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L. S. FRYER

2,248,406

APPARATUS FOR DRYING THREADLIKE ARTICLES

Filed Aug. 31, 1938

2 Sheets-Sheet 1

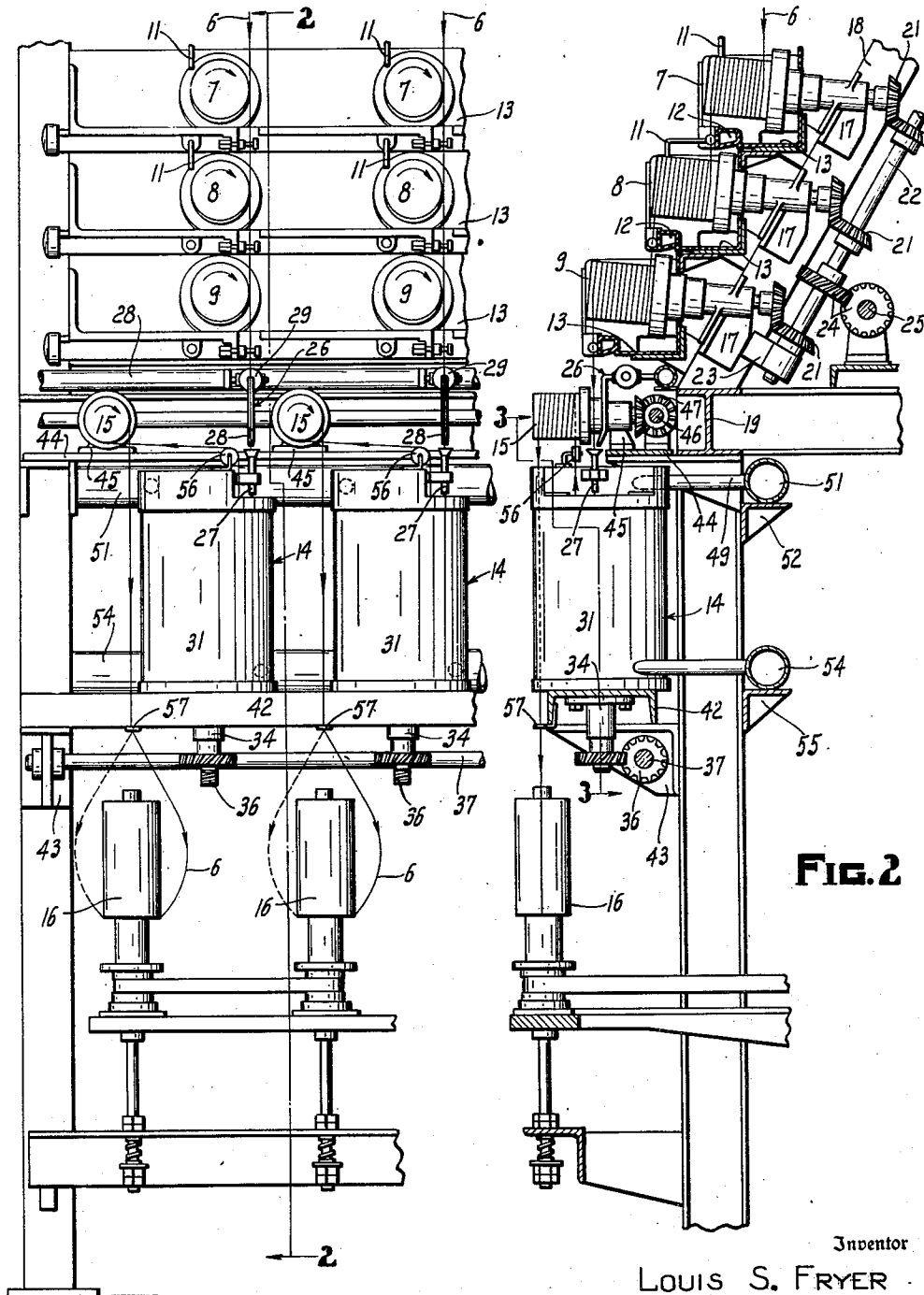


FIG. 1

FIG. 2

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2 Sheets-Sheet 2

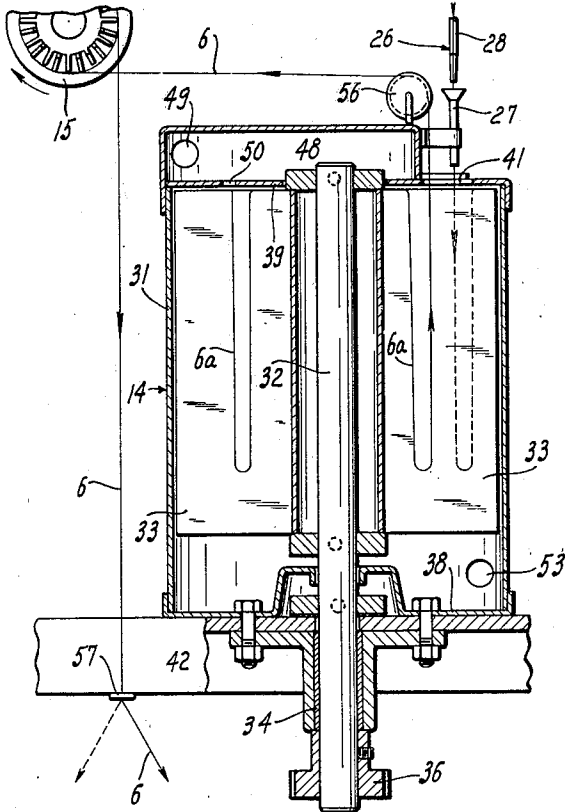


FIG. 3

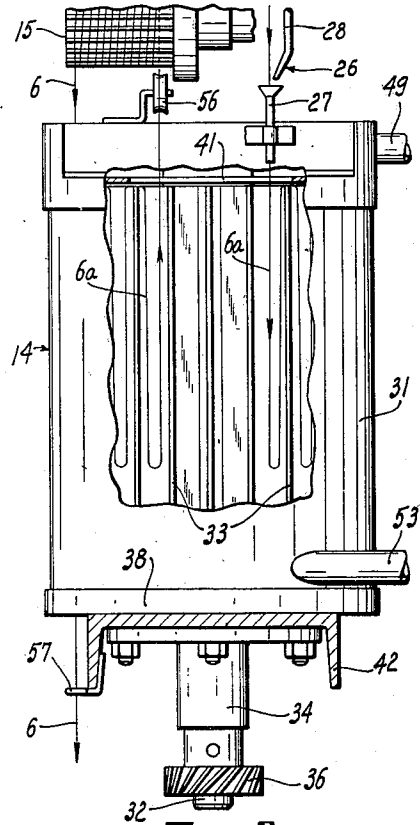


FIG. 5

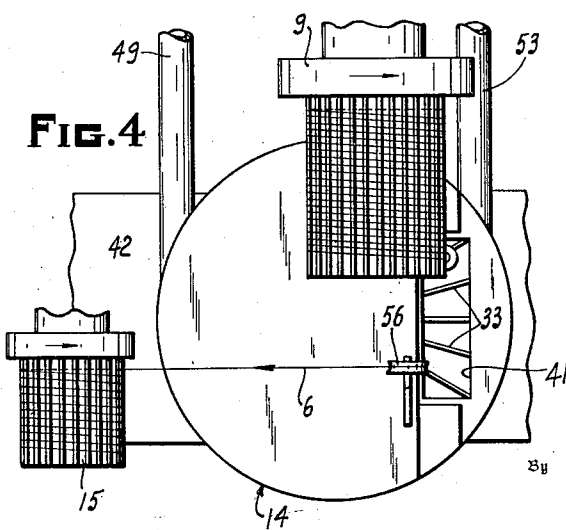


FIG. 4

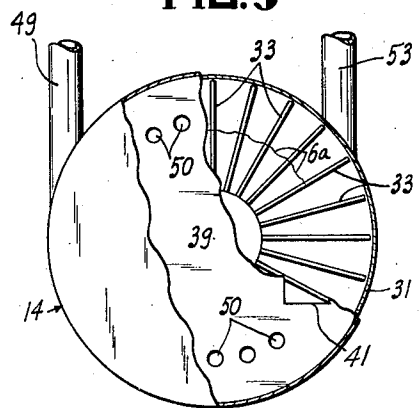


FIG. 6

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APPARATUS FOR DRYING THREADLIKE ARTICLES

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Application August 31, 1938, Serial No. 227,753

6 Claims. (Cl. 34—157)

The present invention pertains to means for drying thread-like articles in a series of loosely suspended loops permitting unrestrained shrinkage to take place.

While the apparatus of the invention may be employed to advantage in the drying of thread-like articles generally, all of which are embraced within the intended scope of the instant application, the invention is particularly useful in connection with the drying of thread-like articles of synthetic origin, such, for example, as multiple filament thread produced according to the viscose, cuprammonium, cellulose acetate or casein process. For the sake of simplicity, the description which follows will be confined to the processing of multiple filament viscose artificial silk thread. The term "thread" will, however, be used in the claims to cover not only any multiple filament thread of the kind customarily employed in knitting and weaving operations but thread-like articles generally, regardless of whether they are of natural or synthetic origin.

It is desirable that multiple filament viscose artificial silk thread have uniform physical and physico-chemical characteristics, particularly a uniform residual capacity to shrink of low order. Uniformity of these characteristics is of great importance in thread employed in weaving for the reason that in the course of the process of their manufacture woven fabrics are washed, dyed and thereafter dried on tentering frames. If the thread from which the fabric is woven possesses a non-uniform residual capacity to shrink, or, if uniform, a comparatively high residual capacity to shrink, tearing of the cloth in the tentering frames may easily result. Other difficulties, particularly in dyeing, tend to develop if the physical and physico-chemical properties of the thread are not uniform.

The term "residual capacity to shrink" has reference to the amount, in proportion to its original length, by which a dry thread will shrink upon being rewet and redried under conditions permitting it to shrink without restraint.

Thread dried in the manner characteristic of the usual discontinuous processes, such, for example, as the conventional spool-spinning system, possesses a very high residual capacity to shrink, in addition to which it possesses considerable non-uniformity of its physical and physico-chemical characteristics generally. Numerous undesirable concomitants develop such, for example, as the tearing of cloth in the tentering frames in consequence of uneven shrinkage properties, as well as defects in dyeing of the kind known as "dye

barré," "shiners," "railroad tracks," etc. Such difficulties are partly or wholly traceable to the fact that the thread is not permitted to shrink freely when dried on the spool, on which varying degrees of tension are exerted upon the thread in consequence of the fact that certain layers are prevented from shrinking either by the rigid spool or by the undried center portion of the thread package.

With a view to overcoming difficulties of the kind referred to above, many proposals looking to the substitution of collapsible winding spools for the conventional spin spools have been made, but few have been found to be commercially practicable. Other suggestions have been directed to the use of padded spools as a possible solution to the problem. None of these proposals has succeeded in wholly overcoming the troubles experienced in the drying operation. None, furthermore, is adaptable to the continuous method of producing thread, which presents even more troublesome problems than those experienced in discontinuous processes. At the present time, the practice in continuous installations is to dry on tapered reels.

In contrast to the above-described practices, the novel method and apparatus of the instant application overcome virtually all of the difficulties heretofore experienced. Generally speaking, the invention contemplates the formation in a continuous length of thread of a series of slack loops which are subjected to the action of the drying medium, dried to the desired extent, and collected in any desired form of package. As is readily apparent, this procedure, with slight modifications in the apparatus which in no way affect the scope or spirit of the invention, lends itself with equal adaptability to both continuous and discontinuous processes.

The apparatus shown in the accompanying drawings as illustrative of the invention is especially advantageous in that it will continuously accept thread directed to it, dry the thread—which meanwhile is in a condition in which it is free from all tensional stress—and deliver it to a suitable collecting device. The complete absence of tensional stress upon the thread during the drying operation permits the thread to shrink freely, eliminating the stretching action which gives rise to the undesirable effects referred to above in connection with the ordinary methods of drying thread produced by the conventional discontinuous processes. The invention gives rise to a thread of uniform physical and physico-chemical

cal properties characterized by an extremely low residual capacity to shrink.

A preferred embodiment of the invention is illustrated in the accompanying drawings, in which Figure 1 represents a front elevation of the lower portion of one form of a continuous thread-processing machine in which the thread-drying apparatus of the invention is incorporated. Figure 2 is a sectional elevation along the line 2—2 of Figure 1. Figure 3 is an enlarged sectional elevation of the drying apparatus of the invention from line 3—3 of Figure 2. Figure 4 is a plan of the thread-drying apparatus of Figure 1. Figure 5 is a front elevation of the thread-drying apparatus with parts broken away for clearness. Figure 6 is a plan with parts omitted.

The continuous thread-processing machine of which, as previously explained, only a portion is shown in Figures 1 and 2 is generally of the type shown and described in copending application Serial No. 7,114 for "Manufacture of artificial silk" filed February 18, 1935, by Walter F. Knebusch and Alden H. Burkholder (Patent 2,225,642). As described in said prior application, the machine includes a plurality of thread-advancing thread store devices arranged in a vertically stepped relation. By means of such a machine, a continuous length of thread formed at the upper end of the machine may be advanced downward from one device to another through a sequence of processing treatments each of which may be applied to said thread while temporarily stored on one of said devices.

The thread-advancing thread store devices referred to may conveniently take the form of thread-advancing reels of the kind shown, described and claimed in application Serial No. 652,089, filed January 16, 1933, by Walter F. Knebusch (Patent 2,210,914), from which they differ principally in that they are of cantilever form.

In the apparatus shown in Figures 1 and 2 of the accompanying drawings, the thread 6 passes downward to each of the reels 7, 8 and 9, the latter being the last three of the several reels present in a complete thread-processing apparatus. The treatments performed on the various reels of the sequence, which may be as many as ten in number, may include any of the appropriate steps, depending upon the process used; for example, in the viscose process, the steps of desulphurizing, bleaching, sizing, washing and finishing. Processing liquid may be applied to the reels by the distributors 11 supplied by conduits 12 and may be removed by the troughs 13 disposed therebelow.

It will be noted that no processing liquid is applied to the thread while stored on reel 9, which is utilized as a drip reel to permit excess processing liquid carried by the thread from the previous stages to drip off, thus reducing the amount of exterior moisture clinging to the thread. From the reel 9, the thread 6 passes to the thread-drying apparatus 14, being removed therefrom by some suitable means such as a withdrawing reel 15. From the withdrawing reel 15 the thread may be directed to any suitable type of collecting device such as the conventional cap twister 16.

The processing reels 7, 8 and 9, as will be seen from Figure 2, are secured by brackets 17 to the diagonal 18 forming part of the frame of the machine. Several of these members 18 are supported by a longitudinally extending frame member 19. The reels are arranged, as previously explained, in vertically stepped relation with their free ends extending toward a common front so

that the free end of each reel is directly above the supported end of the next succeeding reel in the series. In addition, the free ends of the reels are tilted slightly above the supported end thereof. Liquid supplied from distributors 11 travels in countercurrent flow from the unsupported toward the supported end of each reel.

The reels 7, 8 and 9 are driven through gearing 21 by the vertically extending shaft 22 supported from diagonal 18 by the bearing brackets 23. The vertical shafts 22 for each series of processing reels are actuated through gearing 24 by the shaft 25 which extends lengthwise of the thread-processing machine and is rotated by a power source (not shown). Any other suitable arrangement for mounting or driving the units may readily be substituted for that herein described and illustrated. A similar series of reels and their associated driving mechanism may advantageously be provided on the opposite face of the machine to provide a maximum number of thread-producing units in a minimum floor space.

From the last of the reels 7, 8, and 9, the thread 6 is advanced as previously explained to the thread-drying apparatus 14, to which it is fed by the air injector device 26 which comprises a short tube 27 through which an air jet is directed from the air supply line 28 and controlled by the cock 29. The air injector device 26 serves to draw the thread 6 off the free end of the reel and insure a positive feed for the drying apparatus 14. Any other suitable type of threading device which will accomplish the same or similar results without introducing tension into or damaging the thread may be substituted for the air injector device 26.

The drying apparatus 14 comprises an enclosing jacket 31 which is preferably cylindrical in shape and which entirely encloses the vertically extending rotatable shaft 32 to which are secured a plurality of vanes 33 which extend radially from said shaft 32. These vanes 33 may take the form of frames with foraminous coverings or they may be made in the form of solid plates, preferably of some non-corrosive material such as stainless steel, aluminum, Bakelite, hard rubber or metal coated with a non-corrosive material. Shaft 32 extending through the base 38 of the jacket 31 is supported in the bearing 34 and rotated through the gearing 36 by the shaft 37 extending longitudinally of the machine and operating similar devices in the case of each of the various thread-processing units.

Jacket 31 of the drying apparatus 14 may be provided with a base 38 and a cover portion 39 with an opening 41 cut therein to permit the thread 6 to be supplied to the vanes 33. Through the opening 41 the thread 6 is also withdrawn from the vanes 33 and passed to the withdrawing reel 15 as will shortly be explained in detail. The plurality of drying devices 14, one being provided for each processing series, is secured to the longitudinal channel 42 which extends the entire length of the machine supported by the brackets 43 from the machine frame. Withdrawing reel 15 is mounted upon a longitudinally extending plate 44 by means of the reel frame member 45 and 15 is driven from a power source (not shown) by the longitudinally extending shaft 46 through the gearing 47.

Heated air is directed to the manifold 48 by the inlet pipe 49 supplied by the longitudinally extending duct 51 which serves a plurality of drying units 14, and is carried on brackets 52. The air in manifold 48 passes through the ports 50 in

cover portion 39 of jacket 31, where it strikes the rotating vanes 33 between which the thread 6 to be dried is suspended in loops 6a as indicated in Figures 3 and 5. After passing downward between the several vanes 33, the air is withdrawn from the jacket 31 by the outlet pipe 53 located at the lower portion of said jacket and preferably at the opposite side of the jacket 31 with respect to the shaft 32 to insure adequate circulation of the air. Outlet pipe 53, like inlet pipe 49, connects with a duct 54 which is carried on brackets 55 and extends lengthwise of the machine. A slight negative pressure or suction may be placed upon the duct 54 to withdraw the air from the jacket 31 and eliminate the possibility of turbulence.

As previously explained, the thread 6 is fed to the rotating vanes 33 by the air injector 26. The thread-drying apparatus 14 may readily be threaded up by withdrawing a short length of thread from the drip reel 9, holding a portion of the end of said thread across the mouth of the tube 27 of the injector 26 directly below the air line 28, and turning on the supply of air by adjusting the cock 29. The injector will continuously withdraw the thread 6 from the drip reel 9 and as the vanes 33 rotate beneath the discharge end of the injector tube 27 the thread will be fed through the opening 41 in the cover 39 of the jacket 31 and caused to hang over the upper edges of said vanes forming loops 6a (Figure 5). The thread 6 is slowly carried in this manner through the portion of the thread-drying apparatus to which the heated air is supplied.

In the threading-up operation, the leading end of the thread, after being carried through the thread-drying apparatus, again reaches the opening 41 from which it is withdrawn by the operator tending the machine. It is then passed over the roller guide 56 and threaded upon the withdrawing device, which may take the form of a small reel 15 of the same general type and operating in the same manner as the other reels of the processing machine. The leading end of the thread is advanced along the reel 15 and when discharged from the free end thereof may be passed through the guide 57 to any suitable type of collecting device, such as the conventional cap twister 16.

When the threading-up operation has been completed, thread 6 will be continuously processed upon the machine, passed through the thread-drying apparatus, and collected in the desired kind of package. It is unnecessary thereafter for the operator to be in attendance except to check the operation and to re-thread the apparatus in the event that breakage of the thread occurs. Occasionally, the apparatus may have to be shut down for periodical cleaning, oiling and minor repairs or replacements, after which it is again necessary to thread up the apparatus.

The drying of the thread may be accomplished in a number of other ways than by the introduction of heated air to the enclosing jacket 31 of the drying apparatus 14. By way of illustration, it is possible to employ a hollow central shaft with communicating hollow vane elements and to circulate therein a heated fluid so that the thread may be dried by the heat radiated from said vane elements. The vane elements may also be made tapered or wedge-shaped in form, widening from the top thread-supporting edge toward the bottom and either heated by the circulation of a fluid heating medium in contact with the under side of said vane element or by contact of

said under surface of said vane elements with a flame.

Numerous other modifications may be made in the illustrated apparatus without in any way departing from the spirit or scope of the invention. For example, for withdrawing reel 15 may be substituted any suitable type of device such as a godet wheel or the like which will serve to withdraw the thread from the thread-drying apparatus. Likewise, for the roller guide 56 any other suitable type of guide may readily be used. Many similar changes of a character such as to suggest themselves to one familiar with the art may also be made.

It is intended that the patent shall cover, by suitable expression in the appended claims, whatever features of patentable novelty reside in the invention.

What is claimed is:

1. Apparatus for drying thread comprising an upright generally cylindrical enclosure; a member mounted in said enclosure for rotation about an upright axis and comprising a plurality of spaced radially extending partitions, whereby a substantially enclosed space is defined by each pair of adjacent partitions and said enclosure; means for rotating said member in said enclosure; means for depositing thread on the partitions of said member as it rotates in such manner that the thread hangs suspended in loops in said spaces between adjacent partitions; and means for circulating a drying medium through said enclosure.

2. Apparatus for continuously drying thread comprising an upright generally cylindrical enclosure; a member mounted in said enclosure for rotation about an upright axis and comprising a plurality of spaced radially extending partitions, whereby a substantially enclosed space is defined by each pair of adjacent partitions and said enclosure; means for rotating said member in said enclosure; means for continuously depositing thread on the partitions of said member as it rotates in such manner that the thread hangs suspended in loops in said spaces between adjacent partitions; means for drying the thread while it so hangs between the partitions of said rotating member; and means for continuously withdrawing the dried thread from said partitions.

3. Apparatus for continuously drying thread comprising an upright generally cylindrical enclosure; a member mounted in said enclosure for rotation about an upright axis and comprising a plurality of spaced radially extending partitions, whereby a substantially enclosed space is defined by each pair of adjacent partitions and said enclosure; means for rotating said member; means for continuously depositing thread on the partitions of said member as it rotates in such manner that the thread hangs suspended in loops in said spaces between adjacent partitions; means for heating the partitions of said rotating member to dry the thread carried thereby; and means for continuously withdrawing the dried thread from said partitions.

4. Apparatus for drying thread comprising an upright generally cylindrical enclosure; a member mounted in said enclosure for rotation about an upright axis and comprising a plurality of spaced radially extending partitions, whereby a substantially enclosed space is defined by each pair of adjacent partitions and said enclosure; means for rotating said member in said enclosure; pneumatic means for continuously deposit-

ing thread on the partitions of said member as it rotates in such manner that the thread hangs suspended in loops in said spaces between adjacent partitions; means for drying the thread while it so hangs between the partitions of said rotating member; and means for continuously withdrawing the thread from said partitions.

5. Apparatus for drying wet thread comprising an enclosure having an upright wall; a plurality of upright partitions extending transversely of said wall, disposed in said enclosure, said partitions forming spaces within said enclosure; means for supporting and moving said partitions along said wall; means for depositing the wet thread in said spaces in a series of loops at least one of which is disposed between each pair of adjacent partitions; means for drying the thread while suspended in said loops; and means for

withdrawing the dried thread from said partitions.

6. Apparatus for drying wet thread comprising an enclosure having an upright wall; a plurality of upright partitions extending transversely of said wall, disposed in said enclosure, said partitions forming spaces within said enclosure; means for supporting and moving said partitions along said wall; means for depositing the wet thread in the spaces between said partitions in a series of loops, at least one of which is disposed between each pair of adjacent partitions; means for circulating a drying medium through said spaces to dry the thread suspended therein; and means for withdrawing the dried thread from said partitions.

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