

PATENT SPECIFICATION

DRAWINGS ATTACHED

- (21) Application No. 44480/67 (22) Filed 29 Sept. 1967
 (23) Complete Specification filed 20 Sept. 1968
 (45) Complete Specification published 7 April 1971
 (51) International Classification B 32 b 3/28
 (52) Index at acceptance

B5N 171 17X 17Y 221 22X 252Y 254Y 255Y 256 262Y
 265Y 266Y 267Y 270Y 273Y 280Y 282Y 283Y
 290Y 291Y 299Y 326Y 334Y 55Y 583 584 638 662
 66Y 682 686 690 706 707 715 71X

B1R 3D
 C1C 223 230 23X 431 433 43Y 635
 F4K 12A1

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(54) FILM-FLOW PACKING UNIT

(71) We, **IMPERIAL CHEMICAL INDUSTRIES LIMITED**, Imperial Chemical House, Millbank, London, S.W.1, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to an improved film-flow packing unit for the treatment of liquids which are allowed to flow as a film over the surfaces in the unit. Film-flow packing units in accordance with this invention are particularly suitable for use in cooling towers, chemical plant and the treatment of effluents with micro-organisms.

In British Patent Specification Nos. 962,432, 1,080,991 and 1,065,612 we have described film-flow packing units comprising a stack of alternate flat and corrugated sheets of a rigid thermoplastic organic polymer material. The adjacent sheets in the stack may be attached together using a suitable adhesive along the lines of contact of a corrugated sheet with a flat sheet.

In use the units are arranged so that the medial planes of the sheets within a unit are vertical so that a liquid, for example water, can flow from the top to the bottom of the unit along the surface of the sheets and air can pass through the channels formed between the adjacent sheets in the unit. The units themselves are then stacked, one above the other, in a tower-like structure.

When the units are stacked to heights greatly in excess of 10 feet without intermediate supports, particularly when the units are used in the treatment of effluent with microorganisms, then the severe compressive loads imposed on the lower units in the stack are sufficient to cause physical breakdown of these units along the lines of contact between the flat and corrugated sheets. Attempts have been made to

alleviate this inherent weakness of the units by attaching the flat and corrugated sheets together by high frequency welding technique. Also in British Patent Specification 962,432 we have described an alternative method of attaching the sheets together by means of press studs which are moulded on the peaks of a corrugated sheet and which pass through holes punched in an adjacent flat sheet, the press studs engaging with corresponding recesses formed in the peaks of the adjacent corrugated sheets. Apart from such methods being far more expensive to achieve they do not significantly improve the compressive strength of the units.

According to the present invention we provide a film-flow packing unit comprising a stack of alternate flat sheets and corrugated sheets of a rigid thermoplastic organic polymeric material, the corrugated sheets having flat bases, the alternate sheets in the stack being attached together where the flat bases on a corrugated sheet and the adjacent flat sheet are in abutment.

By rigid thermoplastic organic polymeric material we mean any thermoplastic organic polymeric material having a Young's modulus of the order of 10^5 lbs./square inch or more. Examples of rigid thermoplastic organic polymeric materials which may be used include polyvinyl chloride, polyethyl methacrylate, polypropylene, polyethylene, polyvinylidene chloride, copolymers of vinyl chloride and vinyl acetate, polystyrene, oxymethylene polymers, mixtures of butadiene/acrylonitrile copolymers rubbers and styrene/acrylonitrile resins and polyesters such as polyethylene terephthalate.

In the film-flow packing unit of the invention the alternate corrugated and flat sheets may be attached together at some or all of the positions where the sheets are in abutment.

In the unit a flat sheet will abut against an adjacent corrugated sheet over areas

1 which follow curvilinear or zig-zag paths in the plane of the flat sheet.

5 In one form of the invention the corrugations, and so the areas of contact with a flat sheet, of a corrugated sheet on one side of the flat sheet follow paths which are the same as the paths followed by the corrugations, and so the areas of contact with the flat sheet, of the corrugated sheet
10 on the other side of that same flat sheet. In this form of the invention the areas of contact between a flat sheet and the corrugated sheets on opposed sides of the flat sheet will coincide.

15 In another form of our invention the corrugations, and so the areas of contact with a flat sheet, of a corrugated sheet on one side of the flat sheet follow paths which are the reverse, or opposite, of the paths followed by the corrugations, and so the areas of contact with the flat sheet, of the corrugated sheet on the other side of that same flat sheet. In this case the areas of contact
20 between a flat sheet and the corrugated sheets on opposed sides of the flat sheet will only coincide over certain areas.

25 In order that the invention may be more clearly understood it will now be described with the aid of the accompanying drawing showing a perspective view of a corrugated sheet used in the film-flow packing unit of the invention.

30 Referring to the drawing it will be seen that the corrugations on the corrugated sheet, apart from the following zig-zag paths along their length, have flat bases. Also the corrugations have a cross section in the form of an isosceles trapezoid which provides good rigidity combined with a high surface
40 area for the space occupied.

45 The film-flowing packing unit is constructed by arranging the flat sheets and the corrugated sheets alternately in a stack. The alternate sheets in the stacks are attached together, either through the medium

of a suitable adhesive or by high frequency welding, at some or all of the positions where a flat sheet and the bases of the corrugations on a corrugated sheet are in abutment.

50 The units are capable of withstanding high compressive loads so that they may be stacked one above the other.

55 The corrugated sheets, being made from a thermoplastic organic polymeric material, can be manufactured by any of the usual moulding techniques.

WHAT WE CLAIM IS:—

1. A film-flow packing unit comprising a bonded stack of alternate flat sheets and
60 corrugated sheets of a rigid thermoplastic organic polymeric material, the corrugated sheets having corrugations which follow either curvilinear or zig-zag paths along their length, the corrugated sheets having corru-
65 gations with flat bases.

2. A film-flow packing unit as claimed in Claim 1 in which the flat based corrugations, and so the areas of contact with a flat sheet, of a corrugated sheet on one side of the flat sheet follow paths which are the same as the paths followed by the corrugations, and so the areas of contact with the flat sheet, of the corrugated sheet on the other side of that same flat sheet.
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3. A film-flow packing as claimed in Claim 1 in which the corrugations, and so the areas of contact with a flat sheet, of a corrugated sheet on one side of the flat sheet follow paths which are the reverse, or oppo-
80 site, of the paths followed by the corrugations, and so the areas of contact with the flat sheet, of the corrugated sheet on the other side of that same flat sheet.

4. A film-flow packing unit as claimed
85 in any one of the preceding claims in which the flat based corrugations have a cross section in the form of an isosceles trapezoid.

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1 which follow curvilinear or zig-zag paths in the plane of the flat sheet.

In one form of the invention the corrugations, and so the areas of contact with a flat sheet, of a corrugated sheet on one side of the flat sheet follow paths which are the same as the paths followed by the corrugations, and so the areas of contact with the flat sheet, of the corrugated sheet on the other side of that same flat sheet. In this form of the invention the areas of contact between a flat sheet and the corrugated sheets on opposed sides of the flat sheet will coincide.

15 In another form of our invention the corrugations, and so the areas of contact with a flat sheet, of a corrugated sheet on one side of the flat sheet follow paths which are the reverse, or opposite, of the paths followed by the corrugations, and so the areas of contact with the flat sheet, of the corrugated sheet on the other side of that same flat sheet. In this case the areas of contact between a flat sheet and the corrugated sheets on opposed sides of the flat sheet will only coincide over certain areas.

In order that the invention may be more clearly understood it will now be described with the aid of the accompanying drawing showing a perspective view of a corrugated sheet used in the film-flow packing unit of the invention.

Referring to the drawing it will be seen that the corrugations on the corrugated sheet, apart from the following zig-zag paths along their length, have flat bases. Also the corrugations have a cross section in the form of an isosceles trapezoid which provides good rigidity combined with a high surface area for the space occupied.

The film-flowing packing unit is constructed by arranging the flat sheets and the corrugated sheets alternately in a stack. The alternate sheets in the stacks are attached together, either through the medium

of a suitable adhesive or by high frequency welding, at some or all of the positions where a flat sheet and the bases of the corrugations on a corrugated sheet are in abutment.

The units are capable of withstanding high compressive loads so that they may be stacked one above the other.

The corrugated sheets, being made from a thermoplastic organic polymeric material, can be manufactured by any of the usual moulding techniques.

WHAT WE CLAIM IS:—

1. A film-flow packing unit comprising a bonded stack of alternate flat sheets and corrugated sheets of a rigid thermoplastic organic polymeric material, the corrugated sheets having corrugations which follow either curvilinear or zig-zag paths along their length, the corrugated sheets having corrugations with flat bases.

2. A film-flow packing unit as claimed in Claim 1 in which the flat based corrugations, and so the areas of contact with a flat sheet, of a corrugated sheet on one side of the flat sheet follow paths which are the same as the paths followed by the corrugations, and so the areas of contact with the flat sheet, of the corrugated sheet on the other side of that same flat sheet.

3. A film-flow packing as claimed in Claim 1 in which the corrugations, and so the areas of contact with a flat sheet, of a corrugated sheet on one side of the flat sheet follow paths which are the reverse, or opposite, of the paths followed by the corrugations, and so the areas of contact with the flat sheet, of the corrugated sheet on the other side of that same flat sheet.

4. A film-flow packing unit as claimed in any one of the preceding claims in which the flat based corrugations have a cross section in the form of an isosceles trapezoid.

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