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(12) # EUROPEAN PATENT SPECIFICATION

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(54) **Water-tube heat exchanger for a motor vehicle air-conditioning system, having a header with a baffle for dividing the flow.**

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DE-A- 3 733 866
FR-A- 2 390 692
FR-A- 2 509 447
FR-A- 2 573 190
US-A- 4 114 397

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Description

The present invention relates to a heat exchanger of the kind defined in the first part of Claim 1.

A heat exchanger of this kind is disclosed in FR-A-2,509,447. This known heat exchanger comprises a baffle sealingly interposed between a cover member and a tube plate. The surface of the baffle facing the cover member has a plurality of recesses provided each with a pair of apertures in which there are fitted the end portions of a corresponding pair of tubes. The region comprised between the cover member and each recess of the baffle forms a sealed passage which deflects the flow of the liquid from one tube to the other.

Another similar heat exchanger is disclosed in EP-A-0 328 414.

The object of the present invention is to provide an exchanger of the type specified at the beginning of the description, which allows the liquid to pass tube-side several times without complications in the structure of the exchanger.

According to the invention, this object is achieved by a heat exchanger having the features defined in Claim 1.

By virtue of these characteristics, an exchanger with water tubes can be formed with three or more "rows" (that is, with sets of finned tubes arranged substantially in three different parallel planes) and a flow-divider, without complications in the assembly of the exchanger, in the arrangement of the baffles or in the positioning of the liquid-inlet and -outlet connectors.

Further advantages of the exchanger according to the invention will become clear from the detailed description which follows, purely by way of non-limiting example, with reference to the appended drawings, in which:

Figure 1 is a perspective view of an exchanger according to the invention,

Figure 2 is an exploded perspective view of the exchanger of Figure 1,

Figure 3 is a view of a detail of Figure 2 on an enlarged scale,

Figure 4 is a section taken on the line IV-IV of Figure 1,

Figure 5 is a section taken on the line V-V of Figure 1,

Figure 6 is a section taken on the line VI-VI of Figure 1,

Figure 7 is a section taken on the line VII-VII of Figure 1,

Figure 8 is a section taken on the line VIII-VIII of Figure 1, and

Figure 9 is a section taken on the line IX-IX of Figure 1.

With reference to the drawings (Figure 1), a liquid-gas heat exchanger with three rows of water tubes suitable for installation in a motor-vehicle air-conditioning system is generally indicated 10. The exchanger 10 has a finned matrix 10a composed of finned U-shaped tubes arranged between a header 12 and a tube-support frame 14.

The header 12 includes a convex cover 16 of polymeric material which has a recessed portion 17 formed with two lateral connectors 16a and 16b for respective connection to inlet and outlet tubes for the liquid, a metal tube plate 18 with a plurality of holes 18a for the passage of the tubes T, and a baffle 20 of polymeric material whose characteristics will become clear from the following description (Figure 2).

The baffle 20 has a flat base portion 20a which faces the tube plate 18 with the interposition of a flat gasket 22 of elastomeric material having a plurality of holes 22a for the passage of the ends of the tubes T, and a substantially L-shaped, flow-dividing portion 20b perpendicular to the base portion 20a. The latter has two series of through-holes 23 and 25 respectively, arranged on opposite sides of the portion 20b of the baffle 20, as well as a plurality of elongate recessed portions 27 with substantially channel-shaped cross-sections arranged in correspondence with adjacent pairs of tubes T in an arrangement which, as shown clearly in Figures 2 and 3, forces the liquid circulating in the tubes in the central plane of the matrix 10a to be conveyed either into other tubes in the central plane (the recesses indicated A in Figures 3 and 5) or into tubes in planes parallel to the central plane of the matrix (the recesses indicated B in Figures 3 and 5).

The portion 20b of the baffle 20 has a free edge E which is connected (by pressure or by ultrasonic welding), during the assembly of the exchanger, to the corresponding edge E′ of a central baffle plate 30 formed on the base wall 32 of the cover 16 of the header 12 (Figure 8).

As can clearly be seen in Figures 8 and 9, the edge E of the portion 20b of the baffle 20 is V-shaped and corresponds in shape to a V-shaped recess formed in the edge E' of the baffle plate 30.

During the assembly of the exchanger, the edge of the metal tube plate 18, indicated 18b, is folded over a shaped edge 16c of the cover 16 with the interpositon of the edge 22b of the flat gasket 22. The latter is therefore used both to effect a seal between the cover 16 and the tube plate 18 and to effect a seal between the baffle 20 and the tube plate 18 in order to prevent the leakage of liquid between its various passages tube-side (Figures 2 and 8).

When the exchanger 10 is in use, the fluid admitted by the connector 16a is forced by the portion 20b of the baffle 20 to pass through the first series of holes 23 and to flow along a first set of U-shaped tubes of the matrix 10a and back again. After its first two passages through the matrix 10a, the liquid is returned thereto by the U-shaped recesses 27 and thus

passes twice more through the matrix of finned tubes 10a. The liquid returning from its fourth and last passage through the matrix of tubes flows through the second series of holes 25 and is conveyed to the outlet connector 16b of the exchanger 10 (Figure 2).

Although the embodiment described relates to an exchanger with three "rows", that is, with finned tubes arranged in three parallel planes, the solution according to the present invention may also be applied to different exchangers to provide the same advantages.

Claims

1. A heat exchanger, particularly a liquid-gas or a liquid-liquid heat exchanger with tubes for a motor-vehicle air-conditioning or cooling system, of the type including at least one header (12) with a tube plate (18), a cover (16) and a baffle (20) for dividing the flow, the baffle (20) being interposed sealingly between the cover (16) and the tube plate (18) and having liquid-channelling means (27, A, B) for causing the liquid to pass the tube-side several times;
characterised in that the baffle (20) has a flat base portion (20a) which faces the tube plate (18) and a flow-dividing portion (20b) substantially perpendicular to the base portion (20a) and having a free edge (E) for connection to the cover (E', 30, 32, 16) of the header (12); and
in that the flat base portion (20a) of the baffle (20) has a first series of holes (23) coaxial with the tubes (T) which admit the liquid to the tube matrix (10a) and a second series of holes (25) coaxial with the tubes (T) which discharge the liquid from the tube matrix (10a), and a plurality of U-shaped connectors (27) integral with the baffle (20).

2. An exchanger according to Claim 1, characterised in that a flat sealing gasket (22) of elastomeric material is interposed between the flat base portion (20a) and the tube plate (18) and has a plurality of holes (22a) for the passage of the tubes (T) of the tube matrix (10a).

3. An exchanger according to Claim 1 or 2, characterised in that the cover (16) of the header (12) has a flat base portion (32) with an integral baffle plate (30) substantially perpendicular to the base portion (32) and having a free edge (E') which is adapted to be connected end-to-end to the free edge (E) of the flow-dividing portion (20b) of the baffle (20).

Patentansprüche

1. Wärmeaustauscher, insbesondere Flüssigkeit-Gas- oder Flüssigkeit-Flüssigkeit-Wärmeaustauscher mit Rohren für ein Kraftfahrzeug-Klimatisierungssystem oder Kühlsystem, des Typs, der zumindest einen Verteiler (12) mit einer Rohrplatte (18), einem Deckel (16) und einer Leitwand (20) zur Teilung der Strömung aufweist, wobei die Leitwand (20) abdichtend zwischen dem Deckel (16) und der Rohrplatte (18) positioniert ist und Flüssigkeit kanalisierende Mittel (27, A, B) aufweist, um die Flüssigkeit dazu zu veranlassen, die Rohrseite mehrere Male zu durchlaufen,
dadurch gekennzeichnet,
daß die Leitwand (20) einen der Rohrplatte (18) zugewandten, flachen Basisteil (20a) und einen strömungstrennenden Teil (20b) aufweist, der im wesentlichen senkrecht zu dem Basisteil (20a) angeordnet ist und einen freien Rand (E) zur Verbindung mit dem Deckel (E', 30, 32, 16) des Verteilers (12) hat, und
daß der flache Basisteil (20a) der Leitwand (20) eine erste Serie von Löchern (23), die zu den die Flüssigkeit in die Rohrmatrix (10a) einleitenden Rohren (T) koaxial sind, und eine zweite Serie von Löchern (25), die zu den die Flüssigkeit aus der Rohrmatrix (10a) herausleitenden Rohren (T) koaxial sind,
und eine Vielzahl von integral mit der Leitwand (20) ausgebildeten, U-förmigen Verbindern (27) aufweist.

2. Austauscher nach Anspruch 1, dadurch gekennzeichnet, daß eine flache, abdichtende Dichtung (22) aus elastomerem Material zwischen dem flachen Basisteil (20a) und der Rohrplatte (18) positioniert ist und eine Vielzahl von Löchern (22a) für die Durchführung der Rohre (T) der Rohrmatrix (10a) aufweist.

3. Austauscher nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Deckel (16) des Verteilers (12) einen flachen Basisteil (32) mit einer integralen Trennwand (30) aufweist, die sich im wesentlichen senkrecht zu dem Basisteil (32) erstreckt und einen freien Rand (E') aufweist, der dazu eingerichtet ist, mit dem freien Rand (E) des strömungstrennenden Teiles (20b) der Leitwand (20) durch Ende-Ende-Verbindung verbunden zu werden.

Revendications

1. Echangeur de chaleur, particulièrement échangeur de chaleur à tubes liquie-gaz ou liquide-liquide, pour un système de climatisation ou de re-

froidissement de véhicule automobile, du type comprenant au moins un collecteur (12) possédant lui-même une plaque tubulaire (18), un couvercle (16) et une cloison (20) servant à diviser le flux, la cloison (20) étant interposée à joint étanche entre le couvercle (16) et la plaque tubulaire (18) et ayant des moyens (27, A, B) de canalisation du liquide servant à contraindre le liquide à parcourir plusieurs fois le côté des tubes, caractérisé en ce que la cloison (20) possède une partie de base plate (20a) qui regarde vers la plaque tubulaire (18) et une partie (20b) de division du flux, sensiblement perpendiculaire à la partie de base (20a) et ayant un bord libre (E) destiné à être assemblé au couvercle (E', 30, 32, 16) du collecteur (12) ; et en ce que la partie de base plate (20a) de la cloison (20) possède une série de trous (23) coaxiaux aux tubes (T) qui laissent le liquide atteindre la matrice de tubes (10a) et une deuxième série de trous (25) coaxiaux aux tubes (T), qui débitent le liquide en provenance de la matrice de tubes (10a), et une pluralité de raccords (27) en forme de U, d'une seule pièce avec la cloison (20).

2. Echangeur selon la revendication 1, caractérisé en ce qu'un joint d'étanchéité plat (22) en matière élastomère est interposé entre la partie de base plate (20a) et la plaque tubulaire (18) et possède une pluralité de trous (22a) pour le passage des tubes (T) de la matrice de tubes.

3. Echangeur selon la revendication 1 ou 2, caractérisé en ce que le couvercle (16) du collecteur (12) possède une partie de base plate (32) munie d'une plaque de cloison (30) venue de matière, sensiblement perpendiculaire à la partie de base (32) et ayant un bord libre (E') qui est adapté pour être assemblé boutà bout au bord libre (E) de la partie (20b) de division du flux de la cloison (20).

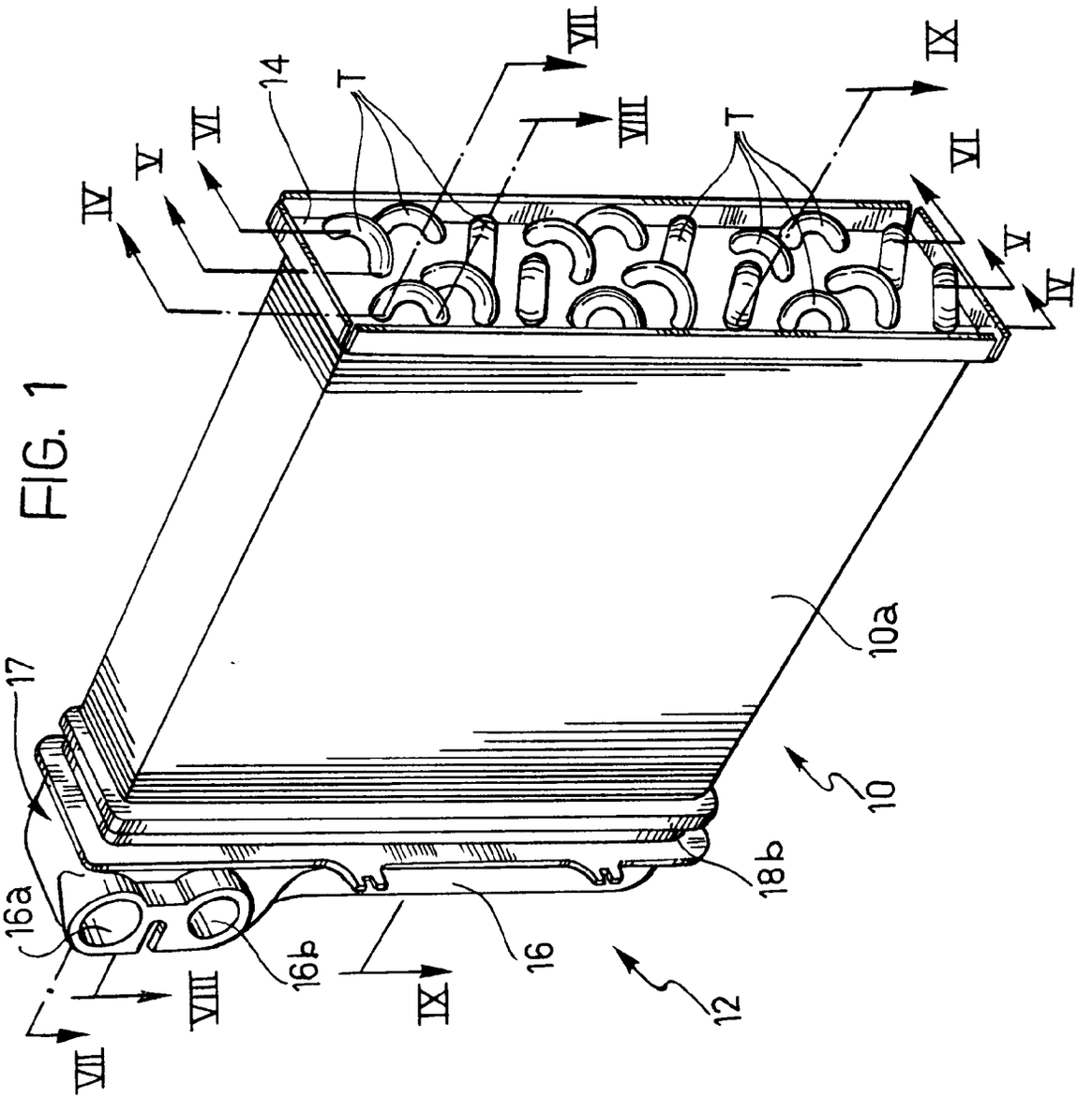

14
I
I
VII
VIII
IX
IV
V
VI
VI
V
IV
17
16a
16b
16
18b
10a
10
12
VII
VIII
IX

FIG. 1

FIG. 2

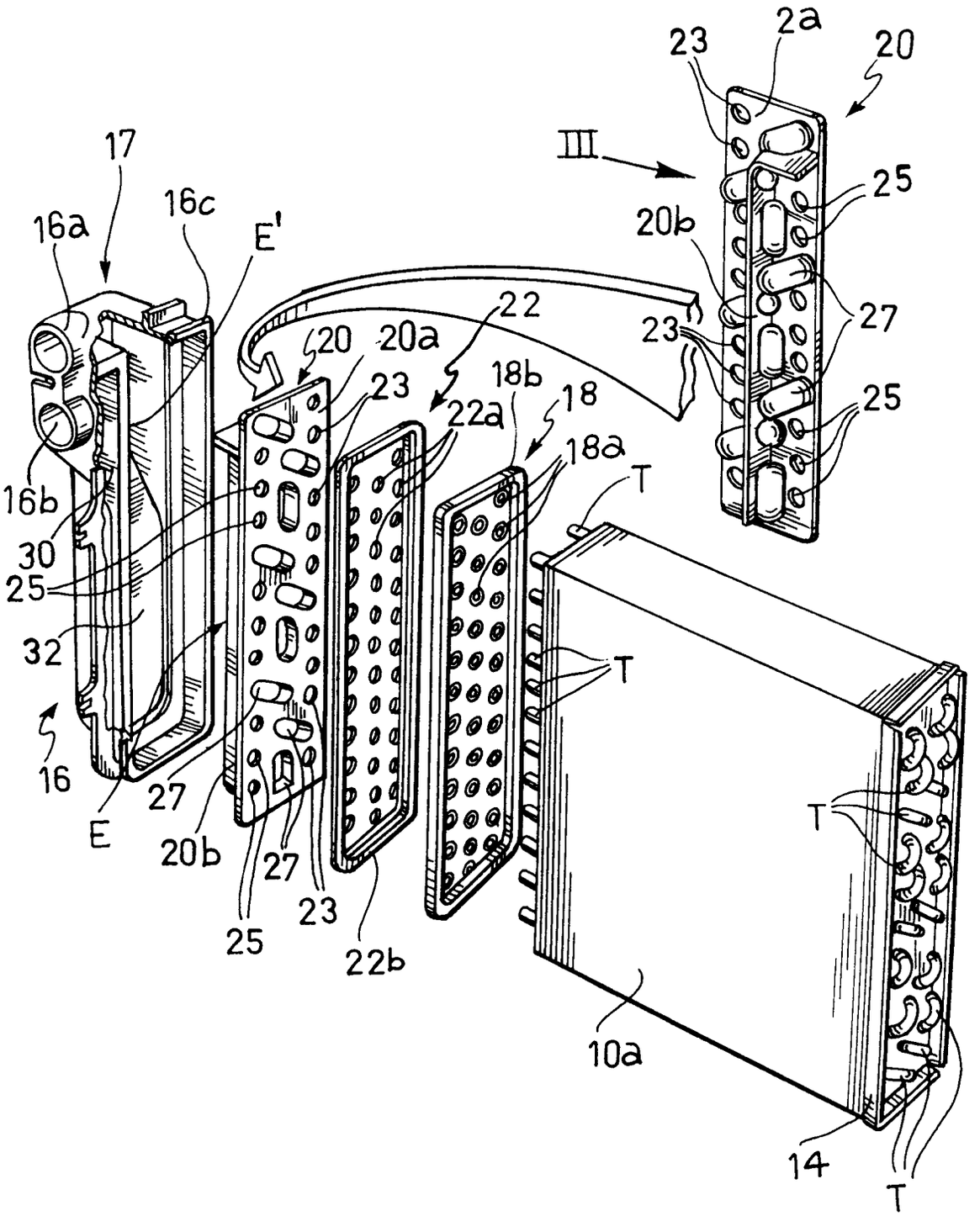

23
2a
20
III
25
20b
27
23
25
17
16a
16c
E'
22
20
20a
23
18b
22a
18
18a
T
16b
30
25
32
16
E
27
20b
27
23
25
22b
T
T
T
10a
14
T

FIG. 3

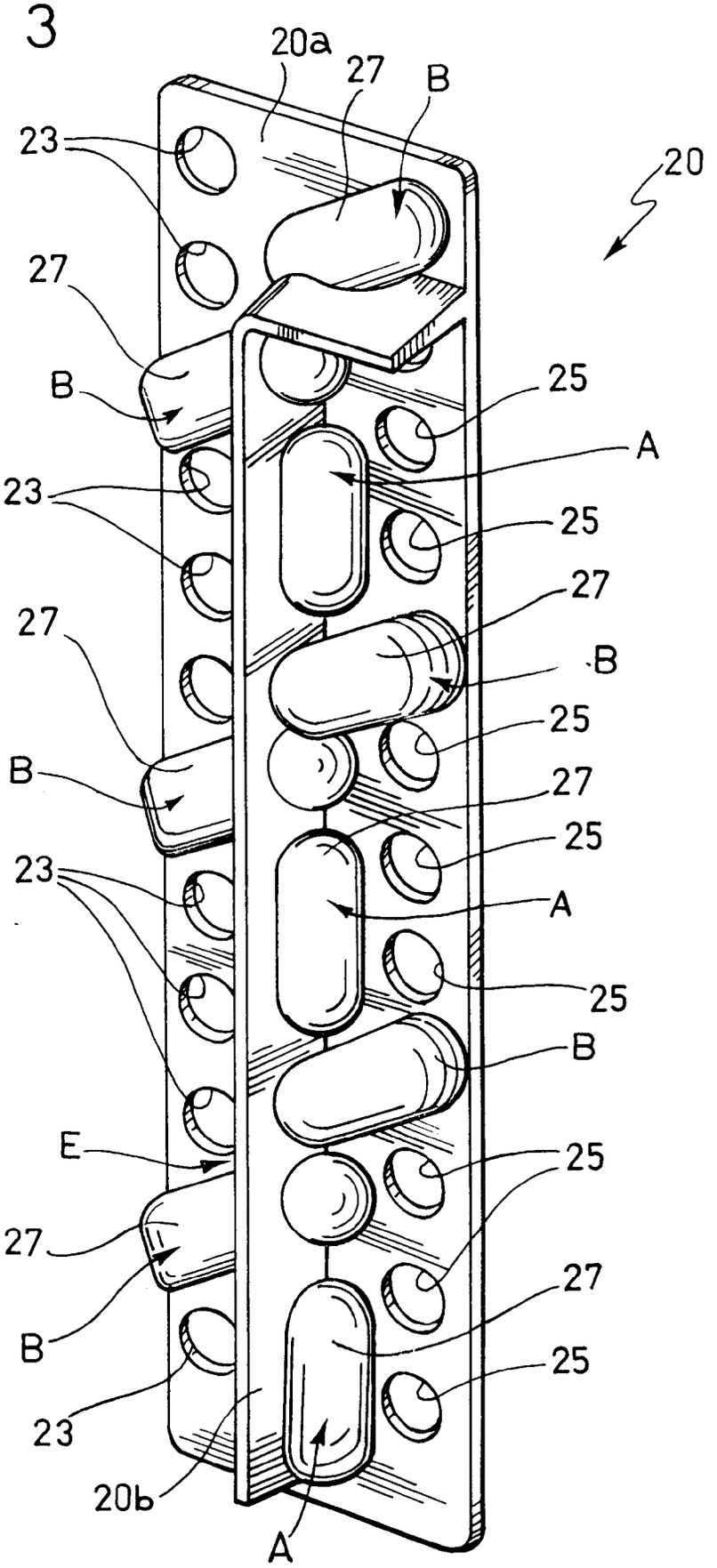

20a
27
B
23
20
27
B
25
A
23
25
27
27
B
25
B
27
25
23
A
25
B
E
25
27
27
B
B
23
20b
A

FIG. 4

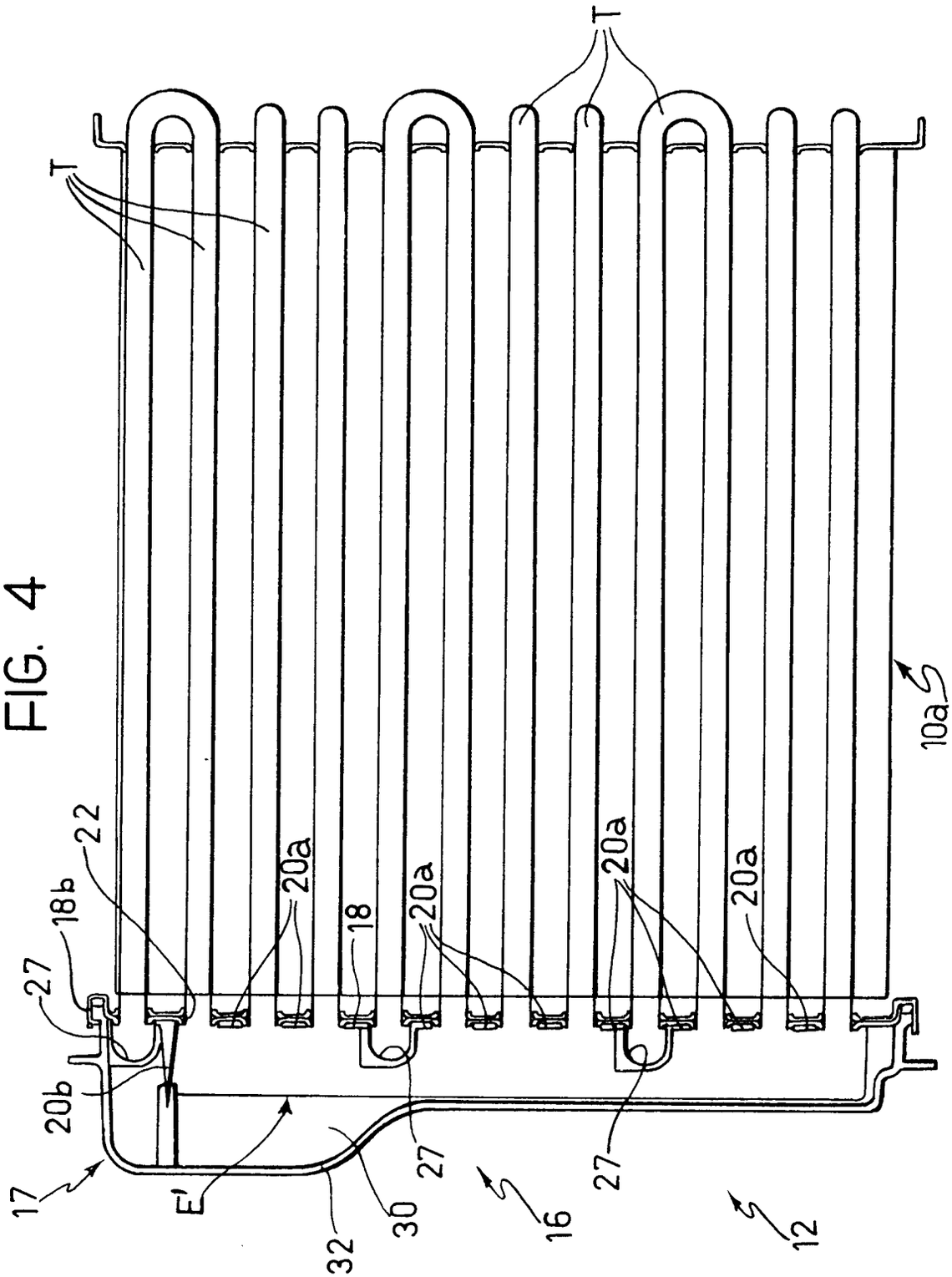


FIG. 5

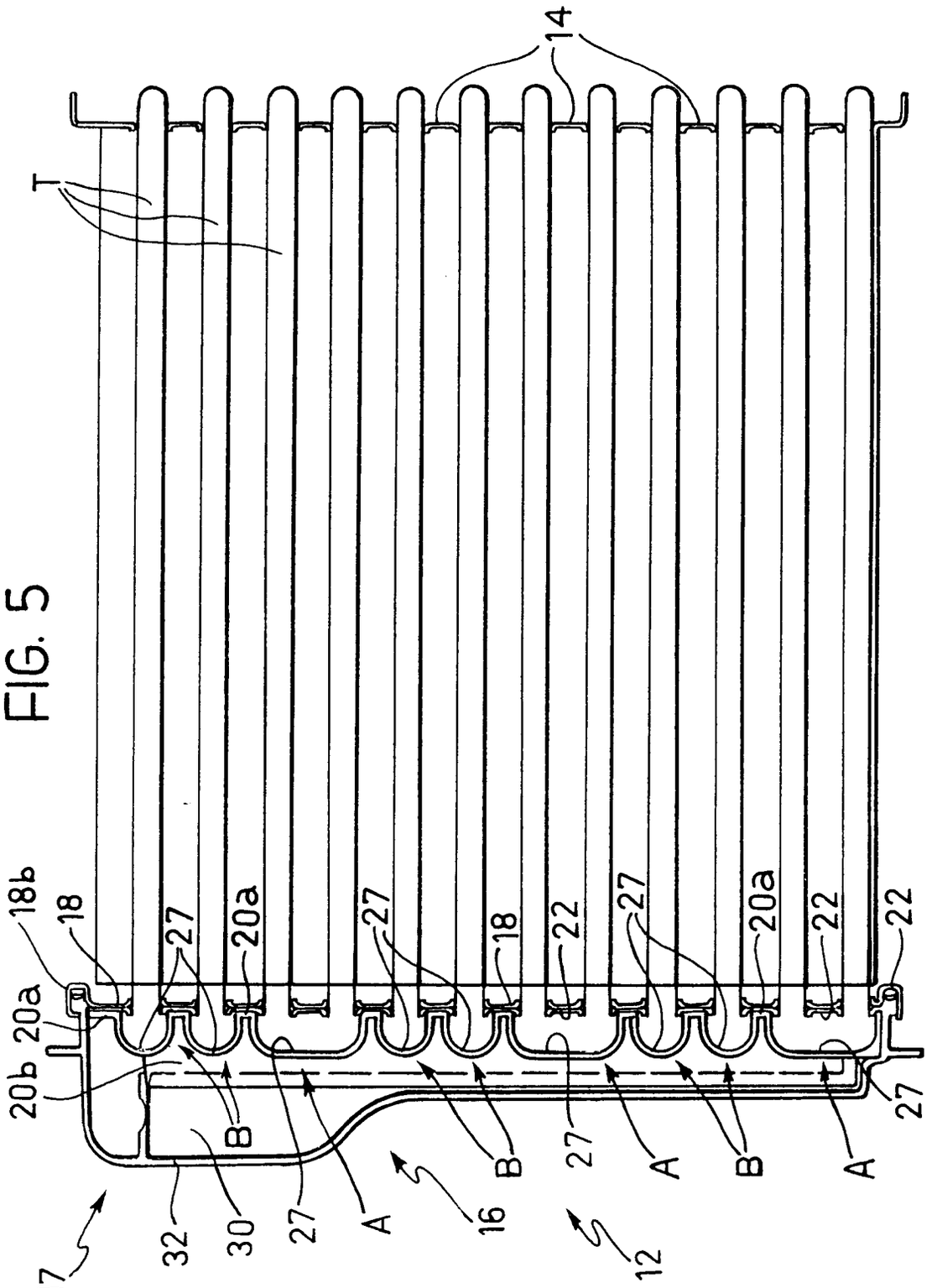
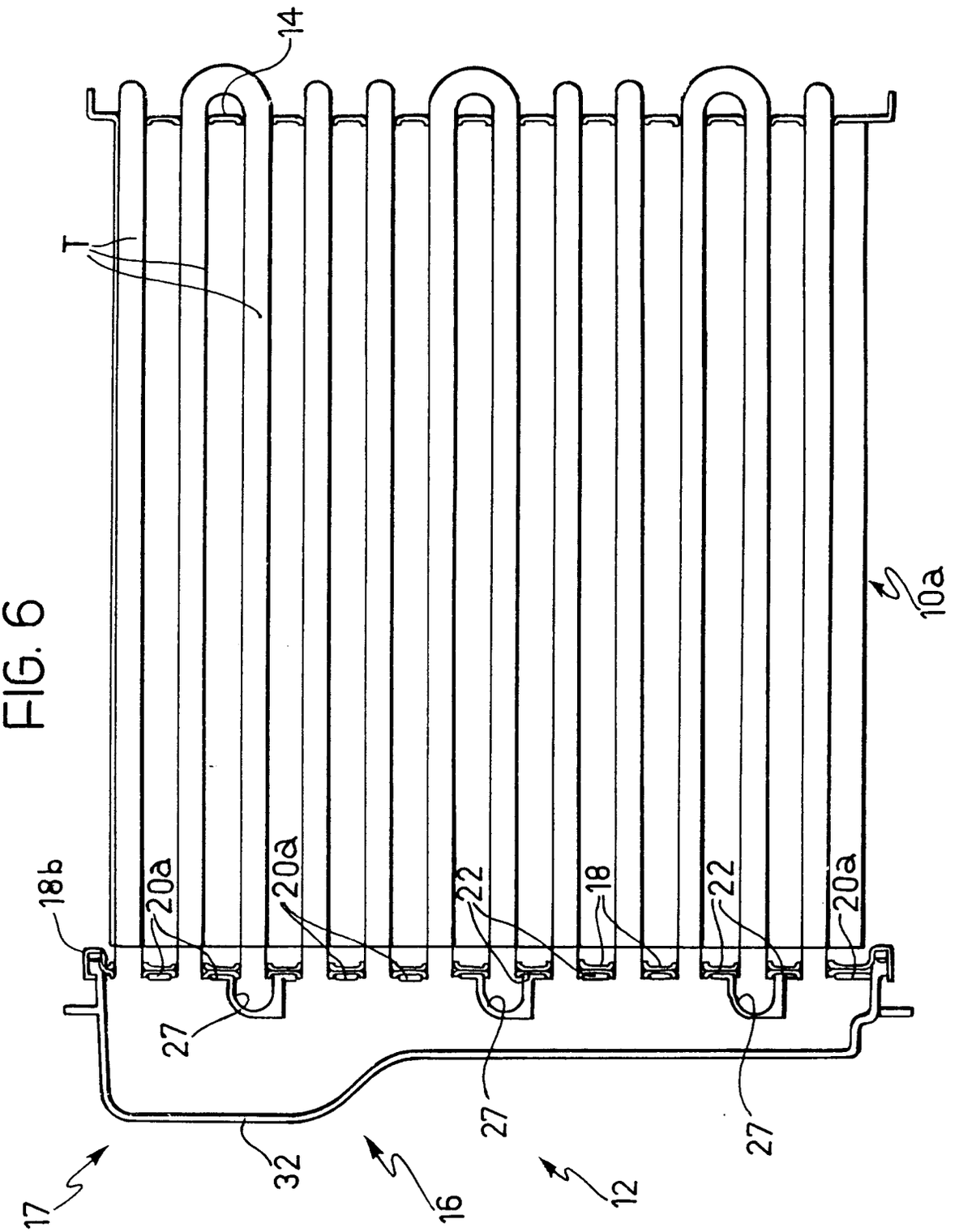

14
T
18b
18
27
20a
27
18
22
27
20a
22
22
20a
20b
27
B
B
B
27
A
A
A
27
32
30
27
16
12
17

FIG. 6



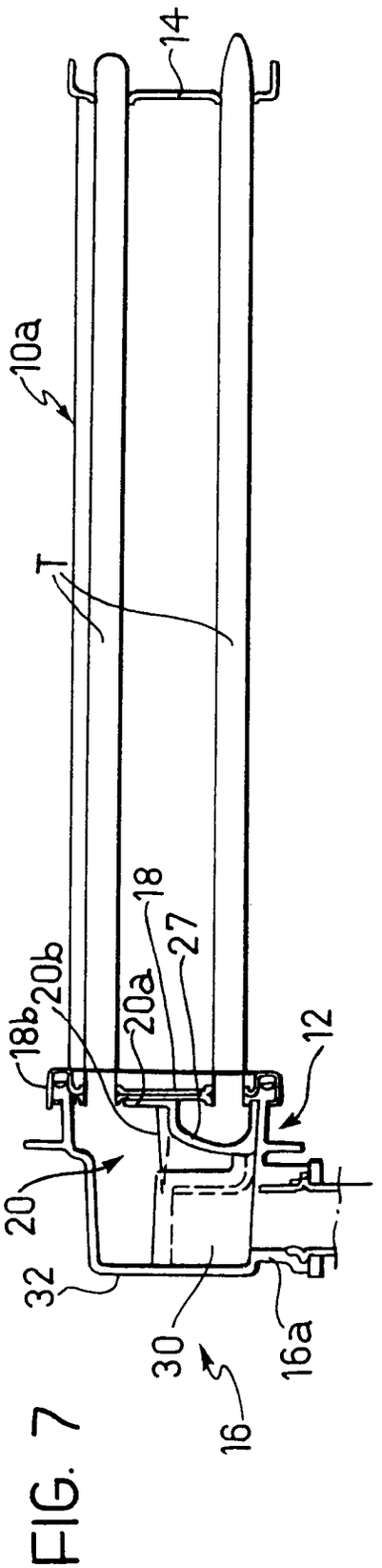


FIG. 7

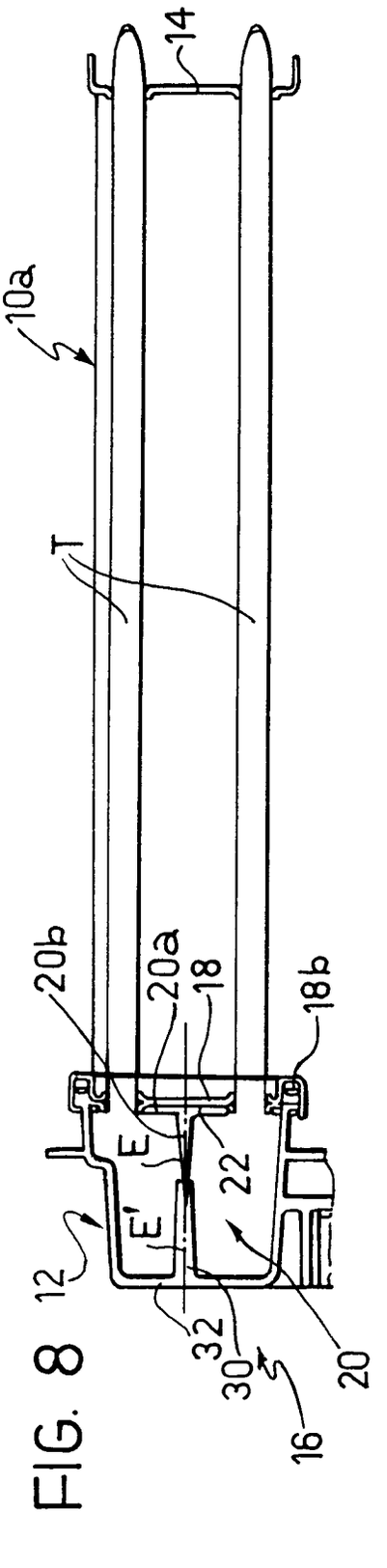


FIG. 8

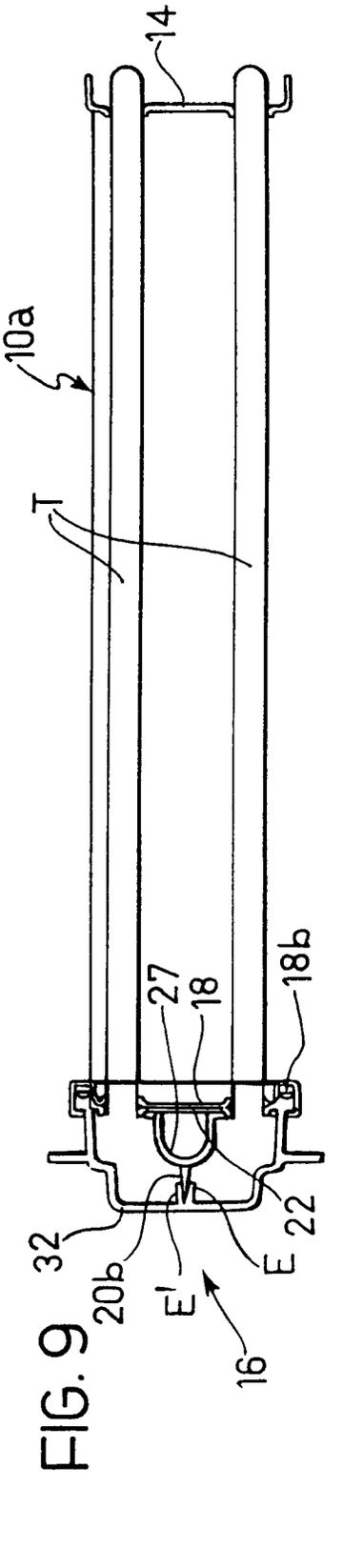


FIG. 9