United States Patent

[11] **3,602,966**

[72] Inventor **Heinz Fleissner**
Egelsbach near Frankfurt, Germany

[21] Appl. No. **824,457**
[22] Filed **May 14, 1969**
[45] Patented **Sept. 7, 1971**
[73] Assignee **Fleissner GmbH**
Germany
[32] Priority **May 18, 1968**
[33] **Germany**
[31] **P 17 60 452.3**

[54] **PROCESS AND APPARATUS FOR TREATING SYNTHETIC FILAMENT GROUPS**
23 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **28/1.2, 28/75**
[51] **Int. Cl.** **D02j 1/22, D06p 3/00, D02q 1/00**
[50] **Field of Search** 28/1, 72, 1.2, 71.3, 72, 72.1, 72.11, 74, 75, 76

[56] **References Cited**
UNITED STATES PATENTS

3,434,189	3/1969	Buck et al.	28/75 WT
3,456,431	7/1969	Fleissner	28/75

Primary Examiner—Louis K. Rimrodt
Attorney—Craig, Antonelli and Hill

ABSTRACT: The present disclosure is directed to a process and apparatus for the continuous pad-dyeing or crimping of endless synthetic filament groups wherein the pad-dyeing process can be combined with fiber production and the drawing of the fiber filaments is effected after the application of the dyestuff to the synthetic filament groups.

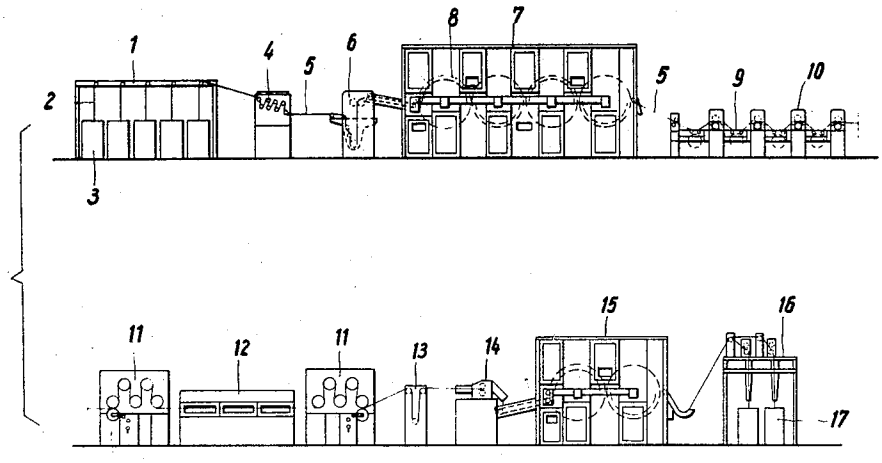
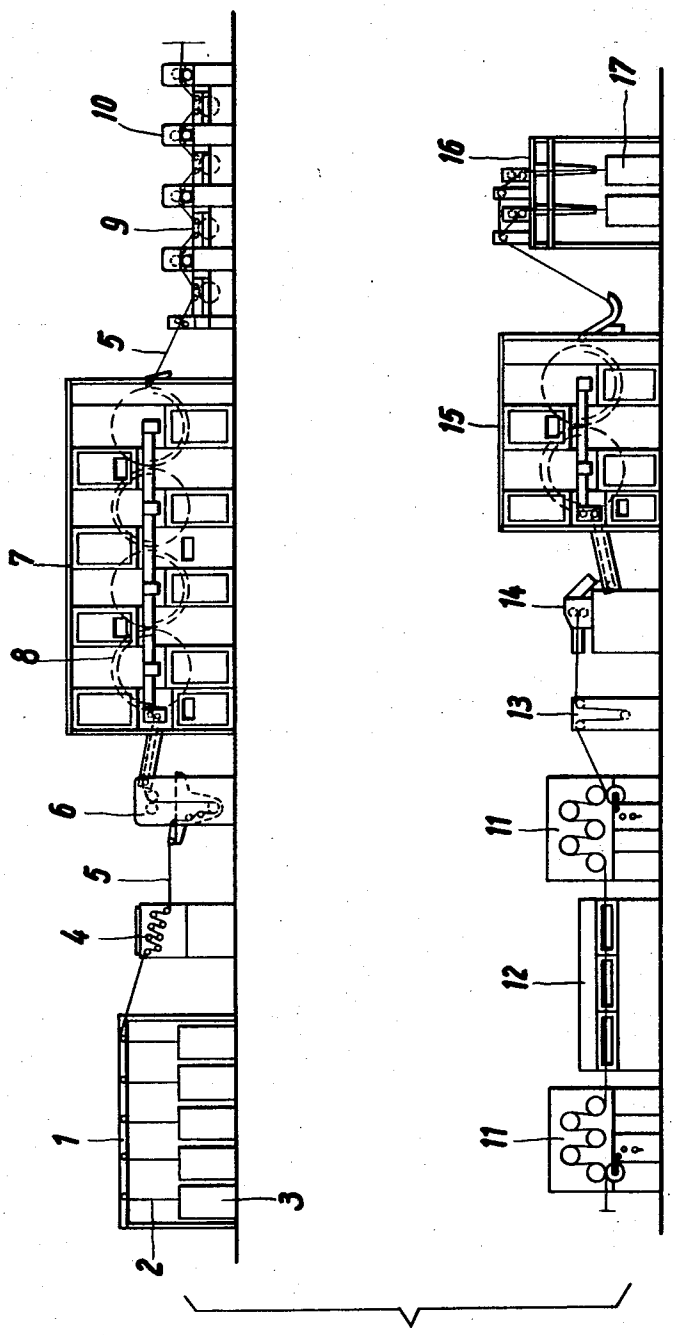


FIG. 1.



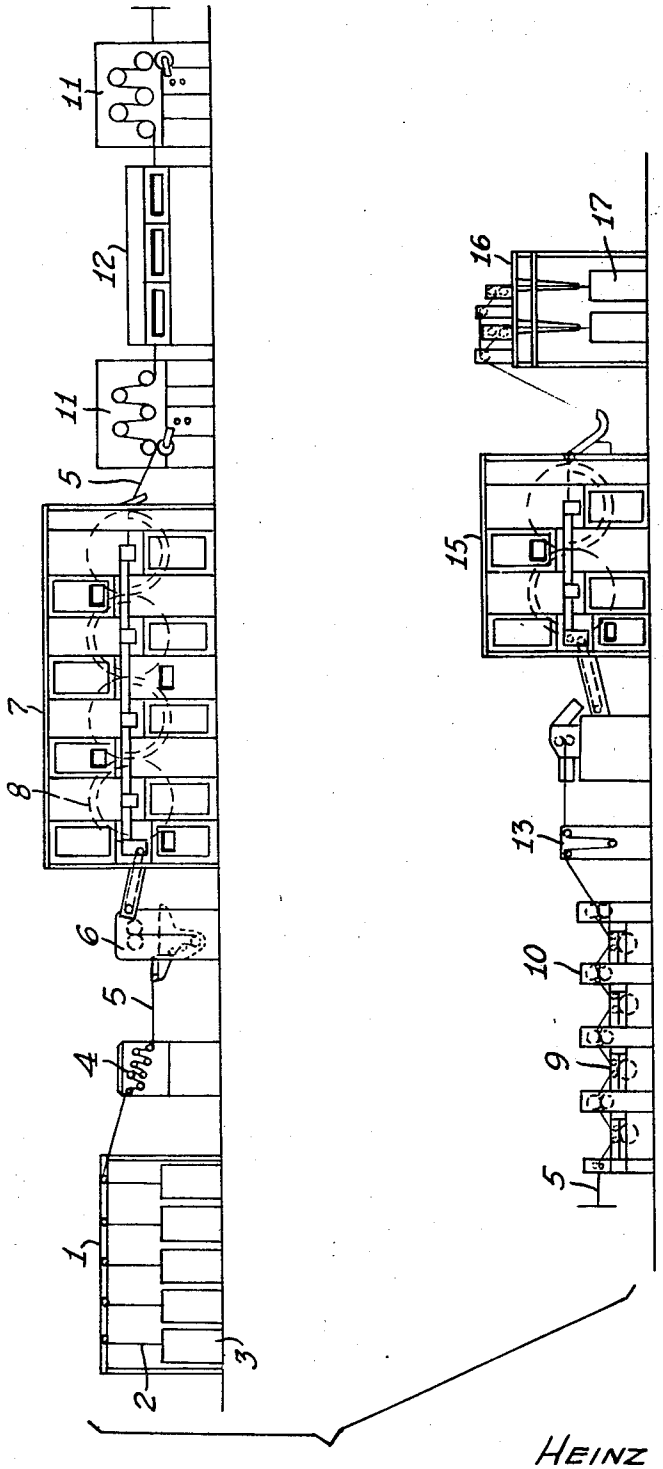
Inventor:

HEINZ FLEISSNER

BY Craig, Antonelli, Stewart & Hill

ATTORNEYS

FIG. 2.



INVENTOR.

HEINZ FLEISSNER

PROCESS AND APPARATUS FOR TREATING SYNTHETIC FILAMENT GROUPS

BACKGROUND OF THE INVENTION

The present invention relates to a process and apparatus for the continuous pad-dyeing or printing of endless synthetic filament groups, particularly tow, with dyestuffs which become fixed under the influence of heat. According to the present invention filament groups which have been printed or padded with preparations which contain said dyestuffs, as well as thickening agents and other common auxiliary agents and which have possibly been dried, are heated to the fixation temperature, for example to about 170° to 230° C., whereby the pad-dyeing process can be combined with fiber production, especially if the treatment of polyester fibers is involved.

Up to the present time, when dyeing synthetic filament groups, for example polyesters, the spinning slurry or the ready fiber has been dyed using the conventional full-bath method. Furthermore, woven fabrics of polyesters and polyamides have been dyed using the Thermosol process with a short period hot-air fixation. When dyeing the spinning slurry it is difficult to mix the suitable pigments uniformly into the highly viscous slurry. This applies to the production of granulates as well as to the continuous reesterification and polycondensation processes. The very delicate melt-spinning might be considerably disturbed by the intercalation of pigments. When changing colors, serious production losses result apart from the heavy material loss. Therefore, the process is used generally for the black colors only.

Processes and apparatus for the continuous dyeing of synthetic filament groups, especially for the Thermosol-dyeing of polyester and polyamide tow have already been suggested. Polyacrylonitrile tow is already dyed continuously on a pad-steam process. This continuous dyeing process for synthetic filament groups is very economical and the dyeing results are extremely uniform. Also, short runs of 500 kg. and less can be dyed economically in this process. Furthermore, processes can now procure colored tow or flock.

As compared with the conventional, discontinuous dyeing processes, the continuous dyeing process, for example the Thermosol process, offers the further advantage that hardly any oligomeres are formed. These small particles form during an extended high-temperature treatment of the fiber and especially in a moist medium. If the material is exposed to the influence of high temperatures for a long period, said particles migrate to the surface of the fiber and may affect the rubbing fastness of the dyeing and thus result in heavy dusting during further processing. Moreover, the fiber surface may be rendered so rough that proper drafting of the roving, that is of the synthetic filament groups, in the ring spinning mill would no longer be possible. Increased thread breakage would be the result.

In order to further define this dyeing process, it has been suggested to combine the dyeing process with fiber production. The dyeing process should follow the crimping process so that the fixation of the fiber and the dyestuff could be effected in one single step.

SUMMARY OF THE INVENTION

An object of the present invention is to avoid the prior art disadvantages in the treatment of synthetic filament groups.

Another object of the present invention is to provide an improved process and apparatus for the dyeing of synthetic filament groups, particularly polyester fibers wherein the dyeing stage of the process is effected prior to the drawing of the synthetic filament groups.

A further object of the present invention is to provide an improved process and apparatus for the dyeing of synthetic filament groups wherein the dyeing process is incorporated into the production process of the synthetic filament groups.

Other objects and further scope of applicability of the present invention will become apparent from the detailed description given hereinafter; it should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various change and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

Pursuant to the present invention, it has been found that the above-mentioned disadvantages may be eliminated and a much improved process and apparatus for the treating of synthetic filament groups, particularly for the dyeing of synthetic filament groups may be obtained by incorporating the dyeing process in the production process of these synthetic filament groups and by carrying out the dyeing process before drawing the synthetic filament groups. The present invention is based upon the discovery that generally only the amorphous portion of the filament groups can be dyed well. This is particularly true in the case of polyester fibers. Furthermore, it has been found that during the drawing process of the synthetic filament groups, particularly with respect to polyester fibers, the amorphous portion of the filament groups decreases and the crystalline portion of the filament groups increases. Thus, according to the present invention, it has been found that the molecular structure of a nondrawn tow permits a quicker and better dyeing effect. Accordingly, it is therefore suggested to carry out the dyeing process before drawing the synthetic filament groups. Dyeing before drawing offers the further advantage that for the same production quantity slower speeds are possible, for example a speed of about four times lower, if the synthetic filament groups are drawn at a ratio of about 1 to 4.

Furthermore, by utilizing this method, it is advantageous to incorporate the dyeing process in the production process of the synthetic filament groups. It is suggested to draw the filament groups after the dyestuff fixation, to subsequently wash said groups and to subject them to a reducing aftertreatment and to a finishing treatment at this stage. Drawing the filament groups directly after the dyestuff fixation is advantageous because part of the unfixed dyestuffs and auxiliary agents are removed during the drawing process and accordingly need not be washed out or removed by the reducing aftertreatment.

If the synthetic filament groups are to be crimped, it is suggested to carry out the crimping process after the finishing process so that the crimp may be set during the subsequent drying stage. In order to obtain a good setting of the crimped fiber, it is advantageous if the drying temperature is higher than the temperature for the fixation of the dyestuff.

In a further embodiment of the present invention it is suggested to combine the drawing stage of the process with the dyestuff fixation stage of said process. In this case dyestuff fixation may be effected during the drawing stage or immediately after the drawing stage, that is, the drawing units are, for this particular arrangement, provided with heated rollers, so that the filaments can be dried on said rollers. Dyestuff fixation can then take place in a heating duct which is disposed between the drawing units or in a sieve drum fixation plant which can be similarly used for this purpose. For complete dyestuff fixation, the rollers of the subsequent drawing unit may also be heated to the fixation temperature.

As an apparatus for carrying out the process according to the present invention, it is suggested to combine the following individual units and to provide them with a common control:

1. A can creel,
2. A tow forming unit, consisting preferably of a roller or a rod arrangement,
3. An impregnating or printing unit,
4. A drying and fixation unit, preferably a sieve drum drier containing sieve drums subjected to a suction draft and/or containing heated cylinders.
5. A drawing unit,
6. A washing unit, for example for rinsing, for conducting the reducing-aftertreatment, and for acidifying and finishing the filament groups,
7. Possibly a crimping unit,

8. A drying and possibly a heat-setting unit, and

9. A plaiting and/or packing unit.

The individual units need not necessarily be arranged in the sequence as set forth above. For example, it is also possible to arrange the drawing unit behind the washing machine, or, as already mentioned, to design the drying and heat-setting unit in such a way that it may serve as a drawing unit at the same time.

BRIEF DESCRIPTION OF THE DRAWING

The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawing which is given by way of illustration only and thus is not limitative of the present invention and wherein,

FIG. 1 illustrates on e possible arrangement of the apparatus for treating synthetic-filament groups according to the present invention; and

FIG. 2 shows a preferred embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawing, the apparatus of the present invention comprises a can creel 1 provided with cans 3 out of which individual ribbons 2 are drawn as loose filament groups. These individual ribbons 2 are spread by means of a roller arrangement 4 and are combined into one or several tows 5. The tows 5 of loose filament groups are then impregnated with the dyeing liquor and preparations in a padder 6, and conveyed to a sieve drum diner drier 7 containing sieve drums subjected to a suction draft wherein the material is dried and the dyestuffs are fixed. Instead of using a sieve drum drier 7, a steaming unit, for example with a conveyor belt may be used or, when conducting a Thermosol process, a device with heated cylinders can also be utilized. After the dyestuff fixation, the tows 5 are washed relatively clean, acidified, rinsed and finished in sieve drum bowls 9. The finishing agent may be added to the last bowl or it may be sprayed on to the material by means of spray nozzles, not shown. Behind each sieve drum bowl 9 a squeezer 10 is provided. Subsequently the tows are drawn between the drawings units 11 and a heating duct 12 at a ratio of, for example, about 1 to 4. For the production of crimped tow, a crimping unit 14 with a preceding rocking-roller control 13 is installed behind the drawing units 11. In the device shown, the tows 5 are dried and set in another sieve drum unit 15 and are finally folded into containers 17 by means of a tow packing unit 16.

In the apparatus as shown, a very economical and uniform dyeing of the filament groups is effected. The apparatus is also suitable for very high production quantities. Furthermore, since intermediate packing processes are eliminated, an entangling of the individual filaments is substantially avoided and accordingly the fiber quality is further improved.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, a and all such modifications as would be apparent to one skilled in the art are intended to be included.

I claim:

1. In an apparatus for the continuous pad-dyeing or printing of endless synthetic filament groups comprising, in combination, a can creel, means for drawing a plurality of filament groups from said filaments into one or more tows, padder or printing means for impregnating said tow with a dyeing liquor, a first drier means for drying and fixing the dyed tow, drawing means disposed behind the drier means, a washing unit provided behind the drawing means for rinsing, reducing, acidifying and finishing the tows, a second drier means disposed behind the washing unit and a tow packing unit provided behind said second drier for packing said tow into a container, the improvement which comprises providing the drawing means in front of the washing unit, thereby removing at least part of the unfixed dyestuffs and auxiliary agent in the drawing means rather than in the washing unit.

2. The apparatus of claim 1, wherein the means for drawing the plurality of filament groups from said can creel is an arrangement of roller means.

3. The apparatus of claim 1, wherein the first and second drier means are sieve drum driers, each of which contains at least one sieve drum means subjected to a suction draft.

4. The apparatus of claim 1, wherein the first and second drier means comprises a steaming chamber containing a conveyor belt as the conveying means.

5. The apparatus of claim 1, wherein the first and second drier means comprises a chamber-containing heated cylinders as the conveying means.

6. The apparatus of claim 1, wherein a crimping means is provided after the washing unit in front of the second drier means.

7. The apparatus of claim 6, wherein a rocking roller control is provided in front of the crimping means.

8. The apparatus of claim 1, wherein the washing unit comprises sieve drum bowls containing sieve drums subjected to a suction draft.

9. The apparatus of claim 1, wherein the drawing means comprises a plurality of roller means.

10. The apparatus of claim 1, wherein the drawing means comprises a plurality of heated roller means.

11. The apparatus of claim 1, wherein the drawing means comprises first and second drawing elements with a heating duct disposed between said drawing elements.

12. The apparatus of claim 11, wherein the first and second drawing elements contain a plurality of roller means.

13. The apparatus of claim 11, wherein the first and second drawing elements contain a plurality of heated roller means

14. In a process for the continuous pad-dyeing or printing of endless synthetic filament groups with dyestuffs which become fixed under the influence of heat which comprises drawing a plurality of filament groups from a creel and combining them into one or more tows, impregnating said tows with a dyestuff preparation, heating said tows to fix said dyestuff, drawing said tows and subsequently washing, reducing and finishing the tows, drying the tows and packing said tows into a container, the improvement which comprises drawing the tows prior to washing, thereby removing at least part of the unfixed dyestuffs and auxiliary agents in the drawing step rather than in the washing step.

15. The process of claim 14, wherein the synthetic filament groups are polyester fibers.

16. The process of claim 14, wherein the dyestuff is fixed at a temperature of about 170°—230° C.

17. The process of claim 14, wherein the tows are crimped before the last drying stage.

18. The process of claim 17, wherein the tows are dried at a temperature higher than the fixation temperature to set the crimp.

19. The process of claim 14, wherein during the drawing stage the tows are conveyed over-heated-conveying surfaces to at least partially fix the dyestuff.

20. The process of claim 14, wherein the tow is drawn at a ratio of about 1 to 4.

21 The process of claim 14, wherein the dyestuff is fixed under the influence of heat by drawing the heated treatment medium through the synthetic filament groups while it is being conveyed on the surface of at least one sieve drum means subjected to a section draft.

22. The process of claim 14, wherein the drying of the tows is effected by drawing the heated treatment medium through the synthetic filament groups while it is being conveyed on the surface of at least one sieve drum means subjected to a suction draft.

23. The process of claim 14, wherein the tow is drawn on the surface of at least one roller means, conveyed through a heating duct and again drawn on the surface of at least one roller means.