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J. A. GOODMAN  
STOCKING WITH MEANS FOR IMPROVING THE ELASTICITY,  
AND PROCESS OF PRODUCING THE SAME  
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2,268,818

Fig. 1.

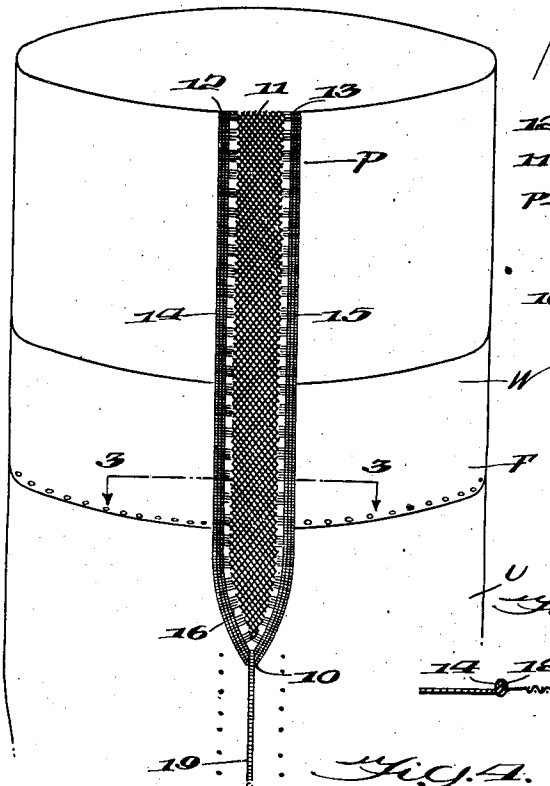


Fig. 2.

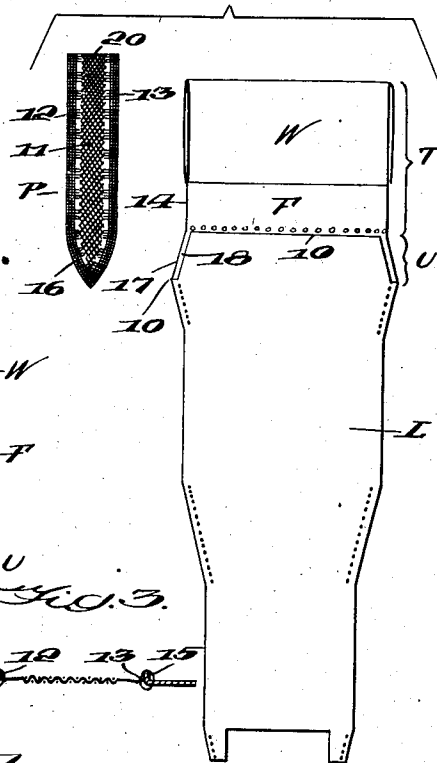


Fig. 3.



Fig. 4.

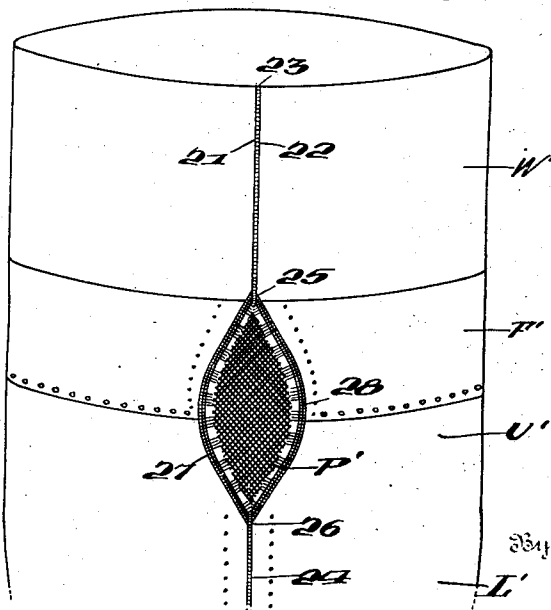
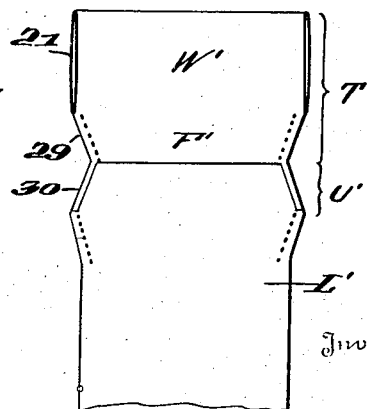


Fig. 5.



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## UNITED STATES PATENT OFFICE

2,268,818

STOCKING WITH MEANS FOR IMPROVING  
THE ELASTICITY, AND PROCESS OF PRO-  
DUCING THE SAMEJacob A. Goodman, Indianapolis, Ind., assignor to  
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Application March 21, 1939, Serial No. 263,297

17 Claims. (Cl. 66—173)

This invention relates to hosiery and has for the general object the provision of a stocking wherein the upper portion is less subject to strain and breakage under stresses such as developed by change in diameter of the leg when flexed and tension imposed by garter fastenings, and which is adapted to conform itself to legs of varying diameter without developing in the fabric any excessive strain.

It has heretofore been proposed to increase the stretchability of the top area of knitted stockings by modifying the texture thereof through the use of special stitch formations producing an open lace-work and by also knitting covered rubber thread with the relatively inelastic body yarn. It has also been proposed to reduce the amount of reinforcement in parts of the stocking top so as to include areas of lighter fabric therein which may be somewhat more elastic than the reinforced fabric normally employed.

The present invention has the advantage over practices just referred to in that the upper portion of the stocking need not be modified in its knitted texture in order to attain the benefits of the invention, and a construction is provided which has an extremely high degree of stretchability and so designed as to materially reduce the effect of stresses set up in the stocking when worn. The invention is equally applicable to stockings having the usual two-ply welt and those having a single ply welt, regardless of the knitted stitch structure, character of thread employed, and extent of reinforcement.

According to the invention an elastic panel is employed in the upper portion of a stocking, of limited circumferential dimension and so located as to both render the upper portion of the stocking capable of a high degree of stretch beyond its normal diameter and relieve the main fabric of the stocking upper of excessive stresses.

The elastic panel is formed separately from the stocking proper. Aside from the fact that it is difficult to knit a satisfactory stocking with rubber thread knit therein, the usual fine gauge knitting machine employed in the production of hosiery is not adapted to knitting fabric of rubber thread which will have adequate stretch per unit dimension thereof for purposes of the present invention. To attain the desired degree of stretchability the panel is preferably made of an entirely different texture from the stocking fabric. Woven or knitted webbing of relatively coarse open-work texture made of rubber yarn, and capable of stretch both longitudinally and

circumferentially is particularly suitable. Inasmuch as it is desirable that the panel be confined to a relatively small area of the upper portion of the stocking, the panel should be capable of stretch to an extent, at least in a circumferential direction, to a substantial multiple of its normal dimension. At the same time the resiliency of the panel, that is the resistance thereof to being stretched to expanded condition and the contractile tendency to return from distended to normal condition, must be sufficiently low that the panel has the character of easy stretchability so that it may stretch simultaneously with, but to a degree greater than, the main stocking fabric. It will be recognized that if the panel is so resistive to stretch that the main stocking fabric is stretched to its elastic limit before the panel begins to stretch, the main fabric may be weakened and ruptured before a portion of the stress acting thereon can be absorbed by the panel.

A particular feature of the invention includes a manner of inserting the panel in a stocking without entailing weaknesses along the lines of joinder thereof with the adjoining areas of the stocking fabric. As hereafter explained the invention permits a panel to be inserted in a stocking by joining the same only to salvage edges of the stocking fabric through a simple seaming operation, and without liability of runs.

In its application to women's stockings having delicate leg fabric extending up over the knee followed by a single ply reinforced area and a reinforced double ply welt at the upper extremity, the invention serves not only to increase the circumferential expansibility of the stocking to accommodate the portion of the leg of largest diameter, but has additional primary benefits in relieving the delicate leg fabric at and above the knee from strain and danger of breaking, and also accomplishes a similar purpose along the lines where the unreinforced delicate leg fabric meets the single ply reinforced flare and where the single ply flare meets the double ply welt. Runs frequently originate in the latter areas, particularly adjacent the rear stocking seam.

It should be observed before passing to a detailed description of the invention that the portion of a stocking at and above the knee is subject to both vertical and circumferential stresses. Supporting garters, which connect with the top usually at two or three circumferentially spaced points, impose an initial vertical tension which tends to elongate the knitted loops of the fabric

walewise. Such tension is considerably increased both at the front and rear upon bending the knee and bending the hip. An initial circumferential tension is imposed in the stocking above the knee in stretching the stocking top to the diameter of the thick portion of the leg above the knee, the degree of tension varying with the diameter of different legs, and such tension is considerably increased under expansion in leg diameter which occurs under flexing of the muscles when the knee is bent. The transverse tension tends to flatten the knitted fabric loops coursewise at the same time that the vertical tension tends to elongate the loops vertically. The ability of the fabric to stretch circumferentially is necessarily limited by reason of the vertical tension imposed by the garters, and when the leg is bent increased circumferential and/or vertical tension may readily strain the inelastic thread of the knitted fabric loops to the breaking point. The lighter leg fabric at and immediately above the knee, located below the reinforced fabric top, will usually break first because of its weaker character, and experience has shown that runs frequently originate in this area. Concentrated strains also frequently occur adjacent the rear seam where the boundary lines between the unreinforced leg fabric meet the reinforced flare and where the reinforced flare meets the double ply welt, and runs frequently develop also at these points.

The present invention provides a relatively limited area of high stretchability which operates both to minimize the initial stress imposed in the stocking fabric above the knee when expanded to the normal diameter of the leg and to absorb a considerable part of the additional stress imposed when the leg is bent. By minimizing the tension in a circumferential direction the highly elastic area provided also serves to minimize the adverse effect in the stocking fabric of vertical stresses, and through the use of two-way stretch fabric in the highly elastic area the tension in a vertical direction initially created by the garters and accentuated through bending of the leg is lessened to some degree. In short, it may be said that the provision of the highly elastic area serves to maintain the condition of the knitted fabric of the stocking within its elastic limits so that the knitted loops thereof are not distended to the point where the inelastic yarn composing the fabric is strained to the breaking point.

The drawing illustrates the application of the principles of the invention in a woman's full fashioned stocking of generally conventional design, and shows certain minor changes in the form of a portion of the stocking which are desirable to enable the invention to be employed to best advantage. In such drawing:

Fig. 1 is a view of a conventional stocking top of a woman's full fashioned stocking, more or less diagrammatic, and incorporating one embodiment of the invention;

Fig. 2 shows the elastic insert and the preferred form of stocking blank used in making the stocking of Fig. 1;

Fig. 3 is an enlarged cross-sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 shows a stocking similar to Fig. 1 but embodying a further adaptation of the invention; and

Fig. 5 is a fragmentary view of a stocking blank used in the construction of Fig. 4.

The stocking shown in Figures 1 and 2 in-

cludes a top portion T of reinforced fabric integrally knit with the upper portion U of the unreinforced fabric leg L. The top portion may as previously explained be of any desired form but is here shown as comprising the conventional double ply welt W and heavy single ply fabric flare F. Inelastic silk, cotton or other thread may be employed throughout the fabric of these areas, and the fabric may be knit with any desired stitch.

Located centrally of the rear of the stocking beginning at a point 10 in the unreinforced leg fabric at or slightly above the knee is a panel P of highly elastic material. The panel here represented comprises a strip of open mesh woven webbing composed of rubber thread and comprising a highly elastic two-way stretch central portion 11, and opposite marginal portions 12 and 13 suitable for anchoring securing stitching which are preferably inelastic widthwise but elastic lengthwise.

The panel in the present embodiment extends upwardly from its beginning point in the area of the leg portion to the upper extremity of the welt W and is capable of a high degree of stretch both transversely and vertically to a substantially greater degree than the fabric in the various areas referred to. The opposite edges 14 and 15 of the stocking fabric above the point 10 are spaced apart as shown in Figure 3 and are seamed by suitable stitching to the margins 12 and 13 of the elastic panel. The seaming may be done on a machine as employed in forming the rear seam in the usual full fashioned stocking.

In order to permit the elastic panel to be incorporated without undue difficulty, and in such manner as to prevent runs, it is desirable that the panel have a tapered lower portion 16 terminating substantially in a point. To enable the panel to be inserted without varying the normal diameter of the stocking, the stocking blank is preferably formed as shown in Figure 2. Therein the welt W and flare F are each narrower than the corresponding portions in a conventional stocking by a width corresponding substantially to the width of the panel P so that when the blank is folded a space will be left between the side edges 14 and 15. The blank is then progressively widened out to reach its normal diameter in the leg fabric, reaching its maximum diameter at the lower extremity of the arbitrarily indicated upper leg portion U. The frequency and extent of the progressive widening will be determined generally according to the length of the tapered lower portion 16 of the panel P. In widening it is important to maintain a selvage edge 17 in continuation of the vertical selvage edge 14 to avoid danger of runs. Various ways have been heretofore proposed for widening flat knit fabric and maintaining an interlocking of the edge loops such as to form a selvage. I prefer to employ the method shown and explained in the copending application Serial No. 290,662, of Benjamin F. Somers, filed August 17, 1939. By reason of the unreinforced character of the leg fabric in the upper portion U the seaming stitches therethrough along the edge 17 and the lower portion 16 of the panel may in some cases injure the leg fabric. To avoid strain and breakage it is therefore desirable that the edge portions 18 in the leg fabric be reinforced by incorporating an additional thread for a distance of say 2 to 20 wales adjacent the edges in which the seaming thread can be anchored. If the reinforced marginal areas be maintained narrow,

they will be substantially hidden when the panel is seamed thereto and will not be seen in the completed stocking as it appears in Figure 1.

After the stocking blank has been knit down through the upper leg portion U, the knitting of the leg portion is continued in the usual manner, preferably being narrowed below portion U because of the reduced diameter of the knee. After the stocking including the foot portion has been completed the panel P will be seamed to the opposite edges of portions T and U, and the edges of the main leg portion will be secured together in seam 19. As a matter of convenience the joiner of one margin of the panel with one edge of the stocking blank above point 10 may be formed in a continuous seam with the seam 10 in the leg portion. In the event the panel P has a raw upper edge a short marginal portion 20 may be doubled over to provide a folded edge prior to seaming the panel into position.

The embodiment of the invention shown in Figure 4 obtains the main benefits of the invention in reducing strain and the danger of breakage in the upper leg portion in the knee area and the adjoining reinforced flare as in the case of Figure 1. In this case, however, the two-way elastic insert P' does not extend to the upper extremity of the stocking welt W' and is shown arbitrarily as terminating approximately at the line of joiner between welt W' and the reinforced flare F', being confined to the area of sections F' and U'. The welt W' will extend throughout the diameter of the top portion with its opposite edges 21 and 22 secured in seam 23 while the edges of the leg portion L' below the insert panel will be secured together in seam 24.

To avoid danger of runs and to enable the panel P' to be readily secured in position, it is preferable that the same should taper substantially to points at its upper and lower ends 25 and 26. The opposite margins 27 and 28 of the panel will be seamed to the adjoining edges of the stocking fabric.

To accommodate the two-way elastic insert panel P', it is preferable to form the stocking blank in the manner shown in Figure 5. While in the blank of Figure 2 used for the stocking shown in Figure 1 the welt was knit of narrower width, in the present case the welt W' is knit to standard dimensions. To accommodate the upper tapering portion of the insert panel P', the flare F' is progressively narrowed, preferably by the usual loop transfer method, to provide inwardly inclined selvage edges 29. Thereafter, to accommodate the converging lower portion of the panel, widening is employed in the upper leg portion U' to provide oppositely inclined selvage edges 30 and as previously explained it is preferable to reinforce the fabric along the widened portions 30 because of the delicate texture of the leg fabric. The stocking blank is thereafter completed. The panel may be seamed to the opposite edges 29 and 30 at the time the stocking welt and leg portions are seamed.

By using highly elastic fabric for the panels P and P' in the embodiments of Figures 1 and 4, the upper unreinforced leg portion and the reinforced top portion are rendered capable of a substantially greater degree of stretch than permitted by the knitted texture of the stocking fabric, with the result that the knitted loops of the fabric are subjected to substantially less stress than in the ordinary stocking. Hence, increased stress either circumferentially or vertically, when the leg is flexed, will be insufficient to

strain the stocking threads to the breaking point in the area at and above the knee. By employing a panel which is stretchable vertically as well as horizontally, the danger of undue stress frequently encountered along the rear seam of the stocking is minimized to a great extent. Whereas the conventional stocking has its lowest degree of vertical stretch along the rear seam, both embodiments of the invention provide for ready stretchability in the line of the seam.

By extending the elastic insert to the upper extremity of the stocking as in the embodiment of Figure 1, the welt is rendered extremely expandable in a circumferential direction so as to provide a nice fit on legs of different diameter in addition to relieving stresses which ordinarily occur in the welt due to tension produced therein by the leg and supporting garters.

The use of a separate elastic panel as an insert in the stocking top provides an extremely convenient way of obtaining different diameter tops for slim and large legs without necessitating any change in the stocking blank itself. It has been found that many women with large thighs should have a stocking with leg and ankle portions of standard diameters although requiring an extra large top. The knitting of an extra width top on a standard leg involves practical difficulties. With the present invention, the top portion of a stocking blank may be knit as shown in Figure 1 with standard leg and ankle portions and the diameter of the top varied merely by using different width elastic inserts between the edges of the stocking blank fabric. Thus, the same knitted stocking blank may be provided with different size top portions for slim, medium, and large thighs, and in each instance the benefits of the invention are obtained by reason of the elastic character of the insert as previously explained.

It will be understood that the specific forms of elastic panels illustrated are merely suggestive with respect to texture, length and width. The scope of the invention is to be determined in accordance with the appended claims.

I claim:

1. The method of making a flat-knit full-fashioned stocking which includes knitting the upper portion of a stocking for at least a part of its length to a narrower width than the widest part of the leg part so as to provide an opening in the upper portion between the margins of the stocking blank, seaming the margins of the stocking together other than at said narrow portion, and seaming an elastic panel in the opening at said narrow portion.

2. The method of producing a full-fashioned stocking which includes knitting a flat stocking blank with an area of narrow width in its upper portion, widening the blank to terminate said area by knitting a limited number of courses of progressively increasing width, discontinuing the widening and thereafter knitting the main leg portion and the foot portion, securing a fabric insert between the marginal edge parts of the blank in said narrow area of the upper portion down to the lower end of the series of widened courses, and seaming together the other marginal edge parts of the blank.

3. The method of producing a full-fashioned stocking which includes knitting a flat stocking blank with an area of narrow width in its upper portion by knitting an initial series of courses of the same width at the uppermost part of the stocking blank and then knitting a limited num-

ber of courses of progressively increasing width to widen the blank, discontinuing the widening and thereafter knitting the main leg portion and the foot portion, securing a fabric insert between the marginal edge parts of the area of narrow width in the upper portion down to the lower end of the series of widened courses, and seaming together the marginal edge parts of the other areas of the blank.

4. The method of producing a full-fashioned stocking which includes knitting a flat stocking blank with an initial series of wide courses, forming a narrow area in the upper portion thereafter by knitting a series of courses of progressively decreasing width and a subsequent series of courses of progressively increasing width, thereafter knitting the main leg portion and the foot portion, securing a fabric insert between the marginal edges of the narrow area of the upper portion of the blank along the narrowed courses and the widened courses, and seaming together the marginal edge parts of the other portions of the blank.

5. A stocking including a reinforced knitted fabric top portion and an adjoining lighter knitted fabric main body portion, and a separately formed elastic panel embodying rubber thread inserted at the rear of the stocking top portion and seamed between opposite edges of the stocking, said panel extending downwardly below the boundary between the top portion and main body portion and terminating in a lower end portion tapered to a point in the upper part of the main body portion at the back of the knee area.

6. A full-fashioned stocking defined by opposite selvage edges, a separately formed elastic panel embodying rubber threads inserted in the upper portion of the stocking, said panel having opposite edges which are parallel in their upper area and taper in their lower area to a pointed lower end, a main rear seam joining together the opposite edges of the stocking below the panel, and seams joining the respective edges of the panel to the edges of the stocking in the upper portion thereof, said seams converging to meet the main seam at the lower end of the panel.

7. A full-fashioned stocking having a rear seam joining the opposite edges thereof and terminating below the upper end of the stocking, and a vertically and horizontally stretchable fabric panel extending from the end of the seam upwardly through the upper portion of the stocking and being secured at its side edges to the upper opposite edge portions of the stocking.

8. A knitted stocking comprising a knitted fabric body having spaced vertically extending opposite edge portions in the rear upper portion thereof, and a vertical panel insert having a relatively elastic body portion and having opposite marginal side portions which are relatively inelastic at least widthwise, said panel being secured in the stocking by stitching interconnecting said side margins of the panel with the spaced opposite side edge portions of the stocking fabric.

9. A knitted stocking comprising a knitted fabric body having a reinforced top portion and an adjoining unreinforced leg portion, said fabric body having spaced opposite edge portions in the rear upper part of the unreinforced leg portion in the back knee area, and an elastic panel insert embodying rubber thread and capable of stretching to a greater extent circumferentially than the leg fabric secured between the spaced edge portions of the fabric body.

10. A knitted stocking comprising a knitted

fabric body including a top portion and a leg portion, said fabric body having spaced opposite edge portions at the rear of the stocking beginning in the leg portion and extending up-

wardly in the top portion, the top portion comprising reinforced fabric, the leg portion mainly comprising unreinforced fabric but having local margin areas along said spaced edge portions comprising reinforced fabric, and a separately formed elastic panel insert embodying rubber threads secured by stitching connecting the sides thereof to the reinforced spaced edge portions of the leg and top portions.

11. A full fashioned knitted stocking having rear selvage edges and including a reinforced top portion and an adjoining unreinforced leg portion, said rear selvage edges being spaced apart beginning at a point in the upper part of the leg portion at the back of the knee area and extending upwardly to the upper end of the top portion, and an elastic panel embodying rubber thread and having a lower end portion tapering to a point secured between the spaced portions of the rear selvage edges, and a seam joining together the rear selvage edges below the panel.

12. A knitted stocking comprising a knitted fabric body including a reinforced top portion and an adjoining unreinforced leg portion, said fabric body having spaced opposite edge portions at the rear of the stocking beginning at a point in the upper part of the leg portion and terminating in the top portion short of the upper end of the stocking, and an elastic panel embodying rubber thread and having upper and lower end portions tapering to points inserted between and secured to said spaced edge portions.

13. A knitted stocking comprising a knitted fabric body including an unreinforced leg portion, and a top portion comprising a reinforced double ply welt and a reinforced single ply portion connecting the welt with the leg portion, said fabric body having spaced edge portions at the rear of the stocking beginning at a point in the upper part of the leg portion and extending upwardly through at least the single ply portion of the top, and a panel embodying rubber thread and having a lower end portion tapering to a point inserted between and secured to said spaced edge portions.

14. A knitted stocking comprising a knitted fabric body including an unreinforced leg portion, and a top portion comprising a reinforced double ply welt and a reinforced single ply portion connecting the welt with the leg portion, said fabric body having spaced edge portions at the rear of the stocking extending downwardly through at least the lower area of the double ply welt at least into the reinforced single ply portion of the top, and a fabric panel embodying rubber thread inserted between and seamed to said spaced edge portions.

15. A full-fashioned stocking comprising a knitted fabric body, said body having an area of reduced width in the upper portion thereof, the edges of the stocking being joined together in a rear seam except in said portion of reduced width, and an elastic panel embodying rubber thread secured in the opening between the edges of the stocking in the portion of reduced width.

16. A full-fashioned stocking comprising a knitted fabric body having the opposite edges of its leg portion joined together in a seam, the upper portion of the stocking including an area of reduced width defining an opening, said portion of reduced width in its lower portion gradually

increasing in width so that the edges thereof converge to meet at the upper end of the leg seam, and an elastic panel embodying rubber thread having a lower end portion tapering to a point inserted in the opening and secured to the edges of the stocking fabric.

17. A stocking comprising a knitted fabric body having spaced opposite edge portions, and an

elastic panel embodying rubber thread and having upper and lower end portions tapering to points inserted between and secured to said spaced edge portions, the spaced opposite edge portions meeting each other at the upper and lower end points of said panel.

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