



(11) (21) (C) **2,036,094**
(22) 1991/02/11
(43) 1992/02/26
(45) 2000/05/30

(72) Breitbach, Peter P., DE

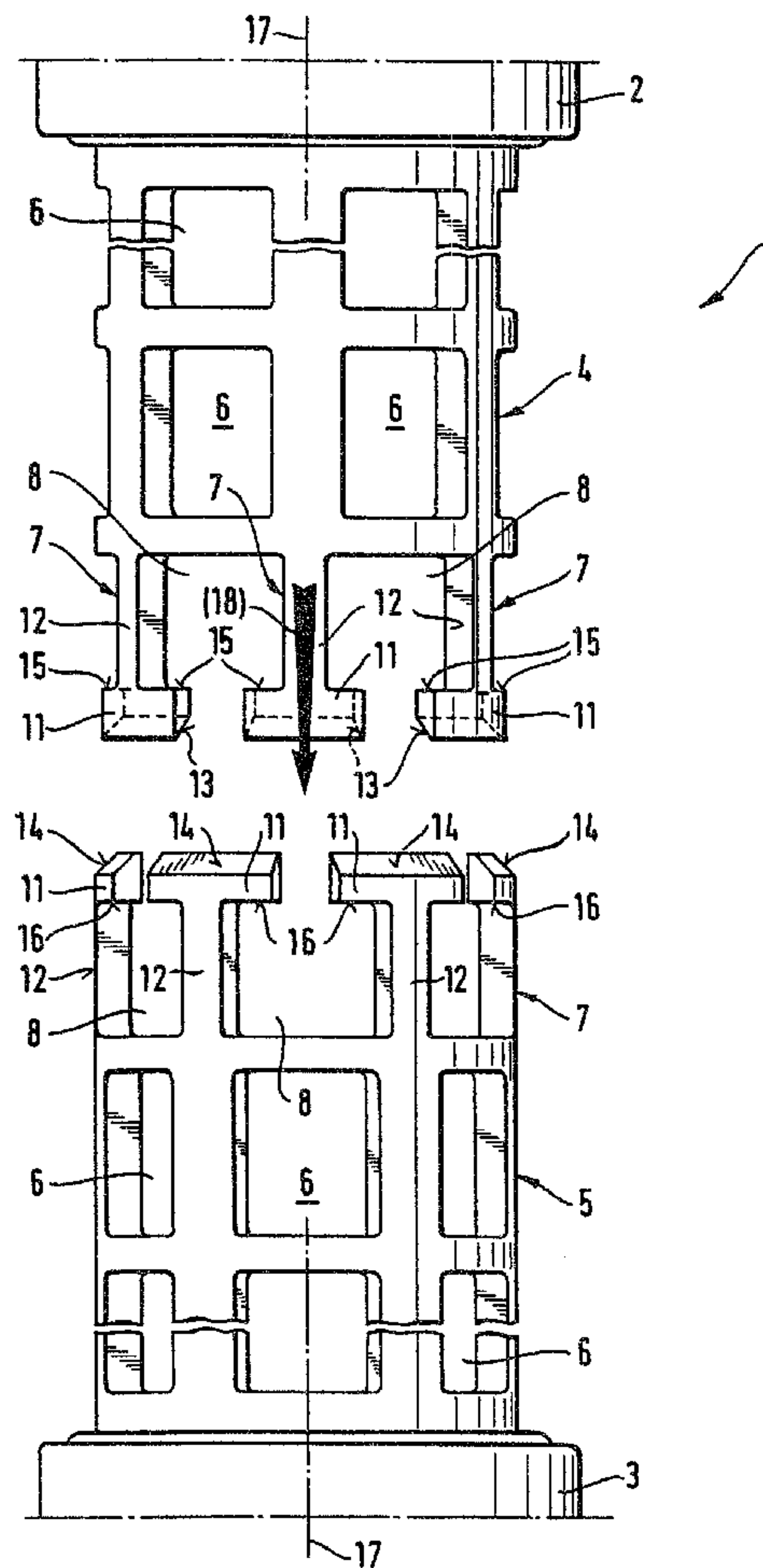
(73) SEITZSCHENK FILTERSYSTEMS GMBH, DE

(51) Int.Cl.⁵ B01D 25/00

(30) 1990/08/25 (P 40 26 934.5-27) DE

(54) **TUBE-SUPPORT SERVANT DE COMPOSANT POUR LA
FABRICATION D'ELEMENTS FILTRANTS**

(54) **SUPPORTING TUBE AS COMPONENT FOR FILTER MODULES**



(57) To simplify the assembly of filter modules 10, the supporting tube 1 which carries the filter cells 9 is designed in two pieces. Both the upper tube piece 4 and the lower tube piece 5 contain locking elements 7 which engage correspondingly large recesses 8, thereby making possible a safe interlock as well as an axial movability of the tube pieces 4 and 5.



Summary:

To simplify the assembly of filter modules 10, the supporting tube 1 which carries the filter cells 9 is designed in two pieces. Both the upper tube piece 4 and the lower tube piece 5 contain locking elements 7 which engage correspondingly large recesses 8, thereby making possible a safe interlock as well as an axial movability of the tube pieces 4 and 5.

(Figure 1)

Supporting Tube as Component for Filter Modules

So that these supporting tubes, provided with filter cells, can be assembled into filtering equipment or connected to other supporting tubes carrying filter cells, appropriate adapters must be attached to the ends of the supporting tube.

According to DE-OS 3,741,552, the filter cells are fastened first to the single-piece supporting tube. The filter cells are then compressed and the adapters attached to both ends of the supporting tube. This has the extreme disadvantage that the adapters have to be welded to the supporting tube in the compressed state of the filter cells.

The production of two pieces of tube which must be joined to each other later could be considered disadvantageous, as opposed to the production of a single component as known from DE-OS 3,741,552. But it has turned out that, in such a two-piece design, the adapters to be attached to the ends can already be attached to the respective tube piece ends prior to the assembly of the filter module. Consequently, the possibility exists to mold the respective adapters integrally onto the tube pieces. This obviates having to produce separate adapters which have to be fused on in an additional operation.

When assembling the filter module it has proved to be advantageous that the filter cells can be attached to the tube pieces first, whereupon the two tube pieces have to be joined

together.

So that the tube pieces carrying the filter cells can be joined together in simple manner, they preferably have, at their end opposite the adapter, locking elements which interlock when interconnecting the tube pieces. Therefore, the two tube pieces need only be pushed against each other until the locking elements engage each other.

Since the filter cells are compressed elastically during the assembly of the filter module, which leads to considerable restoring forces after relief, the locking elements are of appropriately rugged design.

In order to reduce these restoring forces which, after all, can be as high as 1.3 t, there are provided, in the locking area of the tube pieces, recesses which are engaged by the locking elements of the respective other tube piece. These recesses are designed so that, in the assembly of the filter module, the two tube pieces can be pushed beyond their intended end position relative to each other. This, in turn, offers the advantage that the locking elements only need absorb by far weaker forces. The material thickness of the entire supporting tube can also be reduced accordingly.

Another advantage of this design is apparent in particular when several modules are stacked on top of each other and compressed. Drawbars and springs holding the modules together are provided for this purpose. In supporting tubes used so far it could happen that, due to the softening of the materials, the individual filter cells were no longer stacked on top of each other in sealing fashion during operation. Due to the recess provided according to the invention for the locking elements to engage, a certain axial mobility of the tube pieces relative to each other is provided so that the spring compressing the modules can continue to compress the supporting tube when the filter cells soften so as to provide now as before an optimum seal between the filter elements. Beyond this, the possibility exists to improve the sealing action by mechanical retensioning.

The locking elements, as components of the tube piece wall, are formed on its circumference in juxtaposition.

Regarding the design of the locking elements, it must be

seen to it that, when joining the tube pieces together, the locking elements cannot escape radially outward on account of the filter cells already attached to the tube pieces. Another point to be watched out for is that, after interconnecting the tube pieces, the locking elements do not project radially inward because the supporting tube must be placed over a tubular sieve whose outside diameter is adapted to the inside diameter of the supporting tube.

Advantageously, the locking elements are of T shape with a longitudinal and a transverse leg each, the longitudinal legs running parallel to the tube centerline and the transverse legs being of circular arc design. Each two neighboring locking elements of one tube piece encompass the recess to seat a locking element of the respective other tube piece.

The axial length of the recesses of the one tube piece must be selected so as to match at least the thickness of the transverse legs of the respective other tube piece so that, when plugging the two tube pieces together, they can be pushed into each other beyond their final position by a certain distance. This is also necessary to make an axial mobility of the two tube pieces relative to each other possible later.

The axial length of the recesses should preferably equal twice the thickness of the transverse legs of the locking elements of the respective other tube piece. In order to prevent twisting of the tube pieces relative to each other as best as possible, the mutual spacing of two transverse legs of one tube piece, as seen in circumferential direction, should equal at least the thickness of the longitudinal leg of the respective other tube piece.

To assure simple plugging together and safe interlocking of the two tube pieces, the locking elements of at least one tube piece are of spring-elastic design. Since the locking elements cannot expand radially outwardly on account of the filter cells already attached to the tube pieces, it must be made certain that the springy locking elements can expand radially inwardly: Towards this end, the transverse legs of the radially inwardly escaping locking elements have preferably a slide surface pointing obliquely outwardly and interacting with correspondingly

inwardly pointing slide surfaces of the transverse legs of the respective other tube piece when interconnecting the tube pieces. The inclination of the slide surfaces is preferably 45 degrees.

When interconnecting the tube pieces, the locking elements slide past each other on their slide surfaces until the locking elements have reached their assigned recess in the respective other tube piece. Upon reaching the recess, the locking elements spring back into their initial position so that the inside diameter of the supporting tube has not been reduced after the interconnection of the two tube pieces. It is of particular advantage when joining the two tube pieces together that they be aligned relative to each other so that all locking elements are opposite their respective recesses. Otherwise, twisting the tube pieces relative to each other is necessary after their axial interconnection so that they can assume their end position in the respective recesses.

After the two tube pieces are joined together, the undersides of the locking elements are pushing against each other due to the restoring forces active through the filter cells. The underside of one each transverse leg of a locking element is in contact with two transverse legs of two locking elements of the respective other tube piece.

Embodiment examples of the invention are described below in greater detail with reference to the drawings in which

Fig. 1 shows, partly in section, a side view of the filter module after assembly,

Fig. 2 a side view of the locking area of the tube pieces forming the supporting tube, prior to their interconnection;

Fig. 3 the locking area of the two tube pieces after their interconnection;

Fig. 4 an enlarged view, partly in section, of two locking elements while the tube pieces are being interconnected.

Depicted partly in section in Fig. 1 is a filter module 10. Adapters 2 and 3 are integrally molded to both ends of a central supporting tube 1. As shown in Fig. 1, two different adapter parts are provided, one being cupshaped, the other tubular. Also possible are two identical, annular adapter parts 2, 3, as shown

2036094

in Fig. 3. The supporting tube and the adapters are made of a plastic resistant to the medium to be filtered, in particular polyolefin such as polypropylene.

Fastened to the supporting tube, furthermore, are circular filter cells 9, built up in multiple layers. The construction of such filter cells 9 is described in DE-OS 37 41 552. For the outflow of the filtrate from the interior of the filter cells 9, the supporting tube is provided with passages 6 through which the filtrate can flow into the interior of the supporting tube 1.

The supporting tube 1 consists of a first tube piece 4 and a second tube piece 5, both being of the same length in the design shown here. But the possibility also exists to design the two tube pieces 4 and 5 so as to be different in length.

To interconnect the two tube pieces 4 and 5, they have at their ends away from the adapters 2, 3 locking elements 7 which interlock when the two tube pieces 4 and 5 are plugged together.

These locking elements 7 are components of the tube wall and form integral parts of the tube pieces 4 and 5 equipped with breakthroughs 6. The locking elements 7 are juxtaposed around the tube pieces 4 and 5.

The design of the locking elements is shown in detail in Figs. 2 to 4.

In Fig. 2 are depicted the two end areas of the tube pieces 4 and 5 in larger scale, prior to the joining of the two tube pieces. The locking elements 7 of both tube pieces 4 and 5 are of T shape, and each has a longitudinal leg 12 and a transverse leg 11. The longitudinal legs 12 are aligned parallel to the tube centerline 17 while the transverse legs 11 are of circular arc design, lying together on the circumferential circle of the respective tube piece 4, 5.

Two neighboring locking elements 7 always encompass one recess 8 between them, which can be engaged by the transverse leg 11 of the locking element 7 of the respectively other tube piece. This is illustrated in Fig. 3.

These recesses 8 are larger in axial direction than the thickness of a transverse leg 11. In the view shown in Fig. 3, the axial extent of recess 8 corresponds approximately to three times the thickness of the transverse leg 11. This provides for

an axial mobility of the two tube pieces relative to each other in arrow direction 18.

In Fig. 2, the two tube pieces 4 and 5 are aligned relative to each other so that the mutually opposing locking elements 7 are staggered. This offers the advantage that the two tube pieces 4 and 5 merely have to be pushed into each other in axial direction so that the locking elements 7 can engage the recesses 8 respectively assigned to them.

The locking elements 7 of tube piece 4 have inwardly pointing slide surfaces 13 provided on the transverse legs 11. The transverse legs 11 of the locking elements 7 of tube piece 5 have correspondingly inclined slide surfaces 14 pointing outward.

The mutual spacing of the transverse legs 11, as viewed in circumferential direction, is somewhat greater in the view shown in Fig. 3 than the thickness of the longitudinal legs 12. The mutual spacing of two neighboring transverse legs 11 is preferably adapted to the thickness of the longitudinal leg 12 of the engaging locking element 7 of the respective other tube piece so as to exclude as best as possible a twisting of the tube pieces 4 and 5.

The interaction of the two slide surfaces 13 and 14 while the two tube pieces 4 and 5 are joined together is shown in detail in Fig. 4. The inwardly pointing slide surface 13 of the locking element 7 of tube piece 4 rests on the slide surface 14 of the opposite locking element 7 of tube piece 5. When both tube pieces 4 and 5 are pushed together in axial direction, the locking element 7 escapes inwardly in arrow direction A due to its spring-elastic design. This makes it possible for the transverse leg 11 of the locking element 7 of tube piece 5 to slide along the inside of the corresponding locking element of tube piece 4 in arrow direction B until the recess 8 disposed above the transverse leg 11 is reached. Due to its spring action, the deflected locking element 7 snaps into this recess 8 and forms, together with the transverse leg 11 of the locking element 7 of tube piece 4, an interlock in which the respective rear surfaces 15 and 16 of the transverse legs 11 lie on top of each other.

CLAIMS

1 1. Central supporting tube, as component for filter modules, designed to
2 accommodate filter cells, with adapters arranged at both ends, characterized
3 in that the entire supporting tube (1) is formed of two tube pieces (4, 5) to
4 which the respective adapter is permanently attached and in that the tubular
5 pieces (4, 5) at their ends opposite the respective adapter (2, 3), have locking
6 elements (7) with recesses (8) engaged by the locking elements (7) of the
7 respective other tube piece (4, 5), said recesses (8) being designed so that the
8 locking elements (7) are movable in an axial direction in the recesses (8).

1 2. Supporting tube according to claim 1, characterized in that the locking
2 elements (7) of at least one tube piece (4, 5) are of spring-elastic design.

1 3. Supporting tube according to claim 2, characterized in that the
2 spring-elastic locking elements (7) of one of the two tube pieces (4, 5) are
3 designed so that they yield radially inward when connecting the tube pieces (4,
4 5).

1 4. Supporting tube according to claim 3, characterized in that the
2 transverse legs (11) of the locking elements (7) yielding radially inward have
3 a slide surface (14) which points outwardly and cooperates with inwardly
4 pointing slide surfaces (13) of the transverse legs (11) of the respective other
5 tube piece (4, 5), during connecting of the tube pieces (4, 5).

1 5. Supporting tube according to claim 4, characterized in that the
2 inclination of the slide surfaces (13, 14) is 45°.

1 6. Supporting tube according to claim 1, characterized in that each two
2 adjacent locking elements (7) of the one tubular piece (4, 5) include the recess
3 (8) for the accommodation of a locking element (7) of the respective other tube
4 piece (4, 5).

1 7. Supporting tube according to claim 6, characterized in that the axial
2 length of the recesses (8) of the one tube piece (4, 5) equals at least the
3 thickness of the transverse leg (11) of the respective other tube piece (4, 5).

1 8. Supporting tube according to claim 7, characterized in that the axial
2 length of the recesses (8) equals at least twice the greatness of the transverse
3 legs (11).

1 9. Supporting tube according to claim 1, characterized in that the locking
2 elements are of T-shape with a longitudinal leg (12) and a transverse leg (11)
3 each, the longitudinal legs (12) being arranged parallel to the tube axis (18) and
4 the transverse legs (11) lying generally along an arc of a circle.

1 10. Supporting tube according to claim 9, characterized in that the mutual
2 spacing of any two transverse legs (11) of the one tube piece (4, 5) in a
3 circumferential direction equals at least the thickness of the longitudinal leg
4 (12) of the respective other tube piece (4, 5).

1 11. Supporting tube according to claim 1, characterized in that the
2 adapters (2, 3) are molded integrally to the respective tube pieces (4, 5).

1 12. Supporting tube according to claim 1, characterized in that the locking
2 elements (7), are components of the wall of the tube pieces (4, 5) and are
3 molded along their circumferences in juxtaposed position.

1 13. Supporting tube according to claim 1, characterized in that the
2 adapters (2, 3) are of identical and annular design.

1 14. Supporting tube according to claim 1, characterized in that one adapter
2 (2 or 3) is of cup-shape and one adapter (3, or 2) if of tubular design.

1 15. A supporting tubular assemblage according to claim 1, characterized
2 in that the locking elements (7) comprise integral molded portions of the walls
3 of the tubular pieces (4, 5).

1 16. A supporting tubular assemblage according to claim 1, characterized
2 in that the locking elements (7) of at least one tubular piece are resilient.

1 17. A supporting tubular assemblage constituting a central component for
2 a filter module of the type which has adapters disposed on both of its ends,
3 characterized in that said assemblage (1) comprises a first tubular piece (4) and
4 a second tubular piece (5), said pieces being axially aligned with each other
5 and having cooperable interconnectable means at their juxtaposed ends to form
6 a joint between the pieces, said joint providing a degree of axial mobility, the
7 remote ends of the pieces respectively having adapters (2, 3), said cooperable
8 means of the tubular pieces (4, 5) comprising locking elements (7) which
9 engage and lock to each other, and the tubular pieces (4, 5) having at their
10 juxtaposed ends recesses (8) constituting parts of said cooperable means, the
11 recesses of one tubular piece being respectively engaged by locking elements
12 (7) of the respective other tubular piece, said recesses (8) being so constituted
13 that the locking elements (7) are movable therein in an axial direction after they
14 have been received in the recesses.

1 18. A supporting tubular assemblage according to claim 17, characterized
2 in that each two neighboring locking elements (7) of one of the tubular pieces
3 (4, 5) encompass a recess (8) for receiving a locking element (7) of the
4 respective other tubular piece.

1 19. A supporting tubular assemblage according to claim 18, characterized
2 in that the axial length of the recesses (8) of the one tubular piece (4, 5) is at
3 least equal to the axial dimensions of the heads (11) of the respective other
4 tubular piece.

1 20. A supporting tubular assemblage according to claim 19, characterized
2 in that the axial length of the recesses (8) is at least equal to twice the axial
3 dimensions of the heads (11).

1 21. A supporting tubular assemblage according to claim 19, characterized
2 in that, as viewed in circumferential direction, the mutual spring of two

3 adjoining heads (11) of one tubular piece (4, 5) is at least equal to the width
4 of the stem (12) of the respective other tubular piece.

1 22. A supporting tubular assemblage constituting a central component for
2 a filter module of the type which has adapters disposed on both of its ends,
3 characterized in that said assemblage (1) comprises a first tubular piece (4) and
4 a second tubular piece (5), said pieces being axially aligned with each other
5 and having cooperable interconnectable means at their juxtaposed ends to form
6 a joint between the pieces, said joint providing a degree of axial mobility, the
7 remote ends of the pieces respectively having adapters (2, 3), said cooperable
8 means of the tubular pieces (4, 5) comprising locking elements (7) which
9 engage and lock to each other, the locking elements (7) of at least one tubular
10 piece being resilient, and in that the resilient locking elements (7) being able to
11 deflect radially inward in response to their engagement with the associated
12 tubular piece.

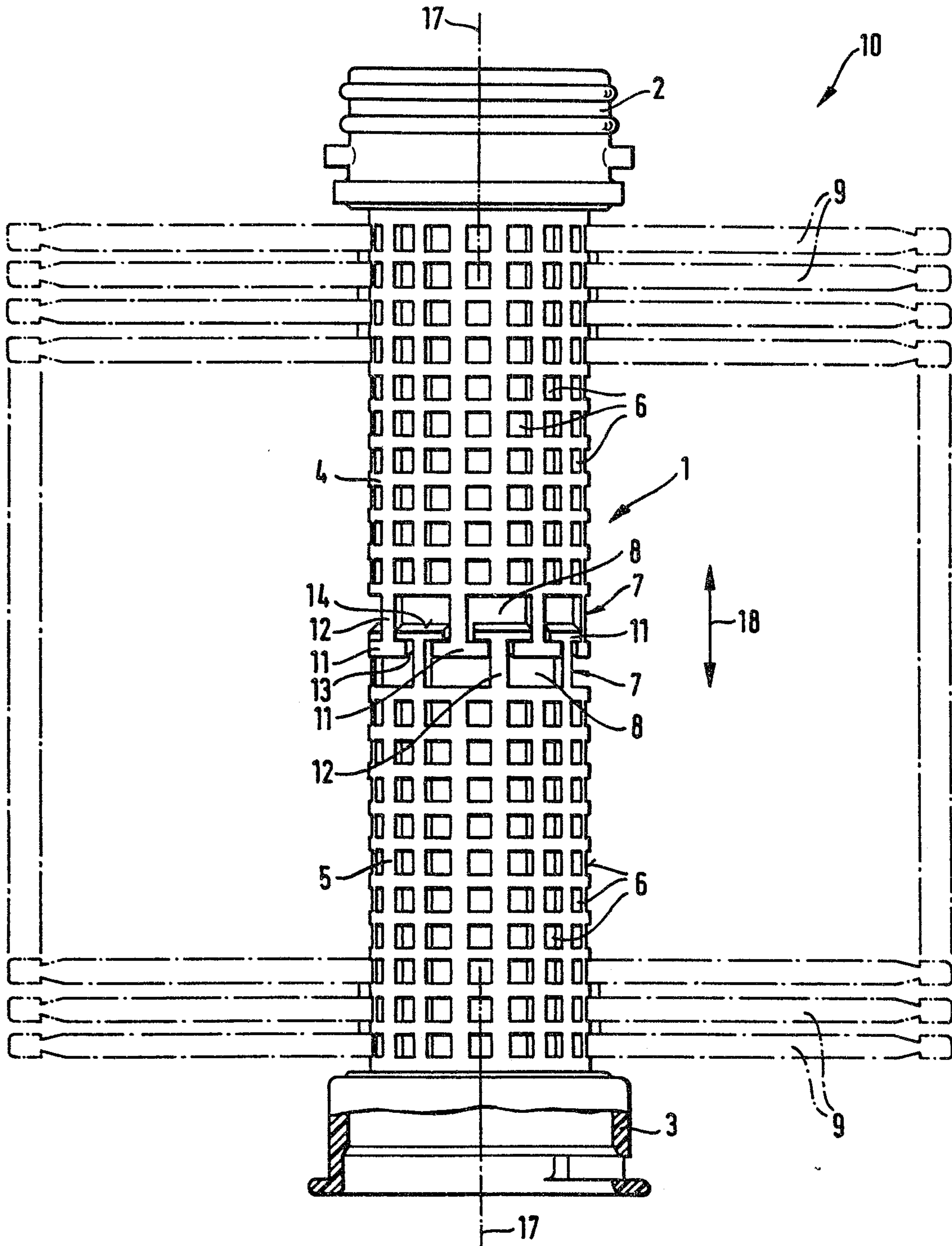
1 23. A supporting tubular assemblage according to claim 22, characterized
2 in that the said resilient locking elements have camming surfaces (14) which
3 face obliquely outward and interact with inwardly facing surfaces (13) of the
4 associated tubular piece.

1 24. A supporting tubular assemblage according to claim 23, characterized
2 in that the said camming surfaces have an inclination of 45 degrees.

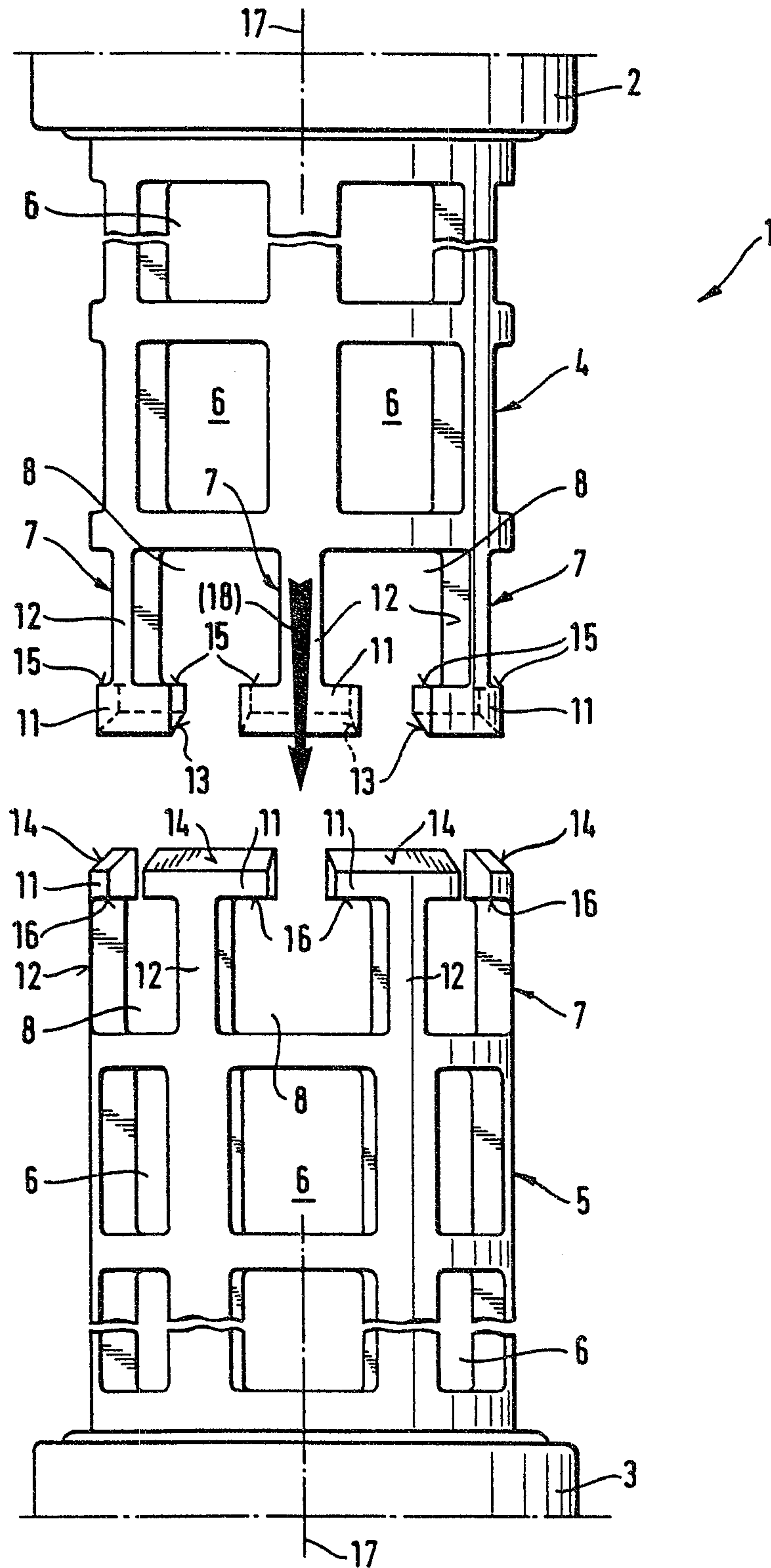
1 25. A supporting tubular assemblage constituting a central component for
2 a filter module of the type which has adapters disposed on both of its ends,
3 characterized in that said assemblage (1) comprises a first tubular piece (4) and
4 a second tubular piece (5), said pieces being axially aligned with each other
5 and having cooperable interconnectable means at their juxtaposed ends to form
6 a joint between the pieces, said joint providing a degree of axial mobility, the
7 remote ends of the pieces respectively having adapters (2, 3), said cooperable
8 means of the tubular pieces (4, 5) comprising locking elements (7) which
9 engage and lock to each other, and the locking elements (7) being T-shaped
10 each with a longitudinal stem (12) and a transverse head (11), the said stems

11 (12) being disposed parallel to the centerline of the assemblage and the heads
12 (11) being shaped as arcs of circles.

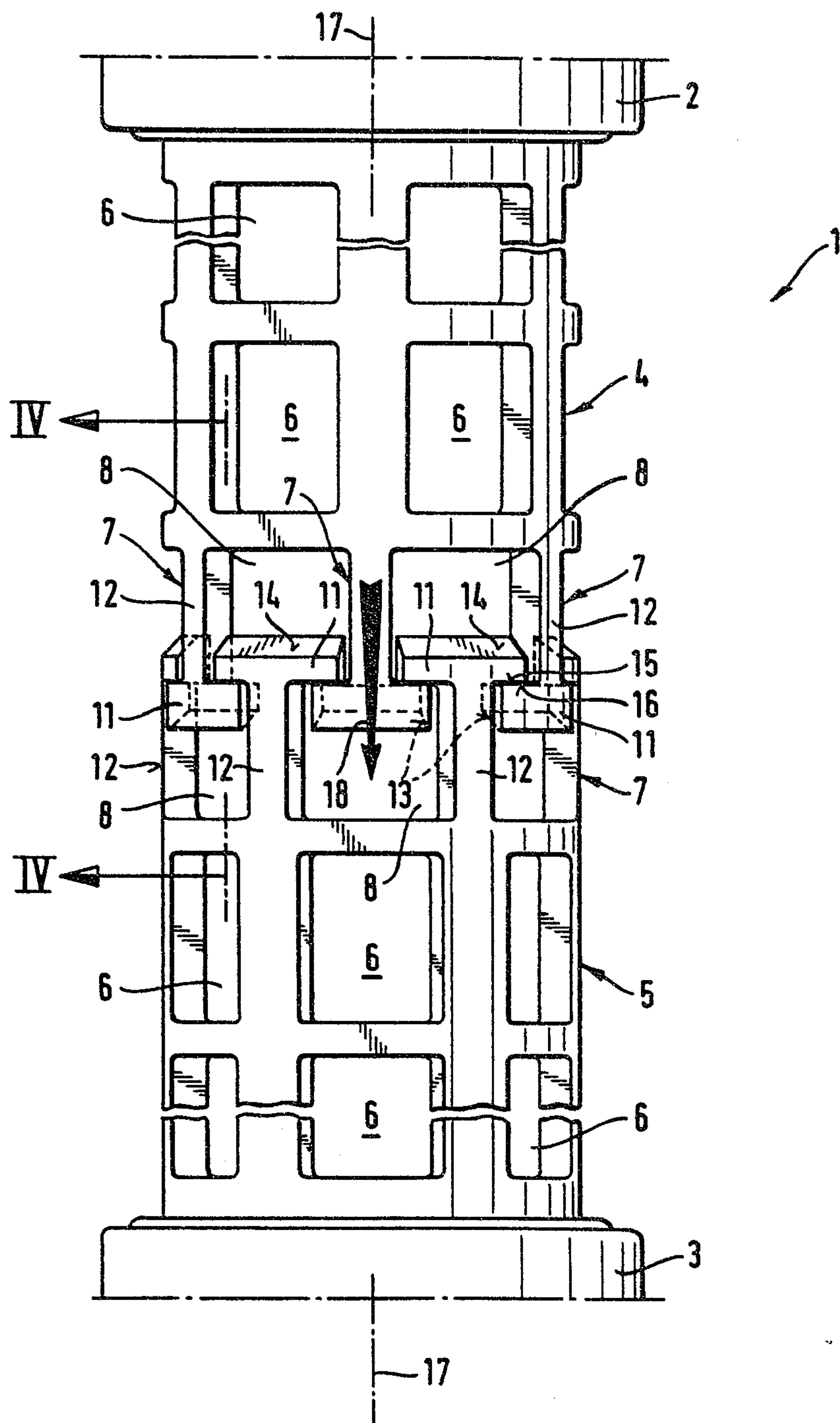
1 26. Filter module, comprising in combination: a central supporting tube
2 with adapters arranged at both ends, with a multiplicity of circular filter cells
3 which are placed on top of each other as a stack on said supporting tube, said
4 supporting tube being provided with passages and said circular filter cells being
5 kept in an axially compressed state while each forms a mutual seal to the
6 adjacent filter cell, the entire supporting tube (1) being formed of two tube
7 pieces (4, 5) to which the respective adapter is permanently attached, the tube
8 pieces (4, 5) at their ends opposite the respective adapter (2, 3), having
9 locking elements (7) with recesses (8) engaged by the locking elements (7) of
10 the respective other tube piece (4, 5), said recesses (8) being designed so that
11 the locking elements (7) are movable in an axial direction in the recesses (8).

**Fig. 1**

Gowling, Strathy & Henderson

**Fig. 2**

Gowling, Strathy & Henderson

**Fig. 3**

Gowling, Strathy & Henderson

