

June 22, 1965

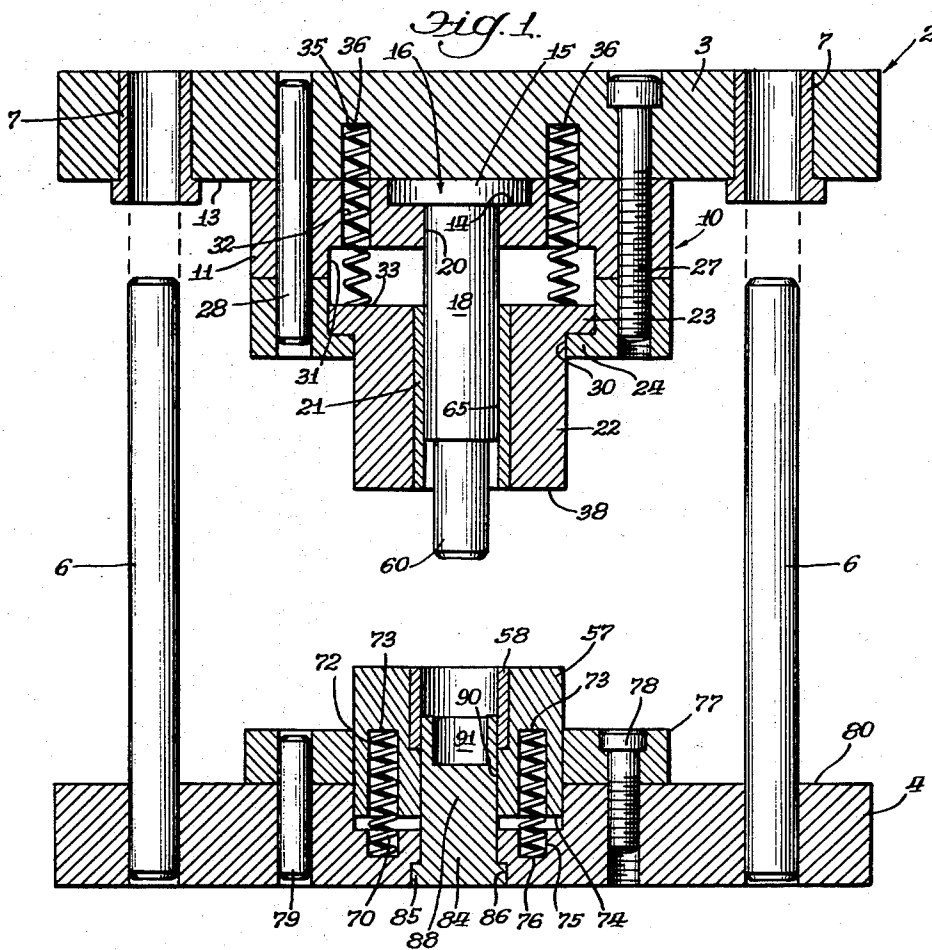
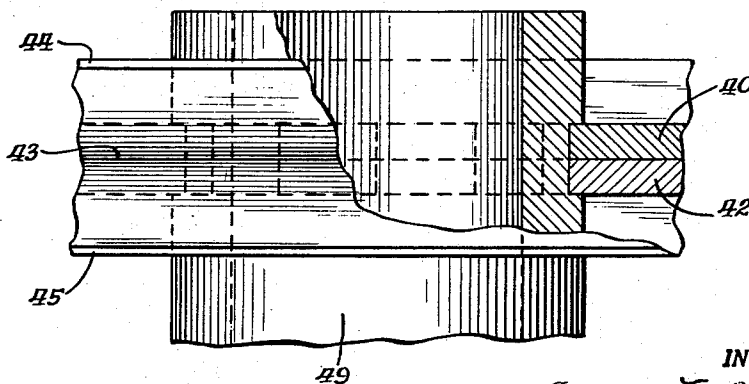
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3,190,134

HUB DRIVEN DEVICE AND MEANS AND METHOD FOR MAKING THE SAME

Filed Aug. 9, 1963

3 Sheets-Sheet 1



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HUB DRIVEN DEVICE AND MEANS AND METHOD FOR MAKING THE SAME

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3 Sheets-Sheet 2

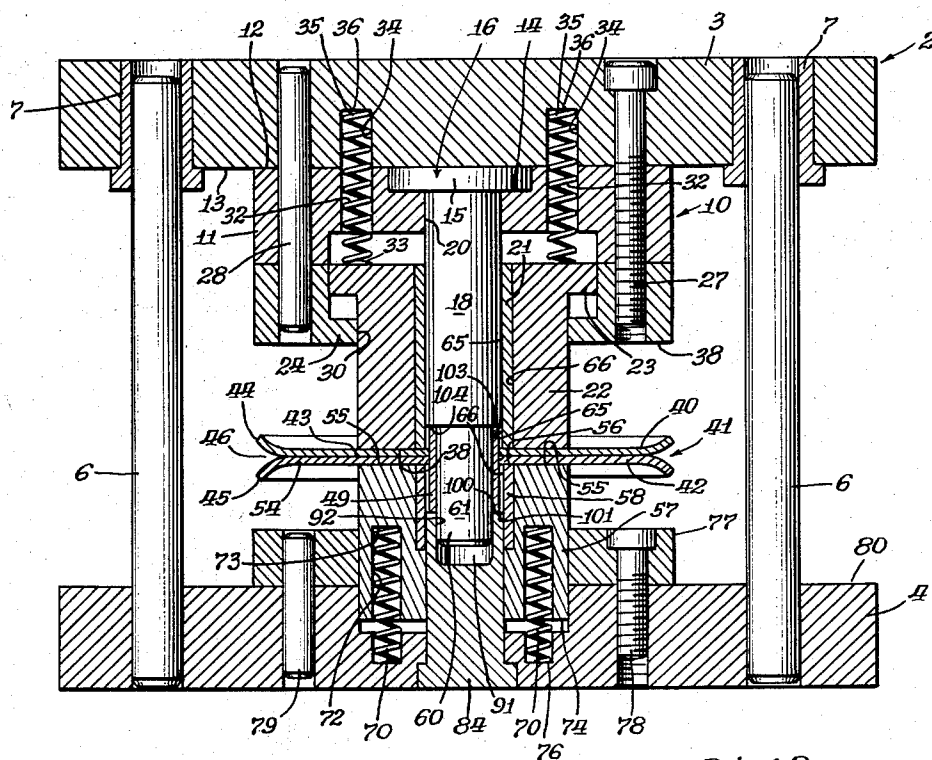


Fig. 2.

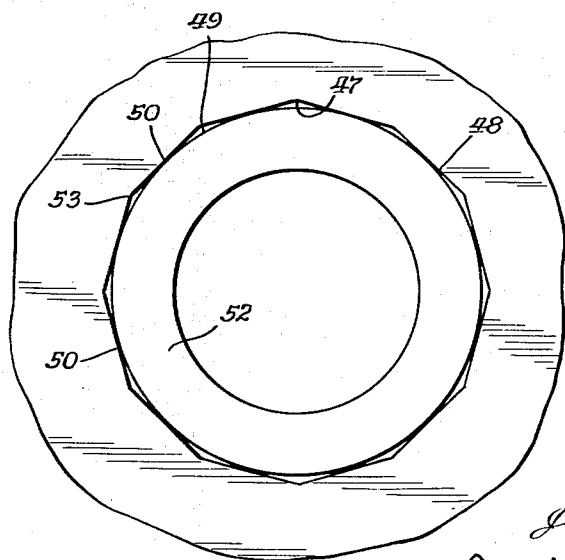


Fig. 4.

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3 Sheets-Sheet 3

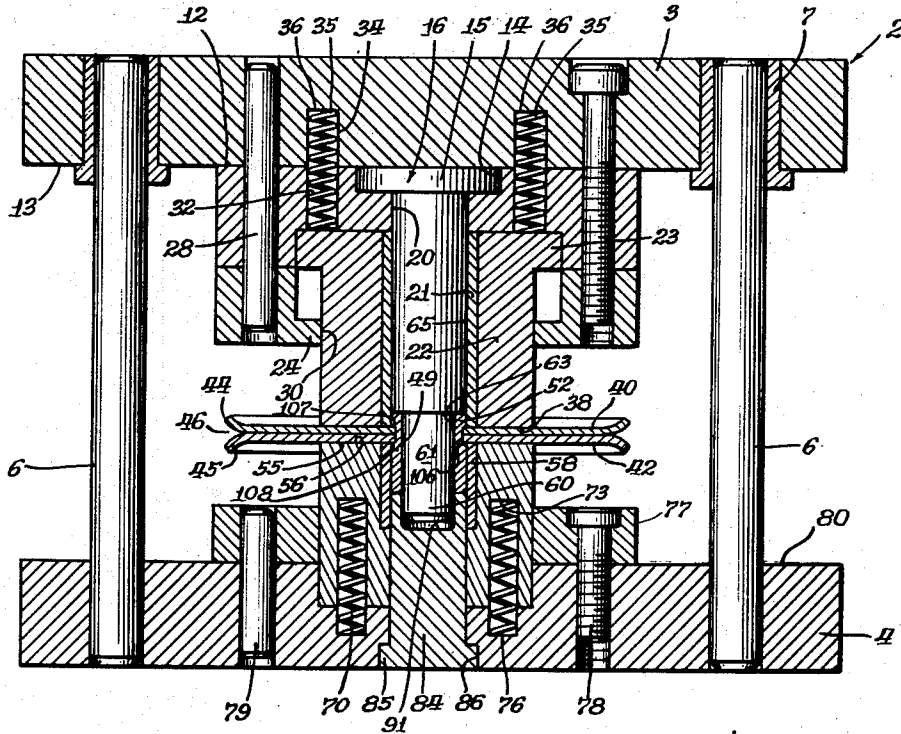


Fig. 3.

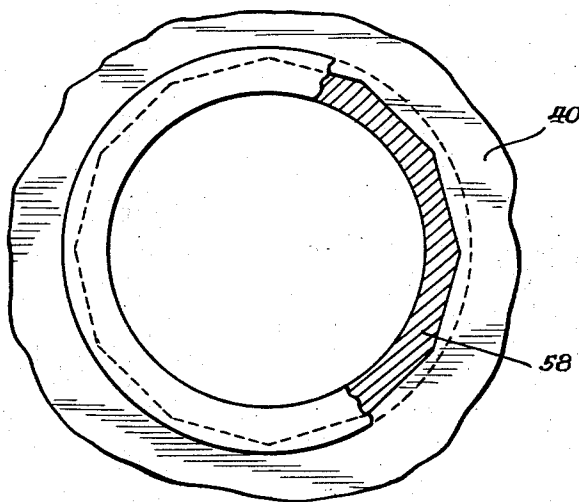


Fig. 5.

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1

3,190,134

HUB DRIVEN DEVICE AND MEANS AND METHOD FOR MAKING THE SAME

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5 Claims. (Cl. 74—230.4)

This application is a continuation-in-part of U.S. application 25,670 filed April 29, 1960, now abandoned, for Hub Driven Device and Method of Making the Same.

This invention relates to hub driven devices such as pulleys, sprockets, gears and the like and more specifically to a novel fabricated hub driven device including the means and the method to fabricate the same.

A general object of the invention is to provide a novel hub driven device wherein the hub and the outward web portion of the device are telescoped and wherein these parts are interlocked through a deformation or extrusion of the hub portion by controlling the flow of the material to embrace the web portion of the device and to cause it to flow into the inner peripheral non-round opening of the web portion.

A primary object of the invention is to provide a novel hub driven device wherein the union between the hub and the surrounding portion obtains universal flexibility which accommodates deviations in the application of the device whether as a driving or a driven element so as to eliminate or materially reduce the fatigue stresses which obtain premature fractures in devices wherein the hub and the surrounding portion are integral or connected by common securing means such as rivets or bolt and nut assemblies.

A further object of the invention is to provide a novel die assembly which incorporates a diameter-maintaining punch which extends into a cylindrical tubing which forms the hub of the device and wherein the tubing is confined within the die structure and pursuant to application of axial pressure on the ends of the tubing the tubing is caused to contract axially with coincidental displacement of the metal and a reduction in the axial dimension as accommodated within the die cavity to cause flow radially outwardly at opposite sides of the flange portion or web portion of the hub driven device, the tube being axially compressed to cause the material to flow radially outwardly beyond an incremental edge portion of the web which projects into the die cavity to tightly embrace the web at opposite sides and hold the same normal to the axis of the hub portion.

A still further object of the invention is to provide a novel hub driven device wherein the hub portion is provided with an aperture having a non-round, preferably geometric configuration providing opposed areas at opposite sides of the opening which are spaced at a distance from each other substantially equal to the outer diameter of the hub forming tube portion which is inserted into the aperture, the aperture providing a series of cavities or notches intermediate these areas into which the metal is caused to flow pursuant to distortion and flow of the material of the tube as it is being formed into a hub within the web portion of the hub driven device.

A further object of the invention is to provide a novel mechanism for forming the parts into a unitary assembly and wherein the dimensions are critically controlled within very close tolerances.

These and other objects of the invention will become more apparent from the specification and the drawings wherein:

FIGURE 1 is a vertical sectional view through the die assembly showing the same in open position;

FIGURE 2 is a similar view showing the die closed and the parts of the hub driven device mounted therein;

2

FIGURE 3 shows the die assembly at the bottom of the stroke;

FIGURES 4 and 5 are fragmentary side elevational view respectively of the parts prior and after forming; and

FIGURE 6 is an enlarged fragmentary edge view partially in radial section.

Describing the invention in detail and having reference to FIGURES 1 through 3, there is shown a die assembly generally designated 2 which comprises upper and lower platens 3 and 4, the lower platen 4 being provided with upstanding guides 6 which enter into the bushed openings 7 in the upper platen 3.

The upper platen 3 carries the male die structure generally designated 10 which includes a clamping plate or member 11 seated as at 12 against the underside 13 of the top platen 3, the said clamp member 11 being provided with a recess 14 receiving the head 15 of a punch generally designated 16, said head 15 being retained within the recess 14 between the surface 13 of the platen 3 and the opposed shoulder 17 of the member 11 which surrounds the shank portion 18 of the punch. Portion 18 extends through an opening 20 in the clamp member 11, and is preferably cylindrical and projects through a bushing or sleeve 21 of an upper blank retainer and guide 22 which at its upper end is provided with a radial flange 23 seated behind an intumed flange or shoulder 24 of a retainer block 25, the block 25 being secured together with the retainer block 11 to the upper platen 3 by means of bolts 27 and dowels 28.

The retainer and guide sleeve assembly 22 is reciprocal within an opening 30 defined by the inner periphery of the flange 24 and is movable into a cavity 31 against the resistance of the springs 32 which at one end bear as at 33 against the upper side or end of the sleeve 22 and at the other end each spring 32 being received within a confining bore 34 extending through the retainer block 11 and into the upper platen 3. The upper end 35 of each spring 32 seats as at 36 against an upper closed end surface of the associated bore 34. The springs 32 urge the sleeve 22 downwardly in stripping relation to the shank 18 of the punch 16. The combination sleeve and retainer or holder provides a gripping end or surface 38 which in the closed position of the die engages the web or flange 40 of the hub driven device generally designated 41 and herein shown as a split pulley. The web 40 as well as the opposing web 42 seats against each other as at 43 and are provided with outturned or diverging peripheral annular portions 44 and 45 which form the V-groove 46 of the pulley. It will be understood that the two-piece outer part is herein shown in the nature of a pulley, however the same could be a one-piece outer part such as a sprocket or gear or the like. As will readily be seen from a consideration of FIGURES 4 and 5, the webs 40 and 42 of the outer part each comprise a non-round opening 47 which is preferably of geometrical polysided configuration to provide edges of tangency at 48 which contact the outer periphery 49 as at 50 of the hub or tubular member 52 so as to concentrically and accurately position the tubular member 52 with respect to the outer structure. At the same time the shape of the opening 47 provides spaces or cavities at 53 for the flow of the material of the hub in order to provide an interlock between the outer and the inner members, as hereinafter explained.

Referring now to FIGURE 2, it will be seen that the bottom side 54 of the outer part of the hub driven device is engaged as at 55 by the outer end clamping edge or surface 56 of the bottom or lower blank retainer and guide 57 which is of tubular construction and which has a carbide or hardened and ground wear and forming sleeve 58 receiving the lower end 60 of the punch head 61 of the punch 16. It will be appreciated that the punch

3

head 61 is of smaller diameter than the shank portion 18 from which the punch head depends and that it is of a diameter or dimension conforming to the internal diameter of the internal bore 63 of the hub portion 52. It will be seen that in the closed position of the die that the internal bores 65 and 66 of the sleeves 21 and 58 are of larger diameter than the initial outer diameter indicated OD₁ of the cold drawn tubing 52 and that the head 61 of the punch serves to center the entire hub driven device 41 within the die.

It will be seen that in order to obtain good closure and clamping action between the upper and lower blank retainer and guides, which are in axial alignment with each other, that the lower blank retainer and guide 57 is spring-loaded by means of a plurality of springs 70 each of which extends into a bore 72 within the guide 57 and seats against a closed end 73 of the bore 72, the lower end of each spring 72 projecting below the lower end 74 of the retainer 57 and entering into a pocket 75 and seating as at 76 in the lower closed end of the pocket 75 which is formed in the lower mounting plate or platen 4. It will be seen that the retainer 57 is guided externally by means of a retainer block 77 which is secured by bolts 78 and dowels 79 on the top side 80 of the lower platen 4, the guide member 57 being movable against the compression of the springs 70 vertically within the bore or opening 82 in the retainer 77 and being urged constantly upwardly by the reaction of the springs 70. The retainer 57 is guided internally by the lower forming punch 84 which has a head 85 complementing fitting within a cavity 86 in the under portion of the platen 4, the punch 84 having an upwardly extending shank portion 88 which fits within an internal bore 90 of the retainer 57. The upper end of the punch 84 is provided with an upwardly opened cavity 91 which receives the lower end 60 of the punch head 61, as best seen in FIGURES 2 and 3.

In preparing the hub portion 52 for insertion in the die the same is treated with a molybdenum-disulfide lubricant, which permits the punch end 61 to be withdrawn from the formed hub portion 52 and the hub portion 52 to be extracted from the upper and lower assemblies 22 and 57 and particularly from the hardened sleeves 21 and 58.

In operation, the hub blank 52 which is a mechanical cold drawn tubing is inserted within outer members 40, 42 and positioned in the die cavities 65 and 66 and sleeved over the lower end portion 60 of the lower end 61 of the punch. Thus in the initial position the member 52 is within the cavity 66 and at its lower end 100 seats against the upper edge 101 of the punch 84. The outer periphery 49 of the member 52 is spaced from the periphery 66 and is disposed inwardly thereof and the member 42 seats as at 55 against the upper edges of the member 57 and the sleeve 58. The upper platen 3 is slightly advanced so as to insert the end 60 into the bore blank of the tubing 52 and the upper edge 103 of the tube 52 seats against the shoulder 104 of the shank portion 18 of the punch. It will be seen that the shank portion 18 fits closely within the sleeve 21 and that the outer periphery 49 of the tube 52 is spaced inwardly of the inner periphery 65 of the sleeve 21. In this position the lower edges 38 of the members 21 and 22 engage the upper member 40 and clamp the assembly together against the lower blank retainer and guide 57. Thereafter the upper platen and lower platen are relatively advanced toward each other whereupon the member 52 is compressed and the lower end of the punch 61 continues into the cavity 91 in the lower punch. The compressive action between the punches causes the sleeve portion 52 to be compressed and flows the material outwardly so that the outer diameter of the hub portion equals that of the bore 65 and 66.

It will be noted from a consideration of FIGURES 2 and 3 that the outer portion 41 of the hub driven device projects its inner edges inwardly of the inner peripheries of the sleeves 21 and 58 whereabouts the material

4

of the hub portion 52 is prevented from flowing or collapsing inwardly because of the punch end 61 and therefore it is caused to flow outwardly and around the opposite sides of the outer portion 42 providing to effect an indentation at 106 and shoulders at 107 and 108 compressively embracing the outer portions 40 and 42. At the same time the material is caused to flow into the pockets 53 to provide locking lugs which interlock with the adjacent edges of the opening 47.

It has been noted that with this type of construction a superior juncture is obtained between the hub and the surrounding portion of the device in that a fatigue-reducing joint is obtained which provides axial or lateral flexibility between the inner and outer parts of the device inasmuch as the union although intimate maintains a seam line part between the segments sufficient to allow small flexing or relative movement between the parts when axial loads are applied to the parts.

After the structure is formed the die is separated and the structure is removed from the die by manual stripping.

It will be realized that the metal is compressed beyond its elastic limit and that its partial recovery preloads the connection of the hub with respect to the pulley flanges. In other words the metal is in a state of compression and it has been found that this connection because of such preloading is far superior even to an integral construction.

What is claimed is:

1. A fabricated torsional device comprising an inner and an outer element, said outer element having a non-round opening therein, said inner element having ends compressively deformed by loading the element axially beyond its elastic limit and having developed inwardly of said ends enlarged sections at opposite sides of the outer element, including portions expanded radially into complementary conformance with areas of radial alignment in said outer element and filling said opening therein and providing a torsional interlock therewith, said inner element being in a state of compression and said enlarged sections being under compression and compressively engaging said outer element therebetween.

2. In a device of the class described, a tube, an outer member including a portion having a non-round opening receiving the tube, said tube having an initial outer diameter admitting the tube within the opening, said tube including parts deformed solely through compressive loading of the tube beyond its elastic limit and thereby being enlarged in the region of radial alignment with said portion into a section complementary to said opening in torsional interlocking engagement therewith and providing at opposite sides of the portion, shoulders formed in engagement with the portion, and coincidentally with said enlargement being under a compressive load of an extent that said outer part is clamped solely with limited flexibility axially of the forces of compression.

3. A device of the class described comprising a tubular center portion having ends and an outer portion having a polysided opening snugly embracing said center portion, said center portion including an area expanded radially outwardly intermediate its ends at said opening into a section complementally fitting the opening and expanded to a diameter larger than the opening into shoulders embracing said outer portion therebetween at opposite sides of the outer portion, said center portion being under axial compression, thereby flexibly holding said outer portion between the shoulders under a compressive load sufficient to accommodate slight axial deflection between said portions.

4. A device of the class described comprising a tubular center portion of initial length and an outer portion having a polysided geometrical opening snugly receiving said center portion, said center portion having a shaft-receiving bore of initial diameter, said center portion comprising a section in alignment with said outer portion

5

expanded radially complementary to said opening and said tubular portion being under compression beyond its elastic limit axially from an initial length to a reduced length and including enlargement of the outer diameter thereof intermediate its ends providing shoulders at opposite sides of the outer part compressively holding the same therebetween, said inner part maintaining said initial diameter of the bore.

5. A pulley comprising an outer part including a pair of opposed segments each comprising a web portion with an outturned peripheral annular V-groove-forming flange, each web portion having a central transverse non-round opening therein, a hub member comprising a tube having an initial outer diameter smaller than the smallest diametrical dimension of said openings, said member extending through said openings, said member being under an axial compressive load beyond its elastic limit and including a section expanded radially outwardly in the region of said openings into a shape conforming with the openings to effect a torsional interlock with the webs

6

and expanded radially outwardly of said webs thereby providing shoulders embracing said webs therebetween, said hub member being resiliently loaded at said shoulders against said webs in compression axially of the hub member.

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