Feb. 16, 1965 J. W. MUSSER 3,169,271

APPARATUS FOR QUENCHING EXTRUDED SPINNERET FILAMENTS

Filed Sept. 13, 1963 2 Sheets-Sheet 1

FIG. 1

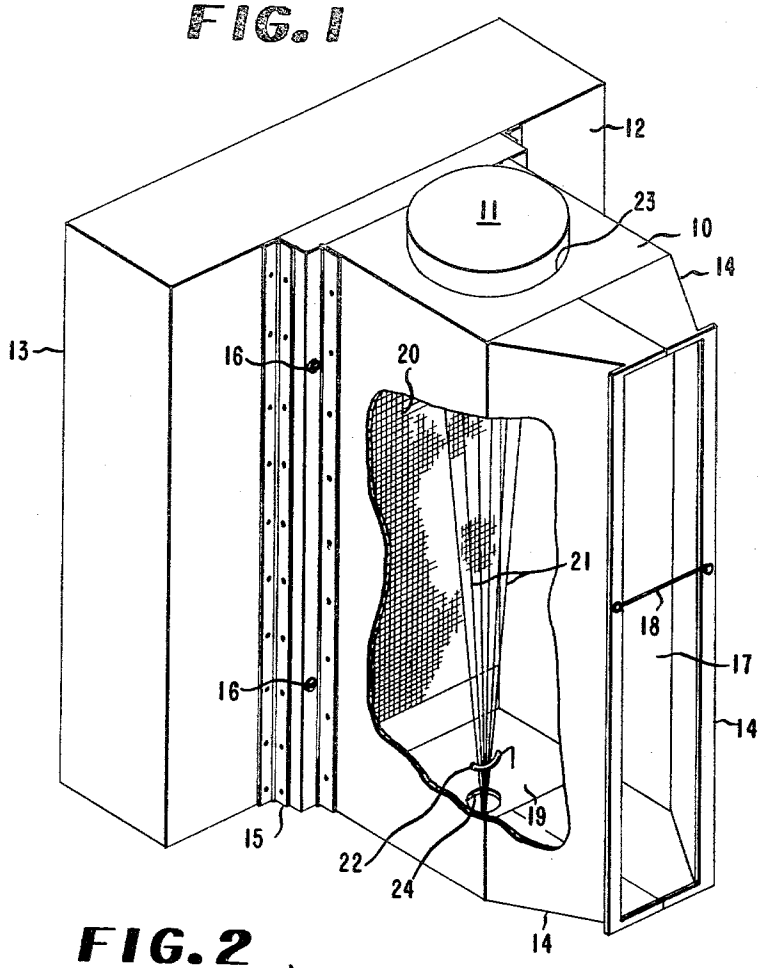
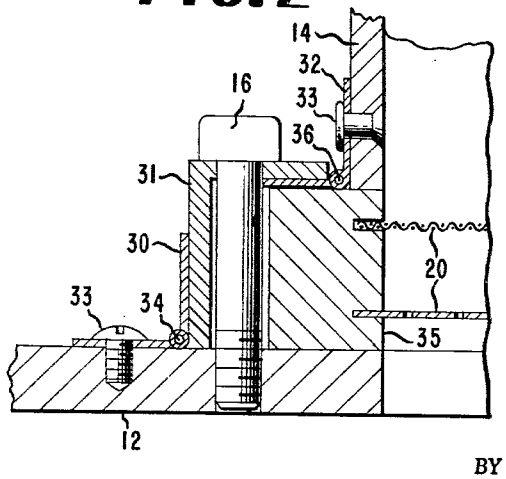


FIG. 2



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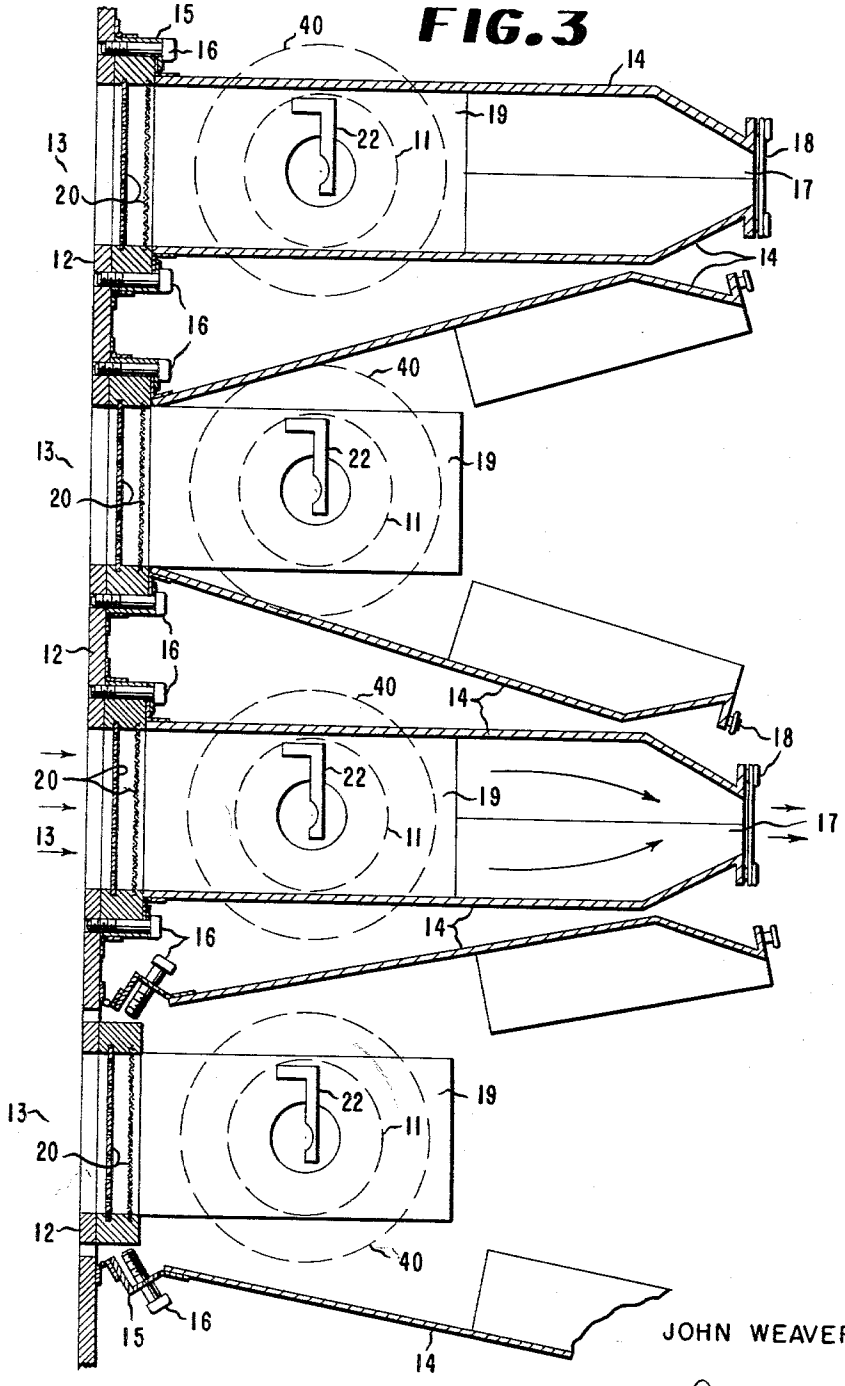
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Filed Sept. 13, 1963 2 Sheets-Sheet 2

FIG. 3



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APPARATUS FOR QUENCHING EXTRUDED SPINNERET FILAMENTS

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Filed Sept. 13, 1963, Ser. No. 308,903
3 Claims. (Cl. 18—8)

This invention relates generally to the production of synthetic filaments by melt-spinning and, more particularly, to an improved apparatus in which the molten filaments are cooled as they are extruded from a spinneret.

In the melt spinning of filamentous materials such as polyamides, polyesters, polyolefins, vinyl polymers and the like, the molten polymer is extruded through a spinneret into a zone where it is quenched by a flow of a gaseous medium. According to Heckert U.S. Patent 2,273,105 the quenching zone can be defined by two side walls interconnected by an integral back wall and a foraminous partition. As freshly-formed filaments descend from the spinneret and pass between the side walls, quenching air flows from a plenum through the foraminous partition, enters the quenching chamber, passes with a straight line flow across the path of the moving filaments and is allowed to escape through the opposite side of the chamber. With a fixed enclosure, however, neither the spinneret assembly nor the threadline is easily accessible to the operators. In attempting to overcome this difficulty, it has been proposed to pivotally mount the quenching chamber so that it may be swung away from the threadline, either through a horizontal arc as in Collat U.S. Patent 2,940,122 or through a vertical arc as in Bakker U.S. Patent 2,947,029. These devices require unobstructed free space in the vicinity of the quenching chamber to permit its movement as it is displaced from the threadline. Hence, they are not always satisfactory for use in compact efficient spinning machines in which the spinnerets and threadlines are closely spaced. Normally such structures also require complicated, bulky and costly assemblies.

Accordingly, it is an objective of this invention to provide a cross-flow quenching chamber in which the gas flow is fully controlled during melt spinning, the enclosing walls being closely spaced with respect to the moving filaments, being free of obstructions which may create disturbances in air flow and being tightly joined so as to avoid gas leakage or external air disturbances.

Another objective is to provide convenient access to the threadline for necessary operating procedures such as installation or removal of the spinneret assembly, string-up of the filaments to start spinning, cleaning or inspection of the interior of the quenching chamber.

Still another objective is to provide a plurality of readily openable quenching chambers which can be installed in a compact side-by-side physical arrangement in a melt-spinning machine.

To accomplish the objectives of this invention, a cross-flow quenching apparatus is provided comprising a vertical elongated chamber with a horizontal top wall with an opening to admit freshly-spun filaments, a back wall with an opening and foraminous partition to introduce the quenching medium and two movable side panels each cooperatively joined to the back wall by a double-action hinge assembly. The side panels project inwardly along their forward edges to form a vertical slot opening for the discharge of the quenching medium. The hinging arrangement is such as to provide three operating positions: (1) closed position during the spinning of filaments, (2) partially open for string-up and maintenance of the moving threadline, and (3) fully open for replacement of either spinneret assembly or foraminous partition.

Other objects and advantages of the present invention will become apparent upon review of the following description and drawings.

FIGURE 1 is a perspective view of a preferred embodiment of the quenching chamber, shown in the closed position with a portion of a chamber wall cut away to show the filaments within the chamber.

FIGURE 2 is a cross-section, in detail, of the double-action hinge connecting the side-panels with the backwall of the quenching chamber.

FIGURE 3 is a horizontal sectional view of a plurality of closely spaced quenching chambers, as shown singly in FIGURE 1, and illustrating alternate operating positions of the side panels of the quenching chamber.

Referring now to FIGURE 1 of the drawings, the quenching zone is defined by a fixed top wall 10, a fixed bottom wall 19, two movable side panels 14, and back wall 12, all snugly fitted together along abutting edges. Filaments 21 are extruded from a spinneret 11, descend through entrance opening 23 in top plate 10, along a central path between side panels 14, converge into a bundle of filaments at guide 22 and the yarn bundle exits through opening 24 in bottom plate 19 to a takeup or a next processing step, not shown. Quenching air is supplied from plenum 13 through a foraminous partition 20 in back wall 12 into the quenching chamber where it flows transversely as it contacts and cools the descending filaments 21 and discharges outwardly through slot 17 and dissipates into the spinning room. The top plate 10, back wall 12 and bottom plate 19 are fixed and may conveniently be integral parts of the housing of the melt-spinning machinery. The side panels 14, movable in a lateral arcuate path, are suspended from the back wall 12 by a double-action hinge assembly 15. The opposed side panels 14, are substantially imperforate. Except for openings 23 and 24, top plate 10 and bottom plate 19 are also substantially imperforate. The structure and function of the double-action hinge 15, shown in a closed position with locking screws 16 in place, will be further described in subsequent paragraphs. A simple catch or latch 18 holds side panels 14 together in the closed position. Side panels 14 project inwardly along their forward edges in defining slot 17. By also flanging them outwardly, as shown, a base is provided for affixing latch mechanism 18. It will be noted that the side wall panels 14 have been folded to provide lower and upper horizontal segments which engage bottom plate 19 and top plate 10, respectively.

The dimensions of the quenching chamber are governed by the conditions of its use. The vertical height must, of course, be sufficient to permit adequate solidification and cooling of the extruded filamentary material. The distance between side panels 14 may be as narrow as the width of the face of spinneret 11. Common materials of construction such as metals or plastics may be used in the fabrication of the various parts.

The apparatus of this invention permits particularly effective control of quenching conditions within the chamber. The quenching air may be admitted through a conventional foraminous sheet so as to provide a substantially uniform cross-current flow from top to bottom of the chamber. A low flow of quenching medium in the upper section may be obtained by use of flow-controlling screens as disclosed in Thompson U.S. 3,070,839. In a preferred embodiment, however, a perforated sheet is mounted within the foraminous partition 20, in which perforations in the upper section of the sheet are uniformly but more widely spaced to retard the flow of air into the quenching chamber, as disclosed in co-pending application S.N. 237,971 filed November 15, 1962. Any desired pattern

of air flow distribution may be obtained by appropriate design of the foraminous wall, which may be readily replaced without dismantling or removal of other parts of the quenching chamber.

In addition, the side panels **14** are spaced as closely as possible to the path of the descending filaments so that maximum use is made of the cooling potential of the flowing gas stream. More intimate contact between the gas and filaments is possible, thereby minimizing the total volume of gas which must be supplied at plenum **13**. The discharge slot **17** affords an opening for visual inspection of the filaments within the chamber during spinning. At the same time, being a restriction, it causes a slight positive pressure within the chamber and a relatively high velocity in the stream issuing through the slot, thus providing a buffer against external drafts or air disturbances which would otherwise upset the smooth travel of the filaments. Close-fitting joints between adjacent walls of the chimney minimize the outward leakage of air from the chamber.

A unique feature of this invention is the double-action hinge **15**, shown in cross-sectional detail in FIGURE 2 and which joins movable side panel **14** to back wall **12**. The hinge assembly **15** comprises a first double-leaf hinge **30**, an intermediate connector member **31** of generally right angle or L-shaped cross-section and a second double-leaf hinge **32**. The double-leaf hinges **30** and **32** are fixedly attached along opposite edges of member **31** by welding or soldering so that the pivot pins **34** and **36** of the hinges are in permanent parallel relationship. In a preferred embodiment, the double-leaf hinges **30** and **32** are of the so-called "piano-hinge" type. The free leaf of hinge **32** is attached to side panel **14** by means of suitable screws or rivets **33** so that hinge **32** is flush with the rear edge of panel **14**. The free leaf of hinge **30** is attached to back wall **12** by means of suitable fasteners such as screw **33** so that the inner surface of side panel **14** is flush with the inside of frame **35** of foraminous partition **20** and the rear edge of panel **14** is in contact with frame **35**. Cap screws **16** or other suitable threaded fasteners screwed into back wall **12** hold hinge **32** and side panel **14** firmly against frame **35** providing a positive mechanical seal against stray air currents either into or out of the quenching chamber along this joint. By this alignment and sealing of the quenching chamber walls with the inlet for the quenching air, a smooth conduit, free of protuberances, is provided and affords optimum conditions for linear flow. When screw **16** is temporarily tightened, only hinge **32** may function. When screw **16** is loosened, both hinge **32** and hinge **30** may function, thereby providing a dual hinging action and permitting the rear portion of the side panel **14** to move laterally through a greater arc. The number and spacing of screws **16** depend largely on the length of the quenching chamber and the rigidity of the hinge assembly.

Referring now to FIGURE 3, there is illustrated a plurality of quenching chambers which are closely spaced in a compact assembly in a spinning machine capable of spinning a plurality of yarns. Any number of chambers may be grouped in this manner.

From top to bottom in the drawing, the first quenching chamber is shown in the closed position. The proximity of the side panels **14** to spinneret face **11** and the path of the filaments to the convergence guide **22** is readily observed. Also it is apparent that the side panels **14** provide a smooth unobstructed passage for flow of the quenching air from plenum **13** and foraminous partition **20** through the chamber and out slot **17**. The filaments within the chamber may be easily viewed through slot **17** for routine inspection without disturbing the spinning process in any way.

The movable side panels **14** are partially opened, as shown in the second chamber of FIGURE 3, by unfastening latch **18** and manually spreading the panels apart. Thus, the operator gains quick access to the thread-line for close inspection, stringup of the yarn to begin spinning or other operating tasks. The width of the access opening is limited only by the spacing of the quenching chambers. Side panels **14** may be moved apart until they come into contact with the side panels of the adjacent chambers without interfering with the spinning process within those chambers. The quenching chamber is quickly and easily closed by moving the side panels **14** together and closing latch **18**. The ease with which the panels may be opened to this position permits rapid stringup of the thread-line or correction of any irregularities in the spinning yarn so that production delays or waste of yarn can be reduced to a very low level.

The lowermost quenching chamber in FIGURE 3 shows the side panels **14** in a position of maximum displacement. To attain this position, the hinge-locking screws **16** are unfastened to release the intermediate segment of double-action hinge **15** and permit the rear edges of the side panels **14** to move apart. By selection of suitable dimensions, a quenching chamber may be constructed which will permit the side panels to assume a parallel relationship at the maximum opening position. Clearance is now provided for removal or insertion of the spinneret assembly which requires the space indicated by the dotted circle **40**. Access is also provided to service the foraminous partition **20** and convergence guide **22**. This is an infrequent but necessary function to permit major mechanical work. However, the alignment and mechanism of the quenching enclosure remain undisturbed. After being opened to this position, the quenching chamber may be restored to the closed position within a matter of minutes and with the help of a single simple tool such as a screwdriver or wrench by inserting and tightening locking screws **16**.

Being relatively simple in structure, the quenching chamber may be constructed by conventional methods. It is recognized that the form and shape of the individual parts of the quenching chamber may be varied from the preferred embodiment shown herein without departing from the concept of this invention.

What is claimed is:

1. Apparatus for the cross-flow quenching of freshly-spun filaments comprising a vertical elongated chamber, said chamber being defined by a horizontal top wall provided with an opening through which the filaments pass in descending through said chamber, a back wall with an opening and foraminous partition for introducing a quenching medium into said chamber, and two laterally movable side panels each cooperatively joined to the back wall by a double-action hinge assembly, said side panels projecting inwardly along the forward edges thereof to form oppositely of said back wall a vertical slot opening for the passage of said quenching medium out of said chamber.

2. Apparatus of claim 2 wherein each said hinge assembly comprises first and second double-leaf hinges and a connector member of generally right angle cross-section which is coextensive with and parallel to the pivot pins of said first and second hinges, said first hinge pivotally mounting said connector member to said back wall and said second hinge pivotally mounting said side panel to said connector member.

3. Apparatus of claim 2 including means for holding said connector member in a fixed position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,940,122	Collat	June 14, 1960
2,947,029	Bakker	Aug. 2, 1960
3,108,322	Tate	Oct. 29, 1963

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,169,271 February 16, 1965

John Weaver Musser

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 57, for the claim reference numeral "2" read -- 1 --.

Signed and sealed this 6th day of July 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents