Aug. 11, 1959 J. D. ROBERTSON 2,898,662

EXPANDING AND CONTRACTING ROLLS

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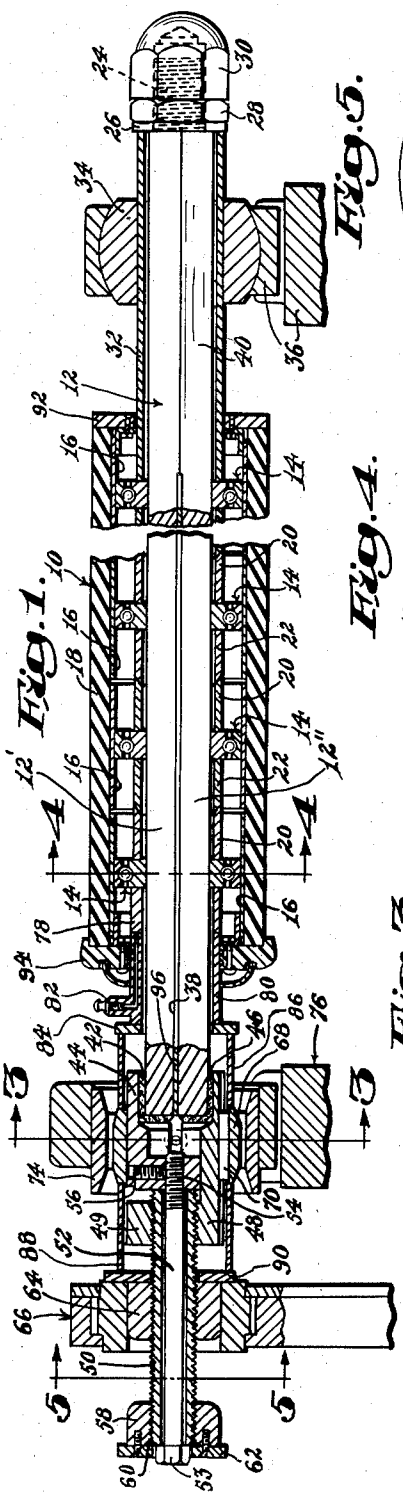


Fig. 1.

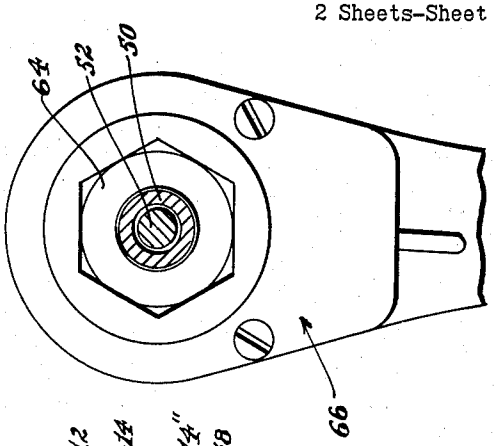


Fig. 5.

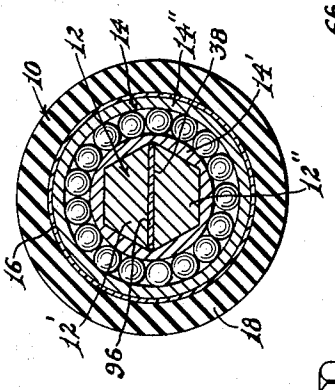


Fig. 4.

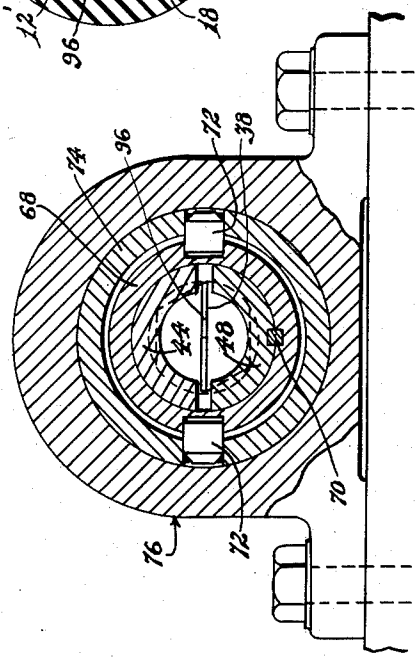


Fig. 3.

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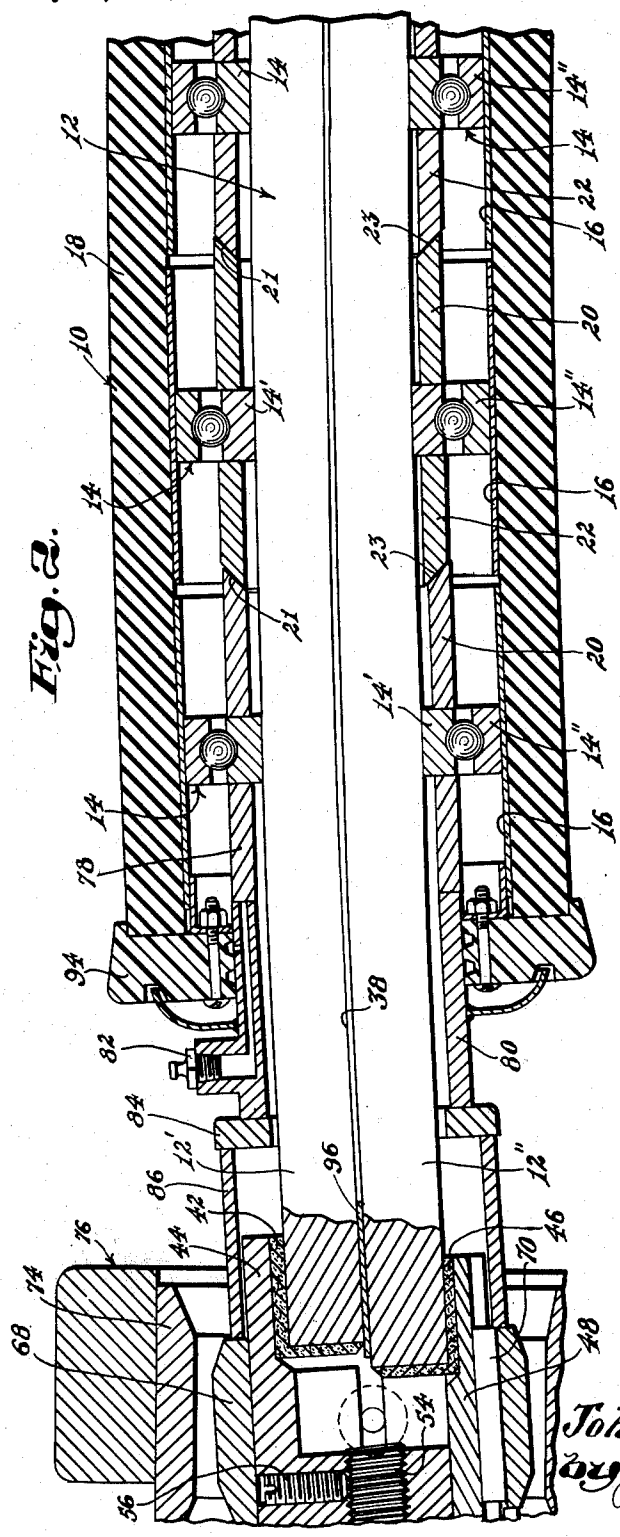


Fig. 2.

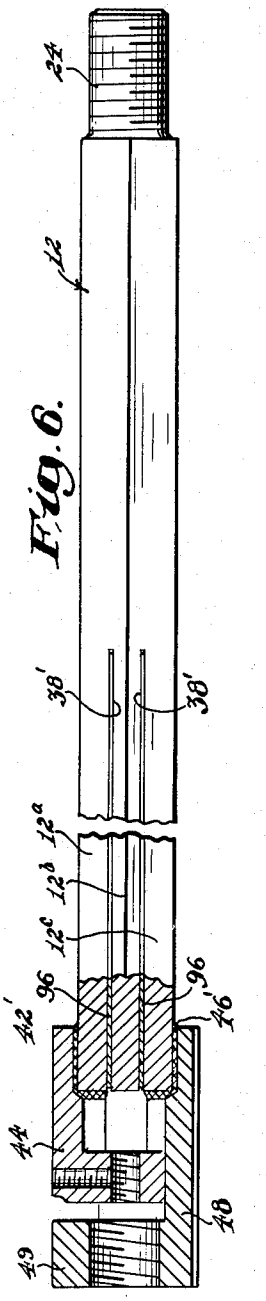


Fig. 6.

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United States Patent Office 2,898,662
Patented Aug. 11, 1959

2,898,662

EXPANDING AND CONTRACTING ROLLS

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Application May 17, 1957, Serial No. 659,957

6 Claims. (Cl. 26—63)

This invention relates to improvements in expanding and contracting rolls and more particularly to such rolls having longitudinal curvature which may be varied to change the expanding or contracting effect of a roll upon travelling flexible sheet material which may be in engagement with the roll.

Longitudinally curved rolls are employed in various arts for laterally expanding flexible sheet materials, or webs, of cloth, paper, plastic films, foils, wire screening, and the like, to remove wrinkles and to ensure that a sheet or web leaving a curved roll will approximate a predetermined width. Also, longitudinally curved rolls may be used for contracting such webs, and for correcting bow of weft or filler elements of woven webs.

My present invention relates to such longitudinally curved rolls whose curvature readily may be varied to suit particular conditions or requirements, and provides improvements over the disclosures of my prior Patents Nos. 2,547,975 and 2,689,392, dated April 10, 1951 and Sept. 21, 1954, respectively.

It is among the objects of my present invention to provide an adjustable-curvature roll which may be produced more economically than prior comparable rolls, and which can have a greater degree of stability in service as compared with the prior comparable rolls.

Another object of my present invention is to provide an adjustable-curvature roll axle which is longitudinally slitted to provide a plurality of relatively long axle portions which are rigidly connected together at one end of the axle and which otherwise are relatively moveable for introducing longitudinal curvature in the axle, there being means at the other end of the axle for effecting controlled relative movements of said axle portions, and for maintaining the axle portions in selected relative positions providing predetermined longitudinal curvature in the axle.

A further object of my present invention is to provide an adjustable-curvature roll having an initially rigid and straight axle which is slit longitudinally from one end inward to a location short of the other end thereby to provide a plurality of relatively long axle portions integrally connected together at said other end and otherwise free for relative longitudinal movements, there being means at said one end of the axle for effecting relative longitudinal movements of said axle portions, and for maintaining a selected relationship of said portions with a predetermined longitudinal curvature in the axle.

It is, moreover, my purpose and object generally to improve the structure and operative efficiency of curved expander and contracter rolls and especially such rolls having provision for varying the longitudinal curvature of the rolls at will.

In the accompanying drawings:

Fig. 1 is an elevational view, mostly in medial cross-section, of a mounted adjustable curvature roll embodying features of the invention, the roll and its axle being shown in straight condition;

Fig. 2 is a view generally similar to Fig. 1 but showing, on a larger scale, only portions of the roll and mounting means at the left hand end of the roll of Fig. 1, the roll and axle having longitudinal curvature introduced therein;

Fig. 3 is a cross-sectional view on line 3—3 of Fig. 1 on a scale larger than that of Fig. 1 and smaller than that of Fig. 2;

Fig. 4 is a cross-sectional view on line 4—4 of Fig. 1, on the scale of Fig. 3;

Fig. 5 is a cross-sectional view on line 5—5 of Fig. 1, on the scale of Figs. 3 and 4; and

Fig. 6 is an elevational view, partly in cross-section, showing a modified form of roll axle embodying features of the invention.

Referring to the drawings, the roll indicated generally at 10 and shown in straight condition in Fig. 1 is adapted to have longitudinal curvature introduced therein as represented in Fig. 2, the degree of curvature being variable to suit particular conditions or requirements.

Roll 10 is rotatable on an axle 12 by reason of distributed ball-bearing units 14, each of which units has an inner ball race 14' non-rotatably mounted on axle 12 and an outer ball race 14'' fixed within one of the series of cylindrical roll sleeves 16, for rotation therewith. A flexible surface sleeve 18 is engaged over all of the roll sleeves 16, tieing them together for rotation in unison with the surface sleeve 18.

Axle 12 may be cross-sectionally round, or of any other suitable cross-sectional shape, with the inner ball-bearing races 14' suitably retained against rotation thereon. The axle is herein represented with hexagonal cross-section, and the inner races 14' have corresponding hexagonal holes therein for nicely fitting on the axle. Each ball-bearing unit preliminarily may be mounted, with force fit, within a different roll sleeve 16, and the bearing units, with the roll sleeves 16 thereon, may be placed on and slid along axle 12 in succession, with the ring spacing elements 20, 22 relatively loose on the axle between adjacent bearing units 14. The spacing elements 20, 22 become clamped between the inner races 14' and their edges which are adjacent to each other are respectively interiorly and exteriorly bevelled, as best seen at 21 and 23 in Fig. 2, so that the spacing elements are self-adjusting for accommodating any introduced curvature in axle 12.

The right-hand end portion of axle 12 (Fig. 1) projects substantially beyond the endmost bearing unit 14, and its extreme end is reduced and threaded at 24 for reception of an abutment element 26 which may be backed by lock-nuts 28, 30. A relatively long spacing sleeve 32 is loose on axle 12 between the abutment element 26 and the inner race 14' of the endmost bearing unit 14, the sleeve 32 extending through a known variety of bearing element 34 which is movably mounted within a bearing member 36 which supports one end of the roll.

According to the invention, the axle 12 is slit longitudinally at 38 from its left-hand end in Fig. 1 throughout the major portion of the extent of the axle to provide the two axle portions 12', 12'', the slit 38 being represented as terminating approximately at the endmost bearing unit 14 at the right hand end portion of the roll as seen in Fig. 1. Hence, a substantial end portion of the axle continues unslit and rigidly solid at 40.

The other end of axle 12 has its portion 12' welded or otherwise rigidly secured at 42 to a member 44, and has its portion 12'' welded or otherwise rigidly secured at 46 to a member 48 which has a part 49 with a threaded hole therethrough for reception of the exteriorly threaded rigid tube 50 which is threaded through part 49 into engagement with member 44. A long bolt 52 extends loosely through tube 50 and has its inner end threaded and screwed into member 44, at 54, and locked

to member 44 by a set screw 56. The outer end of tube 50 has a nut 58 screwed thereon and permanently fixed thereto as by a weld 60. An abutment disk is secured to the outer side of the nut 58, with a central hole loosely accommodating the head 53 of bolt 52. Another nut 64 is screwed on tube 50, and a wrench, indicated generally at 66, is adapted to be engaged with either of the nuts 58 or 64, and to be slid from one nut to the other, for purposes which later will appear.

The members 44, 48 which are, respectively, on the end of axle portion 12', and on the end of axle portion 12", extend slidably through the pivoted bearing element 68, and member 48 is keyed to bearing element 68 as at 70. Bearing element 68 has diametrically opposite recesses therein for pivotal reception of the trunnions 72 (Fig. 3) which project inward from the element 74 of the bearing support indicated generally at 76.

Suitable thrust elements are inserted around axle 12 between the pivoted bearing element 68 and the inner race of the endmost bearing unit 14 at the left-hand end portion of the roll. As represented, a ring element 78 is next to the bearing unit 14, and a longer element 80, equipped with a lubricating fitting 82, engages between ring element 78 and a washer 84, between which and pivoted bearing element 68 a larger diameter ring element 86 is positioned. Another ring or spacer element 88 engages between the outer side of pivoted bearing element 68 and a washer 90 which is loose on tube 50 and engaged by the nut 64. Hence, by screwing nut 64 inward on tube 50 by means of the wrench 66, all of the ring and spacer elements may be put under longitudinal compression.

However, while the assembled parts continue relatively loose, the wrench 66 may be slid from nut 64 onto nut 58 preparatory to introducing curvature into the roll by screwing tube 50 inwardly relative to part 49 of member 48. This effects relative outward movement of axle portion 12" and inward movement of axle portion 12', thereby causing the axle to assume a bowed condition as shown in Fig. 2, and the magnitude of any introduced bowing of the axle may be selected to suit any particular desires or requirements. The pivoted bearing supports 34, 68 adjust themselves to suit any introduced bowing of the axle. Then, the wrench 66 will be shifted to the nut 64 for endwise clamping of the parts to provide a rigid roll structure having the selected longitudinal curvature.

Any suitable end-caps 92, 94 may close the ends of the roll body around the thrust and spacing elements 32, 80.

The slit 38 in axle 12 may be made by a suitable saw blade, and the axle portions 12', 12" preferably are maintained in their slightly spaced relationship by a strip 96 of suitable material loosely inserted into the kerf made by the saw and substantially filling the kerf from end to end thereof.

Fig. 6 illustrates a modified form of axle 12 which has two slits 38' therein which provide three relatively movable axle portions 12^a, 12^b, 12^c of which the portion 12^a is welded at 42', or otherwise secured, to a member 44 which is generally similar to the member 44 in Figs. 1 and 2. Axle portion 12^c is welded at 46', or otherwise secured, to the member 48 which is generally similar to the member 48 in Figs. 1 and 2. The middle portion 12^b of the axle is left free for movement relative to both of the other axle portions 12^a, 12^c. Loose strips 96 preferably substantially fill the kerfs as in the earlier described embodiment.

The Fig. 6 axle may be mounted and flexed as described in connection with Figs. 1 and 2, the two slits being desirable for axles having larger cross-section than can be adequately served by a single slit.

It will be apparent from the foregoing description, in connection with the drawings, that my improved slit-axle rolls may be economically produced to provide roll structures which readily may be flexed to impart selective amounts of longitudinal curvature in the body of the roll, and wherein there is effective means always available for varying the roll curvature and for securing the parts in rigid operative condition with the selected curvature therein.

Various changes in the details of construction may be made within the scope of the appended claims, and it is intended that the patent shall cover, by suitable expression in the appended claims, whatever features of patentable novelty exist in the invention disclosed.

I claim as my invention:

1. An adjustable-curvature roll axle, comprising a relatively long initially rigid axle provided with a slit extending from one end of said axle inward throughout a substantial portion of the length of said axle and terminating a substantial distance from the other end of said axle thereby to provide a plurality of longitudinally relatively movable axle portions integral on a solid non-slit axle portion, said plurality of relatively movable axle portions extending all in the same general direction from said solid axle portion, and means at the slit end of the axle operable to effect longitudinal movement of one of said plurality of relatively movable axle portions relative to another thereby to forcibly introduce longitudinal curvature into at least one of said axle portions, longitudinally spaced means closely engaging around said plurality of relatively movable axle portions at spaced locations along the slit region of the axle whereby all of said plurality of relatively movable axle portions become longitudinally flexed in response to said introduction of curvature into said one of the axle portions, and locking means associated with said curvature-introducing means for securing the said longitudinally flexed axle portions rigidly in any selected longitudinally flexed condition.

2. An adjustable-curvature roll axle as defined in claim 1 wherein there are two of the said slits providing three axle portions at said slit region of the axle and wherein said curvature-introducing means comprises two relatively slidable members rigid on the ends of different ones of the two radially outer axle portions, and mechanism for forcing said members relatively in opposite axial direction.

3. An adjustable-curvature roll comprising an adjustable curvature axle having a roll body rotatably mounted thereon with opposite ends of the axle projecting beyond the opposite ends of said roll body, said axle comprising a relatively long initially rigid shaft having a slit therein extending from one end axially inward and terminating a substantial distance short of the other end of the axle whereby a substantial portion of the axle at said other end thereof continues solid and rigid and the remainder of the axle comprises a plurality of longitudinally relatively movable axle portions all of which are integral on said solid and rigid portion and all of which extend in the same general direction from said solid and rigid portion, a pair of rigid members each rigidly connected to the slit end of a different one of said relatively movable axle portions, and flexing means for forcing said members relatively in opposite axial directions thereby to flex at least one of said relatively movable axle portions, bearing means at spaced locations along said axle rotatably supporting said roll body on the axle, spacing elements intervening between said spaced bearing means, said bearing means having portions engaging closely around all of said relatively movable axle portions at the slitted region thereof whereby all of said relatively movable axle portions become generally correspondingly flexed in response to a said force flexing of any one of said axle portions, and means operable independently of said flexing means for clamping said spacing elements and bearing means axially of the roll body thereby to maintain the axle in a rigid condition with a predetermined longitudinal curvature in the slit region thereof.

4. An adjustable-curvature roll as defined in claim 3 wherein said flexing means comprises two relatively slid-

able members each fixed to an end of different ones of said axle portions, an exteriorly threaded element screwed through a portion of one of said slidable members into engagement with the other of said slidable members, one nut fixed on said element and another nut movable on said element for effecting the said clamping of said spacing elements and bearing means, and a wrench shiftable from one to the other of said nuts for rotating said exteriorly threaded element to introduce curvature in said axle portions when one nut is rotated by the wrench, and for effecting the said clamping of spacing elements and bearing means when the other nut is rotated by said wrench.

5. An adjustable-curvature roll axle as defined in claim 1 wherein said slit is a saw cut and a filler strip, separate from said axle portions, is slidably arranged within the slit preventing any appreciable relative movement of adjacent relatively movable axle portions toward each other.

6. An adjustable-curvature roll as defined in claim 4

wherein there are self-adjusting supports for opposite end portions of said axle, and said relatively slidable members are slidably mounted within one of said self-adjusting supports, and wherein there are thrust elements at opposite sides of said one self-adjusting support through which and said one support the said clamping of said spacing elements and bearing means is effected in response to said rotation of said other of the nuts on said exteriorly threaded element, the opposite end portion of the axle being slidable in its self-adjusting support when the axle is being flexed and subsequently clamped with predetermined curvature therein.

References Cited in the file of this patent

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