Oct. 5, 1965 R. F. GIORDANO 3,209,576

DIE ARRANGEMENT FOR A PRESS

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FIG. 2

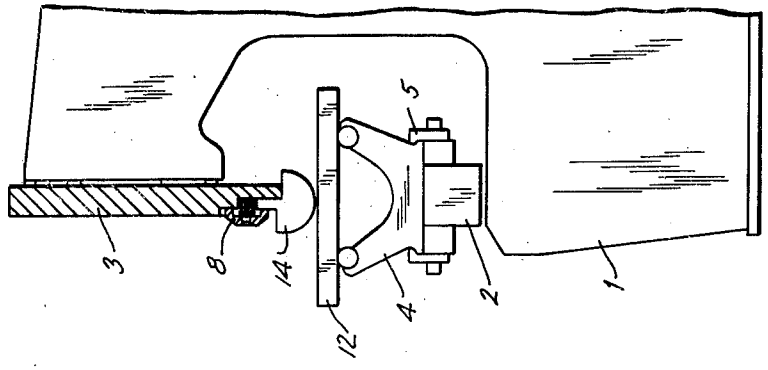
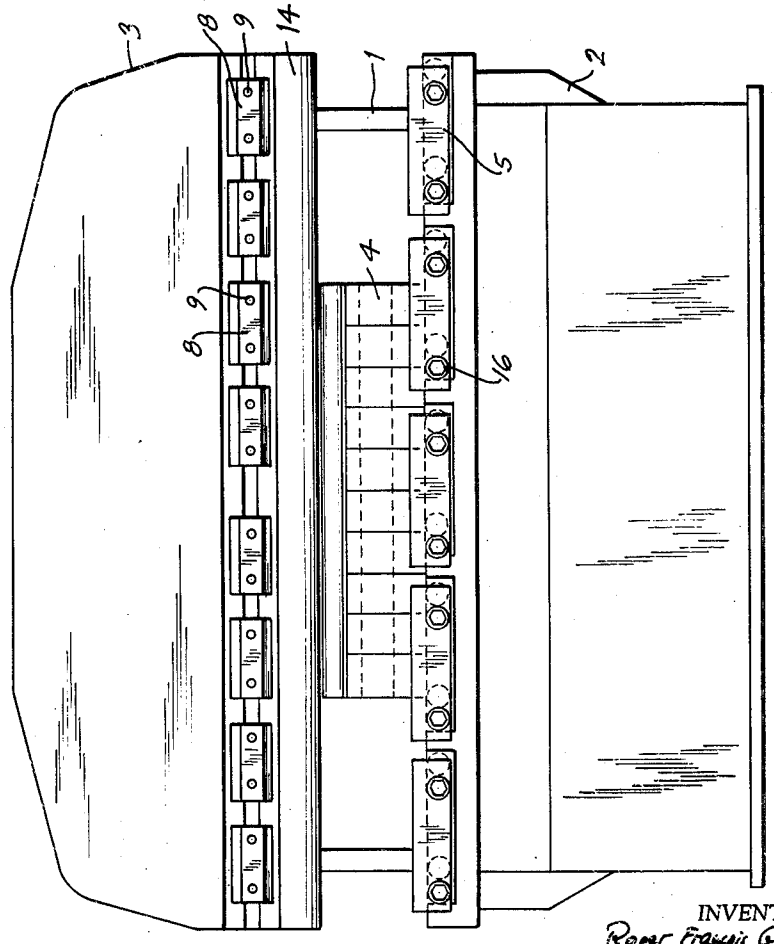


FIG. 1



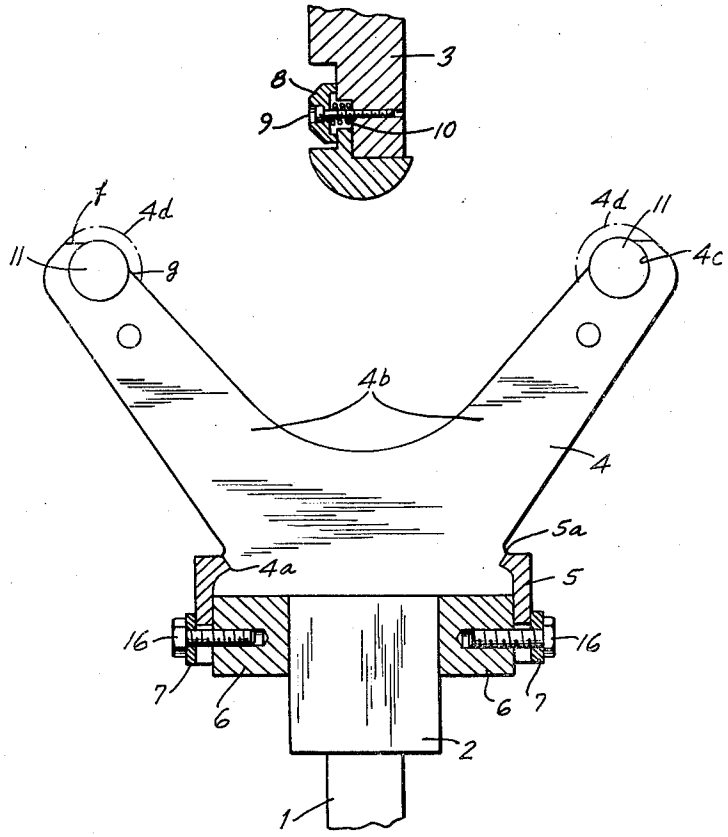
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FIG. 3



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FIG. 4

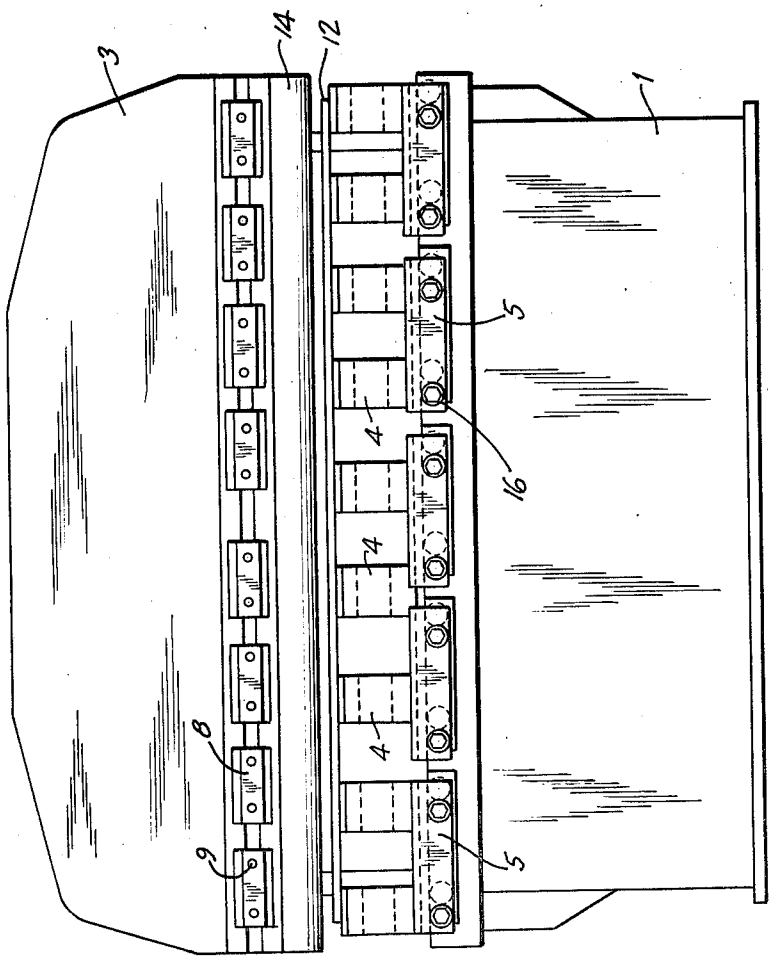
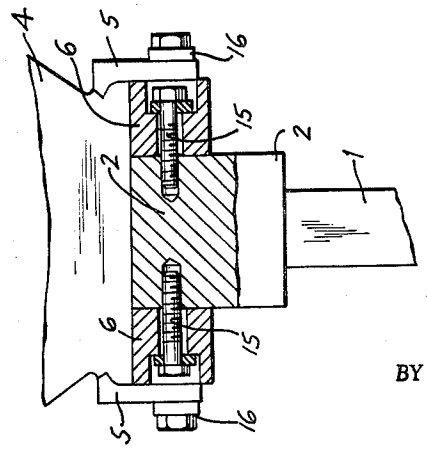


FIG. 5



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DIE ARRANGEMENT FOR A PRESS

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8 Claims. (Cl. 72—389)

The present invention relates to a die arrangement for a press, and more particularly to a die arrangement permitting the folding of metal sheets of different length.

Known presses for folding metal sheets or plates into angular shape, comprise a male die means, and a female die means which are of substantially the same length corresponding to the length of the workpiece which is to be folded.

The female die means has a V-shaped cross section. In order to make the V-shaped female die, a metal bar is machined until the notch between the legs of the V-shape has been removed. The bars of which the female die means are made are very heavy, and difficult to handle, particularly if the female die means is intended for use with very long and thick workpieces.

During the folding operation, the surface of the metal sheet slides on the free ends of the legs of the female die means, and due to the great pressure required for the press operation, a considerable pressure is exerted on the free ends of the legs of the female die means, resulting in very great friction forces between the workpiece and the female die means.

It is one object of the present invention to overcome the disadvantages of known die arrangements for presses, and to provide a die arrangement in which the female die means comprises a plurality of female dies which can be easily manufactured.

Another object of the present invention is to make a die means comprising several aligned female dies which can be spread apart if a longer workpiece is to be deformed.

Another object of the present invention is to provide a die arrangement in which workpieces of different length, but requiring the same press force, can be deformed between male and female die means of the same press although the required press force is the maximum press force of which the press is capable.

Another object of the present invention is to provide a female die of V-shaped cross section with rollers on which the workpiece is guided while the workpiece is folded into the V-shape.

Another object of the present invention is to reduce the friction between the workpiece and the female die means of a folding press.

Another object of the present invention is to mount workpiece guiding rollers on a female die means in such a manner that the bearings of the rollers are capable of sustaining very great pressure.

Another object of the present invention is to provide a method for making a female die in accordance with the present invention.

With these objects in view, one embodiment of the present invention relates to a press which has a male die means and a female die means.

In accordance with the present invention one of the die means has a given extension, for example the male die means has a certain length, and the other die means includes a plurality of dies movable between a spread position in which the dies are spaced from each other, and in which the male die means and the female die means extend substantially for the same distance, and a

contracted position in which the male and female die means have different extensions.

Due to this arrangement, it is possible to deform workpieces of shorter length in the contracted position of the movable dies, and to deform longer workpieces in the spread position of the movable dies.

In the preferred embodiment of the invention, the female die means comprises a plurality of female dies, each of which has a notch. The male die means has a continuous press face adapted to pass into the aligned notches of the female die means. The female dies can be spread to extend along the entire length of the male die means, and can be pushed together to extend only over a part of the male die means. Assuming that the maximum force on which the press is capable is applied to a workpiece, this maximum force is divided to act on all female dies so that each female die is subjected to the same force, regardless of whether the female dies are spread, or in closely adjacent positions. However, in the spread position, a much longer, but thinner, workpiece can be deformed, while in the contracted position of the female dies, a thicker, but shorter workpiece can be deformed.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a front view illustrating a folding press according to one embodiment of the invention;

FIG. 2 is a fragmentary side view, partly in section along line II—II in FIG. 1;

FIG. 3 is a fragmentary cross-sectional view showing the die means of the embodiment of FIGS. 1 and 2 on an enlarged scale:

FIG. 4 is a front view of the press according to the embodiment of FIGS. 1 and 2, but showing the die arrangement in another operational position; and

FIG. 5 is a fragmentary cross-sectional view taken in a plane parallel to the plane in which the section of FIG. 3 is taken.

Referring now to the drawings, and more particularly to FIG. 1, a frame **1** has a lower base part on which a lower die support **2** is mounted. Die support **2** includes a beam portion extending along the length of the machine and having a rectangular cross section, as best seen in FIGS. 3 and 5. An upper die support **3** is mounted on the upper part of frame **1**, and extends along the length of the machine.

A male die **14** is mounted on the die support **3**, and extends along the length of the machine. The male die means **14** may be made of a single piece, or of several pieces, but in any event, the male die means **14** has a continuous press face, shown to be of curved convex shape, which extends along the length of the machine.

Guide members **6** are secured by bolts **15** to the lower die support **2**, and have top faces flush with the top face of die support **2**, so that the bottom faces of a plurality of female dies **4** can slide thereon, as best seen in FIG. 5. Two guide and clamping means **5** are secured by bolts **16** to members **6**. Bolts **16** pass through cutouts in the guide and clamping means **5**, and are provided with washers **7**. The guide and clamping means **5** have inner projecting edges **5***a* engaging corresponding recesses **4***a* in the female dies **4**. When bolts **16** are loosened, female dies **4** can be shifted along the length of members **2**, **6** and **5**, and after a selected position of the female dies **4** is obtained, bolts **16** are tightened so that the guide and clamping means **5** no longer serve as guide means, but

rigidly clamp the female dies 4 to the base of the machine, and more particularly to die support 2.

Female dies 4 can be shifted to a contracted position in which they abut each other, as shown in FIG. 1. Only the three inner guide and clamping means 6 are used in this position.

When the female dies are moved apart to assume the spread position shown in FIG. 4, they are located opposite substantially the entire length of the male die means 14. In this position, the female dies 4 are clamped by all five pairs of guide and clamping means 5.

As best seen in FIG. 4, each female die 4 has a pair of legs 4*b* which define a notch cooperating with the male die means 14. The male die means 14 is clamped to the upper die support 3 by a plurality of clamping plates 8 which are held on the die support by a plurality of bolts 9 against the action of springs 10.

The free ends of the legs 4*b* of the female dies 4 have bearing bores 4*c* which are partly open on the inner surface of the legs 4*b*. A roller 11 is mounted in each bearing bore 4*c*, and projects from the same since the bearing surface of each bearing bore does not extend through a complete circle. Consequently, a sheet located between the male die 14 and the female dies 4, will be folded into an angular shape with its lower surface engaging rollers 11, and the center portion of its upper surface being engaged by the male die means 14. As the male die means 14 passes into the notch between the legs 4*b* of the female dies 4, the deformed sheet will assume an angular cross section, pass into the notches of the female dies 4, and turn the rollers 11 so that no considerable friction develops on the free ends of the legs 4*b*.

While in a corresponding conventional press, the female die will have a length corresponding to the total length of all female dies 4, as shown in FIG. 1, each female die 4 in accordance with the present invention will only have the thickness or length shown in FIG. 1 and FIG. 4. Consequently, it is possible to cut the V-shape of the female dies out of metal plates having a corresponding thickness, which, of course, is not possible for the long continuous female die in corresponding conventional presses.

In accordance with the preferred method according to the present invention, the free ends of legs 4*b* are first formed with bosses 4*d*, whereupon bearing bores 4*c* are drilled through the extremities of the legs 4*b* and also partly into the bosses 4*d*. The bosses 4*d* are cut off along the faces *f* and *g* so that the surface of each bearing bore does not extend through a complete circle. The cutting operations are preferably carried out by an oxy-acetylene torch.

The operation of a press according to the present invention will now be explained with reference to an example. A press having a capacity of 800 tons is capable of folding, according to standard folding tables, a sheet metal plate of 80 millimeter thickness along a length of 1000 millimeters into a V-shape having the free ends of the legs of the V-shape spaced a distance of 500 millimeter.

It is assumed that the female dies 4 have a thickness or length, appearing in FIGS. 1 and 4, of 100 millimeter, and a distance of 500 millimeter between the rollers 11 at the ends of the legs 4*b*. Assuming that each female die is capable of sustaining a force of 80 tons, it is necessary to place ten female dies 4 adjacent each other in the position shown in FIG. 1. The total length of the thus formed female die will be 1000 millimeter. The male die means 14 will be used along the same length in the position of FIG. 1, and since ten female dies are provided, the combined female die means will be capable of sustaining a pressure of 800 tons so that it will be possible to fold a metal plate 12 having a thickness of 80 millimeter, and a length of 1000 millimeter, between the made die means 14 and the composite female die means which consist of the ten female dies 4 in the contracted position shown in FIG. 1.

When a longer metal plate is to be folded, the female dies are moved apart to a spread position, for example to the completely spread position shown in FIG. 4 in which all female dies 4 are distributed along the length of the male die means 14, and consequently spaced from each other. It will not be possible to fold in this spread position, a metal plate having the length of the male die means 14 and of the spread female die means, and having a thickness of 80 millimeter, since in this event, the pressure exerted on each female die means would exceed the maximum pressure of 80 tons.

However, the standard tables for metal plates having a length of 2000 millimeters indicate a requirement of 400 tons for each 1000 millimeter length for a metal plate having a thickness of 50 millimeter. A metal plate of 50 millimeter thickness and having a length of 2000 millimeter, will require a pressure of 800 tons, of which the machine is capable. The female dies 4 are spread to the position of FIG. 4 to extend over 2000 millimeter of the length of the male die 14, and when a metal plate having a thickness of 50 millimeter and a length of 2000 millimeter is folded on the press in the position of FIG. 4, each of the female dies is subjected to a pressure of 80 tons, for which it is designed.

Although the press of the present invention is capable of bending and folding metal plates of very great length, the female die means consists of small dies which can be easily and inexpensively manufactured.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of presses differing from the types described above.

While the invention has been illustrated and described as embodied in a folding press having a female die means composed of a plurality of movable female dies, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In a folding press for folding a sheet into angular shape, in combination, a male die means having an elongated continuous projecting press face extending in one direction, and a female die means including a plurality of female dies, each of said female dies having a pair of die legs forming a V-shaped notch extending in said direction, said notches of said dies being aligned in said direction and facing said projecting press face, and rollers turnably mounted on the ends of said die legs of said female dies with said die legs engaging a major portion of the cylindrical surfaces of said rollers, said rollers facing said notches so as to be adapted to engage a sheet located between said press face and said notches so that said rollers turn when said sheet is folded into said notches by said press face passing into said notches, said female dies being movable in said direction between a spread position in which said female dies are spaced from each other and in which the total extension of said female die means in said direction is substantially the same as the length of said press face, and a contracted position in which the total extension of said female die means in said direction is less than said length of said press face whereby sheets of different length requiring the same

press force can be folded into angular shape between said press face and said aligned V-shaped notches.

2. A folding press as set forth in claim 1 wherein each of said legs of said female dies is formed adjacent the free end thereof with a bearing bore defined by a major portion of a cylindrical surface having an axis substantially parallel to the bight of the V-shaped notch and intersecting a top face of the respective leg and a side face thereof facing the other leg, each of said rollers having a diameter corresponding to the diameter of said bearing bores and being located and turnably mounted in a bearing bore while partly projecting from the same into said notch of the respective female die.

3. A folding press as set forth in claim 1 wherein each of said legs of said female dies has a free end portion formed with a bearing bore extending in said direction and being cut-off across said bore so that said bore has a surface extending through a major portion of a circle and having an opening toward said notch in the respective female die, each of said rollers having a diameter matching the diameter of said bores and being located and turnably mounted in one of said bores, each roller projecting from the respective bore through said opening into said notch of the respective female die.

4. A folding press as set forth in claim 3 wherein said bores are drilled, and wherein said female dies are cut out of a sheet material.

5. A method for making a female V-shaped die, comprising the steps of making a female die having two legs, drilling a bore in each of said legs adjacent the end thereof and having an axis substantially parallel to the bight of the V, removing a portion of each leg located on the side of the respective leg facing the other leg and mounting rollers rotatably in said bores projecting into the space between said legs.

6. A method of making a female V-shaped die, comprising the steps of making a female die having two legs and bosses at the extremities of said legs and on the side of each leg facing the other of said legs, drilling a bore with an axis substantially parallel to the bight of the V in each of said bosses, removing a portion of each boss located on the side of the respective leg facing the other of said legs so that said bores are opened toward the inside of the leg, and mounting rollers rotatably in said bores projecting into the space between said legs.

7. A V-shaped female die having two legs terminating in free end portions, and a roller turnably mounted on each of said free end portions in direct engagement therewith over a major portion of its circumference and adapted to engage a workpiece.

8. A V-shaped female die having two legs terminating in free end portions, each of said end portions having a bearing surface extending through the major portion of a circle so that said bearing surface terminates at an opening at the side of the respective leg facing the other of said legs, and a roller turnably mounted within each bearing surface and having a portion projecting from the respective bearing opening at the side of the respective leg facing the other of said legs and adapted to engage a workpiece.

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CHARLES W. LANHAM, *Primary Examiner.*