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2,916,262

MELTER

Filed June 30, 1955

2 Sheets-Sheet 1

**FIG 1**

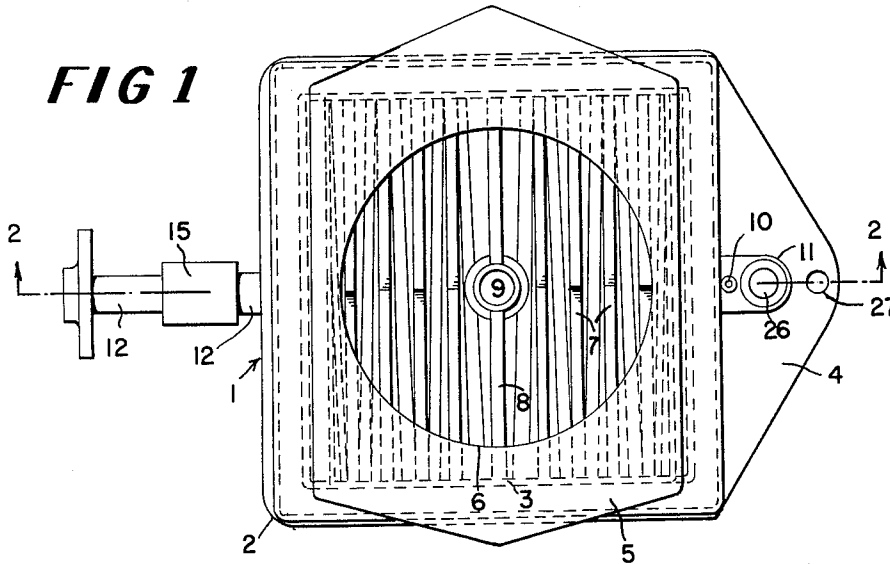
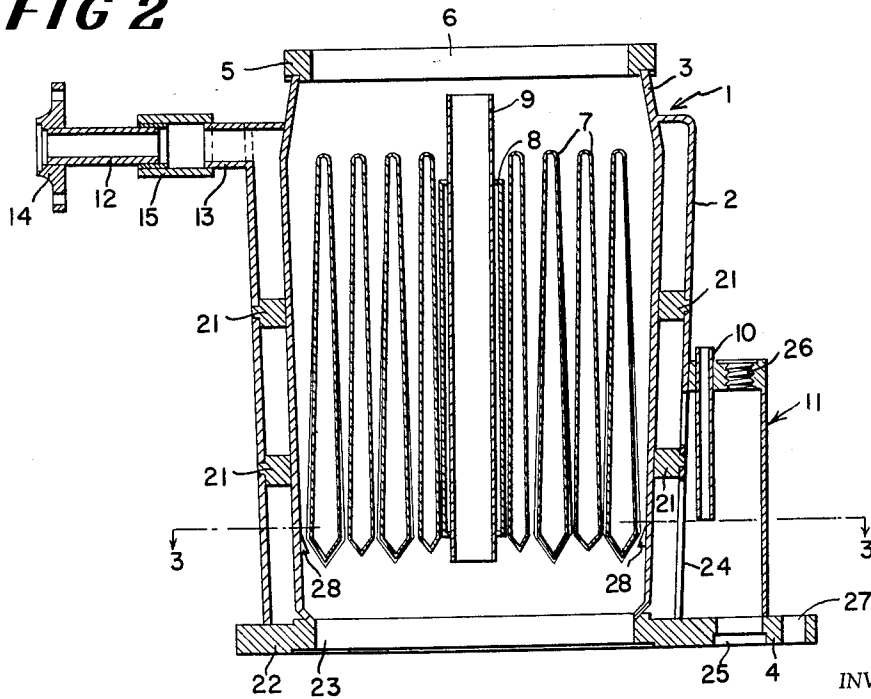


**FIG 2**



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**FIG 3**

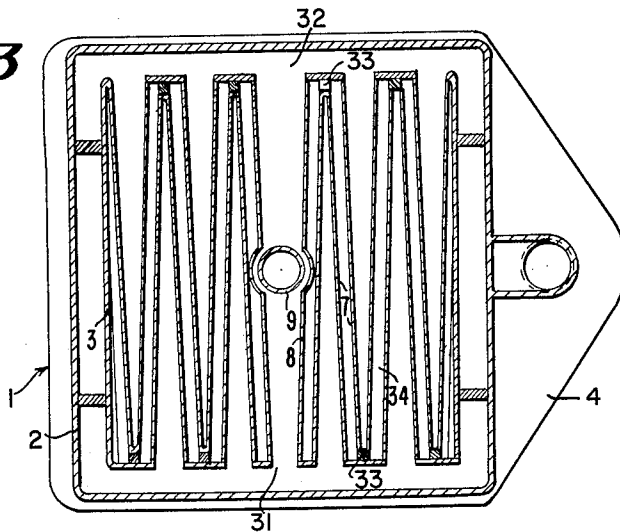


**FIG 4**

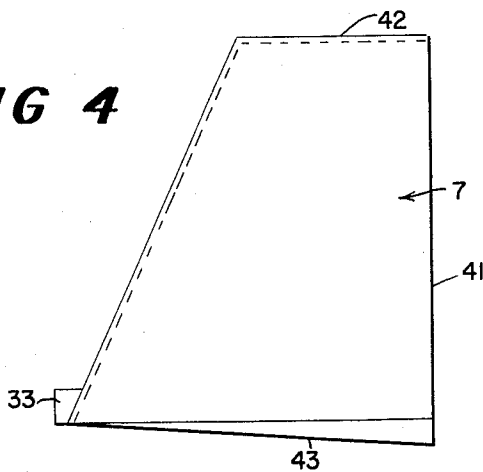
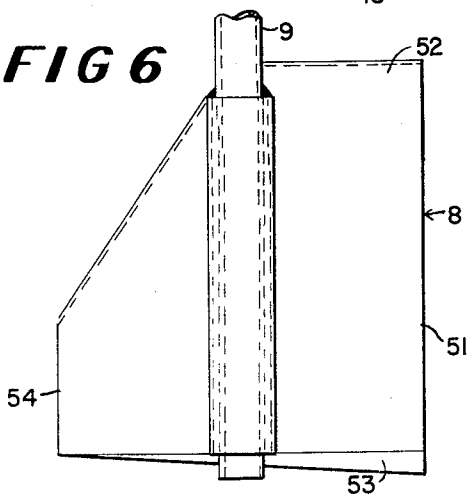


**FIG 5**



**FIG 6**



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8 Claims. (Cl. 257—208)

This application relates to melting of solids, concerning especially conversion of polymeric fiber-forming compositions from particulate to molten form preliminary to extrusion.

Extrusion of molten linear condensation polymers of high molecular weight into filamentary form is a well-known accomplishment. Graves has described in Patent 2,253,176 construction and use of a heated grid for obtaining such polymer in the essential molten condition. However, increased throughput requirements at higher rates of extrusion now employed in manufacture of yarn from linear condensation polymers necessitate unwieldy increase in size or number of known types of melting grid.

A primary object of the present invention is improved melting of particulate fiber-forming linear condensation polymers. A specific object is provision of compact melting apparatus of high capacity. Other objects of this invention, together with means and methods for attaining the various objects, will be apparent from the following description and the accompanying diagrams.

Figure 1 is a plan view of apparatus of this invention. Figure 2 is a sectional elevation taken on 2—2 of Figure 1. Figure 3 is a sectional plan of the apparatus of Figures 1 and 2 taken at 3—3 of Figure 2. Figure 4 is a side elevation of an element of the illustrated apparatus. Figure 5 is an end elevation at 5—5 of Figure 4. Figure 6 is a side elevation of another element of the apparatus of Figures 1 to 3.

In general, the objects of this invention are accomplished by means of hollow fin-like melting elements predominately triangular in transverse vertical section and V-shaped in horizontal section. The invention specifically comprehends melting apparatus comprising a double-walled jacket of rectangular plan having a plurality of hollow fin-like elements oriented on longitudinal axes substantially parallel to one another between opposing faces of the inside wall of the jacket; each fin-like element is trapezoidal in longitudinal vertical section with its base oriented vertically and attached to the inside wall for communication between the inside of the element and the jacket and with its short side extending substantially horizontally from the edge of the base at the top of the wall to a location between opposing faces of the wall and with its long side extending substantially horizontally from the edge of the base at the bottom of the wall to a support adjacent the opposing face of the wall, and each fin-like element is essentially V-shaped in horizontal section with the base of the V being open, alternate elements being affixed to opposing faces of the wall with like spacing between adjacent elements, and also is essentially triangular in transverse vertical section so that the spacing between elements decreases downwardly. A preferred embodiment of this apparatus is described in detail below and in the diagrams.

Figure 1 shows jacket 1 as viewed from above, including outside wall 2, partly in broken lines, support flange 4 affixed to one side near the bottom, and cover plate 5

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with central circular opening 6. Also indicated in broken lines below the cover plate is inside wall 3. Visible through the opening in the cover plate are portions of fins 7, and of central fin 8, which has tube 9 through it concentric with the opening. Broken lines indicate the extent of the various fins underneath the cover plate. Port 11, with blind thermometric insert 10, extends vertically from the flange, and vent pipe 12, joined by coupling 15 to hollow extension 13 near the top of the jacket, extends horizontally (opposite side) to rim 14.

Figure 2 shows the appearance of the apparatus on the indicated central vertical plane. In addition to the elements visible in Figure 1, this view shows spacers 21 between the inside and outside walls of the jacket, base plate 22 having central opening 23 (circular plan) and additional details of the entrance and exit port for the heating fluid. The extent of bolthole 27 in the flange is apparent. Port 11 communicating with the jacket through apertures 24 in the outside wall has combined entrance and exit opening 25 at the bottom and plug 26 as well as blind insert 10, at the top. The generally triangular transverse vertical cross section of the fins is indicated; the central fin, which is traversed from top to bottom by tube 9, lacks the apex of the others and is greater in width. Deflection skirts 28 are located near the bottom of opposite sides of the inside wall running parallel to the outermost fins.

Figure 3 shows the appearance of the apparatus looking downward from a location just above the bottom of the fins, as indicated. The central fin is attached to the inside wall of the jacket at opposing faces 31 and 32, being wider at the latter face than at the former but communicating with the jacket at both faces. Each of the other fins is essentially V-shaped in plan section, being attached to the inside wall of the jacket and communicating therewith at the open base of the V and having support 33 extending from the opposing face to meet the apex of the V. On each side of the center fin the other fins alternate in their attachment to the jacket wall, thus outlining apertures 34, of rectangular plan one between each adjacent pair of fins. The other aspects of the shape of these fins appear in subsequent diagrams.

Figure 4 shows in elevation one of the plurality of identical fins 7. It has a trapezoidal longitudinal shape with open base 41 vertical, closed short side 42 at the top horizontal, and long side 43 at the bottom essentially horizontal, sloping upward slightly from the base edge to junction with support 33, which is included in the drawing also for clarity. The side opposite base 41 is also closed. The top corner opposite the base edge is located slightly more than half the width of the bottom side away from the base so as to bring the corner midway between opposing faces of the inside wall despite the space taken by the supports at the non-communicating apex of the fin; as shown, the oblique side joins the top side at a moderate obtuse angle and the bottom side at a moderate acute angle and is rounded on the edge, as is apparent from Figure 3. Figure 5 shows one of the same fins at the base edge where it communicates with the jacket. This transverse vertical view shows, as does Figure 2, the essentially triangular shape with rounded crown 36 at the top and ridge 37 at the bottom, which accounts for the slope of the bottom edge, as indicated in Figure 4. A transverse horizontal view is essentially V-shaped, the side, or edge, opposite base 41 defining the apex of the V.

Figure 6 shows the longitudinal shape of central fin 8 with tube 9 passing therethrough. The walls of the fin pass about the tube with clearance for circulation of heating fluid therebetween. From base edge 51 where the fin communicates with the jacket from top to bottom, top edge 52 extends horizontally to the vicinity of the

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tube and the ridged bottom edge extends substantially horizontally, rising slightly owing to slope of ridge 53, which terminates at far edge 54 of the fin, where it communicates with the jacket over a shorter vertical distance than on the other side. An oblique side extending from the top point of attachment of this opposite edge rises to the vicinity of the tube at the top.

In operation, heating fluid circulates through the jacket and the communicating fins, entering and exiting at the combined entrance and exit openings 25. The close spacing at the bottom of the fins is only a small fraction of the nearest approach at the tops; the greater spacing at the top ensures entrance of a charge of polymer particles (flakes, chips, etc.) into the apparatus sufficiently to permit prompt contact with the added surfaces, thus preventing lodging or "bridging" of unmelted polymer, and the closer spacing at the bottom prevents the particles from passing through unmelted. The ridged bottoms of the fins aid drainage of molten polymer into the reservoir below the apparatus, which itself may constitute an integral part of fiber manufacturing apparatus as described by Greenewalt in Patent 2,217,743, for example. In such an arrangement the apparatus of the present invention, made of usual steels or other alloys, bolts by the top flange to hopper 30, which according to Greenewalt supplies particulate solid polymer for melting, and between bottom flange to frame 40, which according to Greenewalt provides a communication for flow of the molten polymer to a pump capable of forcing it through extrusion orifices of a spinneret. In this regard the present apparatus resembles that of Graves, referred to above, but is capable of melting more polymer per unit time for the same plan area, and, surprisingly, reducing interruption of supply to the extrusion pump out of all proportion to the increase of capacity.

To enjoy benefits of the present invention it is not necessary to duplicate the exact construction illustrated and described here, which only exemplifies the invention. Thus, the number of fins may be varied, and the center fin may be made identical with the others when no access to the melted polymer is desired for sampling, stirring, or other purpose. The fins need not be trapezoidal longitudinally but may be substantially rectangular, although the trapezoidal form is preferred to afford more ready access for the polymer to the entrance of the melting apparatus. The fins need not be ridged at the bottom, though this is helpful for the reason stated above. Obviously, all the fins may communicate with the jacket at the narrow apex support, as well as at the side V-shaped base 41, much as does the center fin shown here. Additional heating elements may be inserted between or below the respective fins, if desired. An additional tube may extend between the walls from outside the jacket to terminate above the fins as a preheating device for inert gas (nitrogen, carbon dioxide, or other) often used to blanket the melting charge. Other apparatus variations may be effected without involving a departure from the present invention.

#### The claimed invention:

1. In apparatus for melting particulate polymeric material, the improvement comprising a hollow vertical fin-like melting element predominately triangular in transverse vertical section and V-shaped in transverse horizontal section.

2. The apparatus improvement of claim 1 in which the vertical edge of the fin-like element constituting the base of the horizontal triangle is affixed to a double-walled jacket communicating therewith.

3. The apparatus improvement of claim 1 in which the fin-like element is trapezoidal in longitudinal vertical

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section, having essentially horizontal top and bottom edges with the top edge approximately half as long as the bottom edge.

4. The apparatus improvement of claim 1 in which the bottom edge of the fin-like element terminates in a ridge with its peak pointing downward.

5. Apparatus comprising a plurality of hollow fin-like elements arranged vertically side by side with longitudinal axes parallel to one another, each element being V-shaped in transverse horizontal section and adjacent elements being oriented oppositely, apex to base, so as to define rectangular spaces between each pair of adjacent elements, and each element being triangular in transverse vertical section, with narrow crown and broader bottom, whereby the space between adjacent elements narrows from top to bottom.

6. The apparatus of claim 5 in which each fin-like element is trapezoidal in longitudinal vertical section with a short side extending essentially horizontally from the top edge of the base of the transverse vertical triangle and a side approximately twice as long extending from the bottom edge of the base of the transverse vertical triangle, whereby the space between adjacent fin-like elements is rectangular only at the bottom thereof, adjacent spaces merging with one another in a space at least double the width of each thereof, with the total combined width varying directly with the distance above the bottom.

7. Apparatus comprising a double-walled jacket of rectangular plan having a plurality of hollow fin-like elements oriented on longitudinal axes substantially parallel to one another between opposing faces of the inside wall of the jacket, each fin-like element being trapezoidal in longitudinal vertical section with its base oriented vertically and attached to the inside wall for communication between the inside of the element and the jacket and with its short side extending substantially horizontally from the edge of the base at the top of the wall to a location between opposing faces of the wall and with its long side extending substantially horizontally from the edge of the base at the bottom of the wall to a support adjacent the opposing face of the wall, each fin-like element being essentially V-shaped in horizontal section with the open base of the V coinciding with the trapezoidal base, alternate elements being affixed to opposing faces of the wall with like spacing between adjacent elements, each element also being essentially triangular in transverse vertical section so that the spacing between elements decreases downwardly.

8. The apparatus of claim 7 in which each fin-like element terminates at the bottom in a ridge with its peak pointing downward and deviating slightly from the horizontal in a slope downward from the adjacent support to the face of the wall with which the element is in communicating contact.

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