

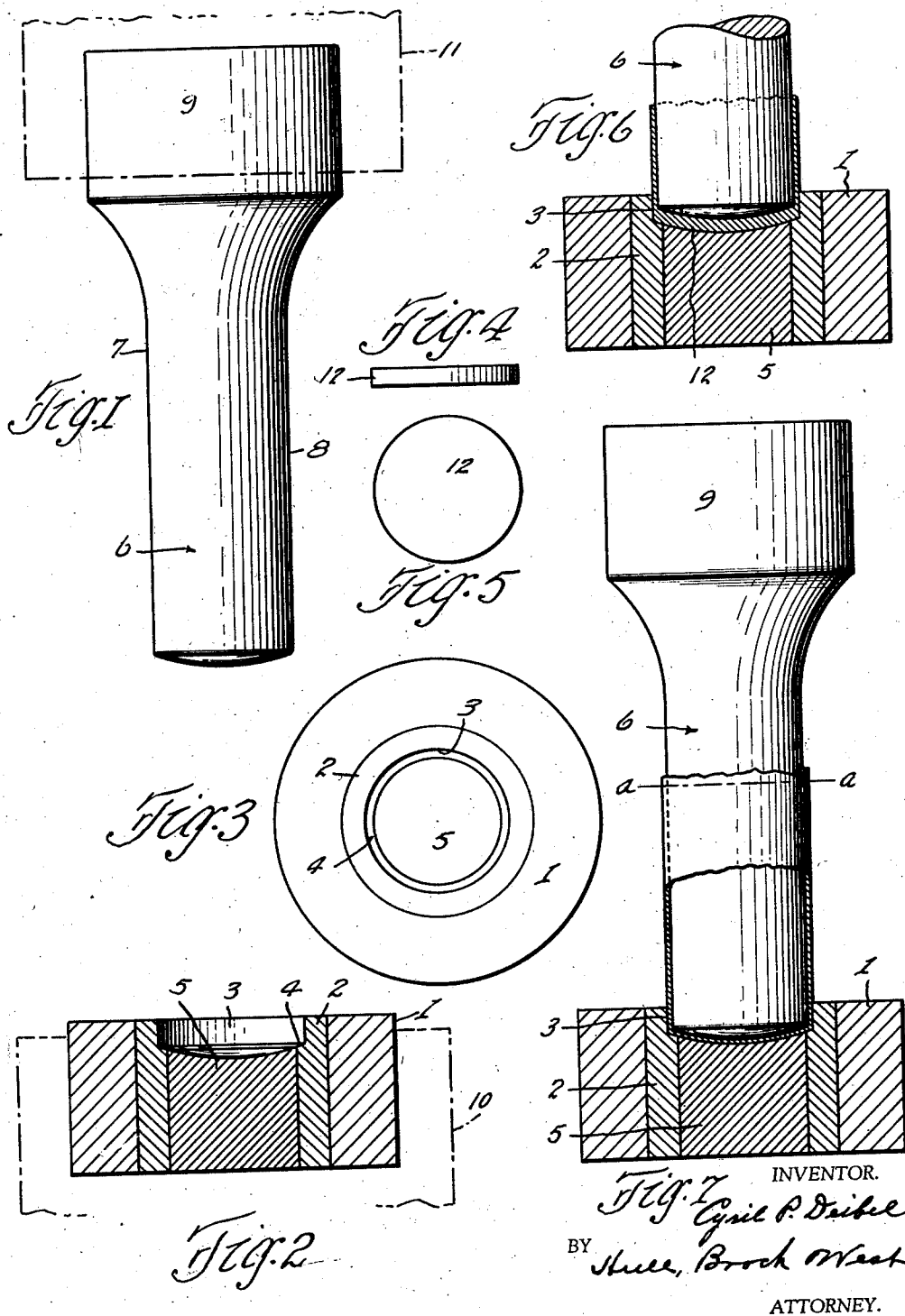
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METAL CONTAINER EXTRUSION DIE

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METAL CONTAINER EXTRUSION DIE

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8 Claims. (Cl. 207—17)

This invention relates to improvements in the tools or dies used in the production of metal cups or containers by an extrusion method which is broadly disclosed in the patent to W. M. Towne, No. 1,492,230, issued April 29, 1924. According to the process disclosed in the aforementioned patent a blank of zinc of suitable structure and dimensions is subjected to pressure between male and female dies and extruded through a contracted annular space surrounding the male die member in a direction opposite to the movement of the male die. With my improved die members I am able to successfully form zinc cans or cups by extrusion at a temperature between ordinary room temperature and slightly below the melting point of the zinc, although I have found that the best results are obtained and the amount of scrap reduced to a minimum if the metal is maintained at a temperature of about 600° F.

In attempting to practice the invention disclosed in the Towne patent hereinbefore mentioned with the use of the die members disclosed in that patent, I found that it was necessary to renew the dies at such frequent intervals that the whole process was found to be unsatisfactory and prohibitive in cost. The stresses and strains produced as a result of the high pressure found necessary caused the female die to break at the corner between the vertical and bottom walls of the die cavity and frequently at the center of the die cavity at the bottom of the die. It appeared that this breaking of the female die member was due to or caused by the fatigue of the metal. It was also thought that the breakage was due to a moment having its fulcrum at the bottom corner of the die cavity and that the continued infinitesimal movement of the die metal would cause it to crystallize and weaken the metal at that point; and that, if this moment could be eliminated the life of the die could be greatly prolonged.

I eliminate this difficulty by forming the female die in two or more parts, the bottom of the die being formed of a renewable piece in order to lower the cost of replacement should replacement be necessary. I also form the member which forms the bottom of the female die of a stronger material which will better withstand the high pressure than that needed for the sides of the die. The member which forms the sides of the female die is formed of a material which will better withstand wear so that the die cost will be lowered or at least the renewal of a whole die will be eliminated in favor of the renewal of

only the worn or fatigued sections. My improved female die is also so constructed and designed that in operation the metal will naturally tend to flow across the crack between the two parts forming the die.

The main object of my invention is to provide a pair of dies which will withstand the hard uses to which they are subjected and which will eliminate the difficulty hereinbefore mentioned.

Another object of my invention is to provide a female die which is made up of a plurality of parts which may be renewed when a part or parts thereof become worn or broken.

Another object of my invention is to provide a pair of dies for use in a process of forming metal cans by extrusion which can be produced at a minimum cost and which may also be replaced with a minimum cost.

Further and more limited objects of the invention will appear as the description proceeds and by reference to the accompanying drawing in which Fig. 1 is a view in front elevation of the male die member or punch; Fig. 2 is a vertical sectional view of the female die member; Fig. 3 is a top plan view of the female die member; Figs. 4 and 5 are views in side elevation and plan respectively of the slug of metal for forming the cups; Fig. 6 is a fragmentary sectional view showing the condition during the early part of the extruding operation and Fig. 7 is a similar view showing the completion of the extruding operation.

In Fig. 1 I have disclosed my male die or punch which is formed of a metal of suitable degree of hardness and which is solid and has straight parallel sides and a somewhat rounded lower end, the corners between the sides and bottoms being rather sharply defined.

In Fig. 2 there is disclosed a female die which is preferably though not necessarily formed in three pieces. This female die consists essentially of an outer die holder or collet 1 formed of any suitable metal and which is provided with a central straight sided or slightly tapered opening preferably circular in shape and into which is fitted a metal sleeve 2 formed of highly tempered and polished steel, Stellite or Carboloy having a suitable degree of hardness and which is provided at its upper end with a straight sided or very slightly tapered opening 3 and below which is formed an inwardly offset shoulder 4 the upper face of which is slightly tapered or curved. Press fitted into the sleeve 2 is an anvil 5 having a maximum outside diameter slightly less than the inside diameter of the offset portion of the

opening in the sleeve 2. The bottom of the cavity formed by the anvil and sleeve is so shaped and designed that in the operation of the dies the metal will naturally tend to flow across the crack between the anvil and the sleeve. The working face of the anvil and the upper face of the shouldered portion of the sleeve provide a continuous smooth slightly concave surface which forms the bottom of the die cavity. The working faces of the anvil and sleeve are formed of steel or other suitable metal of the required degree of hardness and are highly polished and either or both of these surfaces are chromium plated. Should the working surfaces of the sleeve or anvil become worn, it is only necessary to remove the chromium plating and replace it. With such a construction, I have been able to form more than 500,000 zinc cups before replacing either the anvil or the sleeve. The sleeve is preferably formed of a metal of such hardness that it will withstand a great deal of wear while the anvil is formed of a metal which is better adapted for withstanding high pressures. The cost of replacing either the anvil or the sleeve or both is small as compared with the cost of replacing the whole female die member.

The upper face of the anvil is preferably slightly concave and merges with the slightly tapered or curved shoulder on the sleeve to provide a continuous smooth surface which forms the bottom of the die cavity so that the natural tendency of the metal is to flow across the crack between the sleeve and the anvil rather than into such crack.

The male die member 6 or punch shown in Fig. 1 consists of a piece of steel of suitable degree of hardness and has a pair of parallel straight sides 7 and 8 and a head 9 which is joined with the straight sided portion by a slightly tapered portion. The upper end of the punch is constructed to fit the corresponding member of the press in which the dies are to be used. In a press of the usual construction the female die member is carried in a die block 10 on the bed of the press and the punch will have its shank centered or fastened in a bolster 11 or other fitting fastened to the moving head or platen of the press. The construction is such that the punch may be adjusted by suitable means so that the male die is accurately centered with respect to the die cavity of the female die member. The lower end of the punch is preferably slightly rounded and the corners between the lower end and the straight side walls are rather sharp and well defined.

In operation a slug or disc of zinc 12, preferably circular in shape and of the desired construction and consistency is automatically placed within the female die cavity and the punch 6 is then forced down into the die cavity to the position shown in Fig. 6 which causes the metal to flow upwardly around the sides of the punch as shown in Figs. 6 and 7. The zinc slug is preferably maintained at a temperature of about 600° F. which gives sufficient plasticity and ductility to form a cup or tube having a wall of the desired thickness with a minimum pressure. This temperature may be varied depending upon the thickness desired for the walls of the cup and depending upon the construction and consistency of the zinc. Proper lubrication of the blank is necessary and only sufficient lubrication should be used to form a very thin film on the blank. The particular construction of the female die herein described greatly facilitates the flow of

the zinc and causes it to flow uniformly from the center outwardly to the space between the punch and the female die. This flow should be slowest at the center and should accelerate uniformly in radial lines toward the outer wall, the maximum rate of flow being through the contracted annular space where the extrusion finally occurs. Owing to the tendency of the zinc to hug the punch, it is desirable to remove the cup after the extruding operation by the action of a suitable stripper (not shown) which is provided on the press. The extruding operation leaves the cup with an irregular upper edge and the extruded cups are subsequently trimmed to the desired height as indicated by the line *a-a* in Fig. 7.

The male die or punch being straight sided is cheaper to produce and may be ground down or dressed in case of slight wear. The straight sides also facilitate the removal of the formed container.

With my improved dies I am able to successfully practice the process described in the Towne patent hereinbefore referred to which was impractical with the equipment disclosed in the Towne patent because of the breakage of the dies.

It is of course to be understood that the embodiment of the invention herein disclosed is merely illustrative and is not to be considered in a limiting sense as various changes may be made in the details of the construction of the dies without departing from the spirit of my invention, for example, the shape of both die members may be changed to form cups or containers in shapes other than circular. The die holder or collet and the sleeve may also be made integral, if desired. The side walls of the punch may have a slight taper inwardly from the bottom toward the top, if desired, but in no case should the lower end of the punch have a greater diameter than the upper end. I may also use both male and female dies made of suitable metals other than steel, for example, one very satisfactory female die consists of a tempered steel die holder in which is disposed a sleeve formed of Carboloy or Stellite and which receives therein an anvil formed of a suitable tempered steel. I have also found that best results are obtained if the working surface or face of the sleeve is given a slight taper outwardly. The invention is therefore limited only in accordance with the scope of the appended claims.

Having thus described my invention, what I claim is:

1. A die for use in forming metal containers by an extrusion process comprising a die holder having an opening therein, a sleeve fitting in said opening and having a substantially straight portion and an inwardly offset shouldered portion, an anvil fitting within said inwardly offset shouldered portion and cooperating therewith to form a die cavity, the upper surface of said anvil and the upper face of said shouldered portion providing a continuous smooth slightly concave surface forming the bottom of the die cavity.

2. A pair of die members for use in forming zinc containers by an extrusion process consisting of a male die member and a female die member, the female die member comprising an outer member into which is fitted a sleeve having a substantially straight portion and an inwardly offset shouldered portion, an anvil fitting within said inwardly offset shouldered portion and cooperat-

ing therewith to form a die cavity the bottom of which is slightly concave.

3. A die for use in forming metal containers by an extrusion process comprising a die holder, a sleeve fitting within said die holder and having a die cavity therein having a substantially straight portion and an inwardly offset shouldered portion, and an anvil fitting within said offset portion and forming a tight fit therewith, the working face of said anvil and the face of said shouldered portion providing a smooth slightly concave surface forming the bottom of the die cavity.

4. A die for use in forming metal cans by an extrusion process comprising a female die member having an inwardly offset shouldered portion and an upwardly extending slightly tapered portion, said die member having a central opening therein, an anvil fitting within said opening and forming a tight fit therewith, the working face of said anvil being slightly concave and cooperating with said inwardly offset shouldered portion to provide a die cavity the bottom of which has a concave continuous smooth surface, the crack between said die member and anvil being disposed inwardly of the tapered portion of said die member whereby the metal is caused to flow in a substantially radial direction across the crack between the anvil and die member and a die holder surrounding said die member.

5. A die for use in forming metal cans by an extrusion process comprising a female die member having an inwardly offset shouldered portion and an upwardly extending slightly tapered portion, said die member having a central opening therein, an anvil fitting within said opening and forming a tight fit therewith, the working face of said anvil being slightly concave and cooperating with said inwardly offset shouldered portion to provide a die cavity the bottom of which has a concave continuous smooth surface, the crack between said die member and anvil being disposed inwardly of the tapered portion of the die member whereby the metal is caused to flow in a substantially radial direction across the crack between the anvil and die member and a die holder surrounding said die member, said die member being formed of a metal of such hardness that it will withstand great wear and said anvil being formed of a metal which is better adapted for withstanding high pressure.

6. A die for use in forming metal cans by an extrusion process, said die being made up of a plurality of parts and including a die holder

having an opening therein, a sleeve fitting within said opening, the working face of said sleeve having a substantially straight portion and an inwardly offset, narrow, shouldered portion, an anvil fitting within said inwardly offset shouldered portion and cooperating therewith to provide a die cavity, the crack between said anvil and sleeve being disposed below the plane where the greatest radial forces occur and inwardly of the substantially straight portion of said sleeve whereby the metal is caused to flow in a substantially radial direction across the crack, said sleeve being formed of a metal of such hardness that it will withstand great wear and said anvil being formed of a metal which is better adapted for withstanding high pressure.

7. A die for use in forming metal cans by an extrusion process, said die being made up of a plurality of parts and including a die holder having an opening therein, a sleeve fitting within said opening, the working face of said sleeve being made up of a substantially straight portion and a contiguous inwardly offset, narrow, shouldered portion the upper face of which is slightly tapered, an anvil fitting within said inwardly offset shouldered portion and cooperating therewith to provide a die cavity, the crack between said anvil and sleeve being disposed below the plane where the greatest radial forces occur and inwardly of said substantially straight portion of said sleeve whereby the metal is caused to flow in a substantially radial direction across the crack, said sleeve being formed of a metal of such hardness that it will withstand great wear and said anvil being formed of a metal which is better adapted for withstanding high pressure.

8. A die for forming metal cans by backward extrusion, comprising, in combination, a female die portion comprising a sleeve and an anvil closely fitting within and terminating below the top of said sleeve, said sleeve being provided with a shoulder on its inner surface, the surface of said shoulder being continuous with the upper surface of said anvil, the crack between said anvil and said sleeve being below the plane of greatest radial force, said anvil being composed of material selected for high pressure resisting qualities and said sleeve being composed of material selected for high wear resisting qualities, said anvil being substantially concentric with the upper portion of said sleeve, and a male die member having a diameter approximately the same as that of said anvil.

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