

- [54] SANDWICH DIE SET 3,495,495 2/1970 Berry 83/698 X
 3,673,902 7/1972 Strobel..... 83/685 X
- [76] Inventor: James Mangos, 9301 N. Austin,
 Morton Grove, Ill. 60053
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- [52] U.S. Cl..... 83/685; 83/698
- [51] Int. Cl..... B26f 1/14
- [58] Field of Search..... 83/698, 699, 685-691

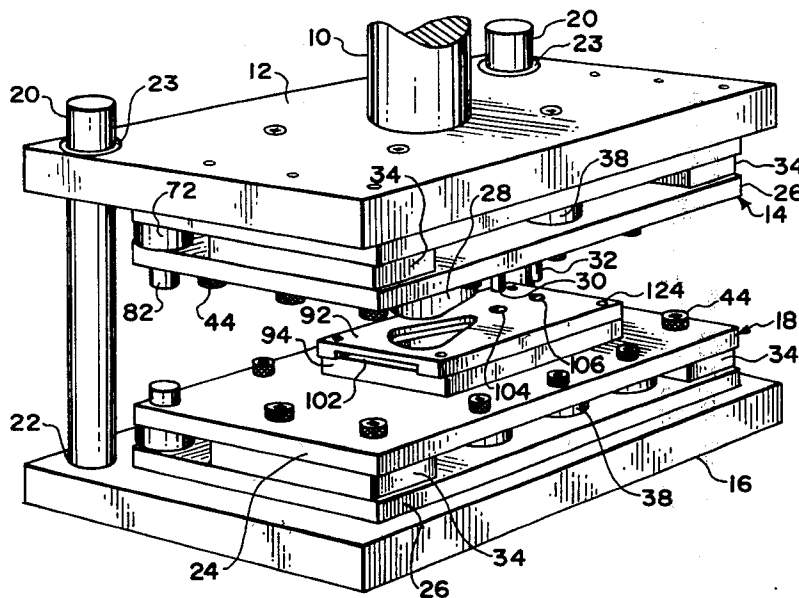
Primary Examiner—J. M. Meister
 Attorney, Agent, or Firm—Harbaugh and Thomas

[57] ABSTRACT

A simple, easily assembled die kit is disclosed comprising a pair of die plates and means to readily attach the plates to and space the plates from the master die parts. In one embodiment the die block and punch are mounted, with or without auxiliary plates, upon locating lugs and clamped down upon spacer discs. Support discs are placed in strategic position about the die to take up the downward punching shock.

6 Claims, 16 Drawing Figures

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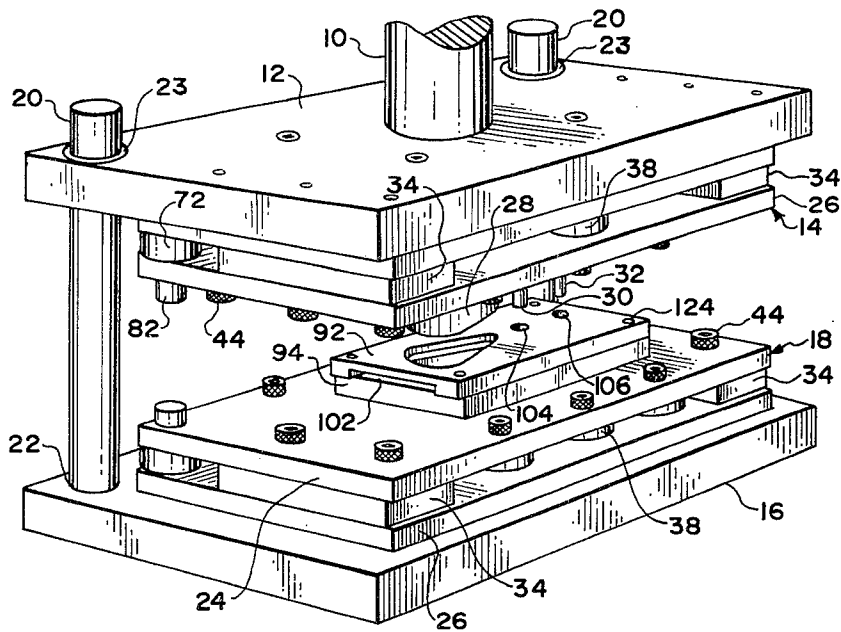


FIG. 1

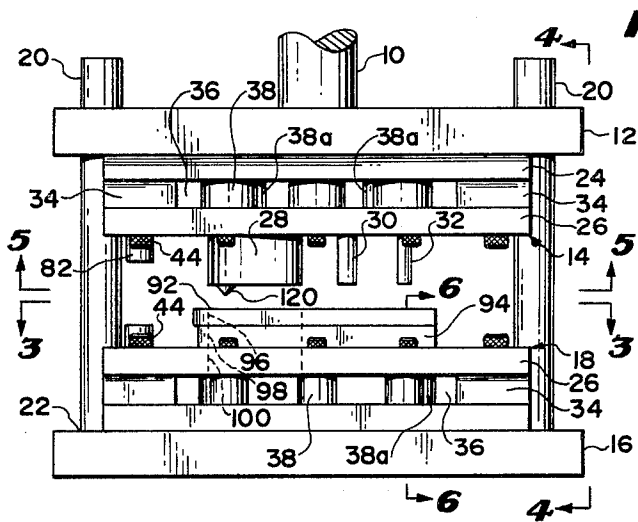


FIG. 2

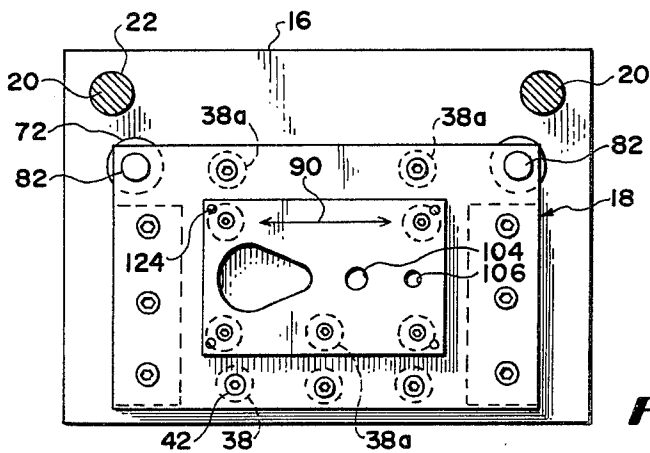


FIG. 3

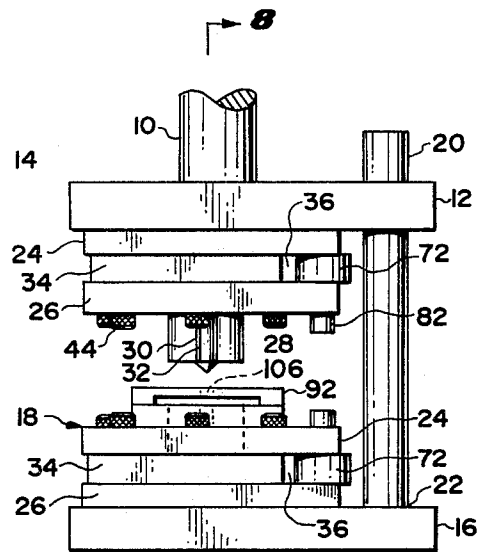


FIG. 4

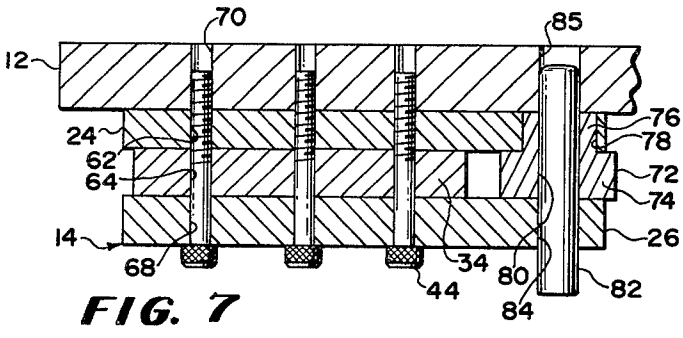
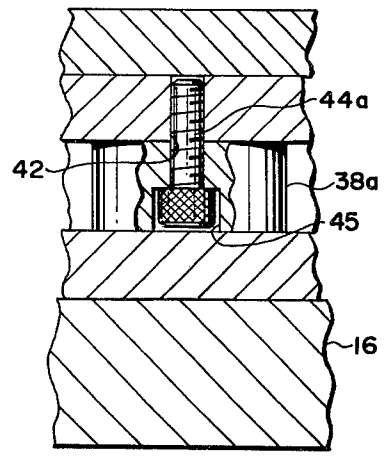
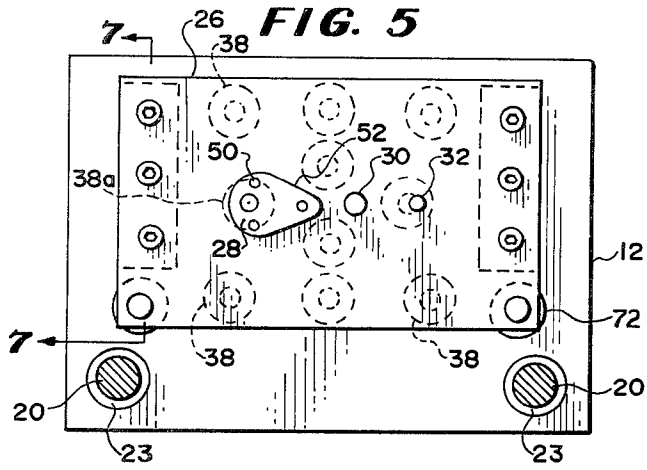


FIG. 6

FIG. 7

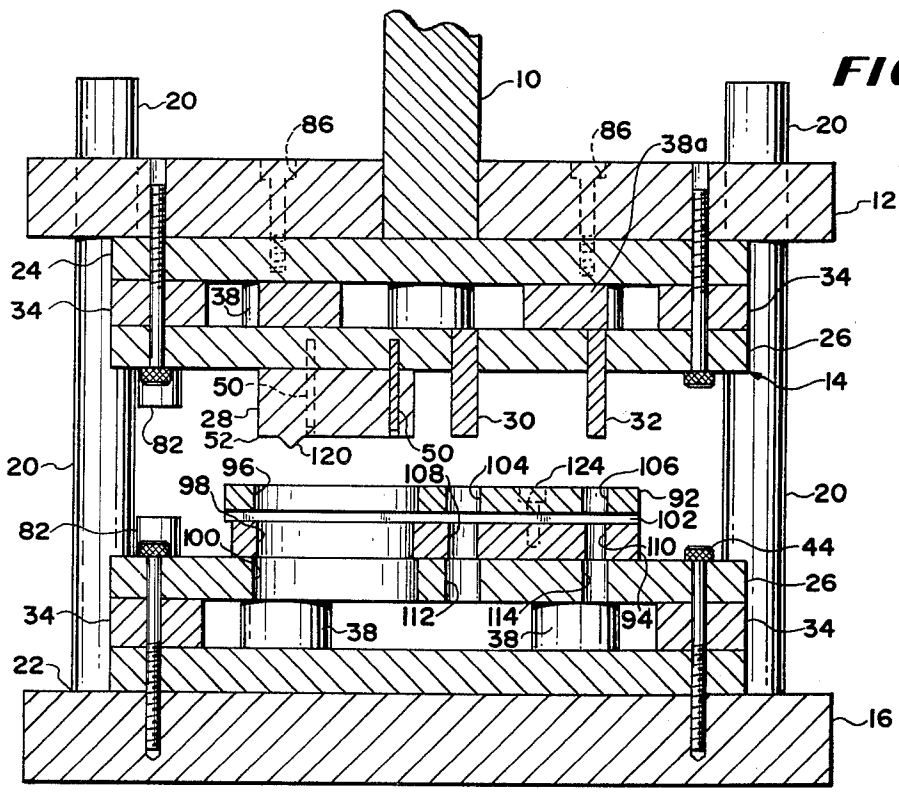


FIG. 8

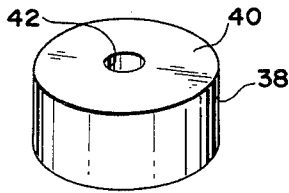


FIG. 9

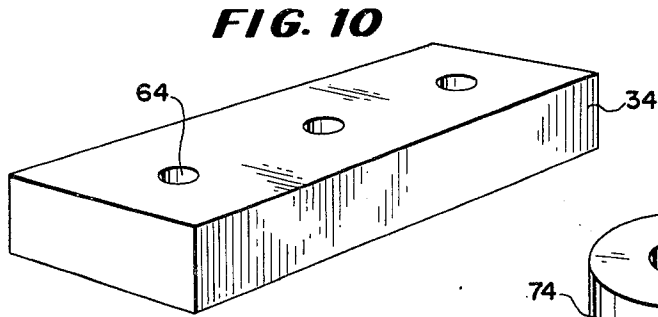


FIG. 10

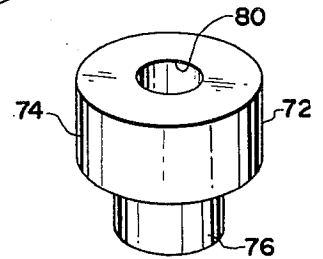


FIG. 11

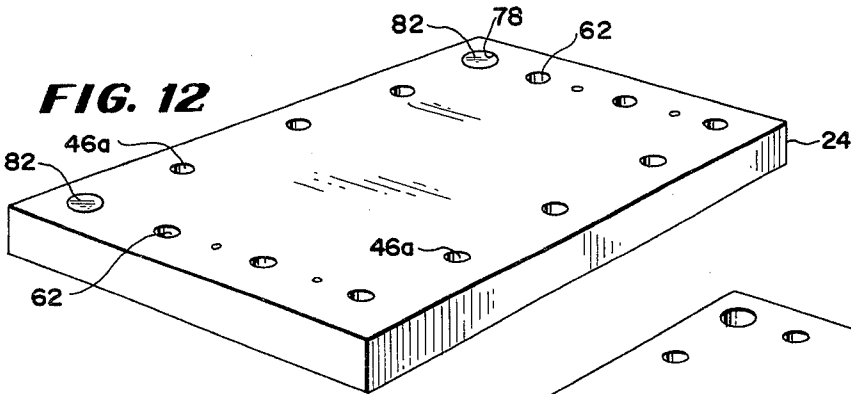


FIG. 12

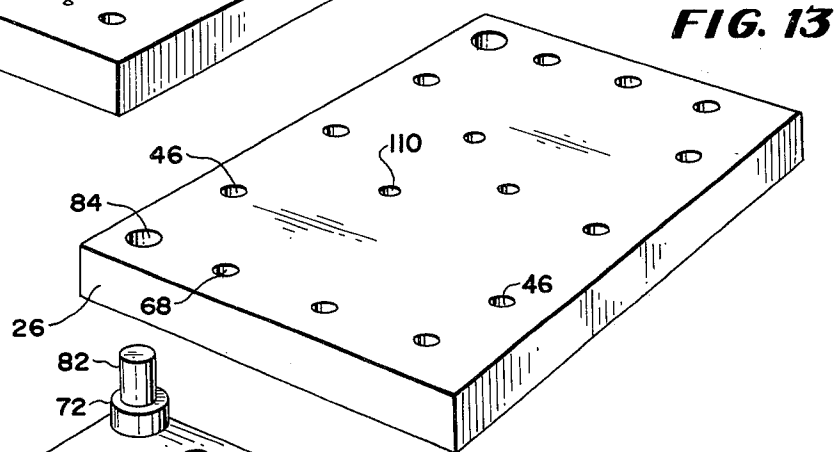


FIG. 13

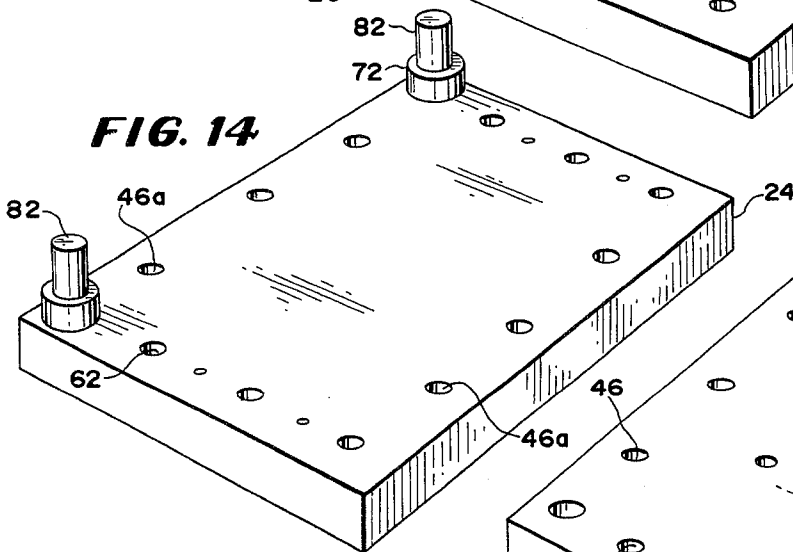


FIG. 14

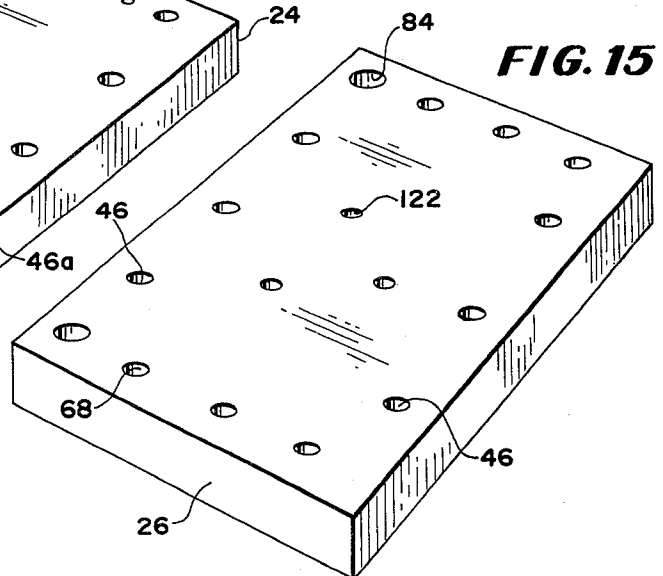


FIG. 15

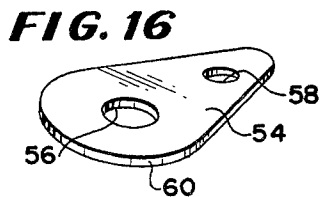


FIG. 16

SANDWICH DIE SET

BACKGROUND OF THE INVENTION

The matter of quick interchangeability of punch and die members has long been a problem in the metal working arts. A large number of different clamping and locating members have been used. A die assembly has been proposed, made from composite slab stock wherein the punch plate or block, the stripping plate and the cutting blade holder or die block are originally profiled while in "sandwich" form and are thereafter separated and assembled to their coating components and attached to the upper and lower fixture holders of a punch press. This device uses resilient stripper plugs of hourglass shape which are cemented between the stripper plate and the blade holder block, with the ends of the plugs seated within recesses of the blade holder. The cutting blade is relieved along its inner surface so that the die block can be originally profiled to the dimensions of the part to be made. The blade holder block, the stripper plate and the punch block are first sandwiched together by solder layers and rough cut to the outline of the item to be stamped, then machine finished. Any holes that are required are then drilled. Heat is applied and the sandwich is taken apart and then assembled to the respective fixture holders and base plates. The cutter blade is properly profiled by bending around the die assembly.

In other quick interchangeable die sets, a die supporting block of wood is used for the purpose of preventing wear on the upper shoe. This necessitates the use of side flanges and clamp plates with adjustable cap screws along the edges of the plates with associated spring clamps and spring-loaded clamp bars. The use of spring-loaded clamps is prevalent in other prior art devices.

SUMMARY OF THE INVENTION

In the instant invention a system allowing the use of a standard die set repeatedly to produce a countless variety of stamped metal parts, eliminating the necessity of producing a die set for each job, is provided. Die maker labor costs are reduced because of the unique construction and mounting design involving support or spacer discs and removable locating plugs. By the use of sandwich plates and spacers, the die setter has but to remove the two sandwich plates and put in two different plates without removing the die from the press. Because of this simple construction storage space is reduced and lead time is gained. Both material costs and heat treating of material is reduced because of the minimal thickness of tool steels used. No springs or C-washers are necessary in the instant punch die set.

An infinite variety of metal parts of any configuration can be stamped from flat metal strip stock with the die kit of this invention. All of the parts are reusable from one die set up to the other and the invention eliminates the necessity of buying a die set or a die kit for each part to be stamped. Also the parts can be assembled by inspection and no great skill is required in mounting and aligning the die parts as in a conventionally designed dies. One set of dies can be running in the press while another set of punch and die blocks is being mounted on the blank removable plates. The stroke of the press remains the same when flat stamping is being carried out. There is no need to adjust the height of the press stroke for each new part. The height of the press

stroke is only adjusted when metal forming is being done.

DESCRIPTION OF THE DRAWINGS

Illustrative embodiments of the invention are shown in the drawings in which:

FIG. 1 is a perspective view of the assembled die kit of this invention;

FIG. 2 is a front view of the embodiment shown in FIG. 1;

FIG. 3 is a cross-sectional view taken along the lines 3—3 of FIG. 2;

FIG. 4 is an end view of the embodiment of FIG. 1;

FIG. 5 is a cross-sectional view taken along the lines 5—5 of FIG. 2;

FIG. 6 is a cross-sectional view taken along the lines 6—6 of FIG. 2;

FIG. 7 is a cross-sectional view taken along the lines 7—7 of FIG. 5;

FIG. 8 is a cross-sectional view of an assembled kit taken along the lines 8—8 of FIG. 2;

FIG. 9 is a perspective view of a spacer disc;

FIG. 10 is a perspective view of a spacer bar;

FIG. 11 is a perspective view of a shoulder bushing;

FIG. 12 is an isometric view to show the top of the upper back-up plate with aligning pins in place;

FIG. 13 is an isometric view of one of the removable plates;

FIG. 14 is an isometric view to show the top part of the bottom back-up plate with all parts removed except the aligning pins;

FIG. 15 is an isometric view of the bottom removable plate which holds the female die and stripper plate; and

FIG. 16 is an isometric view of an illustrative stamped part.

THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 to 4, the generally assembly of the die kit parts will first be described with reference to the remaining FIGURES for details as the description proceeds. The die assembly is illustrated in relation to a press having the top ram 10 and the ram plate 12 carried thereby to which is attached the top die assembly 14. The press includes a stationary bed plate 16 to which is attached the bottom die assembly 18. The ram 10 carries the ram plate 12 up and down in a working stroke as is known in the art. The press assembly has the pair of spaced vertical guide pins 20 that are press-fitted at 22 into the stationary bed plate 16 and extend upwardly through the bushings 23 carried by the ram plate 12. The guide pins orient the ram plate 12 for straight up and down movement and prevent any rotation or lateral movement of the press parts. The ram 10 is operated by suitable hydraulic or mechanical means, (not shown) under either automatic or manual control in a manner known in the art. The various other parts and controls for the press assembly are not illustrated because they form no part of the invention and any type of press can be used.

In order to simplify the description, although certain of the parts used are identical or substantially identical, the top and bottom die assemblies 14 and 18 will be individually described before their manner of assembly and cooperating functions are illustrated.

The top die assembly 14 includes the back-up plate 24 and the removable plate 26 carrying the cutting die 28 along with the illustrative punch dies or perforators

30 and 32. The back-up plate 24 and the removable plate 26 are held in spaced parallel relationship by the pair of rectangular hardened spacer bars 34, one of which is illustrated in greater detail in FIG. 10, located at each end of these plates.

The space 36 (see FIGS. 2 and 4) between the back-up plate 24 and the removable plate 26 is available for the border spacer discs 38 shown in detail in FIG. 9, and the intermediate spacer discs 38a shown in detail in FIG. 6. Each of these spacer discs is the same thickness as the spacer bars 34, having smooth, planar, machined top and bottom surfaces, illustrated by the surface 40 of the spacer disc 38 in FIG. 9.

The bore holes 42 in the spacer discs 38 are smooth (unthreaded) and adapted to receive the threaded shank of the longer cap screws 44 that extend through the smooth bore holes 46 (FIG. 13) that border the longitudinal edges of the removable plate 26 and through the corresponding bore holes 46a in the back-up plate 24 (FIG. 12). The threaded ends of the cap screws engage within threaded blind or open bores in the ram plate 12 for the particular size of die illustrated. Two or three such spacer discs are placed along the front of the die kit assembly 18 and two or three are used along the rear border as shown in FIG. 5 depending on the size of the die cutting parts.

Since the inner or intermediate spacer discs 38a are near or adjacent the working parts of the die, their cap screws 44a (FIG. 6) are shorter and the bore hole 42 therefore in the disc is countersunk as at 45 to receive the head of the cap screw. Note that FIG. 6, though a cross-section of the bottom die assembly 18 in FIG. 2, is the same as would be shown by a cross-section through the same parts of the top die assembly 14. The cross-section FIG. 7 also is representative of the structure at the spacer bars of bottom die assembly 18.

The illustrative cutting die 28 is held to the bottom of the removable plate 26 by two or more press-fitted pins 50 (FIG. 5) which extend through the die into the plate 26. The top ends of the pins 50 are recessed with the bottom flat surface of the die so that the surface of the stamped part will not be marred. The cutting edge of the die 28 is illustrated at 52.

The die 28 protrudes from the bottom of the removable plate 26 and is tear-drop shaped, designed to cut the part 54 (see FIG. 16) from flat metal stock and form therein the larger hole 56 and a smaller hole 58 and the uniformly curved edge 60. As is apparent, the larger perforator 30 cuts the hole 56 and the smaller perforator 32 cuts the smaller hole 58 (as will be described in more detail) while the cutting edge 52 forms the curved edge 60.

The ends of the back-up plate 24 are provided with the spaced bore holes 62 corresponding to the bore holes 64 in the spacer bars 34 (FIG. 10), and also corresponding with the bore holes 68 in the removable plate. Any number of such corresponding bore holes can be provided along the periphery of the back-up plates and spacer bars. Three are used for illustration as shown in FIG. 7. The assembly is fastened by means of the corresponding threaded bores 70 in the ram plate 12.

The top die assembly 14 includes a pair of shoulder bushings 72 (FIG. 12) having a flange portion 74 which is the same thickness as both the spacer bars 34 and spacer discs 38. The flange portion 74 is held between the back-up plate 24 and the removable plate 26 as

shown in FIG. 7 with its shank part 76 press-fitted into the larger bores 78 (FIG. 12) so that the shoulder bushings are permanently affixed. Each shoulder bushing 72 has an internal bore 80 carrying the aligning pins 82. These pins are press-fitted into the bushings so as to extend through the corresponding larger bores 84 located in the rear corners of the removable plate 26 in a slip-fit relationship. The top end of the aligning pins extends into the co-axial bore 85 in the corner of the plate 12.

The assembly includes the additional cap screws 86 (FIG. 8) that extend through the ram plate 12 to hold the back-up plate 24 in fixed relationship with the ram plate. It is thus seen that the removable plate 26 and the die parts are removable from the back-up plate 24, leaving the aligning pins 82 in place in the shoulder bushings 72. The aligning pins 82 extend below the depth of the removable plate 26 sufficient to provide easy access when replacing the top die assembly 14, yet are clear of the bottom die assembly.

The bottom die assembly 18 includes a back-up plate 24 and a removable plate 26 with a pair of spacer bars 34 and border spacer discs 38 with several intermediate spacer discs 38a all of which parts are duplicates of the same parts of the top die assembly and held together by the cap screws 44. A space indicated by the arrow 90 (FIG. 3) is left between the inner or intermediate spacer discs 38a along one side for the easy removal of the stamped part.

This bottom die assembly has the stripper plate 92 carried on top of the female die 94 which rests on top of the removable plate 26. These three parts (FIG. 8) have the tear-shaped openings 96, 98 and 100 respectively conforming to the outer shape of the die 28. The tear-shaped opening 98 is smaller than the others and comprises the female die opening, being in a metal shearing relation with the cutting edge 52 of the male die 28 when the press closes. The openings 96 and 100 clear the outer periphery of the male die and the part 54 cut therefrom by a few thousandths of an inch. The stripper plate 92 has the longitudinal recess 102 that is as wide as the metal stock to be cut. This slot 102 is open at each end so that the metal stock can be moved progressively over the female die opening 98 into cutting relationship.

The back-up plate 92 has the pair of bores 104 and 106, the female die 94 has the pair of bores 108 and 110 while the bottom removable plate is provided with the pair of bores 112 and 114 all of which are aligned to receive, respectively, the perforators 30 and 32 as the ram descends. Here again bores 108 and 110 are smaller than the bores 104 and 106 so that the punching action of the perforators through the metal stock is the same as the die 28. The male die 28 has the orienting cone 120 which protrudes from its bottom surface. This cone is the same size at its base as the cutting bore 108 and the hole 56 in the part 54.

Accordingly, as the metal strip stock is fed intermittently from right to left (FIG. 8) through the recess or opening 102, at each stop, the ram 10 descends and the holes 56 and 58 are cut by the perforators 30 and 32. The stock is then advanced slightly beyond the length of the part and on the next stroke of the ram, the orienting cone 120 passes into the hole 56, adjusting for any shifting of the stock, and the die 28 cuts a finished piece as the perforators punch out the next pair of holes 56 and 58.

As the male die 28 oscillates the stripper plate prevents the cutoff part and punchings from adhering to the die and perforators and they drop through the openings 100 and 114 into the lower space 36 where they are blown out through the space 90 by means of an air jet or similar means known in the art.

FIG. 14 merely illustrates that the bottom back-up plate 24 is the same as the top back-up plate 24 (FIG. 12) of the top die assembly having the bore holes 46a and 62 along the periphery. In this instance the shoulder bushings 72 and the aligning pins 82 are shown in place at the rear corners. In FIG. 15, the bottom removable plate 26 has its front and rear bore holes 46 and the side bore holes 68 exposed so the general pattern is apparent as well as the placement of the corner bore holes 84 which engage these aligning pins. Each of the removable plates 26 has the more central bores 122 for the purpose of attaching the intermediate spacer discs 38a thereabout in any desired pattern around the periphery of the male and female dies, to withstand the work force of the press.

The aligning pins 82 are press-fitted into the shoulder bushings 72 in a manner to be adjustable depending on the depth of dies used and the clearance desired between the moving parts. The aligning pins are shown to be co-axial between the top and bottom assemblies. However, these pins need not be so arranged as long as the pins do not abut when the press closes. The strip-off plate 92 is held to the female die plate 94 by smaller spaced cap screws 124 in FIGS. 1, 3 and 8.

Accordingly, a quick change of the die parts is made possible by this assembly. By using an Allen wrench the cap screws holding the removable plates are removed along with the stripper plate, and the new die parts are affixed to the same or different bore holes. The aligning pins 82 remain in place and the newly assembled plates 26 with the dies and stripper plate thereon are placed over the pins 82 and the cap screws replaced. As many of the spacer discs are used as are necessary to maintain the removable plates in a rigid unyielding relationship. Any one or more of the spacer discs can be replaced by a spacer bar. For instance, a spacer bar can replace the three spacer discs in either the top or bottom die assemblies shown across the front of the device.

I claim;

1. A die kit assembly including:

a pair of back-up plates for separate attachment to the opposing ram plate and base plate of a press; a pair of shoulder bushings at the corners of each back-up plate along an adjacent side of each; the shoulder bushings each having a shank portion extending into its associated back-up plate and a bore hole;

an aligning pin press-fitted into each bore hole; one end of each of said aligning pins having an extension releasably engaging a ram plate;

a pair of removable plates adapted to carry working dies having corner bore holes to adjustably receive the respective aligning pins protruding from said shoulder bushings in press-fitting relationship; and spacer means having the same thickness as said spacer flange of said shoulder bushings adapted for placement opposite said working dies.

2. A die kit assembly in accordance with claim 1 in which said spacer means comprises:

a pair of spacer bars positionable between said plates at opposite sides thereof; and

a plurality of spacer discs positionable between said plates at selected positions surrounding the stress points of said working die.

3. A die kit assembly in accordance with claim 2 in which:

said spacer bars, spacer discs and said plates have matching bore holes to receive threaded members extending therethrough attaching to said ram and base plates.

4. A die kit assembly including:

a first back-up plate for separate attachment to the ram plate of a press;

a second back-up plate for separate attachment to the bed plate of a press;

each of said back-up plates including a pair of spaced aligning pins along one edge;

said aligning pins being carried by flanged bushing members in adjustable press-fit relationship;

a first removable plate carried by said first back-up plate and spaced therefrom by a pair of spacer bars located along opposite edges thereof;

detachable means extending through said first removable plate and said back-up plate holding same in parallel spaced relationship against said spacer bars;

a second removable plate carried by said second back-up plate and spaced therefrom by a second pair of spacer bars located along opposite edges thereof;

detachable means extending through said second removable plate and said back-up plate holding same in parallel spaced relationship against said spacer bars;

a cutting die carried on the underside of said first removable plate;

a second die carried by said second removable plate and in operable relationship with the said cutting die;

a plurality of spacer discs adapted for placement within the space between said spacer bars and between each of said removable plates and its associated back-up plate at selected positions opposite said dies in each assembly;

said flanges of said bushing members having the same thickness as said spacer discs and being engaged between said back-up plates and said removable plates; and

said aligning pins extending through into aligning bore holes along the corresponding edge of said removable plates whereby said removable plates are adapted to be detached and accurately repositioned.

5. A die kit assembly comprising:

a pair of back-up plates for separate attachment to the ram and bed plates of a ram press;

means to hold said back-up plates in opposed positions on said ram and bed plates;

a pair of removable plates for attachment to said backup plates;

said removable plates including means for attaching cutting die parts to their opposing upper and lower surfaces;

each of said back-up plates carrying a flanged bushing member at two or its corners, the flanges of which are disposed toward said removable plates;

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said bushings each carrying an aligning pin in adjustable press-fit relationship extending along and parallel to the axis of said ram press;
 said aligning pins each projecting beyond the height of the respective flange of its associated bushing;
 each of said removable plates including a pair of bore holes to receive said aligning pins in a slip-fit relationship with the flanges of said bushing members spacing said removable plates from said back-up plates;
 a plurality of spacer means adapted for placement in the spacing between each of said back-up plates and its associated removable plate at selected stress points;

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said spacer means being of equal height and the same height as said flanges on said bushings whereby to maintain said removable plates in substantially parallel unyielding relationship; and
 means detachably holding said removable plates against said flanges and spacer means.
 6. A die set in accordance with claim 5 in which:
 said spacer means includes a pair of spacer bars adapted for placement transverse the ends of each of said removable plates and spaced from each other to define additional space for placement of the remaining spacer means at said selected stress points.

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