June 6, 1967 C. G. RICHITELLI ET AL 3,323,553

WIRE-REINFORCED HELICALLY FABRICATED FLEXIBLE CONDUIT

Filed Oct. 5, 1964

FIG. 1

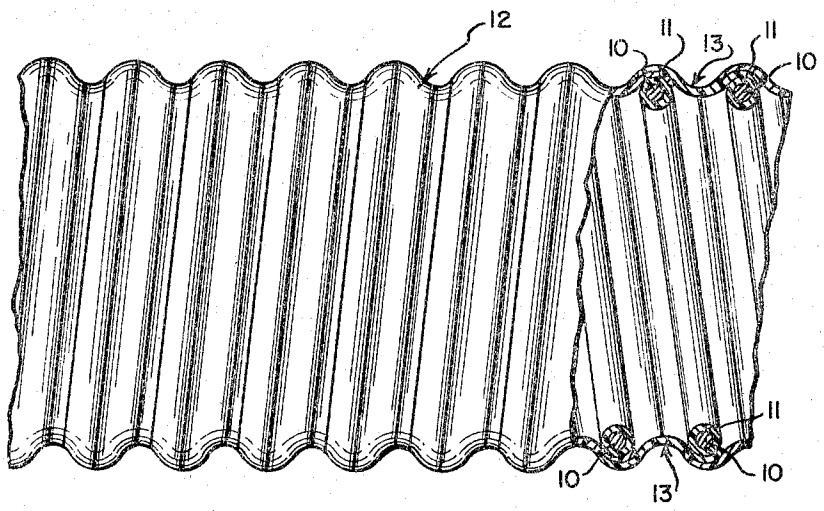


FIG. 2

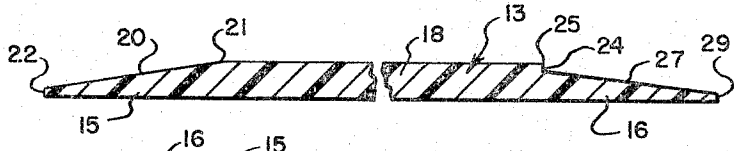
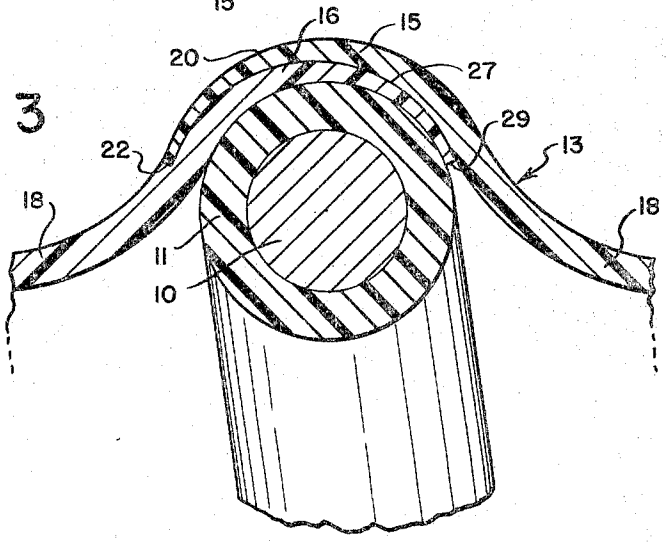


FIG. 3



INVENTORS
MARCUS A. HALL
CHARLES G. RICHITELLI
BY
Pennie, Edmonds, Morton, Taylor & Adams
ATTORNEYS

United States Patent Office 3,323,553 Patented June 6, 1967

3,323,553

WIRE-REINFORCED HELICALLY FABRICATED FLEXIBLE CONDUIT

Charles G. Richitelli, Madison, and Marcus A. Hall, Branford, Conn., assignors to Flexible Tubing Corporation, a corporation of Connecticut

Filed Oct. 5, 1964, Ser. No. 401,494
8 Claims. (Cl. 138—122)

This invention relates to flexible conduit wherein a wire helix is hellically wrapped about by at least one covering strip and, more particularly, to improvements in overlapping side portions of the strip in such conduit.

It is a primary object of this invention to provide a light highly flexible wire-reinforced conduit of the most pleasing appearance for use as hair dryer hose and the like, though the structural features which it embodies make it applicable for many other quite different purposes. Such hose should possess the optimum combination of wear resistance, continuity of exterior surface, thinness of wall, and flexibility, and to achieve these ends the covering applied about the reinforcing wire helix must embody distinct departures in design from what has been accepted as its conventional form. Common wire-reinforced flexible conduit helically covered with strip of the sort suitable for retail products such as hair dryer hose usually includes a strip which is much wider than the pitch of the wire helix so that it overlaps itself a plurality of times to develop a wall covering of substantial thickness. Such structures tend to be too heavy and stiff for the general purposes of this invention. Also, it is desirable to make hair dryer hose with a transparent wall to enhance its attractiveness and this cannot adequately be achieved with the multiple overlapping wide covering strip of the prior art.

Broadly stated, the invention concerns flexible conduit wherein a wire helix is helically wrapped about by at least one covering strip having first and second overlapping side portions. The improvement by which the foregoing advantages are obtained comprises a taper on each of the first and second side portions from the inner to the outer edge thereof. A step is included on at least the inner edge of the second side portion. Both side portions should be narrower than half the strip width and the first side portion should extend from the step to the outer edge of the second side portion.

Since the overlapping side portions of the new hose are narrower than half the strip width, a central longitudinal portion of the strip in each convolution is not overlapped and the wall covering defined by the strip can therefore be quite thin and highly flexible. This permits the conduit to be looped and compressed with no difficulty and allows it to drape easily in a relaxed state, all of which are features of considerable significance for a product such as hair dryer hose. The covering formed by the strip is well adapted to being transparent because at least in the non-overlapped central portion of the strip there is only one thickness of material and thus transparency is not diminished by refraction through an interface between two plies.

However, the benefits resulting from the improved design of the first and second overlapping side portions of the strip are not limited just to these characteristics of the non-overlapping central portion. Since one side portion is tapered and the other is both stepped and tapered, it is possible to form the overlap in a manner such that no shoulder or other discontinuity is visible on the outside of the covering. The outer edge of the tapered first side portion is received within the step on the inner edge of the second side portion at the overlap so that one convolution of the strip proceeds to the next without an abrupt interruption in the thickness of the wall. From the standpoint of appearance, this is a feature of considerable advantage. Also, since both side portions are tapered there

is little variation in the overall thickness of the wall covering in the overlapped region of the convolutions, which again contributes to the attractiveness of the product and improves its flexibility. When this smooth overlap is disposed directly over the wire helix as in the preferred embodiment of the invention, the areas between the turns of the wire helix are left covered only by the single-ply central portion of the strip and an uninterrupted view of the interior of the conduit is made possible through that central portion when the strip is of transparent material. In addition the location of the overlapped zone provides a kind of buffer at the wire helix where the conduit is most vulnerable to wear when the covering is of corrugated form extending inwardly between the turns of the wire helix.

A preferred embodiment of the invention is described hereinbelow with reference to the accompanying drawing, wherein

FIG. 1 is a fragmentary elevation partly broken away of the conduit of the invention;

FIG. 2 is an enlarged lateral section partly broken away of the strip used for the covering of the conduit;

FIG. 3 is an enlarged fragmentary section showing the overlapped side portions of the strip in relation to the wire helix.

In the flexible conduit of FIG. 1, a wire helix **10** of metal, plastic or other suitable self-supporting filament is formed with a coating **11** of elastomeric material such as a synthetic thermoplastic. The coated wire helix **10** is provided with a continuous wall covering **12** by being helically wrapped about with a single covering strip **13**, shown in detail in FIG. 2, which is of the same plastic material as the coating **11**. The covering **12** formed by the strip **13** is bonded to the coating **11** on the wire helix **10** by fusion, a solvent, or some other suitable means. It is preferable that the helical covering strip **13** have the same pitch and direction as the wire helix **10** and be applied under tension so as to extend radially inwardly between the wire convolutions. As shown most clearly in FIGS. 2 and 3, the covering strip **13** has a first side portion **15** which overlaps a second side portion **16** from one convolution to the next. A central portion **18** is located between the side portions **15** and **16** of the strip **13**.

In accordance with the invention a taper **20** is formed on the radially outward face of the first side portion **15** from its inner edge **21** where it is of the thickness of the central portion **18** to its outer edge **22** where it is of diminished thickness. On the radially outward face of the second side portion **16**, a step **24** is provided at its inner edge **25** which reduces the strip from the thickness of the central portion **18** to a first diminished thickness. A taper **27** on that radially outward face of the second side portion **16** extends from the step **24** to the outer edge **29** of the second side portion where it is of a second diminished thickness. The diminished thickness at the outer edge **22** on the first side portion **15** and the step **24** and second diminished thickness at the outer edge **29** on the second side portion **16** are all preferably of equal dimension, and both side portions **15** and **16** are of equal width narrower than half the strip width. In one example of the conduit, the overall width of the strip **13** is .532 inch, the width of the central portion **18** is .310 inch, and each of the side portions **15** and **16** has a width of .110 inch. The thickness of the central portion **18** is .018 inch and both outer edges **22** and **29** have a thickness of .004 inch. The step **24** is also .004 inch, and therefore the first diminished thickness of the second side portion **16** at the foot of the step **24** is .014 inch. It should be noted that both side portions **15** and **16** can include a step such as the step **24** if desired.

As the strip 13 is helically applied about the wire helix 10, the first side portion 15 is the leading margin and it overlaps the trailing margin or second side portion 16 from one convolution to the next. Thus, the first side portion 15 overlaps and is bonded, preferably by fusion, to the second side portion 16 from the step 24 to the outer edge 29 of the second side portion 16 with the overlap disposed directly over the wire helix 10 as shown in FIG. 3. By this construction, the exterior surface of the covering 12 formed by the strip 13 is uniformly smooth without any shoulder or other sharp interruption whatsoever even where the outer edge 22 of the first side portion 15 defines the beginning of the overlapped zone. Because of the tapers 20 and 27 on the side portions 15 and 16, the overlapped zone is virtually no thicker than the remainder of the wall covering, though it is in position to provide a buffer over the wire helix 10 at the crests of the corrugated structure of the covering 12. If the strip 13 is of transparent material, the single ply of its central portion 18 between the convolutions of the wire helix 10 in no way interfers with a clear view into the interior of the conduit. The overlapped region which could diminish optimum transparency is located over the wire helix where it has no obscuring effect, and because it is relatively narrow compared to the central portion 18 of the strip it does not impair the flexibility of the conduit.

We claim:

1. In a flexible conduit wherein a wire helix is helically wrapped about by successive convolutions of at least one covering strip having first and second overlapping side portions, the improvement which comprises

(a) a taper on each of the first and second side portions from the inner to the outer edge thereof, and

(b) a step on the inner edge of the second side portion, the step being abutted by the outer edge of the first side portion of an adjacent convolution,

(c) both side portions being narrower than half the strip width.

2. A flexible conduit according to claim 1 wherein the overlap of the side portions is disposed directly over the wire helix.

3. In a flexible conduit wherein a wire helix is helically wrapped about by successive convolutions of at least one covering strip having first and second overlapping side portions and a smooth central portion, the improvement which comprises

(a) a taper on the first side portion from its inner edge where it is of the thickness of the central portion to its outer edge where it is of diminished thickness, and

(b) a step on the second side portion from the thickness of the central portion to a first diminished thickness and a taper on the radially outward face of the second side portion from said step to its outer edge where it is of a second diminished thickness,

(c) the diminished thickness on the first side portion and the step and second diminished thickness on the second side portion being of substantially equal dimension and both side portions being of equal width narrower than half the strip width, and

(d) the first side portion of one convolution overlapping the second side portion of an adjacent convolution from the step to the outer edge of the second side portion to form a substantially continuous outer surface.

4. A flexible conduit according to claim 3 wherein the respective tapers and the step are on radially outward faces of the respective side portions.

5. A flexible conduit according to claim 3 wherein the overlapping side portions are bonded together.

6. A flexible conduit according to claim 3 wherein the overlap of the side portions is disposed directly over the wire helix.

7. In a flexible conduit wherein a wire helix coated with elastomeric material is helically wrapped about by successive convolutions of a single covering strip of said elastomeric material which is bonded to the wire coating, the covering strip having the same pitch and direction as the wire helix and extending radially inwardly between the wire convolutions and having first and second overlapping side portions, the improvement which comprises

(a) a taper on the first side portion from its inner to its outer edge, and

(b) a step on the inner edge of the second side portion and a taper from step to the outer edge of the second side portion,

(c) both side portions being narrower than half the strip width, and

(d) both side portions overlapping with the first outer edge of one convolution abutting the step of the inner edge of the second side portion of an adjacent convolution.

8. In a flexible conduit wherein a wire helix coated with elastomeric material is helically wrapped about by successive convolutions of a single covering strip of said elastomeric material which is bonded to the wire coating, the covering strip having the same pitch and direction as the wire helix and extending radially inwardly between the wire convolutions and having first and second overlapping side portions and a smooth central portion, the improvement which comprises

(a) a taper on the radially outward face of the first side portion from its inner edge where it is of the thickness of the central portion to its outer edge where it is of diminished thickness, and

(b) a step on the radially outward face of the second side portion from the thickness of the central portion to a first diminished thickness and a taper on the radially outward face of the second side portion from said step to its outer edge where it is of a second diminished thickness,

(c) the diminished thickness on the first side portion and the step and second diminished thickness on the second side portion being of substantially equal dimension and both side portions being of equal width narrower than half the strip width, and

(d) the first side portion of one convolution overlapping and fused to the second side portion of an adjacent convolution from the step to the outer edge of the second side portion with the overlap disposed directly over the wire helix.

References Cited

UNITED STATES PATENTS

2,284,761	6/1942	Nathan	138—150
3,239,400	3/1966	Anselm	138—122 X

LAVERNE D. GEIGER, *Primary Examiner.*

THOMAS L. MOORHEAD, *Assistant Examiner.*