



(11) **EP 2 109 742 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
19.03.2014 Bulletin 2014/12

(51) Int Cl.:
F24D 3/10 (2006.01)

(21) Application number: **08720199.2**

(86) International application number:
PCT/IT2008/000029

(22) Date of filing: **21.01.2008**

(87) International publication number:
WO 2008/090581 (31.07.2008 Gazette 2008/31)

(54) **AUTOMATIC FILLING UNIT FOR HYDRAULIC SYSTEMS WITH A CLOSED CIRCUIT LIKE HEATING SYSTEMS AND SIMILAR**

AUTOMATISCHE FÜLLEINHEIT FÜR HYDRAULISCHE SYSTEME MIT GESCHLOSSENEN HEIZSYSTEMEN UND DERGLEICHEN

UNITÉ DE REMPLISSAGE AUTOMATIQUE POUR DES SYSTÈMES HYDRAULIQUES AVEC CIRCUIT FERMÉ COMME DES SYSTÈMES DE CHAUFFAGE ET SYSTÈMES SEMBLABLES

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT
RO SE SI SK TR**

(30) Priority: **22.01.2007 IT MI20070088**

(43) Date of publication of application:
21.10.2009 Bulletin 2009/43

(73) Proprietor: **Giacomini S.p.A.
28017 S. Maurizio d'Opaglio (NO) (IT)**

(72) Inventor: **GIACOMINI, Corrado
I-28016 Orta S. Giulio (NO) (IT)**

(74) Representative: **Di Bernardo, Antonio
Praxi Intellectual Property S.p.A.
Via Mario Pagano, 69/A
20145 Milan (IT)**

(56) References cited:
**EP-A- 1 239 231 GB-A- 2 377 745
US-A- 5 960 818**

EP 2 109 742 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

Description of the Invention

Technical Field

[0001] The present invention relates to an automatic filling unit for hydraulic systems with a closed circuits, like heating systems and similar, according to the preamble to claim 1, wherein document EP-A-1 239 231 reveals all the features of the preamble of claim 1.

Background of the invention

[0002] As is well known, closed circuit hydraulic systems, such as heating systems, air conditioning systems, heating/cooling systems, and the like, after their installation require to be filled with the necessary quantity of operating circulation water, whereas such filling is also necessary after any total or partial emptying of said systems, e.g. because the radiators are vented or the systems are modified. In the present application, the collective definition of "heating system(s)" means the various executions of closed circuit hydraulic systems, in order to avoid repetitions.

[0003] The automatic filling of heating systems occurs by means of known automatic filling valve units in various embodiments and constructed conceptually as shown schematically in figure 1, in which the automatic filling valve 1 of the valve unit T is inserted in a pipeline 2 connected at one side, through an upstream on-off valve 3, to a water inlet pipeline 4 and, at the other side, through a downstream on-off valve 5, to an inlet pipeline 6 of the heating system, not shown. The valve 1 is provided with a calibration valve, which can generally be set, not shown herein, able to be controlled through a hand wheel 7 to select the predetermined filling pressure, which can be read on the pressure gauge 8. Said calibration spring, operatively associated to a on-off valve, not shown, forms an automatic system for opening/closing the direct path of the flow. The valve unit 1 also comprises a manual valve 9 as well as a filter, not shown, for retaining the impurities present in the passing flow of water. There is also a check valve, not shown, which prevents a reversal of the flow in case of a sudden pressure drop upstream.

[0004] The prior art also provides an external bypass conduit 11 comprising its own on-off valve 12, for a manual charging of the system in much shorter times. Moreover, a cock 13 is generally provided, which serves the purpose of reducing operating pressure or emptying the system.

[0005] From the outline description of the known automatic filling valve units, shown schematically in figure 1, it is apparent that they comprise the external bypass conduit 11 with its on-off valve, which therefore increase the size of the valve unit and thus require more construction/installation space.

[0006] The document US 5 960 818 A (document D2)

discloses a filling fitting for filling a closed hot-water heating system and comprising a tube separator including an upstream backflow preventer, a downstream backflow preventer, a drain valve as well as a pressure reducer, wherein the disclosed construction allows the downstream pressure reducer to be used in two different manner. In the proposed filling fitting inside the pressure reducer 24 is integrated a filter 128, wherein said filter is housed in a stable manner.

Summary of the Invention

[0007] At the basis of the present invention is the task of providing an automatic filling valve unit that is free of the disadvantages of prior art automatic filling valve units.

[0008] This task is accomplished, according to the invention, by means of an automatic filling unit for heating systems, which has the features of claim 1.

[0009] Additional advantageous developments of the invention are the subject of the dependent claims.

[0010] With the automatic filling unit according to the invention, several important advantageous are achieved. In the first place, the external bypass conduit with the related on-off valve present therein is eliminated. Indeed, the external bypass conduit, necessary for a rapid filling of the heating system, is advantageously provided inside the valve body of the filling unit, so that the known external bypass conduit is eliminated altogether, the size of the filling unit is reduced and the installation of the proposed filling unit is facilitated and made faster. The filling unit according to the invention also facilitates the stocking of the necessary installation components, because the union components and tubular sectors necessary for the construction of the known external bypass conduit are eliminated altogether.

[0011] With the incorporation of the bypass conduit within the body of the automatic filling valve, said body is enlarged by a negligible amount and said bypass conduit is obtained from the automatic shaving removal machining, slightly increased with respect to the machining already required to obtain the valve body, and with a wholly negligible lengthening of the machining time, so that, on one hand, production costs are obtained that are substantially similar to those expected for the production of the bodies of known automatic filling valves and, on the other hand, with the elimination of the external bypass conduit, a considerable saving in material is obtained along with reduced installation times.

Brief description of the drawings

[0012] Additional advantages, details and characteristics of the automatic filling unit and valve according to the invention shall become more readily apparent from the following description of a preferred embodiment of an automatic filling unit and valve according to the invention described by way of example hereafter and illustrated in the drawings, in which:

figure 1 shows a front outline view of the automatic filling units of the prior art;

figure 2 shows a perspective view of the unit with automatic filling valve according to the invention, with separate filter cartridge-check valve; and figures 3, 4 and 5 show, each, a longitudinal section of the assembled unit with automatic filling valve of figure 2, more specifically respectively during the manual loading operation (figure 3), during the automatic loading operation (figure 4), and while reaching the set pressure (figure 5).

Description of the preferred embodiment

[0013] With a prior art automatic filling unit and valve, shown in figure 1, the disadvantages mentioned in the introductory part are encountered.

[0014] Reference is now made to the unit T with automatic filling valve according to the invention, illustrated in figures 2 through 5, in which for parts shared with the known unit with automatic filling valve of figure 1, the same reference numbers are maintained.

[0015] More in detail, the automatic filling unit T comprises an automatic filling valve with a valve body 20, which houses a known opening/closing system 21a, which comprises a calibration spring 21, that is antagonist to the pressure P downstream of the valve 1 and that acts on the membrane 22. The valve body 20 comprises an inlet fitting 23 and an outlet fitting 24 able to be connected, the first with the water inlet pipeline, not shown, through an on-off valve 25, and the second is connected, through an on-off valve 26, to the pipeline, not shown, for entering the heating system, not shown. The arrow F indicates the direction of the flow of the water into the heating system. In the valve body 20, between the unions 23 and 24 is housed a filter 27 for retaining impurities, as well as a check valve 28, to prevent reverse flow phenomena in the case of a sudden pressure drop upstream of the valve 1.

[0016] According to the invention, moreover, in the body 20 of the automatic filling valve 1 is provided an internal bypass path 11 derived from the inlet fitting 23 and ending in the outlet fitting 24, whereas on the inlet side of said bypass 11 is provided an on/off valve 12, whose shutter 29 is able to close the shut-off port 30 of said bypass conduit 11 on the inlet side. The hand-wheel for controlling the shutter 29 is designated with the reference number 31.

[0017] Figures 3-5 also show that the shutter 32 of the on-off valve co-operating with the calibration spring 21 and forming therewith the known opening/closing system 21a is able to close the seat 33 of said opening/closing system. In the valve body 20 is also housed, in known fashion, a gauge 8 for reading the downstream pressure P.

[0018] Lastly, the valve body 20 has a union 34 with internal thread for housing the coupling thread 35 of a cartridge 36 housing, preferably coaxially, said filter 27

and said check valve 28 mentioned above.

[0019] With the automatic filling unit T according to the invention, a rapid calibration of the filling pressure is advantageously possible and the presence of the known manual valve 9 of figure 1 is practically made superfluous. Moreover, it is easy to verify whether the calibration of the operating pressure, set by the manufacturer, is maintained, by means of the seal 7a positioned on the adjusting hand-wheel 7. Alternatively, it is possible to use valves that can be calibrated manually by acting on the related hand-wheel 7.

Operation

[0020] Similarly to the automatic filling units of the prior art, with the unit with automatic filling valve according to the invention, three operative steps can be defined, and more specifically:

step 1: The empty heating system must be filled. In this step, the automatic shutter 32 is open, because the pressure P in the system to be filled is lower than the pressure set by means of the calibration spring 21, whereas to fill the heating system more rapidly, the bypass 11 is opened by opening the shutter 29 of the on-off valve 12. In this way, most of the water flow will pass through the bypass 11 as a result of the reduced head losses of said bypass conduit 11 relative to the head losses of the automatic system, i.e. within the valve 1. In this way, the heating system is filled quickly.

Step 2: the heating system is almost completely filled and the pressure in the heating system is close to the set pressure. At this point, acting on the on-off valve 12, the bypass conduit 11 is closed to prevent the filling pressure from reaching the set pressure, which is reached solely by means of the automatic path that traverses the valve 1.

Step 3: in this step, the downstream pressure, i.e. the pressure in the heating system, becomes equal to the set pressure. After the heating system is filled, the automatic shutter 32 moves to the closed position on the seat 33 because the effect of the pressure P downstream of the valve 1 will overcome the force of the calibration spring 21 (and it will open in the opposite case).

[0021] If it is necessary to reduce the operating pressure, or to empty the heating system, this will be obtained in known fashion by opening the drain cock 13. If the system is emptied, for maintenance or modifications to the heating system in operation, or already filled with water, the new filling operation will take place as indicated above.

[0022] Housing the filter 27 and the check valve 28 in the cartridge 36 allows to rapidly remove said cartridge 36 and clean the filter, or to replace the check valve 28 even with the automatic filling valve 1 installed, after sim-

ply closing the two on-off valves 25 and 26, even with the heating system in operation.

[0023] From the above structural and functional description of a filling unit with automatic filling valve according to the invention, it is readily apparent that with said unit and valve, the indicated task is effectively accomplished and the aforementioned advantages are obtained.

[0024] Those skilled in the art may introduce modifications and variants with respect, for example, to the illustrated automatic opening/closing system, as well as to the arrangement of other components, without thereby departing from the scope of protection of the automatic filling unit and valve according to the invention, as it is claimed in the appended claims.

Claims

1. An automatic filling unit (T) for hydraulic systems with a closed circuit, comprising an automatic filling valve (1) with an automatic opening/closing system (21a) with a spring (21) that acts against the pressure downstream housed in the body (20) of the automatic filling valve (1), which automatic filling unit (T) has an inlet fitting (23) to be connected to the water distribution pipeline, as well as an outlet fitting (24) to be connected to the inlet of the heating system, and comprising also a check valve (28) interposed between the inlet fitting (23) and the outlet fitting (24) in a direct path of the flow between the inlet fitting (23) and the outlet fitting (24), as well as a bypass conduit (11) interposed between said inlet fitting (23) and said outlet fitting (24) and housing an on-off valve (12), whereby said bypass path is obtained within the automatic filling unit (T), i.e. of the automatic filling valve body, **characterised in that**

- i) the automatic filling unit also comprises a filter (27), wherein the filter (27) and the check valve (28) provided downstream of the automatic opening/closing system (21a) are housed axially above each other in a cartridge (36) that is removably fastened to the body (20) of the automatic filling valve (1), and **in that**
- ii) the on-off valve (12) has a hand wheel for controlling the shutter (29) able to close a shut-off port (30) of said bypass conduit (11).

2. An automatic filling unit (T) as claimed in claim 1, **characterised in that** the cartridge (36), mounted in the body (20) of the automatic filling valve (1), has an axis coaxial to the axis of the automatic opening/closing system (21a).

3. An automatic filling unit (T) as claimed in claim 1, **characterised in that** in said bypass conduit (11) the on-off valve (25) thereof is positioned in the

branch of said bypass conduit (11) upstream of the automatic opening/closing system (21a) of the automatic filling valve (1).

4. A method of operating the automatic filling unit (T) as claimed in claims 1 and 3, **characterised in that**, with the on-off valve (25) of the bypass conduit (11) closed, the filling flow between the inlet fitting (23) and the outlet fitting (24) takes place through the direct path of the flow provided for the automatic opening/closing system (21a), whilst with the on-off valve (25) of the bypass conduit (11) open, said filling flow occurs partially through the path of said automatic opening/closing system (21a) and, prevalently, through said bypass conduit (11).
5. An automatic filling system for hydraulic systems with a closed circuit, e.g. a heating system, **characterised in that** it comprises an automatic filling unit (T) as claimed in one or more of the claims 1 through 4.

Patentansprüche

1. Automatische Fülleinheit (T) für hydraulische Systeme mit einem geschlossenen Kreis, welche Folgendes umfasst:

ein automatisches Füllventil (1) mit einem im Körper (20) des automatischen Füllventils (1) untergebrachten automatischen Öffnungs-/Schließsystem (21a) mit einer Feder (21), die gegen den stromabwärts auftretenden Druck wirkt, wobei die automatische Fülleinheit (T) ein Einlassstück (23), das mit der Wasserverteilungsrohrleitung zu verbinden ist, sowie ein Auslassstück (24), das mit dem Einlass des Heizsystems zu verbinden ist, aufweist, und auch ein Rückschlagventil (28), das zwischen dem Einlassstück (23) und dem Auslassstück (24) in einem direkten Strömungsweg zwischen dem Einlassstück (23) und dem Auslassstück (24) angeordnet ist, sowie eine Umgehungsleitung (11), die zwischen dem Einlassstück (23) und dem Auslassstück (24) angeordnet ist, und worin ein Schaltventil (12) untergebracht ist, wodurch der Umgehungsweg innerhalb der automatischen Fülleinheit (T), d.h. des Körpers des automatischen Füllventils, erhalten ist, **dadurch gekennzeichnet, dass**

- i) die automatische Fülleinheit auch einen Filter (27) umfasst, wobei der Filter (27) und das Rückschlagventil (28), die stromabwärts des automatischen Öffnungs-/Schließsystems (21a) bereitgestellt sind, axial übereinander in einer Patrone (36) un-

- tergebracht sind, die entfernbar am Körper (20) des automatischen Füllventils (1) befestigt ist, und dass
- ii) das Schaltventil (12) ein Handrad zum Steuern des Verschlusses (29) aufweist, wodurch eine Schließöffnung (30) der Umgehungsleitung (11) geschlossen werden kann.
2. Automatische Fülleinheit (T) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Patrone (36), die im Körper (20) des automatischen Füllventils (1) angebracht ist, eine Achse aufweist, die zur Achse des automatischen Öffnungs-/Schließsystems (21a) koaxial ist.
3. Automatische Fülleinheit (T) nach Anspruch 1, **dadurch gekennzeichnet, dass** in der Umgehungsleitung (11) das Schaltventil (25) im Zweig der Umgehungsleitung (11) stromaufwärts des automatischen Öffnungs-/Schließsystems (21a) des automatischen Füllventils (1) angeordnet ist.
4. Verfahren zum Betreiben der automatischen Fülleinheit (T) nach den Ansprüchen 1 und 3, **dadurch gekennzeichnet, dass** bei geschlossenem Schaltventil (25) der Umgehungsleitung (11) die Füllströmung zwischen dem Einlassstück (23) und dem Auslassstück (24) durch den für das automatische Öffnungs-/Schließsystem (21a) bereitgestellten direkten Strömungsweg stattfindet, während bei geöffnetem Schaltventil (25) der Umgehungsleitung (11) die Füllströmung teilweise durch den Weg des automatischen Öffnungs-/Schließsystems (21a) und vorherrschend durch die Umgehungsleitung (11) stattfindet.
5. Automatisches Füllsystem für hydraulische Systeme mit einem geschlossenen Kreis, beispielsweise ein Heizsystem, **dadurch gekennzeichnet, dass** es eine automatische Fülleinheit (T) nach einem oder mehreren der Ansprüche 1 bis 4 aufweist.

Revendications

1. - Unité de remplissage automatique (T) pour systèmes hydrauliques avec circuit fermé, comprenant une vanne de remplissage automatique (1) avec un système d'ouverture/fermeture automatique (21a) ayant un ressort (21) qui agit à l'encontre de la pression en aval reçu dans le corps (20) de la vanne de remplissage automatique (1), laquelle unité de remplissage automatique (T) a un raccord d'entrée (23) destiné à être relié à la canalisation de distribution d'eau, ainsi qu'un raccord de sortie (24) destiné à être relié à l'entrée du système de chauffage, et comprenant également un clapet de non-retour (28) in-

terposé entre le raccord d'entrée (23) et le raccord de sortie (24) dans un trajet direct de l'écoulement entre le raccord d'entrée (23) et le raccord de sortie (24), ainsi qu'une conduite de dérivation (11) interposée entre ledit raccord d'entrée (23) et ledit raccord de sortie (24) et recevant une vanne tout ou rien (12), ce par quoi ledit trajet de dérivation est obtenu à l'intérieur de l'unité de remplissage automatique (T), à savoir dans le corps de vanne de remplissage automatique, **caractérisée par le fait que** :

i) l'unité de remplissage automatique comprend également un filtre (27), le filtre (27) et le clapet de non-retour (28) situés en aval du système d'ouverture/fermeture automatique (21a) étant reçus axialement l'un au-dessus de l'autre dans une cartouche (36) qui est fixée de façon amovible au corps (20) de la vanne de remplissage automatique (1), et **par le fait que** :

ii) la vanne tout ou rien (12) a un volant de manœuvre pour commander l'obturateur (29) apte à fermer un orifice de fermeture (30) de ladite conduite de dérivation (11).

2. - Unité de remplissage automatique (T) selon la revendication 1, **caractérisée par le fait que** la cartouche (36), montée dans le corps (20) de la vanne de remplissage automatique (1), a un axe coaxial à l'axe du système d'ouverture/fermeture automatique (21a).
3. - Unité de remplissage automatique (T) selon la revendication 1, **caractérisée par le fait que**, dans ladite conduite de dérivation (11), la vanne tout ou rien (25) de celui-ci est positionnée dans la branche de ladite conduite de dérivation (11) en amont du système d'ouverture/fermeture automatique (21a) de la vanne de remplissage automatique (1).
4. - Procédé de fonctionnement de l'unité de remplissage automatique (T) selon l'une des revendications 1 et 3, **caractérisé par le fait que**, avec la vanne tout ou rien (25) de la conduite de dérivation (11) fermée, l'écoulement de remplissage entre le raccord d'entrée (23) et le raccord de sortie (24) a lieu à travers le trajet direct de l'écoulement prévu pour le système d'ouverture/fermeture automatique (21a), alors que, avec la vanne tout ou rien (25) de la conduite de dérivation (11) ouverte, ledit écoulement de remplissage se produit partiellement à travers le trajet dudit système d'ouverture/fermeture automatique (21a) et, de manière principale, à travers ladite conduite de dérivation (11).
5. - Système de remplissage automatique pour systèmes hydrauliques avec circuit fermé, par exemple un système de chauffage, **caractérisé par le fait qu'il** comprend une unité de remplissage automati-

que (T) telle que définie à l'une des revendications
1 à 4.

5

10

15

20

25

30

35

40

45

50

55

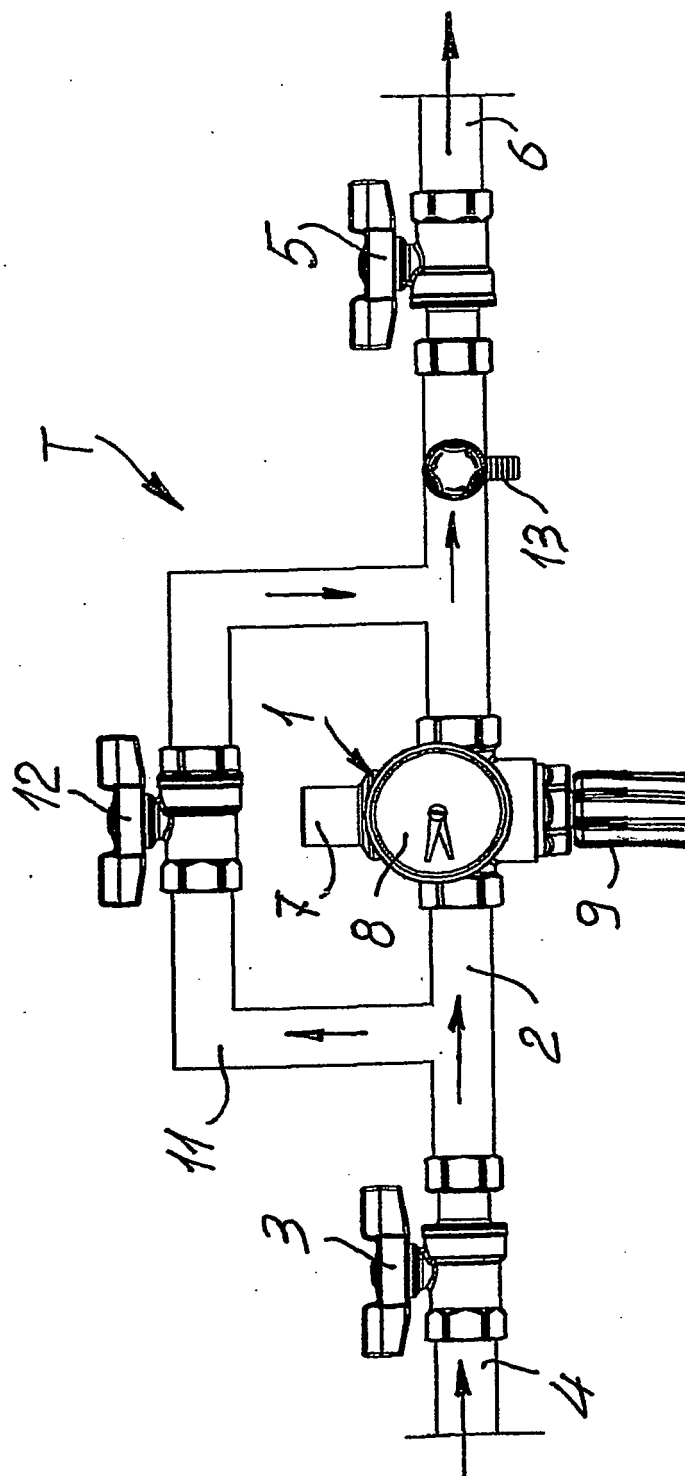


Fig. 1

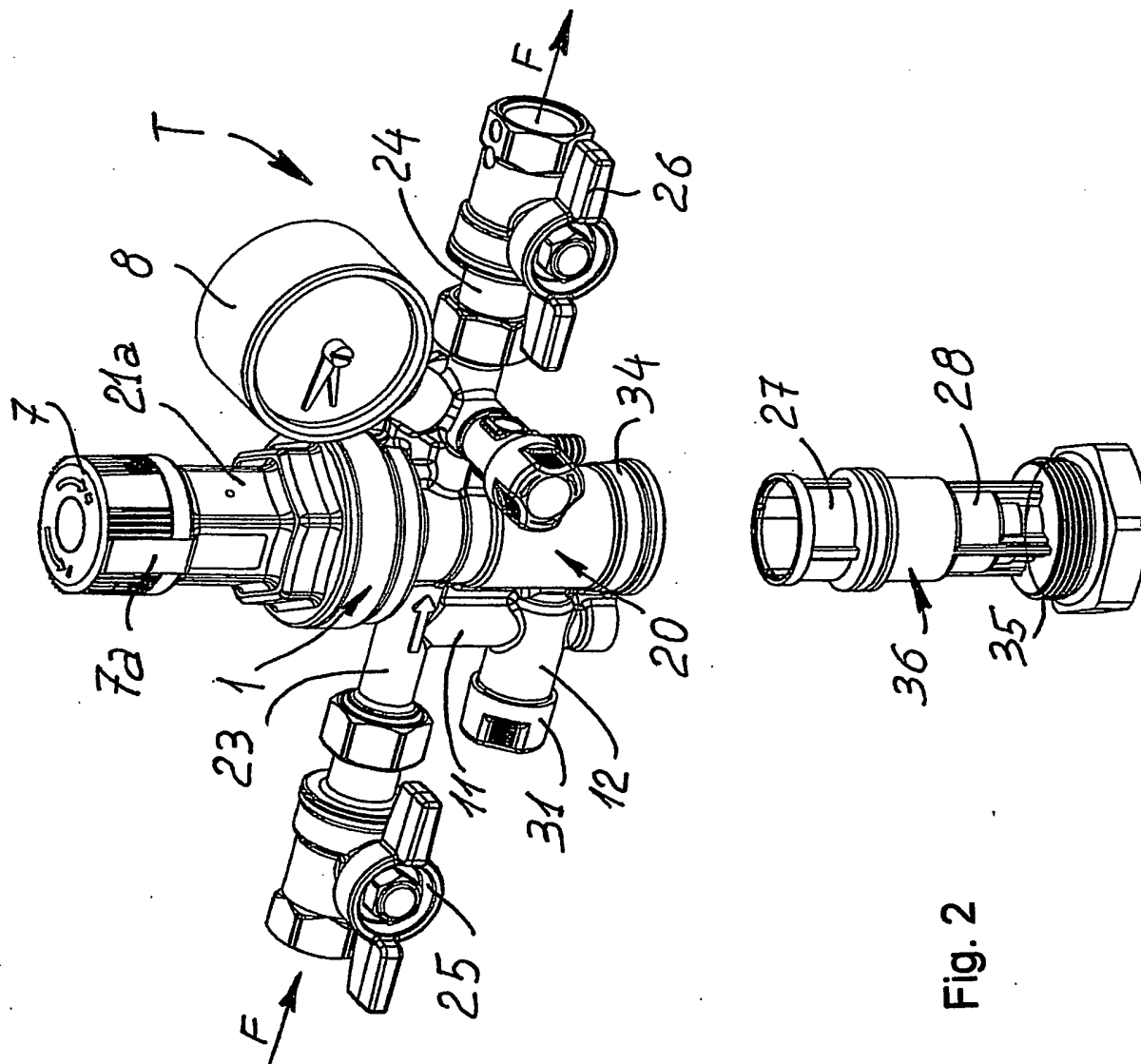


Fig. 2

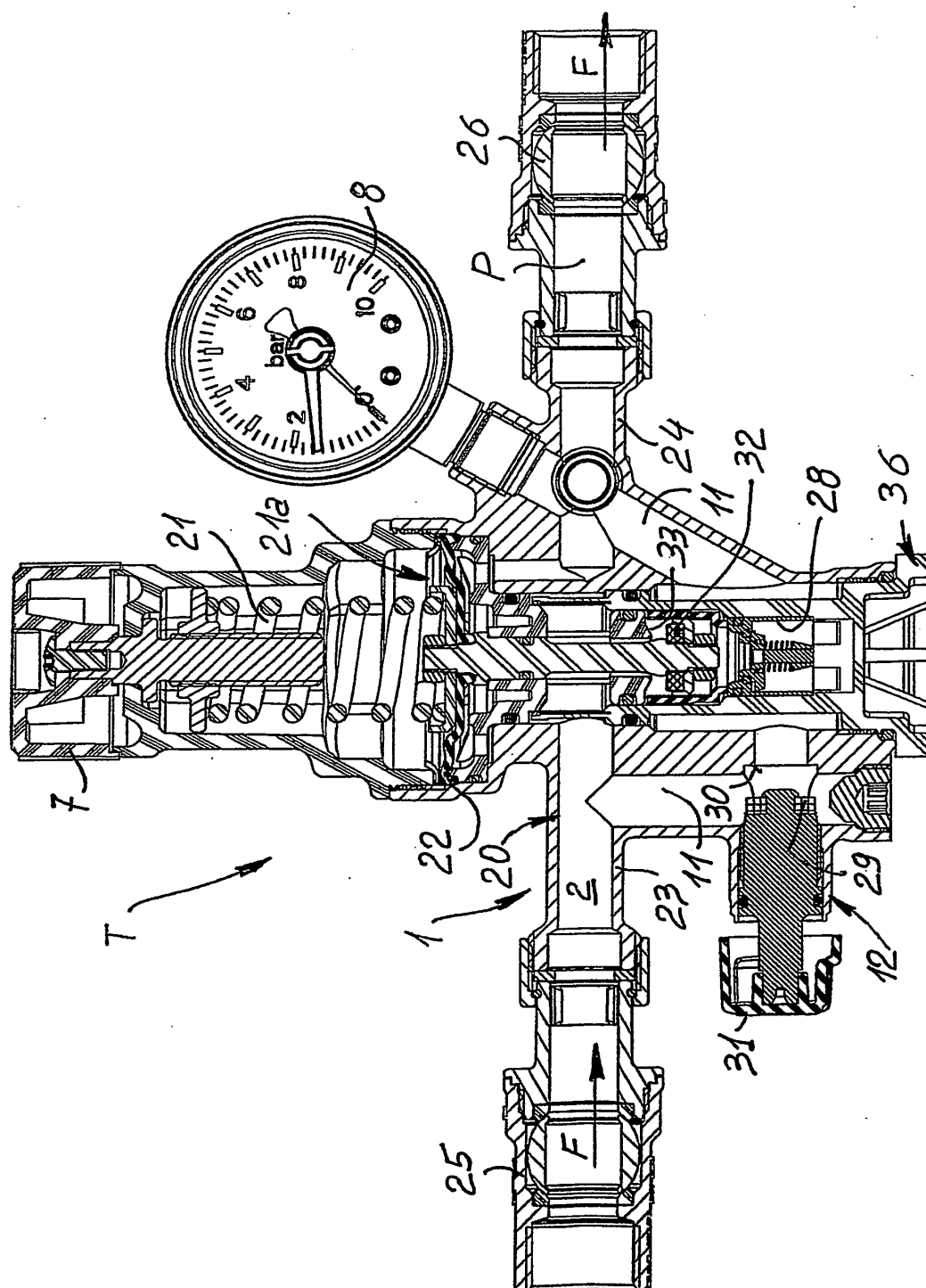


Fig. 3

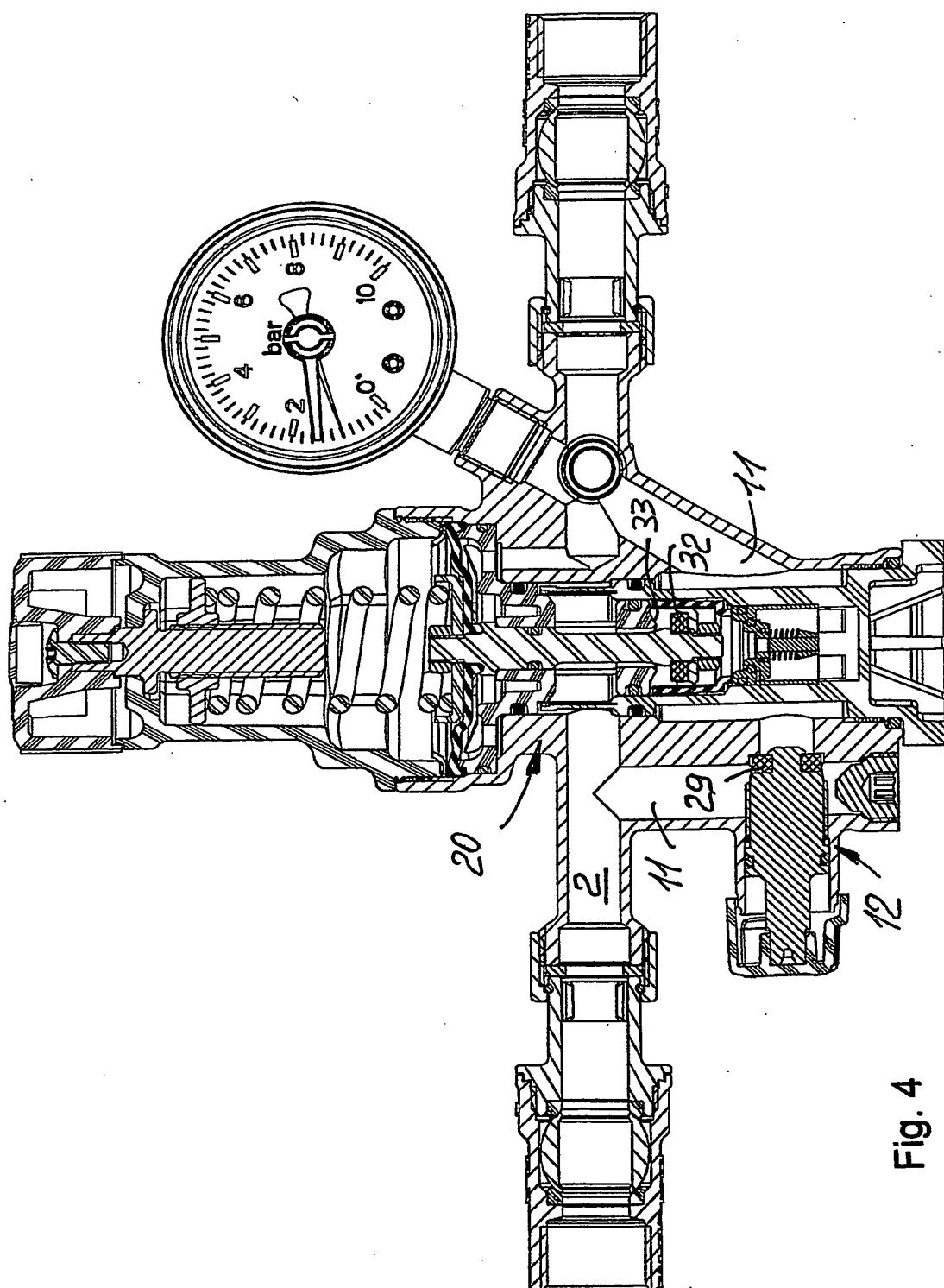


Fig. 4

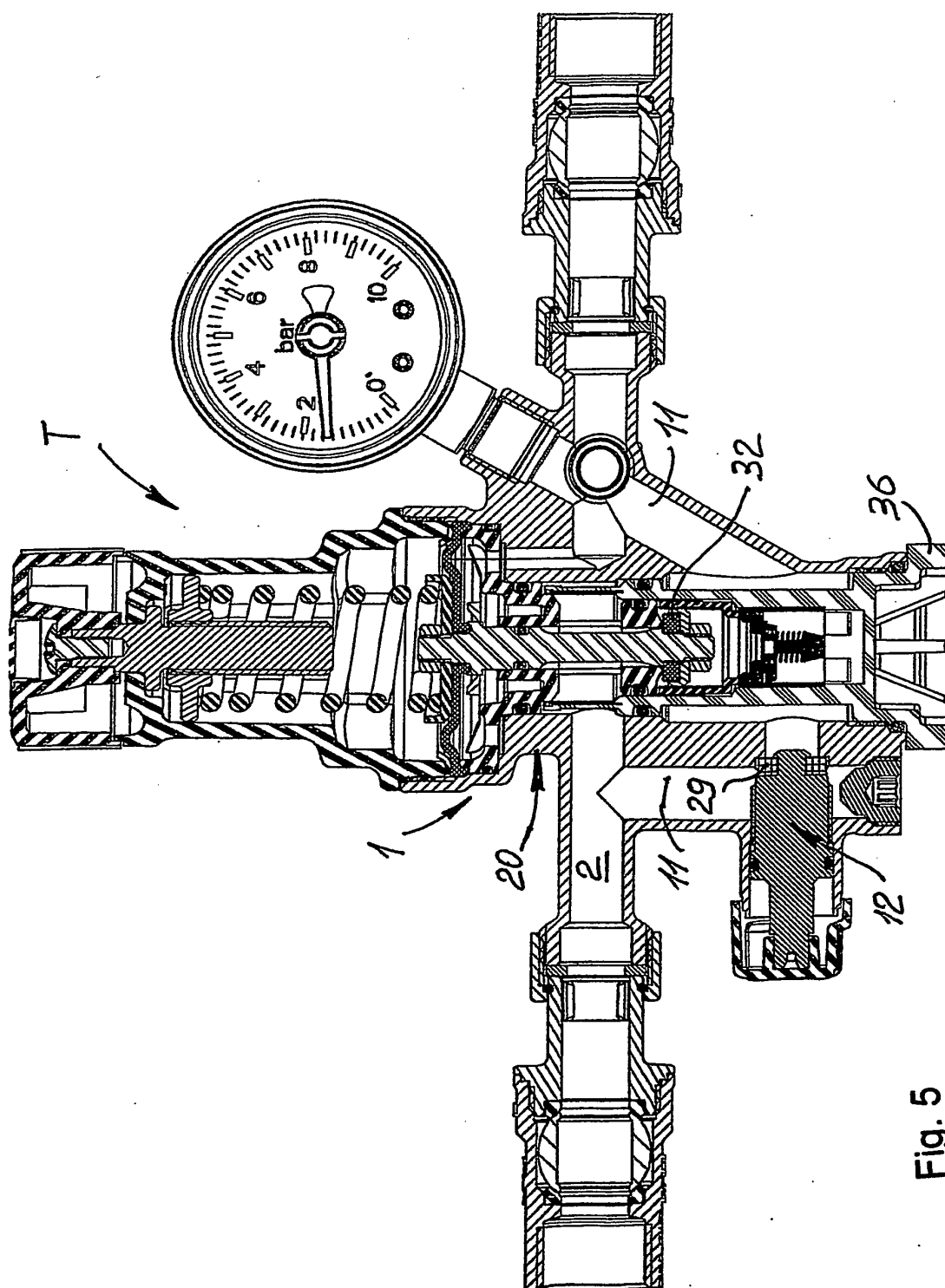


Fig. 5

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1239231 A [0001]
- US 5960818 A [0006]