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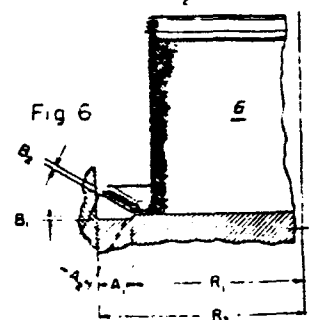
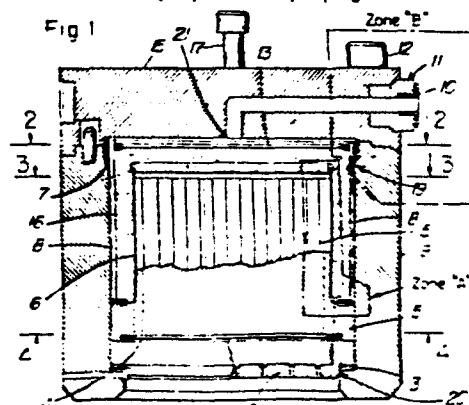
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(54) Filter means for high viscosity liquids and process for the filtration of molten polymers employing such filter means.

(57) Filter means for high viscosity liquids involving a replaceable filtration unit (generally of the self-sealing semi-disposable type) having a screen (6) to support inert granular material (16) within a housing (9), wherein an improvement comprises the screen's rim being swaged into the housing (9), preferably with an interference fit within the range of 0.125 to 0.4 mm. The filter means of this invention are especially applicable to the extrusion of molten polymers into shaped articles, and accordingly the invention provides a process for such use.



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"Filter means for high viscosity liquids and process for the filtration of molten polymers employing such filter means."

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The invention relates to filter means for high viscosity liquids involving a replaceable filtration unit or pack and to a process for the filtration of molten polymers employing such filter means. Such  
5 molten polymers have high viscosity and are forced through the filter means under pressure, generally so as to be extruded into shaped articles such as filaments and films.

Packs for filtering pressurized high viscosity  
10 polymeric material and forming the filtered liquid into spun filaments are well known in the art. A pack of relatively recent design and its mode of operation is disclosed in U.S. Patent 3 307 216. Typically, all such packs are assembled from a mixture  
15 of re-useable components (such as housing, lid, spinnerette and disposable components (such as inert granular material, gaskets, and screens for supporting the inert granular material). The average time interval between replacing packs has a significant effect on both the  
20 economics of the process and the quality of the product.

The invention arose out of the discovery that the type of pack disclosed in the fore-mentioned U.S. Patent 3 307 216 had certain drawbacks,  
25 particularly for the spinning of highly viscous material at high throughputs. In particular, it was found that

some of the seals for controlling polymer flow were not consistently effective, resulting in both external polymer leaks out of the pack, and internal polymer leaks (or by-passing) within the pack. Both types of  
5 leak are highly undesirable.

The present invention, in which the rim of the screen supporting the inert granular material is swaged into the housing, has been found to reduce significantly the number of these highly undesirable leaks, and has  
10 been found in addition to halve the time to assemble the pack components into an integral unit. The improved seal design may be used with advantage in any replaceable filter of the type described regardless of whether the filter is integrally combined with an extrusion die. The  
15 improved seal designs are extremely valuable in melt spinning packs designed for use in combination with already constructed apparatus that imposes severe space limitations. The invention is surprising, particularly since the type of seal shown in U.S. Patent 3 307 216  
20 has been used commercially for over ten years in the manufacture of many billions of kilograms of fiber.

The invention provides filter means for high viscosity liquids involving a replaceable filtration unit comprising a housing (9) having an inlet port (19) and  
25 an exit port (20) and a rimmed screen (6) between the ports for filtering the liquids, characterised in that the screen's rim is swaged into the housing.

The invention, in its preferred form, provides filter means for high viscosity liquids involving a  
30 replaceable pack comprising a housing (9) having an inlet port (19) and an outlet port (20), a lid (15) having an inlet port (11) being rigidly connected via a first gasket (7) to the housing (9) around the housing's inlet port (19), an extrusion die (2) rigidly connected  
35 via a second gasket (3) around the housing's outlet port (20), an internal lip (5) within the housing between the extrusion die (2) and the inlet port (19) of the housing, means for filtering the fluid immediately

upstream of the lip, which filtering means comprises inert granular material (16) immediately upstream of a supporting rimmed fine mesh screen (6) whose rim contacts the housing's internal lip (5), characterised  
5 in that the screen's rim is swaged into the housing, whereby there is a reduced chance of some of the liquid or granular material by-passing the screen.

The invention also provides a prime application of the new filter means, in which the latter's  
10 advantages are fully developed; in this application, molten polymers are forced under pressure through the new filter means, generally in such a way as to subject the polymer to extrusion into shaped articles, such as fibres or films. The invention is thus especially  
15 applicable to melt spinning of polymers.

Reference is made to the drawings in which:

FIGURE 1 is a vertical cross section of an assembled filter means of the invention in the form of a melt  
spinning pack.

20 FIGURES 2, 3 AND 4 are horizontal fragmentary cross sections along lines 2-2, 3-3 and 4-4 respectively of FIGURE 1.

FIGURE 5 is a perspective view of an unassembled "top hat" screen and corresponds to item 6 of FIGURE 1  
25 in assembled form.

FIGURE 6 is an enlarged view of Zone A of FIGURE 1. as it looks during assembly of the pack prior to the swaging operation.

FIGURE 7 is an enlarged view of Zone B of FIGURE 1.  
30 The figures illustrate some preferred embodiments of the invention.

Figure 1 is a vertical cross section of an assembled melt spinning pack incorporating the invention. In particular, Figure 1 shows an improved replaceable  
35 pack for filtering pressurized high viscosity molten polymer and extruding the filtered polymer into shaped articles such as filaments and films, which pack comprises a housing (9) having an inlet port (19) and an outlet port (20), a lid (15) having an inlet port (11) and an

exit port (21) and the lid being rigidly connected via a first gasket (7) to the housing around the lid's exit port and around the housing's inlet port, an extrusion die (2) rigidly connected via a second gasket (3) around the housing's outlet port, an internal lip (5) within the housing between the extrusion die and the inlet port of the housing, means for filtering the fluid immediately upstream of the lip, which filtering means comprises inert granular material (16) immediately upstream of a supporting rimmed fine mesh screen (6) whose annular rim contacts the housing's internal lip (5), wherein the improvement comprises: said screen's rim is swaged into said housing, whereby there is a reduced chance of some of said fluid and said granular material by-passing said screen. Likewise, Figure 1 also illustrates an improved replaceable filtration unit for high viscosity fluids, which filter unit comprises a housing (9) having an inlet port (19) and an exit port (20), a rimmed fine mesh screen (6) between the ports for filtering the fluid, wherein the improvement comprises: said screen's rim is swaged into said housing.

Figure 6 is an enlargement of Zone "A" prior to swaging of the rim (6) into both the housing (9) and a grooved bridge plate (5). The screen is in the shape of a top hat and at least partly annular. It is preferred that the total radial interference fit imposed upon the rim of the screen be between 0.125 to 0.4 millimetre. Thus, in Figure 6, the dimension  $A_2$  is greater than dimension  $A_1$ , by an amount within the range of about 0.125 to 0.4 millimetre. Also, the dimension  $B_2$  is preferably greater than the dimension  $B_1$  by an amount of up to 0.05 millimetre.

Figure 7 is an enlargement of Zone B of Figure 1, and shows the seal between the pack housing and lid. It shows a first gasket (7) in the form of a metal sleeve having a length L, outer diameter D, and wall thickness T; and the housing's inlet port (19) has a

square step around its inner face. The square step has a radial depth of about  $T$  and a height  $h$ . The value of  $h$  must be less than the value of  $L$ . It is preferred that the value of  $\frac{L}{T}$  be in the range 2 to 10, and most preferably in the range 4 to 7. It is preferred that  $T$  be in the range from 0.635 to 2.5 millimetres. The metal sleeve is preferably aluminium, copper, mild steel or stainless steel. It is preferred that the inside face of the lid has a counter bore of diameter  $D$  and depth  $d$ , and the value of the sum of  $h$  and  $d$  is equal to  $L$  in the assembled state and less than  $L$  is in the unassembled state.

It is preferred that the third and remaining seal with the pack, the seal between the extrusion die (2) and the housing's outlet port (20) be obtained conventionally as shown in Figure 1, which shows the housing (9) having a second lip around its outlet port (20) that is rigidly connected to the extrusion die via a second gasket (3) by means of the pressure of the pressurized fluid within the pack.

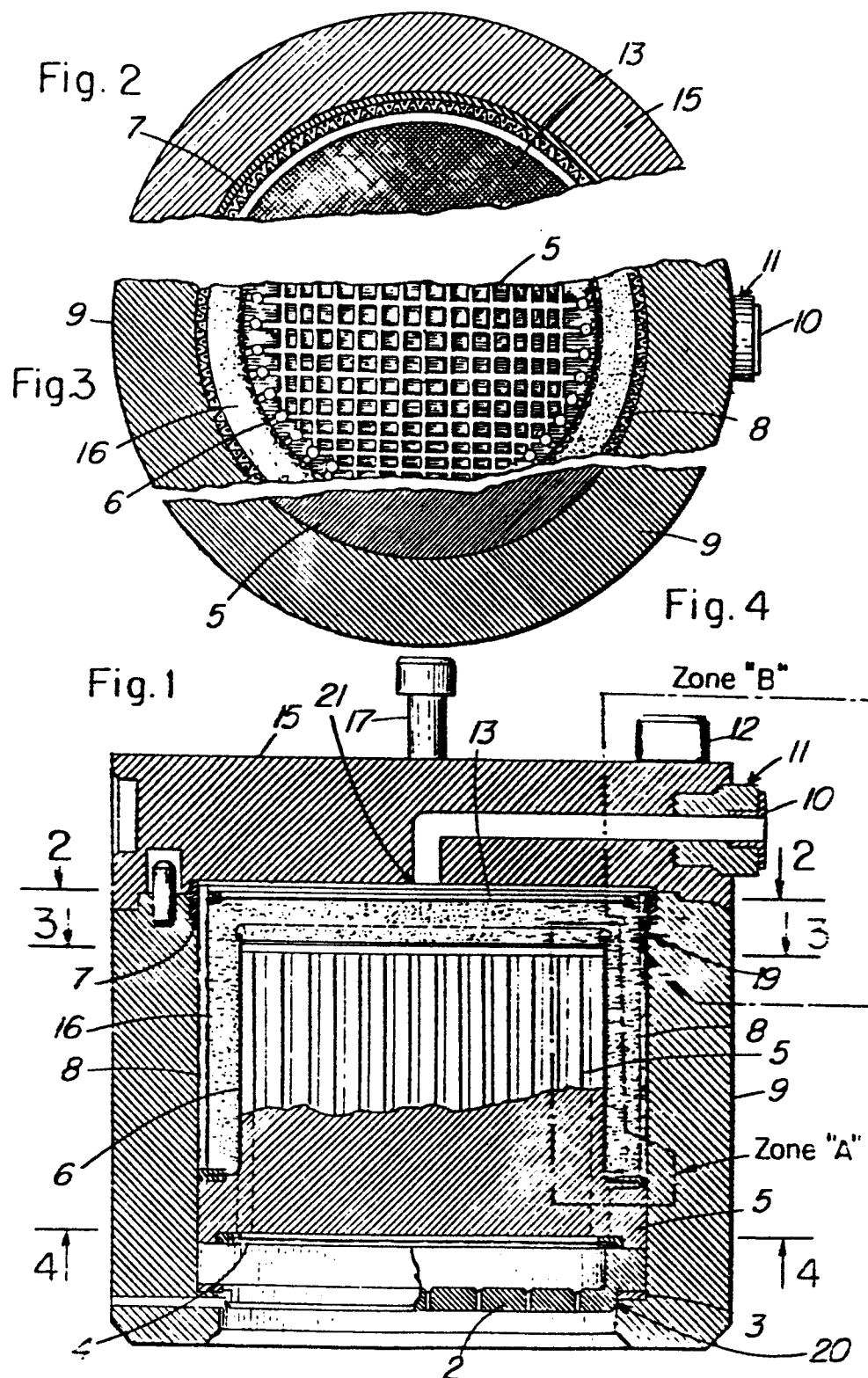
While the foregoing, in combination with the drawings, illustrates the broadest and most preferred embodiments of the invention, it will of course be appreciated that other embodiments of the invention come within the scope of the broadest claims.

Claims:-

1. Filter means for high viscosity liquids involving a replaceable filtration unit comprising a housing (9) having an inlet port (19) and an exit port (20) and  
5 a rimmed screen (6) between the ports for filtering the liquids, characterised in that the screen's rim is swaged into the housing.
2. Filter means as claimed in claim 1, characterised in that the swaged rim has an interference fit within  
10 the range of 0.125 to 0.4 mm.
3. Filter means as claimed in claim 1 or 2, characterised in that a grooved bridge plate (5) is located downstream of the screen and the screen's rim is swaged into the bridge plate.
- 15 4. Filter means for high viscosity liquids involving a replaceable pack comprising a housing (9) having an inlet port (19) and an outlet port (20), a lid (15) having an inlet port (11) and being rigidly connected via a first gasket (7) to the housing (9) around the housing's  
20 inlet port (19), an extrusion die (2) rigidly connected via a second gasket (3) around the housing's outlet port (20), an internal lip (5) within the housing between the extrusion die (2) and the inlet port (19) of the housing, means for filtering the fluid immediately  
25 upstream of the lip, which filtering means comprises inert granular material (16) immediately upstream of a supporting rimmed fine mesh screen (6) whose rim contacts the housing's internal lip (5), characterised in that the screen's rim is swaged into the housing,  
30 whereby there is a reduced chance of some of the liquid or granular material by-passing the screen.
5. Filter means as claimed in claim 4, characterised in that the swaged rim has an interference fit within the range of 0.125 to 0.4 mm.
- 35 6. Filter means as claimed in claim 4 or 5, characterised in that the screen is at least partly annular in shape.

7. Filter means as claimed in any of claims 4 to 6, characterised in that a grooved bridge plate (5) is located downstream of the screen, the screen is in the shape of a top hat, and the screen's rim's inner surface  
5 is swaged into the bridge plate.
8. Filter means as claimed in any of claims 4 to 7, characterised in that the first gasket is a metal sleeve having a length L, outer diameter D, and wall thickness T; and the housing's inlet port has a square  
10 step around the inlet port's inner face, the square step having a radial depth approximately equal to T and a height h which is less than L, the value of  $\frac{L}{T}$  being in the range of 2 to 10.
9. Filter means as claimed in claim 8, characterised  
15 in that the lid has a counter bore of diameter approximately equal to D and depth d, and the value of the sum of h and d is less than L in the unassembled state and equal to L in the assembled state.
10. Filter means as claimed in claim 8 or 9, characterised  
20 in that  $\frac{L}{T}$  is in the range of 4 to 7.
11. Filter means as claimed in any of claims 8 to 10, characterised in that T is in the range of 0.635 to 2.5 mm.
12. Filter means as claimed in any of claims 8 to 11, characterised in that the metal sleeve comprises aluminium,  
25 copper, mild steel or stainless steel.
13. Filter means as claimed in any of claims 4 to 12, characterised in that the housing has a second lip around the housing's outlet port, and the extrusion die is rigidly connectable to the second lip via the  
30 second gasket by reason of pressure of the liquid to be filtered.
14. Process for the filtration of molten polymers comprising forcing them under pressure through filter means, characterised in that the filter means are as  
35 claimed in any of claims 1 to 13.
15. Process as claimed in claim 14, characterised in that the filtered polymers are subjected to extrusion into shaped articles.





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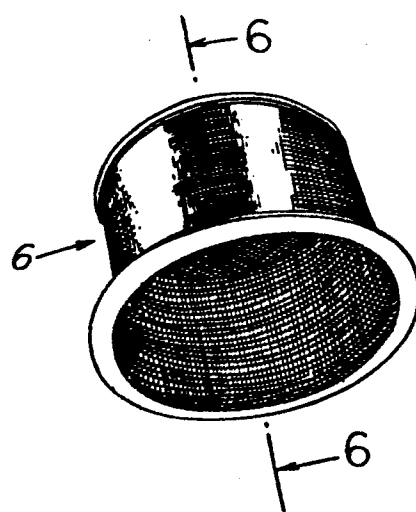


Fig. 5

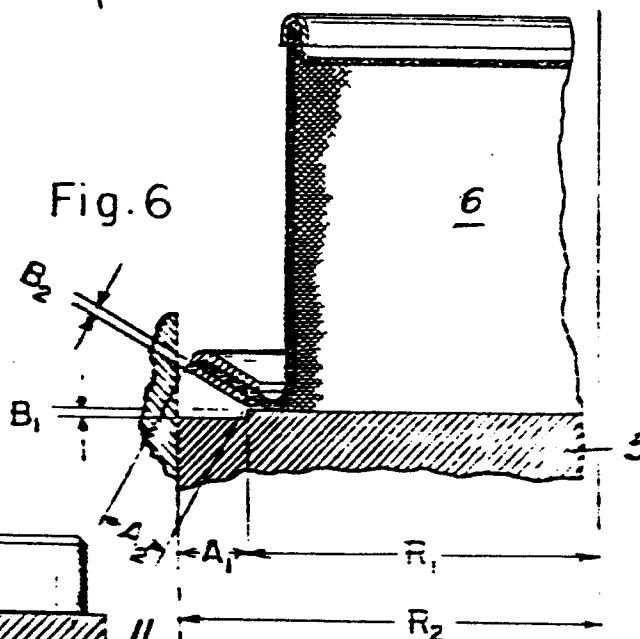


Fig. 6

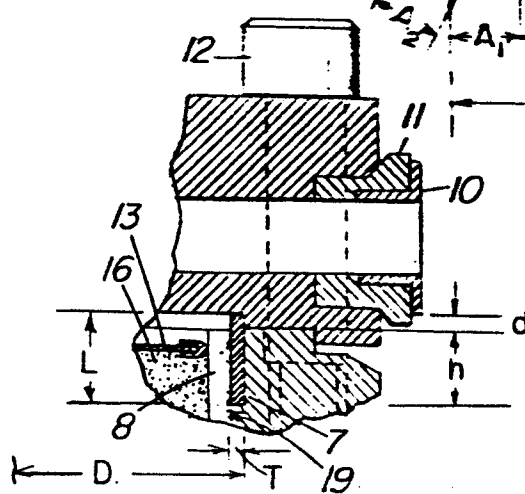


Fig. 7

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