Oct. 15, 1940. A. R. BELL 2,218,413

SURGICAL HOSIERY

Filed Dec. 20, 1937 3 Sheets-Sheet 1

Fig. 3.

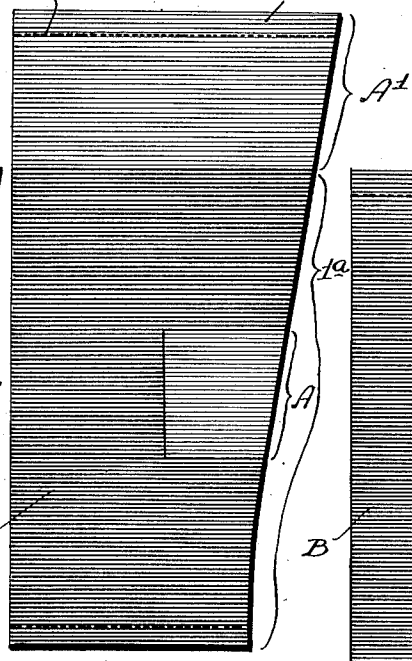


Fig. 1

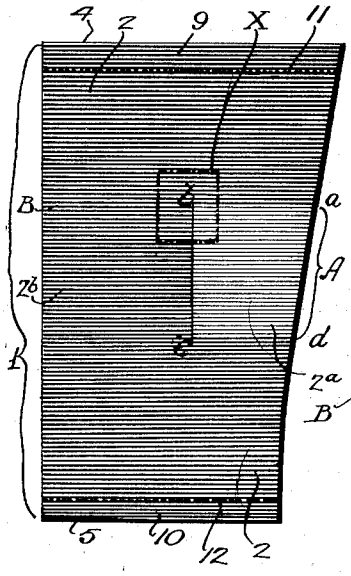


Fig. 4.

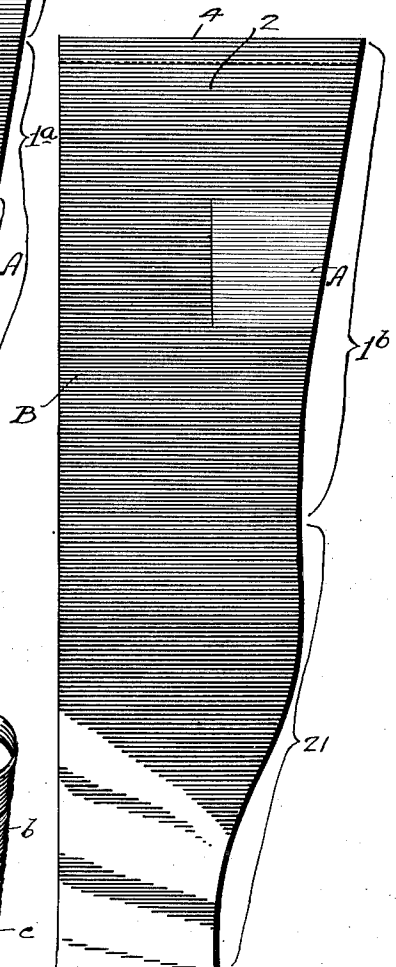


Fig. 7

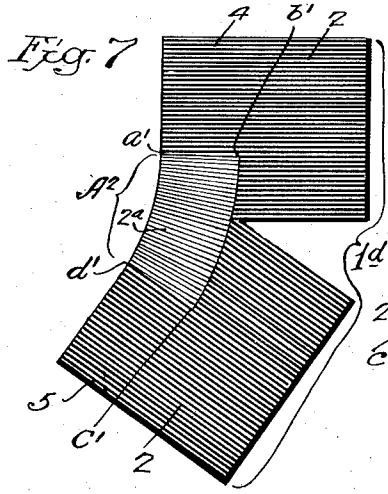
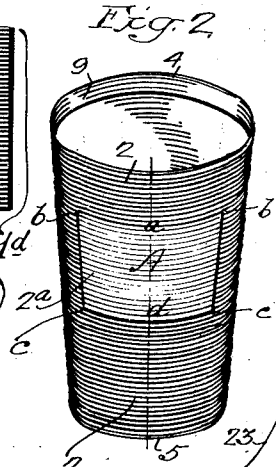


Fig. 2.



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Fig. 5.

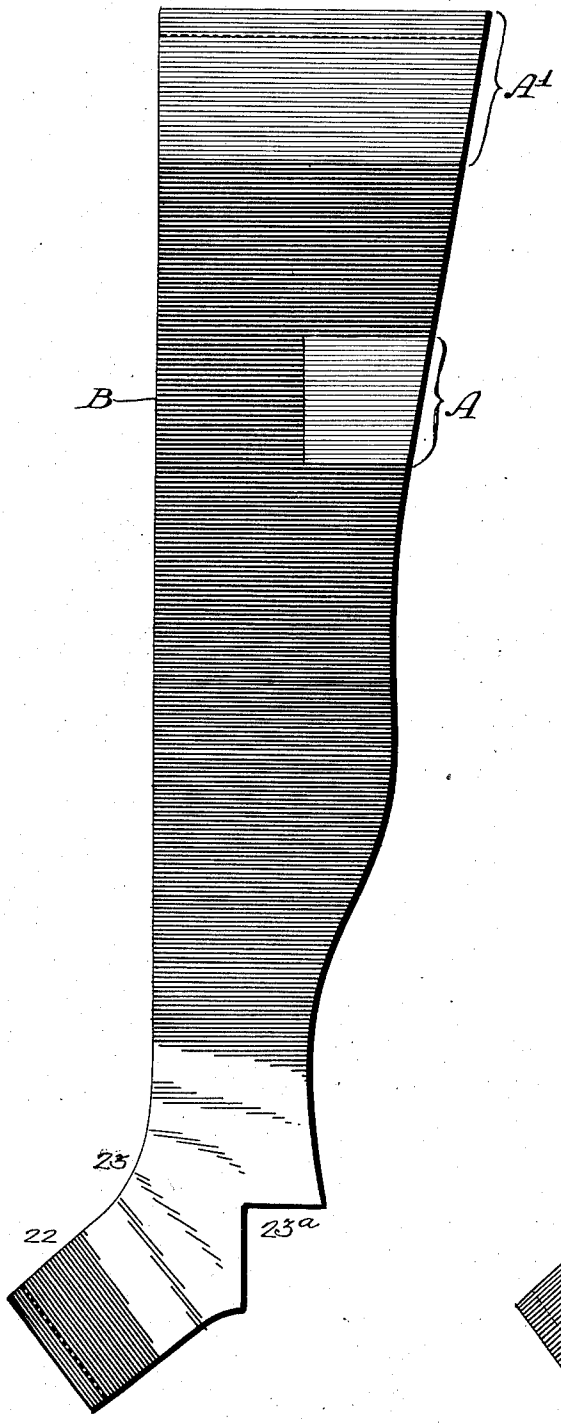
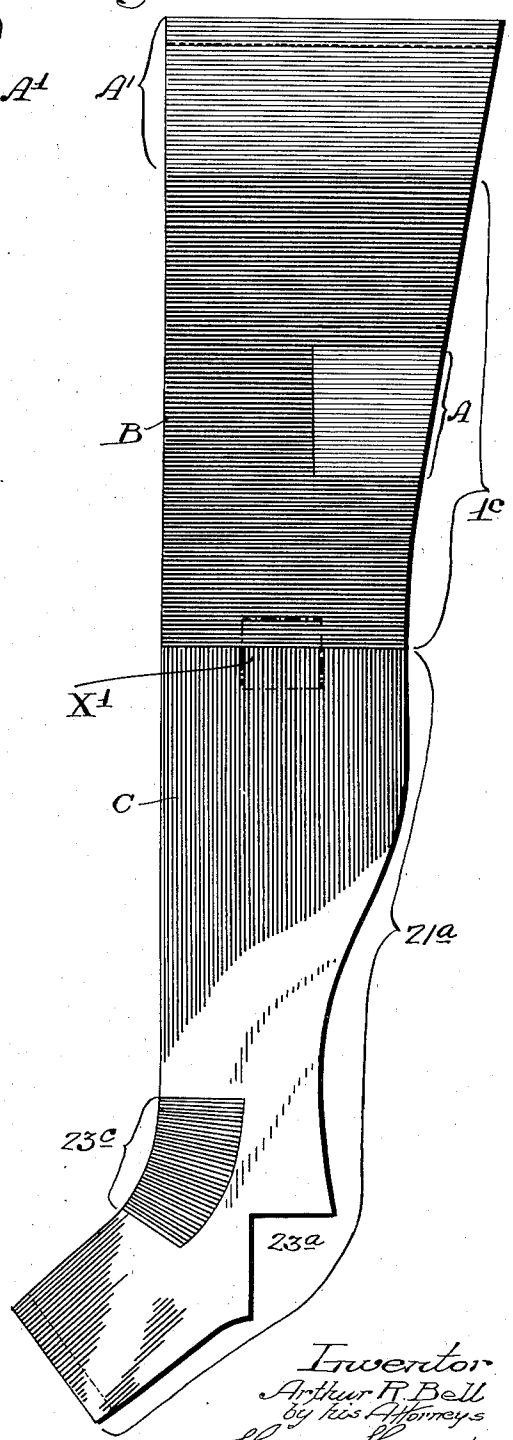


Fig. 6.



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Fig. 8.

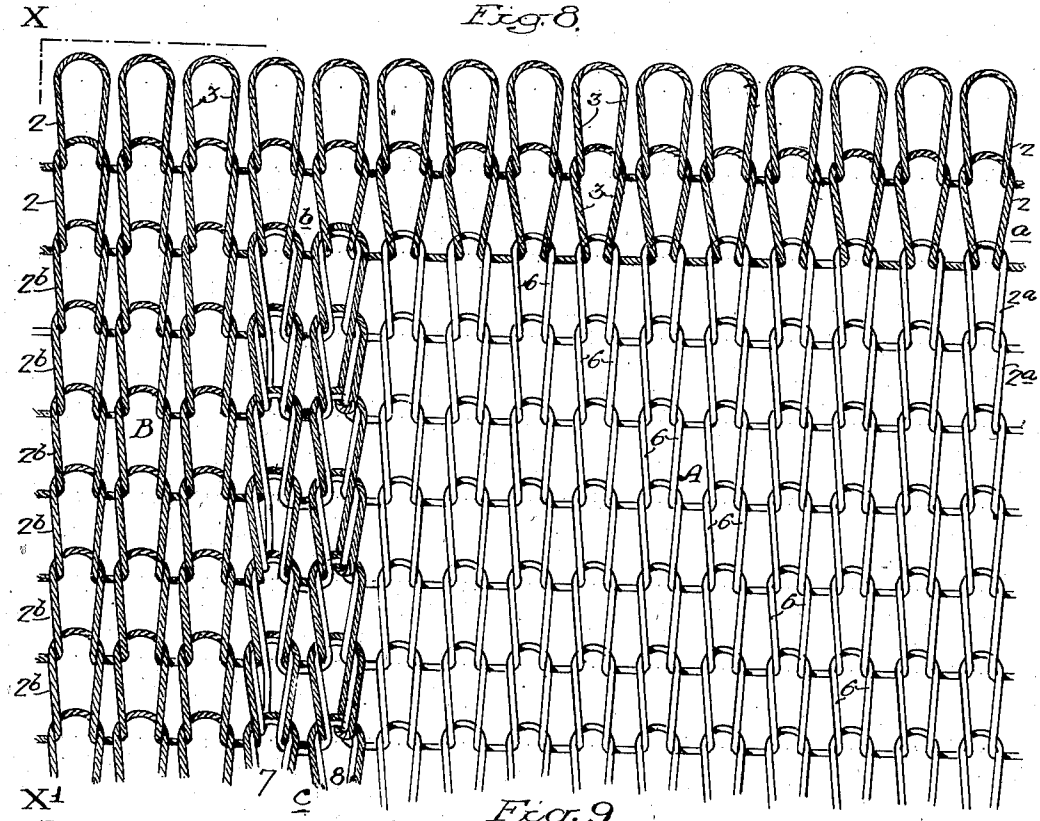
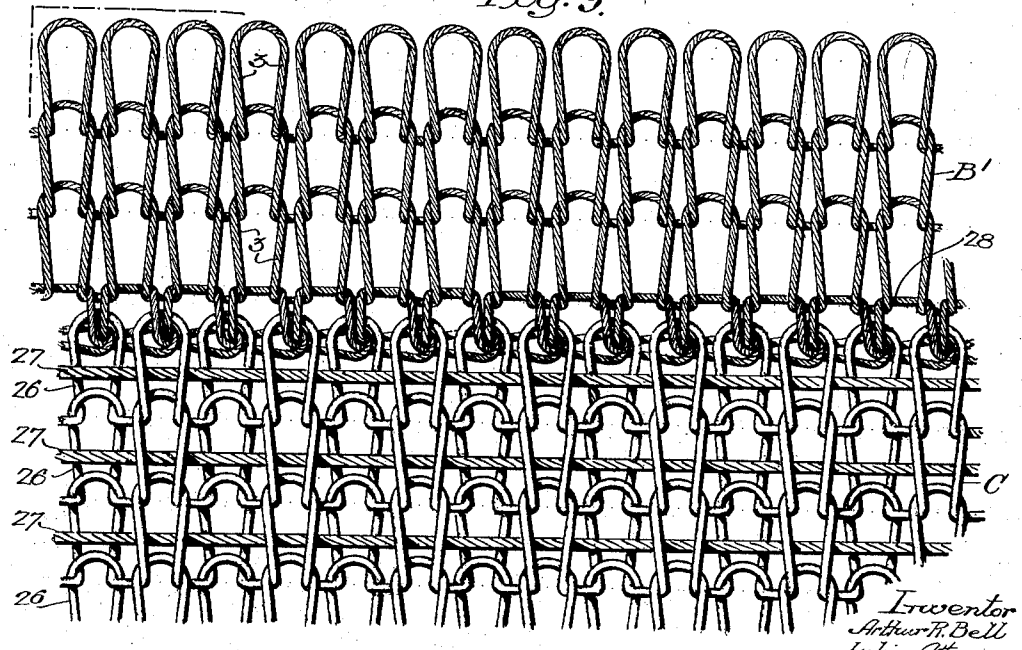


Fig. 9.



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Patented Oct. 15, 1940

2,218,413

UNITED STATES PATENT OFFICE

2,218,413

SURGICAL HOSIERY

Arthur R. Bell, Philadelphia, Pa., assignor of twenty-five per cent to Walter J. Horn and twenty-five per cent to Franklin S. Horn, both of Philadelphia, Pa., and twenty-five per cent to Albert J. Miller, Bala Cynwyd, Pa.

Application December 20, 1937, Serial No. 180,872

2 Claims. (Cl. 66—178)

This invention relates to surgical appliances such as elastic stockings, ankle, knee and elbow braces, bands, etc. which are normally composed of knitted textile fabric having rubber incorporated therein to supplement the normal elastic tension of the knitted fabric, for the purpose of placing a yieldable, corrective or preventive confining restriction on those portions of the anatomy respectively encircled by or encased within the various articles.

Prior to the present invention it has been customary to form surgical appliances of the kinds above noted of ribbed knit fabric, and to lay strands of rubber in each of the courses of stitches of which the fabric is composed, with the rubber disposed between the stitch wales drawn to one face of the ribbed fabric and the stitch wales drawn to the opposite face of the ribbed fabric. Such articles have been of a more or less stiff, harsh, heavy, bulky nature, and when worn under modern silk hosiery, for example, are extremely conspicuous. Furthermore, the bulkiness and harshness of the fabric causes chafing of the skin at the places where the encased portion of the anatomy and the article are required to bend, such as the back of the knee, the front of the elbow, the instep, etc.

Modern methods of manufacture of rubber filaments, such as are employed in elastic fabrics, have made it possible to produce the rubber filaments with cross sectional areas sufficiently small to permit the filaments to be formed into relatively fine gage knitted stitches.

In order to overcome the bulkiness of the surgical articles, as formed of fabric having the rubber strands laid in the stitch courses, the articles more recently have been composed of fine rubber filaments covered with silk, cotton, etc. with the covered rubber knitted into successive courses of stitches. This procedure produces an elastic fabric having elastic reactionary qualities substantially equal to or better than those of the prior inlaid rubber fabrics, while the knit-in rubber fabric is of considerably lesser weight and bulk than had been possible prior to the development of the fine rubber filaments.

Furthermore, where the rubber laid-in fabrics were capable of stretching in a coursewise direction only, the knit-in rubber fabrics are capable of stretching in both the coursewise and walewise directions.

In order to reduce the stiffness or harshness of the ribbed knit fabric having the rubber laid in the courses at the bending portions thereof, to enable the article to bend more readily at the back of the knee, etc., a practice such as that disclosed in the patent to James O. Willmott, No. 1,428,465, dated September 5, 1922, was resorted to. This method involves expensive and tedious hand operations, including the removal of the rubber strands in the bending areas of the fabric, the replacement thereof by soft fibrous textile filaments, and the tying of the ends of the elastic and fibrous filaments together, in the fabric. The result was a soft, readily bendable area which reduced or eliminated the tendency toward chafing.

With the advent of the lighter articles composed of fine rubber filaments knit into and solely forming the courses of stitches of which the fabric was composed, it was impossible to remove the rubber in any portion of the fabric according to the Willmott practice, therefore, the knit rubber articles prior to the present invention have presented the same objectionable characteristics as originally presented by the ribbed fabric articles having the rubber laid in the courses.

The object of the present invention, therefore, is to produce a knit-rubber article having a bending area devoid of rubber, for the purpose of facilitating the bending of the part of the anatomy encased by the article and to eliminate the tendency toward chafing in said portion.

The construction of the article made in accordance with the principles of the present invention, and various applications thereof, will be more fully disclosed hereinafter, reference being had to the accompanying drawings, of which;

Fig. 1 diagrammatically illustrates a knit-rubber knee band made in accordance with the principles of the present invention;

Fig. 2 is a rear view, in perspective, of the article shown in Fig. 1;

Fig. 3 is a view similar to Fig. 1, showing the knee band as provided with a rubberless top;

Fig. 4 is a view of a surgical stocking including the knee section according to Fig. 1 with additional calf and foot portions;

Fig. 5 is a view similar to Fig. 4, showing the article provided with the rubberless top of Fig. 3;

Fig. 6 is a view similar to Fig. 4 and illustrates the upper portion of the article composed of knit-rubber fabric and the lower portion composed of in-laid rubber fabric;

Fig. 7 is a view similar to Fig. 1 but showing an elbow or ankle band made in accordance with the principles of the present invention;

Fig. 8 is a stitch diagram of that area of the fabric designated by the character X, in Fig. 1; and

Fig. 9 is a stitch diagram of that area of the fabric of Fig. 6 designated as X1.

As shown in Figs. 1 and 8 the limb encircling band 1 is composed of a multiplicity of successively knit courses 2 of any desired type of regular or fancy knit stitches. The stitches are composed solely of a thread or yarn 3 which comprises an elastic filament covered, in the present instance spirally, with a textile filament of silk, cotton, wool, etc.

The successively interknit courses of stitches 2 extend from the upper end 4 to the lower end 5 of the article 1, with the exception of the portion A which is defined by and included within the lines *a*—*b*, *b*—*c* and *c*—*d*.

The portion A is composed of a multiplicity of stitch courses 2*a* which respectively constitute parts of those of the rubber knit courses 2*b*, 2*b* which lie between the lines *a*—*b*, and *c*—*d*. The stitches of the part courses 2*a*, 2*a* are composed preferably of a relatively soft textile thread or filament 6 which is devoid of rubber.

The juncture line *b*—*c* is in the form of a suture produced by the stitches adjacent the ends of the part courses 2*b*, which are formed of the rubber containing yarn 3, and the stitches adjacent the ends of the course portions 2*a*, which are composed of the textile rubberless yarn 6, overlapping each other to the extent of one or more stitch wales, 7 and 8 respectively, whereby the rubberless portion A is joined with the rubber containing portion B and forms therewith an integrally united and interknit limb encircling band 1.

The rubberless portion A of the limb encircling band 1, as noted above, is made exclusively of soft, pliable yarn and is readily susceptible to bending. Its soft, light-weight, pliant nature substantially eliminates chafing.

The upper and lower ends 4 and 5 respectively of the article 1 may be finished in any suitable manner. Preferably these ends are provided with turned hems 9 and 10 respectively, the edges of the turned-over portions of the fabric forming said hems being secured to the body of the article 1 by elastic sutures 11 and 12 which are preferably produced in the manner disclosed in my copending application, Serial No. 164,282, filed September 4, 1937.

The article shown in Fig. 3 is the same as that shown in Fig. 1 with the exception that a rubberless portion A1, composed of successively interknit courses of stitches of rubberless textile yarn similar to the yarn 6, is provided at the upper end of the article. The upper rubberless portion A1 is preferably provided with a turned hem 9*a* formed by securing the edge of the folded fabric to the body of the portion A1 by means of an elastic suture 11*a*. The rubberless portion A1 is provided in instances where a person desired to support the main rubber bearing portion 1*a* against possibility of slipping down, by the use of garters of the suspender type extending downwardly from a girdle, etc.

The article shown in Fig. 4 is substantially the same, in the upper portion 1*b* thereof, as the article shown in Fig. 1, and includes a lower calf portion 21 composed of rubber-knit courses 2 which are substantially the same as the rubber-knit courses 2 of the portion 1*b*. The article also includes a partial foot portion 22 composed of the same sort of rubber-knit courses of stitches. The foot portion is preferably provided with a turned hem 10*a* formed with an elastic suture 12*a*. The portion 23*a*, lying behind the instep portion 23 of the stocking shown in Fig. 4, is in some instances left open for the accommodation of the heel, however, a rubberless fabric heel 24 may be knit into the stocking to close the portion 23*a* thereof, if desired. If the closed heel 24 is employed the same would be composed of rubberless courses of stitches 2*c* corresponding to the rubberless courses 2*a* of the rubberless portion A of the fabric of Fig. 8, along the lines *e*—*f*, *f*—*g*, which define the normally open area 23*a*, to the rubber bearing courses of the main body of the article in the same manner as the rubber bearing and rubberless stitches are joined on the lines *a*—*b*, and *c*—*d* of Fig. 1. The closed heel section 24 would be formed by reciprocating kniting, in the usual manner, whereby the usual gore line 25 would be formed where the course portions 2*c* of one half of the heel are joined to the course portions 2*c* of the other half of the heel as a result of said reciprocating knitting.

The article shown in Fig. 5 is the same as that shown in Fig. 4 with the addition of the rubberless top portion A1 of Fig. 3 attached thereto, and with the heel section 23*a* open.

The article shown in Fig. 6 includes a main portion 1*c* which corresponds to the article 1 of Fig. 1 and with the rubberless top portion A1 of Fig. 3 applied thereto. The lower portion 21*a* is composed of fabric of the ribbed type, as shown at C in Fig. 9. The fabric C of the lower portion 21*a* of the article is composed of successively knit courses of stitches 26 formed of fibrous textile yarn such as the yarn 6. The stitches of each course 26, in alternate wales, are drawn to opposite faces of the fabric and thereby form a fabric of the ribbed type. A rubber-bearing yarn 27, either of the covered or bare rubber type, is laid in each of the stitch courses between the oppositely extending stitches thereof. This rubber laid-in portion 21*a* is joined to the rubber-knit portion B by an elastic suture 28, formed in the same manner as the elastic sutures 11 and 12 of Fig. 1.

The instep portion 23*c* of the article shown in Fig. 6 is preferably formed with a natural curvature produced in the manner disclosed in the prior patent to Charles E. Southwick, Jr., No. 2,015,608, dated September 24, 1935, or in the manner disclosed in the copending application of Walter J. Horn, Serial No. 95,884, one of the coassignees of the present application.

The article shown in Fig. 7 may be employed either as an elbow band or as an instep or ankle band. It includes a main portion 1*d* composed of knit-rubber courses 2, the same as the courses 2 of Fig. 1. The article also includes a bending portion A2 composed of rubberless courses of stitches 2*a*, the same as the courses 2*a* of the rubberless portion A in Fig. 1, said area A2 being defined by the lines *a*1—*b*1, *b*1—*c*1, *c*1—*d*1. The upper and lower edges 4 and 5 may be provided with turned hems the same as the turned hems 9 and 10 of the article 1 disclosed in Fig. 1.

The articles shown in Figs. 1 to 7 are preferably of a seamless tubular fashioned type capable of production on the Lamb type or similar flat knitting machine employing two banks of needles in parallel spaced relation to each other with cam and yarn feeding means operable continuously in one direction to form a tubular fashioned structure or in opposite directions, reciprocally, to produce segmental portions of a tube. This lat-

ter mode of operation is employed in the knitting of the courses formed partly of the rubber bearing yarn 3 and partly of the rubberless yarn 6 in the knitting of the course portions 2b and 2a respectively.

While a seamless fashioned tubular article is preferred circular non-fashioning machines may be employed to form the article as a straight tubular structure, or the structure may be made as a flat blank on a flat machine and its opposite edges subsequently joined to form the tubular structure, without departing from the spirit of the invention.

It will be understood that the articles disclosed in Figs. 3 to 7 are tubular in form, like the article shown in Figs. 1 and 2, and that Figures 1, 3, 4, 5, 6 and 7 illustrate the articles are being flattened and depicting but one side of the article in each instance, and that the opposite side of the article in each instance is a duplicate of the side depicted in each of said figures, thus, the rubberless portions A, A2 are laterally balanced in the backs of the leg encircling articles as shown in Fig. 2 and laterally balanced in the fronts of the elbow and ankle encircling articles, and, in each instance, these rubberless areas A, A2 are included within and completely surrounded by knit-rubber fabric B which constitutes the major portion of the article.

The invention in its broader scope may also include a surgical appliance, such as shown in Figs. 1 to 6 wherein the knit-rubber fabric B and the rubberless fabric A would be formed separately and subsequently joined together, with the marginal edges of the rubberless fabric A connected to the edges of a correspondingly shaped opening formed in the rubber-knit fabric B. Under such circumstances the interconnected edges of the fabrics A and B would preferably have selvage edges and the suture between the edges of the two fabrics would preferably be formed by an elastic yarn in the manner noted in my aforesaid copending application. While this form of structure may not be as acceptable as the integrally interknit structure above described it would serve its purpose within the scope of the present invention.

I claim:

1. A surgical appliance for enclircling a human limb at a bendable joint therein, said appliance being composed of plain knit fabric and constructed throughout of successively interknit courses of stitches extending completely around the limb, the courses adapted to embrace the limb at and adjacent said joint being composed in part of rubber bearing yarn and in part of rubberless yarn with said yarns knit together in stitches common to both yarns at the opposite sides respectively of said joint, and with the course parts composed of the rubber bearing yarn arranged to embrace the convexed surface of said joint when bent and the course parts composed of said rubberless yarn arranged to embrace the concaved surface of said joint when bent.

2. A surgical appliance for encircling a human limb at a bendable joint therein, said appliance being composed of plain knit fabric and constructed throughout of successively interknit courses of stitches extending completely around the limb, the courses adapted to embrace the limb at and adjacent said joint being composed in part of rubber bearing yarn and in part of rubberless yarn with said yarns knit together in stitches common to both yarns at the opposite sides respectively of said joint, and with the course parts composed of the rubber bearing yarn arranged to embrace the convexed surface of said joint when bent and the course parts composed of said rubberless yarn arranged to embrace the concaved surface of said joint when bent, and with complete limb encircling courses of stitches composed solely of said rubber bearing yarn arranged above and below the courses which are composed partly of said rubber bearing yarn and partly of said rubberless yarn.

ARTHUR R. BELL.