June 13, 1972 SEIBI YAMADA ET AL 3,669,584

MELT-SPINNING APPARATUS

Filed Oct. 22, 1969

Fig. 1

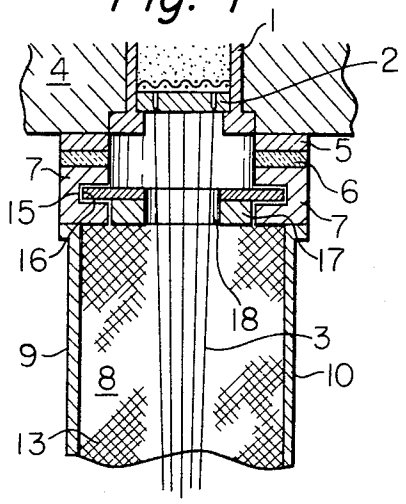


Fig. 2

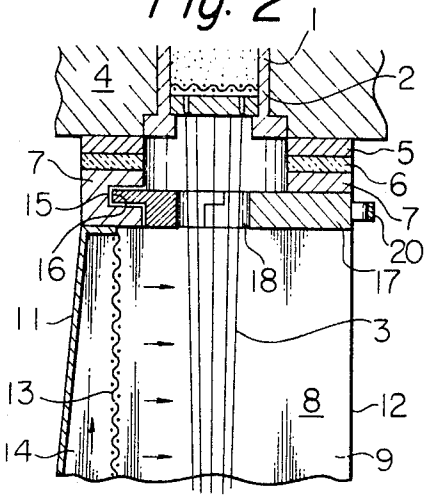


Fig. 3

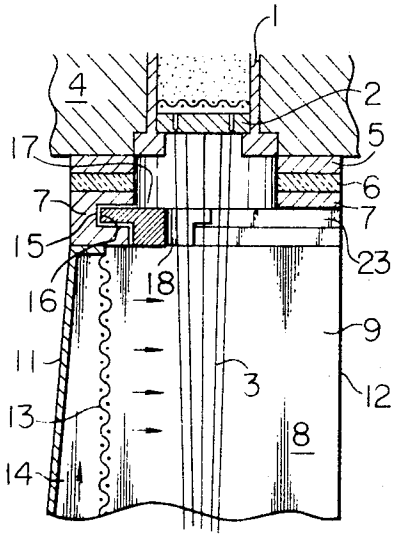


Fig. 4

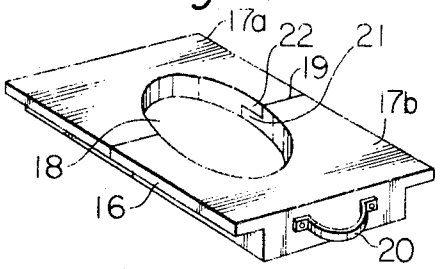
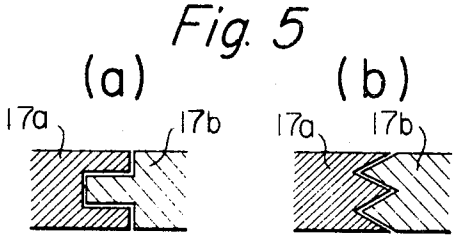


Fig. 5



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MELT-SPINNING APPARATUS

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Int. Cl. D01d 13/02
U.S. Cl. 425—72 3 Claims

ABSTRACT OF THE DISCLOSURE

In a melt-spinning apparatus comprising a spinning assembly extruding molten filament-forming polymeric materials into a number of filaments, a spinning chimney provided below the spinning assembly, in which a stream of fluid quenches said filaments, flowing from the back part of the chimney to the front opened part thereof, and a shutter provided between said spinning assembly and spinning chimney, said shutter having an opening through which extruded filaments pass; said shutter is divided into at least two parts within a plane of the shutter in order to facilitate a threading operation at the beginning of the spinning operation and an observation of the spinneret surface during the spinning operation by moving one of said parts.

This invention relates to a melt-spinning apparatus having a spinning chimney for quenching and solidifying filaments extruded through a spinneret from molten filament-forming polymeric materials, and more particularly it relates to a melt-spinning apparatus having a spinning chimney for facilitating a threading operation at the beginning of the spinning operation and an observation of the spinneret surface during the spinning operation.

Generally in the melt-spinning of synthetic organic filaments such as polyester and polyamide, a spinning chimney is provided below the spinneret so that extruding filaments are uniformly quenched and solidified by a stream of fluid therein. Said chimney is opened at the front part thereof, to which a stream of cooling fluid is allowed to flow from the back part, thereby filaments being subjected to quenching and solidifying.

Conventionally in such a chimney, if the cooling fluid flows up to and cools the surface of the spinneret, unstability of extrusion conditions of molten polymer occurs. As a result, extruded filaments include troubles such as breakages and denier irregularities of filaments. To prevent such troubles, a shutter having an opening through which filaments run, is usually provided between the spinneret and the upper end of the chimney, thereby said shutter preventing a cold fluid from flowing up to and cooling the surface of the spinneret. However, in such an arrangement of the shutter, we have experienced difficulties in that it is perfectly impossible to mount or dismount a spinning pack onto the spinning assembly from below because the diameter of the opening is less than that of the spinning pack, and also to survey wherether kneeling and bending phenomena of the extruded filaments occur on the surface of the spinneret. Further when said kneeling and bending phenomena occur difficulties have been encountered in the operations for cleaning the surface of the spinneret, adjusting it through the very small opening of the shutter and threading filaments through said opening at the beginning of the spinning operation. When the shutter is secured to the upper end portion of the spinning chimeny, the operation for mounting or dismounting of the spinning pack and the surveying or cleaning of the spinneret surface can be made by removing the spinning chimney from the spinning apparatus through

troublesome operations such as opening, tilting, and moving it downwardly. However, if the chimney is moved everytime for such purpose, these operations bring about not only complicated processes but also the looseness of the assembly of the spinning chimney and the stream condition of the cooling fluid varies with the result that differences such as denier, tenacity, dyeing characteristics between other spinning apparatuses occur and the breakages or denier irregularities of the filaments occur by intense turbulent flow even in a chimney. Still further, in the case that the shutter is provided rigidly on the upper end of the chimney, it will take a long time to thread a bundle of filaments through the opening of the shutter at the beginning of the spinning operation.

It is therefore an object of this invention to provide a melt-spinning apparatus having a spinning chimney which is so constructed that a spinning pack can be easily mounted or dismounted on the spinning assembly from therebelow without moving the spinning chimney and that the surface of the spinneret can be easily cleaned and surveyed.

It is another object of this invention to provide a melt-spinning apparatus having a shutter which is constructed in such a manner that a stream of cooling fluid does not flow up to the spinneret surface and cool it except through the opening through which filaments pass.

It is the other object of this invention to provide a melt-spinning apparatus having a shutter which is constructed to facilitate its reciprocation on the horizontal plane between the spinning assembly and the chimney.

These objects are achieved according to a melt-spinning apparatus of this invention comprising a melt-spinning assembly extruding polymer into a number of filaments, a spinning chimney provided below molten polymer into a number of filaments, a spinning chimney provided below flowing from the back part of the chimney to the front opened part thereof, and a shutter provided between said spinning assembly and spinning chimney, said shutter having an opening through which extruded filaments pass, characterized in that said shutter is divided into at least two parts within the plane of the shutter.

For a full understanding of the invention, a detailed description of the spinning apparatus embodying the invention in a preferred form will now be given in connection with the accompanying drawings and the features forming the invention will be specifically pointed out in the appended claims.

In drawings:

FIG. 1 is a front view in the central vertical section of the spinning apparatus.

FIG. 2 is a side view in the central vertical section of the spinning apparatus.

FIG. 3 is a side view in the central vertical section of the spinning apparatus with one of the divided parts of the shutter removed therefrom.

FIG. 4 is an enlarged perspective view of the shutter.

FIGS. 5(*a*) and (*b*) are other embodiments in the enlarged section divided parts of the shutter.

Referring to FIGS. 1, 2 and 3, a spinning pack **1** having a spinneret **2** through which a bundle of filaments **3** is extruded, is provided in a spinning assembly **4**, at the lower end of which a ring **5**, a heat insulating plate **6**, and a shutter guide plate **7** are provided in this order. Under the shutter guide plate **7**, there is provided a spinning chimney **8** which comprises side plates **9**, **10** and a back plate **11** in such a manner that a front part **12** is opened, while a back part is closed. A screen **13** is positioned between the back plate **11** and filaments **3** passing through the spinning chimney **8** so as to form a plenum chamber **14** between the back plate **11** and the screen **13**. The cooling fluid such as air and inert gas to pass through the

plenum chamber **14**, therefore, must pass through the screen **13** just prior to contacting filaments **3**. The shutter guide plate **7** at its inner side provides a groove **15** into which the projected portion **16** of the shutter **17**, having an opening **18** through which filaments run, is so engaged that the shutter **17** can be supported by the shutter guide plate **7**. Said shutter guide plate **7** has an opened end **23** on the side in which direction the shutter **17** can be reciprocated. Said shutter **17** is divided into two parts **17***a*, **17***b* at the divided portion **19** around the opening **18** within the plane of the shutter **17** as shown in FIG. 4. A member **20** e.g. knob, handle, or the like is fixed to one **17***b* of said parts at the side of the front part of the chimney **8** so as to pull it toward the front surface of the chimney **8**. The divided surface of one part **17***b* of the shutter **17** is formed with a ledge **21** against which a projected portion **22** in the divided surface of the other part **17***a* abuts as shown in FIG. 4. Though the shutter **17** is divided into two parts shown in FIG. 4, this invention may include the shutter which is divided into more than two parts, wherein a handle member may be fixed to one or all parts of the shutter. The divided surfaces of parts **17***a* **17***b* of said shutter **17** may be formed as a slot and tongue respectively as in FIG. *5a* or zigzag as in FIG. *5b* and meshed with each other when said parts **17***a* **17***b* are arranged. The shutter at the divided surfaces of said parts are so formed that cooling air does not flow up from the divided portion and does not cool the surface of the spinneret. The shutter is made of metal or asbestos. The magnitude of the opening may be preferably as small as possible within the range of non-contacting the inner wall of the opening with running filaments not so as to affect the surface of spinneret by the cooling fluid. The configuration of the opening may be not only circle but also ellipse, rectangle, and other desired form. In the case of passing more than one bundle of filaments through only one chimney, it is essential that the same number of openings as that of said bundles be provided with the shutter.

In operations for mounting or dismounting the spinning pack **1** on the spinning assembly **4**, these operations can be quite easily carried out through the opened front part of the spinning chimney **8** by pulling out all parts **17***a* **17***b* of the shutter **17** from the shutter guide plate **7** without moving said chimney **8**. Further, in the case of the observation and the cleaning of the spinneret surface during the spinning operation, it will be noted that these observation and cleaning can be easily done by pulling out only one part **17***b* of the shutter **17** positioned at the side of the front part of the chimney **8** without cutting off the bundle of the filaments which pass through the opening **18** of the shutter **17**.

At the beginnig of the spinning operation, the part **17***b* of the shutter **17** positioned at the front part of the chimney **8** is under the condition pulled out and removed from the shutter guide plate **7**, and a bundle of filaments **3** extruded from the spinneret **2** is permitted to thread through the half part of the opening **18** and then wound up onto a bobbin not shown. After that operation, said part **17***b* of the shutter **17** is inserted into the shutter guide plate **7** until said part **17***b* comes into contact with the other part

17*a*. The opening of the shutter is divided so wide that a bundle of filaments can be easily threaded through the opening.

Therefore, it will be understood that this invention is advantageous in easy threading operation and slight danger of the burn by molten polymer etc., during said operation in comparison with that of the conventional method in which the threading operation has been done by inserting a tool or the like through a non-divided narrow opening from below.

This advantage leads to another advantage in which the threading operation of this invention can be done without moving the spinning chimney so that the looseness of the chimney does not increase at all. Therefore, the flow condition of the cooling fluid in the spinning chimney comes to be so stable that extruded filaments can be uniformly quenched, and thus uniform dyeing characteristics, uniform denier of the filaments can be ensured.

Although this invention has been described with reference to specific emodiments thereof, it will be appreciated that many variations may be made without departing from the scope of this invention.

We claim:

1. A melt-spinning apparatus comprising a spinning assembly suitable for extruding molten filament-forming polymeric materials into a number of filaments, a spinning chimney provided below said spinning assembly, said spinning chimney having side walls and a back wall, means to provide a stream of fluid which quenches said filaments, said stream blowing in a direction from the back wall to the opposite side of said back wall, a shutter guide plate positioned between said spinning assembly and said spinning chimney, said guide plate being provided with a horizontal groove, and a shutter positioned in the groove of the guide plate to prevent said spinning assembly from being cooled with said stream towards said spinning assembly, said shutter consisting of at least two unattached, reciprocable plate members having complementary cutaway portions which form an opening when said plate members are moved into contact with each other through which the extruded filaments pass before entering the spinning chimney.

2. A melt-spinning apparatus according to claim **1**, wherein the respective opposite edges of said plate members are formed to interengage in the form of a slot and a tongue.

3. A melt-spinning apparatus according to claim **1**, wherein a handle member is secured to the outside of each plate member.

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U.S. Cl. X.R.

264—176 F; 425—192, 173