J. A. LUTHER.

DIE STRUCTURE.

APPLICATION FILED APR. 22, 1920.

1,428,174.

Patented Sept. 5, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

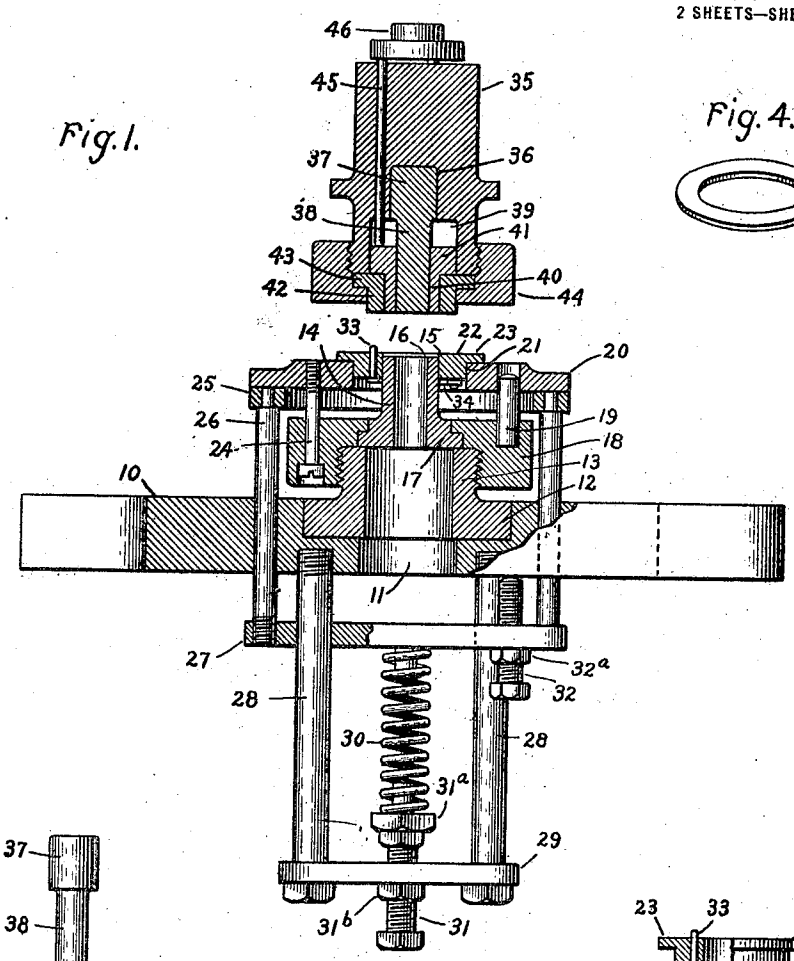


Fig. 4.

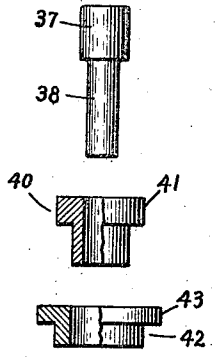


Fig. 2

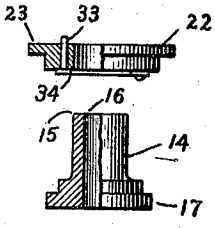


Fig. 3

Inventor

John A. Luther

by Alex. L. Macdonald

Atty.

J. A. LUTHER.

DIE STRUCTURE.

APPLICATION FILED APR. 22, 1920.

1,428,174.

Patented Sept. 5, 1922.

2 SHEETS—SHEET 2.

Fig. 5.

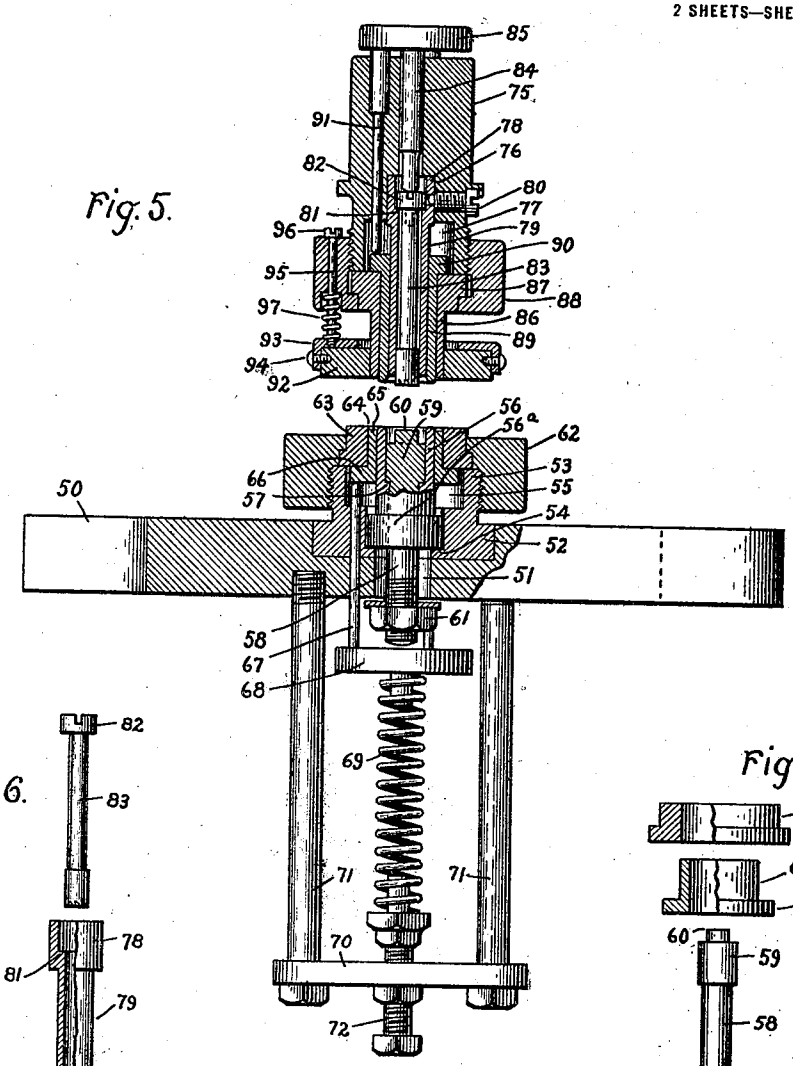


Fig. 6.

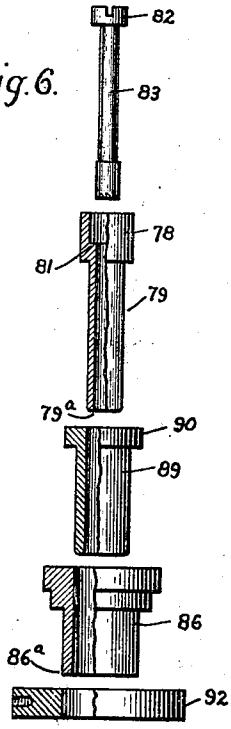


Fig. 8.

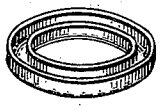
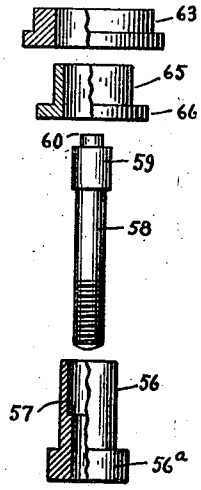


Fig. 7.



Inventor:
John A. Luther
by Alex. F. Macdonald
Atty.

Patented Sept. 5, 1922. 1,428,174

UNITED STATES PATENT OFFICE.

JOHN A. LUTHER, OF SCHENECTADY, NEW YORK.

DIE STRUCTURE.

Application filed April 22, 1920. Serial No. 375,833.

To all whom it may concern:

Be it known that I, JOHN A. LUTHER, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Die Structures, of which the following is a specification.

The present invention relates to dies such as are used with punch presses for punching out or forming small articles from strips or plates of sheet material. In connection with the manufacturing of certain articles on punch presses it is necessary to make a large number of different sizes and this, as is obvious, requires an equal number of different sized dies. For example, in manufacturing washers it is necessary to be prepared to furnish them in many sizes of both inside and outside diameters often differing from each other by only a few hundredths of an inch and this means that there must be a die for every size.

The object of my invention is to provide an improved structure and arrangement in a die whereby I am enabled to provide dies of various sizes in a very simple manner and at exceedingly low cost, it being possible to turn out the die parts by simple machine operations and without the services of highly skilled die makers.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the drawing, Fig. 1 is a sectional view of a die structure embodying my invention; Fig. 2 is an exploded view of the upper die parts; Fig. 3 is an exploded view of the lower die parts; Fig. 4 is a perspective view of an article adapted to be made by the die structure shown in Fig. 1; Fig. 5 is a view similar to Fig. 1 of a modification; Figs. 6 and 7 are exploded views of the upper and lower die parts respectively and Fig. 8 is a perspective view of an article adapted to be made by the die structure shown in Fig. 5.

Referring to Sheet 1 of the drawings, 10 indicates a shoe which is adapted to be mounted in the lower part or member of a punch press as is well understood. At the center of shoe 10 is an opening 11 counterbored on its upper side to form a recess in which is fixed the flange 12 of an externally threaded stud 13. Stud 13 is perfectly made of hard steel and it is shrunk into the recess in shoe 10 to make a tight fit. Supported on the upper end of stud 13 is a combined punch and die 14. It is in the form of a tube the upper or outer end having sharp cutting edges 15 and 16 and the lower or inner end being provided with a flange 17 which is clamped against stud 13 by a nut 18 which threads over stud 13 and has an annular shoulder which engages over flange 17. Projecting from nut 18 are a number of guide pins 19, for example three, which project through openings in and form guides for an annular reception plate 20. Reception plate 20 has an opening 21 at its center through which die 14 projects. Opening 21 is of greater diameter than die 14 and located between die 14 and the edge of opening 21 is a stripper plate 22 provided with a flange 23 which rests on reception plate 20. Stripper plate 22 acts as a guide for the outer end of die 14. Reception plate 20 is prevented from separating entirely from nut 18 by a suitable number of holding screws 24, for example three, which pass loosely through holes in nut 18 and thread into the underside of plate 20, the holes in nut 18 being counterbored to receive the heads of screws 24.

Reception plate 20 rests on an ejector ring 25 which is connected by posts 26 to a cross piece 27. Cross piece 27 is guided in its movements by posts 28 which are fastened to and depend from the lower side of shoe 10 and have their ends connected together by a bar 29. Between bar 29 and cross piece 27 is a spring 30 which serves to hold ring 25 against reception plate 20. Spring 30 may be adjusted by means of bolt 31 which carries a nut 31^a against which the lower end of spring 30 rests. At 31^b is a lock nut for fastening bolt 31 in adjusted position.

The upward movement of cross piece 27 and ring 25 is limited by an adjustable stop 32 in the form of a threaded bolt adapted to be locked in adjusted position by a lock nut 32^a. Projecting through stripper plate 22 is a stop pin 33 which is yieldingly held in the position shown in Figs. 1 and 3 by a curved spring 34 fastened to the underside of plate 22. It will be seen that ring 25, posts 26, and cross piece 27 form an ejector frame which is yieldingly pressed against plate 20 by spring 30 and is limited in its upward movement by stop 32 and the heads of bolts 24.

The upper member of the die structure comprises a holder 35 adapted to be fastened to the movable jaw of a punch press, and provided with a central recess 36 to receive the head 37 of a combined punch and die 38. Recess 36 is counterbored to form a chamber 39 which surrounds die 38, and sliding on die 38 is an ejector 40 having a head 41 which is located in chamber 39. Supported on the end of holder 35 is a combined punch and die 42, the same having a flange 43 which is clamped against the end of holder 35 by a flanged nut 44 which threads into the end of holder 35. The ejector 40 fits the annular space between dies 38 and 42 and is adapted to slide therein. Extending through openings in holder 35 are a suitable number of ejector pins 45, for example three, which at their inner ends engage ejector head 41 and at their outer ends are fastened to a pad 46.

A die structure as described is adapted to make washers 47 as shown on an enlarged scale in Fig. 4 and the operation is as follows:

The upper and lower die members are placed in the respective parts of a punch press which periodically brings them together and away from each other, the die member standing at a sufficient angle to the vertical so the punched out parts will fall by gravity from between them. The end of a strip of material from which the washers are to be punched is slid across the lower die member until it comes into contact with stop pin 33. When the die members come together upper die 42 strikes stripper plate 22 and forces it and reception plate 20 downward against the action of the ejector frame, the inner edge of die 43 co-operating with the outer edge 15 of die 14 to sever the strip of material on the outer diameter of the washer. At the same time die 38 co-operates with the inner cutting edge 16 of die 14 to punch out the center of the washer, such punched out center falling through the central opening of die 14. The die 14 is of the same size as the upper ejector 40 and the washer when punched out will be forced by die 14 up around the lower end of die 38, die 14 projecting through the opening in the strip of material formed by the punched out washer. When the dies separate, the ejector frame is pushed upward by spring 30 to force stripper plate 22 against the strip of material and remove it from die 14 so the operator may feed it ahead for another washer. Toward the top of the stroke of the upper die member, pad 46 strikes a fixed abutment on the press which drives pins 45 down against the head 41 of ejector 40 of the upper die thereby forcing ejector 40 downward to knock the washer off die 38.

It will be noted that the upper and lower die structures are each built up from a plurality of comparatively simple parts which can be easily made in various sizes and quickly changed to adapt the press for stamping out washers, in this particular instance, of any size. For example, if it is desired to stamp out washers of a slightly greater or lesser outside diameter than that for which the die members are now set up, it is only necessary to change die 42 and ejector 40 in the upper die structure, and die 14 and stripper plate 22 in the lower die structure. This can be quickly and easily done in the case of the upper die member by removing nut 44, replacing the present die 42 and ejector 40 by similar parts of the required dimensions and replacing nut 44; and in the case of the lower die member, by removing stripper plate 22 unscrewing nut 18, substituting a new die 14 and stripper plate 22 and clamping the new die in place by nut 18. In a similar manner the die members can be changed for punching out washers of various dimensions as is obvious.

In connection with the upper die structure, die 38 is axially aligned and guided by ejector 40 and die 42 and as a result the only parts which need be accurately sized are the lower or outer end of dies 38, ejector 41 and die 42. These are all plane surfaces of revolution and are easily made to exact dimensions and fitted. Head 37 of die 38 is made to fit loosely in recess 36 and may be hung therein by a pin or other suitable means. This permits die 38 to readily align itself in ejector 40. It also permits die 38 to be easily removed and replaced when changing the die structure, and does not require the careful fitting of head 37 in recess 36. As to the lower die structure, the only parts to be accurately sized are the punching or external end of die 17 and the stripper plate 22 in which it is guided. The other parts need be fitted with only ordinary accuracy.

By the foregoing construction I obtain a die structure which while accurate is at the same time simple and cheap to build and readily changed to adapt it for many sizes.

Die structures embodying my invention may be made for stamping out and forming articles of various shapes and for various uses, and on sheet two of the drawings I have illustrated a die structure for stamping out an article of the contour shown in Fig. 8, i. e., a ring, U-shaped in cross section.

Referring to sheet two, 50 indicates a shoe provided at its central portion with an opening 51, which is counterbored to receive the flange 52 of an externally threaded stud 53. Stud 53 has an axially extending opening which aligns with opening 51 and it is counterbored to provide an annular shoulder 54 and a chamber 55. 56 is an annular form-

ing tool having a head 56ª which fits loosely in the lower counterbore of stud 53 and rests on annular shoulder 54. Tool 56 is in the form of a tube provided with an internal shoulder 57 and extending through it is a rod 58 having a head 59 which rests on shoulder 57. Projecting from head 59 is a punching tool 60. Rod 58 projects through opening 51 in shoe 50 and its end is threaded to receive a nut 61 for fastening forming tool 56 and rod 58 to the shoe. Clamped on the end of stud 53 by a flanged nut 62 is an annular die 63 having an inner cutting edge 64, and between die 63 and the outer end of forming tool 56 is an ejector 65 provided with a flange 66 located in chamber 55. Bearing against flange 66 are a number of ejector pins 67, three for example, which extend out through openings in shoe 50 and are connected at their lower ends to a disk 68 against which bears one end of a spring 69, the other end of which rests on a cross bar 70 carried by posts 71 depending from shoe 50. The tension of spring 69 may be adjusted by threaded bolt 72 in an obvious manner. Spring 69 serves to bias ejector 65 to the position shown in Fig. 5.

The upper member of the die structure comprises a holder 75 having a central recess 76 which is counterbored to form a chamber 77. Fastened in recess 76 is the head 78 of a tubular inner die 79. Head 78 fits loosely in recess 76 and is hung therein by a pin 80. Die head 78 is counterbored from its upper inner end to form an internal shoulder 81 against which rests the head 82 of a center ejector 83. When head 82 is against shoulder 81, the lower or outer end of ejector 83 protrudes just beyond the end of die 79. Engaging head 82 of ejector 83 is a rod 84 which extends out through an axial opening in holder 75 and is connected to a pad 85. Surrounding die 79 and spaced therefrom is an outer die 86 having a flange 87 which rests against the end of holder 75 and is fastened thereon by a flanged nut 88 which threads onto the end of holder 75. In the annular space between dies 79 and 86 is an ejector 89 having a head 90 located in chamber 77, and engaging head 90 on a suitable number of ejector pins 91 which extend out through holder 75 and are fastened to pad 85. Surrounding the lower end of die 86 is a compressor and stripper plate 92 which is fastened in a holder 93 by screws 94. Holder 93 is supported by a suitable number of rods 95, for example three, which extend freely through openings in nut 88 and have heads 96 resting on the nut. Surrounding each rod 95 between nut 88 and holder 93 is a spring 97. Holder 93 and stripper plate 92 are thus yieldingly held against upward movement.

As the best shown is Figs. 6 and 7, die 79 has an inner cutting edge 79ª, the outer edge being cut back slightly, and die 86 has an outer cutting edge 86ª, the inner edge being cut back slightly. Cutting edges 79ª and 86ª co-operate with the outer edge of punch 60 and the cutting edge 64 of die 63 respectively. Forming tool 56 has rounded end.

The die members shown in Figs. 5, 6 and 7 are used in a punch press the same as those described in connection with Figs. 1, 2 and 3, and when they come together with a sheet of material between them, an annulus is first cut out by edge 79ª of die 79 and the outer edge of punch 60, and edges 86ª and 64, and this annulus is then pressed down over the end of forming tool 56 by the cut back edges of dies 79 and 86 to form a structure as shown in Fig. 8. The strip of material from which the annulus is punched is pushed up around upper die 86 by lower die 63, stripper plate 92 being pushed upward against the action of springs 97 and the disk punched from the center of the annulus is pushed up inside die 79. In forming the U-shaped ring of Fig. 8, dies 79 and 86 move beyond the end of forming tool 56, die 86 pushing ejector 65 downward against the action of spring 69. At the same time the end of forming tool 56 pushes ejector 89 upward. Now as the dies separate ejector 65 will push the U-shaped ring which has been formed off the end of forming tool 56 and such ring will be carried upward between dies 79 and 86, while at the same time stripper plate 92 will push the strip of material from which the U-shaped ring has been formed, off die 86 so it will rest on the lower die member ready to be moved for forming the next U-shaped ring. At the top of its stroke, pad 85 strikes a stop on the punch press thereby pushing ejectors 83 and 89 downward to knock the punched out disk from out the center of die 79, and the U-shaped ring from between dies 79 and 86.

It will be seen that the die members of Figs. 5, 6 and 7 are made up of separate concentric parts the same as the die members of Figs. 1, 2 and 3, and these parts likewise need be exactly sized only at their outer ends. In connection with the lower die member the head 56ª of die 56 may fit loosely in the counterbore of stud 53 and nut 61 need not be particularly tight since the outer end of die 56 is centered and guided by ejector 65; and in the case of the upper die member, the only parts to be closely fitted and dimensioned are the outer and lower ends of ejector 83, die 79, ejector 89 and die 86, and the inner diameter of stripper plate 92. In this connection it will be noted that only the lower end of ejector 83 is finished, the remaining portion being cut back. Likewise the die members can be changed easily for making U-shaped rings of various dimensions by merely changing the die parts.

Holder 93 is adapted to hold stripper plates having various sizes of central openings and various sizes of dies may be supported by holder 75.

It will be seen from a consideration of my invention that I am enabled to produce dies of many sizes from comparatively few parts and in a simple manner. One application of my invention is the making of washers and gaskets for spark plugs, an application which requires the production of many sizes often with but slight variations in size. By my invention I am enabled to reduce very materially the cost for dies. This is due primarily to the fact that there are few surfaces to be exactly sized and fitted to each other and in every case these are surfaces which are readily accessible and easily made to exact dimensions. In each die member there is an outer die which is rigidly fixed to a holder or carrier and other die parts which are loosely connected at their inner ends by the holder, and have their outer ends fitted and located within the outer die. This means that the inner die parts and the adjacent parts of the holder need not be exactly sized and finished to each other. In other words, the portions of the die parts which need be exactly finished are limited to the active working ends of such parts.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A die member comprising a holder, and a plurality of separate concentric parts carried thereby, said parts being dimensioned and fitted together at their outer ends with a ground fit so they serve to support one another in concentric relation at their outer ends whereby the inner ends need not be accurately dimensioned and fitted.

2. A die member comprising a holder, and a plurality of separate concentric parts fastened to said holder at their inner ends and dimensioned and fitted together at their outer ends, with a ground fit so they serve to support one another in concentric relation at their outer ends whereby the inner ends need not be accurately dimensioned and fitted together.

3. A die member comprising a holder having a counterbored recess, a die having a head located in said recess, a second die spaced from the first die and fastened to the end of said holder, and an ejector which fits the space between the outer ends of said dies with a ground fit whereby it serves to center and guide the outer end of the first-named die.

4. A die member comprising a holder having a centrally axially extending counterbored recess, a die having a head which loosely fits said recess, a second die, a nut which fastens it to the end of said holder, and an ejector located in and fitting accurately the space between the outer ends of said dies with a ground fit whereby said second die and ejector serve to position and guide the first-named die.

5. In a die structure, a holder, an outer die fixed thereto, and other die parts carried by the holder and dimensioned and fitted at their outer ends only to the inside of said outer die with a ground fit, said outer die serving as a guide and centering means for said other die parts.

6. In a die structure, a holder having an axially extending recess at one end, an annular die detachably fixed to such end of said holder, and die parts carried by the holder within said recess and detachably fastened thereto, said die parts being accurately dimensioned and fitted to each other with ground fits at their outer ends and guided by said fixed die.

7. In a die structure, a holder having a counterbored end, a die fixed on such end, a second die loosely connected at its inner end to said holder and spaced from the inner surface of said first-named die, an ejector accurately fitted in the space between the outer ends of said dies, with a ground fit, said second-named die and ejector being centered and guided at their outer ends by said first-named die, and ejector pins carried by said holder and engaging said ejector.

8. In a die structure, a holder having an axially extending counterbored recess in one end, an annular die detachably fixed on such end, a second die having its inner end held in and accurately fitting said recess, and an ejector located in the annular space between said dies with a ground fit, said ejector having a head located in the counterbored portion of said recess for limiting the outward movement of the ejector, and said ejector and second die being centered by said first-named die.

9. In a die structure, a holder, a die detachably fixed to said holder, and a stripper surrounding said die and comprising an annular holding part carried by said holder and a second part detachably connected to said holding part and fitted to said die, whereby said second part may be readily changed to conform to various sizes of dies.

10. In a die structure, upper and lower die members each comprising a holder having a recess in one end, a die detachably fixed to such end, and die parts carried by

the holder in said recess, said die parts being centered by said die, and a stripper surrounding one of said dies and comprising a holding part and a second part detachably connected to said holding part and fitted to the die which it surrounds.

11. In a die structure, upper and lower die members, each comprising a holder having an axially extending counterbored recess, a die fixed on the end of said holder, and a second die having its inner end located in said recess and its outer end spaced from said die, and die parts comprising a forming die and ejectors which fit accurately the spaces between the dies of each member with ground fits, said outer die in each case serving to center and guide said die parts.

In witness whereof I have hereunto set my hand this 17th day of April, 1920.

JOHN A. LUTHER.