June 2, 1936. H. C. BOSTWICK 2,042,498

COLLAPSIBLE TIRE-BAND FORM

Filed March 18, 1930 2 Sheets-Sheet 1

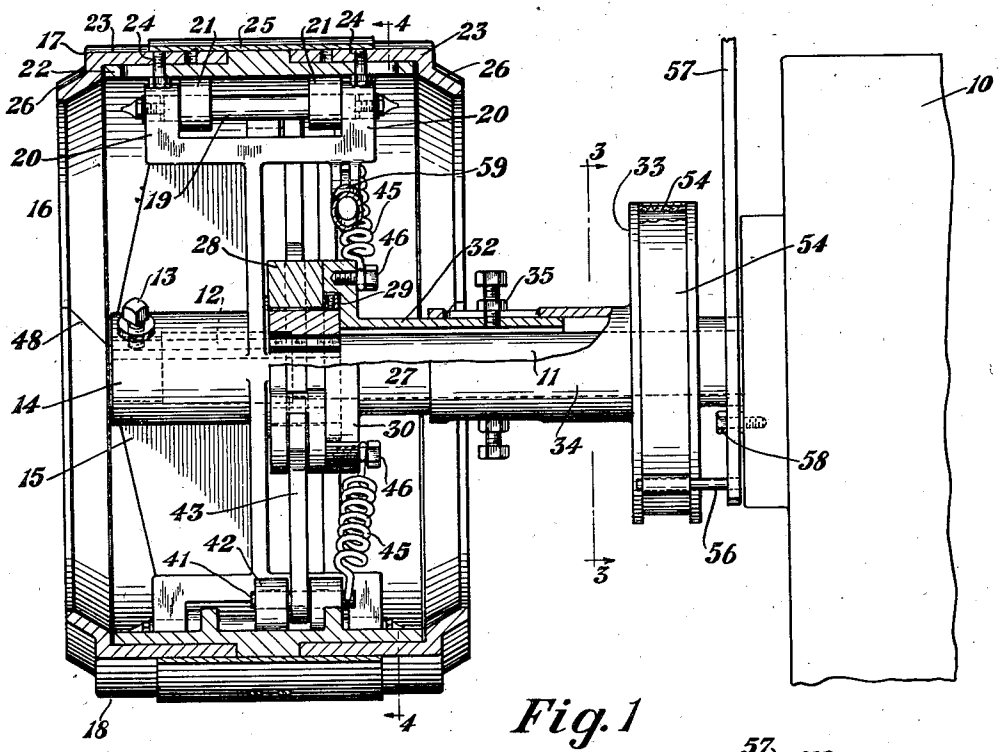


Fig. 1

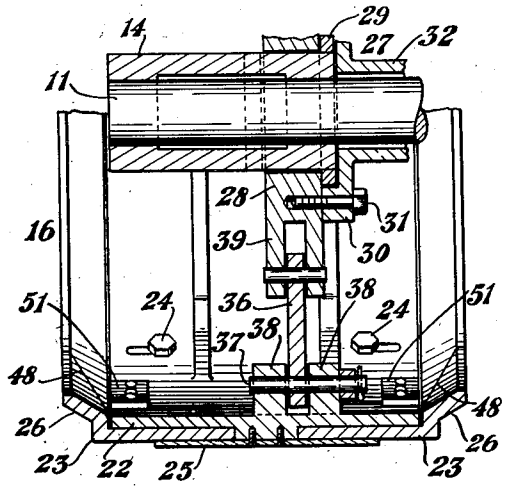


Fig. 2

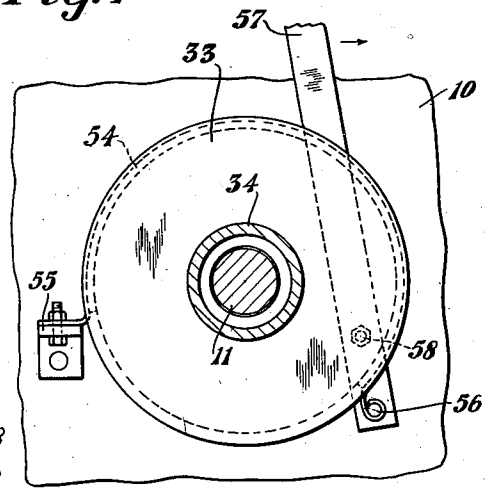


Fig. 3

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June 2, 1936. H. C. BOSTWICK 2,042,498

COLLAPSIBLE TIRE-BAND FORM

Filed March 18, 1930 2 Sheets-Sheet 2

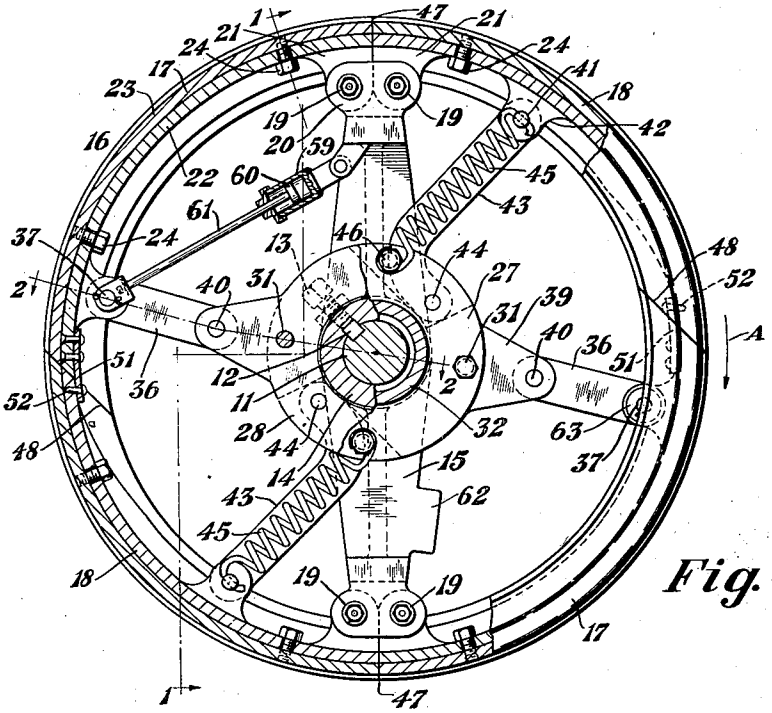


Fig. 4

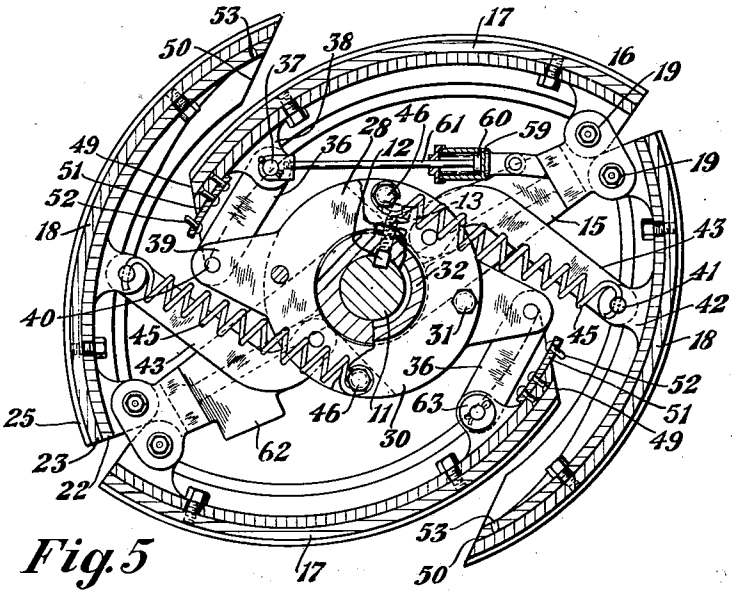


Fig. 5

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UNITED STATES PATENT OFFICE

2,042,498

COLLAPSIBLE TIRE-BAND FORM

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Application March 18, 1930, Serial No. 436,716

56 Claims. (Cl. 154—9)

This invention relates to collapsible forms, sometimes known as "chucks" for building endless laminated bands and particularly semi-flat bands for forming pneumatic tire casings.

Heretofore it has been necessary to stop the drum or core in order to collapse or expand it. One of the principal objects of my invention is to provide a drum or form which is automatic or semi-automatic in operation and adapted to be contracted and expanded while in rotation, thereby effecting a saving of time and labor and also, if desired, bringing into play the action of centrifugal force as an aid in stripping the completed band from the drum.

A further object is to provide a collapsible form whose parts are at all times substantially in rotational balance, so that the structure may be rapidly rotated in either an expanded or collapsed condition without creating unbalanced centrifugal forces.

Further objects are to provide a simple collapsible drum of decreased weight and cost as compared with prior ones, to obtain a greater contraction of the drum periphery than heretofore and otherwise to improve the construction and operation of apparatus of this class as will more fully hereinafter appear.

Of the accompanying drawings, Fig. 1 is a side elevation and partial axial section on the line 1—1 of Fig. 4 illustrating a preferred embodiment of my invention.

Fig. 2 is a partial longitudinal section thereof on the line 2—2 of Fig. 4.

Fig. 3 is a section on line 3—3 of Fig. 1.

Fig. 4 is a section on line 4—4 of Fig. 1.

Fig. 5 is a sectional view corresponding to Fig. 4 showing the drum in its collapsed condition.

In the drawings, 10 represents a portion of the casing of a tire-band building machine, from one side of which projects a horizontal drum shaft 11 adapted to be rotated by power mechanism within the casing, in the direction of the arrow A shown in Fig. 4, or counterclockwise as viewed from the front.

To the outer end of shaft 11 is fixed, by means of a key 12 and set-screw 13, the hub 14 of a two-armed spider 15 to whose ends are pivoted the four segments of a building form or drum 16 for making semi-flat tire bands. These segments are substantially equal in length and arranged in two pairs on opposite sides of the spider 15, the members 17, 18 of each pair being hinged on the opposite arms of the spider upon pintles 19 which are mounted in ears 20, 21, respectively formed on the spider-arms, and projecting inwardly from the drum segments. It has been found that this pivoting of the segments on the spider at opposite ends of two diameters tends to reduce drum breakage as compared with an arrangement in which two segments are connected with the spider arm on a single pivot axis.

Each drum segment could be of integral one-piece construction if intended for only one width of band, but where different widths are to be made on the same machine, I prefer to provide a permanent inner or frame portion 22 upon which the hinge ears 21 are formed, and marginal shell members 23 telescopically fitted on said inner member and adjustably secured thereto by radial cap-screws 24 on the shell members passing through transverse slots in member 22 for varying the effective width of the drum, together with a thin circumferential bridge-plate 25 affixed to a central rib on said member 22 for bridging the spaces between said rib and the inner edges of the shell members 23 when the latter are extended. This axial adjusting means is covered in a divisional application Ser. No. 609,352, filed May 5, 1932. The drum edges are provided with the usual depressed bead seats 26, and the intermediate band-supporting portion may be flat as shown or otherwise shaped as desired.

27 is a sleeve structure surrounding the shaft 11 and made in three parts, of which the forward member is a ring or collar 28 mounted to turn on the rear end of spider hub 14 and held against rearward axial movement thereon by a detachable retaining ring 29. The intermediate member of said sleeve structure includes a head 30 secured to collar 28 by means of bolts 31 and forwardly recessed to receive the retaining ring 29, and a tubular stem 32 integral with said head. The rear member of the sleeve structure is a brake wheel or drum 33 provided with a forwardly-projecting, tubular stem 34 which telescopes on the stem 32 and is adjustably fixed thereto by a bolt-and-slot connection 35 for the purpose of obtaining alignment of the drum with a stock rack or otherwise securing favorable working conditions by adjusting the alignment, without changing the location of the brake-drum. The structure including the collar 28, toggle links and tubular stem or shaft constitutes a collapsing mechanism for the drum.

It will be noted in Figs. 4 and 5 that the duplicate drum segments 17 which are pivoted at opposite ends of a diameter of the spider 15, alternate with the similarly-pivoted duplicate segments 18, and the free end of each of the former is connected by a short link 36, pivoted at 37 between ears 38 on the segment, with a forked arm 39 on the collar 28, by means of a pin 40, the link and collar arm forming a toggle which is nearly straightened in expanding the drum and is broken or folded in contracting it.

Each of the segments 18 is connected, from a pivot pin 41 carried by ears 42 projecting inwardly from said segment less than half-way forward thereon from its pivot 19, through a longer

bent link 43 whose inner end occupies a recess in the collar 28, with a pivot pin 44 on said collar. Each of the segments 18 is further connected with the collar 28 by a helical pull-spring 45 conveniently attached at its outer end to the pivot pin 41 and at its inner end to a screw 46 on the collar. While these springs are not essential to the operation of the drum, they serve a useful purpose in taking up lost motion and holding the overlapping ends of the drum segments together when the drum is expanded.

The heels of adjacently-pivoted drum segments 17, 18 are formed to abut in a radial joint 47 when the segments are expanded in a circle as indicated in Fig. 4, and the remote or free ends of adjoining segments overlap in a semi-tangent joint 48, the two joints 48 being slanted in the same sense or direction and each having an outwardly-exposed face 49 on the segment 17 and an undercut face 50 on the segment 18. These slanting or overlapping ends are interlocked in the expanded condition by means of a tie-plate 51 affixed to the end of segment 17 and having a dowel pin 52 adapted to enter a hole 53 in the end of the segment 18. The dowel and its hole are positioned in line with the path of movement of the segment ends as they come together, so that the interlocking connection will be automatically effected. There are preferably two of these tie plates 51, placed adjacent the margins of the drum as seen in Fig. 2 for each of the joints 48.

54 is a brake-band surrounding the drum 33, one end of said band being anchored to a fixed bracket 55 on the casing 10 and the other end connected with a pin 56 on the lower end of a hand lever 57 which is pivoted at 58 on said casing, whereby the sleeve structure 27 and its collar 28 may be held or slowed down during the rotation of the drum shaft 11 while the drum 16 continues to revolve, for the purpose of collapsing the drum. The use of a mechanical brake is not essential as the same effect can be obtained by manually arresting the drum 33, but I prefer to use the brake in order to save the operator's hands.

For cushioning the radial arrest of the drum segments, especially at the end of their collapsing movement, I may interposed a dash-pot device between the spider 15 and a part connected with the collar 28 so as to control the movement of all four segments, such device as here shown including an air cylinder 59 pivoted to one of the arms of spider 15, and a piston 60 therein having its rod 61 pivoted on the link pin 37 of the adjacent segment 17. The weight of this cushioning means may be counterbalanced by suitable masses on the opposite side of the shaft 11, such as 62 and 63.

By a proper arrangement and proportioning of the parts, including the links 36 and 43 and their pivots, the inward movement of the free ends of the two segments 17, when the drum is being collapsed, will precede that of the segments 18, so that each segment 18 will overlie the mating segment 17 in the collapsed condition as represented in Fig. 5. The weights of the several segments and their immediate connections being approximately equal and symmetrically disposed as just described when the drum is collapsed, the drum may be rotated in its collapsed condition at any speed within the range of the machine without any substantial unbalanced centrifugal action and consequently without imposing harmful strains upon the shaft 11 or its bearings.

On the expanding movement, the toggle pin 44, in passing over the straight line between pin 41 and the center of shaft 11, moves the segment 18 outwardly somewhat beyond its operative position and then allows it to come in and rest on the segment 17 through the force furnished by outward movement of the latter communicated to collar 28, whereupon the spring 45 keeps the segments together and maintains the pin 44 in its over-center position, the heel joints 47 having meanwhile been closed by the outward movement of the segments 17.

In the operation of this invention, assuming the shaft 11 and the drum 16 to be in rotation in the direction of the arrow A (Fig. 4) or counterclockwise as viewed from the front, and assuming a tire band to have been formed on the drum, the operator collapses the drum by applying the brake band 54 to retard the rotation of the sleeve structure 27, including its collar 28, relative to that of the spider 15 and the drum segments. The initial forward displacement of the drum and spider with relation to collar 28 will slightly raise or move outwardly the free ends of the segments 18, and this initial movement, acting through the links 36 of the mating segments 17, which links had not quite straightened out when the drum was expanded to its circular condition, will cause the free ends of said segments 17 to be depressed or drawn inwardly, so that the interlocking dowels 52 on the plates 51 are quickly withdrawn from their holes 53. A continuation of the forward movement of spider 15 relative to collar 28 brings the drum to the collapsed condition represented in Fig. 5, wherein its periphery is contracted well within the expanded diameter of the bead seats 26. To effect such degree of contraction it is desirable or necessary that some at least of the segments in their collapsed positions shall be eccentric to the axis of rotation of the drum, and in this embodiment all of the segments are so arranged. The brake can be applied to collapse the drum either while the power is on the shaft 11 or when the power has been thrown off and the drum continues in rotation by its inertia or momentum. In either case, if the drum is revolving at substantial speed when the brake is applied, the action of centrifugal force upon the tire band aids in stripping it from the drum segments and allowing the latter to collapse inwardly. The collapsed drum having been brought to rest, the tire band is readily slipped off and the drum may then be automatically expanded by the action of centrifugal force upon the segments 17 and 18 when power is applied to the shaft 11 to rotate the latter while the brake is released. Because of the inherent decelerating action of the toggles, and especially the pairs formed by the collar 28 and links 43, as they approach or reach their straightened condition, the described connections perform the important function of arresting the centrifugal expanding movement of the drum segments substantially without shock, thereby practically eliminating the tendency toward breakage of parts under those conditions.

In the collapsed condition of the drum, the tension of the springs 45 is exerted in a direction tending to straighten the toggles and hence to expand the drum, but their strength is insufficient to overcome the friction of the parts.

From the foregoing, it will be evident that my invention provides a simple, light-weight, inexpensive, segmental band form adapted particularly for making semi-flat tire bands and capable of being collapsed and expanded while the

form is in rotation, threby reducing the time required for these operations and also saving the strength of the operator as compared with prior practice. The present invention, so far as I am aware, is the first in this art to perform the function of collapse and expansion of a segmental drum while in rotation.

My invention is not wholly confined to forms for making flat or semi-flat bands, and various changes of embodiment are contemplated as coming within the scope of the claims, such as the provision of any other progressively acting device equivalent to the brake **33**, **54** for collapsing the drum substantially in the manner described.

I claim:

1. A rotary segmental form expansible by centrifugal force, toggle means movable to and past a fully straightened position by the expansion to render it substantially without shock, and relatively rotatable means for collapsing said form.

2. A rotary form composed of pivoted segments expansible by centrifugal force, and toggle means controlling all of the segments and arranged to arrest their expanding movement substantially without shock.

3. A rotary tire-band building form composed of segments collectively expansible by centrifugal force, said segments having depressed bead seats and being collectively collapsible to permit removal of the tire band, in an arrangement substantially in rotational balance, and brake means for effecting the collapse of said segments while the drum is in rotation.

4. The combination of a collapsible rotary form having collapsing mechanism, means for rotating the same, and progressively acting means independent of said form-rotating means, engageable with said collapsing mechanism during rotation of the form and controllable by the operator for applying the momentum of said form to collapse the latter during continued rotation thereof.

5. In a tie-band building machine, the combination of a power shaft, a segmental drum device thereon expansible by centrifugal force and inherently maintained in its expanded condition, and brake-actuated retarding means operable at will and connected with the drum segments for collapsing the latter by their power of rotation.

6. A drum having depressed bead seats and collapsible to a circumference less than that of said seats for building a semi-flat tire band, means for rotating said drum, and means for applying its power of rotation to collapse the drum during continued rotation thereof while centrifugal force acting on the formed band aids in causing it to be stripped from the drum surface.

7. A rotary tire form comprising a spider having at each end a pair of parallel, angularly spaced pivot pins, and two pairs of form segments whose members are pivoted on the respective pins.

8. A collapsible tire-band form comprising a rotary support, a drum thereon composed of a series of adjacent segments interconnected for concurrent inward movement and including a segment movable to a collapsed position eccentric to the drum axis, and manually-controllable braking means affecting the entire series of segments for applying the power of rotation of said drum to collapse the latter.

9. A band-forming drum comprising a rotary support, two pairs of drum segments pivoted thereto and collapsible in symmetrical arrangement, a brake-controlled retardable rotary collar, and means connecting said collar with the segments for collapsing all of the latter by their power of rotation.

10. A segmental rotary drum, a driving shaft carrying said drum, rotary means surrounding and rotatable about the shaft and retardable to collapse said drum, and a brake operable at will for retarding said means.

11. A collapsing band-building form comprising a rotary support, a pair of form segments pivoted thereto, a coaxial relatively-rotatable operating device, and relatively long and short links connecting said device with the respective members of said pair of segments.

12. In a collapsible band-building form, the combination of a pair of pivoted form segments whose ends abut in a semi-tangent joint when the form is expanded, and controlling means for the overlapping segment adapted to swing said segment outwardly beyond its ultimate position and then inwardly against the mating segment end when said segments are moved to their operative position.

13. A collapsible band-building form comprising a rotary support, a pair of form segments pivoted thereto, one of which overlaps the other, a relatively-retardable collar, a relatively-short link connecting said collar with the underlapping segment and movable short of its straightened condition to carry said segment into operative position, and a relatively-long link connecting said collar with the overlapping segment and movable to a straightened condition and beyond, to carry said segment outwardly beyond its ultimate position and then inwardly into operative relation to the underlapping segment.

14. A collapsible form expansible by centrifugal force and comprising interconnected segments one of which is movable outwardly beyond its operative position and movable inwardly to said position by centrifugal force acting on another of the segments.

15. A collapsible drum including a pair of coacting pivoted segments, means for automatically interlocking their ends, collapsing means for separating said ends by an initial outward radial movement of one and inward radial movement of the other, and a spring for holding said ends together in expanded condition.

16. A rotary drum shaft having a drum support, a collapsible, segmental drum mounted on said support, means supported by and surrounding said shaft at the rear of said drum support for controlling the collapse of the drum, and means for fixing the drum on the shaft in varying axial relation to said controlling means.

17. The combination of a rotary segmental drum, coaxial means including telescoped members for controlling the collapse of said drum, and means for fixing said members together at different axial adjustments.

18. A collapsible drum composed of adjacent, coacting, pivoted segments collectively expansible by centrifugal force, and a toggle controlling the motion of said adjacent segments.

19. A collapsible drum having two adjacent, coacting, pivoted segments collectively expansible by centrifugal force, a rotary shaft carrying said drum, and two toggles including a common ring surrounding and turnable on said shaft, for controlling the respective segments, one of said toggles being carried short of and the other beyond its straightened condition as the drum is expanded to its final shape.

20. A tire supporting chuck comprising a plurality of arcuate segments having bead seats and collectively collapsible to a circumference less than that of said seats, a shaft, arms on the shaft, means pivotally connecting an end of each segment to one of the arms, and additional means including a braking device for controlling the free ends of the segments.

21. A tire supporting chuck comprising a plurality of pairs of arcuate segments, a shaft, arms secured to the shaft, each pair of segments having their adjacent ends pivotally connected to one of the arms, and a braking device for controlling movement of the free ends of the segments.

22. A tire supporting chuck comprising a shaft, a plurality of arcuate segments collectively forming an entire drum periphery, arms secured to the shaft, means pivotally connecting each of the segments to the arms, and a braking device for controlling the movement of certain of the segments.

23. A tire supporting chuck comprising a driven supporting member, arms secured to such member, a plurality of arcuate segments adapted to form a substantially circular drum, means pivotally connecting an end of each segment to one of the arms, a double toggle linkage interconnecting certain segments, and means including a brake drum and a brake band for controlling movement of certain of the segments.

24. A tire supporting chuck comprising a shaft, a plurality of arcuate segments, an arm, means pivotally connecting an end of each segment to the arm, and means including a sleeve and a braking device engageable with the sleeve for controlling the movement of the free ends of the segments.

25. Band-building apparatus for inextensible-bead tire casings comprising a rotary segmental form having depressed bead seats and collapsible within the diameter of said seats by power furnished by rotation thereof, and manually-operable brake means associated with said form for bringing said power into action.

26. A rotary band-building form having its entire periphery composed of four segments movable inwardly to positions eccentric to the form axis to collapse the form, brake-controlled rotary retardable operating means, and connections from said means to the form segments for collapsing the latter when said means is retarded.

27. A tire supporting chuck comprising a driven supporting member, arms secured to such member, a plurality of arcuate segments adapted to form a substantially circular drum, means pivotally connecting an end of each segment to one of the arms, shorter arms rotatably mounted on the supporting member, links pivotally connecting the free ends of the shorter arms to the free ends of certain of the segments, and a braking device for arresting movement of the shorter arms.

28. Band building apparatus comprising a drum structure adapted for building and rolling down tire bands and including segments pivotally mounted to expand and collapse said structure, a power shaft supporting said structure, a sleeve around said shaft, rotatable with or relative to the shaft and having connections with certain of the segments for moving the same from a fully expanded to a fully collapsed position in less than one rotation of said sleeve around the shaft, and a friction brake operable at will for retarding said sleeve during forward rotation, to collapse the segments.

29. A collapsible drum structure comprising a central rotary power shaft, a spider thereon, two pairs of segments pivotally supported by said spider in couples on opposite sides of the shaft and meeting in overlapping end-to-end relation, a sleeve surrounding and rotatable with and relative to said shaft rearwardly of the spider and having its forward end located within the drum and linked to opposite segments for collapsing the same when said sleeve is retarded with respect to the shaft, a brake drum on the rear portion of said sleeve, and a brake coacting with said brake drum to arrest the sleeve.

30. Band-building apparatus comprising a collapsible drum composed of overlapping and underlapping segments meeting in end-to-end relation, a segment support, a controlling member rotatable with and relative to said support and having connections with the underlapping segments for initiating their collapsing movement in advance of that of the overlapping segments, and additional connections actuated by relative rotation of said controlling member for thereafter moving inwardly the free ends of the overlapping segments.

31. A collapsible tire-building chuck comprising a central rotary power shaft, a spider thereon, two pairs of drum segments movably supported by said spider in couples on opposite sides of the shaft and including members having their free ends in overlapping and underlapping relation, the underlapping segments being pivotally mounted, and relatively rotatable sleeve surrounding said shaft and having toggle link connections with the underlapping segments for inwardly moving their free ends in advance of those of the overlapping segments when the sleeve is relatively rotated, and means operated by relative rotation of said sleeve for thereafter moving inwardly the free ends of the overlapping segments.

32. A collapsible band-building chuck comprising a central rotary driving shaft, a drum carried thereby and composed of segments movable to collapsed positions in which they are collectively in substantial rotational balance, said drum including pivotally supported segments meeting in end-to-end relation when expanded, and lying one over the other when collapsed, a controlling member coaxial with said shaft and rotatable with or relative thereto, and segment operating connections, including toggle links actuated by the controlling member and foldable therewith circumferentially of said shaft, for fully collapsing all of the drum segments in less than one relative rotation of said shaft and member, said connections producing a greater pivotal collapsing movement of the underlying than of the overlying segments.

33. A collapsible tire-building chuck comprising a drum having depressed bead seats and composed of two pairs of pivoted segments with complemental beveled free ends which, when the drum is expanded, meet in overlapping and underlapping relation, said segments being mounted in couples whose members swing oppositely to an overlying and underlying relation with those of the other couple, a central rotary power shaft extending axially into the middle region of said drum and having a spider supporting the respective segment couples, a sleeve surrounding and rotatable about said shaft, and sleeve-actuated connections for positively col-

lapsing all of the drum segments in less than one relative rotation of the sleeve on the shaft, said connections being adapted to deregister the meeting ends of the segments before the overlapping segments move inwardly.

34. The combination of a collapsible, rotary, tire-building form having collapsing mechanism for stripping the form from the inner surfaces of a tire built thereon, means for rotating the same, and progressively acting means independent of said form rotating means engageable with said collapsing mechanism during rotation of the form and controllable by the operator for applying the momentum of said form to collapse the latter during continued rotation thereof whereby a tire may be removed therefrom.

35. A tire building form including a plurality of sections collapsible to strip the form from inner surfaces of a tire built thereon to permit removal of a tire from the form after it has been built thereon, means for supporting and rotating said form including rotatable members adapted to rotate in unison or relative to each other and to support the form in expanded position, both in a state of rest and while rotating, connections between said members and the form for collapsing the form whereby a tire may be removed therefrom and also for expanding the form after removal of the tire upon relative rotation of said members, and power means for rotating said members in unison and also for causing relative rotation thereof when rotation of one of said members is hindered, whereby said form may be so collapsed or expanded by power by a single operation of said power means to relatively rotate said members.

36. A tire building form including a plurality of collapsible sections, means for supporting and rotating said form including rotatable members adapted to rotate either in unison or relatively and to support the form in expanded condition in a state of rest as well as in motion, connections between said members and said form for collapsing the same upon relative rotation of said members to strip the form from inner surfaces of a tire built thereon, and power means for rotating said members in unison and also operable to cause relative rotation of said members upon hindering rotation of one of said members, whereby said form is so collapsed by power by a single operation of said power means relatively to rotate said members.

37. The combination in a tire building form of relatively rotatable members for operating a plurality of form sections constituting the entire form to collapse the entire form whereby the form is stripped from inner surfaces of a tire built thereon, one of said members comprising a power-operated shaft, and one of said members being adapted to be held against rotation with the other, and connections between said members and said form sections for collapsing all of said sections to permit removal of a tire therefrom when one member is held against rotation with the other, and means operable at will during rotation of the form to hold one member against rotation with the other.

38. A tire building form including a plurality of collapsible sections, means for supporting and rotating said form including rotatable members adapted to rotate either in unison or relatively and to support the form in expanded condition in a state of rest as well as in motion, connections between said members and said form for collapsing all of the collapsible sections of the form upon relative rotation of said members to strip the form from inner surfaces of a tire built thereon, and power means for rotating said members in unison and also operable to cause relative rotation of said members upon hindering rotation of one of said members, whereby said form is so collapsed by power by a single operation of said power means relatively to rotate said members.

39. A tire-band building form composed of sections relatively movable to collapse the form, a rotary support for said sections, retardable means movable on said support and having connections controlling the relative movement of said sections for completely collapsing the form by its own momentum when rotating in a forward direction, and a friction brake operable on said retardable means for effecting such collapse.

40. A tire-band building form having a plurality of sections movable to collapse the form, relatively retardable means having connections operating on all of the movable sections and adapted to completely collapse the form by its own momentum in less than one rotation thereof in a forward direction, and a friction brake operable on said retarding means for effecting such collapse.

41. A rotary tire-band building drum composed of overlapping and underlapping segments radially movable inwardly to collapse the drum, a retardable member having connections for unequally collapsing the underlapping and overlapping segments in timed relation while the drum is forwardly rotating, and brake means controlling said retardable member for effecting collapse of the drum by its own momentum.

42. A rotary collapsible band-builder comprising a central segment carrier, a building form having its entire periphery composed of four movable segments supported by said carrier and including a pair of opposite pivotally mounted segments, controlling means within the drum, concentric with and rotatable relative to said carrier and having an external wheel with its periphery exposed for engagement to produce the relative rotation of said means at will, and operating connections actuated by said controlling means for drawing inwardly all of said segments into underlying and overlying collapsed relation.

43. A rotary collapsible band-builder comprising a central segment carrier, a building form having its entire periphery composed of four pivoted segments supported by said carrier in couples at opposite sides of the form, the end of one member of each couple overlapping that of the other member of the opposite couple, and controlling means concentric with the axis of rotation of the form and rotatable relative to said carrier and having connections for producing the complete collapse of all of said segments, and moving the underlapping segments inwardly in advance of the overlapping ones.

44. A rotary collapsible band-builder comprising a drum having its entire periphery composed of four segments, a central carrier pivotally supporting said segments in two opposite couples, the members of each of which swing oppositely into underlying and overlying collapsed relation to those of the other couple, a control sleeve concentric with and rotatable relative to said carrier, toggle links connecting said sleeve with the underlying segments for moving the latter, and additional connections actuated by said sleeve for moving the overlying segments.

45. A band-builder according to claim 44 in which the additional connections are bent links

connecting said sleeve with the overlying segments.

46. Building apparatus for inextensible-bead pneumatic tire bands comprising a rotary drum composed entirely of pivoted segments having depressed bead seats, a carrier pivotally supporting the segments and having fixed pivots for a pair of segments on opposite sides of the drum, and operating means for all of the segments adapted to collapse the drum in its own plane to a minor diameter at the median plane less than the mean expanded diameter of said bead seats.

47. A rotary collapsible builder for inextensible-bead tire bands comprising a segment carrier, a drum composed of segments having depressed marginal bead seats and pivotally supported by said carrier in opposite couples, each comprising oppositely swinging members which meet those of the other couple in underlapping and overlapping end-to-end relation, and operating devices within the drum including a controlling member concentric with the axis of rotation of the drum and rotatable relative to said carrier and connections actuated by said member for operating all of said segments to collapse the drum to a size permitting removal of the depressed-bead band.

48. A rotary collapsible builder for inextensible-bead tire bands comprising a segment carrier, a drum composed of four segments having depressed marginal bead seats and pivotally supported by said carrier in opposite couples, each comprising oppositely swinging members with beveled ends meeting those of the other couple in underlapping and overlapping relation, and operating devices within the drum including a controlling member concentric with the axis of rotation of the drum, rotatable with and relative to said carrier, and connections between said member and all four segments for completely collapsing said segments in less than one relative rotation of said member, to a size permitting removal of the depressed-bead band.

49. A rotary collapsible builder for inextensible-bead tire bands comprising a segment carrier, a building drum composed of pivotally-mounted segments supported by said carrier and having depressed bead seats, the meeting free ends of said segments being in underlapping and overlapping relation, a controlling member rotatable with and relative to said carrier, concentric with the latter's axis of rotation, and connections operated by said controlling member for separately actuating said underlapping and overlapping segments to collapse them in timed relation avoiding interference between said free ends, to a drum size permitting removal of the depressed-bead band.

50. A rotary collapsible tire-builder comprising a segment support, a concentric controlling member rotatable with and relative thereto, a pair of underlapping and a pair of overlapping segments pivotally carried by said support in opposite couples, toggle links connecting said controlling member with the underlapping segments and foldable with said member circumferentially of the drum for initiating the inward movement of the free ends of said underlapping segments at a time when those of the overlapping segments have no inward movement, and additional operating connections for the overlapping segments, operated by relative rotation of said member, for thereafter moving inwardly the free ends of said overlapping segments.

51. A tire-builder according to claim 50 in which the additional operating connections are longer links connecting said member with the overlapping segments and bent to accommodate the free ends of the underlapping segments in the collapsed condition.

52. A collapsible tire-band builder comprising a rotary segment support, a controlling member rotatable with and relative thereto, concentric with the axis of rotation of said support, a tire-building drum composed of segments pivotally carried by said support by means including fixed pivots at opposite sides of the form, and circumferentially foldable operating connections for collapsing all of the segments by relative rotation of said member, adapted to maintain said drum in expanded condition, against starting inertia, for band-building operations in either direction of drum rotation.

53. A collapsible band-builder comprising a rotary segment support, a controlling member rotatable with and relative thereto, concentric with the axis of rotation of said support, a building drum composed of two pairs of underlapping and overlapping segments pivotally carried by said support in opposite couples, and operating means including circumferentially foldable toggle-link connections from said member to the underlapping segments and additional connections operated by said member for actuating the overlapping segments, to collapse the drum, said connections collectively being adapted to maintain the drum expanded for band-building operations in both directions of drum rotation.

54. A rotary collapsible tire-band builder comprising a segment support, a relatively rotatable concentric controlling member, a band-building drum composed of underlapping and overlapping segments movably carried by said support, and operating connections actuated by said member for moving said overlapping segments outwardly beyond their ultimate position and then inwardly against the mating underlapping segments to maintain the drum, by the binding action of the band thereon during reverse rotation, in an expanded condition for band-building operations in both directions of drum rotation.

55. A rotary tire-building form having its periphery composed of segments arranged in opposite couples each including an overlapping and an underlapping segment at least one of which is mounted on a radially-fixed pivotal axis and whose end abuts that of the adjacent segment of the other couple in the expanded condition, said segments being inwardly movable to collapse the form and outwardly movable by centrifugal force when the form is rotated to automatically expand it, and means for operating and controlling all of the segments, including toggle devices constituting, together with said abutting of adjacent segment ends, the sole means for arresting the outward movement of said segments, and movable to a fully straightened arresting position by said movement.

56. A form according to claim 55 having its masses disposed substantially in rotational balance in both the expanded and the collapsed condition and having all segments pivotally mounted and at all times symmetrically disposed about the center of rotation of the form.

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