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Thatcher

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[54] **FEMALE DIE AND WORKPIECE SUPPORT ARRANGEMENT FOR A PRESS**

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[52] **U.S. Cl.**..... **72/383,** 72/386, 72/389

[51] **Int. Cl.**..... **B21d 5/02,** B21d 9/05, B21d 9/14, B21d 31/00

[58] **Field of Search**..... 72/383, 386, 389, 72/380, 381

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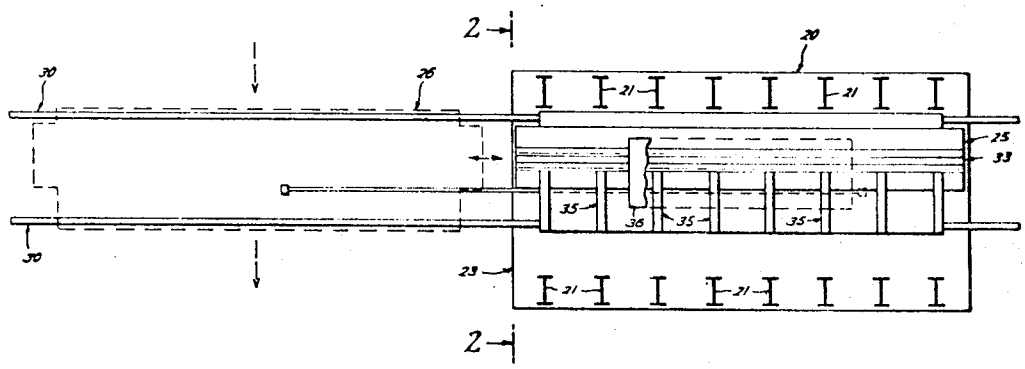
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Assistant Examiner—E. M. Combs
Attorney—Jack W. Hayden

[57] **ABSTRACT**

Opposed cylindrical members are provided in opposed support members or means to provide a female die for a press. A plurality of opposed support members or means may be arranged for receiving cylindrical members therein in axial alignment and end-to-end relationship to provide a female die of desired longitudinal extent for a press. The support means are each provided with cylindrical surfaces arranged in end-to-end relationship for contacting and cradling said cylindrical members substantially throughout their longitudinal extent and over a substantial portion of their circumferential extent or surface area. Thus, when a workpiece is placed on the opposed cylindrical members and engaged on the opposite side by a male die of a press to force the workpiece in the space between the opposed cylindrical members to form the workpiece, the opposed cylindrical members may freely rotate in said support memers while transmitting the load applied to the workpiece from the cylindrical members to the support members over a maximum surface area. The support members are carried on a carriage and means are provided to quickly and easily adjust and regulate the distance between the opposed cylindrical female die members as desired. A support is provided for the workpiece to support it as it is formed including a carriage mounted on rollers which is in turn engaged on tracks so that the carriage can be moved toward and away from the press.

2 Claims, 9 Drawing Figures



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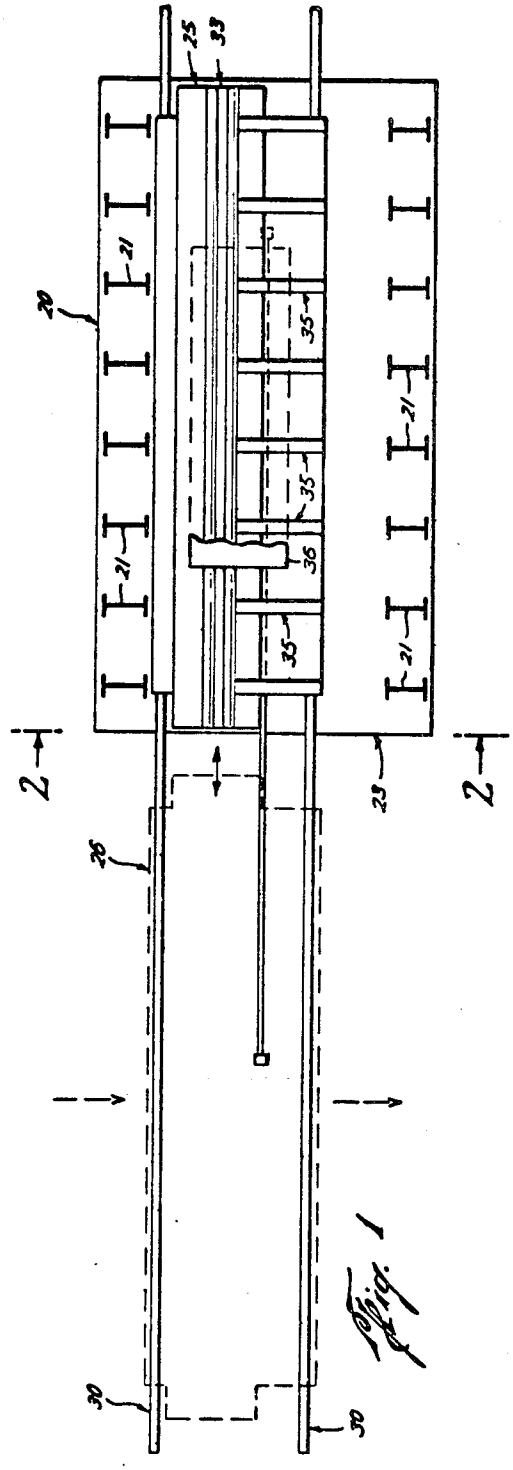


Fig. 1

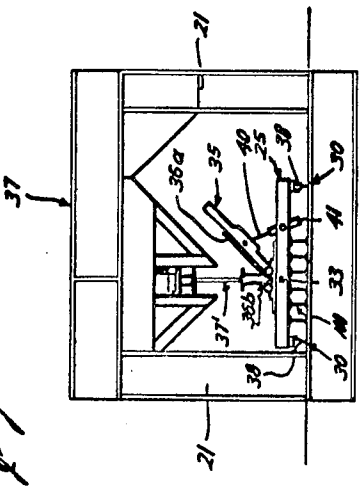


Fig. 3

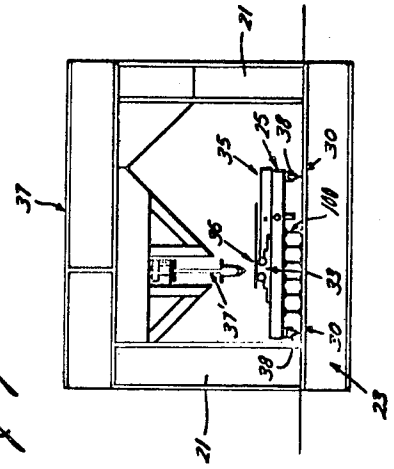


Fig. 2

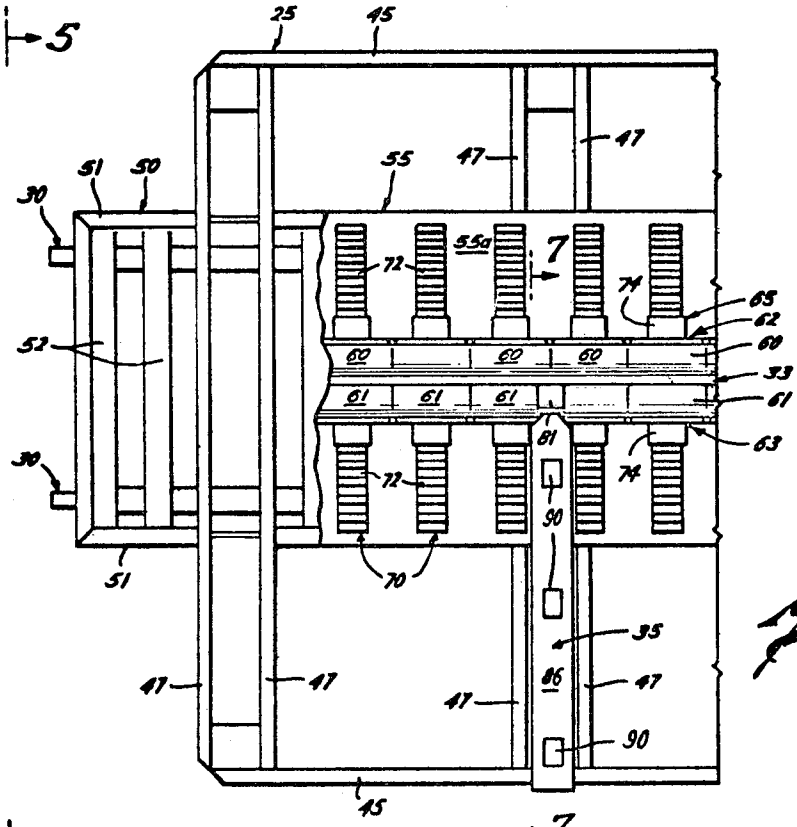


Fig. 4

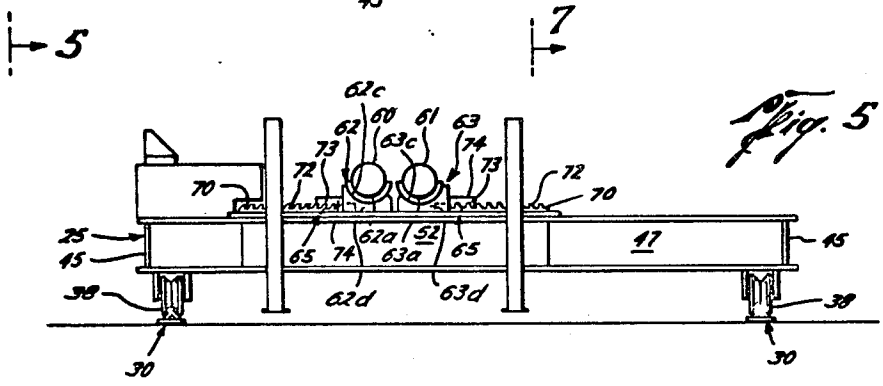


Fig. 5

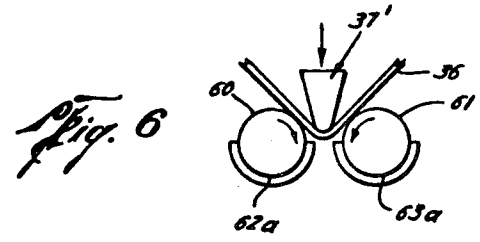


Fig. 6

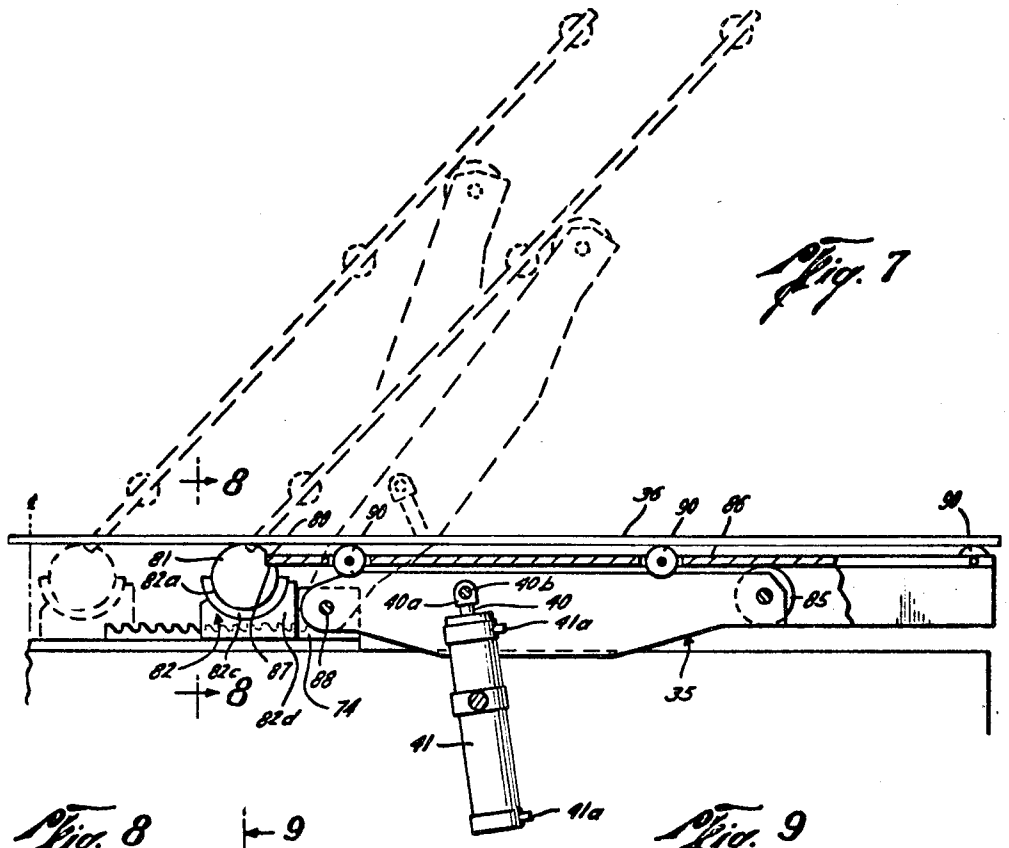


Fig. 7

Fig. 8

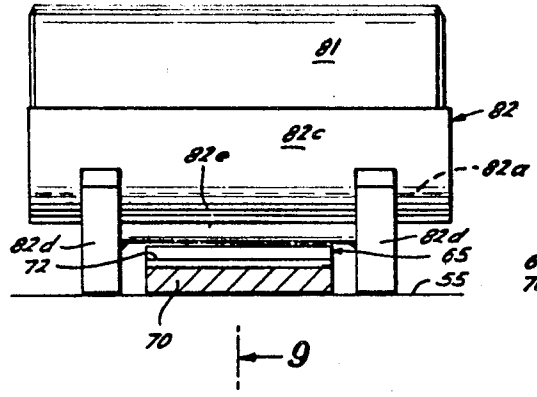
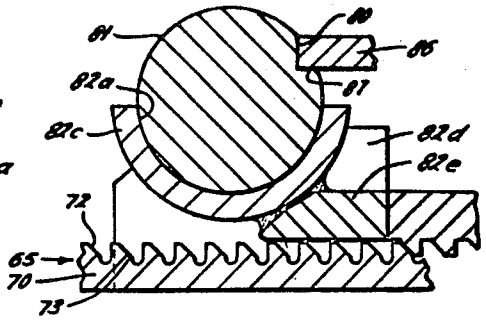


Fig. 9



FEMALE DIE AND WORKPIECE SUPPORT ARRANGEMENT FOR A PRESS

BACKGROUND OF THE INVENTION

The present invention provides a relatively simple female die arrangement for a press comprising opposed cylindrical members rotatably engaged and cradled by a cylindrical surface of support members whereby substantial loads may be applied to a workpiece carried by the female dies. Also, this arrangement inhibits damage to the workpiece being formed or working of the metal workpiece as it is formed by a male die of a press in cooperation with the cylindrical female die members.

The support members are carried on a carriage in a manner so that they may be spaced apart quickly and easily and maintained in such spaced relationship even under extreme loads as the workpiece is formed. The support arms on the carriage which support the workpiece are provided with rollers for engaging the workpiece so that as the workpiece is formed and a portion thereof deflected upwardly, the support arms may pivot upwardly to thereby maintain engagement with the elevated portion of the workpiece and provide support therefor.

Various forms of female die arrangements have been suggested and are shown in the prior art including U.S. Pat. No. 1,965,716 issued on July 10, 1934; U.S. Pat. No. 2,650,637 issued on Sept. 1, 1953; U.S. Pat. No. 3,209,576 issued on Oct. 5, 1965 and U.S. Pat. No. 3,271,990 issued on Sept. 13, 1966, all of which show various die arrangements for a press or apparatus for forming or bending metal workpieces.

It will be noted that all of such art includes rather complicated mechanism that is the female die arrangement of presses. Also, such die arrangements are somewhat difficult to adjust or regulate insofar as positioning one part of the female die relative to another part.

Additionally, in those instances where substantial loads are to be applied to metal workpieces in the forming thereof, it is necessary that the female die receive support over a substantial surface area to avoid damage or deformation thereto as the loads are applied.

One of the objects of the present invention is to provide a female die arrangement for a press wherein substantial loads are adapted to be applied to the dies in the forming of a workpiece, such dies being supported in a manner so that they are in continuous contact with the support surfaces throughout a substantial extent of their peripheral area to thereby transmit the load from the female die to the support and thence in turn to a carriage which carries the support members without creating undue stresses in any specific part of the carriage and the structure supporting it.

Another object is to provide a female die arrangement for a press including opposed cylindrical members whereby the cylindrical members may rotate about their longitudinal axis as a workpiece is forced donwardly in the space between the opposed dies so as to inhibit die abrasion of the workpiece.

Yet a further object is to provide a female die arrangement of substantial longitudinal extent including a plurality of axially aligned cylindrical rotatable members in end-to-end relation in two rows of support members to form a female die of desired longitudinal extent and which provides a die arrangement wherein substantial loads may be applied thereto to form a workpiece.

Still another object of the present invention is to provide a female die arrangement for a press wherein the distance or space between the rows of cylindrical members forming the female die may be quickly and easily regulated.

Yet a further object is to provide a female die for a press wherein a support member supports a cylindrical member over a substantial portion of its area to aid in keeping heavy grease between the cylindrical member and the support to facilitate rotation of the cylindrical member within the support without squirting the grease out from between the cylindrical member and support.

Still another object of the present invention is to provide a female die arrangement for a press including opposed cylindrical members carried and supported in engagement with support members having a cylindrical surface for engaging the opposed cylindrical die members and a carriage for supporting the support members, the carriage also including support arms extending laterally from one side of one of the support members and the support arms being pivotally mounted on the carriage whereby a workpiece may be placed on the carriage and over the female dies and then the support arms pivoted as the workpiece is formed to maintain engagement and support thereof.

Other objects and advantages will become apparent from consideration of the following description and drawings wherein:

FIG. 1 is a schematic diagram showing the carriage in dotted outline in the left-hand side of FIG. 1 and the track means therefor and showing on the right-hand side of FIG. 1 a diagrammatic sectional view of a press with the carriage moved into position and the female dies thereon with a partial showing of a workpiece in position on the carriage and on the female dies to be formed by the press;

FIG. 2 is an end view on the line 2—2 of FIG. 1 showing an end elevational view of a hydraulic press with a female die therein and the carriage and female die arrangement of the present invention positioned within the press and ready to form a workpiece carried on the carriage and female die;

FIG. 3 is a view similar to FIG. 2 but shows the relationship of the support arms on the carriage when they move upwardly as the workpiece is deformed by engagement of the male die against the workpiece and between the cylindrical opposed members of the female die;

FIG. 4 is a top plan view of a portion of the carriage illustrating in greater detail the arrangement of the opposed cylindrical members and the opposed supports therefor, which supports straddle the serrated members extending laterally across the carriage. It will be noted that the opposed cylindrical members are axially aligned and in end-to-end relationship to form a female die of desired extent. One of the support arms which is pivotally mounted on the carriage is also illustrated;

FIG. 5 is an end view on the line 5—5 of FIG. 4 showing one end in elevation of the carriage, and showing further details of the serrated hold down block members and their relationship to the opposed support members and serrated members mounted on the carriage;

FIG. 6 is a diagrammatic view illustrating a male die member engaging and forming a workpiece between the opposed cylindrical female die members and the manner of engagement of the opposed cylindrical fe-

male die members with the cylindrical support surfaces of the support members;

FIG. 7 is a sectional view on the line 7—7 of FIG. 4 and shows in greater detail the arrangement and relationship of the support arms on the carriage and their relation to the opposed cylindrical female die members. The dotted outline form indicates the position of the support arms as the workpiece shown in solid section line thereon is formed whereby the support arms maintain engagement with the workpiece as it is formed and a portion thereof elevated;

FIG. 8 is a sectional view on the line 8—8 of FIG. 7 to illustrate further details of the support members and their relation to the serrated members on the carriage;

FIG. 9 is a sectional view on the line 9—9 of FIG. 8 illustrating still further structural details of the pivot arrangement for the support arms.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. 1, a hydraulic press is referred to generally by the numeral 20 on the right-hand side of such figure. It includes a plurality of vertically extending, spaced structural support members 21 on each side of the press and suitable horizontal load bearing support members referred to generally by the numeral 23 for supporting the loads applied during operation of the hydraulic press. In FIG. 1, the vertically extending structural members 21 are illustrated as being in section in order that the relationship of the carriage referred to generally by the numeral 25 may be illustrated when in position in the hydraulic press, such carriage being referred to at 26 in dotted line showing it moved away from the press on the left-hand side of FIG. 1. The carriage 25 is moved on the spaced track means 30 as shown in FIG. 1, such track means extending longitudinally through the press and to the left thereof as viewed in FIG. 1. The carriage 25 carries a female die arrangement referred to generally at 33 and in the form of the invention shown for purpose of illustration only, the female die arrangement 33 extends longitudinally throughout the extent of the carriage. A plurality of support arms 35 extend from one side of the female die arrangement 33 and are arranged at spaced intervals longitudinally along the carriage 25 for supporting a workpiece, a portion of a workpiece being illustrated in elevation at 36 in FIG. 1.

In FIG. 2, an end view of the press 20 is illustrated and this view includes the top section 37 of the press from which depends the male die referred to generally by the numeral 37'. The carriage 25 is provided with roller means 38 at suitably spaced intervals longitudinally thereof for engaging the track means 30 whereby the carriage means 25 may be moved towards and away from the press 20. The workpiece 36 is illustrated as being carried by the support arms 35 and the female die arrangement 33 which die arrangement is carried by the carriage 25;

FIG. 3 is a view somewhat similar to FIG. 2, and it will be noted that the male die 37' has been moved downwardly so that the workpiece 36 is engaged between the male die 37' and forced into the space between the female die 33 for forming the workpiece in a predetermined manner. It will also be noted that the support arms 35 are connected by means of the piston rod 40 which is connected to a piston (not shown) within the two-way acting hydraulic cylinder 41 so that the workpiece 36 may be engaged at all times by the support arms 35. It can be appreciated that the workpiece 36 can be of substantial size and may have reinforcing members on the portion thereof which is carried on the support arm 35 that further increases its weight. To avoid undue stresses on the workpiece and to maintain it in proper position, the support means 35 is positioned at spaced intervals longitudinally of the carriage 25 to provide proper support for the workpiece 36 as it is formed.

Attention is next directed to FIG. 4 of the drawings wherein the carriage 25 is referred to in greater detail. The carriage 25 is formed of suitable longitudinally extending members 45 which are connected with cross bracing members 47 at spaced longitudinal intervals to provide the necessary strength and rigidity to the carriage. The carriage also includes a portion represented at 50 which has additional longitudinally extending members 51 connected together by the cross members 52, the portion 50 providing additional strength to the carriage 25 to withstand the loads imposed during the forming of the workpiece 36.

The portion 50 of the carriage 25 extends longitudinally of the carriage 25 and is arranged so that it is aligned with the male die 37' when the carriage 25 is moved into the press. The portion 50 of the carriage 25 also provides a support 55 for the female die arrangement 33.

The female die arrangement 33 includes opposed cylindrical members 60 and 61 which are rotatably carried in the opposed support members 62 and 63 respectively.

Means referred to generally by the numeral 65 in FIGS. 4 and 5 are provided for regulating the distance between the opposed support members 62 and 63 so as to maintain the opposed cylindrical members 60 and 61 a predetermined distance apart, as will be described. The opposed cylindrical members 60 and 61 are preferably solid to withstand the loads imposed as the workpiece 36 is formed. The opposed support members 62 and 63 each include a cylindrical surface 62*a* and 63*a* better seen in FIG. 5, in which the opposed cylindrical members are received. It will be noted that the cylindrical surfaces 62*a* and 63*a* conform with the cylindrical members 60 and 61 to thereby provide a means for accommodating rotation of the members 60 and 61 during the forming of the workpiece 36. Also, as noted in FIGS. 5 and 6, the cylindrical surfaces 62*a* and 63*a* of the opposed support members 62 and 63 surround a substantial surface portion of each of the cylindrical members 60 and 61, and as illustrated are shown as surrounding approximately fifty percent of such members. Also, the support members are of substantially the same longitudinal extent as the cylindrical member supported thereby. The amount of surface area contact between the support members 62 and 63 and the respective cylindrical members 60 and 61 that are carried thereby may be varied, but is such that the members 60 and 61 will not become dislodged or disengaged from the support members 62 and 63 as the male die 37 engages the workpiece 36 and deforms it between the spaced cylindrical members 60 and 61 as schematically illustrated in FIG. 6 of the drawings. Also, the surface contact between the cylindrical members and support members aids in distributing the heavy loads imposed more uniformly over a larger area. If desired, and preferably, a suitable lubricant such as heavy grease or the

like may be employed between the cylindrical members **60** and **61** and their respective cylindrical surfaces **62***a* and **63***a* to facilitate rotation of the members **60** and **61** in their respective supports as the workpiece is formed.

Means **65** are provided for enabling the support members **62** and **63** to be easily moved apart on the carriage **25** for regulating the distance between the opposed cylindrical members **60** and **61**, such adjusting and regulating means including the elongated members referred to generally at **70** in FIG. **4** which are arranged at spaced intervals longitudinally of the portion **50** of the carriage at **25** and extend partially across the carriage from each side of each of the support members **62** and **63**. The means **65** also include the holding or hold down block members **74** which abut the rear edge of each of the members **62** and **63**. The elongated members **70** include upwardly facing serrations **72** which mate with the downwardly facing serrations **73** formed on the removable holding block **74** used with each of the support members **62** and **63**. When it is desired to vary the distance between the opposed cylindrical members **60** and **61**, the removable holding block **74** is lifted and the support means **62** and **63** are manually shifted longitudinally of each of the members of **70** until the desired distance between the opposed cylindrical members **60** and **61** is attained. The blocks **74** are then repositioned to bear against the the rear of means **62** and **63** as shown in FIGS. **4, 5,** and **7** to mate serrations **72** and **73** so as to maintain the support members **62** and **63** in any predetermined position which regulates and maintains the desired distance between the opposed, cylindrical members **60** and **61** as the workpiece is formed.

The support members **62** and **63** and the cylindrical members **60** and **61** are too heavy to be lifted, but may be shifted along the plate **55***a* secured to and extending between longitudinal members **51**. The support members **62, 63** each respectively include the body **62***c*, **63***c* in which cylindrical surfaces **62***a*, **63**a are formed and depending side members **62***d*, **63***d* which are connected to their respective bodies **62***c*, **63***c*. The side members rest on plate **55***a* as shown in the drawings. As more clearly illustrated in FIG. **8**, the support members straddle the elongated serrated members **70** with the body **62***c* and body **63***c* being spaced above the members **70**. The members **70** are also positioned on the plate **55***a*.

The cylindrical members **60** and **61** are cradled within the cylindrical surfaces **62***a* and **63***a* as previously noted, and for all practical purposes this is the only means employed for retaining the opposed cylindrical means **60** and **61** within their respective support members **62** and **63**.

As also noted in FIG. **4** of the drawings, the cylindrical members **60** and **61** and the support members **62** and **63** are of relative limited longitudinal extent in relation to the total extent or length of the carriage **25** and a plurality is axially aligned in end-to-end relationship as shown in FIG. **4** of the drawings so as to provide a substantially continuous surface as if the cylindrical members **60** and **61** were of the same extent as the length of the female die if formed of one member rather than a plurality of individual members. However, it is believed that by providing a plurality of individual members such members will, under load, roll or rotate more easily within their respective cylindrical surfaces **62***a* and **63***a* of the support members **62** and **63** then if they were formed from one long piece of bar stock.

In FIG. **7** the metal workpiece is referred to again by the numeral **36** and is shown in enlarged cross section. The support arms are referred to again generally by the numeral **35**. It will be noted that in FIG. **4** the support arm is also referred to at **35** and includes an elongated plate **86** which is connected at one end **80** to a cylindrical member **81** which is of the same shape as the cylindrical members **60** and **61** and is also cradled in a support member as will be described herein; however its longitudinal extent need not be the same as the cylindrical members **60** and **61**. Referring to FIG. **7** it will be noted that the cylindrical member **81** is carried in a support member **82** which support is provided with a cylindrical surface **82***a* for accommodating rotation of the cylindrical member **81** as the support member **35** is elevated. The support member **82** includes body **82***c* and connected side members **82***d* depending therefrom and resting on surface **55***a*. The member **82** straddles one of the elongated members **70**, as do each of the members **62** and **63** and its body **82**c is spaced above the serrated member **70** as shown in FIG. **8**. Suitable means may be provided for effecting elevation of the support arm or support member **35** as the workpiece is deformed between the male die **37** and female die **33**, which, for purposes of illustration, is shown as including the double acting hydraulic cylinder **41** having the connections **41***a* on each side of a piston within the cylinder,which piston is connected to the piston rod **40**. The piston rod **40** is secured at its outermost end **40***a* to a pivot pin **40***b* mounted on the support arm **35**. An enlarged roller **85** is mounted at the outer end of the support member **35** as shown in solid line view of FIG. **7** and this, in turn, engages the plate **86**, which plate is secured at one end **80** to the cylindrical roller **81** in any suitable means and is shown as being secured in a notch **87** formed in the cylindrical surface of the cylindrical member **81**. The plate **86** is provided with a plurality of rollers **90** carried thereby and arranged at spaced intervals throughout the longitudinal extent thereof for engaging the workpiece **36** to more readily facilitate movement of the workpiece relative to the plate **86** as the workpiece **36** is formed and elevated.

The support member **35** is pivotally secured to one end of a holding or hold down member **74** by means of the pivot pin **88** to enable the support member **35** to elevate when power is supplied to the cylinder **41** to urge the support member **35** upwardly along with the plate **86** and the portion of the workpiece supported thereby.

By referring to FIG. **3** of the drawings, it will be noted that the portion **36***a* of workpiece **36** carried on the support arm **35** which extends from one side of one of the cylindrical members forming the female die is elevated substantially higher than the portion **36***b* during the forming operation. Thus, as the plate **36** is formed, power may be supplied to the cylinders **41** which are connected with the various support members **35** extending at spaced intervals throughout the carriage **25** to aid in maintaining the portion **36***a* of the workpiece **36** as viewed in FIG. **3** in its elevated position. The roller means **90** engage the workpiece **36** and lessen the frictional engagement that would otherwise occur, and similarly, the roller **85** engages the plate **86** to reduce the friction.

This arrangement provides support for the portion of the workpiece **36** resting on the support members **35**

during the forming thereof to inhibit improper deflection or bending of the workpiece, which might otherwise occur in relatively large members which are being formed in the press.

In FIG. 8 a load transfer plate 82*e* is shown which is welded or otherwise connected to body 82*c* and arms 82*d* for transferring load as will be described. Each of the support members 62 and 63 also are similarly constructed. The support member includes the means 65 previously described for accommodating spacing of the support members 82 to maintain the cylindrical members 81 in alignment with the cylindrical members 61. The arrangement of the support members 82 is such that as the male die engages the workpiece and deforms it in cooperation with the female dies, the load is transmitted from the support members or means 62, 63 and 82 to the carriage.

For example, when the carriage is moved into the press as previously described, suitable means such as hydraulic cylinders or the like (not shown) may be actuated to elevate rollers 38 slightly. When this occurs, the carriage will rest upon the load bearing members represented at 100 in FIGS. 2 and 3.

The large surface area of contact between the rotatable cylindrical members and their respective supports transmits the load to the carriage and then it is transmitted to the stationary load carrying members 100 positioned in the press as the workpiece is formed.

In FIG. 9, the cylindrical member 81 is again referred to and the end 80 of the plate 86 is shown in greater detail in the notch 87 for engagement therewith. The cylindrical surface 82a cradles the cylindrical member 81 as previously noted, and it will be noted that the regulating means 65 includes upwardly facing serrations 72 on members 70 as well as downwardly facing serrations 73 formed on the hold down block 74.

The die arrangement, by including the construction as shown and described, can withstand relatively high unit loading, while still performing their proper function and without die abrading the metal workpiece.

The press is operated by any suitable power source, such as hydraulic means to move the male die 37′ down into engagement with the workpiece to form it and then to retract the male die 37′ when the forming is completed.

The foregoing disclosure and description of the invention are illustrative and explanatory thereof, and various changes in the size, shape, and materials as well as in the details of the illustrated construction may be made without departing from the spirit of the invention.

What is claimed is:

1. A female die and workpiece arrangement for a press comprising:

a. opposed cylindrical members;

b. opposed support means for said cylindrical members, said support means including:

a. a cylindrical surface conforming with the cylindrical surface on said cylindrical members for engaging and supporting said cylindrical members for rotation on said cylindrical surfaces; and

b. means for regulating the distance between said opposed support means to thereby position said opposed cylindrical members a desired distance apart, said regulating means including:

1. members arranged laterally relative to said opposed support means, said members having upwardly facing serrations thereon; and

2. block means positioned on and longitudinally aligned with said members for abutting against the rear of said support means, said block means being shorter in length than said members and having downwardly facing serrations for engaging a preselected number of said upwardly facing serrations on said members whereby the distance between said opposed support means may be adjusted and maintained at any desired predetermined amount by placing said block means at any preselected position on said members with said serrations in mating engagement;

carriage means upon which said support means are carried;

means for moving said carriage into and away from the press including:

a. track means; and

b. roller means mounted on said carriage for engaging and moving along said track means.

2. The invention of claim 1 wherein said carriage includes:

a. a plurality of support arms extending laterally relative to one of said opposed support means;

b. said support arms being positioned at spaced intervals longitudinally of said carriage for supporting a workpiece;

c. said support arms each being pivotally connected at one end to one of said support means;

d. said support arms each including a plate extending longitudinally thereof and being longer than said support arms, said plate being secured at one end to one of said cylindrical members;

e. said support arms each having roller means adjacent its other end for engaging and supporting said plate in relation to said arms;

f. said plate of each support arm including a plurality of spaced rollers carried thereby for engaging the workpiece; and

g. means to pivot said support arms upwardly to maintain said rollers on each of said plates in supporting relationship with the workpiece as the workpiece is shaped by the press.

* * * * *