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(21) International Application Number: PCT/US91/07145 (22) International Filing Date: 27 September 1991 (27.09.91) (30) Priority data: 591,067 1 October 1990 (01.10.90) US (71)(72) Applicants and Inventors: FLO-CON SYSTEMS, INC. [US/US]; 1404 Newton Drive, Champaign, IL 61821 (US). KING, Patrick, D. [US/US]; 1808 Lon Drive, Rantoul, IL 61866 (US). (74) Agent: DOMINIK, Jack, E.; Dominik, Stein, Saccocio, Reese, Colitz & Van Der Wall, Suite 225, 6175 N.W., 153rd Street, Miami Lakes, FL 33014 (US).		(81) Designated States: AT (European patent), BE (European patent), BR, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent). Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
(54) Title: CLAMP FOR BANDLESS REFRACTORY AND METHOD (57) Abstract A sliding gate valve assembly which has a stationary refractory plate mounted to a mounting plate and secured there by the force pressed against it exerted by another refractory is disclosed. A clamp ring is provided which has extending ears, each of which is bored to ride on a clamp spring assembly. Yieldable means, preferably a coil spring, surrounds the shank of the clamp spring assembly guide shank and engages the underside of the ear and rides in the main frame. When the main frame is closed, pressure is urged on the spring which, in turn, transmits the force to the clamp, the tapered inner edge of which engages the tapered outer edge of the stationary plate. The method of the present invention depends upon utilizing the clamping force of a valve assembly having a main frame and in which yieldable means are provided between the main frame and the mounting plate to urge a continuous clamp ring into engagement with the bandless stationary plate having tapered sidewalls.		

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⁺ Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

CLAMP FOR BANDLESS REFRACTORY AND METHOD

Field of the Invention: The present invention relates to valves of the type used primarily in the teeming of steel.

5 Such valves are exemplified by United States Patent Nos. 4,582,232 and 4,573,616.

Summary of the Prior Art: The prior art is also exemplified by United States Patent No. 4,063,668. The refractory inserts
10 in the valve shown in that patent, however, are encased in a metal jacket. An improved-type refractory is shown in United States Patents Nos. 4,582,232 and 4,573,616 where there is no metal encasement of the refractory, and the refractory side edges are tapered in such a fashion that they receive clamping
15 members which exert a force component both centrally and downwardly to simultaneously retain the refractory against expansion and cracking due to thermal shock, and also provide a downward component (in some instances upward where the top plate is clamped) to hold the refractory to the valve. While
20 this has provided an improvement, the means for clamping the refractory to the mounting plate in the situation of the upstream of stationary plate has required one or more elements which have to be bolted to a mounting plate. This takes time, and the bolts are subject to the highly corrosive environment
25 of the teeming of steel. What is desirable is to develop a clamp which is virtually automatic in nature, and wherein the force of the springs and the clamping to the main frame is employed to urge an external clamping action against the periphery of the refractory.

- Summary of the Invention:** The present invention is directed to a sliding gate valve assembly which has a stationary refractory plate mounted to a mounting plate and secured there by the force pressed against it exerted by another refractory.
- 5 A clamp ring is provided which has extending ears, each of which is formed to ride on a clamp spring assembly. Yieldable means, preferably a coil spring, surrounds the shank of the clamp spring assembly guide shank and engages the underside of the ear and rides in the main frame. When the main frame is
- 10 closed, pressure is urged on the spring which, in turn, transmits the force to the clamp, the tapered inner edge of which engages the tapered outer edge of the stationary plate. The method of the present invention depends upon utilizing the clamping force of a valve assembly having a main frame and in
- 15 which yieldable means are provided between the main frame and the mounting plate to urge a continuous clamp ring into engagement with the bandless stationary plate having tapered sidewalls.
- 20 It is a principal object of the present invention to minimize the time of mounting a bandless refractory having tapered sidewalls into position as the stationary plate of a valve assembly.
- 25 A related object of the present invention is to eliminate the necessity for bolting one or more elements to a mounting plate to thereby secure a stationary bandless refractory in position.

Yet another object of the present invention is to provide the above advantages in a construction which is simple, inexpensive, and repeatedly durable and effective in usage.

5 **Brief Description of the Drawings:** Further objects and advantages of the present invention will become apparent as the following description of an illustrative embodiment proceeds, taken in conjunction with the accompanying drawings, in which:

10

FIG. 1 is a plan view through a central portion of the valve assembly taken essentially along section line 1-1 of **FIG. 2**;

15 **FIG. 2** is a skewed sectional drawing of the valve assembly of **FIG. 1** taken along section line 2-2 and showing on the left side a unitary nozzle plate, and on the right side of center, an exemplary two-piece nozzle and interlocking plate;

20 **FIG. 3** is sectional view taken along section line 3-3 of **FIG. 1** illustrating in particular the spring assemblies utilized in engaging the clamping ring and the bolt assembly utilized in securing the main frame to the mounting plate;

25 **FIG. 4** is an enlarged view of the spring assemblies shown in **FIGS. 2** and **3**;

FIG. 5 is a fragmentary, exploded three-dimensional view of the spring assembly of **FIG. 4**; and

FIG. 6 is an exploded three-dimensional view of the components of FIGS. 1 and 2.

Description of a Preferred Embodiment: Turning now to FIG. 2, it will be seen that the exemplary valve assembly 10 is secured to the exterior portion of a vessel. The nozzle 18 penetrates the vessel wall 11 which is normally a steel shell, and the vessel lining 12 which is normally a refractory brick. In the present instance a stopper rod 14 engages the upper portion of the nozzle 18 to permit or stop the flow of steel from the interior portion of the vessel to the tube 20. The valve assembly 10 is secured to the vessel 11 by means of a mounting plate 15, the same securing the tube 20 to the nozzle plate 16. The nozzle plate 16 shown to the left-hand portion of the center line is unitary including both the nozzle portion and plate portion. Shown diagrammatically at the right-hand side of FIG. 2 is a two-piece nozzle 18, with a lower plate 19 interlocked and secured to the nozzle 18. In the application with a stopper rod, there is a risk of aspiration at any joint, and accordingly the unitary nozzle plate construction 16 is most desirable. On the other hand there are applications where different refractory materials may be employed, and then the individual nozzle 18 cooperating with the plate 19 may prove more desirable. Hereinafter and in the claims the term nozzle/plate collectively refers to both embodiments.

The tube 20 has a tube collar 21 at its upstream portion, and is surrounded by a tube collar band 22 normally of a metal material. The purpose of the tube collar band is to receive the rocker arms 26 and permit the tube to be exchanged or shifted in and out of teeming relationship with the nozzle/plate 16. A stopper rod seat 24 is provided at the upper portion of the nozzle/plate 16 or the nozzle 18. It is curvilinear and seats with the curvilinear bullet nose of the stopper rod 14. The main frame 25 is shown in both FIGS. 1 and 2 and secures the rockers 26 which are mounted to rocker pivots 28 and rocker spring 29 so that the central end of the rocker 26 engages the downstream portion of the tube collar band 22.

In accordance with the invention, the clamp ring 30 as shown in FIGS. 1, 2 and 3 is essentially rectangular and provided centrally with a clamp ring taper 31 which matingly engages the plate taper 32 of the plate 19 or the lower portion of the plate nozzle 16.

Particularly as shown in FIGS. 2, 3 and 4, the clamp spring assembly 35 includes a clamp guide 36 and a clamp spring 38, the clamp spring being secured beneath the guide head 39 and in coaxial relationship to the clamp guide shank 40 above the mounting threads 41. This relationship is shown in enlarged scale in FIG. 4, and in exploded relationship in FIG. 5.

Finally, turning now to FIG. 1, it will be seen that there is a rocker spring cooling manifold 45 with a plurality of orifices mounted to cool the rocker springs in operation. The clamp ring 30 is provided with clamping ears 46 at one side, and the clamp key 48 at the opposite corners is of a different size to prevent reversal of the clamp ring 30. Finally, the mounting bolts 50 are employed, particularly as shown in FIG. 3, to secure the main frame to the mounting plate.

The Method: The method of operating the subject valve assembly 10 includes mounting such a valve assembly 10 onto a vessel wall 11 and positioning a mounting plate 15 onto the vessel wall 11 and inserting a nozzle/plate 16 or nozzle 18 and plate 19 into the vessel. The relationship of the elements and the sequence of assembly is illustrated in FIG. 6. Provision must be made for a main frame 25 having rockers 26 and including a clamp ring 30 having a central clamp ring taper 31 against the plate taper 32. The clamp spring assembly 35 is also provided to bridge the gap between the clamp ring 30 and the main frame 25. Thereafter, the steps of the method involve firstly placing the clamping ring 30 in surrounding relationship to the plate 16, 19 by the opposed tapered sidewalls 31, 32. Thereafter, the clamping ring 30 is loaded in engagement with the tapered sidewalls 32 of the plate 16, 19 by means of clampingly engaging the main frame 25 to the mounting plate 15 thereby applying a compressive pre-stress in plate 16, 19. The final step of the method contemplates proportioning the spacial relationship between the mounting plate 15, main frame 25, clamping ring 30, and yieldable spring assembly 35 to insure that the mounting force of the frame 25 is shared between the preloading of the clamp ring 30 to the plate 16, 18 and the subsequent clamping action by the main frame 25 against the clamping ring 30 as the main frame 25 is secured to the mounting plate 15.

Although particular embodiments of the invention have been shown and described in full here, there is no such limitation

of embodiments. On the contrary, the intention is to cover all modifications, alternatives, embodiments, usages and equivalents as fall within the spirit and scope of the present invention, specification and appended claims.

WHAT IS CLAIMED IS:

1. A valve assembly comprising, in combination,
 - a nozzle/plate assembly for insertion into a vessel in which the side walls of the plate are continuous and continuously taper outwardly from the downstream face of the plate toward the vessel,
 - a mounting plate for securing the valve assembly to a vessel,
 - a main frame for yieldably urging a depending tube having an upstream flat face in face to face relationship with the outer face of the nozzle/plate,
 - a clamp ring for insertion interiorly of the main frame having tapered sidewalls for a meeting engagement with the nozzle/plate sidewalls,
 - spring assemblies for seating in the main frame and bearing against the clamp ring,
 - means for clampingly securing the main frame to the mounting plate,
 - means on the clamp ring for securing the same to the main frame,
 - all of said elements being proportioned and oriented to permit the means for securing the clamp ring to the main frame to preload the spring assembly against the clamp ring, and when subsequently securing the main frame to the mounting plate, further applying pressure to the spring assembly, whereby upon the closing of the main frame to the mounting plate the clamp ring has a preselected substantial central and

clamping force engaging the periphery of the continuous sidewall of the plate.

2. In the valve assembly of claim 1 above,

- said tube having a tube collar at its upstream
5 portion,

- said main frame having a plurality of spring mounted pivotal members for securing the upstream portion of the tube in teeming relationship with the nozzle.

3. In the valve assembly of claim 1 above,

10 - means for engaging said tube with a replacement tube and moving a tube to be exchanged along the rocker arm support assembly by means of a new tube to be placed in service.

4. In the valve assembly of claim 1 above,

- said spring assembly for engaging the clamp ring
15 having a clamping guide,

- said guide having an enlarged head,

- said guide having a guide shank terminating at its lower end with mounting threads,

- and a spring for coaxially engaging the clamping
20 guide beneath the guide head and the opposite end of the spring engaging a seat interiorly of the main frame.

5. A method of securing a valve assembly in which a refractory plate having tapered sidewalls is engaged in surrounding fashion by a clamp ring having mating tapering
25 sidewalls and in which a mounting plate receives a main frame which is clampingly secured thereto and in which a spring assembly is provided interiorly in the frame and coupled relationship to the clamp ring, comprising the steps of

- first placing the clamping ring in surrounding relationship to the plate having tapered sidewalls and pre-loading the same to the spring assembly,

- loading the clamping ring in engagement with the tapered sidewalls of the plate by means of clampingly engaging the main frame to the mounting plate,

- and proportioning the spacial relationship between the mounting plate, main frame, clamping ring, and yieldable spring assembly to ensure that the mounting force of the frame is shared between the loading of the clamp ring to the plate and the loading to effect sealing of the face to face relationship of the plates in the valve assembly.

6. A clamp ring assembly for use in a valve for teeming metal from a vessel in which the valve includes a mounting plate for securing the same to the vessel, a frame which is removably secured to the mounting plate by clamping means, a refractory adjacent a teeming orifice in a nozzle in the vessel, said refractory having tapered end walls tapering outwardly in an upstream direction toward the mounting plate, said clamp ring assembly comprising, in combination,

- a clamp ring proportioned to surround the stationary refractory having tapered walls,

- said clamp ring having spring assembly engaging ears on its periphery,

- a spring assembly mounted in the frame and secured to the clamp ring ears,

- the foregoing all proportioned and oriented to permit preloading of the clamp ring prior to closing the frame onto the mounting plate by means of the mounting means, whereby a first preload is applied to the clamp ring and
5 thereafter a secondary load applied by the frame clamping means to the end that the load on the clamping ring is shared between the spring assembly and the means for clamping the frame to the mounting plate.

7. In the valve assembly of claim 6 above,

10 - said spring assembly for engaging the clamp ring having a clamping guide,

- said guide having an enlarged head,

- said guide having a guide shank terminating at its lower end with mounting threads,

15 - and a spring for coaxially engaging the clamping guide beneath the guide head and the opposite end of the spring engaging a seat interiorly of the main frame.

8. A method of securing a valve assembly in which a refractory plate having tapered sidewalls is engaged in
20 surrounding fashion by a clamp ring having mating tapering sidewalls and in which a mounting plate receives a main frame which is clampingly secured thereto and in which a yieldable assembly is provided interiorly in the frame and coupled relationship to the clamp ring, comprising the steps of:

25 - placing the clamping ring in surrounding relationship to the plate having tapered sidewalls,

- loading the clamping ring in engagement with the tapered sidewalls of the plate by means of clampingly engaging the main frame to the mounting plate,

- and proportioning the spacial relationship between the mounting plate, main frame, clamping ring, and yieldable spring assembly to ensure that the mounting force of the frame is shared between the loading of the clamp ring to the plate and the loading to effect sealing of the face to face relationship of the plates in the valve assembly.

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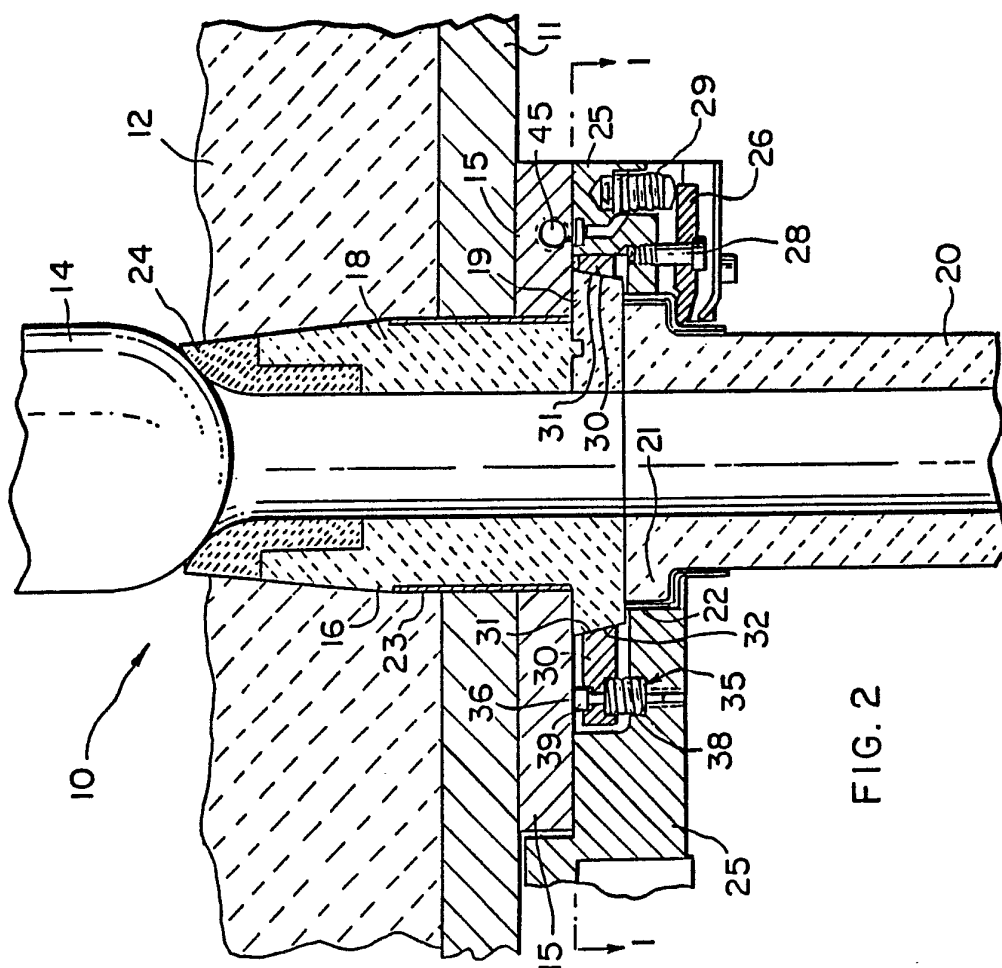


FIG. 2

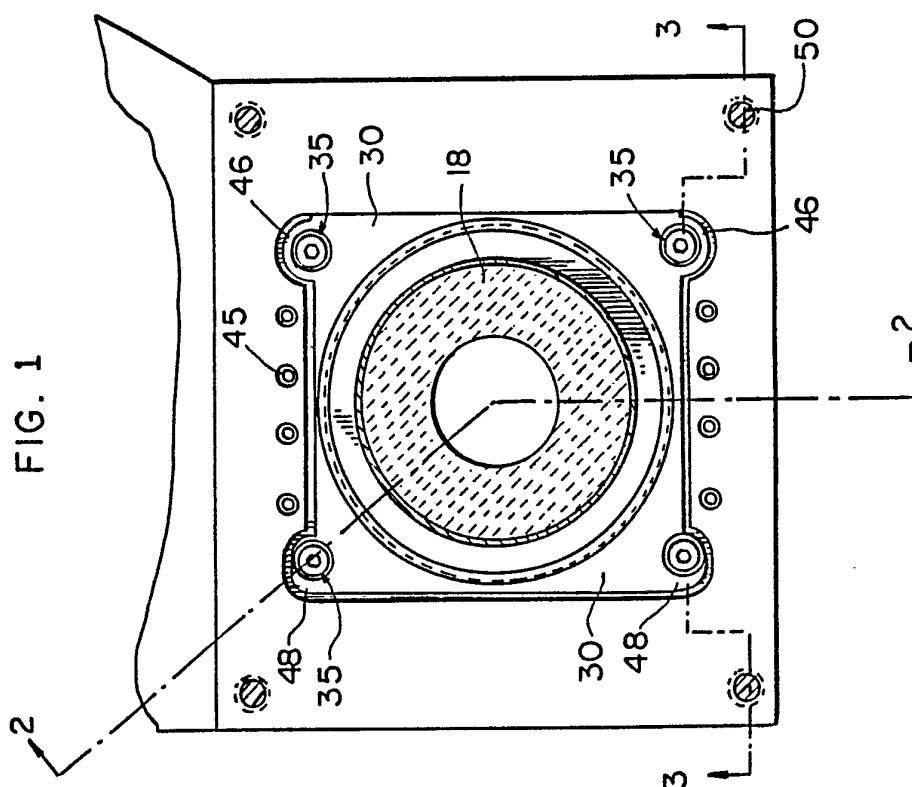
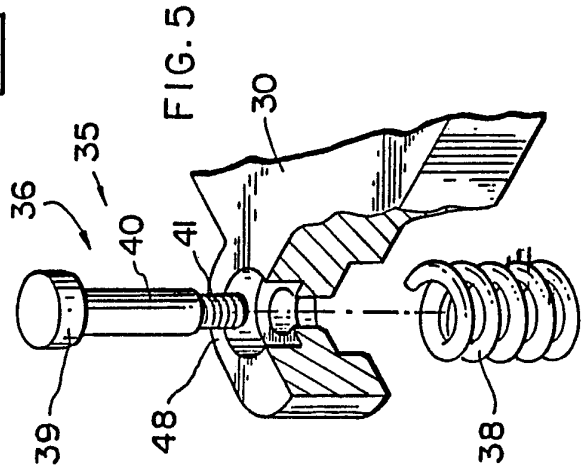
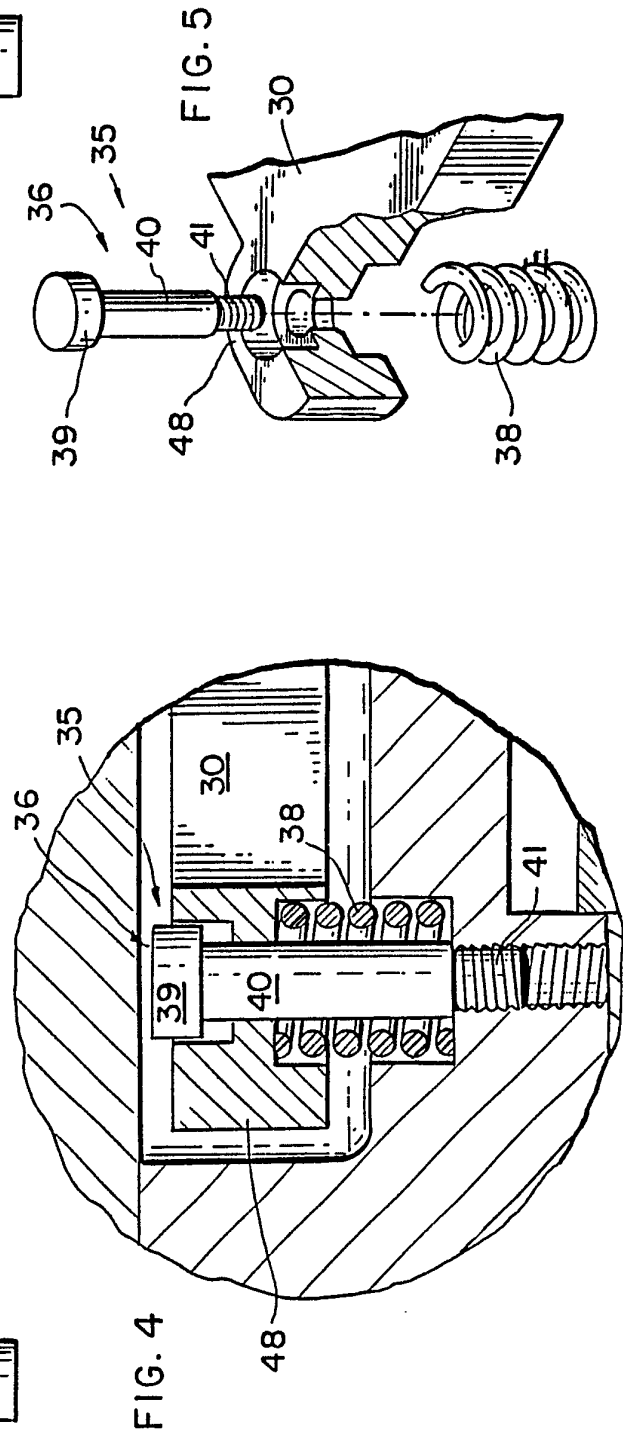
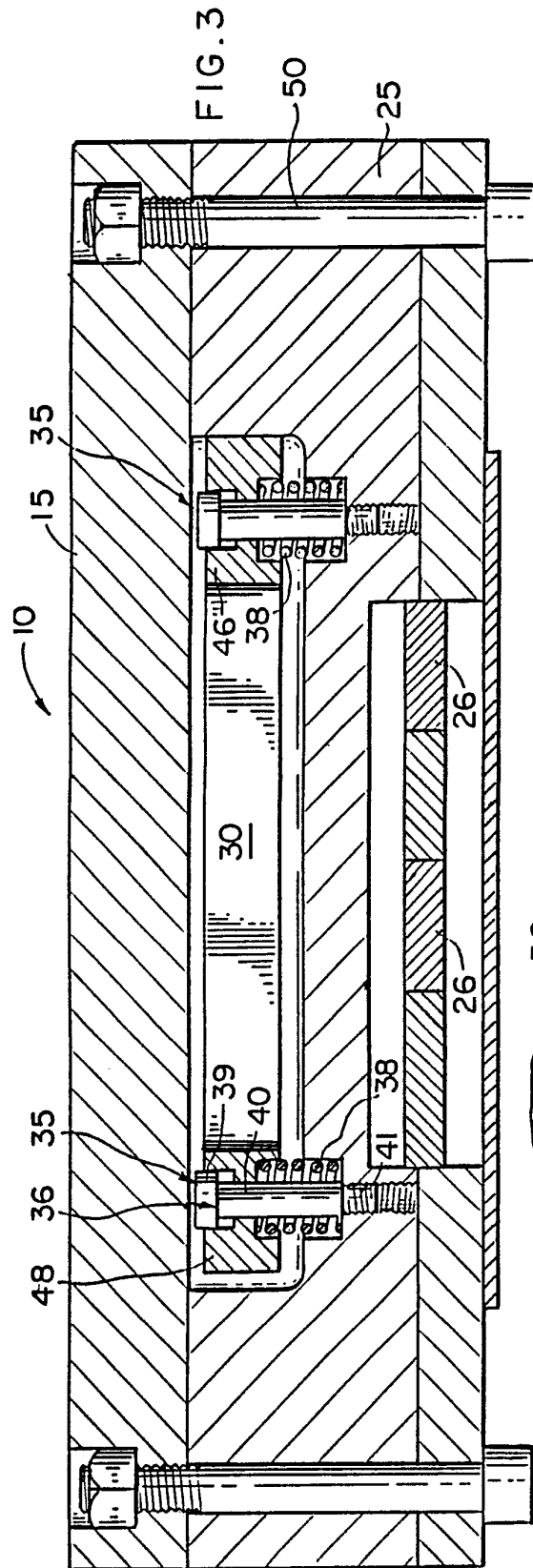
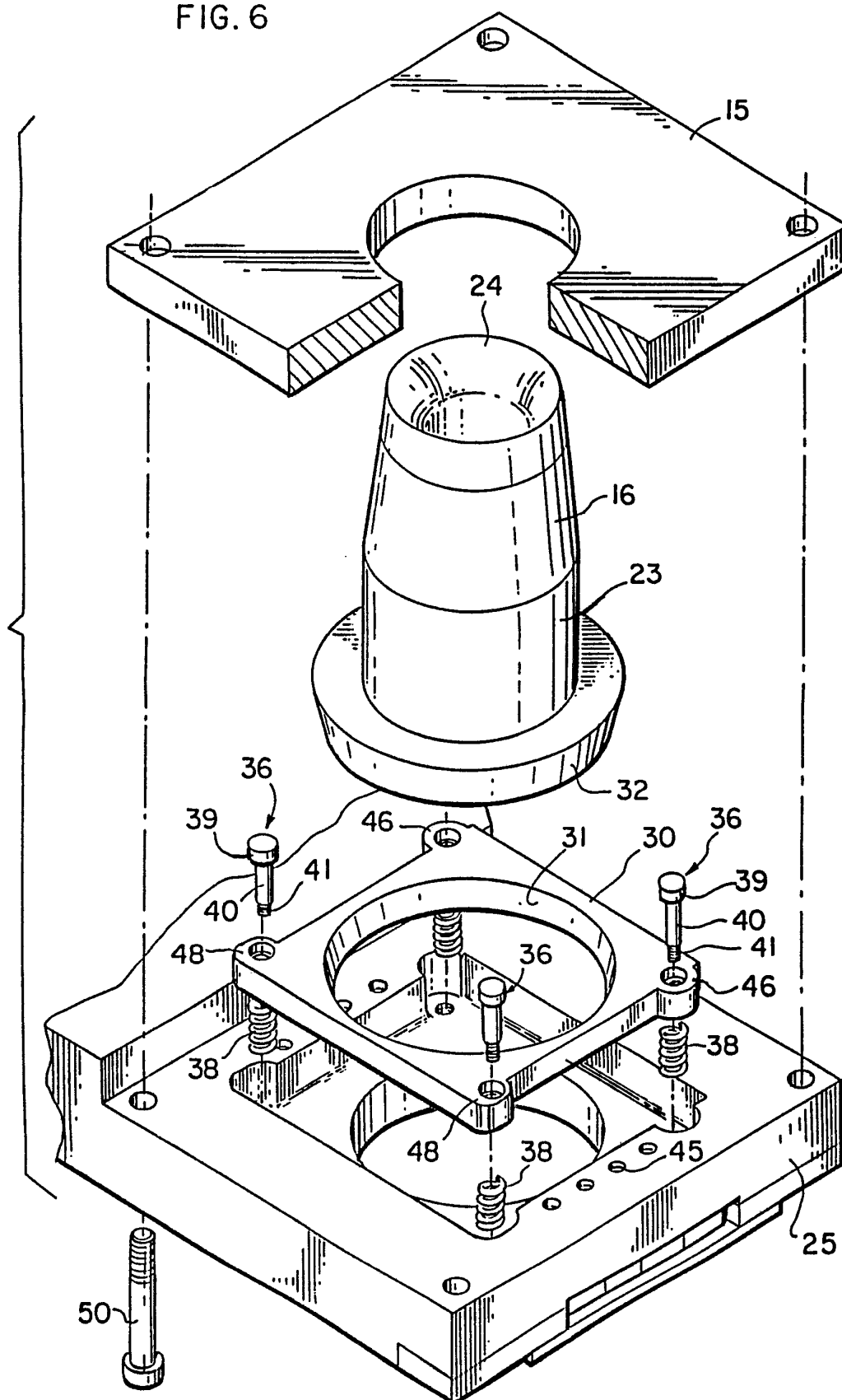


FIG. 1



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FIG. 6



SUBSTITUTE SHEET

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 91/07145

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to international Patent Classification (IPC) or to both National Classification and IPC Int.Cl. 5 B22D41/40		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl. 5	B22D	
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III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	AT,A,171 189 (WACHTER) 4 January 1950 see figures 1,2 ---	1,5,6,8
A	US,A,2 961 722 (LILLJEKVIST) 29 December 1960 see column 3, line 12 - line 27; claims 1,2; figures 2,3 ---	1,5,6,8
A	US,A,4 887 748 (HICKS) 19 December 1989 see column 3, line 66 - column 5, line 10; figures ---	1,5,6,8
A	WO,A,8 803 069 (STOPINC) 5 May 1988 see page 2, line 4 - line 31; figures ---	1,5,6,8
¹⁰ Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
24 FEBRUARY 1992	05 MAR 1992	
International Searching Authority	Signature of Authorised Officer	
EUROPEAN PATENT OFFICE	RIBA VILANOVA M.	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. US 9107145
SA 52110**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
AT-A-171189		None	
US-A-2961722		None	
US-A-4887748	19-12-89	None	
WO-A-8803069	05-05-88	DE-C- 3635717	16-07-87
		EP-A, B 0286647	19-10-88
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