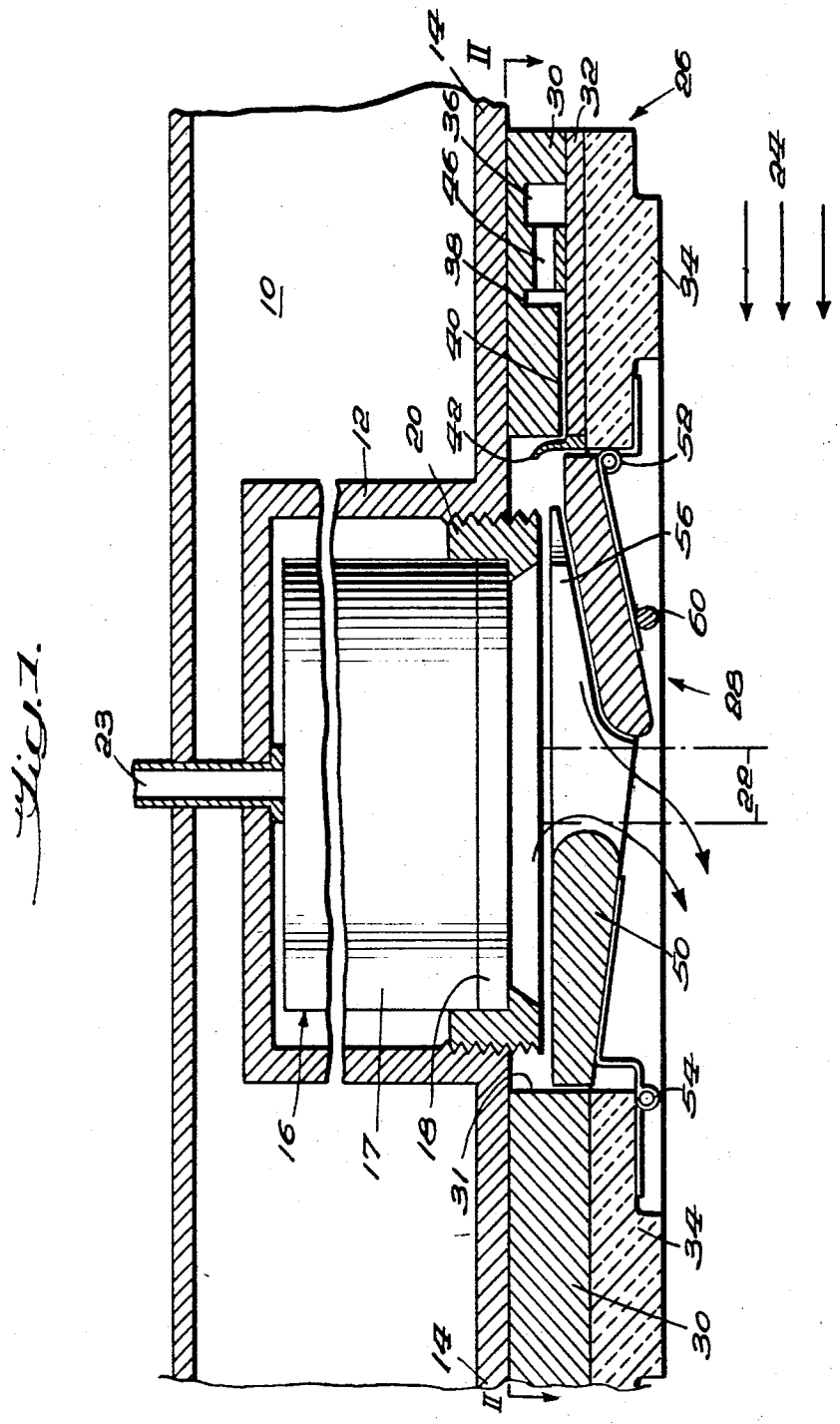
Aug. 27, 1968 F. S. DICKSON III 3,398,429

SPINNERET ENCLOSURE

Filed Oct. 10, 1966 2 Sheets-Sheet 1

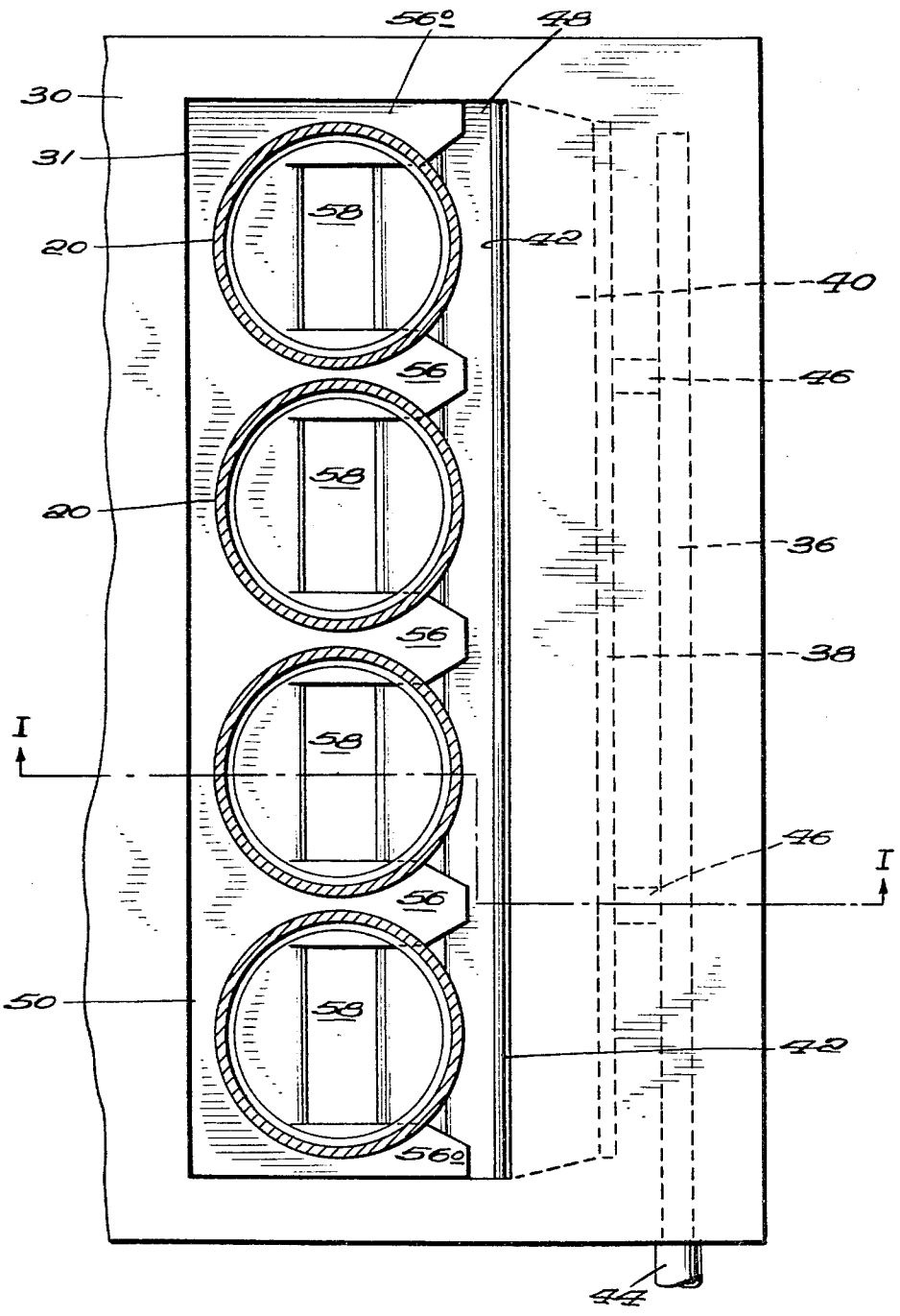


Aug. 27, 1968 F. S. DICKSON III 3,398,429

SPINNERET ENCLOSURE

Filed Oct. 10, 1966 2 Sheets-Sheet 2

Fig. 2.



United States Patent Office 3,398,429 Patented Aug. 27, 1968

3,398,429

SPINNERET ENCLOSURE

Frederick Stoever Dickson III, Martinsville, Va., assignor to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware

Filed Oct. 10, 1966, Ser. No. 585,641
6 Claims. (Cl. 18—8)

ABSTRACT OF THE DISCLOSURE

An array of spinnerets equipped with swingably mounted enclosure flaps for confining a blanketing medium to zones adjacent the spinnerets.

The present invention relates generally to the production of synthetic filaments and, more particularly, to apparatus in which the exposed face of a spinneret is blanketed with an inert gas.

In a melt-spinning operation, there is a tendency for some of the fiber-forming material to build up around each extrusion orifice. The degrading effect of free oxygen on such material manifests itself in the form of bent filaments or "drips." Although these effects can be avoided to a large extent by blanketing the spinneret with an inert medium, the costs cannot be justified in a process where the spinning speed is slow and can instead be stopped periodically for removal of buildups by wiping.

At higher spinning speeds, known routes for blanketing become more practical but are nevertheless inefficient and costly. Although it is relatively easy to blanket a single spinneret with inert gas, a certain amount of air still contaminates the gas, the amount depending on equipment design, quench-air turbulence and filament pattern. In the newer high-speed, high-production, spinning machines, a number of spinnerets may be so closely spaced together as to require a single blanketer. Under these circumstances, it is even more difficult to make the blanketing gas cover critical areas of all the spinneret faces equally and to avoid air intrusion. For effective blanketing, it is essential that the inert gas be so guided and directed that it will cover the orificed area of each spinneret without mixing with air and then exit from the blanketed zones with sufficient velocity that it will prevent stray air currents from coming up and entering those zones. Also, it is advantageous to prevent cross currents between adjacent spinnerets.

The various goals and objectives disclosed herein have been accomplished by providing an enclosure assembly for a spinning block, which block houses an aligned array of closely spaced spinnerets and also carries equipment for blanketing all of the spinnerets with an inert gas. Basically, the enclosure assembly is comprised of a pair of elongated, streamlined flaps pivotally mounted on opposite sides of the array for swinging movement toward and away from a closed position adjacent the spinnerets. When in the closed position, longitudinal edges of the flaps are spaced apart, leaving openings through which groups of filaments emerge from the several spinnerets.

In the drawings, FIGURE 1 is a fragmentary transverse sectional view through a preferred apparatus embodiment, on lines corresponding to I—I in FIG. 2; and FIG. 2 is a fragmentary longitudinal sectional view taken on line II—II in FIG. 1.

With reference to FIG. 1, the spinning apparatus includes a hollow spinning block **10** adapted to contain a suitable heat exchange fluid such as Dowtherm. The lower surface of block **10** has four wells **12** extending inwardly from a bottom wall **14**. Each well **12** houses a pack assembly **16**, which contains the normal filtering and distribution elements in a casing **17** and also includes a spinneret **18**. Each pack **16** is held in its well **12** by a pack nut **20**. Molten polymer is supplied under pressure through polymer supply lines **23** to the tops of the pack assemblies **16**. Filaments **22** issue from the bottom face of each spinneret **18**. A cross-current flow of quenching air has been indicated at **24**.

In order to prevent free oxygen from reaching the exposed faces of spinnerets **18**, a blanketing device **26** and an enclosure assembly **28** are placed below the spinneret. As shown in FIG. 2, the blanketing equipment or device **26** includes a rectangular shaped metal plate **30** having an elongated opening **31** in registry with the aligned array of closely spaced spinnerets **18**. Each spinneret **18** has a rectangular pattern of orifices from which a group of filaments **22** issues and passes downwardly through opening **31**. At both ends and on its left or front side (FIG. 1), metal plate **30** is of one thickness. On its back side, plate **30** is recessed to receive cover plate **32**. Under the metal parts, there is a supporting block **34** which is made from rigid heat insulation material. The blanketing equipment **26** is mounted in heat exchange relationship with the block bottom **14** so that the metal parts, namely the metal plate **30** and the cover plate **32**, are maintained at substantially the same temperature as heated block **10**. In the back side of metal plate **30**, there is a relatively large primary plenum **36** and a secondary plenum **38**. As shown in FIG. 2, plenums **36**, **38** evtend substantially through the length of device **26** and primary plenum **36** extends on to the edge of plate **30**. By further recessing the back side of plate **30**, a shallow passage **40** is provided between plates **30**, **32**, in communication with secondary plenum **38**. Mounted at the inner edge of plate **32**, there is an elongated weir plate **42** over which an inert gas flows from the delivery slot presented by shallow passage **40**. The blanketing medium is supplied to the open end of primary plenum **36** by pipe **44**. In order to achieve good distribution across the four spinnerets, there are two sonic nozzles **46** located between primary plenum **36** and secondary plenum **38**.

In operation, an inert gas, preferably steam, is supplied to primary plenum **36** by pipe **44** and flows through sonic nozzles **46** to the secondary plenum **38**. It then flows inwardly through shallow passage **40**. With the metal plate **30** and the cover plate **32** at or near block temperature and because of the high area-to-volume ratio of heat exchange surface to steam in passage **40**, steam is discharged from the delivery slot at nearly the temperature of heated block **10**. Upon leaving passage **40**, the remaining kinetic velocity is reduced as the steam flows up and over weir plate **42**.

If the steam were just permitted to flow over weir plate **42**, it would blanket the face of spinneret **18** and provide some improvement in spinning. However, it has been found that, because of stray currents and circulation due to the pumping action of filaments **22** and from the thermal currents set up between the faces of the spinnerets, the cooling filaments and the quenching air, free oxygen will circulate close to the spinnerets. Such contamination of the blanketed zones is avoided by confining the steam during its travel to and across the spinneret faces. This is accomplished with the enclosure assembly **28**.

The enclosure assembly of this invention comprises a pair of elongated, contoured doors or flaps, a back flap **48** and a front flap **50**. As illustrated, flaps **48**, **50** are relatively thick and have streamlined inner edges. They are mounted on opposite sides of the spinneret array by hinges **52** and **54**, respectively. Front flap **50** has a series of fingers **56** so shaped and arranged that, when the back flap and front flap are in position, there are four rectangular openings **58** (FIG. 2) defined by the spaced longitudinal edges of flaps **48**, **50** and by fingers **56**. It is through restricted openings **58** that filaments **22** leave the enclosure defined by assembly **28**. There are suitable seals at the edges,

hinges and other joints to prevent air leakage inward. In the latter connection, it should be noted that outermost fingers **56***o* are halved.

The streamlined shapes and angular dispositions of flaps **48**, **50** around each opening **58** are such as to give a venturi effect in the direction of the exiting steam, as indicated by the arrows in FIG. 1. In the latter connection, flap **50** has an upper surface substantially parallel to the faces of spinnerets **18** and the operable length of flap **48** is angularly disposed with respect to and terminates at a lower level than flap **50**. Steam leaving weir plate **42** with low kinetic velocity is directed upward and across the faces of spinnerets **18**. The supply rate is such that the steam as it leaves through the venturi-shaped openings **58** achieves sufficient velocity to preclude turbulence and to prevent any stray air currents from coming upward toward the spinnerets. In this way, the free oxygen level inside the enclosure is greatly reduced. Since there are no other openings, free oxygen cannot get into the enclosure. In addition, fingers **56** function to prevent cross currents between the four spinnerets.

The front flap **50** is held in its closed position adjacent spinnerets **18** by the engagement of spaced fingers **56** with the upper surface of flap **48** which, in turn, is held in position by a releasable pin **60**. When it is desired to change a pack assembly, releasable supporting pin **60**, being mounted on a slide bar arrangement, is moved backward until it is beneath support block **34**. This permits back flap **48** to fall to a vertical position. Removal of the support of back flap **48** permits the front flap **50** to fall into a vertical position. If desired, the operator can rotate the front flap another 90° so that it is now 180° out of its operating position and thereby gain free access to packs **16**.

The following example illustrates that the equipment described above radically reduces the oxygen level at the face of the spinneret.

EXAMPLE

Nylon 6—6 filaments were spun using the equipment described above, but without the blanketing equipment **26** or the enclosure assembly **28**. Dowtherm temperature in block **10** was 293° C. The face of the spinneret had to be wiped every three hours to insure continued spinning of good product.

In a second run, blanketer **26** was attached, the enclosure **28** was left off, and no steam was used. The oxygen level was measured at various locations inside the blanketer and ranged from 2 to 15%. Then, steam at 100° C. and 4 p.s.i.g. was supplied to primary plenum **36** and flowed through the blanketer **26** at the rate of 1.0 lb./hour (454 g./hour). The oxygen level ranged from 3 to 6%. At this level, the time between wipes was increased to over six hours.

Finally, enclosure assembly **28** was added with the steam flow rate remaining at 1.0 lb./hour. The oxygen level was dramatically reduced to less than 1% at all locations. The time between wipes was increased to more than 24 hours.

The use of a large area-to-volume passage **40** has eliminated the need for a heat exchanger in block **10** or for a separate superheater in the inert gas supply line. It has been found that steam, since it is normally so readily available, is the preferred inert gas. The heated block with its heating capabilities usually has sufficient capacity to heat the steam. If additional heat transfer capacity is desirable, it is possible to make primary plenum **36** serpentine-shaped.

Control of gas flow can be monitored by using pressure switches at appropriate locations in the primary or secondary plenums with appropriate signal lights either at the spinning position or in a remote control room. Since a sonic nozzle operates on the principle that when the ratio of upstream to downstream pressures is above a critical value, fluid flow rate is dependent on upstream pressure alone, the flow can be controlled entirely by controlling the upstream pressure. Thus, flow control can be achieved by controlling and monitoring pressure.

The number and location of the sonic nozzles or flow controlling orifices is not critical and depends upon the blanketer design. The essential feature is to assure good distribution of the inert gas across the spinnerets in each blanketer. When more than one blanketer is used, for example on a large spinning machine, it is important to control the flow of inert gas to each blanketer. A single nozzle for each blanketer, external of the blanketing device, will be satisfactory in many installations. Variations and modifications of a similar nature will occur to those skilled in the art without departing from the spirit of the present invention which is, therefore, intended to be limited only by the scope of the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In combination with a spinning block housing an aligned array of closely spaced spinnerets and carrying equipment for blanketing all of the spinnerets with an inert gas, an enclosure assembly comprising a pair of elongated flaps extending through the length of said array and means mounting the flaps on opposite sides of said array for swinging movement toward and away from a closed position closely adjacent the spinnerets, said flaps having spaced longitudinal edges when in said position.

2. The combination of claim **1** wherein one of said flaps is provided with spaced fingers extending outwardly from its longitudinal edge into an overlapping relationship with the other flap when in said position, thereby presenting a restricted opening beneath each spinneret.

3. The combination of claim **2** wherein said flaps are relatively angularly disposed, said one flap being closer to and substantially parallel with said spinnerets, the other flap being in engagement with said fingers.

4. The combination of claim **3** wherein is provided a releasable support for holding the flaps in said position.

5. The combination of claim **1** wherein said flaps are relatively thick and said edges have streamlined contours.

6. The combination of claim **3** wherein said flaps are relatively thick and said edges have streamlined contours.

References Cited

UNITED STATES PATENTS

2,252,689	8/1941	Bradshaw	18—8
2,636,217	4/1953	Hammond et al.	18—8
3,067,458	12/1962	Dauchert	18—8
3,169,271	2/1965	Musser	18—8

WILLIAM J. STEPHENSON, *Primary Examiner.*