Claims

1. A filter element comprising
   - a porous sheet material having a non-filtrate side and a filtrate side, said sheet material being arranged in a plurality of pleats extending in a longitudinal direction, each pleat having a first and second wall portion extending perpendicular to said longitudinal direction from a first, open end to a second, closed end of the pleats, the first and second wall portions being spaced apart from one another,
   - a non-filtrate fluid supply arrangement extending along the longitudinal direction of the pleats, wherein said fluid supply arrangement is in fluid communication with the first or second end of each pleat substantially along the whole length of the pleat, said fluid supply arrangement being provided with openings designed to provide a fluid flow from the supply arrangement into the pleats in a direction substantially perpendicular to the longitudinal direction thereof.

2. The filter element of claim 1, further comprising a plurality of structural elements positioned within the pleats at the non-filtrate side of the sheet material and directing the non-filtrate in fluid flow paths along the first and second wall portions of the pleats, preferably said structural elements being configured substantially co-extensive with the wall portions of the pleats.

3. The filter element of claim 2, wherein said structural elements direct the fluid flow of the non-filtrate in a direction substantially perpendicular to the longitudinal direction of the pleats, preferably by constituting a plurality of parallel flow channels for the non-filtrate, optionally said structural elements defining fluid flow paths for the non-filtrate extending substantially from one end of a pleat to its other end.

4. The filter element of any one of claims 1 to 3, said filter element being designed as a cross-flow filter element and further comprising a reten-

tate receiving arrangement extending substantially along the whole length of the pleats, said retentate receiving arrangement being provided with openings substantially along the whole length of the pleats receiving retentate from the pleats at one end thereof in a direction substantially perpendicular to the longitudinal direction of the pleats.

5. The filter element of any one of claims 2 to 4, wherein the fluid flow paths have a cross-sectional area increasing in the direction of non-filtrate fluid flow.

6. The filter element of any one of claims 2 to 5, wherein the fluid flow paths of the non-filtrate within the pleats run from the open ends of the pleats to the closed ends where the flow direction of the non-filtrate is reversed in the direction to the open end of the pleats, where it optionally exits the pleats as retentate, said structural elements separating the flow of non-filtrate in the two opposite directions within each pleat.

7. The filter element of any one of claims 2 to 5, wherein the non-filtrate is supplied to the closed ends of the pleats and, optionally, the retentate is collected from the open ends of the pleats.

8. The filter element of any one of claims 2 to 5, wherein the non-filtrate is supplied to the open ends of the pleats and, optionally, the retentate is collected at the closed ends of the pleats.

9. The filter element of any one of claims 1 to 8, wherein the filter element comprises drainage elements arranged on the filtrate side of the sheet material.

10. The filter element of claim 9, wherein said drainage elements present a fluid flow resistance to the filtrate decreasing in the direction of non-filtrate fluid flow.

11. The filter element of any one of claims 1 to 10, wherein the plurality of pleats is arranged around a central axis of the filter module circumferentially at predetermined, preferably regular distances to one another, optionally the open ends of the pleats being located closer to the central axis than the closed ends of the pleats.

12. The filter element of claim 11, wherein the pleats are extending radially in a substantially straight direction.

13. The filter element of claim 11, wherein the pleats extend obliquely to the radial direction and optionally have a curved or arcuate cross-sectional shape.

14. The filter element of any one of claims 1 to 12, wherein the wall portions of the pleats have a greater distance from one another at the closed ends of the pleats than at the open ends.

15. The filter element of any one of claims 1 to 12, wherein the wall portions of the pleats have a greater distance from one another at the open ends of the pleats than at the closed ends.

16. The filter element of any one of claims 1 to 15, wherein the non-filtrate supply arrangement includes one or more feed channels, preferably having a cross-sectional area decreasing from the feed side to a closed end thereof.

17. The filter element of any one of claims 4 to 16, wherein the retentate receiving arrangement includes one or more channels, preferably having a cross-sectional area increasing from a closed end to an end discharging said retentate from the filter element.

18. The filter element of any one of claims 2 to 17, wherein the structural elements incorporate a filtrate collecting space within a pleat separated

from the non-filtrate fluid flow by porous sheet material; preferably the filtrate collecting space being in direct fluid communication with the filtrate side of the wall portions of the plurality of pleats, or the structural element comprising a separate component of a fluid pervious material supporting porous sheet material and providing the filtrate collecting space; optionally said filtrate collecting space forming or contributing to a filtrate discharge channel extending substantially all along the longitudinal direction of the pleats.

Claims

1. A filter element comprising
- a porous sheet material having a non-filtrate side and a filtrate side, said sheet material being arranged in a plurality of pleats extending in a longitudinal direction, each pleat having a first and second wall portion extending perpendicular to said longitudinal direction from a first, open end to a second, closed end of the pleats, the first and second wall portions being spaced apart from one another,
- a non-filtrate fluid supply arrangement extending along the longitudinal direction of the pleats, wherein said fluid supply arrangement is in fluid communication with the first or second end of each pleat substantially along the whole length of the pleat, said fluid supply arrangement being provided with openings designed to provide a fluid flow from the supply arrangement into the pleats in a direction substantially perpendicular to the longitudinal direction thereof, and
- a plurality of structural elements positioned within the pleats at the non-filtrate side of the sheet material and directing the non-filtrate in fluid flow paths along the first and second wall portions of the pleats.

2. The filter element of claim 1, wherein said structural elements being configured substantially co-extensive with the wall portions of the pleats.

3. The filter element of claim 1 or 2, wherein said structural elements direct the fluid flow of the non-filtrate in a direction substantially perpendicular to the longitudinal direction of the pleats, preferably by constituting a plurality of parallel flow channels for the non-filtrate, optionally said structural elements defining fluid flow paths for the non-filtrate extending substantially from one end of a pleat to its other end.

4. The filter element of any one of claims 1 to 3, said filter element being designed as a cross-flow filter element and further comprising a retentate receiving arrangement extending substantially along the whole length of the pleats, said retentate receiving arrangement being provided with openings substantially along the whole length of the pleats receiving retentate from the pleats at one end thereof in a direction substantially perpendicular to the longitudinal direction of the pleats.

5. The filter element of any one of claims 1 to 4, wherein the fluid flow paths of the non-filtrate have a cross-sectional area which increases in the direction of non-filtrate fluid flow.

6. The filter element of any one of claims 1 to 5, wherein the fluid flow paths of the non-filtrate within the pleats extends from the open ends of the pleats to the closed ends where the flow direction of the non-filtrate is reversed in the direction to the open ends of the pleats, where optionally the open ends of the pleats comprise an outlet and where the non-filtrate exits the outlet as retentate, said structural elements separating the flow of non-filtrate in the two opposite directions within each pleat.

7. The filter element of any one of claims 1 to 5, wherein the closed ends of the pleats comprise an inlet for supplying the non-filtrate and, optionally, the open ends of the pleats comprise an outlet for collecting the retentate.

8. The filter element of any one of claims 1 to 5, wherein the open ends of the pleats comprise an inlet for supplying the non-filtrate and, optionally, the closed ends of the pleats comprise an outlet for collecting the retentate.

9. The filter element of any one of claims 1 to 8, wherein the filter element comprises drainage elements arranged on the filtrate side of the sheet material.

10. The filter element of claim 9, wherein said drainage elements are designed to provide a fluid flow resistance to the filtrate, while the fluid flow resistance is provided such that it decreases along the fluid flow direction of the non-filtrate.

11. The filter element of any one of claims 1 to 10, wherein the plurality of pleats is arranged around a central axis of the filter module circumferentially at predetermined, preferably regular distances to one another, optionally the open ends of the pleats being located closer to the central axis than the closed ends of the pleats.

12. The filter element of claim 11, wherein the pleats are extending radially in a substantially straight direction.

13. The filter element of claim 11, wherein the pleats extend obliquely to the radial direction and optionally have a curved or arcuate cross-sectional shape.

14. The filter element of any one of claims 1 to 12, wherein the wall portions of the pleats have a greater distance from one another at the closed ends of the pleats than at the open ends.

15. The filter element of any one of claims 1 to 12, wherein the wall portions of the pleats have a greater distance from one another at the open ends of the pleats than at the closed ends.

16. The filter element of any one of claims 1 to 15, wherein the non-filtrate supply arrangement includes one or more feed channels, preferably having a cross-sectional area decreasing from the feed side to a closed end thereof.

17. The filter element of any one of claims 4 to 16, wherein the retentate receiving arrangement includes one or more channels, preferably having a cross-sectional area increasing from a closed end to an end discharging said retentate from the filter element.

18. The filter element of any one of claims 1 to 17, wherein the structural elements incorporate a filtrate collecting space within a pleat separated from the non-filtrate fluid flow by porous sheet material; preferably the filtrate collecting space being in direct fluid communication with the filtrate side of the wall portions of the plurality of pleats, or the structural element comprising a separate component of a fluid pervious material supporting porous sheet material and providing the filtrate collecting space; optionally said filtrate collecting space forming or contributing to a filtrate discharge channel extending substantially all along the longitudinal direction of the pleats.