

March 22, 1932.

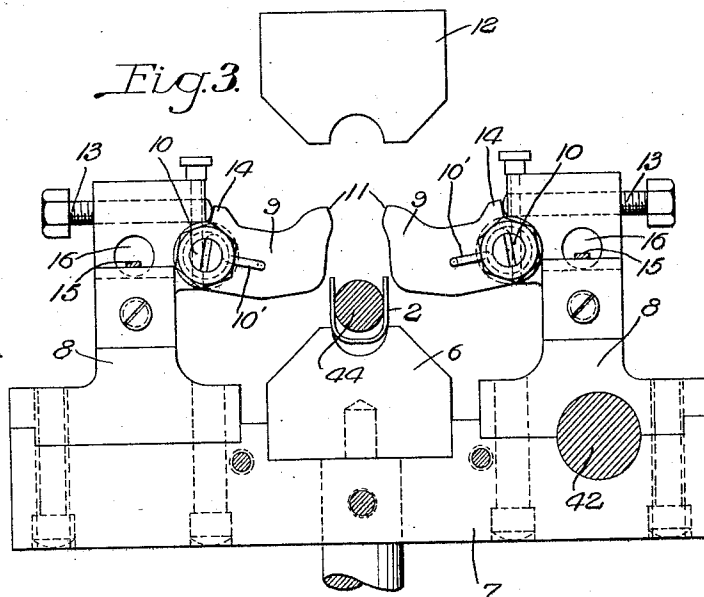
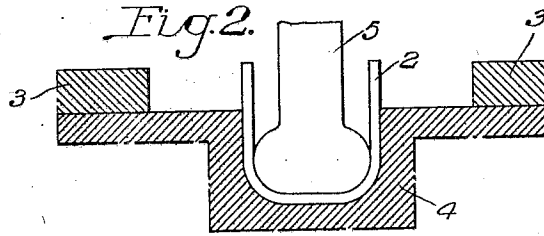
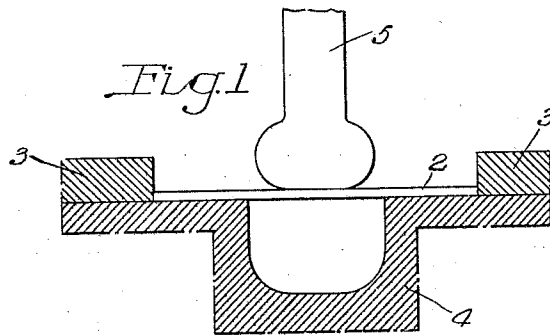
C. H. LEIS

1,850,679

PROCESS AND APPARATUS FOR FORMING BUSHINGS

Filed Feb. 26, 1929

6 Sheets-Sheet 1



INVENTOR

Carl H. Leis
by Byrnes, Stebbins & Parmelee
his Attys.

March 22, 1932.

C. H. LEIS

1,850,679

PROCESS AND APPARATUS FOR FORMING BUSHINGS

Filed Feb. 26, 1929

6 Sheets-Sheet 2

Fig. 4.

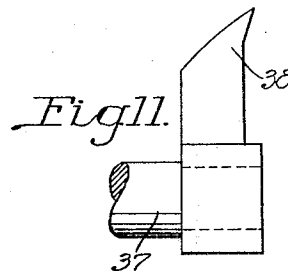
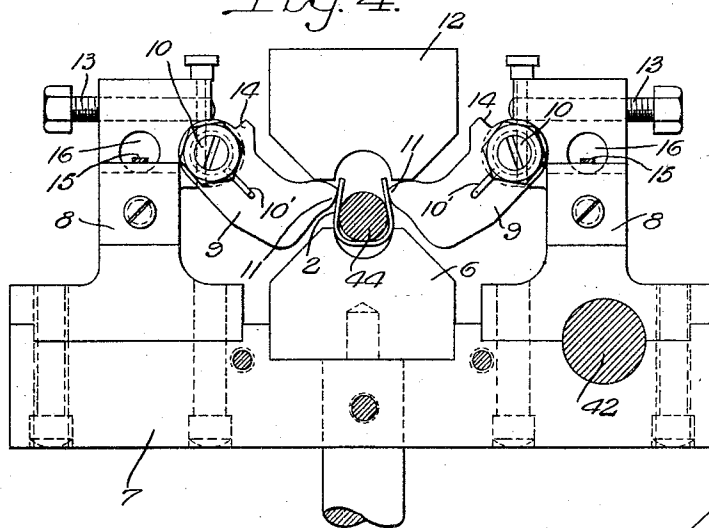
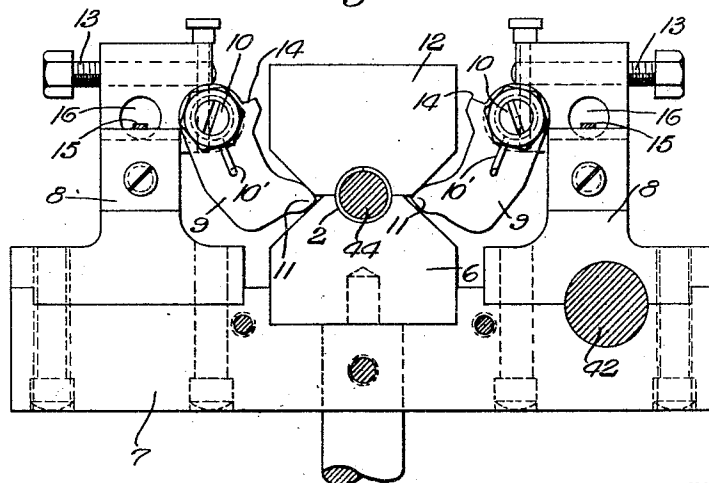


Fig. 5.



INVENTOR

Carl H. Leis

by Byrnes, Stebbins & Parmelee
Attys.

March 22, 1932.

C. H. LEIS

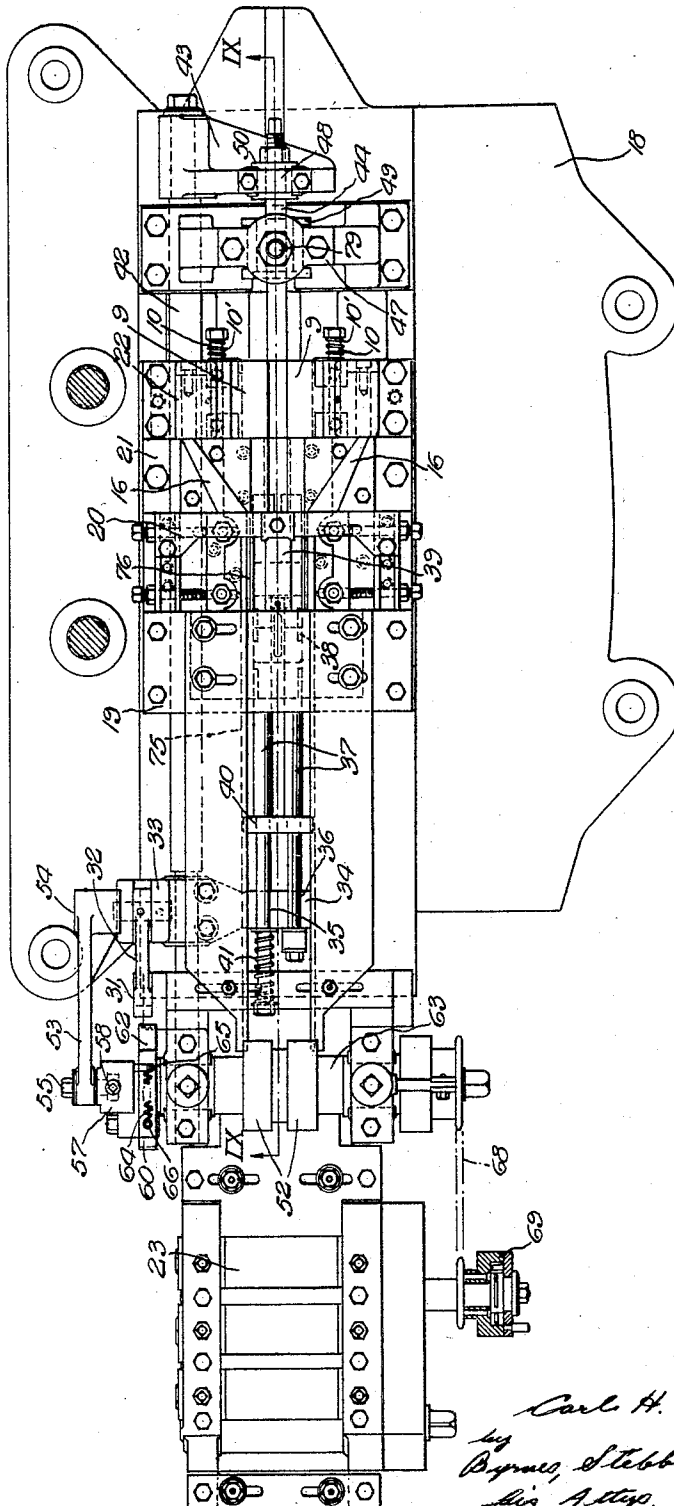
1,850,679

PROCESS AND APPARATUS FOR FORMING BUSHINGS

Filed Feb. 26, 1929

6 Sheets-Sheet 3

Fig. 6.



INVENTOR

Carl H. Leis
by
Byrnes, Stebbins & Parmelee
His Atty.

March 22, 1932.

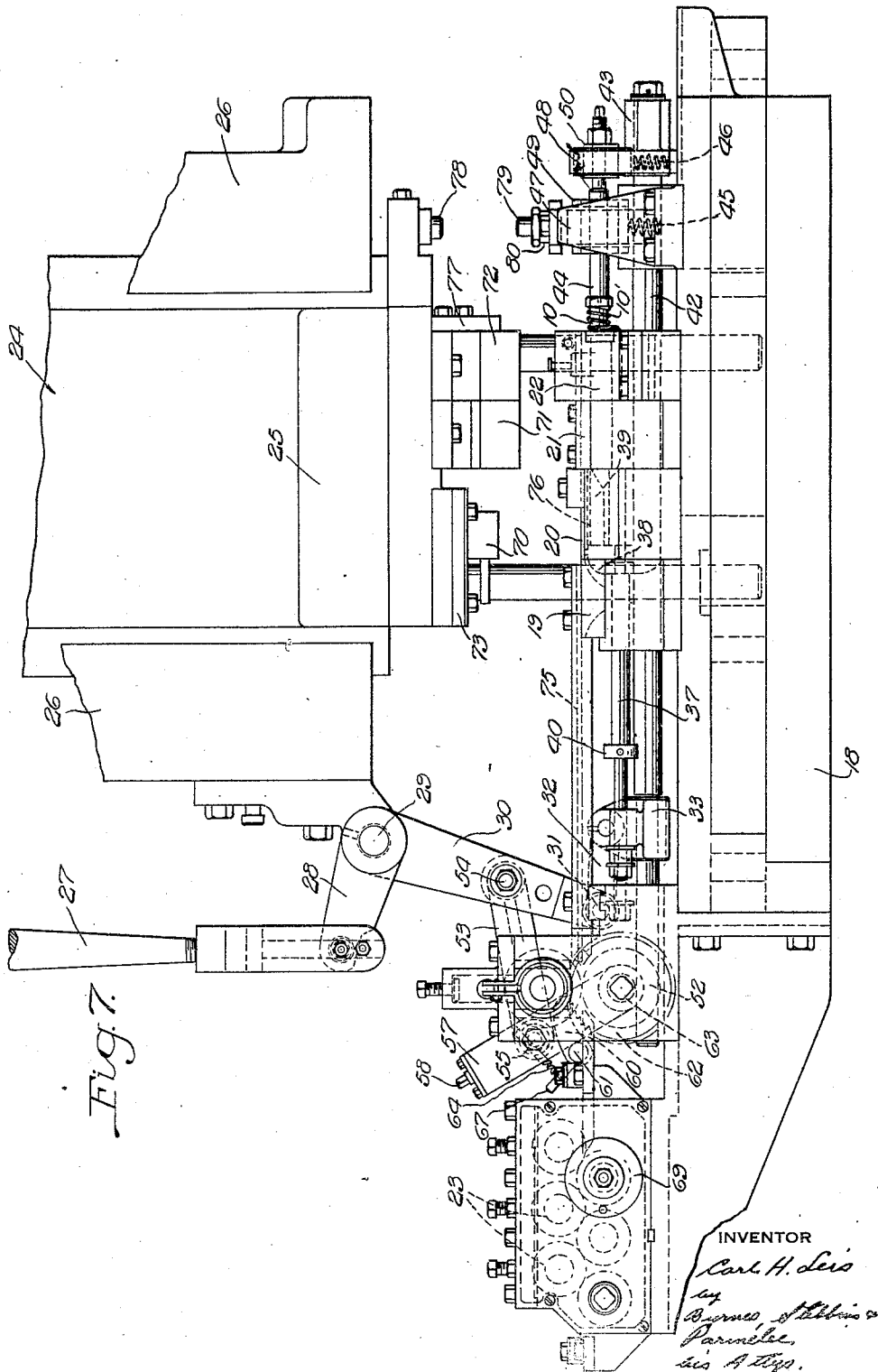
C. H. LEIS

1,850,679

PROCESS AND APPARATUS FOR FORMING BUSHINGS

Filed Feb. 26, 1929.

6 Sheets-Sheet 4



March 22, 1932.

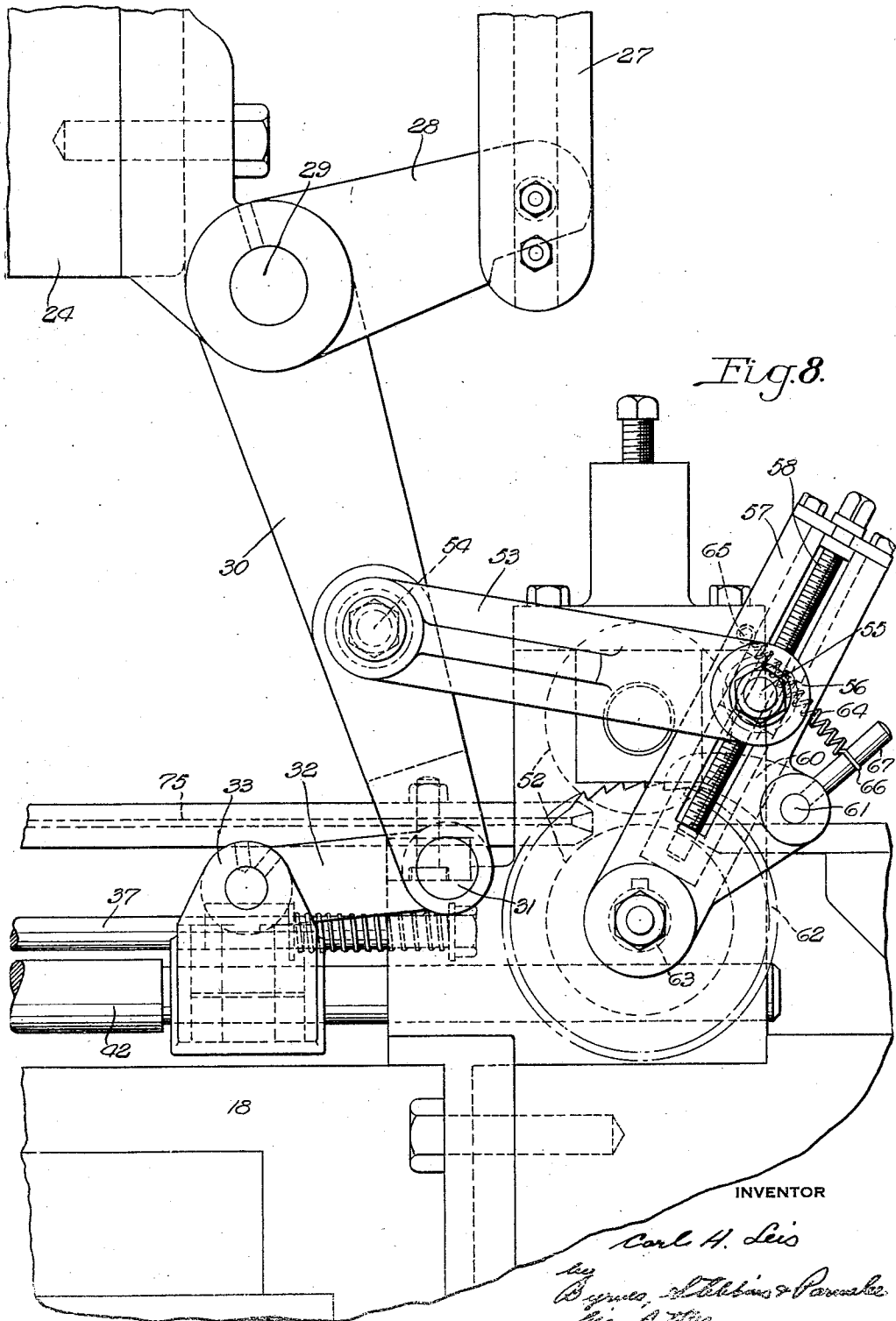
C. H. LEIS

1,850,679

PROCESS AND APPARATUS FOR FORMING BUSHINGS

Filed Feb. 26, 1929

6 Sheets-Sheet 5



March 22, 1932.

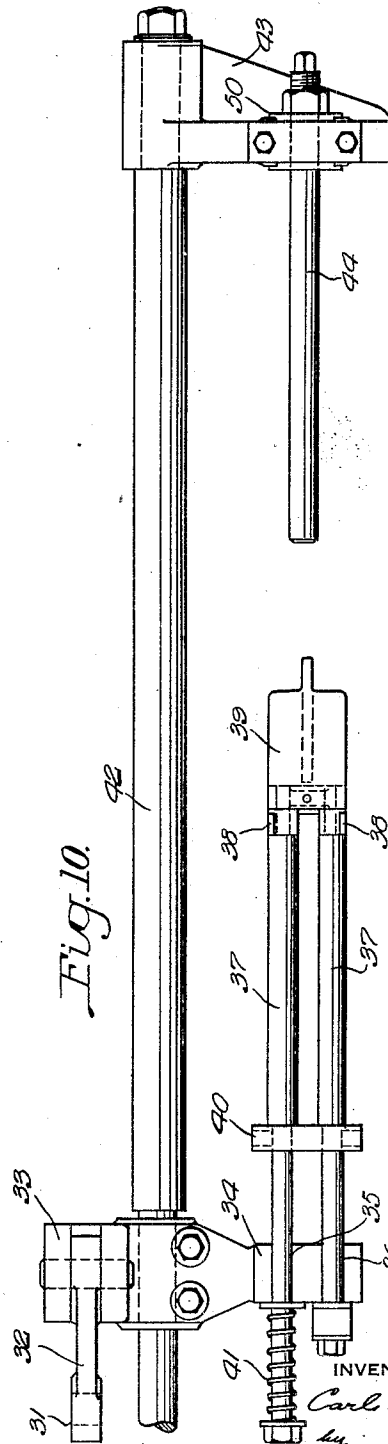
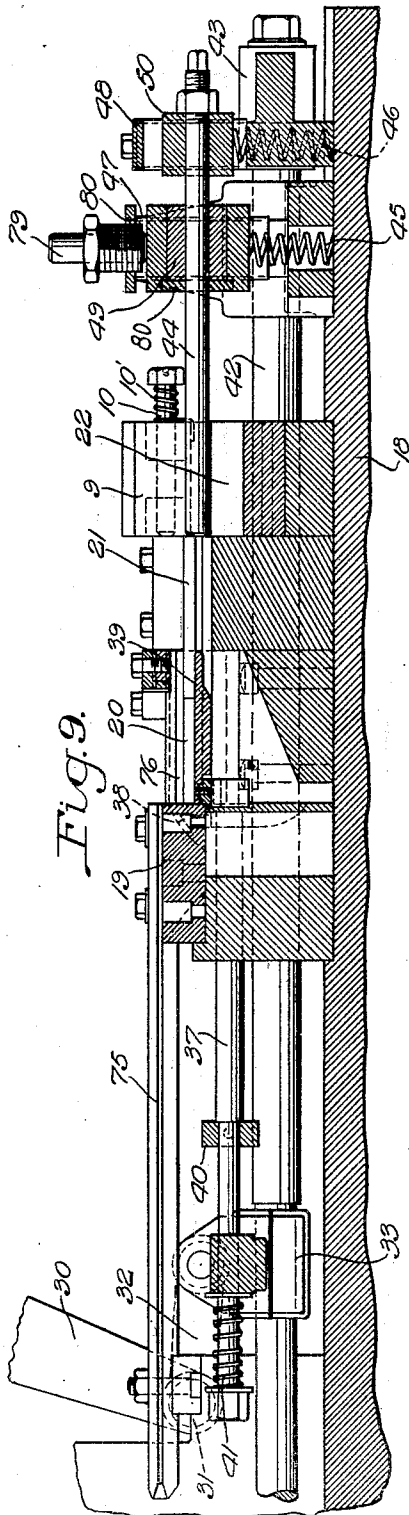
C. H. LEIS

1,850,679

PROCESS AND APPARATUS FOR FORMING BUSHINGS

Filed Feb. 26, 1929

6 Sheets-Sheet 6



INVENTOR
Carl H. Leis
By *Pyman, Smith & Barnard*
his Attys.

UNITED STATES PATENT OFFICE

CARL H. LEIS, OF NEW CASTLE, PENNSYLVANIA, ASSIGNOR TO JOHNSON BRONZE COMPANY, OF NEW CASTLE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

PROCESS AND APPARATUS FOR FORMING BUSHINGS

Application filed February 26, 1929. Serial No. 342,688.

This invention relates to a process and apparatus for forming bushings, and more particularly to such a process in which the bushings are formed from a flat strip of material which is formed into a U-shape, and thereafter formed directly from a U-shape into a cylindrical bushing.

Heretofore, it has been proposed to form bushings from a flat strip of material by first forming the blank which has been cut out from the strip material into a U-shape, then crimping in the upper ends of the U-shaped blank in a die separate from the die in which the U was formed, and thereafter in another die, changing the U-shaped blank having its upper ends crimped in, into a finished cylindrical bushing. In this old method the blank had a U-shape in two successive dies. Because of the fact that the blank was in the form of a U in two successive dies, it was impractical to feed the U-shaped blank having its upper ends crimped in, from the crimping die to the final forming die to produce a cylindrical bushing, except by feeding one bushing by the next succeeding bushing. It was not possible to feed a bushing by means of feed fingers from the die in which the crimping operation was performed, into the final forming die.

Since the feeding of the crimped-in U-shaped bushing from the crimping-in die to the final forming die was accomplished by contact with the next succeeding bushing, only bushings of the same length as the crimping-in die could be employed. This meant that for each change in the length of a bushing, a new die had to be substituted for the crimping-in die.

My invention provides a means whereby the blank, after it has been formed in the shape of a U, is transferred directly to a final forming die in which both the crimping-in of the upper ends of the U-shaped blank and the completion of the cylindrical bushing are accomplished. By this means I use only one die which contains a U-shaped blank, and for this reason I am able to move a blank from the U-forming die into the final forming die by feed fingers, no matter what the length of the bushing may be, provided of course that

it does not exceed the length of the U-forming die. I am therefore able to make bushings of the same diameter, but of greater or lesser length without the necessity of changing the U-forming die for each change in length of the bushing.

In the accompanying drawings which illustrate the present preferred embodiment of my invention,

Figures 1 to 5, inclusive, illustrate in a somewhat diagrammatic manner the various steps employed to transform a flat blank of material into a finished cylindrical bushing;

Figure 6 is a plan view of one form of device embodying my invention;

Figure 7 is a front elevation;

Figure 8 is a partial rear elevation showing the means for feeding the strip material to the forming dies;

Figure 9 is a longitudinal section taken on the line IX—IX of Figure 6, parts being shown in elevation;

Figure 10 shows in a somewhat diagrammatic manner the mechanism employed for feeding the strip of material, blanks and bushing through the machine; and

Figure 11 is a detail view of the feed finger which feeds the blank to the U-forming die.

Referring to Figures 1 to 5 of the drawings, after a blank 2 has been stamped out of the strip material, it is guided between guides 3 to a U-forming die 4. In this die it is formed to a U-shape by the plunger 5. From the U-forming die the U-shaped blank passes to the final forming die 6. As shown in Figs. 3, 4 and 5, the final forming die 6 is mounted on a base 7 on which are supported the side frames 8. Two cams 9 are pivotally mounted on shafts 10 supported by the side frames, the inner ends 11 of the cams projecting inwardly so that they extend over the final forming die. An upper plunger 12 co-operates with the cams 9 and final forming die 6 to change the U-shaped blank into a finished cylindrical bushing. As the upper plunger 12 descends, it contacts with the inner ends 11 of the cams, rotating the cams about their pivot points 10, and causing the inner ends of the cams to contact with, and crimp in, the upper ends of the

U. This is clearly shown in Fig. 4. After the upper ends have been crimped in and while the U-shaped blank is in the same final forming die 6, the upper plunger 12, as it continues its descent, forces the cams 9 away from contact with the blank, and as the upper plunger 12 contacts with the lower die 6, it forms a finished cylindrical bushing, as shown in Figure 5. Adjusting bolts 13 which contact with ribs 14 of the upper side of the cams, are provided in order to adjust the cams for different sized bushings.

As above stated, the blank 2 shown in Fig. 1 is stamped out from a strip of material. The waste strip material 15 left on each side of the blank is led through guides 16 shown in Figs 3, 4 and 5. This strip material is sheared off as it is delivered from the final forming die, as hereinafter more fully described.

A spring 10' has one of its ends secured in the cam 9 and its opposite end secured to the pin 10. By this means the cams are returned to the position shown in Fig. 3 when the plunger 12 is out of contact with the cams.

Referring to Figs. 6 to 10, inclusive, which illustrate the present preferred embodiment of the invention, the device includes a base 18 on which an oil grooving die 19, a blanking die 20, a U-forming die 21, and a final forming die 22, are mounted. The strip material which is to be formed into a cylindrical bushing enters the forming machine from the left, as shown in Figs. 6, 7 and 9. At the left-hand or forward end of the machine there are arranged straightening rollers 23 which straighten out the strip material passing therebetween. Arranged above the lower dies 19, 20, 21 and 22 is a press 24 having a main plunger 25 which is reciprocated up and down between guides 26 by means not shown. A connecting rod 27 is arranged adjacent the forward end of the forming machine and is connected by means (not shown) to a device for reciprocating it up and down. The lower end of the connecting rod 27 has an arm 28 connected thereto, the opposite end of the arm being secured to a shaft 29 mounted at the forward end of the press 24. A link 30 is connected to the opposite end of the shaft 29 and at its lower end 31 is connected to a link 32.

The opposite end of the link 32 is pivotally connected to a bracket 33 which extends forwardly of the machine. The forwardly projecting arm 34 of the bracket 33 provides bearings 35 and 36 for feed finger rods 37. To the right-hand ends of the rods 37 feed fingers 38 and 39 are secured. The feed fingers 38 move the flat blank which has been stamped out of the strip material from the blanking die to the U-forming die. The feed finger 39 moves the U-shaped blank from the U-forming die to the final forming die.

A stop member 40 is secured to the rods 37

intermediate their ends, and a spring 41 is arranged around the left-hand end of one of the rods 37.

A main feed shaft 42 is connected at its left-hand end to the bracket 33, and at its opposite end is provided with a bracket 43 in which is mounted a core 44. The core is arranged so as to cooperate with the final forming die 22 during the formation of the cylindrical bushing from the U-shaped blank. As shown in Fig. 9, springs 45 and 46 are arranged within housings 47 and 48 underneath the bearings 49 and 50 in order to exert an upward pressure on the bearings which act as guides for the core 44.

When the machine is in operation, power is transmitted through the link 32, bracket 33, main shaft 42, and bracket 43, to the core 44, thereby alternately inserting and withdrawing the core from the final forming die. At the same time, through the arm 34 the feed finger rods 37 are caused to move forward and backward, as are the feed fingers 38 and 39 attached thereto, in order to feed the material through the machine. The spring 41 on one of the shafts 37 eliminates jarring and also provides for some lost motion as the bracket 33 is moved from right to left, as shown in Fig. 10.

The straightening rolls 23 and the feed rolls 52 are actuated from the connecting rod 27 through arm 28, link 30, and link 53. The link 53 is pivotally connected at 54 to the link 30, and at its opposite end to a pin 55 arranged in a collar 56. The collar 56 may be adjusted up and down within the housing 57 by means of a screw 58 extending there-through. A pawl 60 is mounted on a pin 61 secured to the housing 57. The pawl engages a ratchet wheel 62 mounted on a shaft 63 to which one of the feed rolls 52 is secured. The pawl 60 is maintained in contact with the ratchet 62 by a spring 64 connected at 65 to the frame of the machine, and at 66 to an arm 67 secured to the pin 61.

As shown in Fig. 6, power is transmitted from the shaft 63 to the straightening rolls 23, through a chain 68 and clutch 69.

Through the mechanism above described, reciprocation of the connecting rod 27 causes the intermittent rotation of the straightening rolls 23 and the feed rolls 52. It also causes movement of the main shaft 42, thereby causing movement of the core 44 and the feed fingers 38 and 39.

The main plunger 25 has three plungers secured to its lower surface. The three plungers are a blanking plunger 70, a U-forming plunger 71, and a final forming plunger 72. Arranged forwardly of the blanking plunger 70 and connected thereto is an oil grooving plunger 73. These plungers cooperate with the lower dies in the successive steps forming the bushing. The lower dies include an oil grooving die 19, a blanking die

20, a U-forming die 21, and a final forming die 22.

In the operation of the device, a flat strip of material is fed between the straightening rollers 23 and the feed rollers 52, which feed the strip intermittently to the lower dies 19, 20, 21 and 22. The strip is guided in its movement between the feed rolls 52 and the dies by a guide 75. During the feeding of the strip material to the dies the connecting rod 27 and the main plunger 25 are reciprocating up and down. As the strip material enters the die 19, oil grooves are made therein by the oil grooving punch 73. The strip then continues to the die 20 where a blank is punched out by the plunger 70. The blank so punched out from the strip material falls downwardly until it rests on guides 76, but the strips 15 of waste material are guided through the guides 16, shown in Fig. 6, and as they are delivered from the guides, are sheared off by a shear 77 connected to the upper plunger 25, as shown in Fig. 7.

The blank which has dropped down in the blanking die 20 is fed into the U-forming die 21 by means of the hook shaped fingers 38 connected to the forward end of the feed finger rods 37. After the U-shaped blank has been formed in the die 21 by the plunger 71, it is moved to the final forming die 22 by means of the finger 39 shown in Figs. 9 and 10. While the U-shaped blank is in the final forming die, the core 44 is inserted in the blank so that when the upper final forming plunger 72 is next lowered, it first contacts with the cams 9 in order to crimp in the upper ends of the U blank, and thereafter forms a cylindrical bushing having the core 44 therein.

During the downward movement of the plunger 25, an upper bumper pin 78 secured to the plunger 25, contacts with a lower bumper pin 79 secured to the core bearing 49 in order to depress the core within the final forming die, to form a perfect cylindrical bushing.

As the upper die 25 rises, the springs 45 and 46 within the core housing cause the core 44 to move upwardly, thereby freeing the core and bushing from the final forming die, after which the core 44 with a bushing surrounding it, is withdrawn from the final forming die and the bushing is stripped from the core by contact with a bumper plate 80.

The bumper plate is secured to the housing 47 and is provided with an opening slightly larger than the diameter of the core 44. The opening is smaller than the outside diameter of the bushing which has been formed. Accordingly, when the core having a cylindrical bushing thereon is moved to the right, as viewed in Figure 9, the bushing contacts with the bumper plate 80, which prevents it from moving farther to the right, while the core 44 continues to slide in the bearings 49 and

50, thus stripping the bushing from the core. The bushing drops downwardly through an opening in the forming machine.

My invention provides means whereby a finished cylindrical bushing can be made in one step and in one die directly from a blank having a U-shape. I therefore am able to make different length bushings of the same diameter without the necessity of changing the U-forming die each time a different size bushing is made.

By practicing my invention the strip material, left after the blanking operation, is fed away from the dies so as not to interfere therewith, and is cut into pieces of convenient size for handling, as it is discharged from the machine.

I have illustrated and described the present preferred embodiment of my invention. It is to be understood, however, that the invention may be otherwise embodied without departing from the spirit of the invention, or the scope of the following claims.

I claim:

1. In the method of forming cylindrical bushings, the steps comprising forming a U having substantially straight legs extending upwardly, feeding the U into an immovable final forming die, and crimping in the ends of the U and forming a cylindrical bushing in said die.

2. In the method of forming cylindrical bushings wherein strip material is fed intermittently to immovable dies, the steps comprising forming a U from a blank in a die, said U having its legs extending upwardly, feeding the U into a die, and crimping in the ends of the U and forming a cylindrical bushing in said last mentioned die.

3. In the method of forming bushings from strip material which is fed intermittently to dies arranged in a forming machine, the steps comprising stamping out a blank, forming a bushing therefrom, feeding the waste strip portions resulting from the stamping operation through the machine, and cutting the strips into smaller lengths as they leave the machine.

4. In the method of forming bushings from strip material which is fed intermittently to dies arranged in a forming machine, the steps comprising stamping out a blank, forming a bushing therefrom, feeding the waste strip portions resulting from the stamping operation through guides spaced laterally of the dies, and cutting the strips into smaller lengths.

5. In the method of forming bushings from strip material which is fed intermittently to cooperating dies and plungers of a forming machine, the steps comprising stamping out a blank, forming a bushing therefrom, feeding the waste strip portions resulting from the stamping operation through guides spaced laterally of the dies, and cutting into

smaller lengths at each stroke of the plungers the strips leaving the machine.

6. In a machine for forming cylindrical bushings from strip material fed intermittently to cooperating dies and plungers, means for stamping out a blank, means for bending the blank into a U, a final forming die adapted to receive the U, a final forming die plunger, and cams arranged in cooperative relation with said plunger and die whereby when the plunger is actuated the cams first crimp in the ends of the U and the plunger thereafter completes the cylindrical bushing.

7. In a machine for forming cylindrical bushings from strip material fed intermittently to cooperating dies and plungers, means for stamping out a blank, means for forming a U from the blank, a final forming lower die having a semi-cylindrical recess therein adapted to receive the U, a final forming die plunger having a semi-cylindrical recess therein of the same diameter as the lower die recess, pivotally mounted cams arranged so as to have portions extending between said plunger and lower die, and means for normally holding said cams from contact with the U, said cams being so arranged that when the plunger is actuated the cams first crimp in the ends of the U and the plunger thereafter completes the cylindrical bushing.

8. In a machine for forming cylindrical bushings from strip material fed intermittently to cooperating dies and plungers, means for stamping out a blank, a U forming die, feed fingers for feeding the blank to the U forming die, a final forming die, a second feed finger for feeding the U from the U forming die to the final forming die, and means for forming a cylindrical bushing from the U in the final forming die.

9. In a machine for forming cylindrical bushings from strip material fed intermittently to cooperating dies and plungers, means for stamping out a blank, means for bending the blank into a U, means for feeding the waste strip portions resulting from the stamping operation through the machine, and means for cutting the strips into smaller lengths as they leave the machine.

10. In a machine for forming cylindrical bushings from strip material fed intermittently to cooperating dies and plungers, means for stamping out a blank, means for bending the blank into a U, guides spaced laterally of the dies for guiding the waste strips through the machine, and means for cutting the strips into smaller lengths.

11. In a machine for forming cylindrical bushings from strip material fed intermittently to cooperating dies and plungers, means for stamping out a blank, means for bending the blank into a U, guides spaced laterally of the dies for guiding the waste strips through the machine, a final forming die, and

shearing elements associated with the final forming die and the plunger for cutting the strips into smaller lengths.

12. In a machine for forming cylindrical bushings from strip material, means for stamping out a blank, means for bending the blank into a U with the legs of the U substantially parallel and the closed end extending downwardly, a final forming die, means for feeding the U to said die, and means including a final forming die plunger for crimping in the ends of the U and forming a cylindrical bushing therefrom.

13. In a machine for forming cylindrical bushings from strip material, means for stamping out a blank, means for bending the blank into a U with the legs of the U substantially parallel and the closed end extending downwardly, an immovable final forming die, means for feeding the U to said die, and means including a final forming die plunger for crimping in the ends of the U and forming a cylindrical bushing therefrom.

14. In a machine for forming cylindrical bushings from strip material, means for stamping out a blank, means for bending the blank into a U with the legs of the U substantially parallel and the closed end extending downwardly, an immovable final forming die, means for feeding the U to said die, and means including a final forming die plunger for crimping in the ends of the U and forming a cylindrical bushing therefrom, said final forming die plunger having contact with the formed cylindrical bushing throughout substantially the entire length thereof.

15. In the method of forming cylindrical bushings, the steps comprising intermittently feeding strip material to immovable dies, forming a blank from the strip material, bending the blank into a U with the legs of the U extending upwardly, feeding the U into an immovable die, and forming in said die a cylindrical bushing from the U.

16. In a machine for forming cylindrical bushings from strip material fed intermittently to cooperating dies and plungers, means for stamping out a blank, a U-forming die, means for feeding the blank to the U-forming die, a final forming die having a semi-cylindrical recess open at its top, means other than the material being shaped for feeding the U into the final forming die, and means for forming a cylindrical bushing from the U in the final forming die.

In testimony whereof I have hereunto set my hand.

CARL H. LEIS.