July 26, 1938. P. W. DEMPSEY 2,125,068

FORGING DIE

Filed Nov. 14, 1935 3 Sheets-Sheet 1

Fig. 1

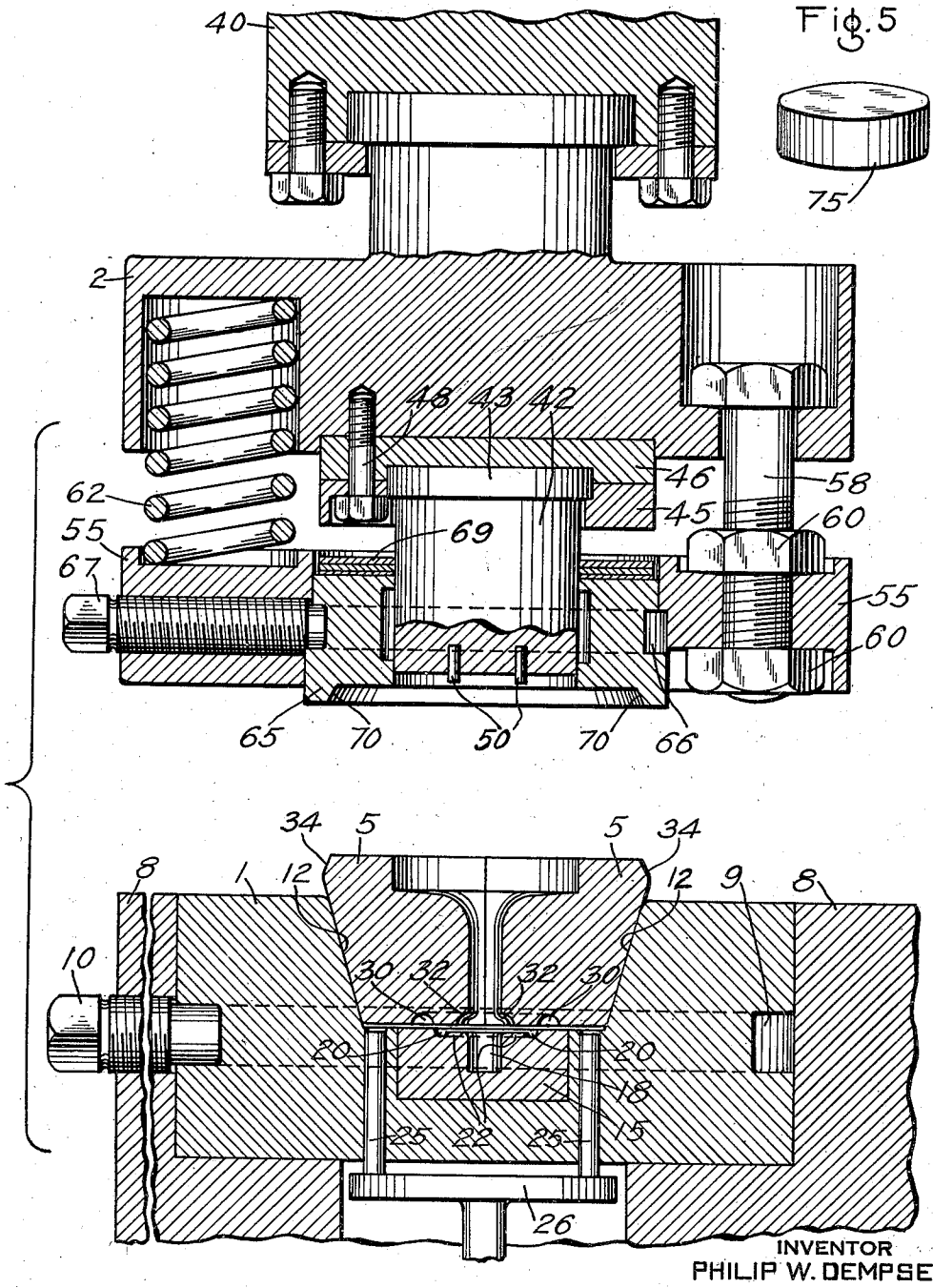


Fig. 5

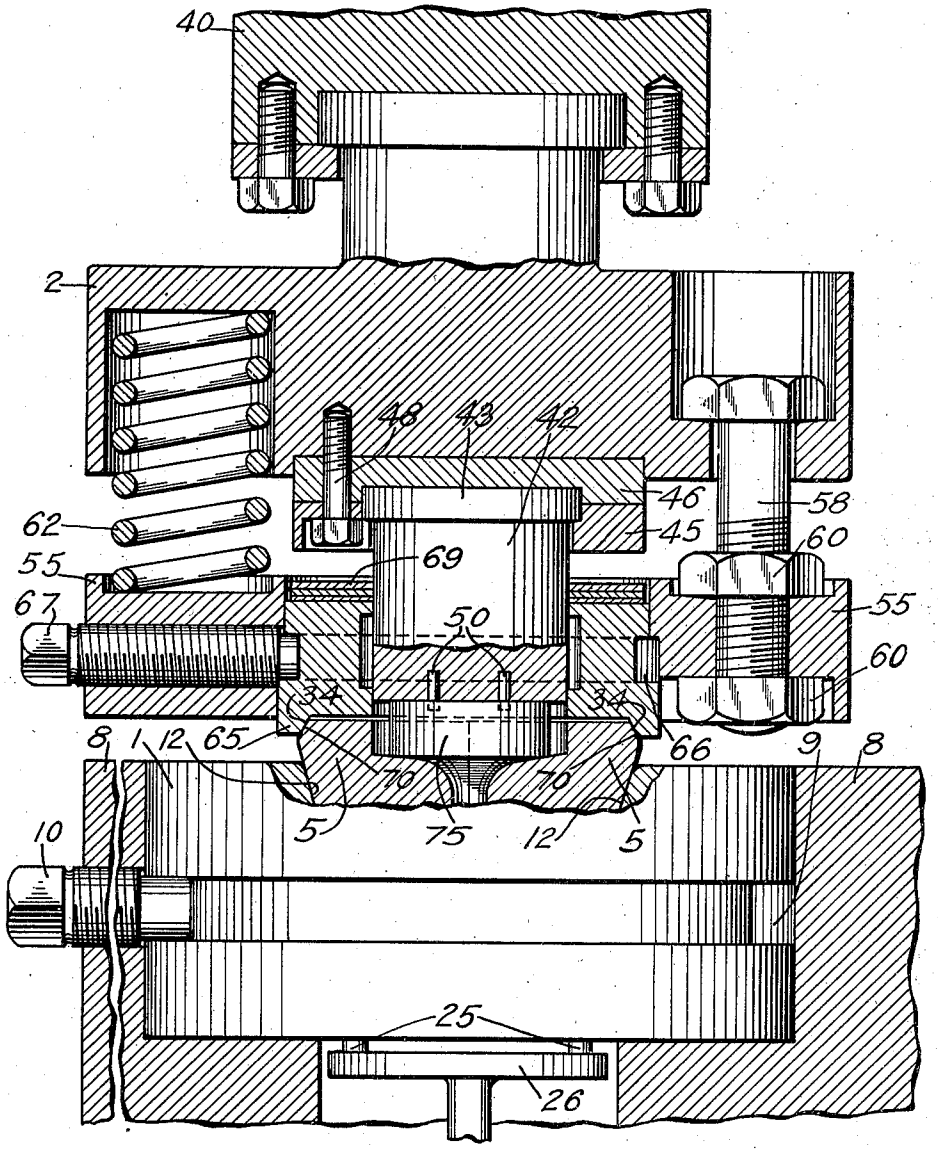
INVENTOR
PHILIP W. DEMPSEY
BY Wm. M. Cady
ATTORNEY

July 26, 1938. P. W. DEMPSEY 2,125,068

FORGING DIE

Filed Nov. 14, 1935 3 Sheets-Sheet 2

Fig. 2



INVENTOR
PHILIP W. DEMPSEY
BY Wm. M. Cady
ATTORNEY

July 26, 1938. P. W. DEMPSEY 2,125,068

FORGING DIE

Filed Nov. 14, 1935 3 Sheets-Sheet 3

Fig. 3

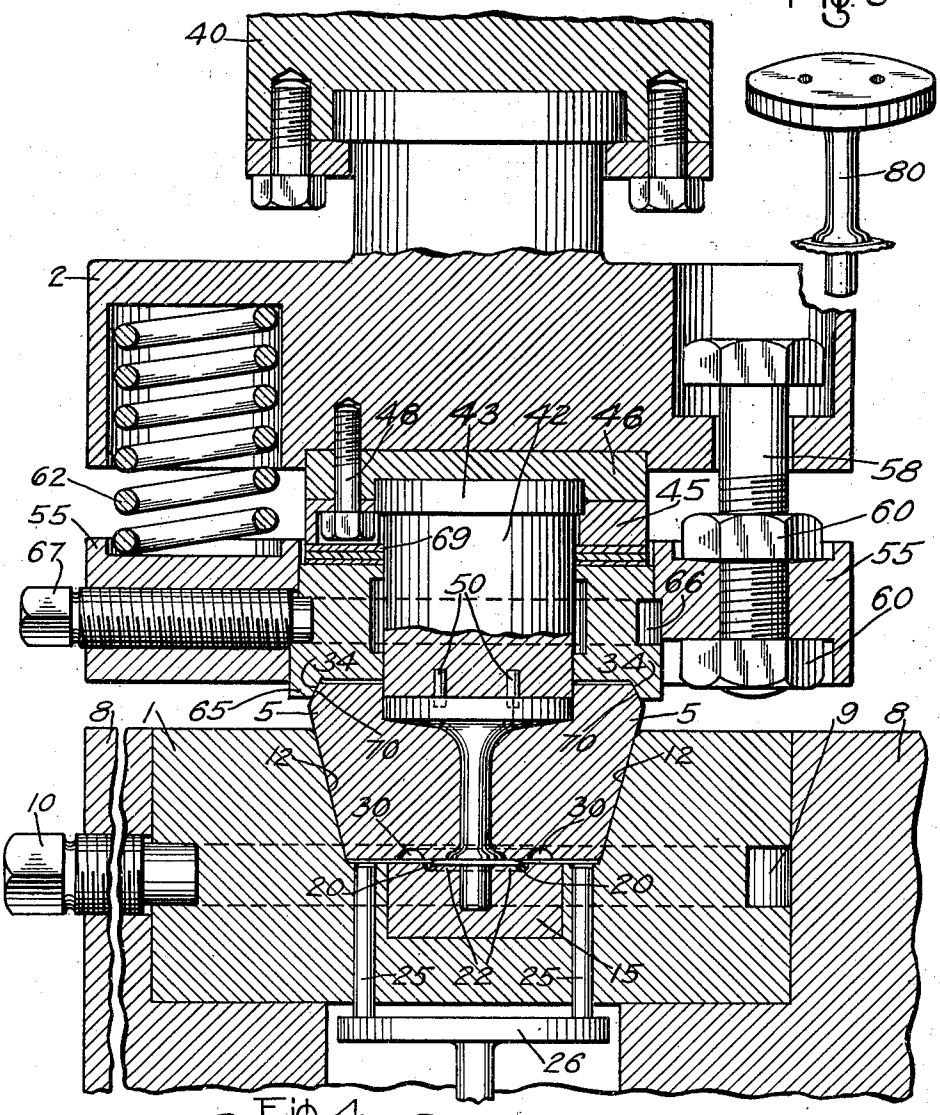
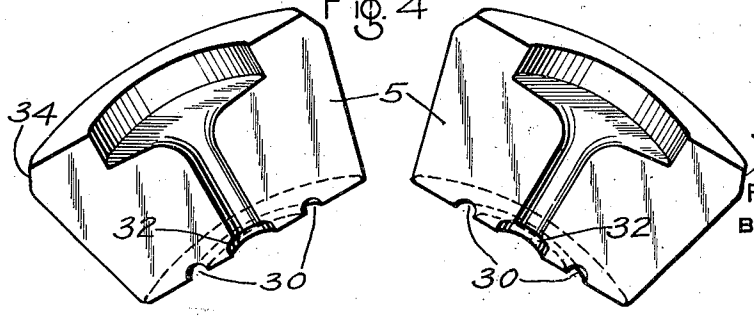


Fig. 6

Fig. 4



INVENTOR
PHILIP W. DEMPSEY
BY Wm. M. Cady
ATTORNEY

Patented July 26, 1938 2,125,068

UNITED STATES PATENT OFFICE

2,125,068

FORGING DIE

Philip W. Dempsey, Pittsburgh, Pa., assignor to The Westinghouse Air Brake Company, Wilmerding, Pa., a corporation of Pennsylvania

Application November 14, 1935, Serial No. 49,724

12 Claims. (Cl. 78—60)

This invention relates to a die adapted to be used in forming a metallic body from a work blank of substantially different shape than the completed body.

This invention relates particularly to a die adapted to be used to form a body comprising a piston of relatively large diameter and a stem of relatively small diameter and of substantial length, the stem having formed thereon at a point intermediate the piston and the end of the stem a flange of larger diameter than the body of the stem.

It is the principal object of this invention to provide a die of the type described which will produce an article of the character described in a single operation from a work blank which is easily prepared from standard sizes and shapes of material.

A further object of the invention is to provide a die which will produce an article of the type described, which is accurate in size and which possesses a satisfactory finish so that a minimum of machining is required to complete the article.

Another object of the invention is to provide a die of the type described which is of simple and rugged construction, and which incorporates means to automatically insure that the several parts of the die are in the proper relationship to each other during use.

A further object of the invention is to provide a die of the type described and in which the force employed to displace the material of the work blank also operates to force the die sections together and oppose separation of the die sections by the flow of material under pressure into the cavities between the die sections.

Another object of the invention is to provide a die of the type described having relatively movable members and incorporating means by which the amount of movement of said members relative to each other may be adjustably varied, whereby the size of portions of the article formed by the dies may be adjustably controlled.

Other objects of the invention and features of novelty will be apparent from the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a view, largely in section, of a die embodying my invention, the die being shown in the open position,

Fig. 2 is a view, largely in section, of the die shown in Fig. 1 after the head piece has moved part of the distance from the open position towards the closed position,

Fig. 3 is a view similar to Fig. 2 showing the die with the head piece moved the entire distance towards the closed position,

Fig. 4 is a perspective view of the die sections employed in the die shown in Figs. 1 to 3,

Fig. 5 is a perspective view of the work blank which is employed with the die provided by this invention, and

Fig. 6 is a perspective view of an article formed by the die provided by this invention.

Referring to the drawings, the die provided by this invention comprises a base member, indicated generally by the reference numeral 1, a head piece indicated generally by the reference numeral 2, and die sections indicated by the reference numerals 5.

The base member 1 may be of any suitable construction and, as shown, comprises a relatively thick, substantially cylindrical body of suitable material adapted to closely fit in a cylindrical recess in the bed plate 8 of a suitable forging machine, and is provided with an annular groove 9 into which extend the ends of the lock screws 10, one of which is shown in the drawings, which are spaced apart around the base member 1 and serve to maintain the base member in position in the recess in the bed plate.

The base member 1 has formed in the upper face thereof a tapered or frusto-conical recess 12 having its end of larger diameter opening on the top face of the base member. The lower or smaller end of this recess is closed by the body of the base member which forms a wall extending across the recess and which, as shown, is provided with a substantially cylindrical recess located centrally of the conical recess 12 in which is mounted an insert 15, which may be constructed of a suitable material such as tool steel.

The insert 15 has formed in the exposed face thereof a substantially cylindrical cavity 18, and an annular groove 20, which is substantially concentric relative to the cavity 18, while the portion of the face of the insert between the cavity 18 and the groove 20, and indicated at 22, is cut away a small distance below the face of the portion of the insert outwardly of the groove 20, which portion of the face of the insert is preferably located in substantially the same plane as the portion of the base member outwardly thereof.

The base member 1 has holes extending through the wall which extends across the bottom of the recess 12, and these holes are adapted to receive the knock out pins 25 which are secured to a member 26 associated with the forging machine. The pins 25 are of such length that the upper

ends thereof are located slightly below the lower end of the recess 12 when the member 26 is in the position in which it is shown in the drawings, and so that on movement of the member 26 towards the base member 1 the ends of the pins will project into the recess 12 a short distance.

The die sections 5 are of substantially identical construction, and have confronting faces in which are formed complementary cavities which are of the shape of a portion of the surface of the piece to be formed by the die.

The die sections 5, when placed together form a substantially frusto-conical or tapered body which is adapted to be received by the recess 12 in the base member 1, and are of such size that, when in position in the recess 12, the lower ends of the die sections are adjacent to the wall extending across the bottom of the recess 12, but are spaced therefrom a short distance.

The small ends of the die sections are provided with curved recesses which cooperate to form an annular groove 30 which is located radially outwardly of the groove 20 in the insert 15 when the die sections are in position in the recess 12.

The cavities in the confronting faces of the die sections 5 extend to and open on the small ends of the die sections and are enlarged somewhat, as indicated at 32, adjacent the juncture of the cavities with the faces of the small ends of the die sections and these portions of the cavities in the die sections cooperate with the insert 15 to provide a cavity portion of somewhat larger cross-sectional area than the portions of the cavities between the die sections, and the periphery of this cavity portion communicates, through a restricted passage formed between the bottom of the die sections and the surface 22 of the insert 15, with the chamber formed by the groove 20 and the die sections.

As is clearly shown in the drawings, the recess 18 in the insert is open to the cavities between the die section 5, when the die sections are in position in the recess 12.

The cavities between the die sections 5 also open upon the upper or larger faces of the die sections, and these portions of the cavities cooperate to form a substantially cylindrical recess of relatively large diameter which is adapted to receive a work blank.

The upper margin of each of the die sections 5 is chamfered or bevelled as indicated at 34, so as to form a tapered or conical surface substantially concentric relative to the tapered or conical lower portion of the die sections, and also substantially concentric relative to the substantially cylindrical work blank receiving recess in the large end of the die sections.

The head piece 2 comprises a body which is adapted to be detachably secured to a reciprocating member 40 of the forging machine, while the head piece carries a substantially cylindrical plunger 42, which has a flange 43 formed on an end thereof and adapted to be received by recesses in the plates 45 and 46, which are secured to the head piece by means of cap screws 48, one of which is shown in the drawings.

The plunger 42 is of substantially the same diameter as the work blank receiving recess in the die sections 5, and is adapted to extend into this recess, as will hereinafter more fully appear. The lower face of the plunger 42 has spaced openings formed therein in which are fittted pins 50 which project from the face of the plunger a short distance.

The head piece 2 has associated therewith means for guiding the plunger and for closing the die sections, and this means comprises a movable member 55, which is attached to the head piece 2 by means of a plurality of bolts 58, one of which is shown, and which are spaced apart circumferentially around the plunger 42. The bolts 58 are rigidly but adjustably secured to the member 55 by means of nuts 60, while the bolts 58 are movable relative to the head piece 2, the extent of movement of the member 55 away from the head piece 2 being limited by engagement of the heads of the bolts 58 with the head piece.

The member 55 is yieldingly urged away from the head piece 2 by coiled springs 62, one of which is shown, and which are spaced apart circumferentially around the plunger 42. The springs 62 extend between the head piece 2 and the member 55, and the ends of the springs extend into recesses formed in the faces of the head piece and the member 55.

The member 55 is provided with a central bore in which is fitted a member 65, which has a substantially annular recess 66 formed in the periphery thereof, into which extend the ends of lock screws 67 associated with the member 55 to secure the member 65 in the bore in the member 55. A plurality of lock screws 67 are provided, and one of these is shown in the drawings.

The member 65 is provided with a central bore through which extends the plunger 42 which closely fits the opening in the member 65 so as to be guided thereby, while a plurality of shims 69 which, as shown, are annular rings of sheet metal, are mounted on the plunger 42 between the member 65 and the plate 45 so as to be engaged by the plate 45 to limit movement of the head piece 2 and the member 65 towards each other.

The member 65 is provided with a recess in the lower face thereof and this recess is surrounded by a tapered or conical wall or surface 70 which is complementary to the tapered or conical surface 34 surrounding the upper or exposed face of the die sections 5.

In operation, the forging machine is actuated so as to move the head piece 2 to the upper position, as shown in Fig. 1 of the drawings, and to move the member 26 to the lower position, in which the pins 25 do not extend into the recess in the base member.

The cavities in the die sections 5 are coated with a light application of a suitable lubricant, such as grease, and the die sections 5 are placed in the conical die receiving recess 12 in the base member 1, so as to be substantially in the position shown in Fig. 1 of the drawings.

A work blank 75 is provided and it may be of the type shown in Fig. 5 of the drawings, which is a short length of metallic rod or bar of a diameter and length such that the volume of the material in the blank is slightly greater than the volume of material in the completed article. The blank is heated to a predetermined temperature to soften the material of the work blank, and the work blank is placed in the work blank receiving recess in the top of the die sections 5 while in the heated conditions, and the forging machine is thereupon operated to cause the movable member 40 thereof to move the head piece 2 towards the bed plate 8.

After a certain amount of movement of the head piece 2 towards the bed plate 8 the conical surface 70 on the member 65 engages the tapered or conical surface 34 on the upper margin of the die sections 5, so that upon further movement of

the head piece 2 towards the bed plate 8, the springs 62 are compressed and the member 65 is forced against the die sections 5, thereby firmly pressing the die sections 5 into the die receiving recess 12 in the base member 1 and causing the die sections 5 to be forced towards each other.

At the same time the conical surface 70 on the member 65 operating on the tapered or conical surface 34 on the die sections 5 forces the upper portion of the die sections towards each other, while engagement of the surface 70 on the member 65 with the surface 34 on the die sections 5 insures that the die sections 5 will each be forced into the die receiving recess 12 the same distance. This insures that the die sections 5 will be correctly positioned relative to each other, while the engagement of the surface 34 on the die sections with the surface 70 on the member 65 accurately locates the member 65 relative to the die sections and to the work blank receiving cavity therein.

On further movement of the head piece 2 towards the plate 8 the springs 62 are further compressed and the plunger 42 is moved downwardly relative to the member 65 and engages the work blank. The pins 50 are pressed into the work blank and form blind holes in the face of the completed work piece, and upon further movement of the plunger 42, the work blank is deformed because of the pressure exerted thereon and the material of the work blank spreads out so as to fill the portion of the work blank receiving recess below the plunger 42 and it flows down through the cavities between the die sections and into the recess 18 in the insert 15, and on further movement of the plunger towards the die sections, the metal flowing through the cavities between the die sections is forced outwardly to fill the enlarged cavity portion 32 at the bottom of the die sections.

If there is an excess of material in the work blank some material will be forced out from the periphery of the enlarged cavity portion 32 through the restricted passage formed between the surface 22 on the insert 15 and the bottom of the die sections 5.

The material from the work blank will be forced into the cavities between the die sections at a relatively rapid rate because of the relatively rapid movement of the plunger 42, while the flow of material from these cavities through the passage connecting the enlarged portion 32 and the chamber formed by the groove 20 is restricted because of the limited capacity of this passage. A high pressure therefore will be developed in the material in the cavities between the die sections, thereby insuring that the material of the completed article will be closely compacted and will be free of gas pockets or bubbles, and will possess great strength.

As is clearly shown in Fig. 3 of the drawings, the plunger 42 accurately fits the work blank receiving recess in the upper face of the die sections 5 and prevents the flow of material from the cavity in the die sections around the plunger.

The plunger 42 is guided in its downward movement by the member 65, which is held in a predetermined relationship to the die sections 5 by the interengaging surfaces 34 and 70 on the die sections and the member 65 respectively, and the plunger therefore, will always be accurately aligned with the work blank receiving recess in the open face of the die sections.

After a predetermined amount of movement of the head piece 2 relative to the member 65 the plate 45 will engage the shims 69 which are mounted on the plunger 42, thus preventing further movement of the plunger relative to the member 65 and relative to the die sections 5. This determines the thickness of the piston portion of the completed article, and if desired the thickness of this portion may be varied by changing the number or the thickness of these shims.

The forging machine is provided with yielding means, not shown, which absorbs any movement of the driving means which occurs subsequent to engagement of the plate 45 with the shims 69.

When the material of the work blank is forced into the cavities between the die sections 5 the air which is present in these cavities is forced into the chamber formed by the annular groove 30 in the lower face of the die sections 5 and into the areas adjacent thereto and is held under pressure, while a portion of the lubricant applied to the faces of the cavities between the die sections is changed to a gas by contact of the hot material therewith and this gas is also forced into this chamber and is held under pressure.

On further operation of the forging machine the head piece is moved away from the bed plate 8. On initial movement of the head piece 2 away from the bed plate 8, the member 65 is held in engagement with the die sections 5 by the springs 62, while the plunger 42 is lifted away from the die sections 5. Upon further upward movement of the head piece 2 the heads of the bolts 58 engage the head piece and thereafter movement of the head 2 causes the member 55 and the member 65 to be lifted away from the die sections 5.

On the release of pressure from the top of the die sections 5 the air and gas which are collected in the chamber formed by the groove 30 on the lower face of the die sections 5 lifts the die sections a short distance and thereby loosens them in the tapered recess 12 thus permitting the fluid under pressure to escape. On the escape of this fluid the die sections may drop back into the die receiving recess and they may then be raised by lifting the member 26, thus causing the knockout pins 25 to engage and lift the die sections 5 a short distance.

The operator may then remove the die sections 5 from the die receiving recess by means of a suitable pair of tongs which may engage the portions of the die sections below the conical surface 34. When the die sections 5 are removed the finished work piece 80, which is shown in Fig. 6 of the drawings, is removed from the cavities between the die sections, and these are then given another application of lubricant and are replaced in the die receiving recess 12 and the process is repeated.

It has been found that the work blank will be cooled sufficiently to be rigid enough to maintain its shape on removal from the die sections 5.

It has also been found that the work piece formed by means of the dies provided by this invention is accurate in size and has a satisfactory finish, and is of uniform close grained texture throughout so as to possess great strength and require a minimum of machining operations to complete the article.

It will be seen that the die provided by this invention is of simple and rugged construction and incorporates means which operates automatically to maintain the parts of the die in the proper relationship to each other during the formation of an article by the die and that the

die operates in such a manner as to force the die sections together and to oppose their separation by the material which flows between them.

While one embodiment of the die provided by this invention has been illustrated and described in detail, it should be understood that the invention is not limited to these details of construction and that numerous changes and modifications may be made without departing from the scope of the following claims.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a device of the class described, in combination, a base member having a die receiving recess therein, said die receiving recess being substantially frusto-conical in shape and having its end of larger diameter opening on a face of the said base member, a die comprising complementary sections having a substantially frusto-conical exterior and having cooperating blank forming cavities in the confronting faces thereof, said die being adapted to be removably received by the recess in the base member, and having a recess in the exposed face thereof communicating with the blank forming cavities in said die sections, said recess being adapted to receive a work blank, the exposed portion of the die having a curved tapered surface formed thereon, said surface decreasing in diameter away from said base portion, and a head piece having a member associated therewith and adapted to yieldingly engage said curved tapered surface on movement of the head piece towards the die, the head piece also having a plunger associated therewith and adapted to extend into the blank receiving recess in the die.

2. In a device of the class described, in combination, a base member having a die receiving recess therein, said die receiving recess being substantially frusto-conical in shape and having its end of larger diameter opening on a face of the said base member, a die comprising complementary sections having a substantially frusto-conical exterior and having cooperating blank forming cavities in the confronting faces thereof, said die being adapted to be removably received by the recess in the base member and having a recess in the exposed face thereof communicating with the blank forming cavities in said die sections, said recess being adapted to receive a work blank, the exposed portion of the die having a curved tapered surface formed thereon, said surface decreasing in diameter away from said base portion, a head piece having a movable member associated therewith and adapted to yieldingly engage said tapered surface on movement of the head piece towards the die, the head piece also having a plunger associated therewith and substantially rigid relative thereto, said plunger being adapted to extend into the work blank receiving recess in the die, and means to adjustably vary the range of movement of the head piece relative to said movable member whereby the range of movement of the plunger relative to said die may be adjustably varied.

3. In a device of the class described, in combination, a base member having a die receiving recess therein, said die receiving recess being substantially frusto-conical in shape and having its end of larger diameter opening on a face of the said base member, a die comprising complementary sections having a substantially frusto-conical exterior and having cooperating blank forming cavities in the confronting faces thereof, said die being adapted to be removably received by the recess in the base member and having a recess in the exposed face thereof communicating with the blank forming cavities in said die sections, said recess being adapted to receive a work blank, the exposed portion of the die having a curved tapered surface formed thereon, said surface decreasing in diameter away from said base portion, a head piece having a movable member associated therewith and adapted to yieldingly engage said tapered surface on movement of the head piece towards the die, the head piece also having a plunger associated therewith and adapted to extend into the blank receiving recess in the die, and means to limit movement of the said movable member away from said head piece.

4. In a device of the class described, in combination, a base member having a die receiving recess therein, said die receiving recess being substantially frusto-conical in shape and having its end of larger diameter opening on a face of the said base member, a die comprising complementary sections having a substantially frusto-conical exterior and having cooperating blank forming cavities in the confronting faces thereof, said die being adapted to be removably received by the recess in the base member, and having a recess in the exposed face thereof communicating with the blank forming cavity in said die sections, said recess being adapted to receive a work blank, the exposed portion of the die having a curved tapered surface formed thereon, said surface decreasing in diameter away from said base portion, a head piece having a movable member associated therewith and adapted to yieldingly engage said tapered surface on movement of the head piece towards the die, the head piece also having a plunger associated therewith and substantially rigid relative thereto, said plunger being adapted to extend into the blank receiving recess in the die, means to adjustably vary the range of movement of the head piece towards said movable member whereby the range of movement of the plunger towards said die may be adjustably varied, and means to limit movement of the said movable member away from said head piece.

5. In a device of the class described, in combination, a base member having a die receiving recess therein, said die receiving recess being substantially frusto-conical in shape and having its end of larger diameter opening on a face of the base member, the end of the recess of smaller diameter being closed by the said base member, a die comprising complementary sections having a substantially frusto-conical exterior and having cooperating blank forming cavities in confronting faces thereof, said die being adapted to be removably received by the recess in the base member and having a recess in the exposed face thereof communicating with the cavities in said die sections, said recess being adapted to receive a work blank, the face of the end of the die of smaller diameter and the wall of the base member closing the small end of the die receiving recess cooperating to form a cavity communicating with the cavities between the die sections, said cavity being of larger cross-sectional area than portions of the cavities between the die sections, the face of the end of the die and the wall of the base member also cooperating to form a chamber which communicates with the periphery of the cavity between the die and the base member through a passage of restricted flow capacity, said chamber being adapted to re-

ceive material from the work blank in excess of that required to fill the cavity between the die sections.

6. In a device of the class described, in combination, a base member having a die receiving recess therein, said die receiving recess being substantially frusto-conical in shape and having its end of larger diameter opening on a face of the said base member, a die comprising complementary sections having a substantially frusto-conical exterior and having cooperating blank forming cavities in the confronting faces thereof, said die being adapted to be removably received by the recess in the base member and having a recess in the exposed face thereof communicating with the blank forming cavities in said die sections, said recess being adapted to receive a work blank, the exposed portion of the die having a substantially annular conical surface formed thereon, said conical surface decreasing in diameter away from the base member, a head piece having a movable member associated therewith and movable relative thereto, said movable member having a substantially conical surface formed thereon complementary to the conical surface on the die and adapted to engage the surface on the die on movement of the head piece towards the die, and a plunger associated with said head piece and adapted to extend into the work blank receiving recess in the die.

7. In a device of the class described, in combination, a base member having a die receiving recess therein, said die receiving recess being substantially frusto-conical in shape and having its end of larger diameter opening on a face of the said base member, a die comprising complementary sections having a substantially frusto-conical exterior and having cooperating blank forming cavities in the confronting faces thereof, said die being adapted to be removably received by the recess in the base member and having a recess in the exposed face thereof communicating with the blank forming cavities in said die sections, said recess being adapted to receive a work blank, the exposed portion of the die having a substantially annular conical surface formed thereon, said conical surface decreasing in diameter away from the base member, a head piece having a guide member associated therewith and movable relative thereto, said guide member having a substantially conical surface formed thereon complementary to the conical surface on the die and adapted to engage the face of the die on movement of the head piece towards the die, and a plunger associated with said head piece and adapted to extend into the work blank receiving recess in the die, said plunger being guided by the guide member associated with the head piece.

8. In a device of the class described, in combination, a base member having a die receiving recess therein, said die receiving recess being substantially frusto-conical in shape and having its end of larger diameter opening on a face of the said base member, a die comprising complementary sections having a substantially frusto-conical exterior and having cooperating blank forming cavities in the confronting faces thereof, said die being adapted to be removably received by the recess in the base member, and having a recess in the exposed face thereof communicating with the blank forming cavities in said die sections, said recess being adapted to receive a work blank, the exposed portion of the die having a substantially annular conical surface formed thereon, said conical surface decreasing in diameter away from the base member, a head piece having a guide member associated therewith and movable relative thereto, said guide member having a substantially conical surface formed thereon complementary to the conical surface on the die and adapted to engage the surface on the die on movement of the head piece towards the die, a plunger associated with said head piece and adapted to extend into the work blank receiving recess in the die, said plunger being guided by the guide member associated with the head piece, and means associated with said plunger for limiting movement of the plunger relative to the said guide member in the direction of the die.

9. In a device of the class described, in combination, a base member having a die receiving recess therein, said die receiving recess being substantially frusto-conical in shape and having its end of larger diameter opening on a face of the said base member, a die comprising complementary sections having a substantially frusto-conical exterior and having cooperating blank forming cavities in the confronting faces thereof, said die being adapted to be removably received by the recess in the base member and having a recess in the exposed face thereof communicating with the blank forming cavities in said die sections, said recess being adapted to receive a work blank, the exposed portion of the die having a substantially annular conical surface formed thereon, said conical surface decreasing in diameter away from the base member, a head piece having a guide member associated therewith and movable relative thereto, said guide member having a substantially conical surface formed thereon complementary to the conical surface on the die and adapted to engage the surface on the die on movement of the head piece towards the die, a plunger associated with said head piece and adapted to extend into the work blank receiving recess in the die, said plunger being guided by the guide member associated with the head piece, and means associated with said head piece for limiting movement of the plunger relative to the said guide member in the direction of the die, said means comprising shims interposed between the head piece and the guide member.

10. In a device of the class described, in combination, a base member having a die receiving recess therein, said die receiving recess being substantially frusto-conical in shape and having its end of larger diameter opening on a face of the said base member, a die comprising complementary sections having a substantially frusto-conical exterior and having cooperating blank forming cavities in the confronting faces thereof, said die being adapted to be removably received by the recess in the base member, and having a recess in the exposed face thereof communicating with the blank forming cavities in said die sections, said recess being adapted to receive a work blank, the exposed portion of the die having a substantially annular conical surface formed thereon, said conical surface decreasing in diameter away from the base member, a head piece having a movable member associated therewith and having a substantially conical surface formed thereon complementary to the conical surface on the die and adapted to engage the conical surface on the die on movement of the head piece towards the die, means yieldingly opposing movement of the head piece relative to said movable member, and a plunger associated with said head piece and

adapted to extend into the blank receiving recess of the die on engagement of the movable member with the conical face on the die, and on movement of the head piece relative to said movable member.

11. In a die forging apparatus, in combination, a base member having a frusto-conical die receiving recess therein, a die mounted in said recess and comprising complementary sections having cooperating blank forming cavities in the confronting faces thereof and being provided with a frusto-conical exterior cooperating with the recess in the base member, said die also having an opposed frusto-conical face and having a work blank receiving recess in the exposed face thereof, a head movable toward the base member, a guide member carried by the head and movable relative thereto, the guide member having a frusto-conical face adapted to engage said opposed face on the die on movement of the head towards the die, and a plunger carried by said head and guided by the guide member, the plunger being adapted to extend into the recess in the exposed face of the die only after engagement of the guide member with said die and after movement of the head relative to the guide member.

12. In a die forging apparatus, in combination, a die forging device comprising a base member having therein a frusto-conical die receiving recess, a die mounted in said recess and comprising complementary sections having blank forming cavities in the confronting faces thereof and provided with faces forming a frusto-conical exterior cooperating with the recess in the base member, said die also having an opposed frusto-conical face and having in the exposed face thereof a blank receiving recess communicating with the blank forming cavities, a movable head member having means associated therewith and provided with a frusto-conical face adapted to engage said opposing face upon movement of said head and thus accurately position the head and the die relative to each other, and a plunger adapted to extend into said blank receiving recess to exert force on a work blank positioned in said recess, said plunger being carried by said movable head whereby said plunger is accurately positioned with respect to the blank receiving recess in said die.

PHILIP W. DEMPSEY.