

July 11, 1944.

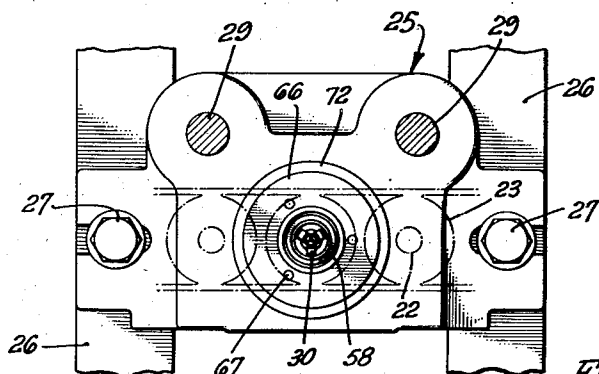
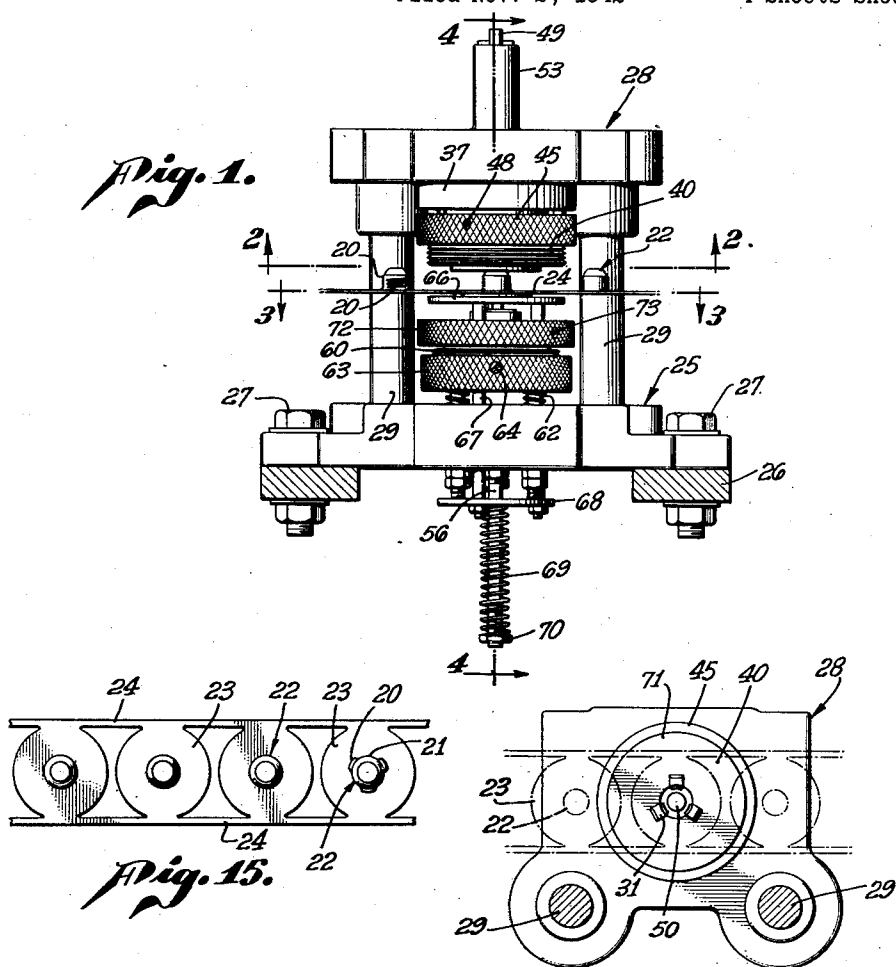
F. W. LIVERMONT

2,353,253

DIE

Filed Nov. 2, 1942

4 Sheets-Sheet 1



INVENTOR.
FRANK W. LIVERMONT
BY *Lyons & Lyons*
ATTORNEYS

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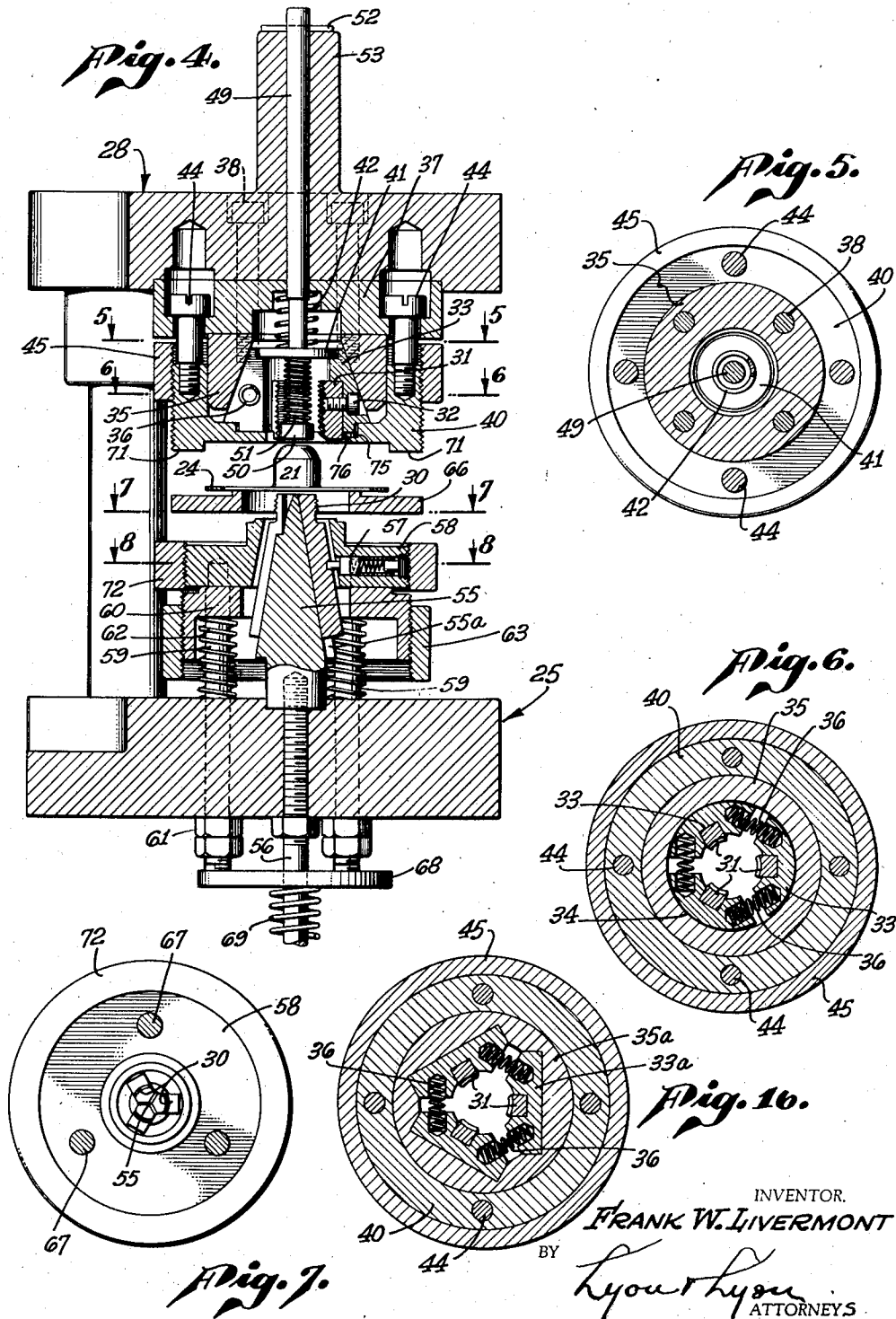
F. W. LIVERMONT

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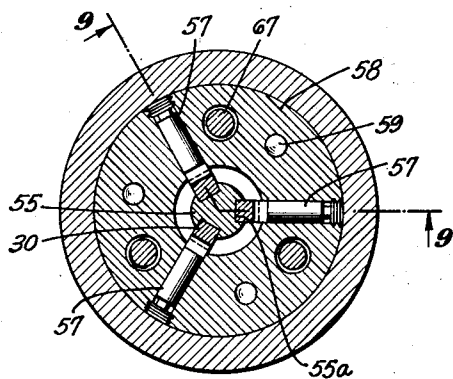


Fig. 8.

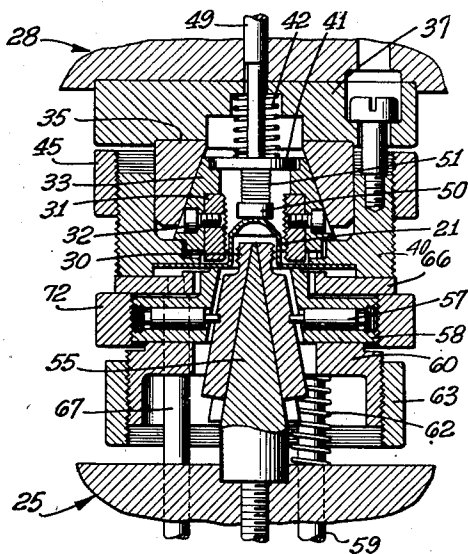


Fig. 10.

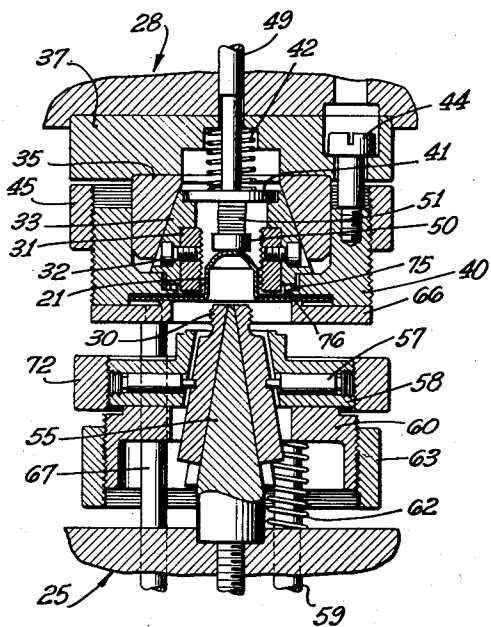


Fig. 9.

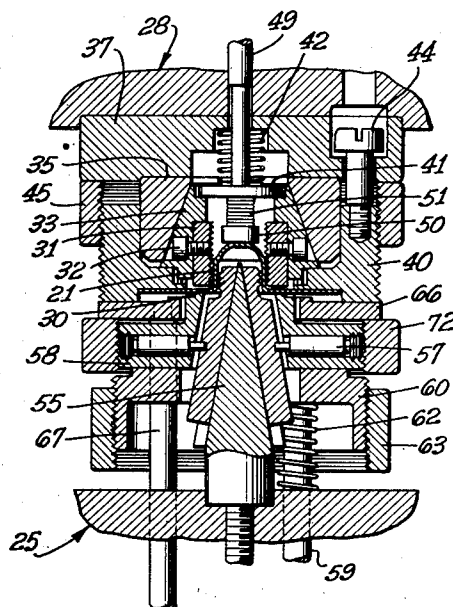


Fig. 11.

INVENTOR.
FRANK W. LIVERMONT
BY
Lyon & Lyon
ATTORNEYS

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F. W. LIVERMONT

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4 Sheets-Sheet 4

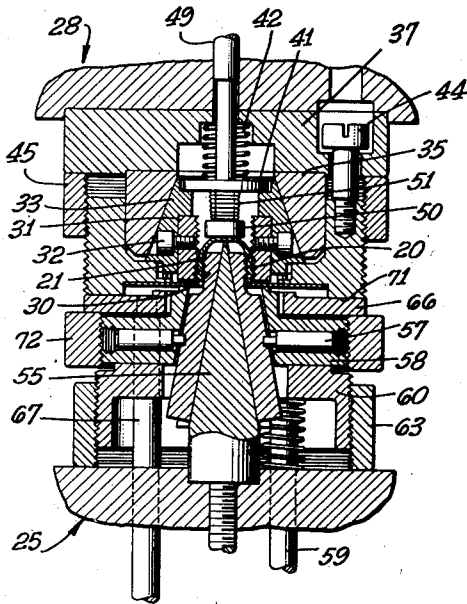


Fig. 12.

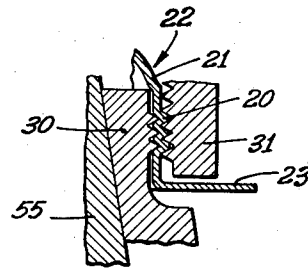


Fig. 12a.

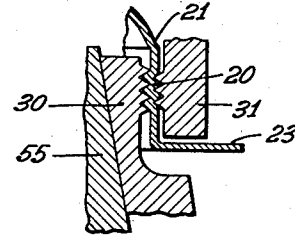


Fig. 14a.

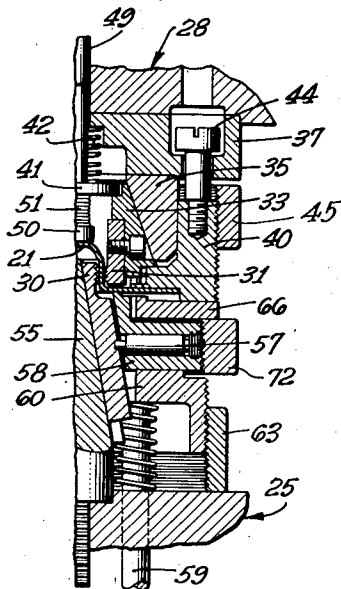
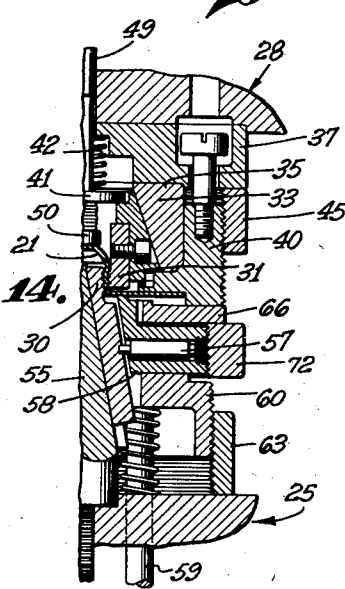


Fig. 13.

Fig. 14.



INVENTOR,
FRANK W. LIVERMONT
BY *Lyon & Lyon*
ATTORNEY, S

UNITED STATES PATENT OFFICE

2,353,253

DIE

Frank W. Livermont, Glendale, Calif., assignor of
one-half to Richard Alwin Livingston, Los
Angeles, Calif.

Application November 2, 1942, Serial No. 464,301

9 Claims. (Cl. 113—48)

This invention relates to dies for use in a press, such as a punch-press for shaping hollow sheet metal articles, and is particularly useful for pressing threads and the like in such bodies.

An object of the invention is to increase the precision and reliability of operation of such dies and increase the uniformity of the product.

A more specific object is to provide a die for pressing threads and the like in tubular blanks, in which the blank is permitted to float freely relative to the dies while, at the same time, the forming movements of the cooperating thread-forming dies on the interior and exterior of the blank are positively and accurately controlled.

The manner in which the foregoing objects are achieved, together with more specific objects and features of the invention, will appear from the detailed description to follow of a particular embodiment of the invention, as illustrated in the drawings, in which:

Fig. 1 is a front elevation of a die in accordance with the invention, the die being shown in open position.

Fig. 2 is a cross-section taken in the plane 2—2 of Fig. 1.

Fig. 3 is a cross-section taken in the plane 3—3 of Fig. 1.

Fig. 4 is a vertical section taken in the plane 4—4 of Fig. 1.

Figs. 5, 6, 7 and 8, respectively, are cross-sections taken in the planes 5—5, 6—6, 7—7 and 8—8 of Fig. 4.

Fig. 9 is a vertical section taken along the irregular line 9—9 of Fig. 8, showing the die partly closed to register the upper external die with the blank.

Fig. 10 is a section similar to Fig. 9, but showing the die closed further to bring the internal die into registration with the blank and the external die.

Fig. 11 is a section similar to Fig. 10, but showing a third stage of closing movement in which the external die has contracted to its limit, and the internal die has partly expanded into contact with the blank.

Fig. 12 is a section similar to Fig. 11, but showing the die in fully closed position with the internal die fully expanded.

Fig. 12a is a portion of Fig. 12 greatly enlarged to show the relative positions of the dies and work-piece.

Fig. 13 is a half-section, similar to Fig. 11, with the apparatus adjusted to form internal threads, and showing the internal die in fully expanded

position and the external die in partially contracted position.

Fig. 14 is a half-section similar to Fig. 13, but showing the dies in fully closed position.

Fig. 14a is an enlargement of a portion of Fig. 14, showing the relative positions of the dies and the threaded blank therebetween.

Fig. 15 is a plan view of a blank that may be used with the dies.

Fig. 16 is a cross-section, similar to Fig. 6 but showing an alternative construction that can be employed.

Referring, first, to Fig. 15, the particular die herein disclosed is adapted to press interrupted threads 20 on the cylindrical portions 21 of domes 22 (Fig. 1) which rise upwardly from flat base sections 23, the latter being interconnected by ribbons 24 so that the blanks can be handled in strips. During subsequent operations, each dome 22 and its associated base portion 23 are severed from the strip and formed into a closure plug or cap, but the present invention relates only to the forming of the threads 20 in the cylindrical portion 21 of a blank.

Referring to Fig. 1, a strip of blanks of the type just described with reference to Fig. 15, is shown with one of the elements thereof positioned within a die in accordance with the invention. This die consists of a lower frame member 25 adapted to be secured to the bed of a punch-press (a portion of which is indicated at 26) as by bolts 27. The die also includes an upper frame 28 adapted to be secured to the ram of the punch-press and be reciprocated vertically with respect to the lower frame member 25. The upper member 28 is guidingly supported in its reciprocatory movement with respect to the lower frame 25 by a pair of guide pins 29 which are secured to and extend upwardly from the lower frame member 25 into guide apertures provided therefor in the upper member 28.

Referring now to Fig. 4, the lower frame member 25 movably supports a set of three internal thread-forming dies 30, and the upper member 28 movably supports a set of three external thread-forming dies 31. As clearly shown in Fig. 4, when the die is in open position, the internal dies 30 are positioned below the level of the blank to be threaded, and the external dies 31 are positioned thereabove. However, each of the dies is so supported that when the upper member 28 is moved downward toward the lower member 25, the dies 30 and 31 are first brought into registration with each other on the inside and the outside, respectively, of the cylindrical

wall 21 of the blank, and are then moved radially to press the desired thread in the blank.

The three external dies 31 are each secured as by a screw 32 to a jaw 33 of a chuck mechanism somewhat similar to a conventional drill chuck. Thus, each of the jaws 33 has an outer conical face 34 (Fig. 6) that rests against a conical inner surface of a seat 35, so that longitudinal movement of the jaws, relative to the seat, moves the jaws radially inwardly or outwardly. To prevent the jaws 33 from shifting circumferentially, each jaw has a pin 75 projecting from its lower end and riding in a radial slot 76 in the cage 40. The jaws are maintained in engagement with the seat 35 by helical compression springs 36 exactly the same as in a conventional drill chuck. The seat 35 is rigidly secured to a plate 37, and the plate 37 is in turn rigidly secured to the upper frame member 23 by screws 38 (Figs. 4 and 5), so that the seat 25 moves with the upper frame member 23 at all times.

The jaws 33 are retained within the seat 35 by a cage 40 which has at its lower end an inwardly extending annular flange on which the lower ends of the jaws 33 rest. The jaws 33 are maintained against the cage 40 by a disc 41, which is pressed against the upper ends of the jaws by a helical compression spring 42 positioned between the disc 41 and the plate 37. In operation, the cage 40 moves vertically relative to the seat 35 to shift the dies 31 radially. Therefore, the cage 40 has a cylindrical inner surface which bears against a cylindrical outer surface on the seat 35 with a loose sliding fit. The cage 40 is retained in position below the plate 37 by four cap screws 44 (Figs. 4 and 5), downward movement of the cage being limited by contact of the undersides of the heads of the cap screws 44 with the plate 37.

The extent of radial movement of the dies 31 is determined by the extent of vertical movement of the jaws 33 with respect to the seat 35, which is in turn determined by the extent of vertical movement of the cage 40 with respect to the plate 37. Extent of this latter movement can be accurately adjusted by means of an upper adjusting ring 45, which has internal threads screwing onto external threads provided therefor on the cage 40. When the upper edge of the adjusting ring 45 contacts the under surface of the plate 37, further upward movement of the cage 40 with respect to the plate 37 is stopped. The ring 6 is locked in a position of adjustment on the cage 40 by a set screw 43 (Fig. 1).

To prevent the blank from being carried upward with the upper die member when the die opens, an ejecting plunger 49 is provided which is guidingly supported in the upper frame member 23, and has a head 50 on its lower end adapted to abut against the upper end of the blank as the die closes. The plunger 49 is yieldably urged downwardly by a light helical compression spring 51, which surrounds the lower end of the plunger and is compressed between the head 50 thereon and the disc 41 through which the plunger extends. Downward movement of the plunger 49 is limited by a pin 52 in the upper end thereof, which bears against the upper end of an extension 53 on the frame member 23.

Referring now to the lower portion of the die, there are three internal dies 30, each juxtaposed to one of the external dies 31, and all slidably mounted on a central stationary cone 55 which is secured to the lower frame member 25

by a bolt 56. The dies 30 are rectangular in cross-section (Fig. 8) and fit in guide slots 55a in the cone 55. They are yieldably maintained in the slots 55a by spring plungers 57 which extend radially in guide holes provided therefor in a cage 58 surrounding the cone and dies. The inner ends of the plungers 57 fit in recesses provided in the outer surfaces of their associated dies 30, so that the dies are constrained to move vertically with the cage 58 but can move radially with respect thereto in response to vertical movement of the cage with respect to the cone 55.

The cage 58 is guidingly supported for vertical movement with respect to the lower frame member 25 by three guide rods 59 which have threaded upper ends screwed into the cage 58. Below the cage 58 the guide rods 59 extend through guide apertures provided therefor in a hub 60, which floats below the cage 58, and through guide apertures in the lower frame member 25. Nuts 61 are provided on threaded lower ends of the guide rods 59 for limiting upward travel of the cage 58, and both the hub 60 and the cage 58 are constantly urged into upper position by helical springs 62 surrounding the rods 59 and compressed between the hub 60 and the lower frame member 25.

During each operation, the cage 58 and the dies 30, together with the hub 60, move downwardly with respect to the cone 55, to expand the internal dies 30, and the extent to which the dies expand against the work-piece is determined by the extent of their vertical travel with respect to the cone 55, which in turn is limited by the downward movement of the hub 60 with respect to the frame member 25. This movement can be accurately controlled by a lower adjusting ring 63, which is internally threaded to screw onto the externally threaded surface of the hub 60, and limits downward travel of the latter by contact of its lower edge with the frame member 25. The ring 63 is locked in a desired position of adjustment by a set screw 64 (Fig. 1).

To support the work-piece at proper elevation while the die is in open position, there is provided a table 66 (Fig. 4) in the general shape of a centrally apertured disc, which in turn is supported by three vertical rods 67 which extend downwardly through apertures provided therefor in the cage 58, the hub 60, and the lower frame member 25, and are connected at their lower ends to a supporting disc 68, which is guidingly supported on an extension of the bolt 56 and is urged into the upper position shown in Figs. 1 and 4 by a helical spring 69, which surrounds the extension of the bolt 56 and is compressed between a nut 70 on the lower end thereof and the disc 68.

The table 66 acts as a guide to determine the vertical position of the work-piece with respect to the internal and external dies 30 and 31, respectively. Thus, during closing movement of the die, a pair of parallel shoulders 71 on the lower end of the upper cage 40 (Fig. 1) straddle the work-piece and bear against the upper face of the disc 66, thereby fixing the position of the table 66 and the work-piece relative to the cage 40 and the external dies 31 during the rest of the closing movement of the dies, the table 66 thereafter being moved downwardly by the shoulders 71 in unison therewith. The upper cage 40, the table 66, and the work-piece continue their downward movement with respect to the lower dies 30 until the table 66 is stopped by abutment against an intermediate adjustment ring 72 having internal

threads screwed onto external threads on the cage 58. The position of the work-piece with respect to the lower dies 30 can be accurately adjusted by rotating the adjusting ring 72 into a desired position and locking it in that position with a set screw 73 (Fig. 1). During final closing movement of the die, the upper cage 40, the external dies 31, the work-piece on the table 66, and the lower dies 30 all move downwardly in unison with each other while the internal and external dies are being moved radially to press the threads in the work-piece.

The operation of the die to form external threads on the work-piece will now be described with reference, particularly, to Figs. 4, 9, 10, 11, 12, and 12a.

In Fig. 4, the die is in fully open position, providing room for movement of the work-piece into alignment with the die mechanism; the external dies 31 are fully expanded because the jaws 33 are in lowermost position with respect to the seat 35; and the internal dies 30 are fully contracted because the cage 58 is in uppermost position with respect to the stationary cone 55. With the parts in this position, the press is tripped to move the upper frame member 28 through a stroke of predetermined length downward and then upward back to the starting position.

Referring now to Fig. 9, initial downward movement of the frame member 28 carries the head 50 of the plunger 49 against the top of the work-piece, and thereafter the rod 49 remains stationary while the rest of the mechanism slides downwardly past it, the spring 51 compressing during this operation. Spring 42 is stronger than spring 51 and retains the disc 41 against the jaws 33 at all times. Compression of the spring 51 ceases when the shoulders 71 on the cage 40 contact the table 66, as shown in Fig. 9, thereby completing vertical movement of the external dies with respect to the work-piece. As the press continues its closing movement, the table 66 and the work-piece move downwardly with respect to the internal dies 30, until such movement is stopped by contact of the underside of the table 66 with the upper edge of the intermediate adjusting ring 72, as shown in Fig. 10. So far, there has been no radial movement of either the external or the internal dies because no force has been applied sufficient to move the upper cage 40 and the jaws 33 against the resistance afforded by the spring 42, and no downward movement has been imparted to the lower cage 58, which actuates the internal dies.

However, as the closing movement continues beyond the position shown in Fig. 10, the resistance to further movement of the cage 40 afforded by the table 66 and the cage 58 compresses the spring 42, permitting the seat 35 to move downwardly, while the disc 41 and the jaws 33 remain at the same level, until the upper adjusting ring 45 abuts against the plate 37, as shown in Fig. 11. This relative movement between the jaws 33 and the seat 35 moves the external dies 31 inwardly a distance just sufficient to engage the outer surface of the work-piece.

As shown in Fig. 11, the upper adjusting ring 45, having contacted the plate 37, prevents any further relative movement between the die jaws 33 and the seat 35, so that the external dies have reached the limit of their contracting movement. Furthermore, since the table 66 has contacted the intermediate adjusting ring 72, any further vertical movement of either die with respect to the other die or other work-piece is

prevented. It follows, therefore, that, as the closing movement continues beyond the position shown in Fig. 11, substantially the entire assembly moves downwardly except the lower frame member 25 and the cone 55 mounted thereon. The internal dies 30 are carried downwardly along the cone 55 by the spring plungers 57 in the cage 58, which expands the dies radially outward through the work-piece. This movement continues until the lower adjusting ring 63 contacts the lower frame member 25, as shown in Fig. 12, and the extent of expanding movement of the internal dies can be accurately regulated by adjusting the ring 63. When proper adjustment is effected, the metal of the work-piece is forced by the internal dies out into the juxtaposed recesses in the outer dies, as shown in the enlarged section of Fig. 12a. In the particular structure shown for forming three sets of interrupted external threads on the work-piece, all three sets of threads are pressed out accurately the same distance from the wall. In the particular construction shown, the lower dies are rigidly centered by virtue of the fact that the cone 55 is rigidly mounted on the lower frame 25. However, it is to be understood that it is sometimes desirable to provide an oversize hole in the lower frame member 25 for receiving the base of the cone 55 and its retaining screw, and permit the cone to have a limited amount of freedom laterally, so that it can align itself with the external die even though the lower and upper frame members 25 and 28 are not perfectly positioned with respect to each other.

The operation described in detail with reference to Figs. 9, 10, 11, 12, and 12a relates to the formation of external threads on the work-piece. Figs. 13, 14, and 14a illustrate the operation when internal threads are to be formed.

In Fig. 13 the apparatus is shown in a position corresponding in general to that of Fig. 11, and both the internal and external dies have completed their vertical movement with respect to each other and to the work-piece. Furthermore, the external dies 31 have engaged the work-piece and further movement of those dies has been delayed by virtue of the resistance of the work-piece while the internal dies 30 were being expanded into contact with the work-piece. In this instance, the outward or expanding movement of the internal dies 30 is positively stopped at the time they contact the work-piece by engagement of the lower adjustment ring 63 against the frame 25, whereas in the corresponding stage of operations shown in Fig. 11 the lower adjustment ring 63 still had a substantial distance to travel before engaging the frame 25. It will be observed that in Fig. 13 the upper adjustment ring 45 has not yet engaged the plate 37, the downward movement of plate 37 with respect to the adjustment ring 45 having been temporarily halted by engagement of the external dies against the work-piece.

However, final closing movement forces the plate 37 downwardly with respect to the upper adjustment ring 45 until the latter seats thereagainst, this movement carrying the seat 35 downwardly with respect to the jaws 33 and forcing the external dies into the work-piece to form internal threads thereon, as shown in Fig. 14a.

Opening movement of the die proceeds in the reverse order to the closing movements described. First, the internal and external dies retract radially to their normal positions, in which they are completely clear of the work-piece. Thereafter,

the upper cage 40 is lifted away from the lower dies into the position shown in Fig. 9, the work-piece being lifted with the external dies because the spring 50 (Figs. 1 and 4), which elevates the work supporting table 63, is stronger than the spring 51 which actuates the plunger 49. However, final opening movement, which carries the upper die structure into its uppermost position, shown in Fig. 4, carries this upper die structure away from the work-piece, because upper movement of the table 66 is limited by contact of the disc 68 with the lower ends of the bolts 59, and, when the upward movement of the table 63 ceases, the spring 51 is effective to hold the work-piece thereagainst as the upper portion of the die ascends into its top position. The machine is then ready to start another cycle of operation.

An important feature of the machine is the particular arrangement of the adjustment rings for positively limiting vertical movements of different portions of the die mechanism without interfering with the free floating mounting of the dies relative to each other and automatic self-centering operation of the dies.

An alternative arrangement of the external die structure is shown in Fig. 16, which corresponds with Fig. 6, except that the jaws 32a have flat rectangular rear faces which are vertically slidable in channels provided therefor in the seat 35a, the latter not having a conical inner surface like the seat 35. The construction shown in Fig. 16 is highly desirable because it provides a large surface of contact between the jaws and the cone in all relative vertical positions thereof. As is well known, it is not possible for two conical surfaces to have surface contact with each other in all positions of vertical adjustment. Hence, with the construction shown in Figs. 4 and 6 there is a tendency for the outer surfaces of the jaws and the inner surface of the seat to wear unevenly.

It will be noted that registration of the internal and external dies is effected by turning the intermediate adjusting ring 72, and that when the table 66 is seated on ring 72 and the cage 40 is seated on the table 66 the relative vertical position of the internal and external dies is independent of the thickness of the work-piece. This is desirable, since there may be variations in the thickness of the work-piece.

Although for the purpose of explaining the invention a particular embodiment thereof has been disclosed and described in detail, it will be understood by those skilled in the art that various departures from the exact construction shown can be made without departing from the invention, which is to be limited only to the extent set forth in the appended claims.

I claim:

1. Apparatus for shaping a sheet work-piece, said apparatus comprising: first and second frame members between which said work-piece is adapted to be positioned, and means for effecting relative longitudinal closing and opening movements of said frame members toward and away from each other; a first die and a complementary second die; means mounting said first die on said first frame member for lateral and longitudinal movement relative thereto, said mounting means including wedge means for forcing said first die laterally against said work-piece in response to closing movement of said first frame member relative to said first die; means mounting said second die on said second frame member for lateral and longitudinal movement relative thereto, said mounting means including a second wedge means

for forcing said second die laterally toward said work-piece on the opposite side thereof from said first die; first adjustable stop means cooperating with said first and second dies for stopping relative longitudinal movement of said dies toward each other when said dies reach longitudinal registration; second adjustable stop means cooperating with said first frame member and said mounting means of said first die for limiting longitudinal movement of said first frame member with respect to said first die and thereby limiting lateral movement of said first die toward the work-piece; and third adjustable stop means cooperating with said second frame member and said mounting means of said second die for limiting longitudinal movement of said second frame member with respect to said second die and thereby limiting lateral movement of said second die toward the work-piece; whereby the lateral movement of each die toward the work-piece is positively controlled independently of the other die.

2. Apparatus for radially shaping a hollow work-piece having radial symmetry with respect to a longitudinal axis, said apparatus comprising: an expandible internal die, first supporting means longitudinally supporting said internal die, and first wedge means movable longitudinally with respect to said internal die for expanding it radially outwardly in response to longitudinal movement of said first wedge means relative to said internal die; a complementary contractible external die aligned with said internal die and normally outwardly displaced therefrom to permit relative longitudinal movement of said dies and said work-piece, second supporting means longitudinally supporting said external die, and second wedge means movable longitudinally with respect to said external die for contracting it inwardly against said work-piece in response to longitudinal movement of said second wedge means relative to said external die; first and second frame members relatively movable toward and away from each other along said longitudinal axis of said work-piece, and means for effecting relative closing and opening movement of said frame members toward and away from each other; means supporting said first wedge means on said first frame member, and means supporting said second wedge means on said second frame member for movement of said internal and external die assemblies from an open position spaced longitudinally apart to permit entry of a work-piece therebetween into closed position in which said dies engage said work-piece; and abutment means independent of the dimensions of said work-piece for limiting movement of said first and second supporting means toward each other whereby the dies of said first and second sheets are stopped in juxtaposed relation to each other.

3. Apparatus for radially shaping a hollow work-piece having radial symmetry with respect to a longitudinal axis, said apparatus comprising: first and second frame members between which said work-piece is adapted to be positioned, and means for effecting relative longitudinal closing and opening movements of said frame members toward and away from each other; a first supporting member longitudinally with respect to one of said frame members, and a contractible external die longitudinally supported by said first supporting member; means responsive to closing movement of said first frame member relative to said first supporting member for contracting said external die; a second supporting member slid-

able longitudinally with respect to said second frame member, and a internal die longitudinally supported by said second supporting member; means responsive to closing movement of said second frame member relative to said second supporting member for expanding said internal die; each of said supporting members having a cylindrical threaded peripheral surface, and an internally threaded adjusting sleeve screwed thereon, each adjusting sleeve projecting longitudinally beyond its associated supporting member for engagement with its associated frame member to adjustably limit closing movement of that frame member with respect to its associated supporting member and thereby limit radial movement of the associated set of dies.

4. Apparatus as described in claim 3, including auxiliary stop means for adjustably limiting longitudinal closing movement of said internal and external dies toward each other, said auxiliary stop means comprising a third threaded sleeve screwed on one of said supporting members and projecting longitudinally beyond said one supporting member toward the other supporting member, and stop means engageable with said third sleeve for limiting its approach toward said other supporting member to a predetermined value.

5. Apparatus as described in claim 2, in which one of said dies is loosely mounted on its associated frame member for limited lateral movement with respect thereto to permit self-alignment thereof with the other die.

6. Apparatus as described in claim 2, in which said external die includes die elements and a hollow wedge member having internal wedging surfaces cooperating with wedging surfaces on the die elements thereof, said hollow wedge member having a cylindrical outer surface, and said second supporting means comprising a cylindrical member surrounding and loosely fitting against the cylindrical surface of said wedge member and having an inwardly extending flange engaging and longitudinally supporting said die elements, spring means urging said die elements longitudinally into engagement with said inwardly extending flange, and means limiting longitudinal motion of said second supporting in each direction with respect to said wedge means.

7. Apparatus for shaping a sheet work-piece, said apparatus comprising: first and second frame members between which said work-piece is adapted to be positioned, and means for effecting relative longitudinal closing and opening movements of said frame members toward and away from each other; a first die and a complementary second die; means mounting said first die on said first frame member for lateral and longitudinal movement relative thereto, said mounting means including wedge means for forcing said first die laterally toward said work-piece in response to closing movement of said first frame member relative to said first die; means supporting said second die on said second frame member for lateral engagement with said work-piece on the side thereof opposite said first die; and abutment means cooperating with said first and second dies for stopping relative longitudinal movement of said dies toward each other when said dies reach longitudinal registration with respect to each other; said abutment means including a first stop shoulder and means connecting it to said first die for longitudinal movement therewith, a second stop shoulder and means connecting it to said second die for longitudinal

movement therewith, one of said connecting means being variable for accurate adjustment of said longitudinal registration.

8. Apparatus for shaping a sheet work-piece, said apparatus comprising: first and second frame members between which said work-piece is adapted to be positioned, and means for effecting relative longitudinal closing and opening movements of said frame members toward and away from each other; a first die and a complementary second die; means mounting said first die on said first frame member for lateral and longitudinal movement relative thereto, said mounting means including wedge means for forcing said first die laterally toward said work-piece in response to closing movement of said first frame member relative to said first die; means supporting said second die on said second frame member for lateral engagement with said work-piece on the side thereof opposite said first die; and abutment means cooperating with said first and second dies for stopping relative longitudinal movement of said dies toward each other when said dies reach longitudinal registration with respect to each other; said abutment means consisting solely of elements of said apparatus, whereby registration of said dies is independent of the thickness of and of the presence or absence of the work-piece, said abutment means including a first stop shoulder on said mounting means for said first die, said first stop shoulder being secured to said first die against longitudinal movement relative thereto; a second stop shoulder on said supporting means for said second die, said second stop shoulder being secured to said second die against longitudinal movement relative thereto; and a supporting member for said work-piece positioned longitudinally between said first and second stop shoulders and in the paths thereof whereby it is engaged between said shoulders during closing movement of said first and second frame members and the relative positions of said first and second dies are determined both with respect to each other and with respect to the work-piece.

9. Apparatus for shaping a sheet work-piece, said apparatus comprising: first and second frame members between which said work-piece is adapted to be positioned, and means for effecting relative longitudinal closing and opening movements of said frame members toward and away from each other; a first die and a complementary second die; means mounting said first die on said first frame member for lateral and longitudinal movement relative thereto, said mounting means including wedge means for forcing said first die laterally toward said work-piece in response to closing movement of said first frame member relative to said first die; means supporting said second die on said second frame member for lateral engagement with said work-piece on the side thereof opposite said first die; and abutment means cooperating with said first and second dies for stopping relative longitudinal movement of said dies toward each other when said dies reach longitudinal registration with respect to each other; said abutment means consisting solely of elements of said apparatus, whereby registration of said dies is independent of the thickness of and of the presence or absence of the work-piece; said abutment means including a first stop shoulder on said mounting means for said first die, said first stop shoulder being secured to said first die against longitudinal movement relative thereto; a second stop shoulder on said supporting means for said sec-

ond die, said second stop shoulder being secured to said second die against longitudinal movement relative thereto; and a supporting member for said work-piece positioned longitudinally between said first and second stop shoulders and in the paths thereof whereby it is engaged between said shoulders during closing movement of said first and second frame members and the relative positions of said first and second dies are determined

both with respect to each other and with respect to the work-piece, the paths of movement of said shoulders being laterally spaced from the work-piece whereby said shoulders directly contact said work-supporting member and registration of said dies is independent of the dimensions of the work-piece.

FRANK W. LIVERMONT.