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FLEXIBLE TUBULAR CASING

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Fig. 1.

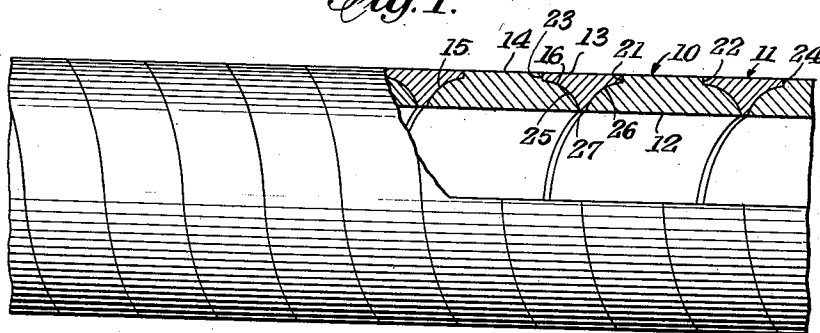
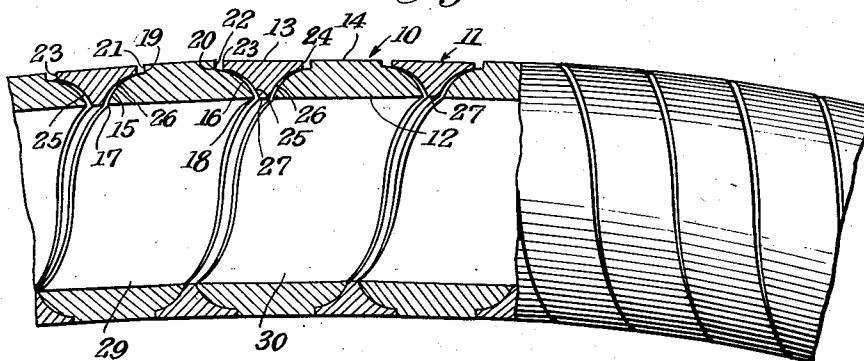


Fig. 2.



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FLEXIBLE TUBULAR CASING

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12 Claims. (Cl. 138—51)

This invention relates to flexible metal casings, and particularly to that type used for housing flexible shafts, radio remote controls, and the like elongated flexible members.

5 Difficulty has heretofore been experienced with flexible casings of limited diameter in that insufficient resistance is offered thereby to longitudinal stretching thereof. The tension customarily put on such casings frequently separates the coils or turns thereof to such an extent as to permit leakage of the lubricants out of the casing. When the coils of the casing separate unduly under the tensile or other stresses thereon, the casing fails to give the necessary protection to the shaft or other flexible members housed in the casing, and cannot be depended on to perform its required functions.

15 Previous attempts to increase the resistance of the casing to longitudinal stretch by constructing the casing of two strands arranged in two layers, while being more or less efficient to resist such stress, has resulted in structures which are too complicated and too expensive for ordinary commercial use.

20 My invention therefore provides a simple, light, but efficient casing, utilizing a minimum amount of material, which is comparatively easy and inexpensive to manufacture and which is highly resistant to longitudinal extension or stretching.

30 My invention further provides a flexible casing which while adequately resistant to longitudinal or end stretch, maintains its proper seal between the respective coils to prevent leakage or loss of lubricants or access of foreign materials to the interior thereof.

35 My invention further provides a flexible casing made of a pair of strips arranged in edge-adjacent-overlapping relation to form a seal therebetween at all times, one of the strips being of considerable width and wider than the other to offer great resistance to end stretch, the strips being further so arranged that while providing two relatively slidable layers of material at the joints therebetween, the total thickness of the casing is not substantially greater than that of the wider strip only.

40 The various objects of the invention will be clear from the description which follows and from the drawing, in which,

45 Fig. 1 is a front view and partial section of a portion of a flexible casing embodying my invention.

50 Fig. 2 is a similar view of the same showing

the relative positions assumed by the coils when the casing is bent.

In the practical embodiment of my invention which I have shown by way of example, the casing comprises an elongated wider strip 10 and a narrower strip 11, said strips being of continuous mill lengths in order that they may be wound into a casing of any length required. The shapes, sizes, proportions and relative arrangement of the strips are important features of my invention.

It will be understood that the strip 10 at its inner face 12 is of substantially twice the width of that of the upper face 13 of the strip 11, and of the upper face 14 of the strip 10. The strip 11 being of generally triangular cross-section and the strip 10 of generally trapezoidal cross-section, the area of the cross-section of the strip 10 is approximately three times that of the strip 11. By reason of its excess width, the strip 10 is highly resistant to end stretch, while making it possible to maintain the thicknesses of the strips 10 and 11, and the consequent thickness of the casing at a minimum. The inner parts of each of the side edges of the strip 10 are preferably rounded as at 15, 16 in arcs of predetermined radius, beginning at points 17 and 18 respectively. At the points 19 and 20 are formed the respective shoulders 21 and 22, the faces of said shoulders being preferably at substantially right angles to the face 12.

30 The strip 11 is of generally triangular cross-sectional shape, the outermost face 13 thereof being preferably flat and being of substantially the same width as the corresponding outermost face 14 of the strip 10. Extending inwardly from the outer face 13 are the respective shoulders 23, 24 adapted normally to engage the corresponding shoulders 22 and 21 respectively of the adjacent coils 29, 30 of the strip 10 (Fig. 1). From innermost corners of the shoulders 23 and 24 extend the respective concavely arcuate edges 25, 26 of substantially the same radius as the edges 15 and 16 of the strip 10 and adapted to overlap said edges and to cooperate therewith to seal the slight space between the faces 12 of the adjacent coils 29, 30 of the strip 10. The edges 25 and 26 extend to the innermost blunt edge 27 of the strip 11. It will be understood that the coils of said strip 11 are consequently fitted into and accurately seal the spaces between the adjacent coils of the strip 10. Said strip 11, therefore, serves as a filler and sealing member and presents an outermost surface on the coils thereof of substantially the same width

as the surfaces 14 of the coils of the main strip, whereby the casing appears to be wound of a single strip of material of substantially the same width throughout.

5 Nevertheless, it will be understood that even though substantial tension, bending stress and/or flexure is applied to the casing, movement of the shoulder 22 of one of the coils as 29 away from the shoulder 21 of the next coil 30 of the strip, does not break the seal formed by the strip 11, 10 owing to the overlapping of the concavely arcuate edges of the strip 11 on the convexly arcuate edges of the coils of the strip 10. (See Fig. 2.)

It will further be understood that since the 15 strips 10 and 11 are wound in the form of a helix to provide turns or coils in adjacent relation, the pitch of each of the coils is twice that which the coils would have had if wound from a single strip only.

20 From the above, it will be noted that by the provision of two helically wound adjacent strips in proper overlapping relation, one strip about twice as wide as the other, great resistance to end stretch is attained, first, by reason of the 25 increased width of the main strip, and second, by the increase of the pitch of the turns or coils without sacrificing the proper sealing effect of the filler strip and while maintaining the amount of material and the resulting thickness of the casing and the labor of assembling the strips 30 at a minimum.

While I have shown and described a certain specific embodiment of my invention, it will be understood that I do not intend to limit myself 35 thereto, but desire to claim my invention as broadly as may be permitted by the state of the prior art and the scope of the appended claims. I claim:

1. In a flexible helically wound metal casing, 40 a wider strip having an innermost cylindrical face of substantially twice the width of the outermost cylindrical face thereof, and having a thickness less than the width of either of said faces, a convexly arcuate edge portion extending from 45 each of the peripheral edges of said innermost face toward the outermost face of the strip and terminating inwardly thereof, a shoulder extending from the outermost point of said convex portion to said outermost face, and arranged 50 at substantially right angles to said faces, said wider strip being wound in a plurality of turns, and a filler strip having concave edge portions in contact with the convex edge portions of the adjacent coils of said wider strip arranged between 55 said coils, said filler strip being of substantially the same thickness as that of said wider strip and having outermost and innermost faces arranged respectively in the same cylindrical surfaces as those in which the outermost and innermost faces of the wider strip are arranged, and a shoulder on the filler strip arranged 60 at substantially right angles to the faces of the filler strip and normally in contact with the corresponding shoulder of the wider strip, the casing wall formed by said strips being of substantially uniform thickness throughout.

2. In a helically wound flexible metal casing, a pair of helically wound strips arranged in adjacent relation, one of said strips being of generally 70 trapezoidal cross-section and the other being of generally triangular cross-section, the base of the trapezoidal cross-section being substantially twice the width of the base of the triangular cross-section, said one strip having convexly 75 ly arcuate edges and said other strip having con-

cavely arcuate edges, said strips having normally contacting shoulders extending inwardly at substantially right angles from the outer faces of the strips to said arcuate edges.

3. In a helically wound flexible metal casing, 5 a pair of flat wire strips arranged in adjacent relation with their respective inner and outer surfaces in substantial alignment and with the edges thereof overlapping through the greater part of the thickness thereof, one of said strips having 10 an inner face of greater width than the outer face of the other strip and having the edges thereof shaped convexly and terminating in substantially perpendicular shoulders intermediate the faces thereof, the corresponding edges of the 15 other strip being shaped concavely and having corresponding perpendicular shoulders adapted normally to engage the shoulders of said first mentioned strip.

4. In a flexible metal casing of a predetermined 20 substantially uniform thickness of material, a pair of strips arranged in edge-abutting relation with their respective inner and outer faces aligned and helically wound, one of said strips having a thickness equal to said predetermined thickness 25 and being of generally trapezoidal cross-section, the other of said strips being of generally triangular cross-section and of the same thickness, the area of the cross-section of said first mentioned strip being substantially three times the 30 area of the cross-section of the second mentioned strip, said casing being highly resistant to longitudinal stretching.

5. In a flexible casing, a strip wound helically 35 into a plurality of coils, said strip having a generally trapezoidal cross-section and being provided with edges each having a portion thereof convex and the remainder thereof providing a re-entrant substantially right angled shoulder, and 40 a filler strip having edges fitted to and overlapping the edges of said first mentioned strip and sealing the space between the coils thereof, both of said strips having outer exposed faces of substantially equal area lying in the same cylindrical surface. 45

6. A flexible casing of substantially uniform thickness throughout and having smooth cylindrical and parallel inner and outer surfaces, comprising a strip wound helically into a plurality 50 of coils, said strip having an inner face wider than the outer face thereof, said outer face forming half of the outer surface of the casing, and a filler strip having an outer face of lesser width than the inner face of said first mentioned strip 55 and forming the other half of the outer face of the casing, the respective inner and outer faces of said strips being aligned with each other and cylindrical.

7. A flexible casing of uniform thickness and highly resistant to end stretch, said casing having 60 an outer smooth and substantially uninterrupted outer surface and a parallel inner surface comprising a main strip wound helically into a plurality of coils, edges on said strip converging from the inner face of said strip toward the 65 outer face thereof, and a filler strip filling and sealing the space between said coils and having an outer face of substantially the same width as and aligned with the outer face of said first mentioned strip, and having edges converging from 70 the outer face thereof toward the inner face.

8. In a flexible casing, a pair of adjacent strips wound helically into a plurality of coils, each of said strips being of the same thickness as that 75 of the casing and having an outer face of substan-

5 tially the same width as that of the other strip
each to form half of the outer exposed surface
of the casing, and one of said strips having an
inner face of greater width than that of the outer
face to impart to said casing maximum resist-
ance to end stretch.

10 9. In a flexible casing, a pair of adjacent strips
wound into a plurality of double pitch coils, one
of said strips having an inner face of greater
width than the outer face of either strip, and the
other of said strips being of generally triangular
cross-section, the corresponding surfaces of the
strip being aligned with each other, and both
strips being of the maximum thickness as that
15 of the casing.

20 10. A flexible casing resistant to end stretch
and having smooth parallel cylindrical inner and
outer faces and being of substantially the same
thickness throughout, said casing comprising a
pair of flat-wire strips in edge-adjacent relation
and each having an outer face of substantially
the same width as that of the other, said strips
being wound into coils of double pitch, and one
of said strips having an inner face of greater

width than that of the outer faces, and the other
having an inner face of less width than that of the
outer faces.

11. A flexible casing comprising a pair of edge-
adjacent flat-wire strips wound into coils of 5
double pitch and having aligned cylindrical outer
faces of substantially the same width, the inner
face of one of said strips being wider and the
inner face of the other strip being narrower than
the outer faces, said strips being of the same 10
thickness and of the same thickness as that of the
casing.

12. In a flexible casing, a pair of metallic flat-
wire strips having complementary interfitting
partly curved adjacent edges, said edges terminat- 15
ing in right-angled shoulders at the outer sur-
faces of said strips, said strips being arranged
in edge-abutting relation and having outer faces
of substantially the same width throughout, the
inner face of one of said strips being wider and 20
the inner face of the other strip being narrower
than said outer faces.

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