

Nov. 5, 1963

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3,109,663

DIE ASSEMBLIES

Filed March 27, 1962

FIG. 1

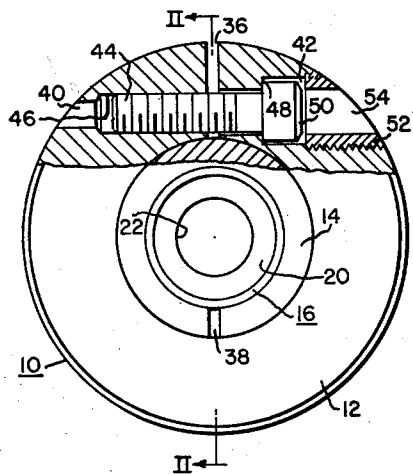


FIG. 2

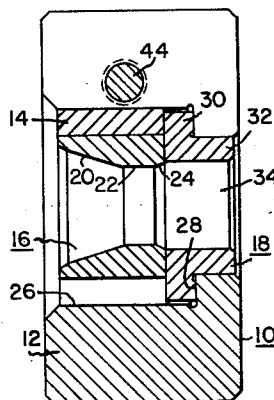
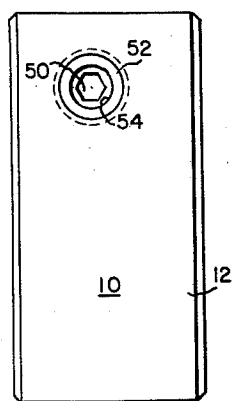


FIG. 3

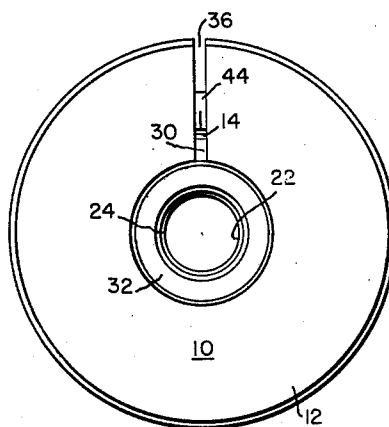


FIG. 4

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DIE ASSEMBLIES

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Filed Mar. 27, 1962, Ser. No. 182,827
10 Claims. (Cl. 279-41)

This invention relates to a die assembly and in particular to a demountable die assembly.

In the past, drawing dies and the like have been formed of refractory metal carbides such as cemented tungsten carbides with or without titanium, columbium, tantalum, vanadium and molybdenum carbides and which contain a binder such as cobalt, it being found that such dies give outstanding performance and have a long life as compared to dies formed of other materials. Different holders have been devised to support and maintain the dies in an operative position. In most cases, the dies are assembled in the holders as by means of either the "hot-shrink method" or the "cold-press method." In assembling the die in the holder by the hot-shrink method, the holder is heated to expand the same and the die is then inserted and the holder is permitted to cool and contract about the die. In the cold-press method, the die is usually made so as to have a diameter slightly in excess of the inner diameter of the holder and the die is forcibly fitted into the holder. Where the die assembly is formed by either the hot-shrink method or the cold-press method, the assembly is sold as a unit and when sufficient die wear has been had, the unit is scrapped or if the die can be remachined to a larger die opening for use in conjunction with larger diameter work pieces, the unit must be dismounted and the die must be machined while mounted in the holder.

An object of this invention is to provide a die assembly for maintaining a die in an operative position in a holder and for facilitating the removal of the die therefrom.

Another object of this invention is to provide a die assembly for accommodating dies of different sizes while properly supporting the same in an operative position and for facilitating the assembly of and the removal of dies of different sizes therefrom.

A further object of this invention is to provide a die assembly having a split casing or holder for supporting a split removable cylindrical spacer disposed to receive and support a cylindrical die of refractory metal carbides, said casing having locking means for applying a compressive force to the split spacer to rigidly hold the die member in assembled position in the casing, and means for applying a positive force to spread the split casing as the locking means is released to thereby effectively remove the compressive force from the split spacer to permit the easy removal of the die member and split spacer from the split casing or holder.

Another object of this invention is to provide, in a die assembly having a split casing or holder with a predetermined bore therethrough and a predetermined backing shoulder in the bore, of means for removably mounting different sized dies of refractory metal carbides therein, said means comprising a removable bushing disposed to seat on the backing shoulder of the holder and to fit snugly in the bore thereof, a split spacer ring disposed to seat on said bushing closely adjacent the inner wall of the holder, and a die insert removably fitted within and closely adjacent the split spacer ring and seated on said bushing, the bushing having a bore therethrough slightly larger than the die opening to permit the work piece to pass therethrough, said split holder having a locking means disposed to be actuated to apply a compressive force to the split spacer ring and said bushing to hold the

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die insert in an operative position, the split holder also having means disposed to cooperate with the locking means when the locking means is actuated to release the compressive force to affect a positive release of such compressive force so as to permit the removal of the die member and split spacer and where desired, the bushing from the holder.

Other objects of this invention will become apparent when taken in conjunction with the accompanying drawing in which:

FIGURE 1 is a top plan view partly in section of a die assembly embodying the features of this invention;

FIG. 2 is a view in section of the die assembly of this invention taken along the line II—II of FIG. 1;

FIG. 3 is a view in side elevation of the die assembly of this invention as viewed from the right-hand side of FIG. 1; and

FIG. 4 is a bottom plan view of the die assembly of this invention.

Referring to the drawings and in particular to FIGS. 1 and 2, this invention is illustrated by reference to a die assembly shown generally at 10. The die assembly 10 comprises an outer mounting ring, casing or holder 12 of steel, an inner spacer ring 14 of steel, and a die member 16 formed of cemented refractory metal carbides as referred to hereinbefore, the spacer 14 and die 16 being disposed to be seated against a backing support member 18 which is in the form of a bushing.

The die 16 has an outer cylindrical shape of a predetermined size for seating within the spacer 14 and may be provided with any suitable entry surface 20, die opening 22 and clearance portion 24 depending upon the work piece (not shown) which is to be reduced or otherwise treated by the die 16. In accordance with this invention, the die 16 is in the form of a relatively thin shell insert instead of having a massive wall portion as has been common practice in the past, the purpose of such thin insert being explained more fully hereinafter.

The mounting casing 12 may be formed of any suitable steel, although in practice it is desirable to utilize a steel having high strength such as AISI 4140 which can be hardened to a Rockwell C hardness of from 45 to 47. The casing 12 is preferably formed with a stepped bore 26 so as to provide a backing or supporting shoulder 28 internally thereof for properly supporting the other components of the die assembly in an operative position. Thus, the enlarged section of the bore 26 is formed of a size to accommodate the spacer ring 14 which is provided with an outer machined diameter of a size complementary to the diameter of such enlarged section of the bore 26 so that while longitudinal movement of the spacer ring 14 within such section of the bore 26 may be had, nevertheless the spacer ring 14 will have a snug fit with the walls of such enlarged section of the bore 26.

The backing support member 18 is in the form of a bushing having a flange portion or lip member 30 of a size to seat on the backing shoulder 28 of the casing 12, it being noted that the lip portion 30 has an outer diameter slightly smaller than the inner diameter of the enlarged portion of the bore 26 so that the bushing 18 can be readily inserted in such bore. The bushing 18 is also provided with a rearwardly extending cylindrical body portion 32 having a length substantially equal to the length of the rearward smaller or constricted section of the bore 26, it being noted that such portion 32 has an outer diameter complementary to the inner diameter of said constricted section of the bore 26 so as to fit snugly therein. As clearly illustrated in FIG. 2, the bushing 18 is also provided with a central bore 34 which has an inner diameter slightly larger than the die opening 22 of the die 16 so as to facilitate uninhibited passage of the work piece (not shown) from the die assembly with-

out marring the surface imparted to the work piece by the die 16.

As stated hereinbefore, the die insert 16 is formed to fit within the spacer ring 14, it being noted that the outer diameter of the die 16 is complementary to the inner diameter of the spacer ring 14 so as to provide a sliding but snug fit therein, the purpose of which will be referred to hereinafter. As clearly illustrated in FIG. 2, the spacer ring 14 and die insert 16 when assembled and positioned in the bore 26 are disposed to seat on the face of the lip portion 30 of the bushing 18, such bushing forming an adequate backing or support for the assembled spacer ring 14 and the die 16. In practice, the bushing 18 and the spacer ring 14 are also usually formed of a strong steel such as the AISI 4140 hardened to 45 to 47 R_c so as to provide adequate strength for the die assembly during the operation thereof.

In order to maintain the die 16 in an operative position in the die assembly 10, the casing 12 and the spacer ring 14 are cut lengthwise to provide predetermined slots 36 and 38, respectively, through a side wall of each such member and the split casing 12 is provided with a locking means for applying a compressive force to the bushing 18 and to the split spacer ring 14 and from thence to the die 16 so as to rigidly hold the assembled components in an operative relation.

Referring to FIGS. 1 and 3, the locking means for the die assembly is illustrated as comprising a pair of aligned openings 40 and 42 which extend from the opposed faces of the slot 36 to the outer periphery of the casing 12 and a cap screw 44 disposed in such aligned openings, it being noted that the openings 40 and 42 and the screw 44 are disposed on a cord of the cylindrical casing 12 closely adjacent the inner bore of such casing. The opening 40 is provided with a threaded portion 46 for receiving the threaded end of the cap screw 44 in threaded engagement therewith, whereas, the opening 42 is an unthreaded opening having a shoulder 48 provided therein for the cap 50 of the cap screw 44 to seat against. Referring to FIGS. 2 and 3, it is also to be noted that the cap screw 44 is preferably positioned substantially half way between the shoulder 28 of the casing and the outer edge of the split ring 14, it having been found that such positioning of the locking means on a cord adjacent the inner casing 12 will provide the largest compressive force for holding the die as will be referred to hereinafter.

In order to provide for a positive release of the compressive force applied to the assembled components as the cap screw 44 is unscrewed, a jack plug 52 is fixedly secured in the outer end of the opening 42 with the inner end of the jack plug terminating closely adjacent to but slightly spaced from the cap end of screw 44 when the cap screw 44 is seated on the shoulder 48 as shown in FIG. 1. When thus secured in position in the opening 42, the outer end of the jack plug 52 is machined in conformance with the outer perimeter of the casing 12 so as to provide a smooth surface thereon. As clearly shown in FIG. 1, when a key (not shown) is inserted through the opening 54 of the jack plug into the head of the cap 50 to actuate the screw 44 in a direction to disengage its threaded engagement with the threads 46 in the opening 40, a slight movement of the screw 44 seats the cap 50 against the inner end of the jack plug 52 so that no further longitudinal movement of the screw 44 within the opening 42 is obtained with the result that continued turning of the screw 44 applies a positive disengaging force to the threads 46 to force the faces of the slot 36 apart to release the compressive force from the assembled components.

In practice, with the bushing 18 positioned in the constricted section of the bore of the casing 12 and with the flange portion 30 seated on the shoulder 28, the die insert 16 is positioned in the split spacer ring 14 and such assembly is positioned to seat against the backing

lip portion of the bushing 18. With the components thus assembled, the screw 44 may be readily tightened to apply a uniform compressive force to the bushing 18 and to the spacer ring 14. As the compressive force is applied to the split spacer ring 14, the opposed faces of the slot 38 move towards one another and the split spacer ring 14 thus applies a uniform compressive force to the die insert 16 whereby the die assembly to all intent and purpose is a solid rigid die assembly capable of withstanding the forces generated during a drawing operation while maintaining the die insert 16 in an accurate operative position.

As will be understood, the casing 12 may be of any predetermined size having a predetermined stepped bore 26 therein depending upon the size of the die insert 16 that is to be utilized. Likewise, the split spacer ring 14 may vary in wall thickness for any given size of split casing 12 depending upon the size of die insert 16 that is to be utilized in the assembly, it being understood that where a die insert 16 having a larger die opening and a larger outer diameter is to be utilized, the spacer ring 16, while having a constant outer diameter for a given size casing 12 will have a thinner wall thickness, that is, a larger inner diameter, to compensate for the increase in the outer diameter of the die insert 16. Likewise, bushings 18 having different sized body portions 32 may be employed, the only limitation on the size of bushing being that it must have an adequate lip portion to support the assembled spacer ring 14 and the die insert 16 and that it must be of a size so that the bore 34 thereof is slightly larger than the die opening 22 of the die insert 16. Many combinations can be formed with any given sized casing 12, it being found in practice that the user of the die assembly will usually have a number of different sized bushings 18 and split spacer rings 14 for utilizing different sized die inserts 16.

The die assembly of this invention has the distinct advantage of making it possible to utilize very thin die inserts 16, it being noted that the inserts are usually the most expensive part of any given die design. With the present die assembly construction, when the die is worn to a point where it can no longer maintain tolerances, the user of the die does not have to go through the expensive procedure of discarding the worn die assembly or of removing a die assembly from operation for a long period of time while the die is machined to a larger size, since by simply actuating the locking cap screw 44 against the jack plug 52, a release of the compressive forces which maintains the die in operative position can be had whereby the worn die insert 16 can be readily removed, thrown away, or otherwise disposed of and a new die insert 16 can be readily inserted in the assembly and locked in position simply by tightening the screw 44. Thus, instead of having to maintain a large inventory of a given size of expensive die assemblies, the user need only maintain a supply of the disposable and relatively inexpensive thin wall die inserts 16. It is to be noted that such die inserts may be had at a fraction of the cost of the larger dies previously used so that the user not only saves on storage of inventory but also can affect a considerable savings in the cost of the die insert which is used in the die assembly.

With respect to the slots 36 and 38 which are formed lengthwise through the casing 12 and spacer ring 14, respectively, such slots are usually formed to have a width not in excess of .10 inch in order to provide adequate contact surface between the assembled elements to apply a substantially uniform compressive force about the elements being held by the respective members. In practice, it is preferred to mount the spacer ring 14 in the split casing 12 so that the slot 38 will not register with the slot 36 as a better distribution of the compressive force exerted by tightening the split casing 12 is thereby obtained.

The die assembly of this invention, while being of a

relatively simple construction, is nevertheless of a rugged construction and, when properly assembled, results in a die assembly that to all intent and purpose is as strong and accurate as the fixed die assemblies formed by the hot-shrink method or the cold-press method but which has the additional advantage thereof of having many different combinations of die assemblies formed with each given sized casing and of utilizing relatively inexpensive disposable die inserts therewith. As will be appreciated, any one skilled in the trade can readily reproduce the demountable die assembly described hereinbefore as no special skill other than that normally possessed by a good machinist is required, it being noted that the different elements of the assembly are formed from well known materials.

It is to be further noted that with the die assembly of this invention, the die inserts have a 30 to 40% increase in life for a particular drawing operation over the life expectancy of the die inserts of die assemblies formed by the hot-shrink or cold-press methods. This increase in life is thought to result from the fact that since the present invention utilizes a thin die insert of carbide, a material having less heat conductivity than the steel casing body and since, by use of the spacer ring, etc., a larger mass of the higher heat conducting material, steel, is utilized as compared to the combination of massive die inserts of carbide and the ferrous base casings of the die assemblies formed by such prior art methods, there is less mass of the poorer heat conducting carbide to retain the heat and any heat developed in the thin disposable die insert is more readily conducted away from such die insert by the steel supporting and encasing structure to thereby increase the life of the die.

I claim:

1. A die assembly comprising, an outer support casing having a stepped bore therethrough, said casing having a longitudinally extending slot through a side thereof to form a split casing, a removable cylindrical spacer ring having a slot lengthwise thereof disposed to seat in said casing stepped bore in engagement with the wall thereof, a removable cylindrical die disposed to seat within said slotted cylindrical spacer ring in engagement therewith, said casing having a pair of aligned screw receiving openings extending in opposite directions from the opposite faces of said slot therein, one of said openings being threaded and the other extending to the outer face of said casing and having a supporting shoulder therein, a screw member disposed in said aligned openings in threaded engagement with the threads of said one opening and disposed to be adjusted to seat the head thereof on the shoulder in said other opening whereby said screw member may be further adjusted to draw the opposed faces of said casing slot towards each other to apply a compressive force to said slotted spacer to effectively hold said die in assembled relation when seated in said slotted casing, and means carried in said other opening to provide a stop closely adjacent the head of said screw member whereby adjustment of said screw member in a direction to disengage the threaded engagement with the threads of said one of said openings seats said screw member against said stop means to thereby limit the disengaging longitudinal movement of said screw member in said other of the openings, said stop means thereby cooperating with said screw member to maintain said screw member in a predetermined position in said other opening whereby further adjustment of said screw member to disengage the threads of said one opening exerts a positive disengaging force thereto to effectively spread the faces of said casing slot to release the compressive force on said slotted spacer ring to thereby release the compressive force on said die whereby said die and spacer ring may be removed from the assembly.

2. A die assembly comprising, an outer support casing having a stepped bore therethrough for providing a supporting shoulder therein, said casing having a longitudi-

nally extending slot through a side thereof to form a split casing, a removable cylindrical spacer ring having a slot lengthwise thereof disposed to seat in said casing bore in engagement with the wall thereof, a removable cylindrical die disposed to seat within said slotted cylindrical spacer ring in engagement therewith, said spacer ring and said die being disposed to be supported by said shoulder in said casing bore, said casing having a pair of aligned screw receiving openings extending in opposite directions from the opposite faces of said slot therein, one of said openings being threaded and the other extending to the outer face of said casing and having a supporting shoulder therein, a screw member disposed in said aligned openings in threaded engagement with the threads of said one opening and disposed to be adjusted to seat said screw member on the shoulder in said other opening whereby said screw member may be further adjusted to draw the opposed faces of said casing slot towards each other to apply a compressive force to said slotted spacer to effectively hold said die in assembled relation when positioned in said slotted casing, and stop means disposed in said other opening closely adjacent said screw member to limit movement thereof in said other opening when said screw member is adjusted to release said threaded engagement whereby continued adjustment of said screw member to disengage said threaded engagement exerts a positive disengaging force thereto to effectively spread the faces of said slot to release the compressive force on said slotted spacer ring to thereby release the compressive force on said die whereby said die and spacer ring may be removed from the assembly.

3. A die assembly comprising, an outer support casing having a stepped bore therethrough, said casing having a longitudinally extending slot through a side thereof to form a split casing, a removable cylindrical spacer ring having a slot lengthwise thereof disposed to seat in said casing stepped bore in engagement with the wall thereof, a removable cylindrical die disposed to seat within said slotted cylindrical spacer ring in engagement therewith, said casing having a pair of aligned screw receiving openings extending in opposite directions from the opposite faces of said slot therein, one of said openings being threaded and the other extending to the outer face of said casing and having a supporting shoulder therein, a screw member disposed in said aligned openings in threaded engagement with the threads of said one opening and disposed to be adjusted to seat said screw member on the shoulder in said other opening whereby said screw member may be further adjusted to draw the opposed faces of said casing slot towards each other to apply a compressive force to said slotted spacer to effectively hold said die in assembled relation when positioned in said slotted casing, and a jack plug fixedly disposed in said other opening closely adjacent the end of said screw member whereby adjustment of said screw member in a direction to disengage the threaded engagement with the threads of said one of said openings seats said cap screw against said fixed jack plug to thereby limit the longitudinal movement of said screw member in said other of the openings, the jack plug and said screw member thereby cooperating to maintain said screw member in a predetermined position in said other opening whereby further adjustment of said screw member to disengage the threads of said one opening exerts a positive disengaging force thereto effectively spread the faces of said slot to release the compressive force on the slotted spacer ring to thereby release the compressive force on said die whereby said die and cylindrical spacer ring may be removed from the assembly.

4. A die assembly comprising, an outer support casing having a stepped bore therethrough with a constricted bore portion for providing a supporting shoulder therein, said casing having a longitudinally extending slot through a side thereof to form a split casing, a

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bushing member having a body portion with a central bore therethrough and an outwardly extending flange portion at one end thereof, said bushing member being removably disposed with its body portion in seating engagement with said constricted bore portion of said stepped bore and with said flange portion in seated engagement on said supporting shoulder, a removable cylindrical spacer ring having a slot lengthwise thereof disposed to seat in said casing bore in engagement with the wall thereof, a removable cylindrical die disposed to seat within said slotted cylindrical spacer ring, said spacer ring and said die also being disposed to seat on said flange portion of said bushing member to be supported thereby, said casing having a pair of aligned screw receiving openings extending in opposite directions from the opposite faces of said slot therein, one of said openings being threaded and the other extending to the outer face of said casing and having a supporting shoulder therein, a screw member disposed in said aligned openings in threaded engagement with the threads of said one opening and disposed to be adjusted to seat said screw member on the shoulder in said other opening whereby said screw member may be further adjusted to draw the opposed faces of said casing slot towards each other to apply a compressive force to said bushing member and said slotted spacer to effectively hold said die in assembled relation when positioned in said slotted casing, and stop means disposed in said other opening closely adjacent said screw member to limit movement thereof in said other opening when said screw member is adjusted to release said threaded engagement whereby continued adjustment of said screw member to disengage said threaded engagement exerts a positive disengaging force thereto to effectively spread the faces of said slot to release the compressive force on said bushing member and said slotted spacer ring to thereby release the compressive force on said die whereby said bushing member, die and spacer ring may be removed from the assembly.

5. A die assembly comprising, an outer support casing having a stepped bore therethrough with a constricted bore portion for providing a supporting shoulder therein, said casing having a longitudinally extending slot through a side thereof to form a split casing, a bushing member having a body portion with a central bore therethrough and an outwardly extending flange portion at one end thereof, said bushing member being removably disposed with its body portion in seating engagement with said constricted bore portion of said stepped bore and with said flange portion in seated engagement on said supporting shoulder, a removable cylindrical spacer ring having a slot lengthwise thereof disposed to seat in said casing bore in engagement with the wall thereof, a removable cylindrical die having a predetermined die opening therein disposed to seat within said slotted cylindrical spacer ring, said spacer ring and said die also being disposed to seat on said flange portion of said bushing member to be supported thereby, the central bore of said bushing member being slightly larger than said die opening and being aligned therewith for permitting uninhibited passage of work pieces from said die opening, said casing having a pair of aligned screw receiving openings extending in opposite directions from the opposite faces of said slot therein, one of said openings being threaded and the other extending to the outer face of said casing and having a supporting shoulder therein, a screw member disposed in said aligned openings in threaded engagement with the threads of said one opening and disposed to be adjusted to seat the head thereof on the shoulder in said other opening whereby said screw member may be further adjusted to draw the opposed faces of said casing slot towards each other to apply a compressive force to said bushing member and said slotted spacer to effectively hold said die in assembled relation when positioned in said slotted casing, and stop means disposed in said other opening closely adjacent said screw

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member to limit movement thereof in said other opening when said screw member is adjusted to release said threaded engagement whereby continued adjustment of said screw member to disengage said threaded engagement exerts a positive disengaging force thereto to effectively spread the faces of said slot to release the compressive force on said bushing member and said slotted spacer ring to thereby release the compressive force on said die whereby said bushing member, die and spacer ring may be removed from the assembly.

6. A die assembly comprising, an outer support casing having a stepped bore therethrough for providing a supporting shoulder therein, said casing having a longitudinally extending slot through a side thereof to form a split casing, a removable cylindrical spacer ring having a slot lengthwise thereof disposed to seat in said casing bore in engagement with the wall thereof, a removable cylindrical die disposed to seat within said slotted cylindrical spacer ring in engagement therewith, said spacer ring and said die being disposed to be supported by said shoulder in said casing bore, said casing having a pair of aligned screw receiving openings extending in opposite directions from the opposite faces of said slot therein, one of said openings being threaded and the other extending to the outer face of said casing and having a supporting shoulder therein, a cap screw disposed in said aligned openings in threaded engagement with the threads of said one opening and disposed to be adjusted to seat its cap on the shoulder in said other opening whereby said screw may be further adjusted to draw the opposed faces of said casing slot towards each other to apply a compressive force to said slotted spacer to effectively hold said die in assembled relation when positioned in said slotted casing, and a jack plug fixedly disposed in said other opening with the end of said jack plug terminating closely adjacent the cap of said cap screw whereby adjustment of said cap screw in a direction to disengage the threaded engagement with the threads of said one of said openings seats the cap against said fixed jack plug to thereby limit the disengaging longitudinal movement of said cap screw in said other of the openings, the jack plug and said cap screw thereby cooperating to maintain said cap screw in a predetermined position in said other opening whereby further adjustment of said cap screw to disengage the threads of said one opening exerts a positive disengaging force thereto to effectively spread the faces of said slot to release the compressive force on said slotted spacer ring to thereby release the compressive force on said die whereby said die and spacer ring may be removed from the assembly.

7. A die assembly comprising, an outer support casing having a stepped bore therethrough with a constricted bore portion for providing a supporting shoulder therein, said casing having a longitudinally extending slot through a side thereof to form a split casing, a bushing member having a body portion with a central bore therethrough and an outwardly extending flange portion at one end thereof, said bushing member being removably disposed with its body portion in seating engagement with said constricted bore portion of said stepped bore and with said flange portion in seated engagement on said supporting shoulder, a removable cylindrical spacer ring having a slot lengthwise thereof disposed to seat in said casing bore in engagement with the wall thereof, a removable cylindrical die disposed to seat within said slotted cylindrical spacer ring, said spacer ring and said die also being disposed to seat on said flange portion of said bushing member to be supported thereby, said casing having a pair of aligned screw receiving openings extending in opposite directions from the opposite faces of said slot therein, one of said openings being threaded and the other extending to the outer face of said casing and having a supporting shoulder therein, a screw member disposed in said aligned openings in threaded engagement with the threads of said one opening and disposed to be adjusted to seat the head thereof on the shoulder in said other opening whereby said screw

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member may be further adjusted to draw the opposed faces of said casing slot towards each other to apply a compressive force to said bushing member and said slotted spacer to effectively hold said die in assembled relation when positioned in said slotted casing, and a jack plug fixedly disposed in said other opening closely adjacent the end of said screw member whereby adjustment of said screw member in a direction to disengage the threaded engagement with the threads of said one of said openings seats said screw member against said fixed jack plug to thereby limit the disengaging longitudinal movement of said screw member in said other of the openings, the jack plug and said screw member thereby cooperating to maintain said screw member in a predetermined position in said other opening whereby further adjustment of said screw member to disengage the threads of said one opening exerts a positive disengaging force thereto to effectively spread the faces of said slot to release the compressive force on said bushing member and said slotted spacer ring to thereby release the compressive force on said die whereby said bushing member, die and spacer ring may be removed from the assembly.

8. A die assembly comprising, an outer support casing having a stepped bore therethrough with a constricted bore portion for providing a supporting shoulder therein, said casing having a longitudinally extending slot through a side thereof to form a split casing, a bushing member having a body portion with a central bore therethrough and an outwardly extending flange portion at one end thereof, said bushing member being removably disposed with its body portion in seating engagement with said constricted bore portion of said stepped bore and with said flange portion in seated engagement on said supporting shoulder, a removable cylindrical spacer ring having a slot lengthwise thereof disposed to seat in said casing bore in engagement with the wall thereof, a removable cylindrical die having a predetermined die opening therein disposed to seat within said slotted cylindrical spacer ring, said spacer ring and said die also being disposed to seat on said flange portion of said bushing member to be supported thereby, the central bore of said bushing member being slightly larger than said die opening and being aligned therewith to permit uninhibited passage of work pieces from said die opening, said casing having a pair of aligned screw receiving openings extending in opposite directions from the opposite faces of said slot therein, one of said openings being threaded and the other extending to the outer face of said casing and having a supporting shoulder therein, a cap screw disposed in said aligned openings in threaded engagement with the threads of said one opening and disposed to be adjusted to seat its cap on the shoulder in said other opening whereby said screw may be further adjusted to draw the opposed faces of said casing slot towards each other to apply a compressive force to said bushing member and said slotted spacer to effectively hold said die in assembled relation when positioned in said slotted casing, and a jack plug fixedly disposed in said other opening with the end of said jack plug terminating closely adjacent the cap of said cap screw whereby adjustment of said cap screw in a direction to disengage the threaded engagement with the threads of said one of said openings seats the cap against said fixed jack plug to thereby limit the disengaging longitudinal movement of said cap screw in said other of the openings, the jack plug and said cap screw thereby cooperating to maintain said cap screw in a predetermined position in said other opening whereby further adjustment of said cap screw to disengage the threads of said one

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opening exerts a positive disengaging force thereto to effectively spread the faces of said slot to release the compressive force on said bushing member and said slotted spacer ring to thereby release the compressive force on said die whereby said bushing member, die and spacer ring may be removed from the assembly.

9. A die assembly comprising, an outer support casing having a stepped bore therethrough for providing a supporting shoulder therein, said casing having a longitudinally extending slot through a side thereof to form a split casing, a removable cylindrical spacer ring having a slot lengthwise thereof disposed to seat in said casing bore in engagement with the wall thereof, a removable cylindrical die disposed to seat within said slotted spacer ring in engagement therewith, said spacer ring and said die being disposed to be supported by said shoulder in said casing bore, adjustable means positioned to bridge the slot of said casing and being disposed to be actuated in a predetermined manner to force the opposed faces of the slot of said casing towards each other to apply a compressive force to said slotted spacer to effectively hold said die in assembled relation therewith, and means carried by said casing disposed to cooperate with said adjustable means as said adjustable means is actuated in an opposed predetermined manner to force said opposed faces of said casing slot away from each other to effect a positive release of said compressive holding force whereby said die and spacer ring may be removed from the assembly.

10. A die assembly comprising, an outer support casing having a stepped bore therethrough with a constricted bore portion for providing a supporting shoulder therein, said casing having a longitudinally extending slot through a side thereof to form a split casing, a bushing member having a body portion with a central bore therethrough and an outwardly extending flange portion at one end thereof, said bushing member being removably disposed with its body portion in seating engagement with said constricted bore portion of said stepped bore and with said flange portion in seated engagement on said supporting shoulder, a removable cylindrical spacer ring having a slot lengthwise thereof disposed to seat in said casing bore in engagement with the wall thereof, a removable cylindrical die disposed to seat within said slotted cylindrical spacer ring, said spacer ring and said die also being disposed to seat on said flange portion of said bushing member to be supported thereby, adjustable means positioned to bridge the slot of said casing and being disposed to be actuated in a predetermined manner to force the opposed faces of the slot of said casing towards each other to apply a compressive force to said bushing member and said slotted spacer to effectively hold said die in assembled relation therewith, and means carried by said casing disposed to cooperate with said adjustable means as said adjustable means is actuated in an opposed predetermined manner to force said opposed faces of said casing slot away from each other to effect a positive release of said compressive holding force whereby said bushing member, die and spacer ring may be removed from the assembly.

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