. A two stage die set as claimed in claim 1 wherein said female die sleeve defines in plan, a shape having at least some linear portions and having radiussed corners joining said linear portions, and wherein said linear portions define a predetermined first width, and wherein said radiussed corners define a predetermined second width less than said first width.

8. A two stage die set as claimed in claim 1 wherein said female die sleeve defines a predetermined first height, and wherein said movable support plate means, in its said first position, defines a predetermined second height, greater than said first height, whereby upon closing of said male

and female die assemblies, said work piece is initially clamped between said male forming die member and said movable support plate means, just prior to blanking of said opening.

9. A two stage die set as claimed in claim 5, and wherein said die base member defines a generally frustoconical shape, and wherein said movable plate means defines an interior generally frustoconical recess, shaped to substantially correspond to said frustoconical shape of said die base, whereby said mounting plate means may be moved over and around said die base means.

10. A two stage die set for use in a rotary apparatus, having upper and lower rotary members, and having at least one generally semi-cylindrical die support member in each of said upper and lower rotary members, for sequentially blanking an opening in a work piece, and thereafter forming edge formations on said work piece around said opening and being characterized by:

a male forming die assembly, in turn comprising a male blanking die member defining a male blanking edge;
 a male forming die member spaced from said male blanking die member defining a male forming corner;
 recess means between said blanking die and said forming die;
 a female die assembly in turn comprising a generally hollow female die sleeve member, said female die

sleeve member being shaped and dimensioned to correspond to said male blanking die member and to receive the same in telescopic relation and defining inner and outer sides;

wherein said male dies assembly is supported on said semi-cylindrical die support member of said upper rotary apparatus and wherein said female die assembly is supported on said semi-cylindrical die support member of said lower rotary apparatus, and
10 having upper spring recess means in said upper semi-cylindrical die support member, and including lower spring recess means in said lower semi-cylindrical die support member;

blanking edge means on the inner side of said female die sleeve;

forming corner means on the outer side of said female die sleeve;

a moveable female support plate means located around said outer side of said female die sleeve member,
20 and pressure means operable on said moveable female support plate means, whereby to urge the same into a first position, and said moveable plate means being adapted to yield to said male forming die member of said male die assembly, when said male and female dies are closed together, whereby said male blanking die co-operates with said female die sleeve of said female die assembly

to blank out a portion of a work piece and form an opening therein, and whereby upon further relative moveable between said male and female die assemblies towards one another, said male forming die sleeve will co-operated with said moveable support plate means and said female die sleeve, to cause deformation of an edge portion of said work piece around said opening;

10 wherein said female die sleeve defines a predetermined first height, and wherein said movable support plate means, in its said first position, defines a predetermined second height, greater than said first height, whereby upon closing of said male and female die assemblies, said work piece is initially clamped between said male forming die member and said moveable support plate means, just prior to blanking of said opening, and said work piece is blanked prior to any deformation thereof;

20 ejector means in said male blanking die member, said ejector means being resiliently moveable, whereby the same may be withdrawn into said blanking die member, upon closure of said blanking die member on said work piece, and, after blanking of said portion of said work piece by said male and female die members, said ejector means being adapted to be extended from said male blanking die, whereby to displace said blanking outer portion; and,

passageway means in said female die assembly communicating with the interior of said female die sleeve for receiving said blanked out portion of said work piece, whereby the same may be disposed of through said passageway means.

11. A two stage die set as claimed in claim 10 and wherein said female die assembly includes a movable support plate means in the form of a generally rectangular plate, edge rib means on said plate, extending outwardly from opposite sides of said plate, and a pair of retaining rails, defining retaining ribs interengaging with said edge ribs, said retaining rails defining spaces enclosed by said retaining ribs, whereby said edge ribs may move relative thereto within said spaces.

12. A two stage die set as claimed in claim and including die support means for supporting said male and female die assemblies, recess means in said die support means and spring means extending between said recess means and said male die assembly and spring means extending from said recess means and said female die assembly, and means for securing respective said male and female die assemblies to respective said support means.

13. A two stage die set as claimed in claim 10 and including slug ejection opening means in said lower semi-cylindrical die support member for receiving a slug from said female die, and ejecting the same.

14. A two stage die set as claimed in claim 13 and wherein

said female assembly includes a female hollow die sleeve, of regular section from top to bottom, and a female die base member, defining ledge means engaging the lower end of said hollow die sleeve, and opening means in said die base member registering with said hollow female die sleeve, said die base member being attachable to said die support member, for supporting said hollow die sleeve in position, and securing means for securing said hollow die sleeve to said die base member.

10 15. A two stage die set as claimed in claim 14, and wherein said die base member defines a generally frusto-conical shape, and wherein said movable plate means defines an interior generally frusto-conical recess, shaped to substantially correspond to said frusto-conical shape of said die base, whereby said mounting plate means may be moved over and around said die base means.

16. A two stage die set as claimed in claim 10 wherein said female die sleeve defines in plan, a shape having at least some linear portions and having radiussed corners joining
20 said linear portions, and wherein said linear portions define a predetermined first width, and wherein said radiussed corners define a predetermined second width less than said first width.

17. In combination with a rotary apparatus, having upper and lower rotary members, and having at least one generally semi-cylindrical die support member in each of said upper and lower rotary members, and wherein two-stage die sets

having a male die assembly supported on said semi-cylindrical die support member of said upper rotary apparatus and a female die assembly supported on said semi-cylindrical die support member of said lower rotary apparatus, each of said die sets being characterized by:

a male die assembly, in turn comprising a male blanking die member defining a male blanking edge;

a male forming die member spaced from said male blanking die member defining a male forming corner;

recess means between said blanking die and said forming die;

a female die assembly in turn comprising a generally hollow female die sleeve member said female die sleeve member being shaped and dimensioned to correspond to said male blanking die member and to receive the same in telescopic relation and defining inner and outer sides:

and having upper spring recess means in said upper semi-cylindrical die support member, and including lower semi-cylindrical die support member;

blanking edge means on the inner side of said female die sleeve;

forming corner means on the outer side of said female die sleeve;

a moveable female support plate means located around said outer side of said female die sleeve member,

and pressure means operable on said moveable female support plate means, whereby to urge the same into a first position, and said moveable plate means being adapted to yield to said male forming die member of said male die assembly, when said male and female dies are closed together, whereby said male blanking die co-operates with said female die sleeve of said female die assembly to blank out a portion of a work piece and form an opening therein, and whereby upon further relative movement between said male and female die assemblies towards one another, said male forming die sleeve will co-operated with said moveable support plate means and said female die sleeve, to cause deformation of an edge portion of said work piece around said opening;

wherein said female die sleeve defines a predetermined first height, and wherein said movable support plate means, in its said first position, defines a predetermined second height, greater than said first height, whereby upon closing of said male and female die assemblies, said work piece is initially clamped between said male forming die member and said moveable support plate means, just prior to blanking of said opening, and said work piece is blanked prior to any deformation thereof; ejector means in said male blanking die member, said

ejector means being resiliently moveable, whereby the same may be withdrawn into said blanking die member, upon closure of said blanking die member on said work piece, and, after blanking of said portion of said workpiece by said male and female die members, said ejector means being adapted to be extended from said male blanking die, whereby to displace said blanked out portion; and,

passageway means in said female die assembly
10 communicating with the interior of said female die sleeve for receiving said blanked out portion of said work piece, whereby the same may be disposed of through said passageway means.

18. The combination as claimed in claim 17 and wherein said female die assembly includes a movable support plate means is in the form of a generally rectangular plate, edge rib means on said plate, extending outwardly from opposite sides of said plate, and a pair of retaining rails, defining retaining ribs interengaging with said edge ribs, said
20 retaining rails defining spaces enclosed by said retaining ribs, whereby said edge ribs may move relative thereto within said spaces.

19. The combination as claimed in claim 18 and including die support means for supporting said male and female die assemblies, recess means in said die support means, and spring means extending between said recess means and said male die assembly and spring means extending from said

recess means and said female die assembly, and means for securing respective said male and female die assemblies to respective said support means.

20. The combination as claimed in claim 19 and including slug ejection opening means in said lower semi-cylindrical die support member for receiving a slug from said female die, and ejecting the same.

21. The combination as claimed in claim 20 and wherein said female die assembly includes a female hollow die sleeve, of
10 regular section from top to bottom, and a female die base member defining ledge means engaging the lower end of said hollow die sleeve, and opening means in said die base member registering with said hollow female die sleeve said die base member being attachable to said die support member, for supporting said hollow die sleeve in position, and securing means for securing said hollow die sleeve to said die base member.

22. The combination as claimed in claim 20, and wherein said die base member defines a generally frusto-conical shape,
20 and wherein said movable plate means defines an interior generally frusto-conical recess, shaped to substantially correspond to said frusto-conical shape of said die base, whereby said mounting plate means may be moved over and around said die base means.

23. The combination as claimed in claim 17 wherein said female die sleeve defines in plan, a shape having at least some linear portions and having radiused corners joining

said linear portions, and wherein said linear portions define a predetermined first width, and wherein said radiused corners define a predetermined second width less than said first width.

24. A rotary press having a pair of rotating assemblies mounted to counter-rotate in mutual co-operation to perform a forming operation on a web work piece as it passes in a forming plane lying between the rotating assemblies, the web work piece moving in a work piece feed direction, wherein:

10 each of said rotating assemblies has a first member mounted for rotation about a main rotor axis parallel to the forming plane and perpendicular to the feed direction;

each of said rotating assemblies has a die support member mounted to pivot relative to said first member, about an axis parallel to said main rotor axis;

one die of a pair of mating dies is mounted to each of said die support members, said dies being moveable
20 to engage the web work piece as said rotating assemblies rotate;

said die support member being controllably pivotable to present said die to the work piece at a controlled angular orientation;

one of said pair of mating dies has a first element and a second element, said first element being moveable relative to said second element in a direction perpendicular to the web under

rotation of said one rotating assembly, while said die engages the web work piece.

25. The rotary press of claim 24 wherein one of said elements is resiliently mounted relative to said support member.

26. The rotary press of claim 24 wherein said first element is spring mounted relative to said support member and rotation of said first assembly causes the first element to engage the web work piece, the spring to compress, and said
10 first element to move relative to said second element in said direction perpendicular to the plane of the web work piece.

27. The rotary press of claim 26 wherein said first element is mounted for telescoping motion relative to said second element.

28. The rotary press of claim 27 wherein, when viewed perpendicular to the plane of the web work piece, said second element is surrounded by the first element.

29. The rotary press of claim 28 wherein said second element is a sleeve mounted within said first element.

20 30. The rotary press of claim 24 wherein the other die of said pair of dies has a blanking die portion and a forming die portion; said dies are moveable relative to each other as said rotating assemblies counter-rotate to cut a blank from the web work piece, thereby defining an opening the web work piece, the opening having an edge; and said dies are further moveable relative to each other to form the edge of the opening.

31. The rotary press of claim 24 wherein:

the other of said pair of dies has a forming portion
and a blanking portion, said blanking portion
having a blanking edge;

said first element is a forming plate for engaging said
forming portion;

said second element includes a blanking edge for co-
operating with the blanking edge of said blanking
portion;

10 said dies are moveable to engage said forming plate and
said forming portion on opposite faces of the web
work piece;

said blanking edges of said dies are moveable, under
counter-rotation of said rotating assemblies, to
cut a blank from the web work piece to define an
opening therein, the opening having an edge; and

said dies are operable to form the edge of the opening.

32. The rotary press of claim 24 wherein:

the other of said pair of dies has a forming portion
20 and a blanking portion, said forming portion
having a forming corner and said blanking portion
having a blanking edge;

said first element is a forming plate for engaging said
forming portion;

said second element is a die having a blanking edge for
co-operating with the blanking edge of said
blanking portion and a forming edge for co-

operation with said forming corner;

said dies are moveable to engage said forming plate and
said forming portion on opposite faces of the web
work piece;

said blanking edges of said dies are moveable relative
to each other to cut a blank from the web work
piece to define an opening therein, the opening
having an edge; and

10 said forming edge is moveable relative to said forming
plate and said forming corner to form dies are
operable to form the edge of the opening out of
the plane.

33. The rotary press of claim 32 wherein said forming edge
is operable to form the edge of the opening about said
forming corner into a flange.

34. The rotary press of claim 24 wherein said dies are
operable to cut a blank from the web work piece, one of said
dies has a chamber for receiving the blank cut from the work
piece, and said press includes a slug ejector mounted to one
20 of said dies, said slug ejector being operable to eject the
blank from said chamber.

35. The rotary press of claim 34 wherein said chamber is
formed to receive an advancing portion of the other of said
dies, and a passageway extends from said chamber to an exit
from said press; and, said advancing portion includes said
slug ejector, and said slug ejector is operable to urge the
blank from the chamber to said passageway.

36. The rotary press of claim 34 wherein said slug ejector is a spring loaded pin.

37. A rotary press having a pair of rotating assemblies mounted to counter-rotate in mutual co-operation to perform a forming operation on a web work piece as it passes in a forming plane lying between the rotating assemblies, the web work piece moving in a work piece feed direction, wherein:

each of said assemblies has a first member mounted for rotation about a main rotor axis parallel to the forming plane, and perpendicular to the feed direction;

each of said rotating assemblies has a die support member mounted to pivot relative to said first member, about an axis parallel to said main rotor axis;

one die of a pair of mating dies is mounted to each of said die support members, one of said pair being a female die set, the other of said pair being a male die set, said dies are moveable to engage the web work piece as said rotating assemblies rotate;

said die support member being controlledly pivotable to present said die to the work piece at a controlled angular orientation;

said female dies set has a first element and a second element, said first element being moveable relative to said second element in a direction perpendicular to the web under rotation of said

one rotating assembly, while said die engages the web work piece.

38. The rotary press of claim 37 wherein:

said male die set has a forming die and a blanking die,
and, in plan view, said blanking die is surrounded
by said forming die;

said forming die has a forming corner on an edge
thereof facing said blanking die;

10 said blanking die has a blanking edge on an edge
 thereof facing said blanking die;

a gap is defined between said forming corner and said
blanking edge;

said first element of said female die set is a forming
plate for co-operation with said forming die;

said second element of said female die set is a female
die having a blanking edge for co-operation with
said blanking edge of said male die set, and a
forming edge for co-operation with said forming
corner of said forming die of said male die set;

20 said female die being reciprocally moveable within said
 gap;

said assemblies are rotatable to clamp the web work
piece between said forming plate and said forming
die;

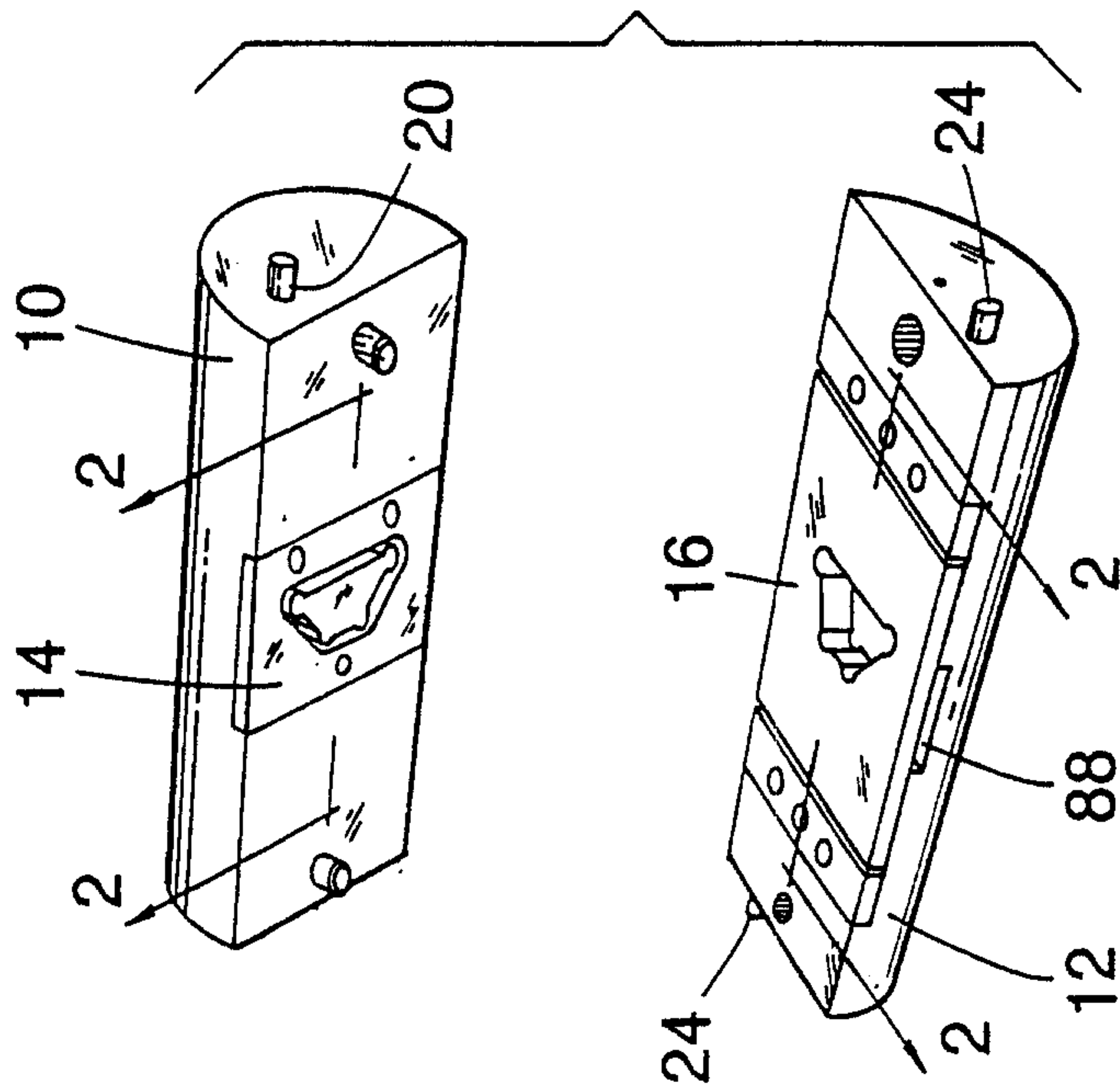
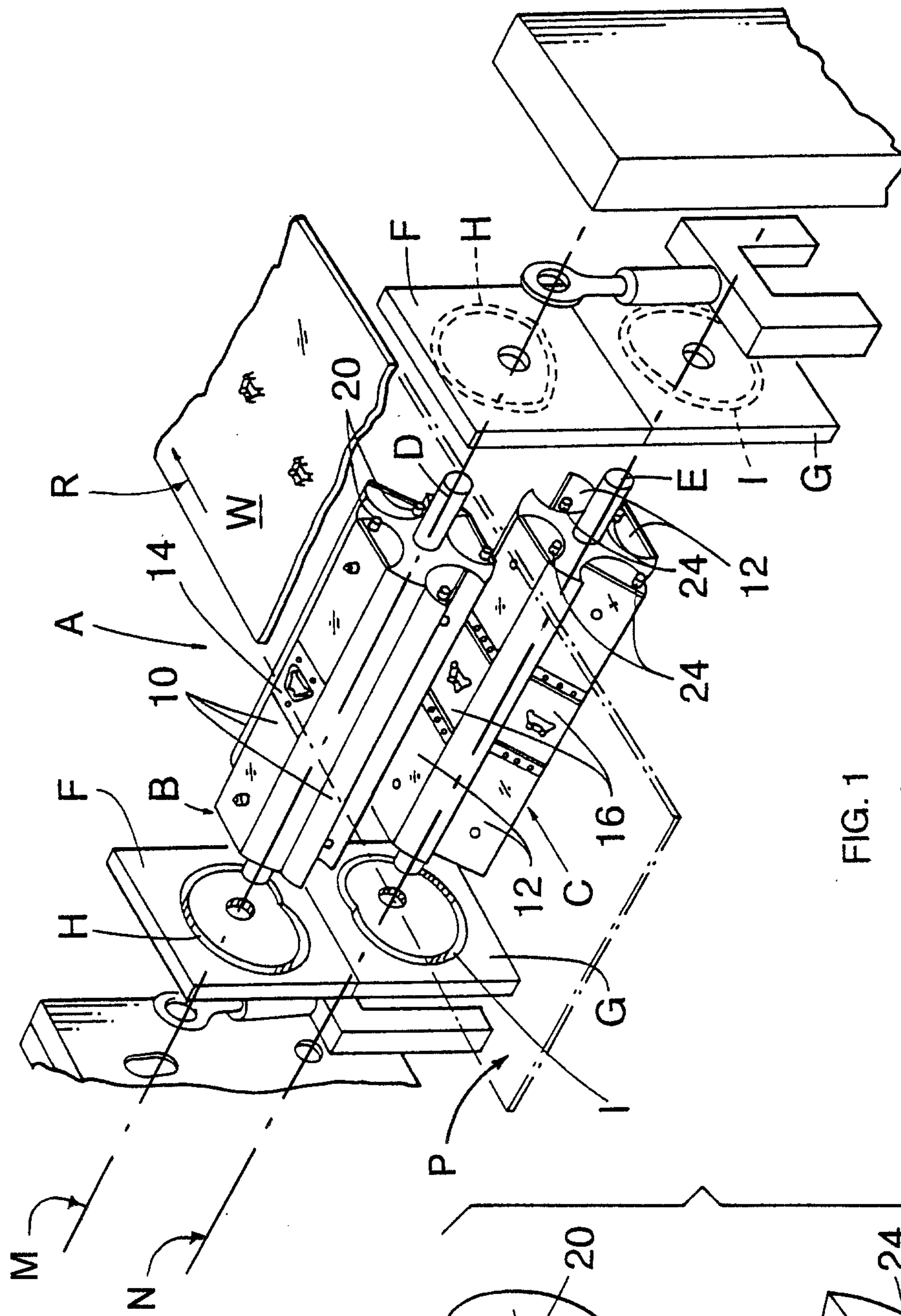
said assemblies are rotatable to operate said blanking
edges of said blanking die and said female die to
cut a blank from the web work piece to define an

opening having an edge; and

said assemblies are rotatable to move said forming edge of said female die relative to said forming corner of said forming die to form the edge into a flange.

39. The rotary press of claim 38 wherein said forming plate is resiliently mounted relative to said support member, and said female die is rigidly mounted to said support member.

40. The rotary press of claim 38 wherein said female die is
10 a sleeve and has a chamber defined therein for receiving the blank cut from the web work piece, said chamber has a passageway extending therefrom to an exit from said rotary press, and said male blanking die has a slug ejector mounted thereto for urging the blank to leave said chamber.



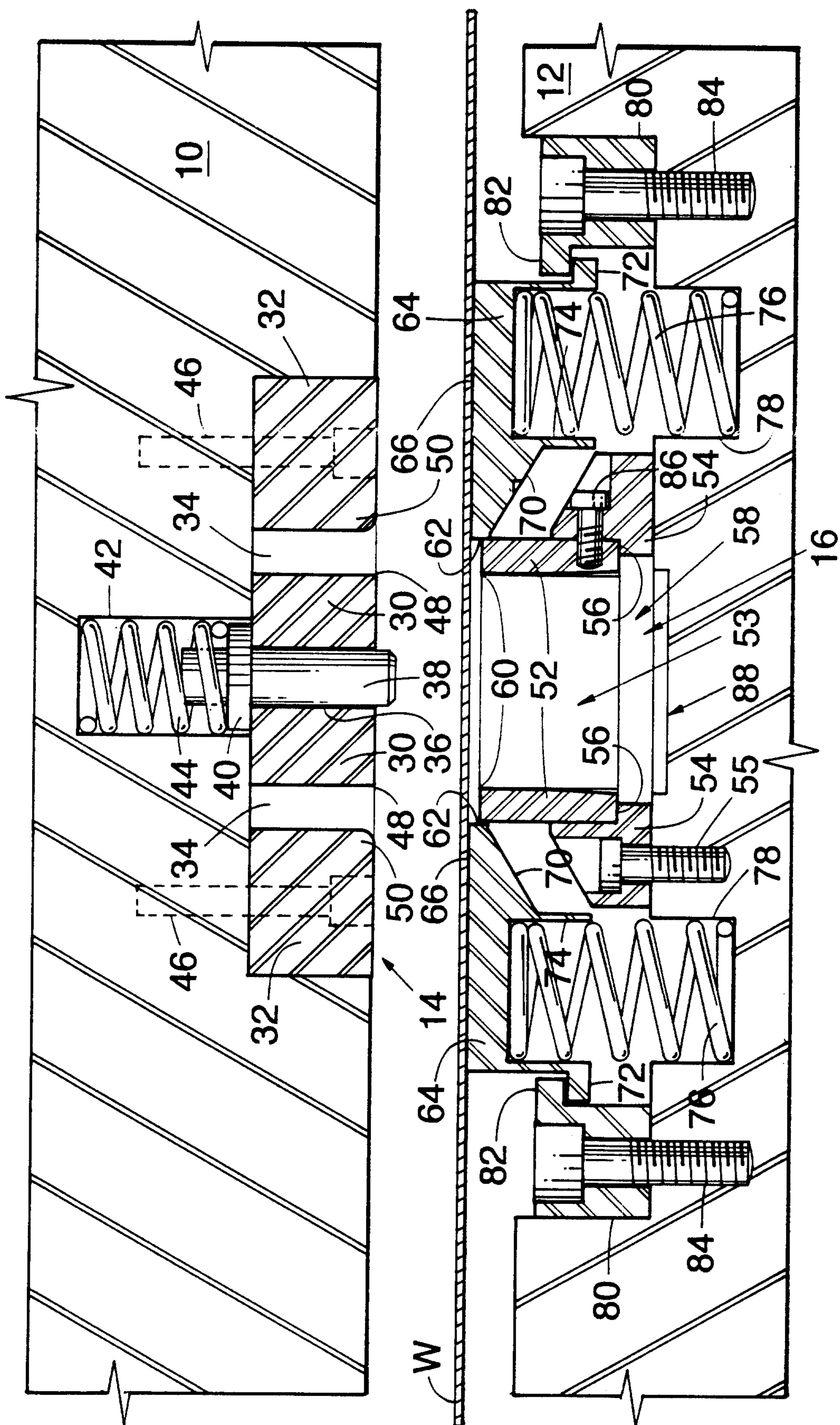


FIG. 2

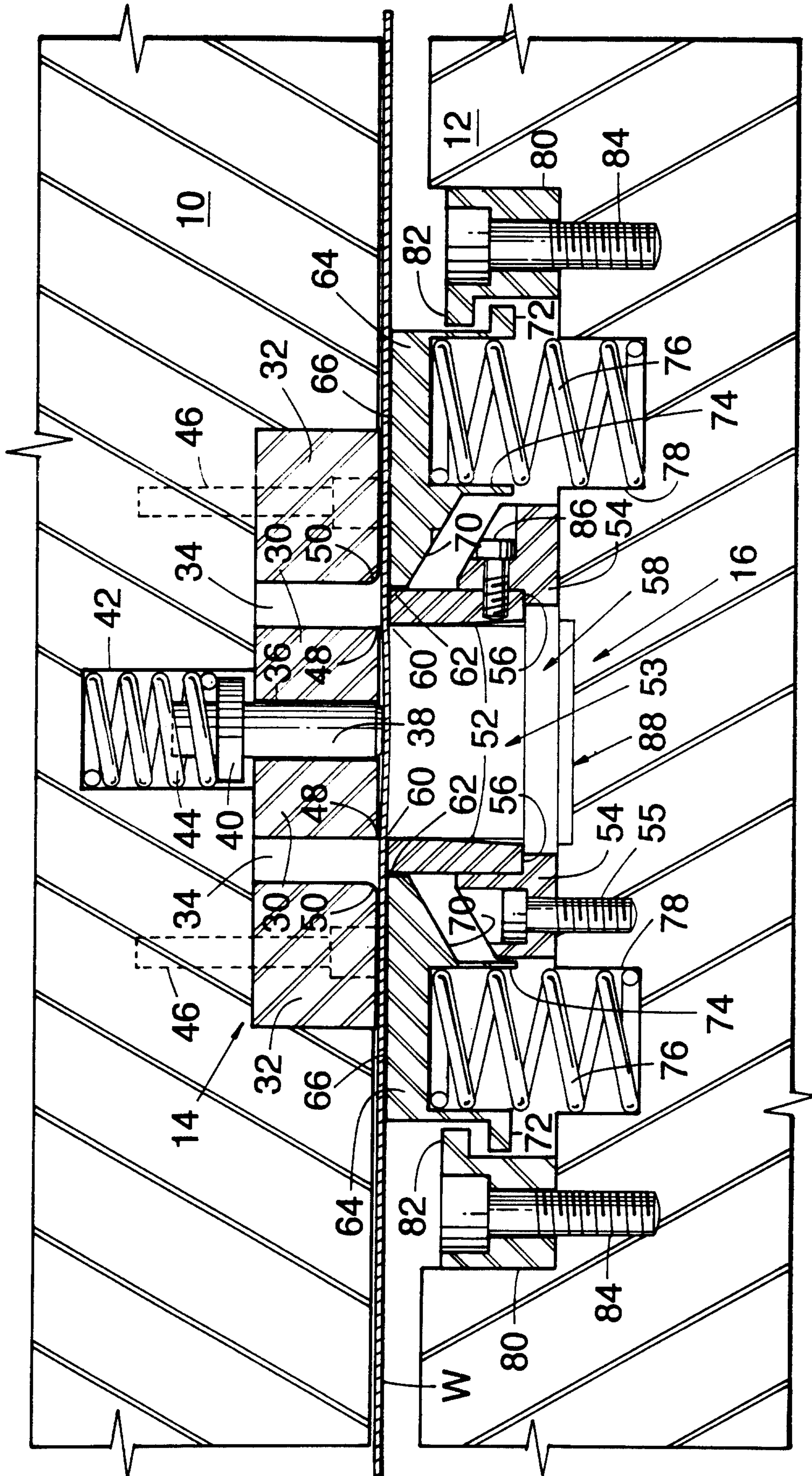


FIG. 3

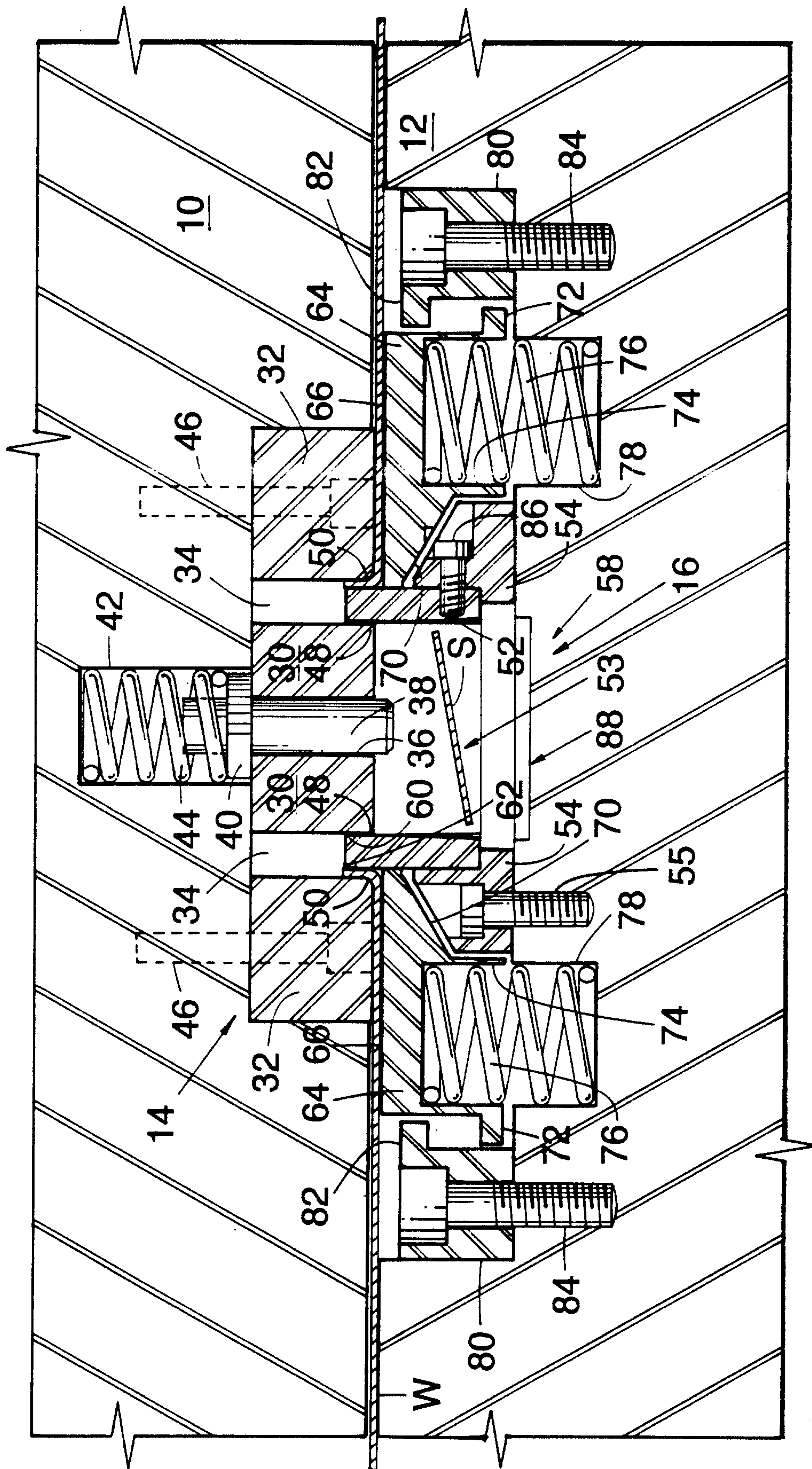


FIG. 4

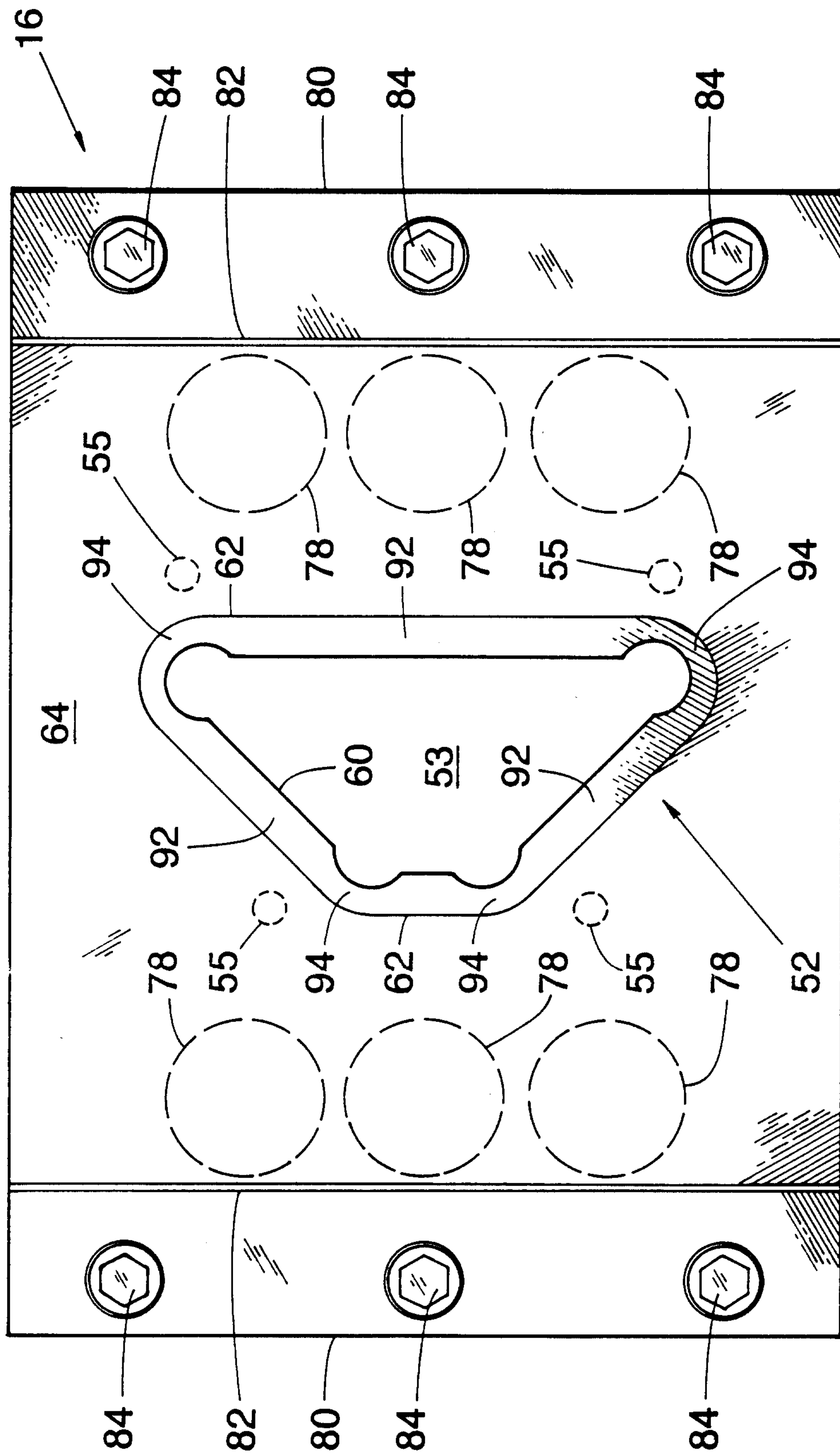


FIG. 5

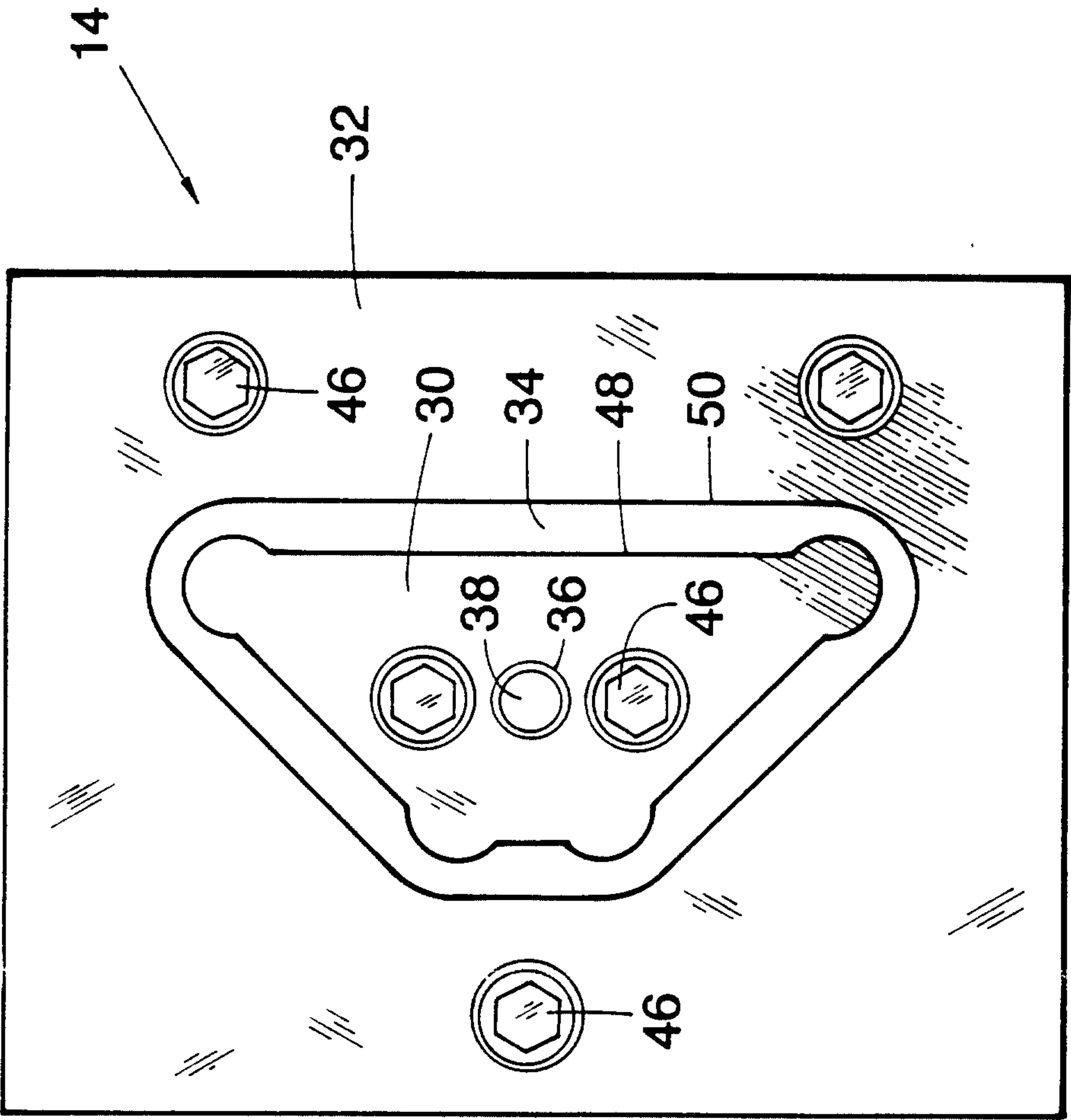


FIG. 6

