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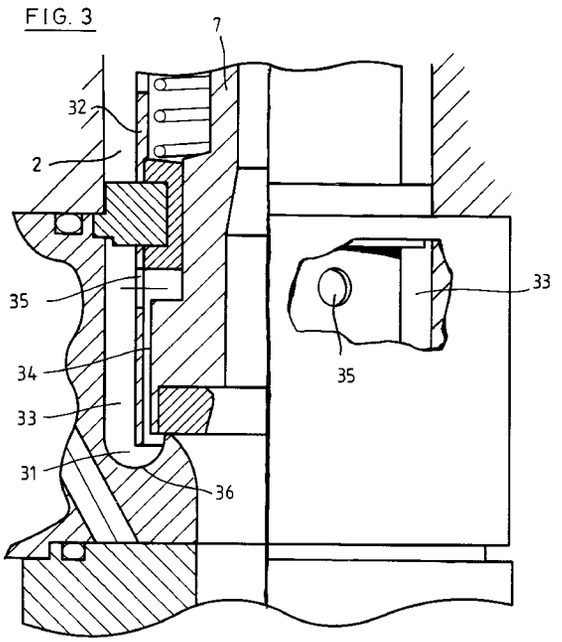
(54) Filling device.

(57) A device for filling a bottle by means of an annular siphon (3) which is provided with an annular bowl (31), the siphon being accommodated in a feed pipe (2). Provided upstream of the siphon is a pipe (32) which is external to and concentric with the feed pipe and is designed to extend into the annular bowl (31) of the siphon. The diameter of said pipe (32) lies between the external diameter of the siphon and the average diameter of a gas pipe (7). The result of this is that the useful throughflow section of the liquid can be divided by the siphon into a first (33) and a second (34) annular throughflow channel, and the useful throughflow section of the second channel is smaller than that of the first channel, in such a way that the flow in the second channel is virtually laminar in character. In addition, at least one aperture (35) is provided in the intermediate pipe in such a way that the at least one aperture forms a passage between the first and the second channel.

FIG. 3



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The invention relates to a device for filling a bottle, in particular a cap bottle, with a gaseous filling liquid, by means of an annular siphon.

Such a device is already known. Here the siphon is provided with an annular bowl and is accommodated in a central feed pipe. The latter is designed for transferring the gaseous filling liquid from a liquid tank to the bottle up to a predetermined filling level in the bottle. Here a pipe for the infeed of gas is provided virtually concentrically with the central feed pipe. For this purpose it is preferable to work in an undisturbed manner and at constant pressure. For this, the pressure prevailing in the liquid tank must first be transferred to the bottle, in order in this way to permit working in isobaric conditions. Once this has taken place, the actual filling can commence. The siphon along which the filling liquid flows to the bottle to be filled is used for this. When the liquid level in the bottle reaches the level of the end of the gas pipe contained therein, the filling phase ends and the filling liquid occupies a part of the gas pipe which corresponds to the static height. Through the siphon action there is a state of equilibrium between the filling liquid and the residual gas coming out of the neck of the bottle. The setting-up height of the bottle relative to the gas pipe is selected in such a way here that when the state of equilibrium between gas and liquid is finally reached the desired liquid level is reached.

When bottles are being filled in series, the liquid level obtained in the bottle must, of course, be as constant as possible. In the case of the known filling devices with siphon the liquid levels obtained in the successively filled bottles generally fluctuate. This is a disadvantage in the case of, for example, the drinks bottling industry.

The object of the device according to the invention is to eliminate this disadvantage.

To this end, an intermediate pipe is provided upstream of the siphon, said pipe being external to and concentric with the central feed pipe. Said intermediate pipe is intended for reaching into the annular bowl of the siphon. The diameter of the intermediate pipe lies between the external diameter of the siphon and the average diameter of the gas pipe. The result of this is that the useful throughflow section of the liquid through the siphon can be divided into a first and a second annular throughflow channel respectively, the useful throughflow section of the second channel being smaller than that of the first channel, in such a way that the flow in the second channel is virtually laminar in character. In addition, at least one aperture is provided in the intermediate pipe in such a way that the at least one aperture forms a passage between the first and the second channel.

Thanks to this division of the overall throughflow section in the siphon into a larger and a smaller part respectively, a construction comprising a main channel with a larger throughflow section and a side channel with a smaller throughflow section is obtained.

Thanks to this construction, we have been able to establish that a finer and more precise regulation of the liquid levels in successively filled bottles is obtained. In other words, a virtually constant liquid level is obtained in the bottles after their filling.

A further advantage of the device according to the invention is that a considerable increase in the flow rate of the filling liquid through the filling device, and thus a higher filling output, is obtained.

According to a further embodiment of the device according to the invention, provision is made for several apertures which are placed at virtually equal intervals along the periphery of the intermediate pipe. A better distributed flow pattern of the filling liquid from the main channel into the side channel is obtained in this way.

The apertures are advantageously provided in the same plane, in particular in a plane lying virtually perpendicular to the axis of the intermediate pipe. A particularly uniform flow pattern of the filling liquid in the annular side channel is obtained in this way.

According to an advantageous embodiment of the device according to the invention, the useful throughflow section of the second channel lies between 0.5 and 1.5 mm. This produces a special effect, the so-called "racering effect", which is known per se.

The narrowness of the second channel ensures that gas is prevented from escaping through said second channel at the end of the filling operation, and the equilibrium of pressure which has arisen between liquid and gas is thus not disturbed. Nevertheless, the side channel is broad enough to allow through liquid, but over the channel path considerable friction forces with the channel walls have to be overcome by the throughflowing liquid.

It was, however, established with the device according to this invention that the combination of said race-ring effect and the siphon had a particularly advantageous effect on the filling output and the filling efficiency, on the one hand, and on the liquid level in the successively filled bottle remaining constant, on the other.

It is also known that an effect similar to the race-ring effect is obtained per se with a so-called screen construction in the form of a sort of screen. The dimensions of the mesh therein are selected in such a way that a similar effect is obtained with the screen construction per se to that with the race-ring construction and the siphon, i.e. blocking of the passage of the gas in one direction, but allowing through the liquid in the other direction. However, a combination of a siphon with a screen downstream thereof was found not to give satisfactory results.

It is also advantageous for the ratio of the useful throughflow section of the second channel to that of the first channel to be equal to maximum one quarter.

In a fairly advantageous manner the apertures

are virtually circular and are of such diameter that the second channel can be occupied continuously and completely by the filling liquid. This means that the racering effect is optimized, and thus also the improvement of the filling efficiency and standardization of the filling levels in the bottles to be filled.

An additional advantage of the filling device according to the invention is that component parts thereof, in particular siphon and different pipe elements, are easy to dismantle and slide into each other. This is particularly useful for quickly setting up the device according to the invention.

It is also advantageous to fit projecting supporting elements on the outside wall of the intermediate pipe, in particular in a plane lying virtually perpendicular to the axis of the intermediate pipe and at virtually equal intervals from each other. In this way it can be ensured that the lower edge of the intermediate pipe goes into the bowl of the siphon at the correct height.

Further details and special features of the siphon device according to the invention will emerge from the description which follows of an example of an embodiment with the appended drawings.

Figure 1 is a section in the direction of the axis of the siphon device, in a first position of the siphon device.

Figure 2 is a similar view of the siphon device to that of Figure 1, but of a second position of the siphon device.

Figure 3 is a detail view of the siphon device according to the invention, in a partially cutaway illustration.

Figure 4 is a sectional view of a part of the view of Figure 3 in a first working position of the siphon device according to the invention.

Figure 5 is a similar view of the siphon device according to the invention to that of Figure 4, but in a second working position.

The same reference numbers relate to the same or to similar elements.

In general, the invention relates to a siphon device used for a filling device for bottles, in particular cap bottles. The purpose of the siphon device is to obtain an optimum bottle filling, in particular a bottle filling in which the liquid level of the respectively filled bottles is virtually constant.

Such a filling device is shown in Figure 1. In the case of such a filling device 10 a gaseous liquid shown by 11 has to be transferred from a closed liquid tank 1, for example an annular boiler, to a bottle 12 through a feed pipe 2 and a schematically shown filling element 4. The filling device according to the invention is particularly designed for cap bottles. Figure 1 shows how a bottle 12 to be filled is presented to the filling device. In this case the bottle is held at the level of its neck 14 by means of a holder 21. The up and down movement of the holder 21 to take the bottle into the desired filling position, i.e. with the bottle against the filling element 4, is imposed in a manner known per se by the following movement of a roller 22 on a guide which is not shown. The position of the holder is fixed in the filling position of the bottle by a locking mechanism 30.

Figure 2 shows how the locking is obtained, for example, by the clicking into each other of two hook elements 25 and 26 directed towards each other, as already known. In this case a spring 27 connected to the rod 24 is in the tensioned state. On unlocking, the spring 27 is released.

Figure 2 also shows the path travelled by a liquid 11 from a liquid tank 1 through the pipe 2 and a siphon 3 in the direction of arrows F to the bottle 12 to be filled. The arrows indicated by G represent the direction of flow of the part of the gas flowing back out of the bottle 12 to the tank 1 through a pipe 6 and a pipe 7 under the influence of the liquid level rising in the bottle. When the liquid level reaches the bottom end 16 of the pipe 6, which lies at a level indicated by N1 in the figure, the flowback of gas out of the bottle 12 through the pipe 6 is stopped and liquid penetrates into the pipe 6 to a certain height in that pipe which corresponds to the static height and gives rise to a so-called liquid column in the pipe 6. Residual gas is confined in the space 15 lying between the liquid level N1 and the mouth 13 of the bottle 12. In fact, the pressure exerted by the latter is not strong enough to overcome the liquid column. Said residual gas cannot therefore escape through pipe 6.

Nor can it escape through the pipe 2, on account of the siphoning effect of the siphon 3. In these circumstances the static height of the liquid column in the pipe will compress the residual gas in the space 15. This will cause a build-up of pressure which is slightly greater than the pressure P prevailing in the liquid tank 1. A part of the residual gas in the space 15 is released through a bypass channel 8. The liquid level rises further from N1 until it reaches the desired filling level indicated by N2.

Hitherto there were fluctuations in the filling levels finally obtained for a series of successively filled bottles, while the object in series filling is, of course, to ensure as constant a filling level as possible.

Figure 3 shows a detail view of the siphon device according to the invention. This figure shows how a side channel 34 is provided in parallel with a main channel 33 formed by the siphon 3, which has an annular bowl 31. Main and side channel are annular. The division into main and side channel takes place by inserting a pipe 32 into the space bounded by said bowl 31 and at a certain distance from the bottom 36 of the bowl. Passages 35 are provided in this pipe to permit throughflow of the filling liquid through both channels 33 and 34.

It has been found that with this filling device according to the invention, in which the side channel 34 is provided working parallel to the main channel 33 in

the siphon, a virtually constant filling level is obtained and the level fluctuations are thus eliminated. A further essential advantage of the combination of said side channel 34 with the main channel 33 is the considerable increase in filling output. Structurally, side and main channel are obtained by fitting the pipe 32 on the outside of and concentrically with the pipe 7 and on the inside of pipe 2. The cross-section of the side channel 34 preferably comprises a maximum of one quarter of the cross-section of the main channel 33. In this case the cross-section of the side channel 34 has a width lying between 0.5 and 1.5 mm, preferably almost 1 mm according to what was found. Selecting the dimensions of the side channel in such a way means that the so-called race-ring effect, which is known per se and has already been explained above, is obtained. Thanks to the combination according to the invention of such a so-called race-ring with a siphon, it has been found that fluctuations in the filling levels obtained in the end after filling of the bottles are as good as eliminated. A desired predetermined volume of drink, for example, can consequently be dispensed into a bottle with greater operating reliability. Moreover, because of the above-mentioned combination of race-ring and siphon, a considerable increase in output is found, in particular of the order of magnitude of 15 to 20% compared with a filling device containing only the siphon, this being for the above-mentioned measurements.

Besides, in order to have the optimum race-ring effect, several apertures 35, which in each case form a passage between main and side channel, have to be made in the pipe 32, for example six at virtually equal intervals along the periphery of the pipe 32. This ensures a more uniform flow in the race-ring-forming channel 34. The effect is even further enhanced by providing the apertures 35 in the same plane, all the more so if the plane lies virtually at right angles to the axis of the pipe 32. The apertures are, for example, circular and their diameter is calculated in such a way that the side channel 34 can be occupied permanently and completely by the filling liquid.

Figure 4 shows the situation in the siphon during the filling operation. In this situation the siphon acts as an admission element for the liquid flow from the liquid tank to the bottle. A part of the liquid flowing through under the influence of its own weight in this case undergoes a slowing-down in the bowl 31 which forms a bend for the liquid path before it flows through the bottom part of the pipe 2 to the bottle 12. Another part of the throughflowing liquid flows to the bottle through the apertures 35 and the race-ring-forming side channel 34, in which case the flow rate of the throughflowing liquid is greatly reduced by the friction forces along the walls of the side channel 34.

Figure 5 shows in a detailed manner how the above-mentioned residual gas in the neck of the bottle filled with liquid in its return flow is blocked under the influence of the static pressure exerted by the above-mentioned liquid column thanks to the device according to the invention, this being both along the main channel 33 and along the side channel 34. The residual gas flows back along the pipe 2, past a notch-forming turning point 37 of the siphon 3 until it is against the pipe 32. The gas cannot, however, flow back further to the bowl 31 of the siphon 3, thanks to the well-known siphon effect. Nor can the residual gas flow back through the side channel 34, due to the dimensioning, designed for this purpose, of the side channel 34 forming a race-ring. Said channel is in fact narrow enough and high enough for the residual gas to be unable to overcome the liquid column present in said side channel 34. A state of equilibrium is thus established between the liquid and the residual gas at the end of filling of the bottle.

In order to guarantee the efficiency of the racering effect, in the case of the device according to the invention it is preferable to work with clear drinks, such as still or carbonated drinks, for example, containing little or even no pulp, for example from pressed fruits. For, this pulp could lead to blockage of the side channel 34 forming the race-ring. This must, of course, be avoided, in order to ensure good functioning of the device according to the invention.

Provision is also made for various parts thereof to be slid freely in and out of each other during assembly and dismantling respectively of the device. This is carried out without screws or other fixing elements, and a great time saving is obtained when the device is being assembled or dismantled. This applies, inter alia, to the pipes 6, 7, 2, 32 and to different springs shown in Figures 2 and 3 which are provided concentrically therewith. Projecting support elements 38 are in this case provided on, for example, the outside wall of the pipe 32, in order to hold the pipe 32 at a certain distance from the bottom of the bowl of the siphon during the assembly of the device. This ensures a free passage for the flowing liquid into said main channel of the device. When the various parts are slid into each other, these projecting support elements then come to rest on the top edge of the siphon 3. The projecting elements are preferably provided in one plane which lies virtually at right angles to the axis of the pipe 32 and at a more or less equal distance from each other. This ensures that the respective axes of the pipes 6, 7, 2, 32 run parallel.

In order to ensure greater stability of the pipe 32 on the pipe 2, four projecting support elements, for example, are provided in this way all the way around the outside wall of the pipe 32, two successive projecting support elements in each case forming an angle of almost 90°.

It goes without saying that the embodiment described above in a detailed manner has been given only by way of example, and that the scope of protection of this patent application is in no way limited

thereto. This also applies to the variants of embodiments thereof.

Claims

1. A device for filling a bottle, in particular a cap bottle, with a gaseous filling liquid, by means of an annular siphon (3) which is provided with an annular bowl (31), the siphon being accommodated in a first pipe (2), forming part of a central feed pipe designed to transfer the filling liquid from a liquid tank (1) to the bottle (12), to a predetermined filling level in the bottle, a second pipe (7) for feeding in gas being provided virtually concentrically with the first pipe, wherein a third pipe (32) is provided upstream of the siphon (3), said pipe being external to and concentric with said first feed pipe, and being intended for reaching into the annular bowl (31) of the siphon, and the diameter thereof lying between the external diameter of the siphon and the average diameter of said second pipe (7), in such a way that the useful throughflow section of the liquid through the siphon can be divided by said third pipe into a first (33) and a second (34) annular throughflow channel, while the useful throughflow section of the second channel is smaller than that of the first channel, in such a way that the flow in the second channel is virtually laminar in character, and wherein at least one aperture (35) is provided in said third pipe (32), in such a way that the at least one aperture forms a passage between the first and second channel.

2. The device as claimed in claim 1, wherein several apertures (35) are provided, at virtually equal intervals along the periphery of the third pipe (32).

3. The device as claimed in claim 2, wherein the apertures (35) are provided in the same plane.

4. The device as claimed in claim 3, wherein said plane lies virtually perpendicular to the axis of the third pipe (3).

5. The device as claimed in any of claims 1 to 4, wherein the useful throughflow section of said second channel (34) lies between 0.5 and 1.5 mm.

6. The device as claimed in any of claims 1 to 5, wherein the ratio of the useful throughflow section of the second channel (34) to that of the first channel (33) is equal to maximum one quarter.

7. The device as claimed in any of claims 2 to 6, wherein the apertures (35) are virtually circular and are of such diameter that the second channel (34) can be occupied continuously and completely by the filling liquid.

8. The device as claimed in any of claims 1 to 7, wherein the siphon (3), the first pipe (2), the second pipe (7) and the third pipe (32) are easy to dismantle or slide into each other.

9. The device as claimed in any of claims 1 to 8, wherein the projecting support elements (38) are provided on the outside wall of said third pipe (32).

10. The device as claimed in claim 9, wherein the projecting elements (38) are provided in a plane lying virtually perpendicular to the axis of the third pipe (32) and at virtually equal intervals.

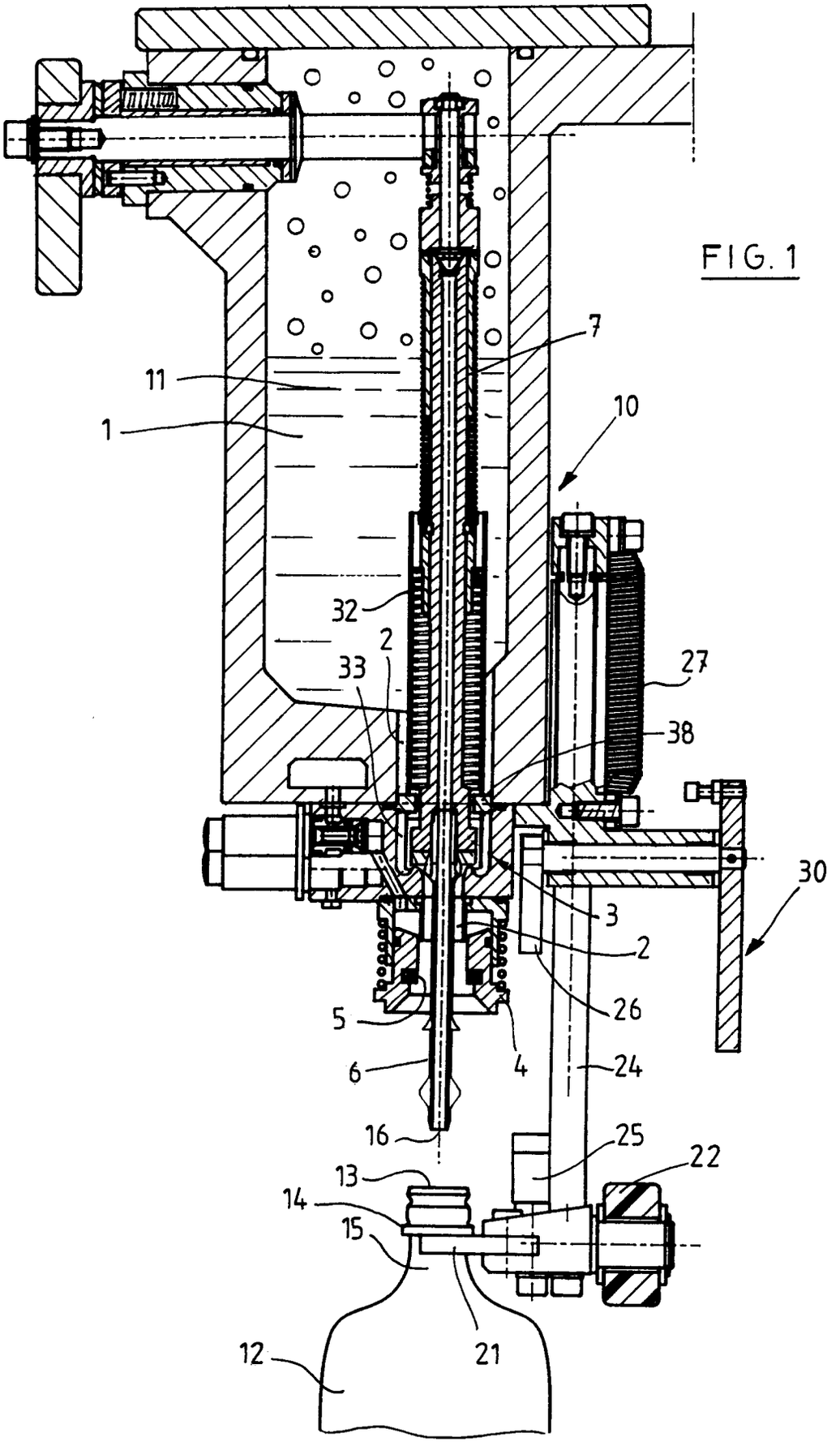


FIG. 1

FIG. 2

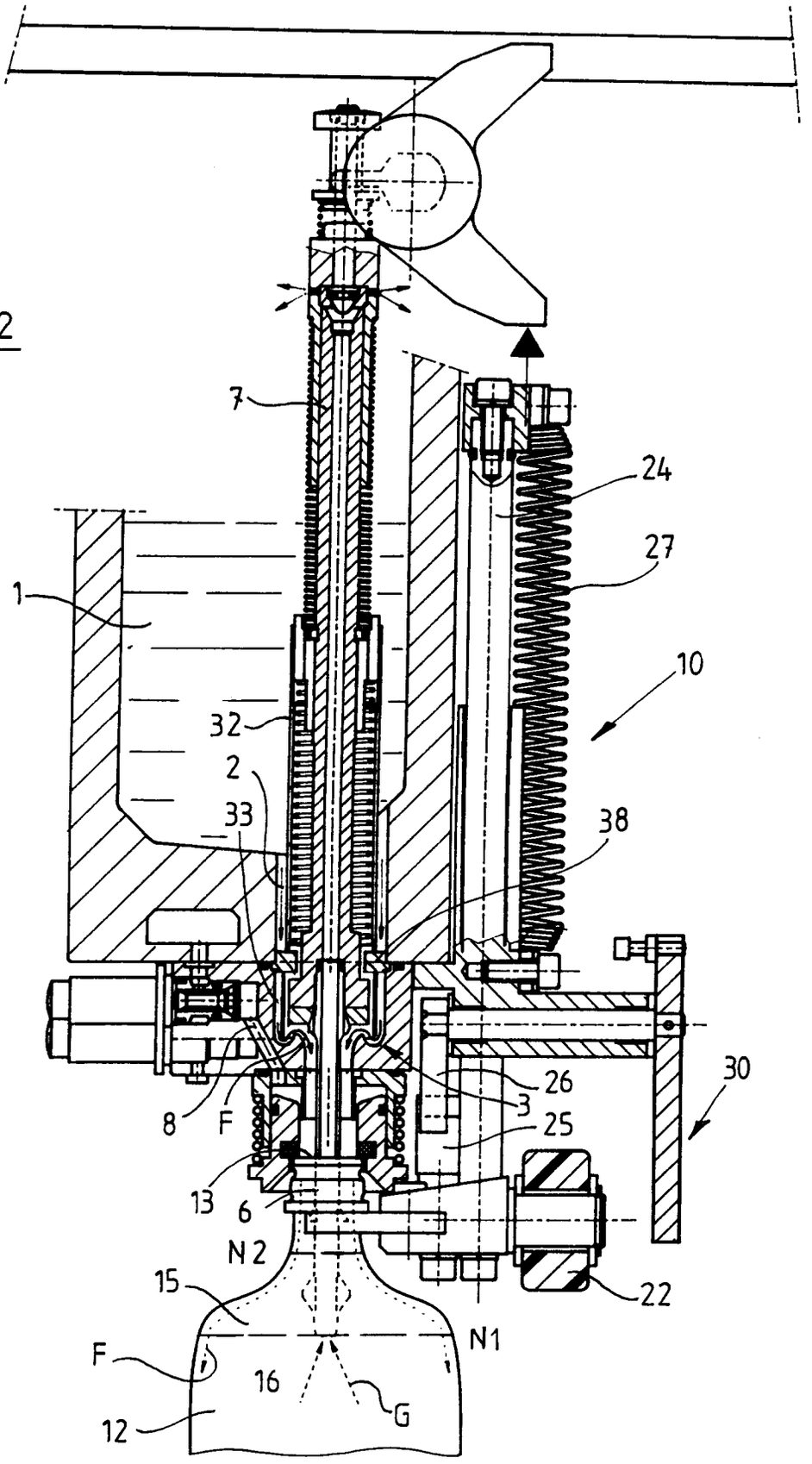


FIG. 3

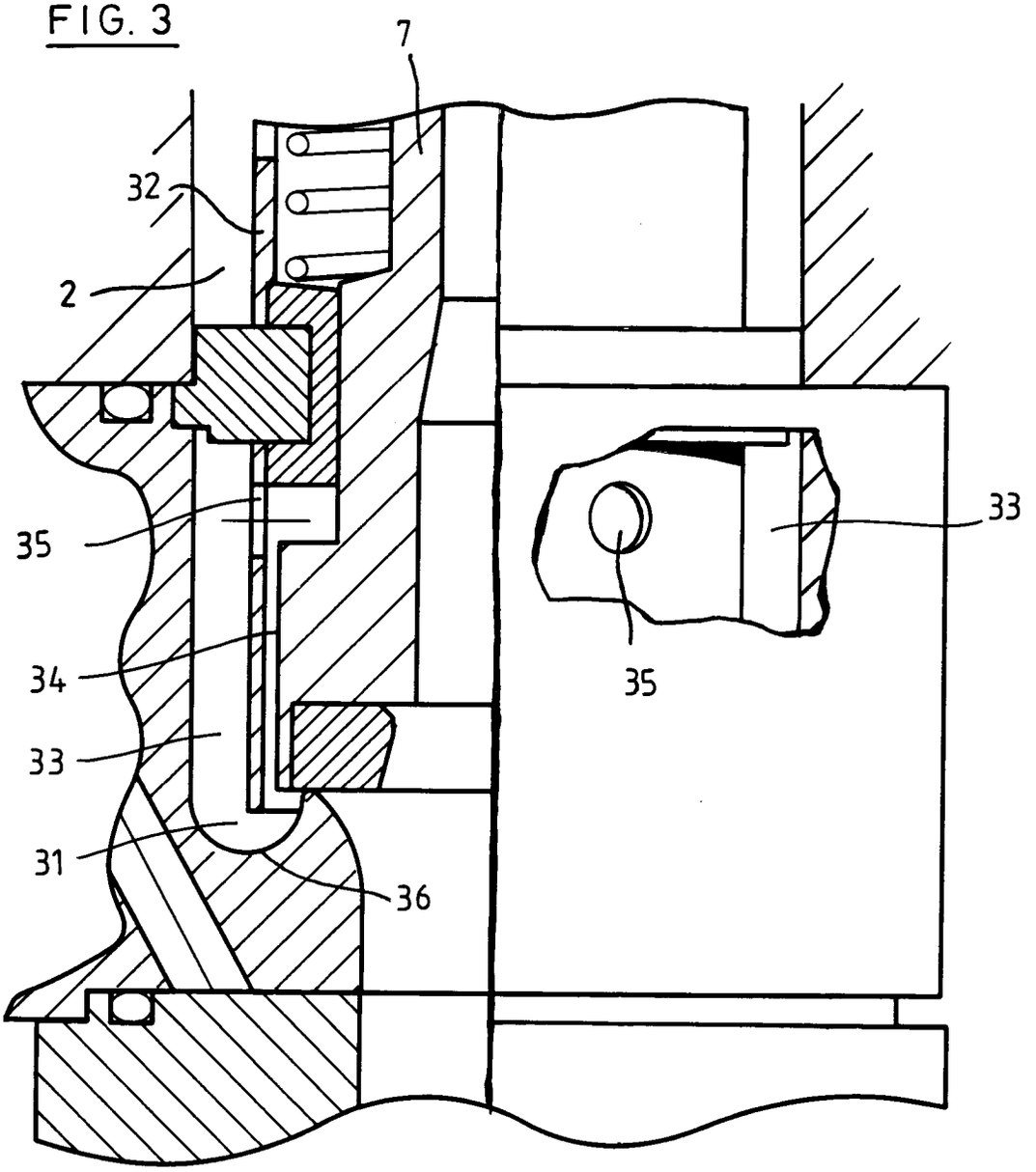


FIG. 4

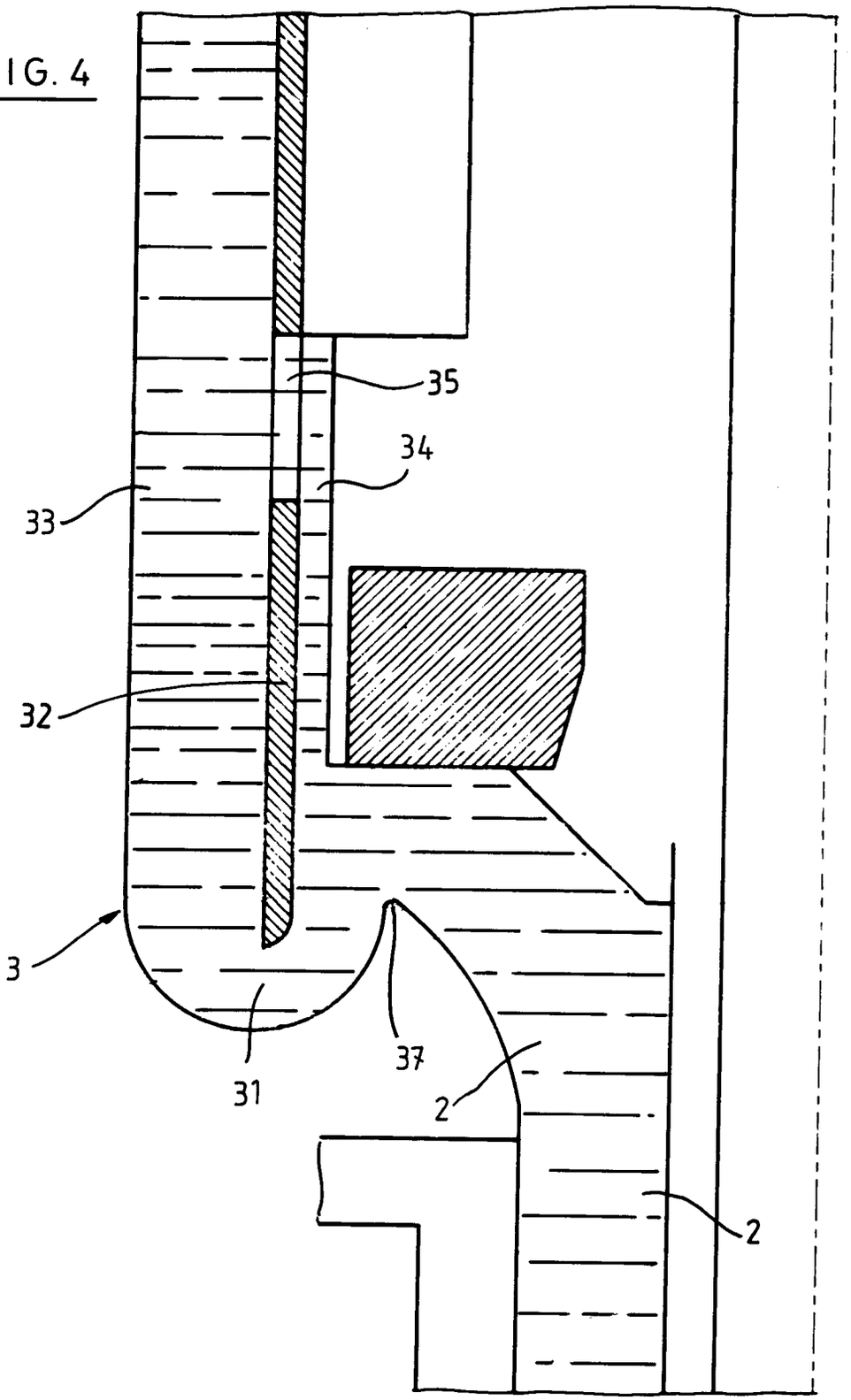
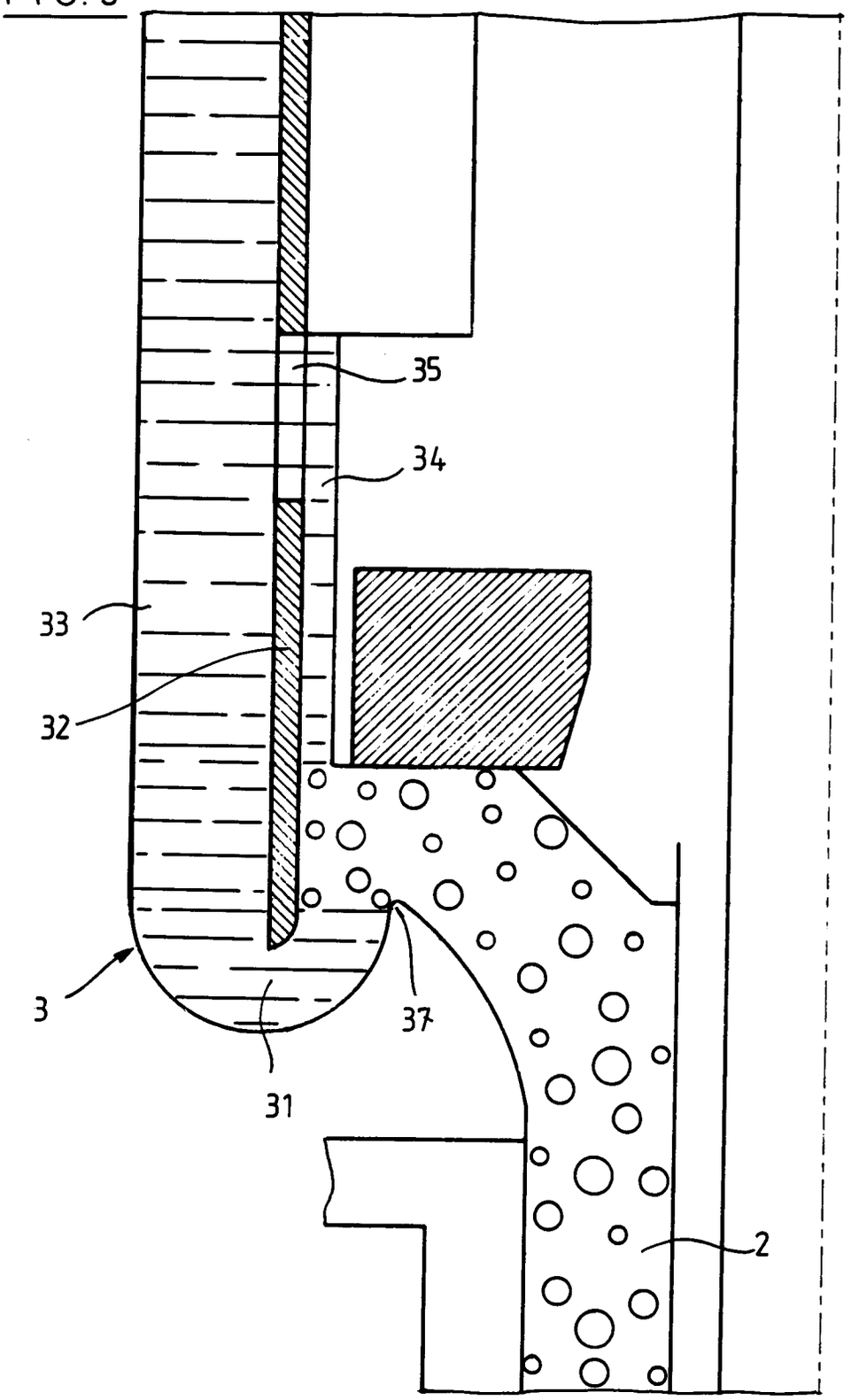


FIG. 5



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EUROPEAN SEARCH REPORT

Application Number

EP 92 87 0053

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	DE-A-2 428 553 (VEB KOMBINAT NAGEMA) * page 6; figure 1 * ---	1-4	B67C3/26
A	FR-A-1 329 189 (HOLSTEIN & KAPPERT MASCHINENFABRIK PHÖNIX GMBH) * claims; figures * ---	1	
A	DE-U-9 014 772 (SEITZ ENZINGER NOLL MASCHINENBAU AG) * figure * ---	1	
A	DE-A-2 727 723 (HOLSTEIN UND KAPPERT GMBH) * figure * -----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B67C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	08 SEPTEMBER 1992	MARTINEZ NAVAR

CATEGORY OF CITED DOCUMENTS

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