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(54) **STRIPPER-PLATE ALIGNMENT SYSTEM AND DIE SET**

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(57) **ABSTRACT**

A stripper-plate for a progressive die sets is provided including open-ended tubular guide bushings that project outwardly from at least one side. A first anti-friction bearing assembly is positioned within each of the guide bushings, and a second anti-friction bearing assembly is positioned on an outer surface of each of the guide bushings. A die set is also provided including an upper die shoe having a plurality of guide posts arranged in a pattern and projecting outwardly from a surface. A lower die shoe is arranged in confronting relation to the surface of the upper die shoe, and includes a first plurality of open ended tubular guide bushings positioned so as to each receive a corresponding one of the guide posts. A first anti-friction bearing assembly is positioned within each of the guide bushings. A stripper-plate is positioned between the upper die shoe and the lower die shoes, and includes a second plurality of open-ended tubular guide bushings each having an outer surface and an inner surface. The second guide bushings project outwardly toward the lower die shoe in a pattern that corresponds to the pattern of guide posts. Each of the first anti-friction bearing assemblies slidingly engages an outer surface of a corresponding one of the second guide bushing. Each of the second guide bushings includes a second anti-friction bearing assembly that is positioned on an inner surface so as to engage a corresponding one of the guide posts.

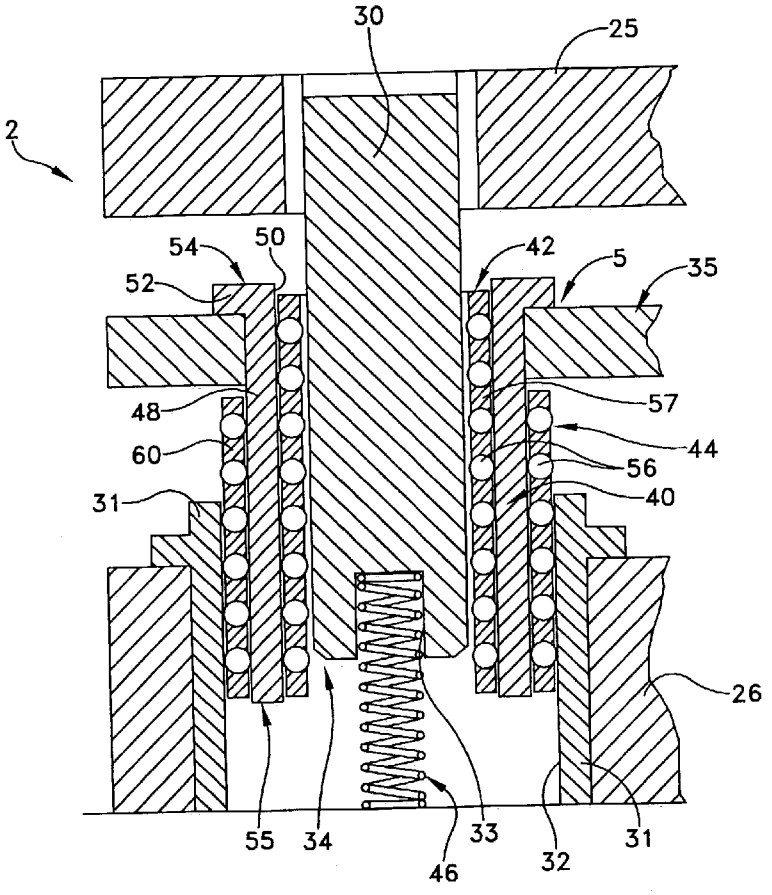


FIG. 1

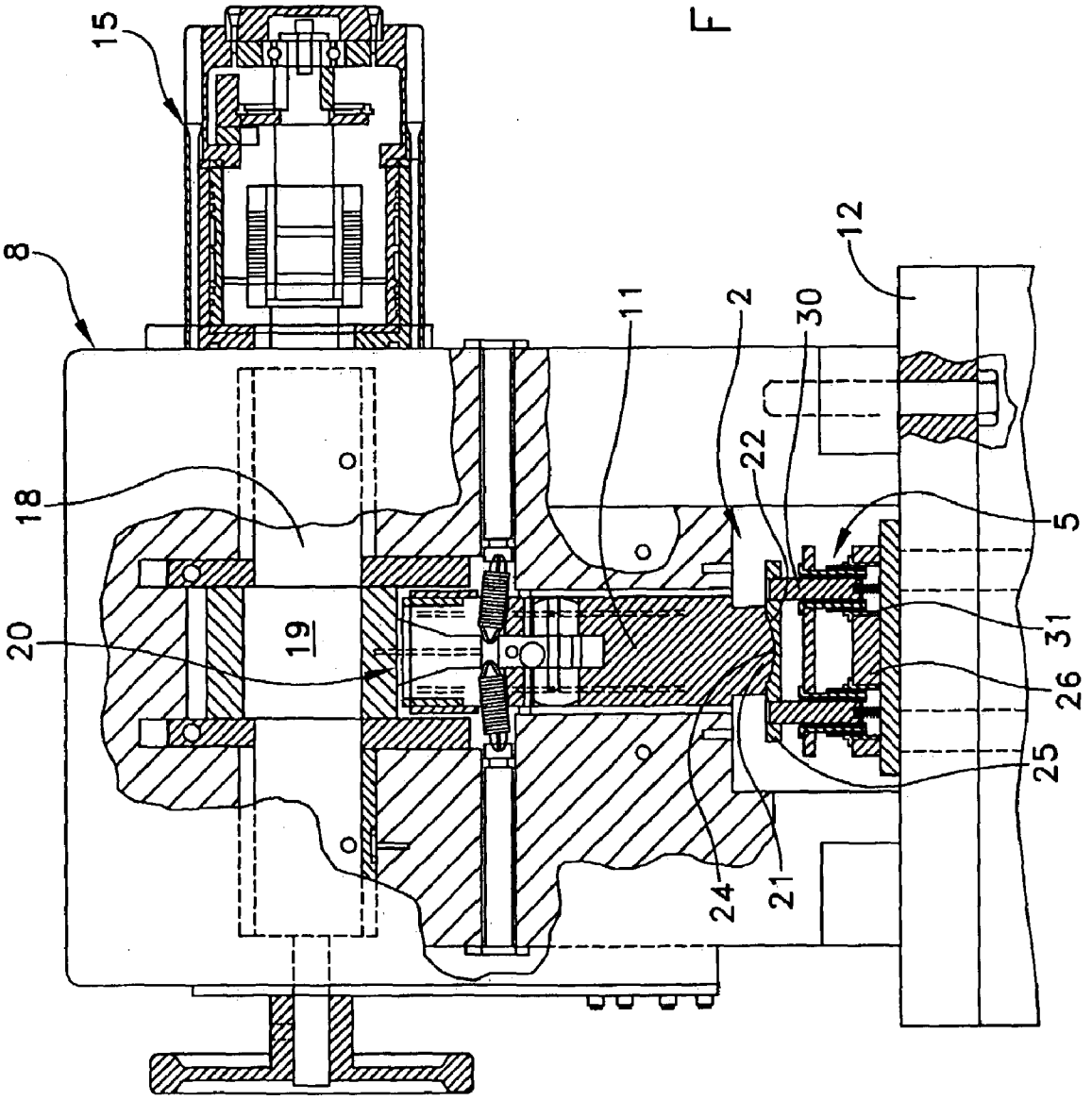


FIG. 2

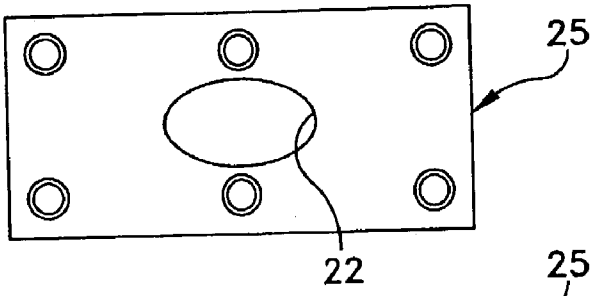


FIG. 3

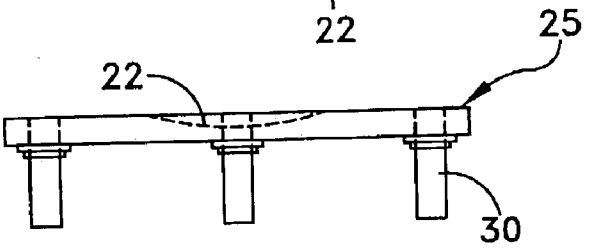


FIG. 4

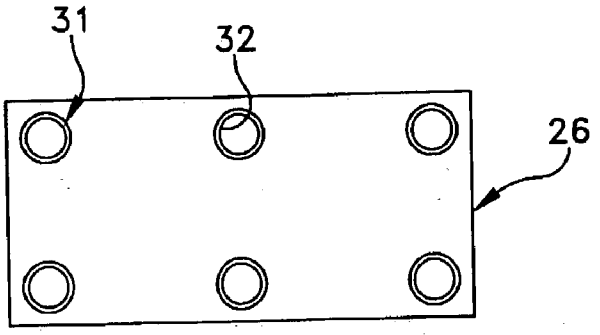


FIG. 5

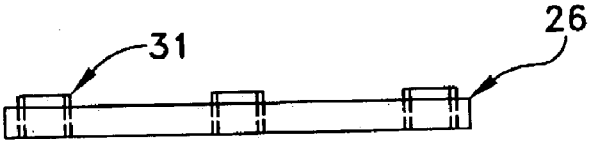


FIG. 6

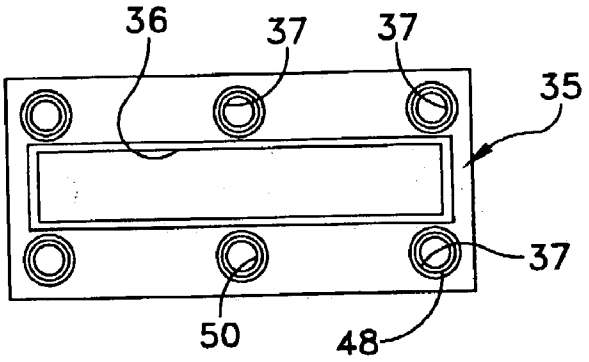
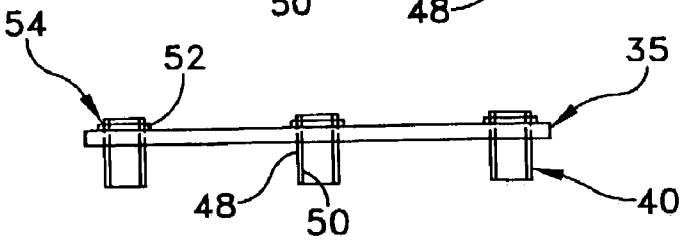


FIG. 7



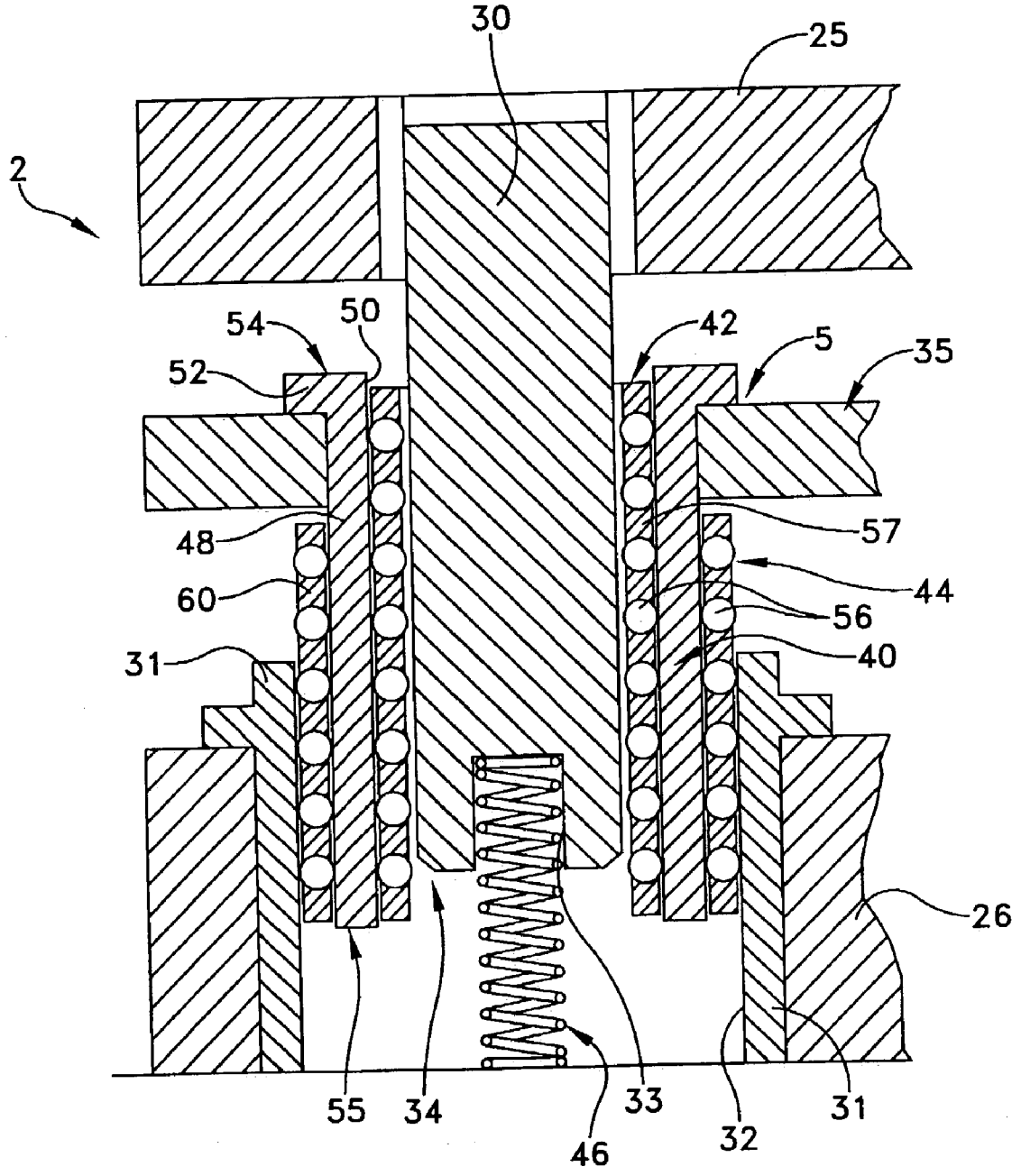


FIG. 8

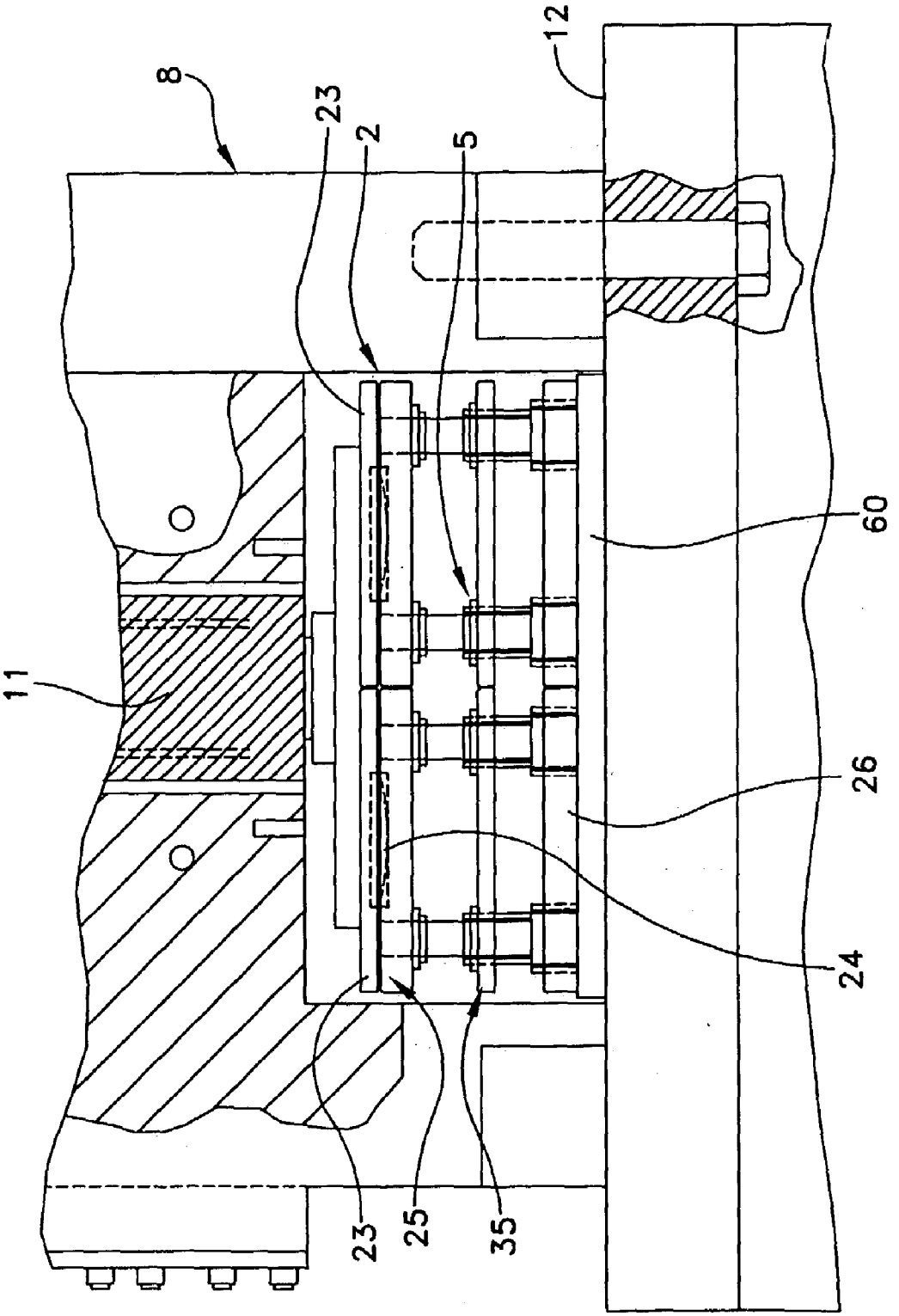


FIG. 9

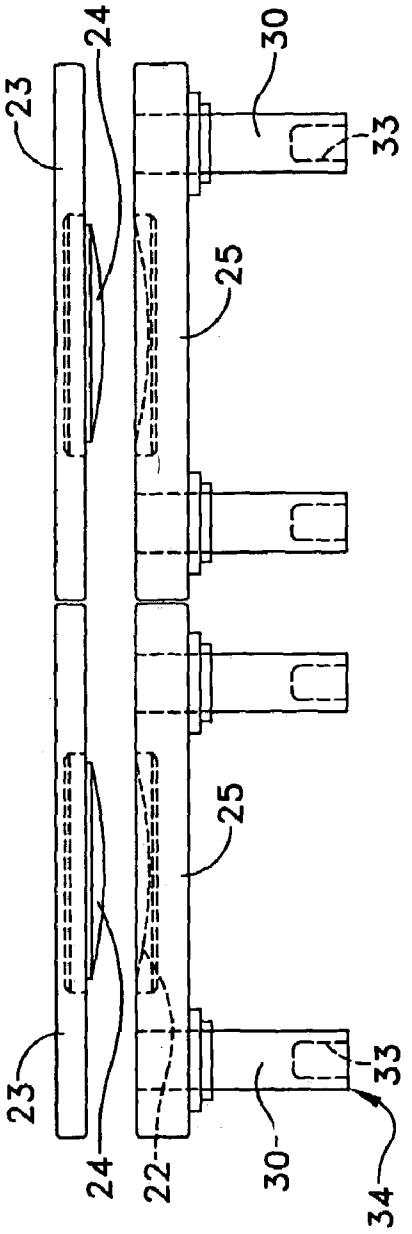


FIG. 10

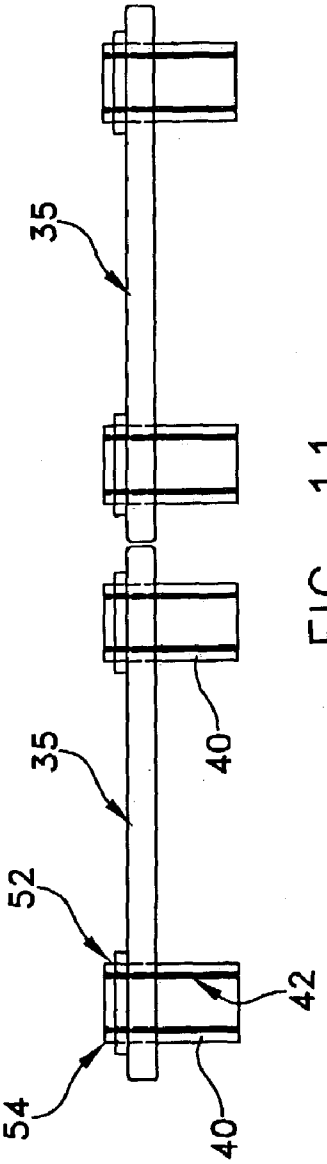


FIG. 11

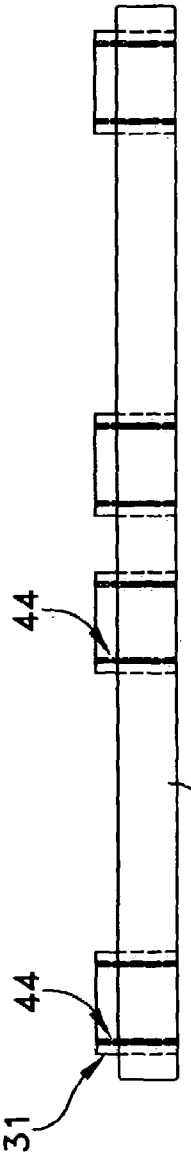


FIG. 12

STRIPPER-PLATE ALIGNMENT SYSTEM AND DIE SET

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 60/398,855, filed Jul. 26, 2002.

FIELD OF THE INVENTION

[0002] The present invention generally relates to metal forming equipment and, more particularly, to progressive metal stamping dies.

BACKGROUND OF THE INVENTION

[0003] Progressive metal stamping in which a metal strip or the like is guided along a predetermined path through a die set in cadence with the operation of a reciprocating press is well known. Prior art metal stamping die sets typically consist of confronting upper and lower die shoes, where one or the other of the die shoes includes two or more solid metal guide posts (usually four) affixed to it, and the other of the die shoes includes a corresponding number of bushings affixed to it. The bushings receive the guide posts, and thereby serve to guide the shoes as they are brought together during reciprocating press operation for the forming or punching of a metal strip. A plurality of tools are positioned on the inner punching of a metal strip. A plurality of tools are positioned on the inner confronting surfaces of the upper and lower die shoes that are circumscribed by the posts and bushings. These tools are shaped and sized to enable piercing, punching, drawing, or other operations to be performed upon the metal strip as it progresses through the die set.

[0004] Upon each reciprocating movement or "stroke"of the press, the metal strip is lifted and then advanced by one step through the die set. The tools that are located on the upper die shoe, above the metal strip, thus move toward and away from the surface of the metal strip during each full cycle of the press. These tools, often simply referred to as "punches," are guided through a stripper-plate which is located just above the metal strip. The stripper-plate often has a plurality of guide openings to guide the punches toward the metal strip, and to retain the metal strip in position during the punching, piercing, or drawing operation, while permitting movement of the metal strip as it is progressively fed through the die between punching strokes. The stripper-plate is pressed by releasable spring pressure against the metal strip during each downward stroke of the press. The punches pass through the guide openings in the stripper-plate during the downward stroke of the press and toward the metal strip. The punches engage or penetrate the metal strip and then are retracted with the upward stroke of the press. During the upward stroke of the press, as the punches are pulled away from the metal strip, the metal strip is pulled or "stripped" off the punches by the stripper-plate. At the same time, the spring pressure is,released from the stripper-plate, which then also moves away from the metal strip, thereby releasing the metal strip so that it may be advanced an incremental step through the die set prior to the next downward stroke.

[0005] Because of the complex timed movement of the foregoing elements, it is essential that accuracy be maintained in guiding the upper and lower die shoes together, so that the mating parts of the die set, i.e., tools and recesses, cooperate as intended, otherwise damage and destruction of the tools mounted on the die set, and possibly also the press, itself, may result. Thus, the solid guide post and bushing system along with the stripper-plate are essential to optimum progressive die and press operations.

[0006] In order to make this metal forming system more rigid and thereby afford greater accuracy, single ball bearing cages located between the outer surface of the guide posts and guide bushings have been used in many prior art progressive dies. As alignment of the punching components has become more critical over time, the stripper-plate has become the mechanism to guide the male punching components into the female components. To accomplish this critical task, a second system of guide posts and bushings has often been added to the first set of guide posts and bushings. The second system of guide posts and bushings are located on the interior confronting surfaces of the die shoes. As a function of available space within the die set and press, this second system of guide posts necessarily has to be smaller than the first guide posts and bushings that guide the upper and lower die shoes together. As a consequence, prior art die sets have increased accuracy through greater rigidity in the system by trading a smaller bearing surface to guide the stripper-plate and therethrough guide the punches, and a greater bearing surface to guide the upper die shoe. Unfortunately, the upper die shoe often does not require the same accuracy as the stripper-plate. The second system of guide posts and bushings also limits the effective work surface available in the die set for the varied operations now required from high speed metal stamping.

[0007] One way to increase both the bearing surface and guidance of the stripper-plate is to use very large (diameter) guide posts and guide them directly into bushings in the lower shoe. This technique has been found, however, to add considerable weight to the stripper-plate, requiring larger spring constant springs to provide additional releasable spring pressure in an already crowded workspace. This technique also often inhibits press running speeds.

[0008] As a consequence, there has been a long felt need for a metal stamping die set that has a maximum workspace available between the upper and lower die shoes, while at the same time, provides for reliable, high speed press operation and greater die set and stripper-plate accuracy.

SUMMARY OF THE INVENTION

[0009] The present invention provides a metal stamping system including a press having a reciprocating ram. A bulbous protrusion projects outwardly from an end of the ram. An upper die shoe is provided including (i) a recess formed in a top surface, the recess being complementary to the bulbous protrusion, and (ii) a plurality of guide posts arranged in a pattern and projecting outwardly from a bottom surface. During operation of the system, the bulbous protrusion is freely received within the complementary recess, i.e., the bulbous protrusion is not fastened to the upper shoe. A lower die shoe is positioned in confronting relation to the surface and includes a first plurality of open ended tubular guide bushings each having a first anti-friction bearing assembly positioned within a central passageway, and each located so as to receive a corresponding one of the

guide posts. A stripper-plate is positioned between the upper die shoe and the lower die shoe. The stripper-plate includes a second plurality of open-ended tubular guide bushings each having an outer surface and an inner surface and each projecting outwardly toward the lower die shoe in a pattern corresponding to the pattern of guide posts. In this way, each of the first anti-friction bearing assemblies slidingly engages an outer surface of a corresponding one of the second open ended guide bushing. Each of the second plurality of open-ended guide bushings includes a second anti-friction bearing assembly that is positioned on the inner surface so as to engage a corresponding one of the guide posts. Spring means are provided for separating the upper shoe from the lower shoe after each downward stroke of the ram.

[0010] In an alternative embodiment of the invention, a die set is provided of the type that is to be reciprocatingly driven in a stamping press. The die set of the invention includes an upper die shoe including (i) a recess formed in a top surface, the recess being complementary to a bulbous protrusion located on a ram portion of the press, and (ii) a plurality of guide posts arranged in a pattern and projecting outwardly from a bottom surface. The bulbous protrusion is freely received within the complementary recess. A lower die shoe is positioned in confronting relation to the surface, and includes a first plurality of open ended tubular guide bushings each having a first anti-friction bearing assembly positioned within a central passageway, and each located so as to receive a corresponding one of the guide posts. A stripper-plate is positioned between the upper die shoe and the lower die shoe. The stripper-plate includes a second plurality of open-ended tubular guide bushings, each having an outer surface and an inner surface and each projecting outwardly toward the lower die shoe in a pattern corresponding to the pattern of guide posts. In this way, each of the first anti-friction bearing assemblies slidingly engages an outer surface of a corresponding one of the second open ended guide bushing. Each of the second plurality of open-ended guide bushings includes a second anti-friction bearing assembly positioned on the inner surface so as to engage a corresponding one of the guide posts.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] These and other features and advantages of the present invention will be more fully disclosed in, or rendered obvious by, the following detailed description of the preferred embodiments of the invention, which are to be considered together with the accompanying drawings, wherein like numbers refer to like parts and further wherein:

[0012] **FIG. 1** is a partially broken-away, front elevational view of a high speed metal stamping press including a die set and stripper alignment system formed in accordance with the present invention;

[0013] **FIG. 2** is a top elevational view of an upper die shoe;

[0014] **FIG. 3** is a side elevational view of the upper die shoe shown in **FIG. 2**;

[0015] **FIG. 4** is a top elevational view of a lower die shoe;

[0016] **FIG. 5** is a side view of the lower die shoe shown in **FIG. 4**;

[0017] **FIG. 6** is a top view of a stripper-plate formed in accordance with the present invention;

[0018] **FIG. 7** is a side view of the stripper-plate shown in **FIG. 6**;

[0019] **FIG. 8** is a partially broken-away, cross-sectional view of assembled upper and lower die shoes, a stripper-plate, and including a stripper-plate alignment system formed in accordance with the present invention;

[0020] **FIG. 9** is a partially broken-away, partially phantom, view of a portion of the stamping press shown in **FIG. 1**, having a side-by-side pair of die sets, each including a stripper-plate alignment system formed in accordance with the invention, mounted to an intermediate locator plate positioned on the bolster of the press;

[0021] **FIG. 10** is a side elevational view, partially in phantom, of a pair of upper die shoes arranged in accordance with an alternative embodiment of the invention;

[0022] **FIG. 11** is a side elevational view, partially in phantom, of a pair of stripper-plates arranged in accordance with an alternative embodiment of the invention; and

[0023] **FIG. 12** is a side elevational view, partially in phantom, of a single lower die shoe arranged in accordance with an alternative embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0024] This description of preferred embodiments is intended to be read in connection with the accompanying drawings, which are to be considered part of the entire written description of this invention. The drawing figures are not necessarily to scale and certain features of the invention may be shown exaggerated in scale or in somewhat schematic form in the interest of clarity and conciseness. In the description, relative terms such as "horizontal,""vertical, ""up,""down,""top" and "bottom" as well as derivatives thereof (e.g., "horizontally,""downwardly,""upwardly," etc.) should be construed to refer to the orientation as then described or as shown in the drawing figure under discussion. These relative terms are for convenience of description and normally are not intended to require a particular orientation. Terms including "inwardly" versus "outwardly,""longitudinal" versus "lateral" and the like are to be interpreted relative to one another or relative to an axis of elongation, or an axis or center of rotation, as appropriate. Terms concerning attachments, coupling and the like, such as "connected" and "interconnected," refer to a relationship wherein structures are secured or attached to one another either directly or indirectly through intervening structures, as well as both movable or rigid attachments or relationships, unless expressly described otherwise. The term "operatively connected" is such an attachment, coupling or connection that allows the pertinent structures to operate as intended by virtue of that relationship. In the claims, means-plus-function clauses are intended to cover the structures described, suggested, or rendered obvious by the written description or drawings for performing the recited function, including not only structural equivalents but also equivalent structures.

[0025] Referring to **FIG. 1, a** die set **2** comprising a stripper-plate alignment system **5** formed in accordance with the present invention is often mounted within a high speed stamping and forming press **8** of the type well known in the art. For example, a typical high speed stamping and forming

press **8** includes a ram **11** that moves toward and away from a bolster plate **12** at a rate of between approximately 1,000-3000 strokes per minute, or more. The length of the stroke is often about 0.25 inches. An electric motor **15** is coupled to a drive shaft **18** having an eccentric **19** which drives ram **11** by means of a crank **20**. Drive shaft **18** and crank **20** are journaled in hydrostatic bearings, and ram **11** is journaled in a linear hydrostatic bearing, including fluid conduits, all of which are specially designed to allow high speed stamping and forming press **8** to operate at the above-mentioned 1,000-3000 strokes per minute. In the present invention, end **21** of ram **11** includes an outwardly projecting bulbous protrusion **22**, such as a chord of a sphere, on the surface of ram **11** that opposes bolster plate **12**. In some arrangements, an intermediary plate **23**, having an outwardly projecting bulbous protrusion **22**, may be positioned between upper die shoe **25** and end **21** of ram **11** so as to distribute forces more equally, and allow for retrofitting of prior art presses in the field **(FIGS. 9 and 10)**.

[0026] Referring to FIGS. **1-5**, die set **2** comprises an upper shoe **26** attached to and carried by ram **11**, and a mating lower die shoe **26** secured to bolster plate **12** in a conventional manner well known in the art. Two or more guide posts **30** project downwardly from upper die shoe **25**, and are received within internal passageways **32** of correspondingly positioned guide bushings **31** mounted in lower die shoe **26**. In one preferred embodiment of the present invention, six mating pairs of guide posts **30** and guide bushings **31** are arranged on upper die shoe **25** and lower die shoe **26**. Each guide post **30** includes a recess **33** defined at a free end **34 (FIG. 8)**. Upper die shoe **25** also includes a ram coupler comprising a recess **24** defined in a top surface. Ram coupler **24** is adapted to non-fixedly engage complementarily shaped bulbous protrusion **22** on the end of ram **11**. The engagement is such that ram **11** can force upper die shoe **25** downwardly toward lower die shoe **26**. Some relative motion is permitted within the coupling between ram **11** and upper die shoe **25** as a result of the implementation of stripper-plate alignment system **5**.

[0027] Referring to FIGS. **1, 6-7**, and **8**, a stripper-plate **35** is located between upper die shoe **25** and lower die shoe **26**, and is maintained in position via stripper-plate alignment system **5 (FIGS. 1 and 8)**. Stripper-plate **35** comprises one or more central openings **36** that receive punches and the like (not shown) and peripheral through-bores **37** arranged in a pattern that corresponds to the pattern of guide posts **30** and guide bushings **31** on upper die shoe **25** and lower die shoe **26**.

[0028] Referring to FIGS. **6-8**; stripper-plate alignment system **5** is assembled between upper shoe **25** and lower shoe **26**, and comprises a plurality of stripper guide bushings **40**, a plurality of internal anti-friction bearing assemblies **42**, a plurality of external anti-friction bearing assemblies **44**, and a plurality of return springs **46**. In a preferred embodiment of the invention, there is at least one stripper guide bushing **40**, one internal and one external anti-friction bearing assemblies **42,44**, and a return spring **46** associated with each pair of guide posts **30** and guide bushings **31**. Of course, other arrangements of return springs are possible, as long as such structures allow for the axially upward displacement of upper die shoe **25** upon each upward portion of the stroke of ram **11**. Each stripper guide bushing **40** comprises an open ended, cylindrical tube **48** having an internal passageway **50**, an annular shoulder **52** that projects radially outwardly from a top end **54**, and includes a bottom end **55**. Internal passageway **50** of each stripper guide bushing **40** is defined by the hardened internal surface of cylindrical tube **48**, and is sized to slidingly accept an internal anti-friction bearing assembly **42** and a guide post **30**.

[0029] Each internal anti-friction bearing assembly **42** includes a plurality of circularly and longitudinally spaced ball bearings **56** that are each confined in a bearing cage **57**. Each bearing cage **57** is preferably cylindrical, and is sized so as to longitudinally enclose and encircle a guide post **30** with appropriate space between guide post **30** and bearing cage **57** to avoid contact between them, but to allow for a prestressed loading of ball bearings **56** against the outer surface of guide post **30**. The outer surface of each guide post **30** is hardened, ground, and polished to permit relative longitudinal movement between ball bearings **56**, bearing cage **57**, and guide post **30** with good control so as to prevent relative rotational movement between them. The foregoing assembly is very often lubricated with an appropriately selected oil or other lubricant of the type that is well known in the art.

[0030] Each external anti-friction bearing assembly **44** also includes a plurality of circularly and longitudinally spaced ball bearings **56** that are each confined in a bearing cage **60**. Bearing cage **60** is also cylindrical, and each is sized so as to (i) longitudinally enclose and encircle a stripper guide bushing **40**, and (ii) be received within internal passageway **32** of lower die shoe guide bushing **31** with appropriate space between lower die shoe guide bushing **31**, stripper guide bushing **40** and bearing cage **60** to avoid contact between them. The outer and inner surfaces of each stripper guide bushing **40** are often hardened, ground, and polished to permit relative, self-aligning longitudinal movement between ball bearings **56** of both internal anti-friction bearing assembly **42** and external anti-friction bearing assembly **44** with good control so as to prevent relative rotational movement between them. The foregoing assembly is also very often lubricated with an appropriately selected oil or other lubricant well known in the art.

[0031] The present invention is assembled to die set **2** in the following manner. Stripper-plate **35** is first arranged with a stripper guide bushing **40** press-fit within each peripheral through-bore **37**. In this arrangement, each annular shoulder **52** engages an upper surface of stripper-plate **35** adjacent to the entrance to a through-bore **37** so as to seat stripper guide bushing **40** within through-bore **37**. Internal anti-friction bearing assemblies **42** are then preloadingly press-fit within internal passageways **50** of each stripper guide bushing **40**. The "prestressing" or "preloading" of internal anti-friction bearing assemblies, i.e., preloading bearings **56** against the internal surface of stripper guide bushing **40**, provides a mechanical coupling of these structures, which in turn, allows for a mechanical and structural coupling of guide posts **30** and lower die shoe guide bushings **31** to stripper-plate **35**. Thus, the internal and external bearing assemblies **42,44**, provide both anti-frictional movement between guide posts **30**, stripper guide bushing **35**, and lower die shoe guide bushings **31**, and a structural coupling of these structures which effects a highly accurate guidance of these moving parts.

[0032] With stripper guide bushings **40** and internal anti-friction bearing assemblies **42** assembled to stripper-plate **35**, it is then positioned between upper die shoe **25** and lower die shoe **26** such that guide posts **30**, stripper guide bushings **40**, and lower die shoe guide bushings **31** are arranged in confronting coaxial relation to one another. Coil springs **46** are positioned within recesses **33** at bottom free end **34** of each guide post **30**. Of course, other arrangements of springs may be utilized to aid in the upward return of stripper-plate **35** without departing from the present invention. Once in this position, upper die shoe **25** is moved towards stripper-plate **35** and lower die shoe **26** such that guide posts **30** enter internal passageway **50** of each stripper guide bushing **40**. It will be understood that internal anti-friction bearing assembly **42** provides smooth relative longitudinal movement between upper die shoe **25** and stripper guide bushing **40**. At the same time, stripper-plate **35** is moved toward lower die shoe **26** so that each stripper guide bushing **40** enters a lower die guide bushing **31**. Each return spring **46** is employed to automatically return die set **2** to an open position after each downward stroke of ram **11**. Here again, external anti-friction bearing assembly **44** provides for smooth relative longitudinal movement between each stripper guide bushing **40** and each lower die guide bushing **31** thereby providing accurate guidance that allows for a non-fixed engagement between end **21** of ram **11** and upper die shoe **25**.

[0033] In operation, the increased rigidity of alignment provided by stripper-plate alignment system **5** disassociates die set **2** from the over-powering alignment system of press ram **11**. In other words, the combination of internal anti-friction bearing assembly **42**, external anti-friction bearing assembly **44**, stripper-plate guide bushings **40** and lower die shoe guide bushings **31** provide an essentially independent guidance system for die set **2** that is not coupled to the guides controlling the reciprocating movement of ram **11**. In this way, internal and external anti-friction bearing assemblies **42,44** in combination with stripper-plate guide bushings **40** and lower die shoe guide bushings **31** alleviate effects from press ram misalignment. As a result of this improved arrangement, upper die shoe **25** does not require clamping or bolting t press ram **11**, such that bulbous protrusion **24** is freely received within complementary recess **22**, i.e., the bulbous protrusion is not fastened to upper die shoe **25**, during operation of the system. This arrangement dramatically simplifies and reduces the time required to assemble die set **2** within press **8**. In addition, die set **2** may be segmented into upper die shoe and stripper sections with each segment having its own stripper-plate. This enables critical stations in die set **2** to operate independently, so that scrap metal produced through the stamping operation does not effect other die stations (FIGS. **9-12**). Either a single lower die shoe **26***a* may be used **(FIG. 12)** or a pair of lower die shoes **26** may be mounted upon a locator plate **60 (FIG. 9)**.

[0034] It is to be understood that the present invention is by no means limited only to the particular constructions herein disclosed and shown in the drawings, but also comprises any modifications or equivalents within the scope of the claims.

What is claimed is:

1. A metal stamping system comprising:

a press including a ram having a bulbous protrusion projecting outwardly from an end;

an upper die shoe including (i) a recess formed in a top surface, said recess being complementary to said bulbous protrusion, and (ii) a plurality of guide posts arranged in a pattern and projecting outwardly from a bottom surface, wherein said bulbous protrusion is received within said complementary recess;

a lower die shoe positioned in confronting relation to said surface and including a first plurality of open ended tubular guide bushings each having a first anti-friction bearing assembly positioned within a central passageway, and each located so as to receive a corresponding one of said guide posts; and

a stripper-plate positioned between said upper die shoe and said lower die shoe, including a second plurality of open-ended tubular guide bushings each having an outer surface and an inner surface and each projecting outwardly toward said lower die shoe in a pattern corresponding to said pattern of guide posts such that each of said first anti-friction bearing assemblies slidingly engages an outer surface of a corresponding one of said second open ended guide bushing wherein each of said second plurality of open-ended guide bushings includes a second anti-friction bearing assembly positioned on said inner surface so as to engage a corresponding one of said guide posts; and

spring means for separating said upper shoe from said lower shoe after each downward stroke of said ram.

2. A metal stamping system according to claim 1 wherein each of said open-ended tubular guide bushings includes an annular shoulder that projects radially outwardly from a top end.

3. A metal stamping system according to claim 1 wherein each of said open-ended tubular guide bushings comprises an internal passageway defined by a hardened surface and sized to slidingly accept one of said first anti-friction bearing assemblies.

4. A metal stamping system according to claim 3 wherein each of said first anti-friction bearing assemblies includes a plurality of circularly and longitudinally spaced ball bearings that are each confined in a bearing cage, wherein said ball bearings are preloaded against said hardened surface.

5. A metal stamping system according to claim 3 wherein each of said first anti-fiction bearing assemblies comprises an open ended tubular cylinder.

6. A metal stamping system according to claim wherein each of said second anti-friction bearing assemblies includes a plurality of circularly and longitudinally spaced ball bearings that are each confined in a bearing cage, wherein said ball bearings are preloaded against a surface of one of said open-ended tubular guide bushings.

7. A metal stamping system according to claim 6 wherein each of said second anti-friction bearing assemblies include a bearing cage that is cylindrical.

8. A metal stamping system according to claim 1 wherein said bulbous protrusion projects outwardly from an intermediate plate positioned on an end of said ram.

9. A metal stamping system according to claim 1 comprising a pair of upper die shoes, a pair of lower die shoes, and a pair of stripper-plates positioned between said upper die shoes and said lower die shoes, wherein said pair of lower die shoes is mounted upon an intermediate plate positioned upon a bolster.

10. A die set to be reciprocatingly driven in a stamping press comprising:

an upper die shoe including (i) a recess formed in a top surface, said recess being complementary to a bulbous protrusion located on a ram portion of said press, and (ii) a plurality of guide posts arranged in a pattern and projecting outwardly from a bottom surface, wherein said bulbous protrusion is received within said complementary recess;

a lower die shoe positioned in confronting relation to said surface and including a first plurality of open ended tubular guide bushings each having a first anti-friction bearing assembly positioned within a central passageway, and each located so as to receive a corresponding one of said guide posts; and

a stripper-plate positioned between said upper die shoe and said lower die shoe, including a second plurality of open-ended tubular guide bushings each having an outer surface and an inner surface and each projecting outwardly toward said lower die shoe in a pattern corresponding to said pattern of guide posts such that each of said first anti-friction bearing assemblies slidingly engages an outer surface of a corresponding one of said second open ended guide bushing, wherein each of said second plurality of open-ended guide bushings includes a second anti-friction bearing assembly positioned on said inner surface so as to engage a corresponding one of said guide posts.

11. A die set according to claim 10 wherein said upper die shoe includes at least two of said guide posts that are each received within one of said first open ended tubular guide bushings.

12. A die set according to claim 10 wherein said upper die shoe includes six guide posts wherein each are received within one of said first open ended tubular guide bushings.

13. A die set according to claim 10 wherein each guide post includes a recess defined at a free end, having a spring mounted therein for separating said upper shoe from said lower shoe after each downward stroke of said ram.

14. A die set according to claim 10 wherein said stripper-plate includes a pattern of peripheral through-bores arranged in corresponding relation to the positions of said guide posts and said first plurality of open ended tubular guide bushings.

15. A die set according to claim 10 wherein each of said second plurality of open-ended tubular guide bushings includes an internal passageway and an annular shoulder that projects radially outwardly from a top end.

16. A die set according to claim 15 wherein each of said internal passageways is defined by a hardened surface, and is sized to slidingly receive a first anti-friction bearing assembly and one of said guide posts.

17. A die set according to claim 16 wherein each of said first anti-friction bearing assemblies includes a plurality of circularly and longitudinally spaced ball bearings that are each confined in a bearing cage, wherein said ball bearings are preloaded against a said hardened surface.

18. A die set-according to claim 17 wherein said bearing cage is cylindrical, and sized so as to longitudinally enclose and encircle one of said guide posts.

19. A die set according to claim 17 wherein each of said first anti-friction bearing assemblies is located between said guide post and bearing cage so as to allow for a prestressed loading of said ball bearings against an outer surface of said guide post.

20. A die set according to claim 10 wherein each of said second anti-friction bearing assemblies includes a plurality of circularly and longitudinally spaced ball bearings that are each confined in a bearing cage.

21. A die set according to claim 20 wherein each of said bearing cages is cylindrical, and each is sized so as to (i) longitudinally enclose and encircle one of said second plurality of open-ended tubular guide bushings, and (ii) be received within one of said first plurality of open ended tubular guide bushings.

22. A die set comprising:

two upper die shoes positioned adjacent to one another, and each including a plurality of guide posts arranged in a pattern and projecting outwardly from a surface;

two lower die shoes positioned adjacent to one another, and each positioned in confronting relation to a respective one of said surfaces, and each including a first plurality of open ended tubular guide bushings each having a first anti-friction bearing assembly positioned within a central passageway, and each located so as to receive a corresponding one of said guide posts; and

two stripper-plates, one positioned between each pair of said upper die shoes and said lower die shoes, and each including a second plurality of open-ended tubular guide bushings each having an Outer surface and an inner surface and each projecting outwardly toward said lower die shoe in a pattern corresponding to said pattern of guide posts such that each of said first anti-friction bearing assemblies slidingly engages an outer surface of a corresponding one of said second open ended guide bushing, wherein each of said second plurality of open-ended guide bushings includes a second anti-friction bearing assembly positioned on said inner surface so as to engage a corresponding one of said guide posts.

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