

Jan. 8, 1924.

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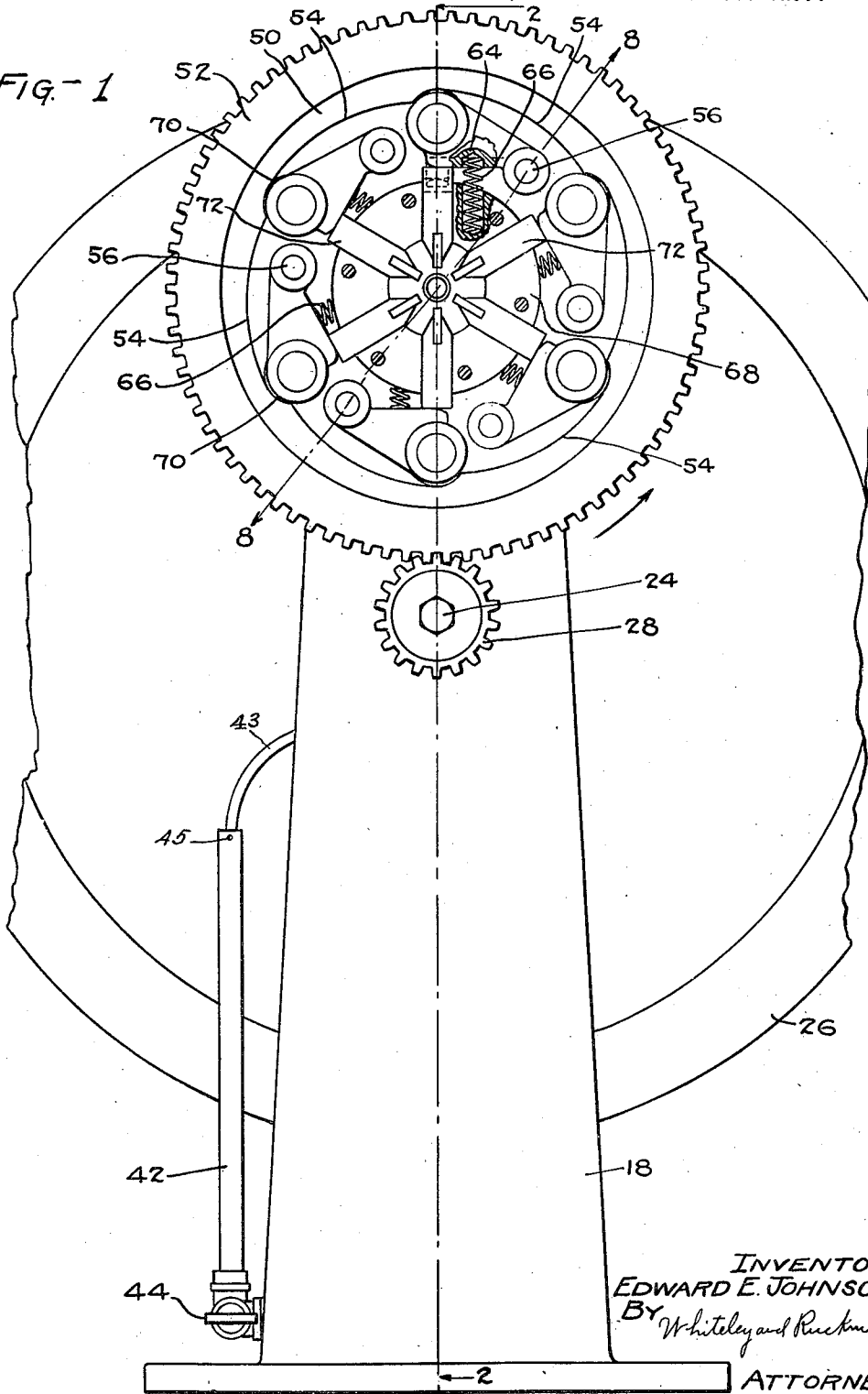
E. E. JOHNSON

DIE FORGING MACHINE

Filed Feb. 13, 1920

5 Sheets-Sheet 1

FIG. 1



Jan. 8 , 1924.

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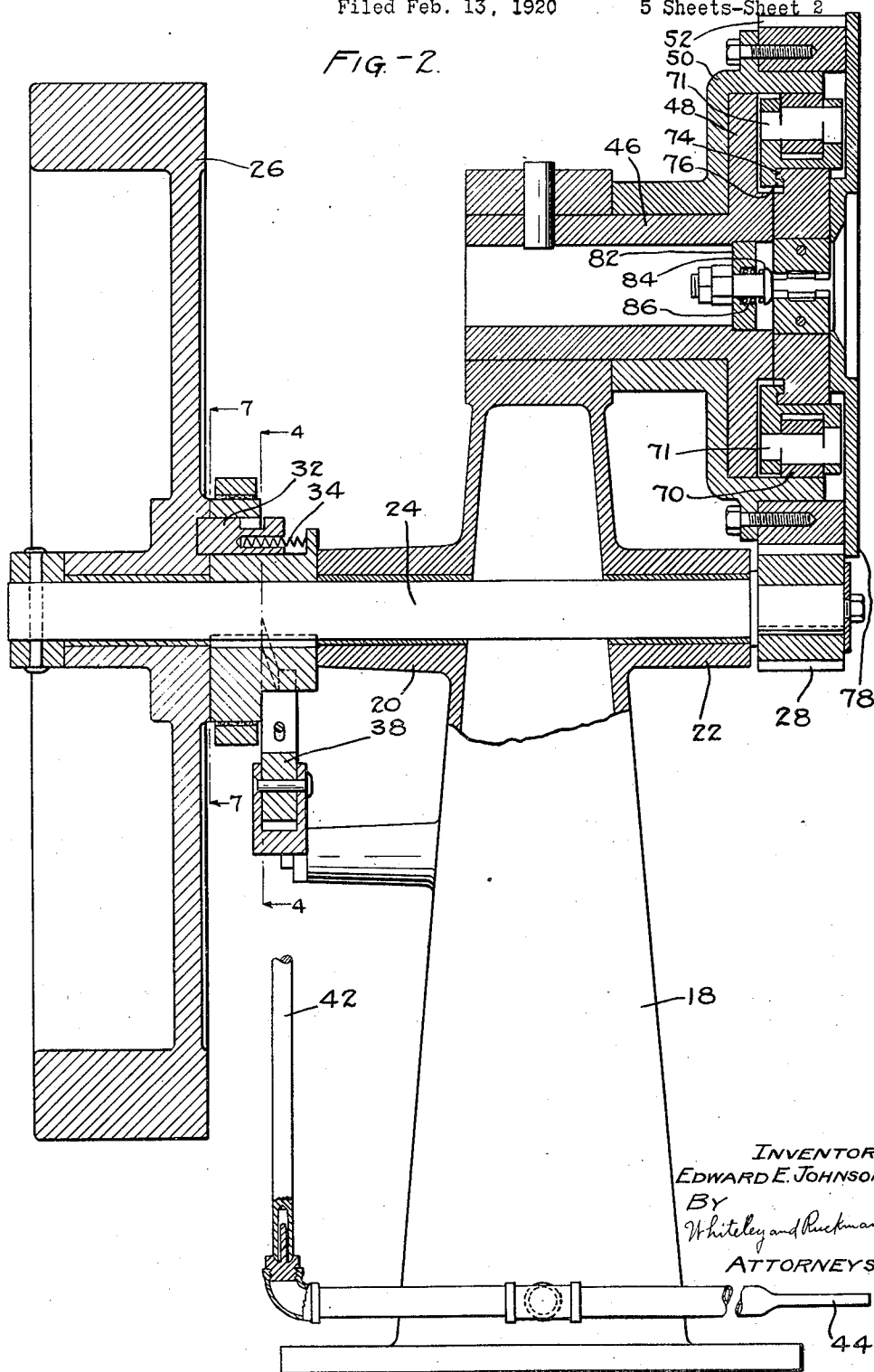
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FIG. 2.



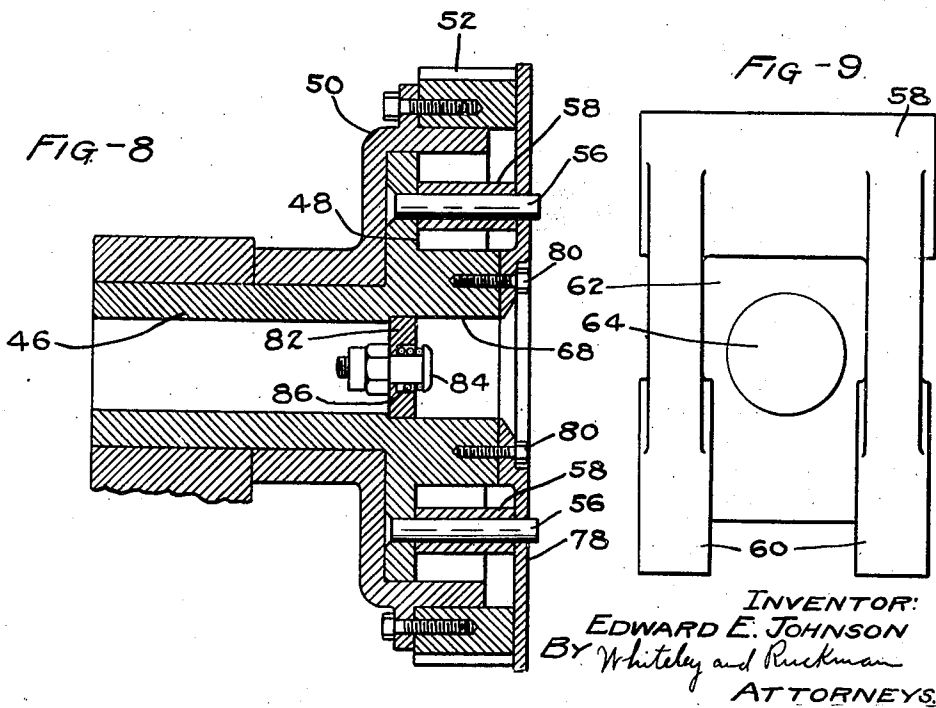
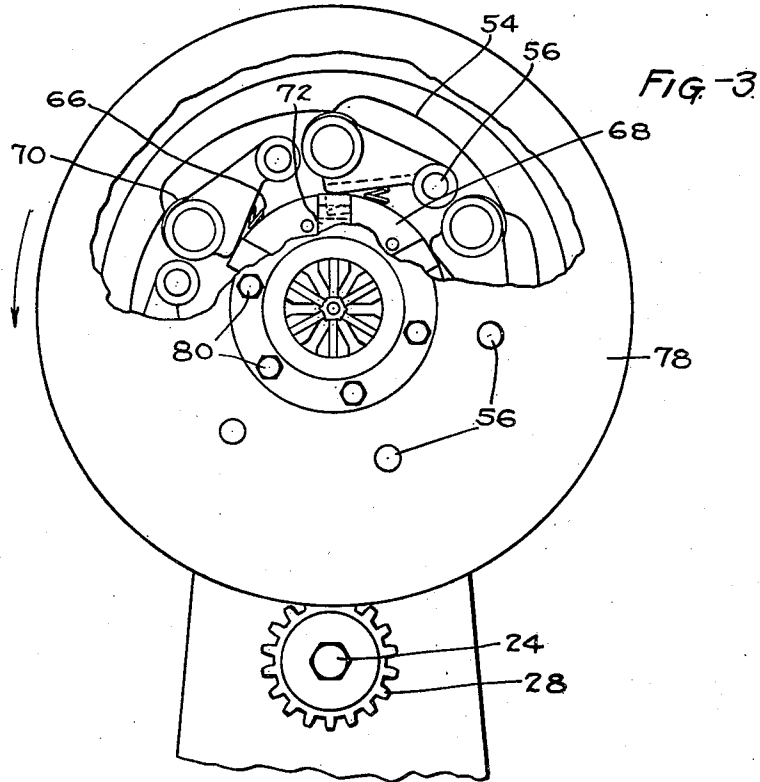
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5 Sheets-Sheet 3



INVENTOR:
EDWARD E. JOHNSON
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Jan. 8, 1924.

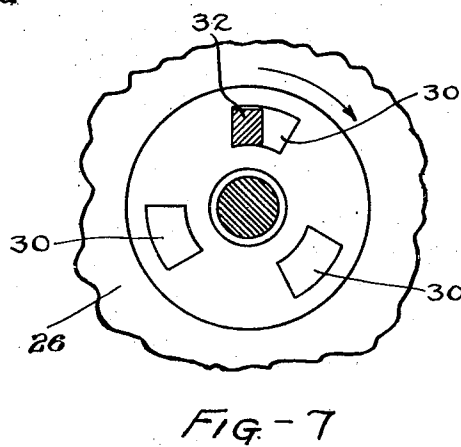
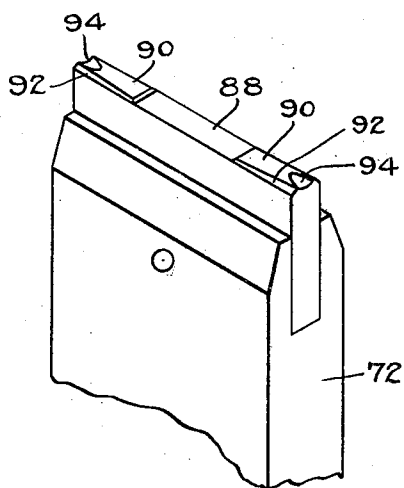
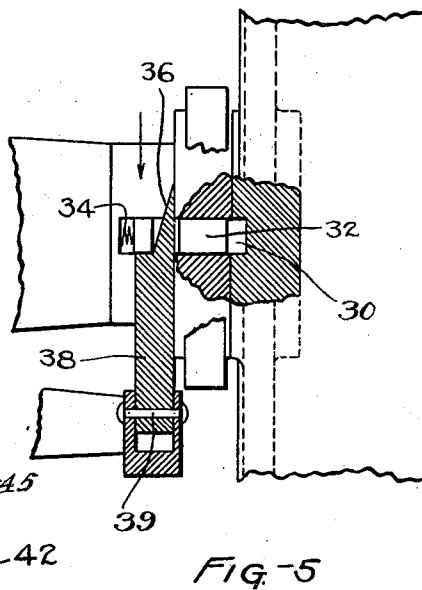
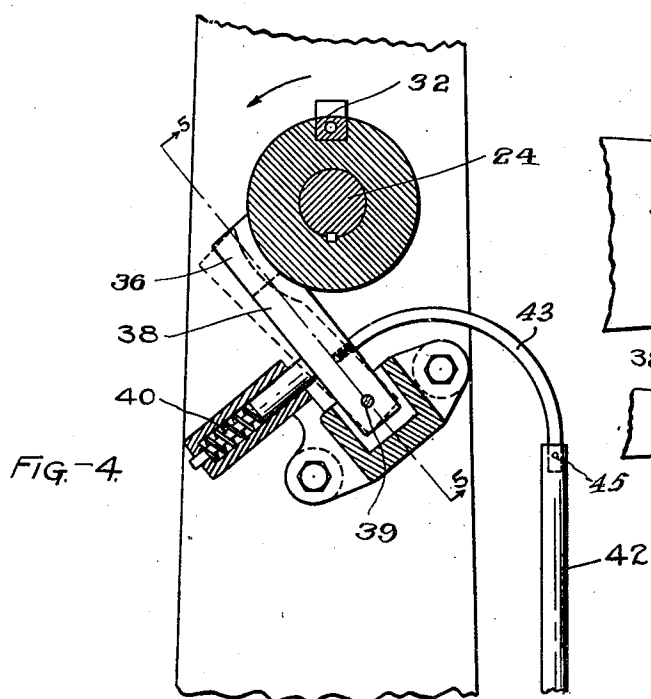
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5 Sheets-Sheet 4



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DIE FORGING MACHINE

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Fig.-10

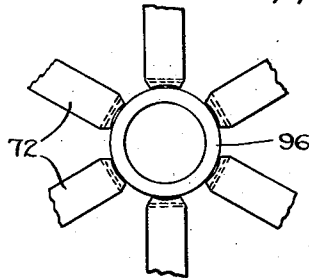


Fig.-11.

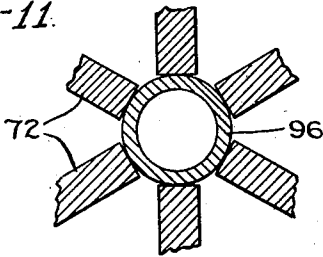


Fig.-12

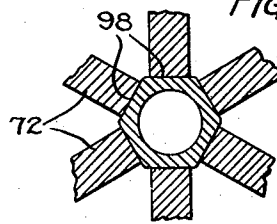


Fig.-13

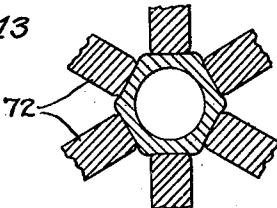


Fig.-14

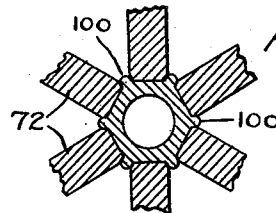


Fig.-15

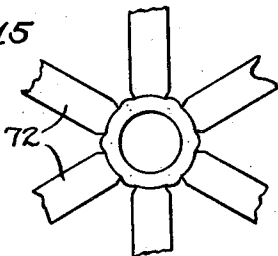


Fig.-16

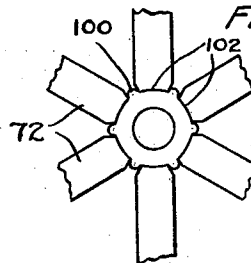
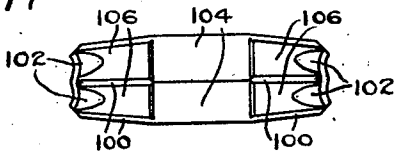


Fig.-17



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Patented Jan. 8, 1924.

1,480,077

UNITED STATES PATENT OFFICE.

EDWARD E. JOHNSON, OF ST. PAUL, MINNESOTA.

DIE-FORGING MACHINE.

Application filed February 13, 1920. Serial No. 358,449.

To all whom it may concern:

Be it known that I, EDWARD E. JOHNSON, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Die-Forging Machines, of which the following is a specification.

My invention relates to die forging machines and an object is to provide a machine for forging heated blanks by compression between dies to form couplings. An object in particular is to provide a machine of this character for expeditiously and economically making couplings such as disclosed in my application for patent Serial Number 358,447, filed Feb. 13, 1920.

The full objects and advantages of my invention will appear in connection with the detailed description thereof and the novel features of my inventive idea will be particularly pointed out in the claims.

In the accompanying drawings,—

Fig. 1 is a front elevational view of the machine having the cover plate removed. Fig. 2 is a view mostly in section on the line 2—2 of Fig. 1. Fig. 3 is a view showing the die-operating mechanism in a different position from that shown in Fig. 1 and with the cover plate partly broken away. Fig. 4 is a view in section on the line 4—4 of Fig. 2. Fig. 5 is a view in section on the line 5—5 of Fig. 4. Fig. 6 is a view in perspective of one of the die members. Fig. 7 is a view in section on the line 7—7 of Fig. 2. Fig. 8 is a view in section on the line 8—8 of Fig. 1. Fig. 9 is a plan view of one of the operating levers for the dies. Figs. 10 to 16 are detail views showing different positions of the dies and coupling blank during the forging operation. Fig. 17 is a side elevational view of the coupling after it has been finished by the dies.

Referring to the construction shown in the drawings, a standard 18 is provided with bearings 20 and 22 for a shaft 24 upon one end of which is loosely mounted a belt-pulley fly-wheel 26 while a pinion 28 is secured to the other end of said shaft. The fly-wheel 26 and the shaft 24 are adapted to be clutched together by a suitable one-revolution clutch. In the embodiment shown the hub of the fly-wheel is provided with recesses 30 any one of which is adapted to receive

a clutch member 32 when the latter is forced toward the fly-wheel by a spring 34, the clutch member being normally retracted by an inclined surface 36 carried by an arm 38. This arm is pivoted upon a pin 39 and is held in clutch-disengaging position by a spring 40 and is moved out of this position into clutching position by operation of a connecting member 42 when a pedal 44 is depressed to give the shaft 24 one rotation.

The connecting member 42 is provided at its upper portion with a curved extension 43 which is pivoted at one end as indicated at 45 to the main portion of the connecting member, and which at its other end is attached to the arm 38. To the upper end of the standard 18 is secured a sleeve 46 which is provided with annular flange 48. Rotatably mounted upon said sleeve and flange is an annular member 50 upon the outer margin of which is a gear 52 meshing with the pinion 28. The inner margin of the annular member 50 is provided with a plurality of cam surfaces 54, preferably six in number. Pivottally mounted upon pins 56 carried by the annular flange 48 are sleeves 58 from which extend arm members each of which includes two side portions 60 and a floor portion 62. The floor portions 62 are provided with sockets 64 for receiving one end of springs 66 as shown in Fig. 1. The other ends of these springs are received by sockets formed in guide members 68 which extend outwardly from the sleeve 46. Mounted between the side portions 60 are rollers 70 which are maintained in contact with the cam surfaces 54 by means of the springs 66. The rollers 70 may be supported upon eccentrically mounted pins 71 to permit adjustment of the position of the rollers. The members 72 are arranged for radial sliding movement between the guide members 68, the die members corresponding in number with the cam faces 54 which when the gear 52 is rotated move the die members simultaneously toward the center of rotation of said gear. The outer ends of the die members are provided with flanges 74 which are engaged by flanges 76 carried by the floor portions 62 as shown in Fig. 2, so that the die members are caused to move simultaneously inward and outward as the gear 52 and the cam faces 54 rotate. An open center plate 78 is secured to the guide

members 68 by screw-bolts 80, and the outer ends of the pins 56 extend through holes in this plate whereby the pins are additionally supported, as best shown in Fig.

8. The sleeve 46 is slightly enlarged toward its outer end to receive a disk 82 which supports a button 84 backed up by a spring 86.

The die members 72 are provided with die faces, which are best shown in Fig. 6. Each die face consists of a middle portion 88 and two end portions 90 which are raised above the middle portion and are inclined slightly upwardly as they extend away from the middle portion. The end portions 90 are beveled at each side as indicated at 92 and at their outer ends are provided with curved depressions 94. The reason for constructing the die faces in this manner will be understood from Figs. 10 to 16. Fig. 10 is an end view in which the blank 96 and the dies 72 are shown in the position which they occupy at the inception of the forging operation. The end portions of the dies are in contact with the surface of the blank while, as shown by dotted lines, the middle portions of the dies have not yet reached the blank. Figs. 11 and 12 are sectional views through the middle portion of the blank 96 and the dies 72, Fig. 11 showing the dies advanced so that they just contact with the blank and Fig. 12 showing the blank and dies in final position. In the latter figure the hexagonal shape of the middle portion of the coupling having faces 98 is shown. Figs. 13 and 14 are sectional views through the dies and the blank about midway of an end portion of the latter. Fig. 13 shows the dies advanced sufficiently to partly shape the blank, while Fig. 14 shows the dies advanced into final position whereby the end portions of the coupling have a reduced hexagonal exterior the faces of which are separated by longitudinal radial ribs 100 which are formed on account of the die faces being beveled as shown at 92 in Fig. 6. Figs. 15 and 16 are end views, Fig. 15 showing the dies advanced sufficiently to partly shape the blank while Fig. 16 shows the dies advanced into final position. The end of the coupling in Fig. 16 is shown with the curved portions 102 which are formed by the depressions 94 at the ends of the die faces. It will be apparent from Figs. 10 to 16 that the coupling is provided with reduced end portions or neck portions having cylindrical ends merging into an outer surface of hexagonal form the faces of which are separated by reinforcing ribs which extend longitudinally from the middle portion to the extreme ends of the coupling. Fig. 17 shows the exterior shape of the coupling after it has been finished by the dies. By reference to Fig. 6, which shows one of the six cooperating dies, it will be readily seen how the final shape is given the coupling by means of the die faces.

The middle portion 88 of each die face forms one of the faces 104 of the middle portion of the coupling, the end portions 90 form the faces 106 of the end portions of the coupling, the beveled portions 92 provide for the ribs 100, and the curved depressions 94 form the curved elevations or protuberances 102.

The operation and advantages of my invention will be readily understood from the foregoing description. The blanks are preferably produced by cutting off sections of proper length from a cylindrical metal tube. These blanks are heated and inserted one at a time through the open center of the plate 78 so that a blank extends between the dies with its rear end engaging the spring-pressed button 84. The operator then steps on the pedal 44, which causes the shaft 24 and the pinion 28 to make one complete turn or rotation. While I have shown six dies it is obvious that the number of dies may be varied without departing from the principle of the invention, and hence, I do not consider it necessary to show any exact gear ratio. It will be understood that the gear ratio will be such that the one revolution clutch each time it is operated causes the gear 52 and the annular member 50 to make a fractional part of a rotation which corresponds to the number of dies used. The cam faces cause simultaneous inward radial movement of the dies with the result that the heated blank is forged into the shape corresponding to the die faces. The gear 52 comes to rest with the rollers 70 in the low portion of the cam faces 54 and the springs 66 cause the dies to be simultaneously retracted. The spring-pressed button 84 allows a slight longitudinal flow of the metal but most of the surplus material resulting from the contraction of the ends of the blank is utilized in producing the ribs 100 and the protuberances 102 which serve to strengthen the coupling. Bulging or distortion of the inner wall of the blank is avoided and the cylindrical interior shape of the contracted end portions is maintained so that these portions may be readily provided with interior screw threads. By employing my process, in which heated cylindrical tubular blanks are subjected to radially-directed inward pressure applied at regular intervals around the blank to give a polygonal exterior shape thereto, I am able to dispense with a mandrel and still maintain the interior cylindrical surface of the blank. Since the pressure is equally distributed around the blank, there is no distortion of the internal surface from the true cylindrical shape. The result of the applied pressure is to cause an exterior flow of metal to produce the polygonal shape, but the interior curve of the blank acts in the manner of an arched structure and the interior cylindrical shape is maintained.

I claim:

1. A die forging machine comprising a rotatable member, a plurality of dies mounted for radial movement toward and away from the article operated upon, operating connections between said dies and said rotatable member for moving all of said dies in unison inwardly and outwardly, and means for imparting to said rotatable member a fractional part of a complete rotation corresponding to the number of said dies.

2. A die forging machine comprising a rotatable member, a plurality of fixed spaced guides arranged in annular relation, dies mounted between said guides for radial movement toward and away from the article operated upon, operating connections between said dies and said rotatable member for moving all of said dies in unison inwardly and outwardly, and means for imparting to said rotatable member a fractional part of a complete rotation corresponding to the number of said dies.

3. A die forging machine comprising a standard, a driving shaft journaled in said standard, a pinion secured to said shaft a rotatable member mounted on said standard, a gear secured to said rotatable member meshing with said pinion, a plurality of fixed spaced guides arranged in annular relation, dies mounted between said guides for radial movement toward and away from the article operated upon, operating connections between said dies and said rotatable member for moving all of said dies in unison inwardly and outwardly and means for driving said shaft to impart to said rotatable member a fractional part of a complete rotation corresponding to the number of said dies.

4. A die forging machine comprising a standard, a driving shaft journaled in said standard, a pinion secured to said shaft, a rotatable member mounted on said standard, a gear secured to said rotatable member meshing with said pinion, a plurality of cam surfaces annularly arranged on the inner margin of said rotatable member, a plurality of pivotally supported arm members, means for maintaining the free ends of said arm members in contact with said cam surfaces, a plurality of fixed spaced guides arranged in annular relation, dies mounted between said guides for radial movement toward and away from the article operated upon, operating connections between said dies and said pivoted arm members, and means for driving said shaft to impart to the said rotatable member a fractional part of a complete rotation corresponding to the number of said dies.

5. A die forging machine comprising a standard, a driving shaft journaled in said standard, a pinion secured to said shaft, a sleeve secured to said standard, an annular

flange on said sleeve, a rotatable member mounted on said sleeve and said flange, a gear on the outer margin of said rotatable member meshing with said pinion, a plurality of cam surfaces annularly arranged on the inner margin of said rotatable member, a plurality of pivotally supported arm members, means for maintaining the free ends of said arm members in contact with said cam surfaces, a plurality of fixed spaced guides arranged in annular relation, dies mounted between said guides for radial movement toward and away from the article operated upon, operating connections between said dies and said pivoted arm members, and means for driving said shaft to impart to said rotatable member a fractional part of a complete rotation corresponding to the number of said dies.

6. A die-forging machine comprising a standard, a shaft journaled in said standard, a one-revolution clutch for operating said shaft, a pinion secured to said shaft, a fixed sleeve secured to said standard, an annular flange secured to said sleeve, an annular member journaled on said sleeve and flange, a gear carried by the outer margin of said annular member, said gear meshing with said pinion, a plurality of cam surfaces formed on the inner margin of said annular member, a plurality of arm members pivoted to said annular flange, rollers mounted on the free ends of said arm members adjacent said cam surfaces, springs for maintaining said rollers in contact with said cam surfaces, a plurality of guide members extending outwardly from the front of said fixed sleeve, dies mounted between said guides for radial movement toward and away from each other, said dies being attached to said pivoted arm members, and a spring-pressed button supported at the center of said fixed sleeve at the rear of said dies.

7. A die-forging machine comprising a standard, a shaft journaled in said standard, a one-revolution clutch for operating said shaft, a pinion secured to said shaft, a fixed sleeve secured to said standard, an annular flange secured to said sleeve, an annular member journaled on said sleeve and flange, a gear carried by the outer margin of said annular member, said gear meshing with said pinion, a plurality of cam surfaces formed in the inner margin of said annular member, a plurality of pivot pins carried by said annular flange, sleeves pivotally mounted on said pins, arm members having side portions and floor portions extending from said sleeves, rollers adjustably mounted in said side portions adjacent said cam surfaces, springs for maintaining said rollers in contact with said cam surfaces, a plurality of guide members extending outwardly from the front end of said fixed

sleeve, dies mounted between said guides for radial movement toward and away from each other, means for attaching said dies to the floor portions of said pivoted arm members, a spring-pressed button supported at the center of said fixed sleeve at the rear of said dies, and an open center cover-plate secured to the front of said guide members, said cover-plate being provided with holes for receiving the outer ends of said pivot pins. 10

In testimony whereof I hereunto affix my signature.

EDWARD E. JOHNSON.