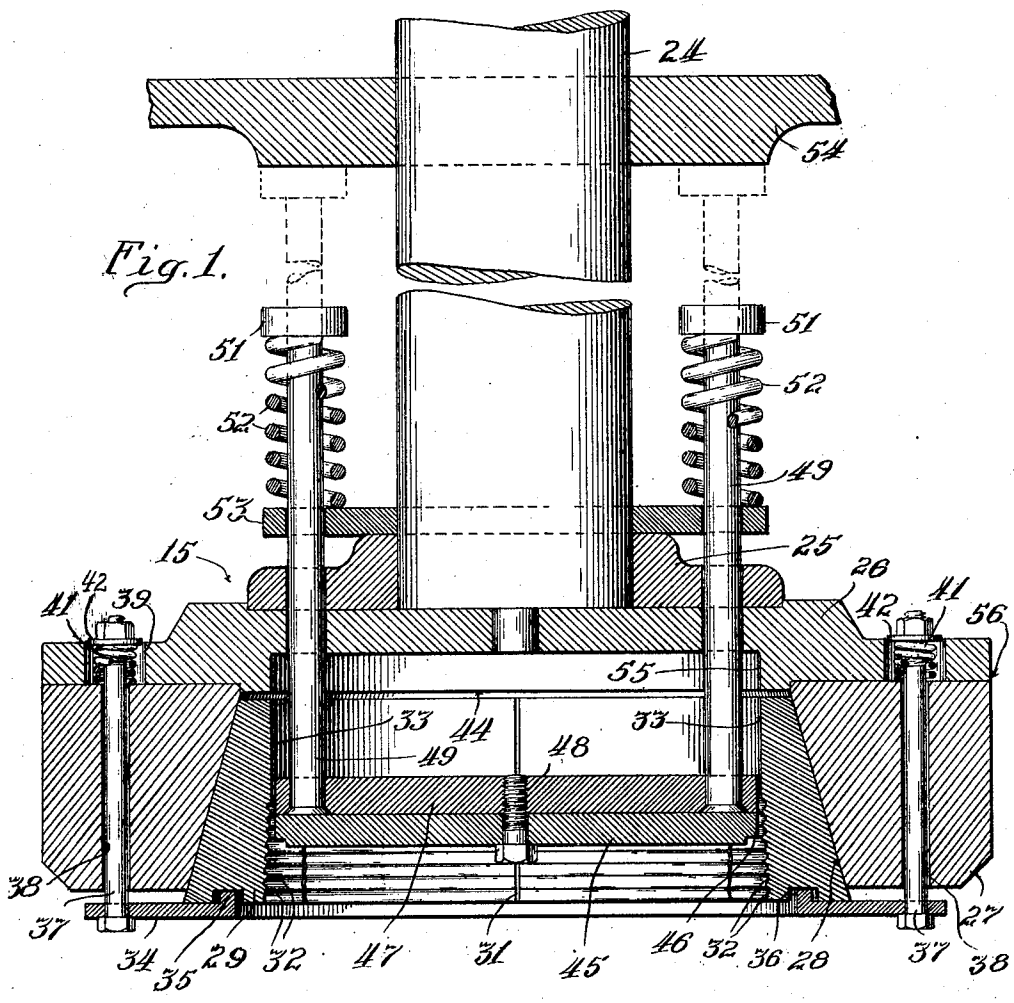
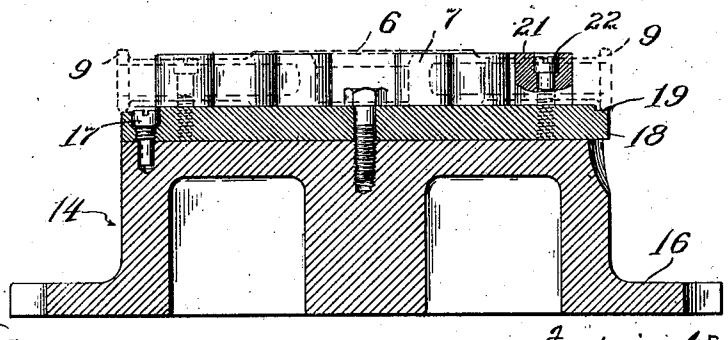
June 24, 1930. F. W. BURGER 1,765,756

DIE MECHANISM FOR SIZING AND TESTING METAL WHEEL SPIDERS

Filed April 19, 1926 2 Sheets-Sheet 1

Fig. 1.





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DIE MECHANISM FOR SIZING AND TESTING METAL WHEEL SPIDERS

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Fig. 2.

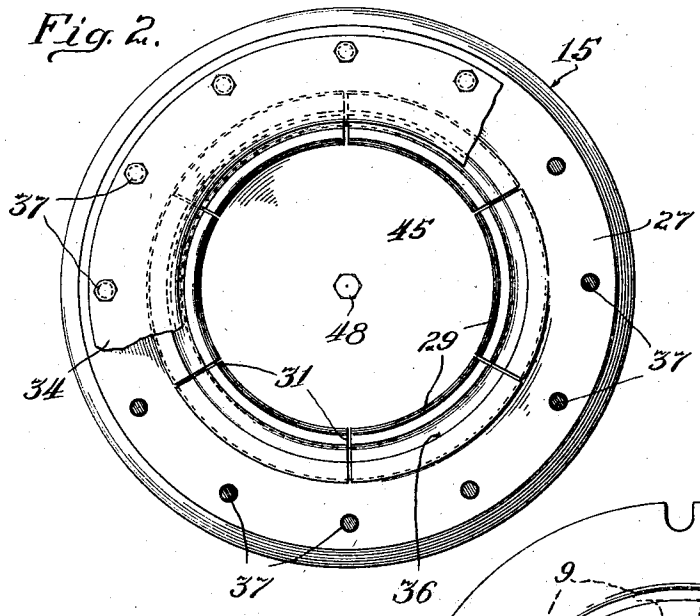


Fig. 3.

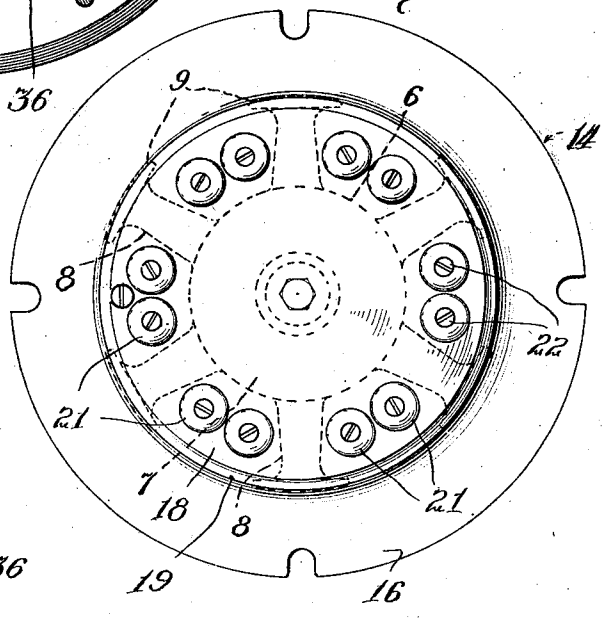
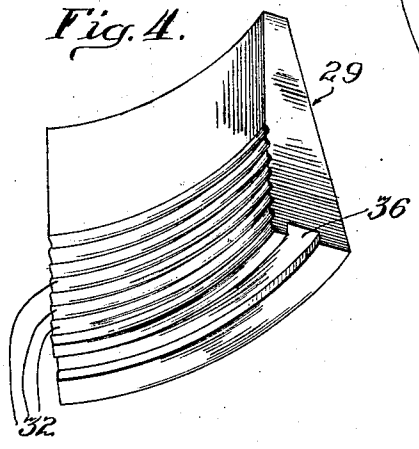


Fig. 4.



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DIE MECHANISM FOR SIZING AND TESTING METAL-WHEEL SPIDERS

Application filed April 19, 1926. Serial No. 102,893.

The present invention relates to die mechanism for sizing and testing metal wheel spiders.

In co-pending applications, Serial Numbers 33,657 and 49,161, filed by myself and Edmund C. Mogford, we have disclosed an improved construction of metallic wheel and method of making the same, in which the wheel is built up from a cast metal spider, constituting a hub and hollow spoke structure, and a rolled metal rim which is secured to the spoke ends of this cast metal spider.

The present invention has to do particularly with the manufacture of the spider, and has as its general object to provide an improved construction of die mechanism which will size and straighten the rough casting of the spider so that machine finishing will be entirely eliminated or reduced to a minimum, and which will also subject the casting to certain testing stresses in order to detect flaws therein.

One of the particular features of the invention resides in the sizing die which finishes the outer ends of the spokes. This die comprises a plurality of die segments which have relative diverging movement after the completion of a sizing operation, thereby to increase the effective diameter of the sizing die so as to facilitate the stripping of the spider from the die. This construction also affords the further advantage of providing an adjustment for varying the sizing diameter of the die so as readily to adapt the die to different sizes of spiders and to adjust the die for wear.

The testing of the wheel spider is performed simultaneously with this sizing and straightening operation, this testing consisting in subjecting the entire spider to radial and lateral stresses and the hub thereof to lateral compression stresses. It often happens that a casting from its outward appearance appears to be perfect, but actually contains flaws, such as shrink cracks, hot-shorts, etc. The present die mechanism subjects the spider to more intensive stresses than it would receive in normal use and hence discloses any of these flaws which might impair the life and strength of the casting.

The other features of the invention pertaining to the yieldable mounting of the die segments, the knock-out or stripping mechanism, etc., will be apparent from the following description of the preferred embodiment of my invention.

In the drawing, accompanying this description:

Fig. 1 is a vertical sectional view through the present die mechanism, the movable sizing die being shown in its elevated position above the stationary die block which supports the wheel spider;

Fig. 2 is a bottom plan view of the movable sizing die, a portion of the spring pressed retaining ring being broken away;

Fig. 3 is a top plan view of the stationary die block, the wheel spider being indicated in dotted lines on this die block; and

Fig. 4 is a perspective view of one of the die segments.

The wheel spider 6 is illustrated in dotted lines in Figs. 1 and 3, and consists of a hub and spoke structure cast as a unit. The hub 7 is hollow, and as fully described in the co-pending applications above mentioned, the inner wall of this hub has a peripheral groove therein in order to give this hub a certain degree of lateral compressibility. The spokes 8 are also hollow and formed on the outer ends of these spokes are pads 9 which receive and support the outer wheel rim. As the spider comes from the foundry, the outer surfaces of these pads 9 will generally vary somewhat in shape and diameter, and it is one of the objects of the present die mechanism to size and finish the outer surfaces of these pads so that they will be of the proper curvature and diameter for engaging within the wheel rim. Furthermore, the upper and lower sides of the hub 7 will not always be parallel in these rough castings and the thickness of this hub may slightly exceed the desired thickness for the hub. It is a further object of the present die mechanism to press both sides of this hub 7 into parallelism and to compress the hub to its proper thickness. The

spider is preferably composed of malleable iron or steel and will permit these sizing and straightening operations without injury unless, by chance, the casting contains serious flaws which will make themselves evident in this sizing and straightening operation. The present die mechanism comprises a stationary die block or follower 14, on which is placed the wheel spider, and a movable sizing die 15 which is adapted to move down over the circumference of the spider and subject it to these sizing and straightening operations. The stationary die block 14 is constructed in the form of a raised pedestal having a lower flange 16 which can be bolted to the bed of the press or to any other stationary support. Secured to the top of this stationary die block by screws 17 is a removable plate 18 having a circumferential groove 19 formed in its upper face for receiving the lateral edges of the pads 9. This construction permits the under side of the spider hub to rest upon this top plate 18. This plate is hardened to withstand the compression pressure exerted on the hub of the spider.

The spider is held against any rotative or lateral displacement of this stationary die surface 18 by a plurality of spacing blocks 21, which are secured to the top of the plate 18 by screws 22. These blocks are arranged in pairs, grouped to dispose one pair of blocks between adjacent spokes of the spider, as clearly shown in Fig. 3. The height of these blocks corresponds exactly to the desired thickness of the hub portion of the casting so that this hub portion will be compressed just to this thickness as determined by these spacing blocks. These spacing blocks can be readily substituted or rearranged on the plate 18 for receiving different types of spiders having different thicknesses. Similarly, the die plate 18 may be substituted by other plates for receiving spiders of different diameters, or having different widths of pads 9.

The female or ring die 15 comprises a ram or plunger 24 of a hydraulic press of any suitable description. This ram is reciprocated vertically by this hydraulic press and is provided at its lower end with a female sizing die adapted to press down over the outer circumference of the spider 6 in sizing and straightening the spider. A flange 25 is rigidly secured to the lower end of the ram, and a circular plate 26 extends across the bottom of the ram, both being rigidly secured to the ram in any suitable manner. A heavy die ring 27 is secured to the under side of the plate 26, as by releasable screws or bolts (not shown), the inner surface of this ring 27 being formed with an upwardly converging annular taper 28. Bearing against this tapered surface are a plurality of jaws or die segments 29, there being one of these die segments for each spoke of the spider and each of the segments being so positioned in the outer die ring 27 that it will engage its respective pad 9 substantially intermediate the ends of the segment. The lateral edges of these die segments are spaced slightly from each other, as indicated at 31 in Fig. 2, this spacing permitting of the relative converging and diverging movement occurring between these die segments, as will hereinafter appear.

The inner surfaces of these die segments are formed at their lower ends with a plurality of grooves or corrugations 32 which function as sizing or burnishing surfaces for engagement with the pads at the ends of the wheel spokes. These sizing or burnishing surfaces lie on a slight taper with the larger diameter at the bottoms of the segments, so that these surfaces will perform their sizing and burnishing operations on the pads with a gradually progressive motion across the entire width or depth of each pad periphery. The cylindrical upper surfaces 33 above these corrugations represent the finished shape and diameter of the pads 9. The die segments 29 are yieldably supported in engagement with the tapered surface 28 by a spring suspended supporting ring 34. This supporting or retaining ring is formed with an upwardly turned flange 35 at its inner edge, which flange engages in the matching grooves 36 formed in the lower surfaces of the die segments 29. Bolts or pins 37 pass through holes in the outer edge of the supporting plate 34 and pass up freely through holes 38 in the die ring 27. The upper ends of these bolts repose in large openings 39 formed in the cross plate 26, these ends of the bolts having compression springs 41 confined thereon tending to raise the supporting plate and die segments upwardly. Any suitable adjustment shoulder 42 may be provided on these bolts, such as a washer and a nut threading over the end of each bolt for adjusting the pressure of the spring 41. The upward movement of the die segments 29 is limited by engagement of their upper surfaces with an abutment surface 44 formed on the under side of the mounting plate 26, the spaces 31 between the segments permitting sufficient converging movement between the die segments to enable their upper ends to strike the surface 44.

Resiliently suspended in the circular die opening defined by the die segments 29 is a knock-out or stripping member 45 for ejecting the spider from this sizing die. This knock-out member comprises a circular plate having a circumferential recess 46 formed in its under side for accommodating the upper sides of the pads 9, similarly to the manner in which the recess 19 accommodates the opposite edges of these pads. This plate is removably mounted on an upper

plate 47 by the screw 48, whereby it can be substituted by other plates having different dimensions. This knock-out plate 45 is hardened as it must bear the compression pressures which are imposed on the hub 7 of the spider. The upper plate 47 is suspended on two or more pins 49 which pass up freely through holes in the mounting plate 26 and flange 25. The upper ends of these pins have heads 51, against the under sides of which bear compression springs 52. The lower ends of these compression springs bear against any suitable abutment surface, such as a collar 53 resting on the flange 25 and having holes therein through which the pins 49 can pass. A stationary web or plate 54 surrounds the ram 24 above the die mechanism, being positioned at a predetermined height relative to the die mechanism so that it will be engaged by the heads 51 on the pins 49 when the ram and die have moved upwardly to a predetermined point where ejection of the spider from the die is to occur. When the sizing die is being forced down over the spider, the knock-out element precedes the movement of the spider up into the die, the under side of the mounting plate 26 having a circular recess 55 formed therein for receiving the upper part of this knock-out element during this downward movement of the sizing die.

In the operation of the die mechanism, the spider is merely dropped down over the spacing blocks 21, these spacing blocks approximately centering the spider on the stationary die block 14. Thereupon, the hydraulic press is brought into operation to force the upper sizing die down over the spider. Normally, the die sections 29 are held at the upper limits of their movement, which is determined by the engagement of their upper ends with the abutment surface 44. In this position of the die sections they define a die opening of the desired diameter for sizing the spider. As the corrugations 32 of these die sections engage the pads 9 they progressively size and burnish the outer surfaces of these pads, bringing the latter to the proper curvature and circumference. As the spider moves up into this ring die, it pushes the knock-out plate 45 ahead of it, and at the bottom of the stroke of this ring die the spider will be disposed in the plane of the cylindrical die surfaces 33, and the plate 47 of the knock-out member will be contacting with the top wall of the recess 55. At this point the pressure exerted through the ram 24 will be transmitted through the plates 47 and 45 to the upper side of the spider hub 7. This pressure will compress the hub down to the thickness defined by the spacing blocks 21.

The hydraulic press is now operated to elevate the ram 24. The spider will have a more or less binding engagement in the ring die and would tend to remain therein except for the provision of the knock-out plate 45. During this initial upward movement the knock-out plate is of course in its upper position with its upper surface engaging or substantially engaging the top of the recess 55. Hence, the heads 51 on the pins 49 are elevated considerably above the top of the die. Therefore, these heads 51 engage the stationary abutment surface 54 in the early part of this raising movement and thereafter the continued upward movement of the ring die results in the knock-out plate 45 forcing the spider downwardly in the die segments. This downward movement, imparted to the spider by the knock-out plate, operates to press the die sections 29 downwardly against the resiliency of the springs 41, and as these die sections move downwardly along the tapered surface 28, they diverge or separate, so that their gripping engagement with the spider is released very quickly after the spider is started downwardly by the knock-out plate 45. As soon as the spider falls clear of the die sections they are immediately returned to their raised positions in contact with the abutment shoulder 44, in position for another sizing operation on the next spider.

It will be observed that when the die sections engage the pads 9 and begin to size and burnish the outer surfaces thereof, they will exert a downward stress or pressure on the outer ends of the spokes which will test the strength of the spokes to withstand lateral pressures. Simultaneously, therewith, these die sections will exert a radial squeezing pressure on the ends of these spokes, which radial pressures will be transmitted through the spokes and through the hub and will test the ability of the casting to withstand these radial pressures. As previously described, at the termination of the sizing operation, the full pressure of the hydraulic press is exerted through the plates 47 and 45 on the upper side of the hub portion 7, and this pressure will press the opposite sides of the hub into exact parallelism and will reduce this hub to a predetermined thickness, as well as test its ability to withstand certain compression pressures.

The female ring die 15 is capable of ready adjustment for adjusting the effective sizing diameter of the die, for receiving spiders of slightly different diameters, or for taking up wear occurring in the die surfaces. This adjustment is effected by changing the spacing between the die ring 27 and supporting plate 26, which in effect, shifts the tapered surface 28 upwardly or downwardly. For example, by interposing shims of proper thickness between the mounting plate 26 and die ring 27, at the line of juncture indicated at 56, the die ring 27 and tapered surface 28

can be lowered to any desired degree relative to the abutment surface 44 so that the die sections will converge to a smaller diameter in moving up into engagement with the abutment surface 44.

While I have described my invention in a particular adaptation for sizing, straightening and testing wheel spiders of a particular form, nevertheless I wish it to be understood that this die mechanism may be adapted for operating upon other forms of wheel spiders, and in some of the appended claims I have defined the invention in terms of a structure for operating upon any form of generally circular blank.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. An apparatus for finishing wheel spiders comprising a male die adapted to support the spider, a female die comprising a plurality of die sections, said dies having relative axial movement for causing relative axial movement between said die sections and the circumference of said spider, and means releasably supporting said die sections to permit their disengagement from said spider.

2. An apparatus for finishing wheel spiders, comprising male and female dies having relative axial movement, said male die being adapted to support the spider, said female die comprising a plurality of relatively movable die sections and knock-out means for ejecting the spider from between said die sections.

3. An apparatus for finishing wheel spiders comprising male and female dies having relative axial movement and adapted by such movement to cause relative axial movement between the spider and the die surfaces of said female die, said female die comprising a plurality of die sections, and means normally holding said sections substantially to the predetermined sizing diameter for the spider, said means yieldably supporting said die sections for relative movement to permit their disengagement from said spider.

4. An apparatus for finishing wheel spiders, comprising male and female dies having relative axial movement and operating to force the spider axially within said female die, said female die comprising a plurality of die sections, means yieldably supporting said die sections for relative movement to release said spider, and knock-out means cooperating with said die sections to eject the spider therefrom.

5. An apparatus for finishing wheel spiders, comprising a stationary die block for supporting the spider, a ring die into which said spider is forced under pressure by relative axial movement between said die block and said ring die, said ring die comprising a plurality of relatively movable die sections adapted to move transversely across the periphery of said spider in contact therewith, and releasing means permitting said die sections to diverge to a releasing diameter for releasing said spider.

6. An apparatus for finishing wheel spiders, comprising a stationary die block adapted to support the spider, a ring die adapted to be moved axially over the circumference of said spider, said ring die comprising a plurality of die sections, releasing means supporting said die sections for relative diverging movement, and a knock-out member operating within the die opening of said ring die for ejecting the spider therefrom.

7. An apparatus for shaping wheel spiders, comprising a stationary die block, adapted to support the spider, a sizing die adapted to move axially over said spider, said sizing die comprising a plurality of die sections, a supporting ring for supporting said sections, spring means cooperating with said supporting ring for normally holding said die sections in operating position, and a knock-out member operating within the die opening for ejecting the spider from said die sections.

8. An apparatus for finishing wheel spiders, comprising male and female dies adapted to have relative axial movement for forcing the wheel spider within said female die, said female die comprising a ring having a tapered surface, and a plurality of die segments having converging and diverging movement on said tapered surface, said die segments being adapted to move transversely across the circumference of said spider in contact therewith.

9. An apparatus for finishing wheel spiders, comprising male and female dies, adapted by their operative movement to cause relative axial movement between the wheel spider and said female die, said female die comprising a ring having an internal tapered surface, a plurality of die segments bearing against said tapered surface, yieldable supporting means for said segments normally moving said segments to a sizing diameter, and means for exerting ejecting pressure on said spider, said ejecting pressure causing said die segments to move outwardly along said tapered surface for separating said die segments from said spider.

10. An apparatus for finishing wheel spiders comprising a stationary die block, adapted to support the wheel spider, a sizing die adapted to move over said spider, said sizing die comprising an outer ring having an inner tapered surface, a plurality of die segments having tapered surfaces engaging with the tapered surface of said ring, a supporting member engaging the outer ends of each said die segments, releasing means cooperating with said

supporting member for normally urging said die segments inwardly along said first tapered surface into engagement with an abutment surface in said sizing die, a knock-out plate disposed within the die opening, a pin extending from said knock-out plate, spring means yieldably supporting said knock-out plate and an abutment surface adapted to be engaged by said pin for actuating said knock-out plate.

11. An apparatus for finishing wheel spiders comprising a supporting block adapted to have the wheel spider mounted thereon, a sizing die adapted to move axially across the entire width of the circumference of said spider in sliding contact therewith for sizing the same, and means carried by said sizing die for axially compressing the hub of the spider against said supporting block.

12. An apparatus for finishing wheel spiders comprising a supporting block adapted to have the wheel spider mounted thereon, a sizing die adapted to move axially across the circumference of said spider for sizing the same, means carried by said sizing die for axially compressing the hub of the spider against said supporting block, and spacing means on said supporting block for limiting the compression of said hub.

13. An apparatus for finishing wheel spiders comprising a supporting block adapted to have the wheel spider mounted thereon, a sizing die adapted to move axially over the circumference of said spider for sizing the same, means carried by said sizing die for laterally compressing the hub of the spider against said supporting block, and spacing blocks projecting from said supporting block between the spokes of the spider for limiting the lateral compression of said hub.

14. An apparatus for finishing wheel spiders comprising a stationary supporting block adapted to have the wheel spider mounted thereon, a female sizing die adapted to move axially over the circumference of said spider for sizing the same, means carried by said sizing die for laterally compressing the hub of the spider against said supporting block, and a plurality of spacing blocks releasably supported on the top of said stationary supporting block and adapted to project upwardly between the spokes of the spider for limiting lateral compression of said hub.

15. An apparatus for finishing wheel spiders comprising male and female dies having relative axial movement and adapted by such movement to force the spider within said female die, the spider receiving end of said female die being tapered and having annular corrugations formed in said tapered surface.

16. An apparatus for finishing wheel spiders comprising a stationary die block adapted to support the wheel spider, a movable die head comprising a supporting plate having an abutment surface, a die ring mounted on said supporting plate and having a tapered internal surface, a plurality of die segments bearing against the said tapered surface and adapted to engage said abutment surface, said die segments being moved down over the outer circumference of said wheel spider for sizing the same, and means releasably securing said die ring to said supporting plate, and permitting variable spacing between said ring and supporting plate to adjust the limit of converging movement between said die segments.

17. In combination, a movable female die adapted to operate upon a generally circular object, a stationary male die adapted to support said object in stationary position while said female die is moving over the same, and knock-out means moving with said female die for ejecting said object therefrom.

18. In combination, means for supporting a generally circular blank, a ring die comprising a plurality of relatively movable die sections, means for forcing said die sections transversely across the peripheral surface of said blank while maintaining said sections in pressure contact therewith for sizing said blank and frictionally burnishing the periphery thereof, and means yieldably supporting said die sections to permit ejection of the blank from said die.

19. In combination, means for supporting a generally circular blank, a ring die comprising a plurality of radially movable die sections, means for forcing said die sections transversely across the entire width of the peripheral surface of said blank while maintaining said sections in pressure contact therewith for sizing said blank and frictionally burnishing the periphery thereof, means yieldably supporting said die sections to permit ejection of the blank from said die, and means for forcibly ejecting the blank from between said die sections.

20. An apparatus for finishing wheel spiders comprising a follower adapted to support the spider, a female die comprising a tapered ring and a plurality of die sections adapted to move inwardly and outwardly along the tapered surface of said ring and radially relatively to each other, the inner surfaces of said die sections having burnishing projections thereon, means for causing relative axial movement between said female die and said follower, and means for normally holding said die sections substantially at the inner limit of their movement along the tapered surface of said ring during the axial movement of said female die toward the spider, whereby said burnishing projections are caused to move transversely across the entire width of the peripheral surface of the spider in pressure contact there-

with for sizing the spider and frictionally burnishing the peripheral surface thereof, said latter means permitting radial separation of said die sections to permit their disengagement from the spider in the axial separating movement between the female die and the follower.

21. An apparatus for finishing wheel spiders comprising means for supporting the spider, a femal die adapted to move over the periphery of the spider for sizing the same, said female die comprising a main supporting member and a plurality of die sections, a supporting ring on which said die sections are mounted and on which they are movable radially relatively to each other, and spring means yieldably connecting said supporting ring with said main supporting member.

22. An apparatus for finishing wheel spiders, comprising a follower adapted to support the spider, and a female die, said parts being adapted to have relative axial movement for forcing the spider under pressure axially into the female die, said female die comprising a ring die and a plurality of die segments movable radially thereof, and axially therewith relatively to the follower.

23. An apparatus for finishing wheel spiders, comprising a follower adapted to support the spider, a female die, said parts being adapted to have relative axial movement for forcing the spider under pressure axially into the female die, said female die comprising a ring die and a plurality of die segments movable radially thereof, and axially therewith relatively to the follower, and means for positively ejecting the finished spider from the female die upon reverse movement of said parts.

24. An apparatus for finishing wheel spiders comprising a female die having a plurality of circularly arranged die sections adapted to move radially relatively to each other, a follower cooperating with said female die, means for causing relative axial movement between said female die and said follower to cause relative shearing movement between said die sections and the spider in a direction transversely across the circumference of said spider, and means permitting radial separation of said die sections to permit their disengagement from said spider.

25. An apparatus for finishing wheel spiders comprising a die ring having a tapered internal surface, a plurality of circularly arranged die segments bearing against such tapered surface and adapted to be moved therealong for relative converging and separating movement of said die segments, a follower cooperating with said die segments, means for producing relative axial movement between said follower and said die segments for causing relative movement between said segments and the spider in a direction transversely across the circumference of the spider, and means for adjustably limiting the extent of sliding movement of said die segments along said tapered surface whereby to adjust said apparatus to different sizing diameters.

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