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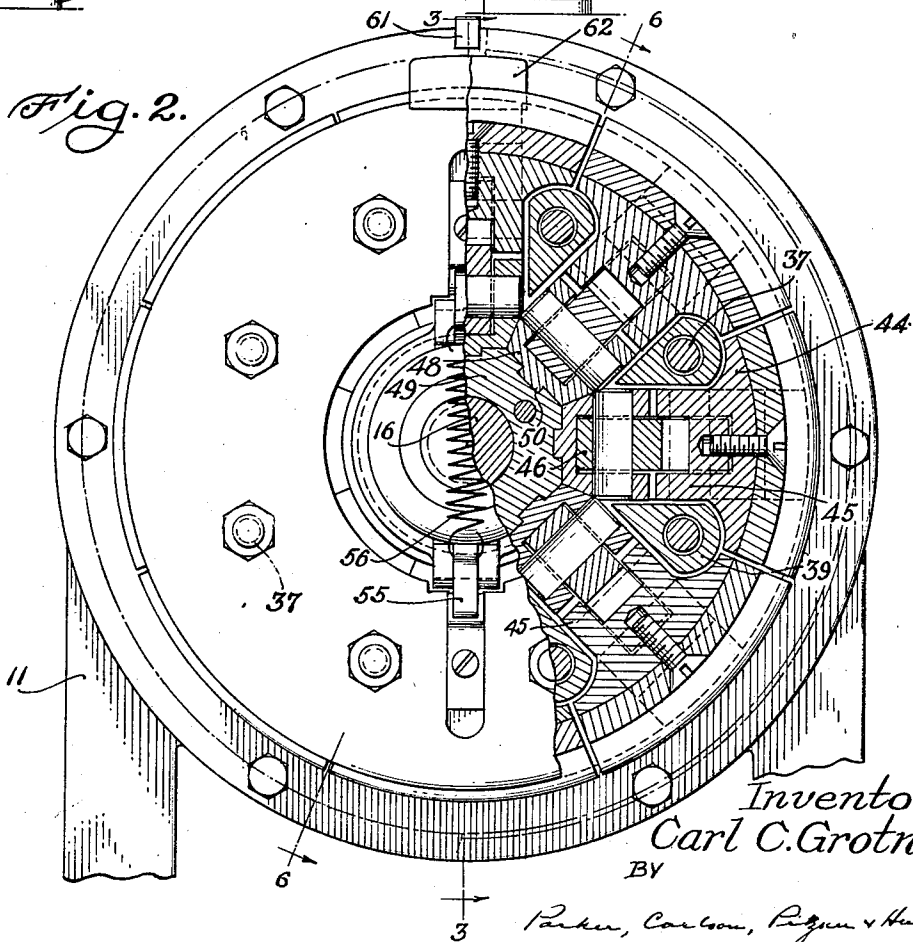
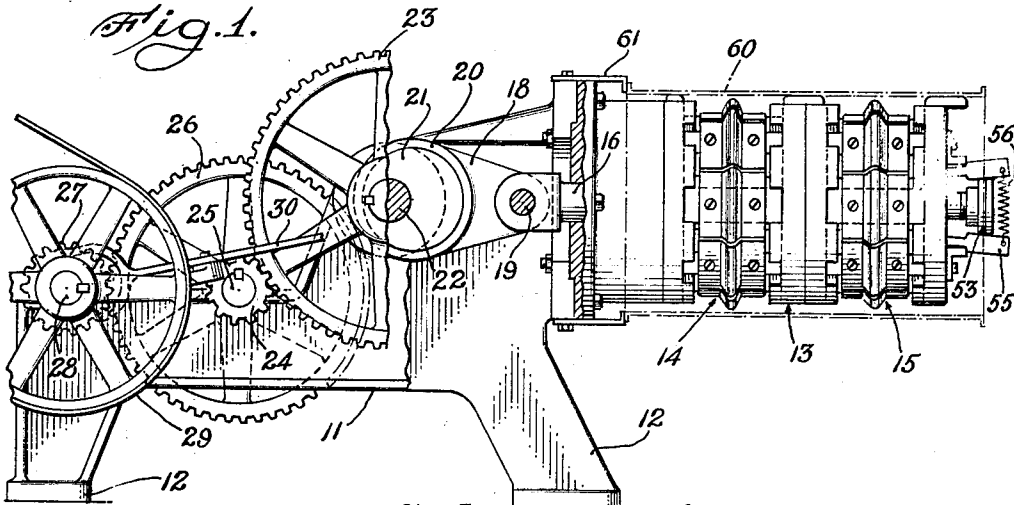
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2,089,476

METALWORKING MACHINE

Filed March 20, 1935

3 Sheets-Sheet 1



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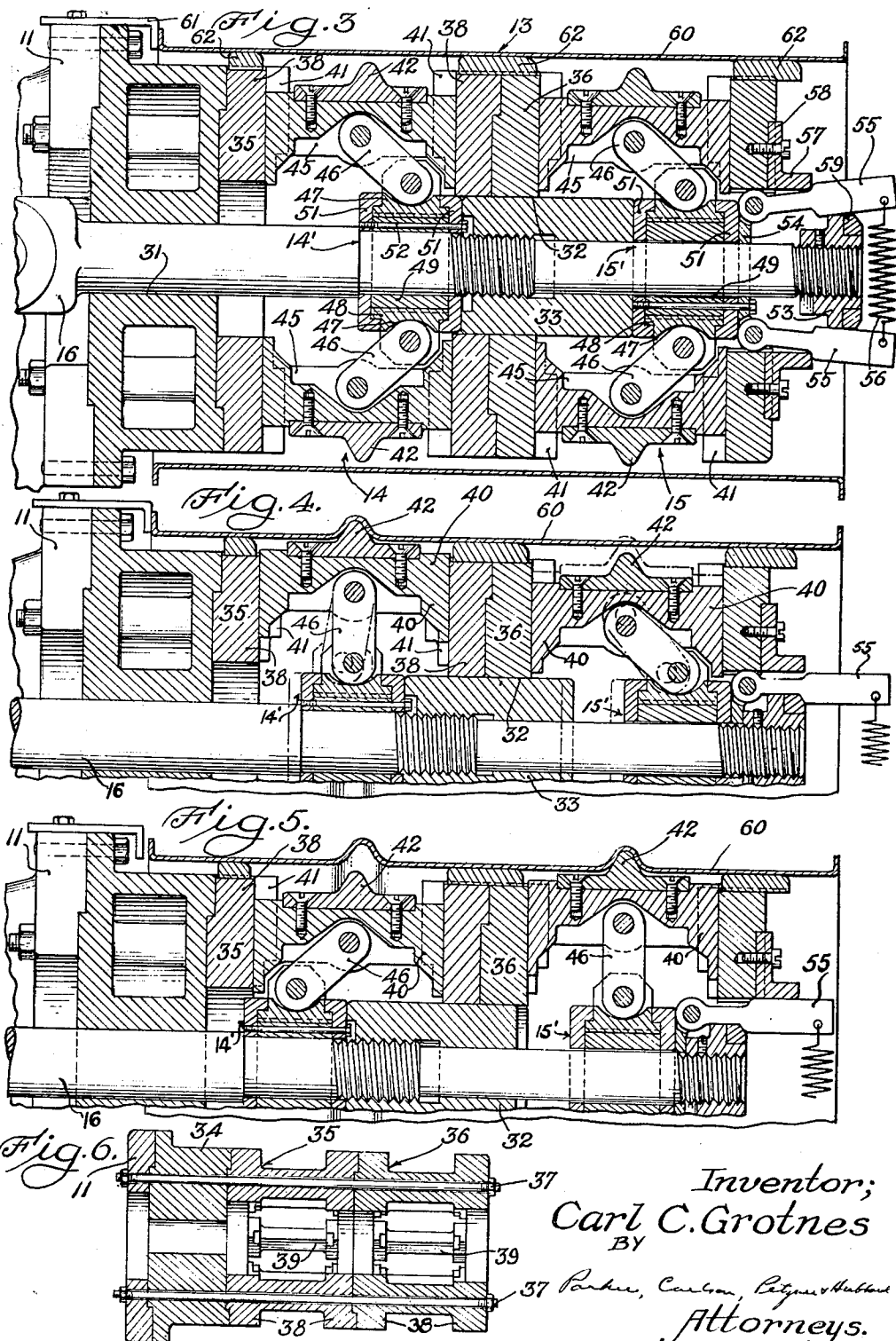
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METALWORKING MACHINE

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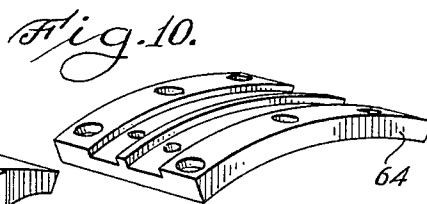
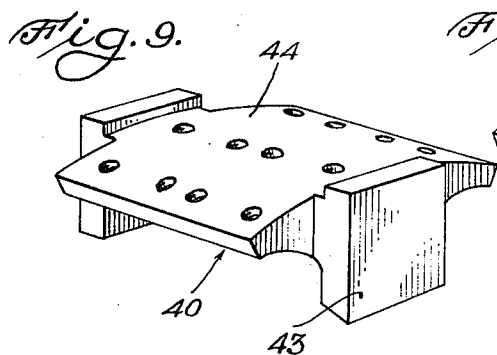
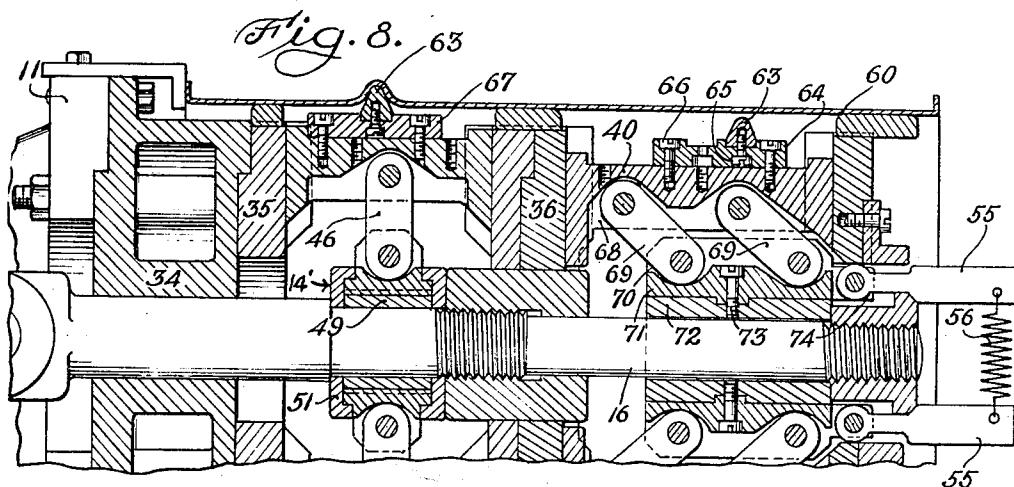
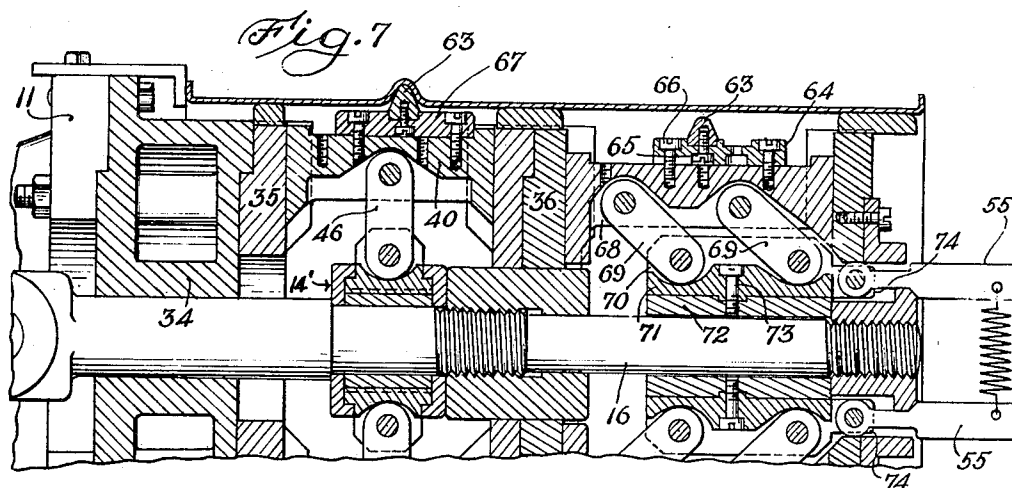
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METALWORKING MACHINE

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,089,476

METALWORKING MACHINE

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Application March 20, 1935, Serial No. 11,916

19 Claims. (Cl. 153—73)

The invention relates to bead forming machines and more particularly to machines for forming spaced beads in cylindrical metal bodies or shells.

5 The general object of the invention is to provide a machine of this character which is simpler in construction and requires a smaller number of parts and at the same time is more efficient in operation than machines of this general type as heretofore constructed.

10 A further object is to provide means of an advantageous character for actuating a pair of dies for forming beads in a cylindrical metal article whereby the dies may be mounted in fixed axially spaced relation and operated to form correspondingly spaced beads in the article successively so as to avoid undesired distortion or weakening of the metal.

15 An additional object is to provide for the operation of two dies successively by a single power driven operator.

20 Another object is to provide an improved machine for forming a plurality of spaced beads in a cylindrical shell in which the spacing between the beads can be readily varied.

25 A still further object is to provide an improved die expanding mechanism by means of which the force of an operating member may be applied uniformly to a die supporting member so as to avoid unnecessary strain on the various parts when the die is supported substantially away from the center of the supporting member and to thereby permit a variable positioning of the die relative to the work.

30 Other objects and advantages will become apparent from the following detailed description taken in connection with the accompanying drawings, in which:

35 Figure 1 is a side view of a machine embodying the features of the invention.

40 Fig. 2 is an end view, partly in section, of the die head of the machine.

Fig. 3 is a sectional view through the die head taken on the line 3—3 of Fig. 2 and showing the die operating mechanism in normal position.

45 Fig. 4 is a fragmentary sectional view taken along the same line as Fig. 3 and showing the die operating mechanism in intermediate position.

50 Fig. 5 is a fragmentary sectional view taken along the same line as Fig. 3 and showing the die operating mechanism in retracted position.

Fig. 6 is a sectional view through the die head taken along the line 6—6 of Fig. 2.

55 Fig. 7 is a fragmentary sectional view through

the die head showing a modification of the die operating mechanism.

Fig. 8 is a fragmentary sectional view similar to Fig. 7 showing the manner in which the dies may be adjusted for varying the spacing between 5 beads.

Fig. 9 is a perspective view of a die block arranged for adjustably supporting a bead forming die.

Fig. 10 is a perspective view of a die member 10 adapted for use with the jaw shown in Fig. 9.

While the invention is susceptible of various modifications and alternative constructions, I have shown and will herein describe in detail 15 a preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended 20 claims.

In the embodiment illustrated, I provide a suitable supporting structure such as a frame 11 (Fig. 1) supported on the floor by legs 12, and carrying on its forward end in projecting relation a single cylindrical head 13 over which a 25 cylindrical shell constituting the work may be supported. Embodied in this head in fixed longitudinally spaced relation are two annular bead-forming dies generally designated by the reference characters 14 and 15, respectively. 30

The two dies are advantageously operated successively by means including a single operating element. In attaining this result I employ in the preferred embodiment, a reciprocatory member 35 in the form of a drawbar 16, and die actuating means such that in each complete reciprocation of the drawbar a complete operating cycle of both dies is effected. To provide for proper timing of the die operations, I provide actuating 40 members 14' and 15' for the respective dies, one of which is secured to the drawbar in fixed relationship. The other actuating member is associated with the drawbar by means including a lost motion connection and a latch mechanism 45 such that the drawbar coacts with the member only during a predetermined range of the drawbar travel, thus effecting the operation of the dies successively. By this arrangement I avoid the virtual duplication of parts heretofore considered necessary in machines of this character and provide a machine which is simpler and less expensive to manufacture than prior machines.

Reciprocation of the drawbar 16 is effected through a suitable connection with a source of 55

power which, as shown, may comprise a short connecting rod 18 pivotally connected by means of a pin 19 to one end of the drawbar, and having a sleeve 20 mounted on a crank eccentric 21 fixed on a driven shaft 22. The shaft 22 is preferably journaled in the frame transversely of the longitudinal axis thereof, and in the present instance, is driven through a speed reducing gear train. The gear train, as shown, includes a spur gear 23 fast on the shaft 22 meshing with a pinion 24 fast on the shaft 25. A spur gear 26 also fast on shaft 25 meshes with a pinion 27 fast on a shaft 28. A belt driven pulley 29 loosely mounted on the shaft 28 may be connected in driving relation therewith by a clutch operated by a forked clutch throw-out lever 30. The shafts 24 and 28, like shaft 22, may be journaled in the frame transversely of the longitudinal axis thereof.

The drawbar 16 is preferably journaled for reciprocation in bearings formed coaxially in the head 13. One bearing 31 (Figs. 2 to 8) is formed in the end of the head adjacent the frame and is adapted to receive the enlarged shank of the drawbar. The other bearing 32 is formed intermediate the ends of the head and is adapted to receive a sleeve member 33 threaded onto the drawbar in spaced relation to the enlarged shank thereof.

The construction of the head which carries the bead forming means can be readily seen by reference to Figs. 2 to 6, inclusive. As shown, the head comprises cylindrical frame sections 34, 35, and 36 rigidly secured together and supported on the frame 11 by a plurality of tie rods 37. The frame sections 35 and 36 may be of generally similar construction and comprise two annular end plates 38 connected by a series of peripherally spaced members 39. Within the apertures defined by the members 39 and the end plates are two sets of radially movable dies. Each set of dies comprises, as shown, a circumferential series of supporting blocks 40 and die plates or segments 42, the blocks being guided for movement radially in the head by projections 41 formed on the inner faces of the end plates 38.

Each of the supporting blocks 40 is constructed to provide a pair of oppositely spaced, rectangular slide members 43 (Fig. 9) designed to slide between the projections 41 and to coact therewith to guide the blocks 40 in their radial movement. The slide members are connected by an arcuately formed intermediate section 44 which provides a support for the die segment 42. The edges of the arcuate section are preferably formed to project substantially beyond the sides of the slide members and thus overhang the spacing members 39 (Fig. 2) thereby presenting a substantially continuous cylindrical surface with the supporting blocks in normal or contracted position. In this position, the die segments 42, which are bolted or otherwise removably secured to the arcuate sections of the supporting blocks define an annular, bead-shaped ridge of substantially smaller diameter than the cylindrical shell or work piece in which the bead is to be formed.

In order to form the bead, the dies are expanded, that is the supporting blocks and die segments are shifted outwardly from the axis of the head until the annular bead forming ridge is of substantially greater diameter than the cylindrical work piece. In the present instance, positive operation of the dies to and from expanded position is effected by toggle connections between the respective supporting blocks 40 and

the drawbar 16. Each block 40 is provided on its inner side with two longitudinally disposed spaced ribs 45 (Figs. 2 and 3) between which is pivotally secured one end of a toggle link 46. The other end of the link 46 is pivotally mounted between two projecting ears 47 formed on a plate 48. The various plates 48 are supported on the respective peripheral facets of a sleeve member 49 carried by the drawbar 16. To prevent edgewise movement of the plates relative to the facets the plates are splined to the sleeve by means of longitudinally disposed ribs 50 which enter into registering keyways formed in the sleeve. The plates 48 and sleeve 49, which comprise the die actuating members, are assembled as a unit and are rigidly held together by cup-shaped members 51, the flanges of which overlie opposite ends of the plates. The clamping action of the cup members is maintained by bolts 52 which project through the members and the sleeve 49.

In order that the drawbar may actuate the dies through the medium of the toggle links incident to its reciprocation, means for preventing or limiting relative movement of the actuating members longitudinally of the drawbar are provided. In the case of the actuating member 14' which is disposed in the frame section 35 for the operation of die 14, movement of the unit is entirely prevented by clamping the same between the shoulder of the enlarged shank of the drawbar and the sleeve member 33. The member accordingly, moves through a distance equal to the travel of the drawbar, in this instance, from the normal forward position as shown in Fig. 3 to the rearward retracted position shown in Fig. 5. In traveling between these positions, the member passes through the intermediate position shown in Fig. 4 at which the die 14 is expanded to its maximum limit.

The nature of the bead forming operation is such that it is preferable to form only one bead at a time in the work piece. This is to permit the work to contract or shift endwise as the metal flows into the bead and avoids stretching the metal and thereby weakening the structure. To the end that the beads may be formed successively in a single operation of the machine, the operating mechanism for the die 15, which is associated with the frame section 36, is arranged to start its expansion simultaneously with the die 14 reaching its limit of expansion. Accordingly, the die 15 remains inactive until the die 14 completes its forming operation. As the first mentioned die contracts, the latter die expands until it also completes its bead forming operation. To provide for this successive operation, the die actuating member 15' in the frame section 36 is associated with the drawbar by a lost motion connection. This connection may be provided by loosely mounting the sleeve 49 on the drawbar 16 so that it is free to move relative thereto within the limits defined by the sleeve 33 and the shoulder of a nut 53 threaded on the end of the drawbar 16. The nut is positioned on the drawbar so that in the initial movement thereof, a plate 54, secured to the face of the unit, is engaged by the nut at the instant that the die 14 completes its forming operation as shown in Fig. 4. Continued movement of the drawbar effects the expansion of the die 15 while die 14 is contracted simultaneously therewith. Die 15 is expanded to the limit and die 14 is completely contracted when the drawbar reaches its rearmost position as shown in Fig. 5.

To return the dies to normal position, the draw-

bar moves forward to the position shown in Fig. 3 at which position the operating cycle is completed. During this forward movement, the die 15 must be contracted to enable the work piece to shift endwise so that the die 15 may expand into the previously formed bead without deforming the work piece. In order that the die 15 may be operative at the start of the forward movement of the drawbar, connection therewith during such forward movement may be provided by a latch mechanism prepared for operation during the rearward movement of the drawbar. The latch mechanism comprises, in the present instance, a pair of latch members 55 pivotally mounted on opposite sides of the plate 54. The latch members are preferably constructed in the form of spatulate bars having projecting cam faces on opposite sides terminating in inclined shoulders intermediate the ends of the members. The inner cam faces of the bars are adapted to ride over the sides of the nut 53 which cams the members apart against the tension of a spring 56 connecting between the outer ends of the members. When cammed apart in this manner, the shoulders of the outer cam faces abut against the projecting flange 57 of an annular member 58 carried on the end of the head 13 and tend to hold the actuating member 15' of the die 15 stationary during the initial portion of the drawbar movement. When the drawbar moves back sufficiently to bring the nut 53 into engagement with the plate 54, the outer edge of the nut will pass beyond the cam shoulders and lie adjacent the restricted sections of the latch members which are therewith pulled or retracted into the position shown in Fig. 4 by the spring 56. Continued movement of the drawbar shifts the die actuating member rearwardly and thus draws the retracted latch bars into the cylindrical chamber formed by the member 58 and its flange 57. In the rearmost position of the drawbar, the latch members will be in the position shown in Fig. 5.

On the return movement of the drawbar, the inwardly facing shoulders of the latch members 55 engage a ring 59, preferably of hardened steel, carried on the outer end of the nut 53. The outer cam faces of the latch members bear against the walls of the chamber formed by the member 58 and its flange 57 which prevents these members from being forced apart. The die actuating member is thus latched securely to the drawbar. The member, accordingly, moves forward with the drawbar until the die 15 is completely contracted, at which time the cam faces of the latch members will pass beyond the edge of the flange 57. Continued movement of the drawbar wedges the latching members apart so that the die 15 is inoperative during the drawbar movement to contract the die 14.

In operating the machine, a cylindrical work piece 60, for example, a steel shell such as is commonly employed in the construction of oil drums and the like, is slipped over the forward end of the die head 13 and pushed back until it engages a stop member 61 carried by the frame of the machine. It will be appreciated that the provision of a single die head particularly facilitates this operation as ample space can readily be provided to permit convenient manipulation of the shell. The shell is supported and substantially centered on the head by the spacing pads 62 disposed at spaced intervals along the upper surface of the head. The shell will then rest in the position shown in Fig. 3 of the drawings.

After a shell has been placed on the die head

as above described, an operating cycle of the machine is initiated by actuating the clutch lever 30 which completes a driving connection between the driven pulley 29 and the crank shaft 22 effective to rotate the crank shaft through a complete revolution. The drawbar 16 is thereby reciprocated to expand the dies 14 and 15 successively. During the initial rearward movement of the drawbar, the die 14 is gradually expanded, forming a bead in the shell 60 which is completed when the drawbar reaches the position shown in Fig. 4. Further rearward movement of the drawbar contracts die 14 and expands die 15 which completes the formation of the second bead when the drawbar reaches its rearmost position as shown in Fig. 5. The shell has now been properly beaded and it is only necessary to return the dies to their normal positions and to remove the shell from the head.

During the formation of the beads, the shell is free to contract or shift endwise to supply the metal which goes into the beads. The beads, accordingly, are spaced somewhat closer together than the forming dies. Moreover, the shell has been contracted so that it is no longer in engagement with the stop member 61. During the initial forward movement of the drawbar, die 15 is contracted due to the latch connection with the drawbar thereby leaving the shell 60 free to shift longitudinally to permit the expanding die 14 to reenter the first-formed bead without injury thereto. Further forward movement of the drawbar contracts die 14, die 15 remaining inoperative due to the interruption of the latch connection, and the finished shell may then be removed from the head.

Since the cylindrical shells upon which the machine is designed to operate may be used for a variety of purposes, it may be necessary at times to change the beading centers, that is, the spacing between beads. In order that this change may be effected conveniently and with a minimum amount of labor and expense, a modification of the die mounting arrangement hereinbefore described may be employed. A preferred die mounting for this purpose is shown in Figs. 7 to 10 inclusive. In this case, die segments 63 are formed without flanges and are carried in grooves in removable base members 64. To provide for the maximum number of adjustments, the base members may be provided with a plurality of grooves as shown in Fig. 10. The die segment may be placed in either groove and rigidly secured to the member by any suitable means as by bolts 65 passing through the member and threading into the die segment.

The base members in turn, are supported on the arcuate sections 44 of the die blocks 43 which are slidably supported in the head for radial movement as hereinbefore explained. In order to provide for further adjustment of the beading centers, the supporting blocks may be arranged to support the die blocks in any of a plurality of positions. As will be seen by reference to Fig. 9, the arcuate section of the block is provided with two separate sets of tapped holes permitting the mounting of the base members in either of two positions. These holes register with corresponding holes in the member to receive the bolts 66 by which the member is secured to the block. This mounting arrangement permits of four different settings of the dies, that is four different bead spacings, when used with a companion die of the fixed or non-adjustable type.

The variations in bead spacing may be further increased by employing a companion die which is also adjustable. For the purpose of illustration, a die similar to the one above described but having a single groove in the base member has been shown in Figs. 7 and 8. In this case the die segment 63 is rigidly secured in the single groove of a base member 67 adapted to be mounted in either of two positions on the supporting block 48. With this combination of two adjustable dies, eight different bead spacings are available.

In order to reduce the strain on the supporting blocks and guide members of the head when adjustable dies are used, a modified toggle connection between the block and drawbar may be employed. A suitable connection of this character is shown in Figs. 7 and 8 as applied to the outer of two dies. In this instance, the supporting block is provided with two longitudinally disposed depending ribs 68 between which the ends of toggle links 69 are pivoted in tandem relation. The other ends of the toggle links are pivoted between upstanding, elongated ears 70 formed on a plate 71. The plate 71 and similar plates are supported on respective facets of a sleeve member 72 loosely mounted on the drawbar 16, this assembly constituting a die actuating member. Relative movement between the plate 71 and sleeve member 72 is prevented by the transverse depending rib on the plate which fits tightly into a registering keyway formed in the sleeve. The plate may be further secured to the sleeve by means of a bolt 73.

As in the previously described embodiment of the invention, the die actuating member comprising the sleeve 72 and plates 71 is operatively connected with the drawbar by a latch mechanism identical with that heretofore described. In this case, the latch members 55 are pivoted on projecting ears 74 formed on oppositely disposed plates 71. The operation of this mechanism as well as the operation of the machine as a whole is substantially the same as that of the machine previously described.

From the foregoing, it will be apparent that the invention provides a bead expanding machine composed of a minimum number of parts of simple, rugged construction which is capable of forming a plurality of beads on a cylindrical shell in a single operation. The machine is readily adjustable to permit variation of the bead spacing as described. Moreover, the single head construction employed facilitates the operation of the machine and thereby increases its productive capacity.

I claim as my invention:

1. A metal working machine having, in combination, means for supporting a cylindrical piece of work, two sets of radially movable forming dies permanently mounted in fixed spaced relation relative to the axis of the work, operating means for said dies including an actuating member individual to each die, said supporting means and said actuating members being mounted for relative movement, and means operative incidental to such relative movement to impart radial movement to said dies successively.

2. A metal working machine having, in combination, means for supporting a cylindrical piece of work, two radially expansible forming dies permanently mounted in fixed spaced relation relative to the axis of the work, each of said dies being operative when expanded to grip the work and form an annular bead therein while

holding the work stationary relative to the die, and means for expanding said dies successively.

3. A metal working machine having, in combination, means for supporting a cylindrical piece of work, a plurality of radially movable die sets disposed in fixed spaced relation axially of the work, operating means for each die set including an actuating member, means for producing relative movement between the supporting means and said actuating members including also relative movement between the respective actuating members, and means operated incidental to said relative movements for operating said die sets in timed relation.

4. A machine for forming in a single operation a plurality of spaced beads in a cylindrical metal shell having, in combination, a frame, a die head projecting from one end of the frame over which the shell is adapted to be supported, a bead expanding die mechanism carried at the rear end of the head adjacent the frame and disposed within the shell, a second bead expanding die mechanism carried at the forward end of the head and disposed within the shell, a die operating member disposed within the head, means carried on the frame for connecting said operating member to a source of power, a positive operating connection between the member and the rear die mechanism, a lost motion connection between the member and the forward die mechanism, and means for actuating said member through an operating cycle to expand said dies into the shell successively to form spaced beads therein.

5. A machine for forming in a single operation a plurality of spaced beads in a cylindrical metal shell having, in combination, a frame, a die head projecting from one end of the frame over which the shell is adapted to be supported, a bead expanding die carried at the rear end of the head adjacent the frame and disposed within the shell, a second bead expanding die carried at the forward end of the head and disposed within the shell, a drawbar reciprocable within the head, means for reciprocating the drawbar through a forward and backward stroke, and means operated by the drawbar incidental to said reciprocation for positively expanding and contracting said dies in succession to form spaced beads in the shell.

6. A machine for forming spaced beads in a cylindrical metal shell having, in combination, means for supporting a piece of work, a pair of die members disposed in fixed spaced relation to the work, each of said members including a plurality of outwardly movable blocks arranged in a circular series, separable die plates mounted on the outer faces of said blocks and having ribbed projections adapted to lie substantially in contiguous relation with the ribs of adjacent plates on adjacent blocks in the circular series to constitute therewith a substantially continuous annular rib around each die member, an operating member, means for producing relative movement between the operating member and said die members, and connections between the operating member and the blocks of said die members operative incidental to said relative movement for shifting the blocks outwardly to force the respective ribs into the work piece and thereby produce spaced beads therein.

7. A machine for expanding spaced beads in a cylindrical metal shell in a single operation comprising, in combination, a frame, a head projecting from one end of the frame over which

said shell is adapted to be supported, a pair of bead expanding dies carried in fixed spaced relation by said head and disposed within the shell to expand spaced beads therein, die actuating members, means including toggle mechanisms for operatively connecting said dies with said actuating members, and means including said actuating members for rendering the dies effective to perform their bead forming operations successively.

8. A machine for forming spaced beads in a cylindrical metal shell having, in combination, a die head over which the shell is supported, a pair of spaced bead forming dies carried by the head and disposed within the shell, a drawbar reciprocable within the head, a sleeve member rigidly secured to the drawbar within the head, a second sleeve member slidably mounted on the drawbar within the head, operative connections between the sleeve members and the respective dies, and means for preventing relative movement between said second sleeve member and said drawbar during the initial portion of one stroke of the drawbar whereby said dies are operated in timed relation.

9. A machine for forming spaced beads in a cylindrical metal shell in a single operation having, in combination, a die head over which the shell is adapted to be supported, a pair of spaced bead forming dies carried by the head within the portion enclosed by the shell, a drawbar reciprocable within the head, a rigid connection between one of the dies and the drawbar, a lost motion connection between the other die and the drawbar, and means for reciprocating the drawbar to operate said dies successively and thereby form spaced beads in the shell.

10. A machine for forming a plurality of spaced beads in a cylindrical metal shell having, in combination, a die head over which the shell is adapted to be supported, a pair of spaced dies carried by said head and disposed within the shell, said dies being operative when expanded to form spaced beads in the shell, a drawbar reciprocable within the head, die expanding toggle connections between the respective dies and the drawbar, and means for rendering said toggle connections effective to expand said dies successively in one stroke of the drawbar and to contract said dies successively in the other stroke of the drawbar.

11. A machine for forming a plurality of beads in a cylindrical metal shell in a single operation having, in combination, a head adapted to project into the shell, a plurality of bead forming dies carried by said head in fixed spaced relation, a drawbar reciprocable within said head, and means operatively connecting said dies to said drawbar to operate the dies successively in each stroke of the drawbar, said means including a pair of die actuating members one of which is fast on the drawbar and the other having a lost motion connection with the drawbar.

12. A machine for forming a plurality of spaced beads in a cylindrical metal shell in a single operation having, in combination, a head for projecting into and supporting the shell, a pair of bead forming dies disposed in fixed spaced relation to the shell, each of said dies being operative to grip the shell and hold the same stationary relative to the die while expanding a bead therein, a die operating member, means for reciprocating said operating member through a forward and return stroke, and means for causing said member to coact with said dies suc-

cursively in one of said strokes and simultaneously in the other of said strokes to operate the dies in timed relation.

13. A machine for forming spaced beads in a cylindrical metal body having, in combination, means for supporting the body, a pair of bead expanding dies permanently mounted in fixed spaced relation relative to the axis of the body, each of said dies comprising a series of radially movable die segments arranged in a circular series, and means for shifting the die segments radially to expand the dies successively and thereby form spaced beads in the body, the arrangement being such that one die is first expanded to form a bead and is thereafter contracted simultaneously with the expansion of the other die to form the second bead, and said one die is again expanded simultaneously with the contraction of said other die to restore the dies to normal position.

14. A machine for forming spaced beads in a cylindrical metal body having, in combination, a pair of expanding dies in fixed spaced relation axially of the body, means for actuating the dies in timed relation to form spaced beads in the body, the first die being expanded to form one bead and then contracted to free the body simultaneously with the second die being expanded to form the second bead, and means for returning the dies to their normal position successively, the arrangement being such that the expanded second die is contracted to free the body and thereby permit the same to shift and enable the simultaneously expanding first die to reenter the first formed bead without injury thereto, said first die subsequently contracting to free the body.

15. A machine for expanding spaced beads in a cylindrical metal shell in a single operation comprising, in combination, a frame, a head projecting from one end of the frame over which the shell is adapted to be supported, a head expanding die carried at one end of the head and disposed within the shell, a second bead expanding die carried at the other end of the head and disposed within the shell, a drawbar mounted in the head for relative movement longitudinally thereof, a fixed connection between the drawbar and said first die for positively expanding and contracting the same, and a lost motion connection between the drawbar and said second die for positively expanding and contracting the same, said connection including means for rendering the connection effective after a predetermined movement of the drawbar in one direction and for rendering the connection ineffective after a predetermined movement of the drawbar in the other direction.

16. A machine for forming spaced beads in a cylindrical metal shell having, in combination, a die head adapted to project into and support the shell, a plurality of bead expanding dies carried by the head in operative relation to the shell, a drawbar mounted for reciprocating movement within the head, and operative connections between the drawbar and the respective dies effective successively whereby one of the dies is expanded while the other die is contracted in response to the movement of the drawbar in either direction.

17. A machine for forming spaced beads in a cylindrical metal shell having, in combination, a die head adapted to project into and support the shell, a pair of spaced bead forming dies carried by the head and disposed within the portion thereof enclosed by the shell, a drawbar recip-

rocable within the head, a sleeve rigidly secured to the drawbar within the head, a second sleeve slidably mounted on the drawbar within the head, operative connections between the sleeves and the respective dies, and a latch member effective when the drawbar moves to a particular position for preventing relative movement between said second sleeve and the drawbar.

18. A machine for expanding spaced beads in a cylindrical metal shell comprising, in combination, a frame, a head projecting from one end of the frame over which the shell is adapted to be supported, a pair of expanding die supporting members carried at spaced points in said head, a plurality of bead forming die segments carried by each supporting member, said segments being disposed so as to define an annular bead forming die around the member, and means for adjusting the position of the dies with respect to the sup-

porting members to vary the spacing between the beads expanded in the shell thereby.

19. A machine for forming spaced beads in a cylindrical metal shell in a single operation having, in combination, a die head over which the shell is adapted to be supported, a pair of spaced bead forming dies carried by the head within the portion enclosed by the shell, a drawbar supported within the head for reciprocation through forward and backward strokes, a rigid connection between one of the dies and the drawbar, and means operatively connecting the other die and the drawbar in the latter portion of one of said strokes and in the initial portion of the other of said strokes, the drawbar operating said dies successively to form spaced beads in the shell and to restore the dies to normal position.

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