July 20, 1965 A. ZUNICH 3,195,341

DIE APPARATUS

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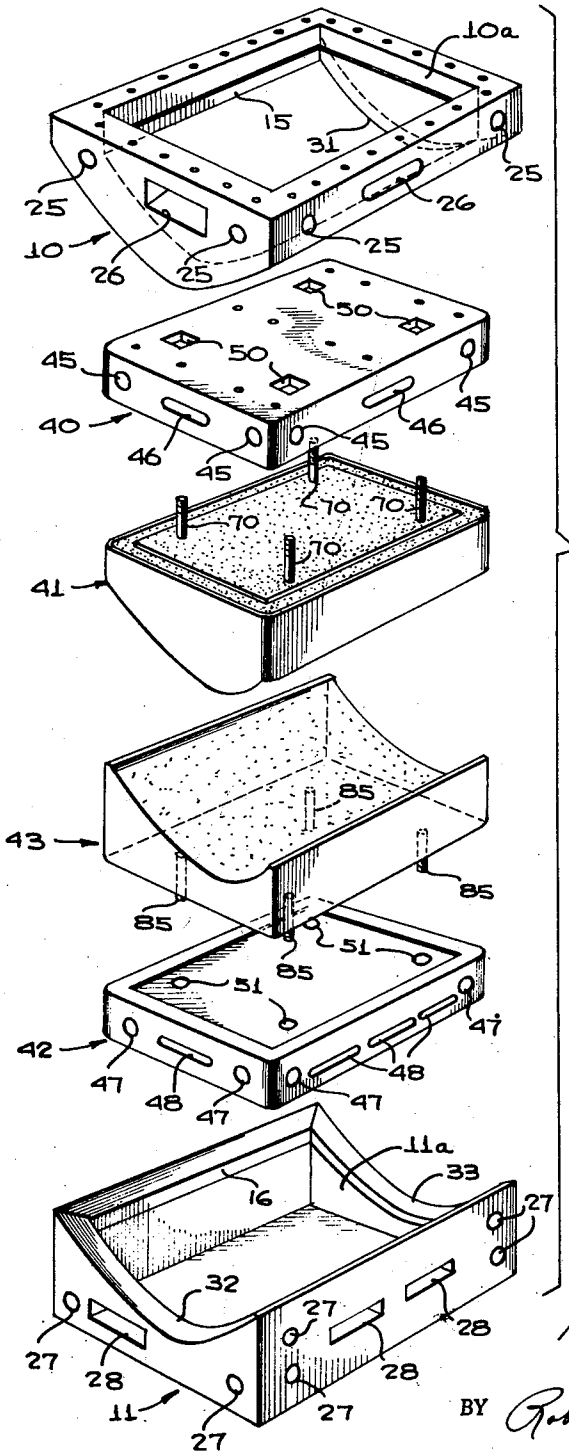


Fig. 1

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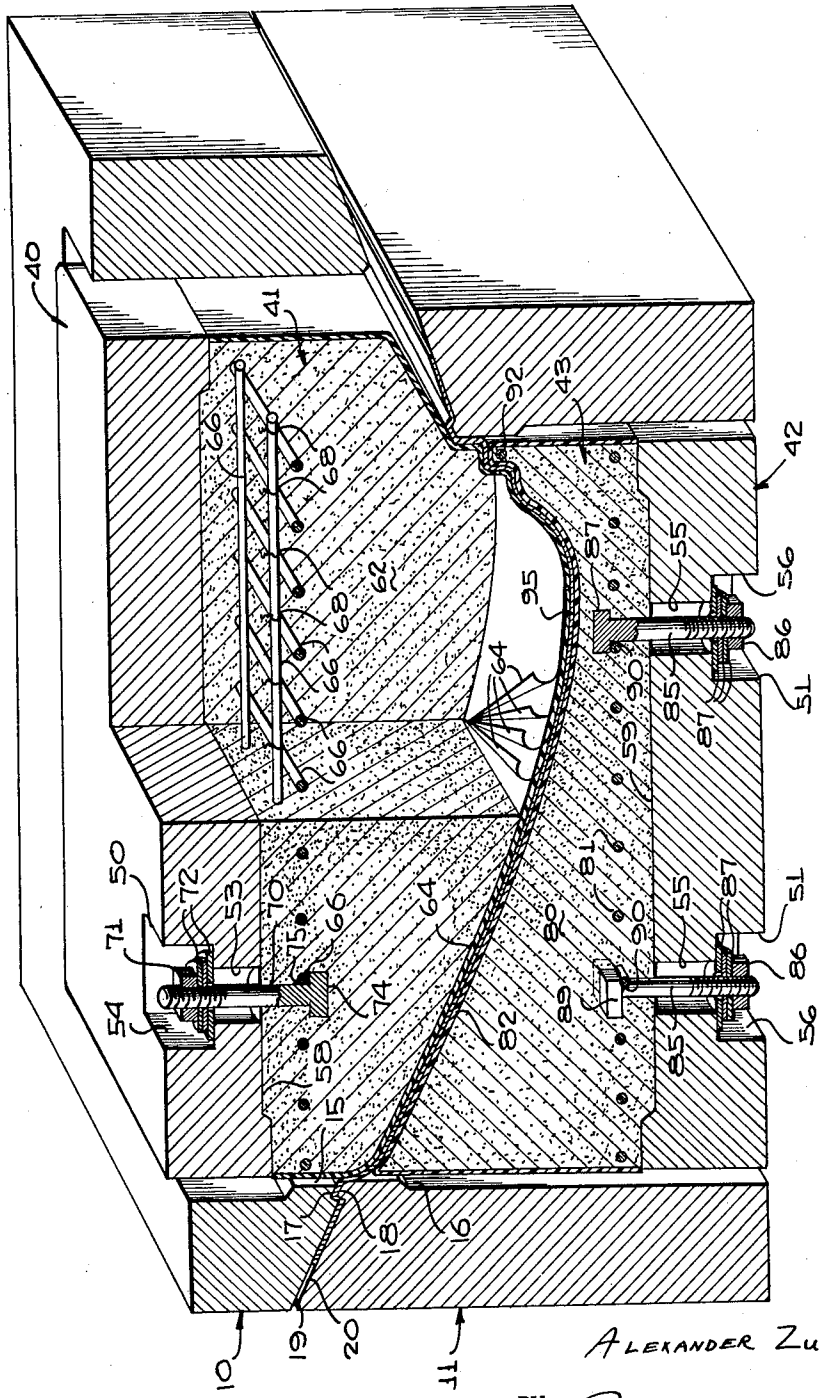


Fig. 2

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DIE APPARATUS

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The present invention relates to new and novel die apparatus, and more particularly to die apparatus wherein a die means is formed of two portions which are readily separable from one another.

The present invention may be applied in various die applications, and is illustrated particularly in connection with draw dies. The die means as utilized in stamping operations and the like is usually formed of an integral piece of material, this material being cast and then ground such that it will fit snugly on the punch and die shoes of the press apparatus with which it is utilized.

In order to provide the desired characteristics of the portion of the dies which are actually attached to and engage the punch and die shoes, a relatively expensive material is employed which can be ground to a fine tolerance. As a typical example, draw dies may be formed of a material such as "Kirksite" (trademark of the National Lead Company of New York, New York), an alloy composed mainly of zinc with smaller quantities of copper, magnesium and aluminum alloyed therewith. After a particular production run has been made on one set of dies, these particular dies may not be used again, and accordingly, it has been a common practice to re-melt the material of the die and use the material in the construction of a new die. This procedure is necessary in order to conserve the relatively expensive material of which the die is composed.

Where the entire die has been re-melted, it has also been necessary to separate impurities from the metallic material such as mentioned above, this procedure, of course, requiring quite a bit of time and accordingly, increasing the cost of the new dies. In addition, when the new dies are made from the re-used material, it is again necessary to grind a face on the new die parts, such that they can be effectively mounted upon a punch or die shoe as the case may be. The present invention overcomes the disadvantages occurring in the prior art where relatively expensive materials such as "Kirksite" are employed by providing a novel arrangement wherein the die means is formed of first and second separable die portions. The first die portion may be formed of the relatively expensive material, and has the face thereof machined to the desired tolerance.

The second die portion of the die means is formed of a material which is much less expensive and which is expendable, the second portion being removable from the first portion. With this arrangement, the second die portion may be removed and discarded after it has served its purpose and the first relatively expensive die portion may be re-used in making new draw dies of similar size.

The relatively expensive first die portion of each die means actually serves as a backing plate means which enables the die means to be attached to either the upper or lower platens of the press. The relatively inexpensive portion of each die means is constructed to have a configuration in accordance with the desired finished shape of the workpiece, and is further so constructed that it has sufficient compression strength to withstand the heavy use encountered during stamping operations.

The second die portion according to the present invention is preferably formed of a very cheap material such as sand, the sand being retained in the desired configuration by associating a suitable binder therewith. Reinforcing means is also embedded within the second die portion such that it can more readily withstand the loads applied thereto during use.

Since the body of the second die portion does not have a very hard surface characteristic, a hard facing is provided on the outer surface thereof, the facing actually engaging a workpiece during stamping operations.

Attaching means is operatively connected with the second die portion of each die means, and means for detachably securing the first and second die portions to one another is connected with these attaching means. This attaching arrangement permits the second die portion to be separated from the associated first die portion in a very simple and effective manner.

A further advantage of the arrangement of the present invention is that actualy the major portion of each die means may be formed of a relatively inexpensive material, while only a minor portion or backing plate means need be provided of the relatively expensive material. This is particularly advantageous in view of the fact that when the entire die means is formed of "Kirksite," for example, a shrinkage problem is involved and it was necessary to make the dies oversized to begin with whereupon they would shrink to the desired finished size. On the other hand, there is no shrinkage problem involved with the second portion of the die means of the present invention, and accordingly, this problem has been overcome with the invention arrangement.

It is apparent that with the arrangement of the present invention, the relatively expensive parts may be readily removed and, of course, it is not necessary to re-melt these portions or to separate any impurities therefrom since the first die portions may be used over and over again. Additionally, it is evident that when the first die portions are re-used, it is not necessary to grind a new face each time a new draw die is made up.

Additionally, the manufacture of new draw dies according to the present invention wherein the first die portions are re-used over and over again can be carried out by relatively unskilled labor in contrast to prior art procedures which require rather highly skilled personnel.

The manufacture of new draw dies can also be carried out in a relatively simple and efficient manner resulting in great savings in time and labor as compared with prior art procedures.

An object of the present invention is to provide new and novel die apparatus wherein a die means incorporates different portions, one of which is relatively expensive material, while the other is of relatively inexpensive material, and wherein these portions may be readily separated from one another.

Another object of the invention is the provision of die apparatus wherein a relatively expensive portion of the die means may be re-used many times in different dies.

A further object of the invention is to provide die apparatus wherein substantial savings are afforded when manufacturing new dies.

Still another object of the invention is to provide die apparatus wherein new dies can be manufactured from old dies by relatively unskilled labor.

A still further object of the invention is to provide die apparatus which is quite simple and inexpensive in over-all construction, and yet which is sturdy and effective in use.

Other objects and many attendant advantages of the invention will become more apparent when considered in connection with the specifications and accompanying drawings, wherein:

FIG. 1 is an exploded perspective view illustrating the various components of a punch and die assembly according to the present invention; and

FIG. 2 is a sectional view through the punch and die assembly shown in FIG. 1 in its operative position.

Referring now to the drawings wherein like reference characters designate corresponding parts throughout the several views, there is shown in FIGS. 1 and 2 a die assembly according to the present invention. The assembly itself includes a first upper draw ring 10 and a lower draw ring 11, these draw rings comprising castings preferably of "Kirksite" and similar material.

Each of the draw rings is substantially rectangular in configuration as shown, and rectangular central openings 10*a* and 11*a* are provided therein respectively, these openings receiving the die means hereinafter described.

As shown, the die assembly is designed to produce a panel of the door of an automobile or the like, it being, of course, understood that the configuration of the die can be infinitely varied in accordance with the object which it is desired to form.

As seen particularly in FIG. 2, wherein the draw ring members are shown in operative position, inwardly projecting portions 15 and 16 are provided on the adjacent surfaces of draw ring members 10 and 11, and a portion 17 of the upper draw ring is recessed while a projecting portion 18 of draw ring 11 projects upwardly as seen. Portions 17 and 18 cooperate to provide along with the adjacent surfaces 19 and 20 of the draw ring members a tortuous path which serves to restrain a workpiece when clamped between the draw ring members as is well understood in the art for causing the material of the workpiece to be drawn properly into the desired shape between the die means.

As seen especially in FIG. 1, the upper draw ring may be provided with a plurality of circular recesses 25 and elongated recesses 26 formed in the side walls thereof, these recesses facilitating handling of the draw ring and securing to the press by inserting suitable members therein. In a like manner, the lower draw ring 11 is provided with a plurality of circular recesses 27 and elongated recesses 28.

It will be noted that the lower edges 30 and 31 at opposite ends of the upper draw ring 10 are complementary and adapted to snugly fit against the upper surfaces 32 and 33 respectively formed at opposite ends of the lower draw ring 11.

The upper die means includes a first portion 40 and a second portion 41 which are adapted to be interconnected with one another, while the lower die means includes a first portion 42 and a second portion 43, these latter two portions being adapted to be interconnected with one another.

The portion 40 of the first die means has formed in the outer walls thereof a plurality of circular recesses 45 and elongated recesses 46 for facilitating handling thereof, while the first portion 42 of the lower die means has formed in the outer surface thereof a plurality of circular openings 47 and elongated openings 48 for a similar purpose.

The portion 40 has four or more spaced openings 50 formed completely therethrough, while the portion 42 has four spaced openings 51 formed completely therethrough. As seen particularly in FIG. 2, each of openings 50 includes a lower portion 53 and an upper enlarged portion 54, while each of openings 51 includes an upper portion 55 and a lower enlarged portion 56.

The central portion of the under surface 40 is recessed as indicated by reference numeral 58, while the upper central portion of portion 42 is recessed as indicated by reference numeral 59, these central recessed portions facilitating locating of the portions 40 and 42 to the respective portions 41 and 43.

Each of portions 40 and 42 is formed of a relatively expensive material such as "Kirksite" or the like, the upper surface of portion 40 and the lower surface of portion 42 being machined such that these surfaces may be abutted against the supporting surfaces of press platens respectively of a press with which the die assembly is employed.

The main body portion 62 of the portion 41 is formed of a relatively inexpensive filler material, and is preferably formed of sand or a similar substance. The sand is held in place by a suitable binder, and in the present example, the sand is maintained in its desired shape by an epoxy plastic interspersed with the sand. The sand may comprise approximately 95 percent by weight of the body 62 while the epoxy plastic makes up the remaining 5 percent by weight. It is apparent that the body portion 62 is of very cheap construction and is readily expendable after the die has served its purpose.

Since the outer surface of the sand and plastic material forming the body 62 does not possess the desired qualities for engaging a workpiece, a facing or layer 64 is secured as by adhesive or the like to the outer surface of body 62. Facing 64 is preferably formed of a hard plastic material and as shown a plurality of layers are illustrated, these layers forming a laminated facing. The facing need not be laminated, however. The plastic facing should be hard enough to form the workpiece, and must have good strength and be capable of casting to tolerance. A suitable substance for this purpose is a plastic such as "Nalcolite" (trademark of the National Lead Company of New York, New York). The plastic is preferably reinforced with fiberglas to provide additional structural strength characteristics.

In order to reinforce the body 62 and ensure the desired degree of strength, reinforcing means is provided in the form of a plurality of reinforcing rods 66 which may be conventional steel concrete reinforcing rods, these rods being secured together by tying wires 68 around the points of intersection thereof so that the rods 66 define a mesh-like lattice which is embedded in the body portion 62.

Attaching means is provided for securing portion 41 to portion 40 in the form of a plurality of spaced bolts 70 shown as being four in number in FIG. 1. As seen in FIG. 2, each of bolts 70 extends up through an associated opening 50 formed in portion 40. A nut 71 is threaded onto the upper end of each of the bolts 70, the nut engaging a plurality of washers 72 which bear against portion 40. Bolts 70 are anchored in place within portion 41 by welding the head 74 of the bolt to one or more of the embedded reinforcing rods 66 as indicated at 75 in FIG. 2.

The body portion 80 of portion 43 is identical in construction to body portion 62 and a reinforcing mesh identical to that discussed in connection with body means 62 is provided in body means 80 and comprises a plurality of reinforcing rods 81. A plastic facing 82 is secured to the outer surface of body portion 80, facing 82 being identical in all respects with the facing 64 previously described.

As seen particularly in FIG. 1, attaching means in the form of four bolts 85 project downwardly from portion 43. As seen in FIG. 2, each of bolts 85 passes through one of the openings 51 provided in portion 42. Nuts 86 are secured to the outer ends of bolts 85, these nuts engaging a plurality of washers 87 which bear against portion 42. The bolts 85 are anchored to portion 43 by welding the heads 89 thereof to one or more of the reinforcing rods 81 as indicated by reference numerals 90.

It will be noted that in addition to the reinforcing rods 81 forming a mesh-like reinforcing means in the body 80, an additional reinforcing rod 92 is shown in the reduced upwardly projecting portion at the right-hand side thereof as seen in FIG. 2. It is apparent that reinforcing rods may be inserted any place within either of the body portions 62 or 80 where additional reinforcing is required.

It is, of course, evident that the outer shape of each of body portions 62 and 80 as well as the facings 64 and 82 thereon respectively will depend upon the con-

figuration of the finished article it is intended to produce. As mentioned previously, the die assembly as illustrated is intended to produce door panels for an automobile or the like, and as seen in FIG. 2, a workpiece 95 is illustarted as clamped between the upper and lower dies at the termination of the operating stroke whereupon the material of workpiece 95 has been drawn between the upper and lower die means, and has been suitably shaped. The body portions 62 and 80 which are formed of sand plus a binder have proved to be completely satisfactory in use since this material provides good compression strength which is adapted to withstand the forces applied thereto during stamping operations. In addition, these body portions 62 and 80 do not shrink as was the case with comparable large areas of "Kirksite," and additionally, the material as employed in the present invention adheres well to the hard outer facings 64 and 82.

It is evident that as shown the upper and lower die means comprise units which operate in a manner fully equivalent to a die formed as a single casting. On the other hand, when the die has served its purpose, it is further apparent that portions 40 and 42 may be separated from portions 41 and 43 respectively merely by removing the nuts 71 and 86 whereupon the anchor bolts are released. To additionally aid in separating the portions 40 and 42 from portions 41 and 43 respectively, a suitable parting agent may be provided between the adjacent surfaces of portions 40 and 41 as well as the adjacent surfaces of portions 42 and 43.

It is evident that when it is desired to change the shape of the die, the portions 40 and 42 are removed whereupon new portions 41 and 43 may be formed in accordance with the new configuration. The new portions 41 and 43 can then be attached to portions 40 and 42, and the die assembly is again ready to be used. It will, of course, be evident that portions 40 and 42 will again be employed where the new portions 41 and 43 are of the same general dimension as the old portions 41 and 43. In a typical example, where door panels are being made, different door panels may have substantially the same dimensions with a slightly altered outer contour. When this is the case, the draw rings 10 and 11 can generally be utilized again also since the die members employed for different panels are substantially similar to one another with minor variations in contour being the main difference.

It is apparent from the foregoing that there is provided new and novel die apparatus wherein each die means incorporates different portions, one of which is relatively expensive and the other of which is relatively inexpensive, and wherein these portions may be readily separated from one another simply by disconnecting a few nuts, which thereby releases the anchor bolts. The relatively expensive portions of the die means may be re-used many times in different die assemblies, and, of course, it is not necessary to re-grind these expensive portions each time a new die is produced. It is evident that substantial savings are provided when making new dies since it is not necessary to melt down the relatively expensive portion, nor is it necessary to re-grind the face thereof.

The portions of each die means can be separated by even the most inexperienced personnel, and the new die means may be constructed by relatively unskilled labor. The apparatus is simple and inexpensive in over-all construction, and yet is quite sturdy and effective in use.

As this invention may be embodied in several forms

without departing from the spirit or essential characteristics thereof, the present embodiment is therefore illustrative and not restrictive, and since the scope of the invention is defined by the appended claims, all changes that fall within the metes and bounds of the claims or that form their functional as well as conjointly cooperative equivalents are therefore intended to be embraced by those claims.

I claim:

1. Die apparatus comprising a first relatively expensive die portion formed of metallic material and a second relatively inexpensive die portion formed principally of sand and including binder means for retaining the proper configuration of the second portion, said first and second portions including complementary facing contacting surfaces whereby said first portion serves as backing plate means for said second portion, attaching means rigidly affixed to said second portion and extending outwardly from the said surface associated therewith, said first portion having opening means for receiving said attaching means, and means removably engaging said attaching means for affixing said first portion to said second portion and permitting the first and second portions to be detached from one another so that said first portion can be readily removed, said first portion being adapted to be secured to the shoe of a press for securing the first and second die portions to such shoe.

2. Apparatus as defined in claim 1 wherein said second die portion is provided with a hard facing material disposed on the outer surface thereof for engaging a workpiece.

3. Die apparatus comprising a first relatively expensive die portion and a second relatively inexpensive die portion, said first die portion being formed of metallic material and said second die portion being formed principally of sand and including binder means for retaining the proper configuration of the second portion, said first and second portions having facing interengaging surfaces whereby said first portion serves as backing plate means for said second portion, said second portion having embedded therein a plurality of bolts which extend outwardly therefrom, said first portion having a plurality of openings for receiving said bolts, said bolts extending through said openings, nut means associated with said bolts for detachably securing said first portion to said second portion whereby said first portion may be removed after use of the die apparatus and re-used and whereby said second portion may be discarded if desired, said second portion including reinforcing means embedded therewithin, said second portion also having a hard facing material disposed on the outer surface thereof for engaging a workpiece, said first die portion being adapted to be secured to the shoe of a press for securing the first and second die portions to such shoe.

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