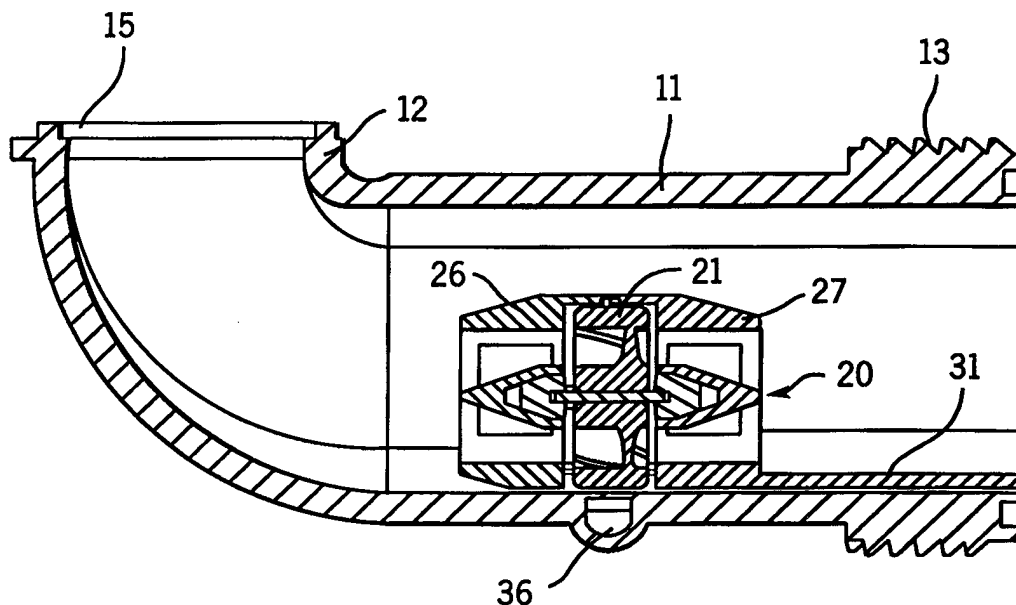




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(21) International Application Number: PCT/US98/05132 (22) International Filing Date: 16 March 1998 (16.03.98) (30) Priority Data: 60/039,626 19 March 1997 (19.03.97) US (71) Applicant (for all designated States except US): AUTOTROL CORPORATION [US/US]; 5730 North Glen Park Road, Milwaukee, WI 53209 (US). (72) Inventors; and (75) Inventors/Applicants (for US only): WALCZAK, Thomas, J. [US/US]; Apartment 1, 4828 Vista Park Court, Nashota, WI 53058-9617 (US). SIETH, Kenneth, J. [US/US]; 2730 Peninsula Drive, Delafield, WI 53018 (US). HONZELKA, Thomas, P. [US/US]; 950 7th Avenue, Grafton, WI 53024 (US). (74) Agent: EHRMANN, Thomas, W.; Quarles & Brady, 411 East Wisconsin Avenue, Milwaukee, WI 53202-4497 (US).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>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: ELBOW MOUNTED TURBINE FLOWMETER**(57) Abstract**

A flowmeter including a conduit (10) having an elbow portion (12) and a straight section (11) downstream of the elbow. A turbine (20) is mounted inside the conduit in the straight section adjacent the elbow portion. The turbine occupies less than the entire cross section of the conduit and is disposed adjacent the side of the conduit which receives the laminar flow exiting from the elbow portion. The turbine contains a permanent magnet (35), the rotation of which is picked up by a Hall-effect sensor mounted in a cavity (36) in the wall of the conduit.

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ELBOW MOUNTED TURBINE FLOWMETER

CROSS REFERENCES TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 60/039,626, filed on March 19, 1997.

BACKGROUND OF THE INVENTION

This invention relates to turbine flowmeters and particularly to a turbine flowmeter mounted adjacent an elbow of a conduit.

Turbines are widely used to monitor the flow of fluid through conduits. Typically, the turbine occupies the full cross-section of the conduit so that the entire flow rotates the turbine. Generally, the turbine mounts a permanent magnet whose rotation with the turbine is detected by a Hall-effect sensor disposed adjacent the turbine. The frequency of pulses generated by the sensor directly correlates with the volume of flow through the turbine.

The present invention is directed to a turbine flowmeter which does not occupy the entire cross-section of the conduit in which it is mounted, but which provides an accurate indication of the total amount of fluid flow through the conduit.

SUMMARY OF THE INVENTION

In accordance with the invention, a flowmeter includes a conduit having an elbow portion and a straight section downstream of the elbow. A turbine is mounted inside the conduit in the straight section adjacent the elbow portion. The turbine

occupies less than the entire cross section of the conduit and is disposed adjacent the side of the conduit which receives the laminar flow exiting from the elbow portion.

Preferably, the turbine is mounted in a structure that is insertable into the conduit. In one embodiment, the structure is inserted through the open end of the straight section. In a second embodiment, the structure is inserted through an opening in the elbow portion.

The turbine contains a permanent magnet, the rotation of which is picked up by a Hall-effect sensor mounted in a cavity in a wall of the conduit.

It is a principal object of the invention to provide a turbine flowmeter that occupies only a portion of the cross-section of the conduit through which the fluid is to flow but which gives an accurate indication of the total flow through the conduit.

The foregoing and other objects and advantages of the invention will appear in the detailed description which follows. In the description, reference is made to the accompanying drawings which illustrate preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a top view of a first embodiment of a flowmeter in accordance with the invention;

Fig. 2 is an end view of the flowmeter of Fig. 1;

Fig. 3 is a view in vertical section taken in the plane of the line 3-3 of Fig. 2;

Fig. 4 is an exploded view of the turbine assembly of the first embodiment of the flowmeter;

Fig. 5 is a view in vertical cross section of a second embodiment of the flowmeter;

Fig. 6 is an end view of the flowmeter of Fig. 5;

Fig. 7 is an exploded view of the turbine assembly of the second embodiment of the flowmeter; and

Fig. 8 is an exploded view of the components of the second embodiment of the flowmeter.

5 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The flowmeter of Figs. 1-4 includes a conduit 10 having a straight section 11 mounted downstream of an integral elbow portion 12. The straight section 11 preferably has a circular cross-section and may be provided with threads 13 to connect to plumbing. The elbow portion 12 in the embodiment illustrated has a cross-section
10 which transitions from that of an oval at its open end 15 to a circle at the junction with the straight section 11.

A turbine assembly indicated generally by the numeral 20 is mounted in the conduit 10 at the bottom of the straight section 11 adjacent the elbow portion 12. The turbine assembly 20 includes a turbine 21 mounted on a shaft 22 the ends of which are
15 received in bearings 23 and 24. The bearings 23 and 24 are mounted in upstream and downstream cowl members 26 and 27, respectfully. The cowl members 26 and 27 are held together by arms 28 and 29 projecting from the members 26 and 27 and snapped in place into recesses 30 in the opposite cowl member. The downstream cowl
member 27 includes an integral trough member 31 which is adapted to extend along
20 the bottom of the straight section 11 of the conduit 10. The trough member 31 has projecting legs 32 which align with legs 33 on the upstream cowl member 26. The legs 32 and 33 are received in parallel recesses 34 in the bottom of the straight section 11, as shown in Fig. 3.

The turbine 21 mounts a permanent magnet 35. A Hall-effect sensor (not shown) is mounted in a cavity 36 in the wall of the conduit 10. The cavity 36 extends tangentially of the conduit.

Fluid flow through the elbow section 12 will tend to be laminar at low flow rates along the outside of the bend of the elbow portion 12. The turbine 21 will be exposed to near laminar flow and with the highest velocity exiting from the elbow portion 12. Although the turbine assembly 20 fills only a small portion of the overall cross-section of the conduit, it will provide an accurate metering of the total flow through the conduit because it is exposed to the highest velocity within the laminar flow.

In the second embodiment of the flowmeter shown in Figs. 5-8, a turbine assembly indicated generally by the numeral 40 is inserted into the straight section 41 of a conduit through a threaded opening 42 in the elbow section 43. The threaded opening 42 is closed by a threaded plug 44. An elbow insert 45 defines a continuation of the portion of the outer bend of the elbow that is removed to allow for the opening 42. The elbow insert 45 is held in place by the plug 44.

The turbine assembly 40 includes a turbine 50 mounted on a shaft 51, the ends of which are received in bearings 52 and 53. The bearings 52 and 53 are mounted in upstream and downstream cowl members 54 and 55, respectively. The upstream cowl member 54 includes an integral trough portion 56 which extends towards the elbow insert 45. The cowl members 54 and 55 snap together as in the assembly 20 of the first embodiment. The upstream cowl member has wings 60 extending from its sides and the downstream cowl member 55 has similar wings 61. The wings 60 and 61 are received beneath rails 62 extending from the sides of the straight section 41 of the

conduit. The wings 60 of the upstream cowl member 54 terminate in stops 63 which define the extent of insertion of the turbine assembly 40 within the straight section 41 of the conduit. As with the first embodiment, the turbine 50 would include a permanent magnet 65, and a Hall-effect sensor (not shown) would be inserted into a tangential cavity 66 in the outside of the straight section 41.

The flowmeter of the second embodiment allows the removal and replacement or servicing of the turbine assembly 40 without disturbing the plumbing of the straight section 41 or elbow section 43.

CLAIMS

We claim:

1. A turbine flowmeter for measuring fluid flow comprising:
a conduit having an elbow portion and an integral straight section
downstream from said elbow portion, said straight section having a bottom and a wall;
a turbine assembly having a turbine with a permanent magnet mounted
5 thereon, said turbine assembly is mounted adjacent to said elbow portion in a portion
of a cross section of said straight section, wherein laminar fluid flow from along an
outside bend of said elbow portion flows along said bottom of said straight section
and drives said turbine; and
a Hall-effect sensor mounted adjacent said turbine for detecting
10 rotation of said permanent magnet on said turbine.
2. A turbine flowmeter as claimed in claim 1, wherein said cross section
of said straight section is circular.
3. A turbine flowmeter as claimed in claim 2, wherein said elbow portion
has a cross section that transitions from an oval to a circle, said elbow portion circle
cross section is at a junction with said straight section.
4. A turbine flowmeter as claimed in claim 1, wherein said straight
section has threads.

5. A turbine flowmeter as claimed in claim 1, wherein said turbine assembly has an upstream cowl member and a downstream cowl member, said turbine is rotatably mounted on a shaft to said cowl members.

6. A turbine flowmeter as claimed in claim 5, wherein said cowl members have bearings for receiving ends of said shaft.

7. A turbine flowmeter as claimed in claim 5, wherein said cowl members have projecting arms that are snapped into recesses in said opposite cowl member.

8. A turbine flowmeter as claimed in claim 5, wherein said downstream cowl member has an integral trough member.

9. A turbine flowmeter as claimed in claim 8, wherein said trough member is adapted to extend along said bottom of said straight section of said conduit.

10. A turbine flowmeter as claimed in claim 8, wherein said trough member has projecting legs that align with legs on said upstream cowl member, said legs are received in parallel recesses in said bottom of said straight section.

11. A turbine flowmeter as claimed in claim 1, wherein said Hall-effect sensor is mounted in a cavity in said wall of said conduit.

12. A turbine flowmeter as claimed in claim 11, wherein said cavity extends tangentially of said conduit.

13. A turbine flowmeter as claimed in claim 1, wherein said elbow section has a threaded opening in said outer bend of said elbow for insertion of said turbine assembly into said straight section of said conduit, said turbine flowmeter further comprising:

5 an elbow insert defining a continuation of said elbow portion of said outer bend removed by said opening; and

a threaded plug received by said threaded opening that holds said elbow insert in place.

14. A turbine flowmeter as claimed in claim 13, wherein said turbine assembly has an upstream cowl member and a downstream cowl member, said upstream cowl member has an integral trough member.

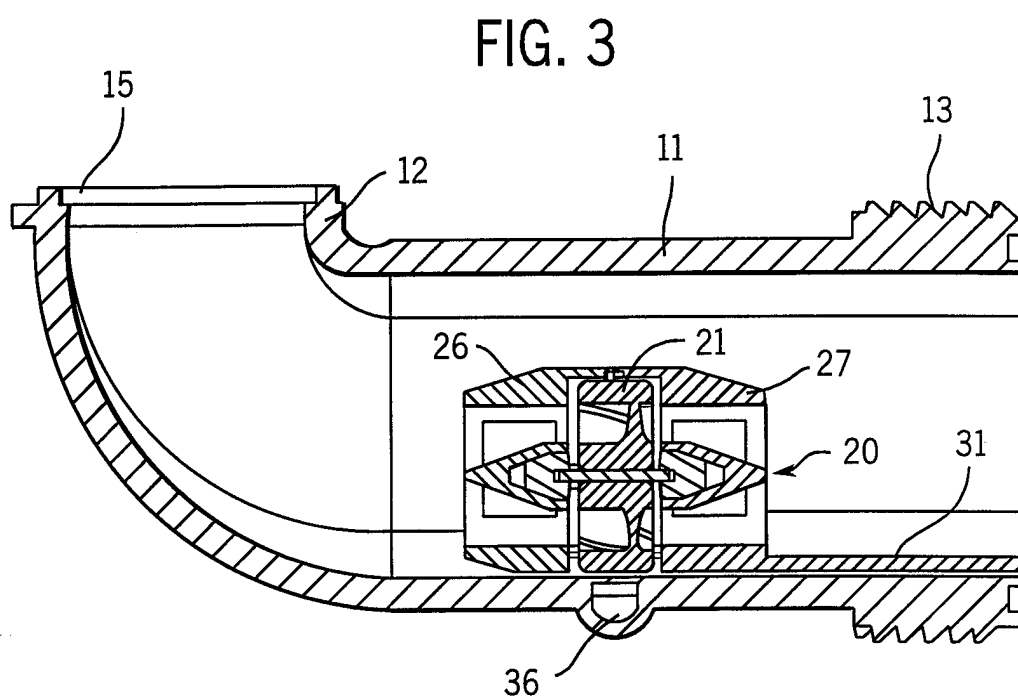
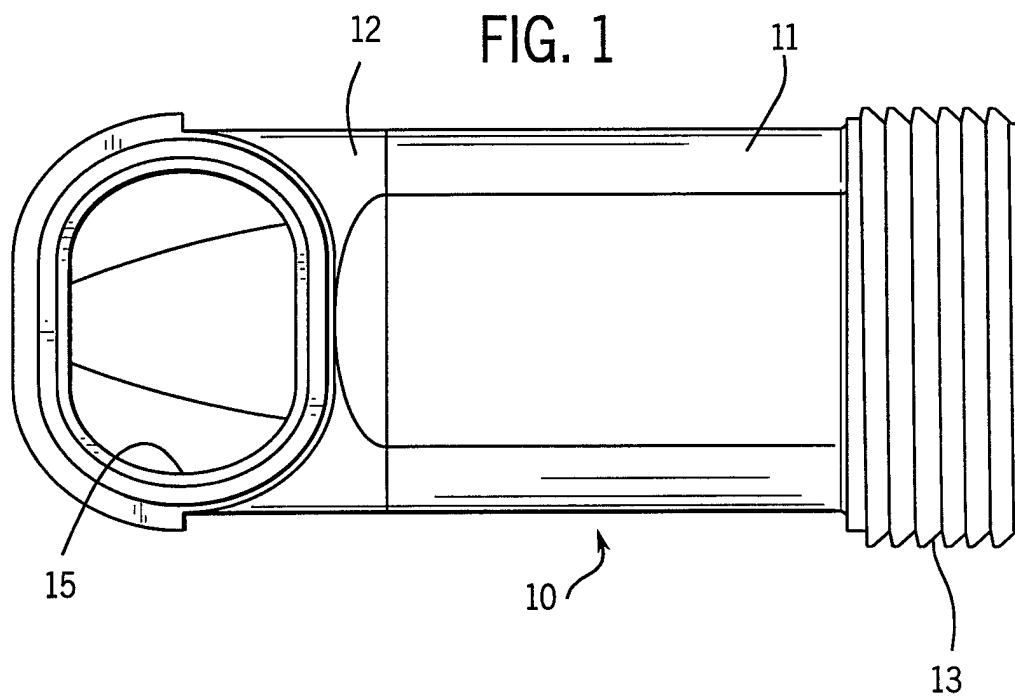
15. A turbine flowmeter as claimed in claim 14, wherein said integral trough member extends toward said elbow insert.

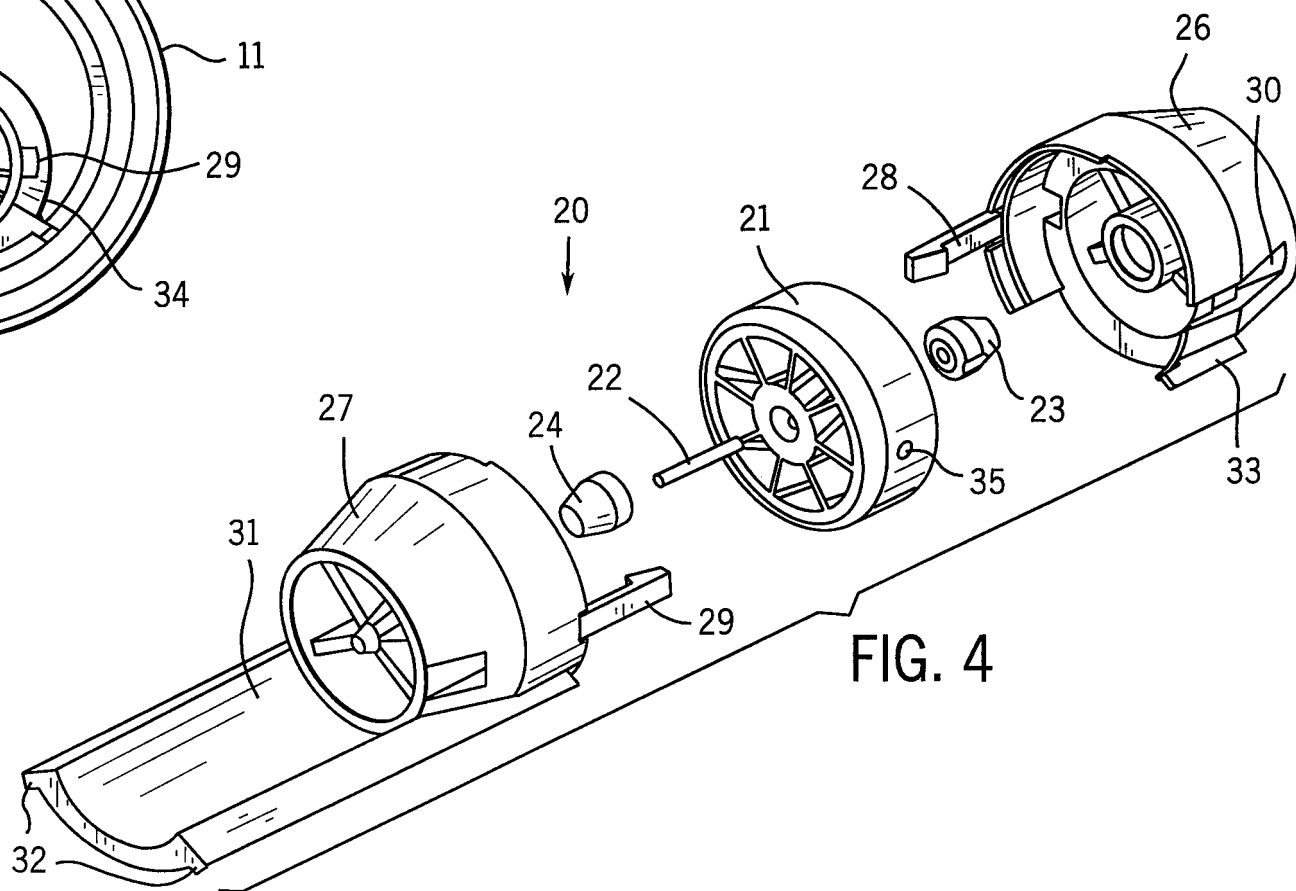
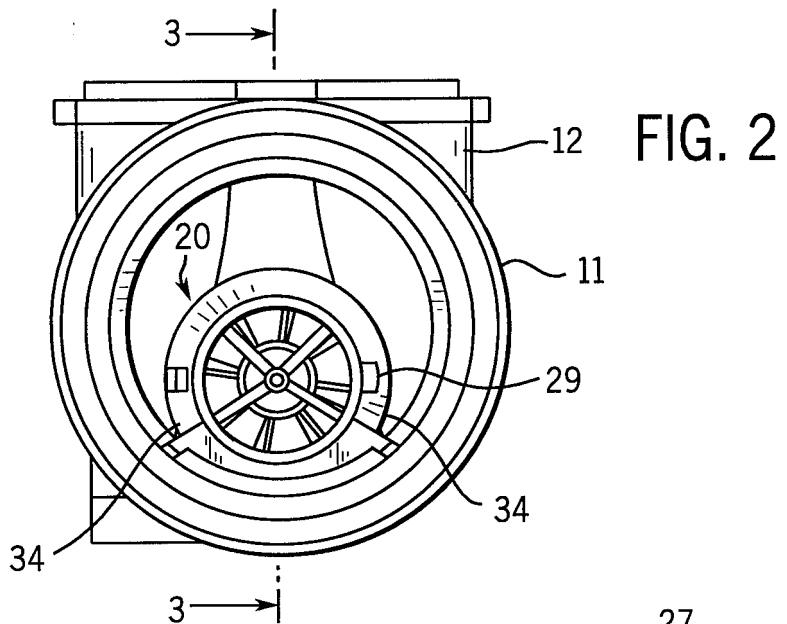
16. A turbine flowmeter as claimed in claim 14, wherein said trough member has projecting wings that align with wings on said downstream cowl member.

17. A turbine flowmeter as claimed in claim 16, wherein said wings are received beneath parallel rails extending from said wall of said straight section.

18. A turbine flowmeter as claimed in claim 16, wherein said wings terminate in stops that define the extent of insertion of said turbine assembly within said straight section of said conduit.

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FIG. 5

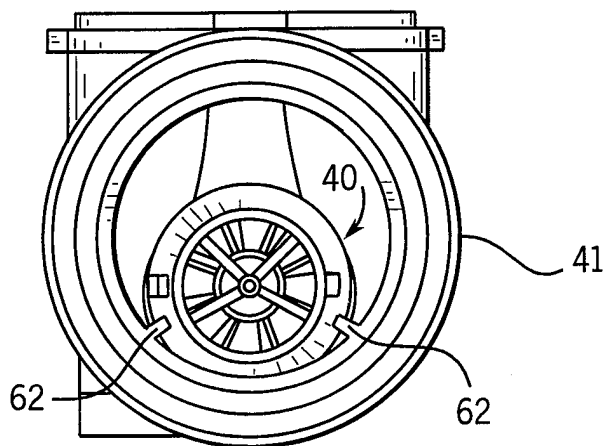
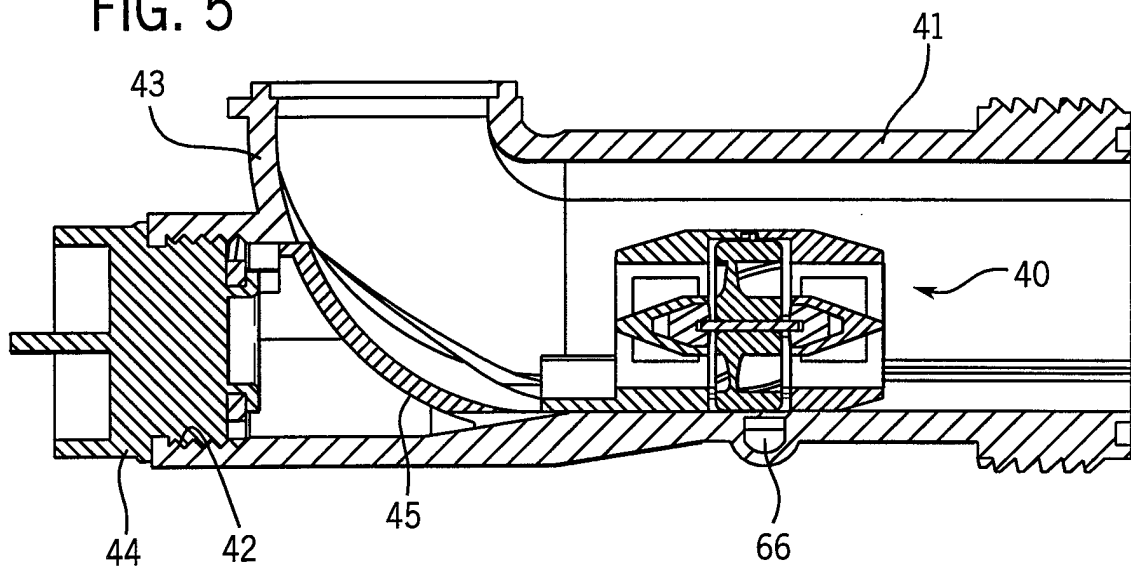


FIG. 6

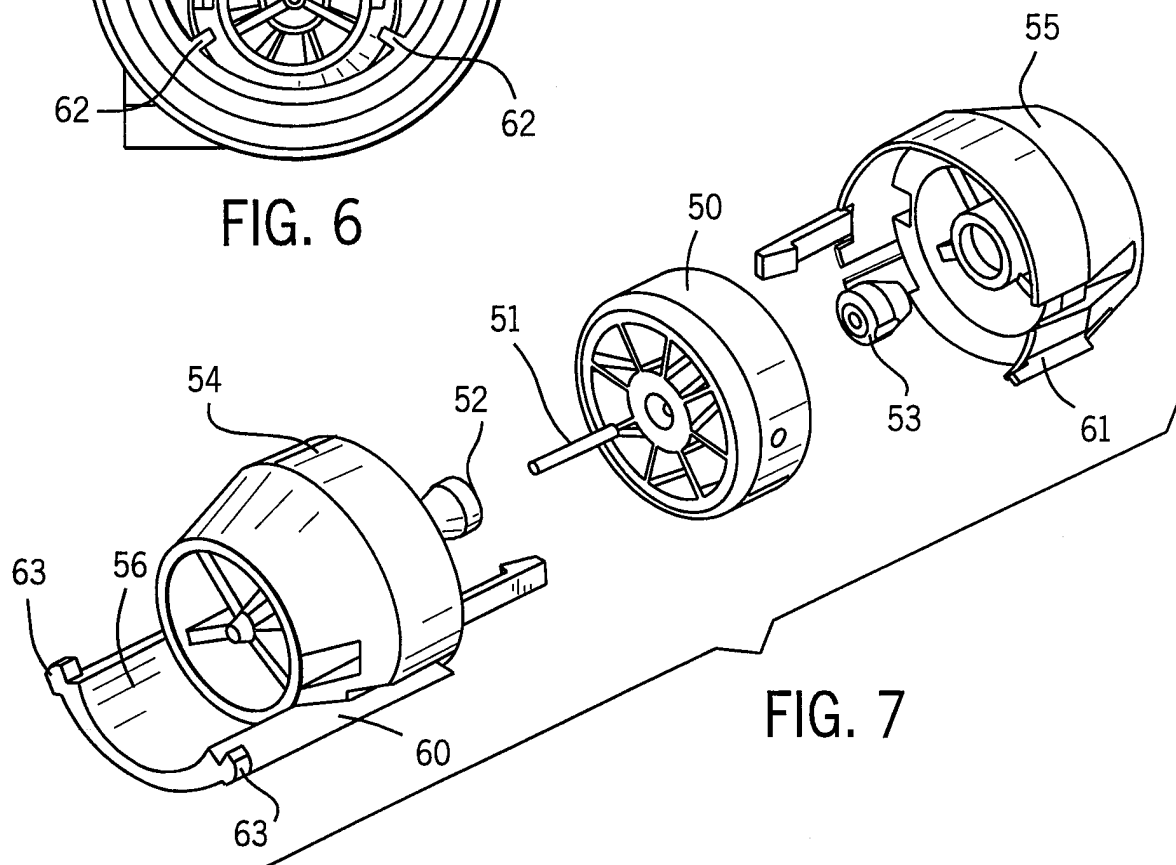
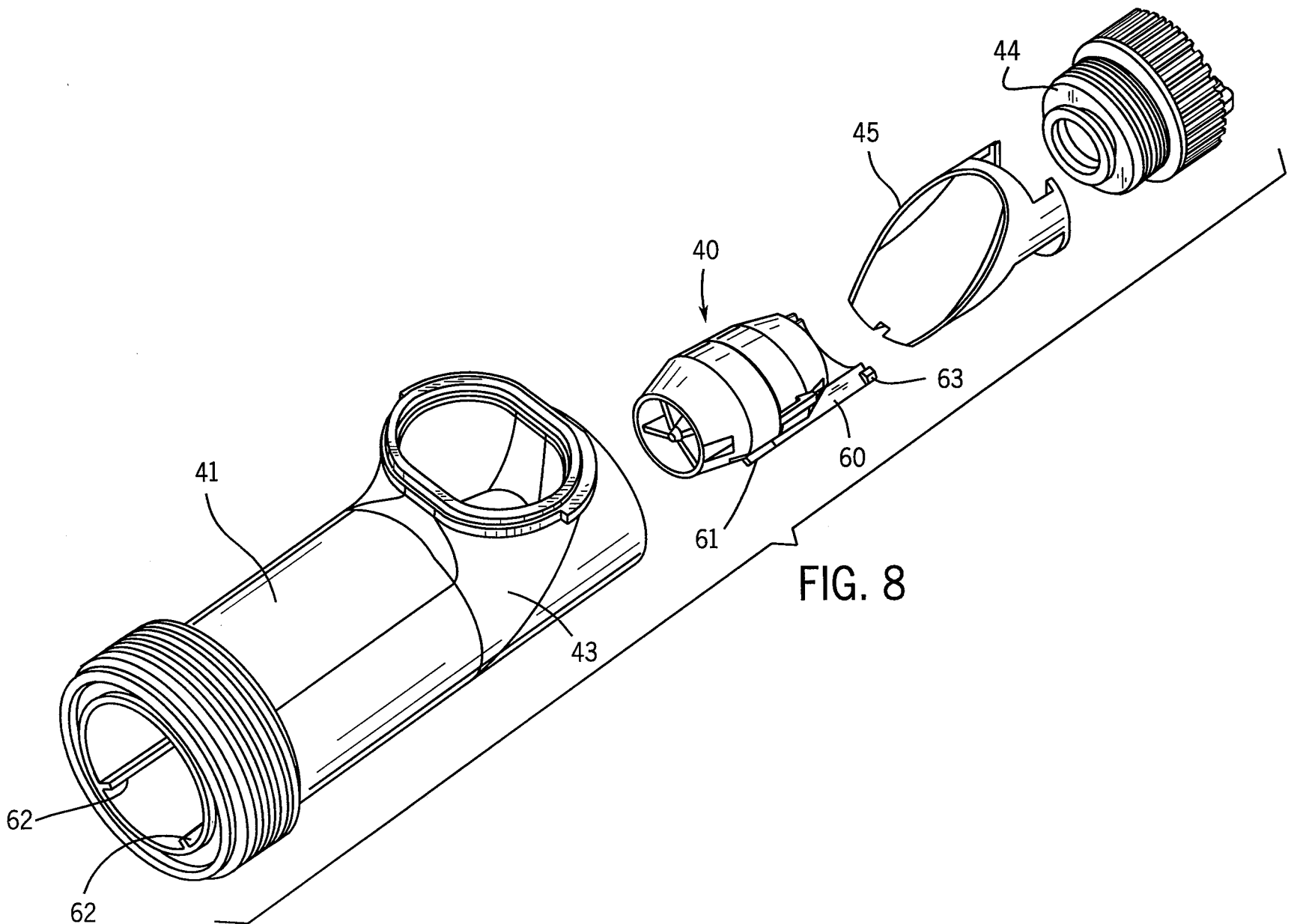


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/05132

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : G01F 1/10

US CL : 73/861.33, 861,79

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 73/861.33, 861.77, 861,78, 861,79, 861,87

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
noneElectronic data base consulted during the international search (name of data base and, where practicable, search terms used)
none

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,308,755 A (MILLAR ET AL) 05 January 1982 (05.01.82), Fig. 2, col. 3, lines 43-50.	1-18
A	US 4,825,707 A (ROSAEN) 02 May 1989 (02.05.89), see entire document.	1-18
A	US 4,936,151 A (TOKIO) 26 June 1990 (26.06.90), see entire document.	1-18

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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