



US008883006B2

(12) **United States Patent**  
**Kovach et al.**

(10) **Patent No.:** **US 8,883,006 B2**  
(45) **Date of Patent:** **Nov. 11, 2014**

(54) **FLUID TREATMENT SYSTEM**

(75) Inventors: **Jerome Kovach**, Chagrin Falls, OH (US); **Stuart L. Park**, Chardon, OH (US); **Peter R. Halemba**, Russell, OH (US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 367 days.

(21) Appl. No.: **13/266,514**  
(22) PCT Filed: **Apr. 28, 2010**  
(86) PCT No.: **PCT/US2010/032773**

§ 371 (c)(1),  
(2), (4) Date: **Oct. 27, 2011**

(87) PCT Pub. No.: **WO2010/127007**  
PCT Pub. Date: **Nov. 4, 2010**

(65) **Prior Publication Data**

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**Related U.S. Application Data**

(60) Provisional application No. 61/173,255, filed on Apr. 28, 2009, provisional application No. 61/323,965, filed on Apr. 14, 2010.

(51) **Int. Cl.**

**B01D 63/00** (2006.01)  
**B01D 61/08** (2006.01)  
**B01D 69/04** (2006.01)  
**C02F 1/44** (2006.01)  
**C02F 1/00** (2006.01)

(52) **U.S. Cl.**

CPC ..... **B01D 61/08** (2013.01); **C02F 2209/03** (2013.01); **C02F 2209/02** (2013.01); **C02F**

(Continued)

(58) **Field of Classification Search**

CPC ..... **C02F 1/441**; **C02F 2209/02**; **C02F 9/005**; **C02F 1/44**; **C02F 1/442**; **C02F 1/444**; **C02F**

2201/006; C02F 9/00; C02F 1/008; C02F 2209/40; C02F 2209/03; C02F 2303/16; C02F 2301/046; C02F 2301/08; B01D 61/022; B01D 61/10; B01D 61/025; B01D 61/08; B01D 65/00; B01D 2313/02; B01D 2317/04  
USPC ..... 210/85, 90, 97, 194, 195.1, 252, 257.1, 210/257.2, 258, 321.6, 321.78, 321.87, 210/323.2, 340, 416.1, 433.1, 450, 455  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,708,069 A 1/1973 Clark  
4,629,568 A 12/1986 Ellis, III

(Continued)

FOREIGN PATENT DOCUMENTS

WO 01/47615 7/2001  
WO 2009097176 6/2009

OTHER PUBLICATIONS

International Search Report and Written Opinion PCT/US10/32772; publication date Nov. 4, 2010.

(Continued)

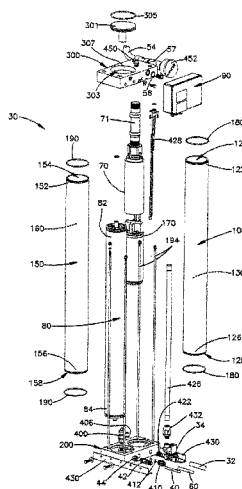
*Primary Examiner* — John Kim

(74) *Attorney, Agent, or Firm* — Tarolli, Sundheim, Covell & Tummino LLP

(57) **ABSTRACT**

A fluid treatment system for treating feed water includes a first tubular member having first and second ends, at least one second tubular member having first and second ends, a pump positioned within the first tubular member, a filtering membrane positioned within the second tubular member, a first end cap for receiving the first ends of the first and second tubular members, and a second end cap for receiving the second ends of the first and second tubular members.

**32 Claims, 25 Drawing Sheets**





US008741148B2

(12) **United States Patent**  
**Park et al.**

(10) **Patent No.:** **US 8,741,148 B2**  
(45) **Date of Patent:** **Jun. 3, 2014**

(54) **WATER TREATMENT SYSTEM**

USPC ..... 210/652, 257.2, 195.1, 134, 136, 90,  
210/110, 321.69, 106, 141, 195.2  
See application file for complete search history.

(75) Inventors: **Stuart Park**, Chardon, OH (US);  
**Stephen Goff**, Burton, OH (US); **Steven**  
**Hoopes**, Warren, OH (US); **Peter**  
**Halemba**, Russell, OH (US)

(56) **References Cited**

U.S. PATENT DOCUMENTS

(73) Assignee: **Kinetico Incorporated**, Newbury, OH  
(US)

3,441,047 A \* 4/1969 Lyall et al. .... 137/343  
4,604,194 A \* 8/1986 Entingh ..... 210/98

(\* ) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 611 days.

(Continued)

FOREIGN PATENT DOCUMENTS

(21) Appl. No.: **12/747,180**

WO WO 03 057998 7/2003  
WO WO 03 106003 12/2003

(22) PCT Filed: **Dec. 12, 2008**

OTHER PUBLICATIONS

(86) PCT No.: **PCT/US2008/086608**

PCT/US2008/088808 International Search Report and Written Opin-  
ion; date of mailing Feb. 9, 2009.

§ 371 (c)(1),  
(2), (4) Date: **Sep. 8, 2010**

*Primary Examiner* — Ana Fortuna

(87) PCT Pub. No.: **WO2009/076606**

(74) *Attorney, Agent, or Firm* — Tarolli, Sundheim, Covell  
& Tummino L.L.P.

PCT Pub. Date: **Jun. 18, 2009**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2010/0326917 A1 Dec. 30, 2010

A water treatment system including a reverse osmosis module and a control valve controlling communication between a water source and the module. A feedwater biased storage tank stores permeate and its pressurization by feedwater is controlled by a feedwater control valve. Flow of signal pressure to a signal pressure chamber of the feedwater control valve is restricted to reduce the rate at which a fluid generated force is applied. A check valve in parallel with the restriction allows relatively unrestricted flow out of the signal chamber when signal pressure is terminated. A tank pressurization control valve controls the operation of the feedwater control valve and controls the pressurization of a feedwater biasing chamber in the storage tank. Per-meate is stored in an accumulator for flushing the reverse osmosis module when the storage tank reaches a predetermined limit. Cleaning substances or additives can be introduced into the system.

**Related U.S. Application Data**

(60) Provisional application No. 61/007,462, filed on Dec.  
13, 2007.

(51) **Int. Cl.**

**B01D 61/00** (2006.01)  
**B01D 63/00** (2006.01)  
**C02F 1/44** (2006.01)

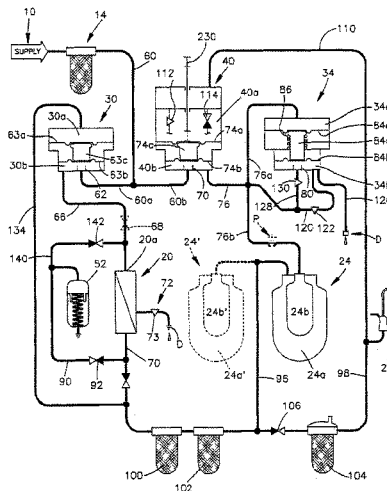
(52) **U.S. Cl.**

CPC ..... **B01D 61/00** (2013.01)  
USPC ..... **210/652**; 210/257.2; 210/134; 210/136;  
210/90; 210/106; 210/416.2

(58) **Field of Classification Search**

CPC ..... C02F 9/00; C02F 1/44; B01D 61/00

**19 Claims, 6 Drawing Sheets**





US00D700283S

(12) **United States Design Patent**  
**Park et al.**

(10) **Patent No.:** **US D700,283 S**

(45) **Date of Patent:** **\*\* Feb. 25, 2014**

(54) **HOUSING FOR A WATER TREATMENT SYSTEM CONTROL VALVE**

(75) Inventors: **Stuart L. Park**, Chardon, OH (US);  
**Francis A. Red**, Parma, OH (US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\*\*) Term: **14 Years**

(21) Appl. No.: **29/405,219**

(22) Filed: **Oct. 31, 2011**

(51) **LOC (10) Cl.** ..... **23-01**

(52) **U.S. Cl.**  
USPC ..... **D23/233**

(58) **Field of Classification Search**  
USPC ..... D23/233–233, 244–249; 137/624.14,  
137/624.18, 332, 625.46, 557; 251/59,  
251/30.05; 210/87, 88, 89, 190–192, 288,  
210/662

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

3,208,476	A *	9/1965	Clack	137/599.15
3,269,410	A	8/1966	Alvarado et al.	
D215,438	S *	10/1969	Livermore	D23/233
3,687,269	A *	8/1972	Fritz et al.	144/250.16
3,891,552	A *	6/1975	Prior et al.	210/88
4,298,025	A	11/1981	Prior et al.	
4,337,153	A	6/1982	Prior	
D271,421	S *	11/1983	Fetterman	D24/129
4,427,549	A	1/1984	Brown et al.	
4,492,247	A	1/1985	Lockwood	
4,693,814	A	9/1987	Brown	
5,022,994	A	6/1991	Avery et al.	
5,135,168	A	8/1992	Wang	

5,490,932	A	2/1996	Hansen et al.	
5,628,899	A	5/1997	Vaughan	
5,910,244	A *	6/1999	Stamos et al.	210/138
6,189,556	B1	2/2001	Blake et al.	
6,214,214	B1	4/2001	Hansen et al.	
D495,030	S	8/2004	Lillback	
D499,107	S	11/2004	Park	
D499,170	S *	11/2004	Park	D23/233
D511,599	S	11/2005	Lillback	
D518,876	S	4/2006	Park	
D538,890	S *	3/2007	Park	D23/233
D674,467	S *	1/2013	Weingarten	D23/233
D674,468	S *	1/2013	Weingarten	D23/233
D687,124	S *	7/2013	Weingarten	D23/233

\* cited by examiner

*Primary Examiner* — Cynthia Ramirez

(74) *Attorney, Agent, or Firm* — Tarolli, Sundheim, Covell & Tummino L.L.P.

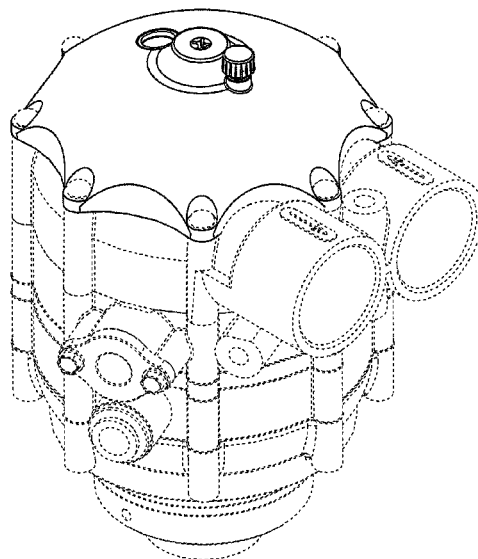
(57) **CLAIM**

We claim the ornamental design for a housing for a water treatment system control valve, as shown and described.

**DESCRIPTION**

FIG. 1 is a perspective view of housing for a water treatment system control valve showing our new design; FIG. 2 is a rear elevational view thereof; FIG. 3 is a left side elevational view thereof; FIG. 4 is a front elevational view thereof; FIG. 5 is a right side elevational view thereof; FIG. 6 is a top plan view thereof; and, FIG. 7 is a bottom plan view thereof. The broken line showing in the figures is included for the purpose of illustrating portions of the housing for a water treatment system control valve and forms no part of the claimed design.

**1 Claim, 4 Drawing Sheets**



(12) **United States Patent**  
**Rath et al.**

(10) **Patent No.:** **US 8,337,686 B2**  
(45) **Date of Patent:** **Dec. 25, 2012**

(54) **ELECTROREGENERATION APPARATUS AND WATER TREATMENT METHOD**

(75) Inventors: **David F. Rath**, Dundas (CA);  
**Christopher L. Hansen**, Newbury, OH (US);  
**Lyle Edward Kirman**, Cleveland Heights, OH (US);  
**Christopher S. Putka**, Cleveland, OH (US);  
**James E. Bolton**, Burlington (CA)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 82 days.

(21) Appl. No.: **12/445,848**

(22) PCT Filed: **Apr. 23, 2008**

(86) PCT No.: **PCT/US2008/005195**  
§ 371 (c)(1),  
(2), (4) Date: **Apr. 16, 2009**

(87) PCT Pub. No.: **WO2009/051612**  
PCT Pub. Date: **Apr. 23, 2009**

(65) **Prior Publication Data**  
US 2011/0042214 A1 Feb. 24, 2011

**Related U.S. Application Data**

(63) Continuation-in-part of application No. PCT/US2007/022204, filed on Oct. 18, 2007.

(60) Provisional application No. 60/852,510, filed on Oct. 18, 2006.

(51) **Int. Cl.**  
**B01D 61/44** (2006.01)  
**B01D 61/48** (2006.01)

(52) **U.S. Cl.** ..... **204/536; 204/537; 204/631; 204/632; 205/747; 205/748**

(58) **Field of Classification Search** ..... **204/537, 204/631, 632, 536; 205/744, 747, 748**  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,980,598 A 4/1961 Stoddard  
(Continued)

FOREIGN PATENT DOCUMENTS

GB 906440 9/1962  
(Continued)

OTHER PUBLICATIONS

Written Opinion of the International Searching Authority issued in corresponding International Application No. PCT/US2008/005195.  
(Continued)

*Primary Examiner* — Keith Hendricks

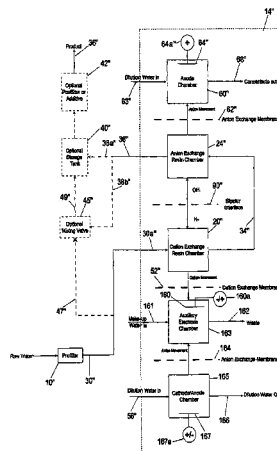
*Assistant Examiner* — Steven A. Friday

(74) *Attorney, Agent, or Firm* — Pearne & Gordon LLP

(57) **ABSTRACT**

A water treatment apparatus that includes a cation exchange chamber containing a cation exchange resin and an anion exchange chamber containing an anion exchange resin. A bipolar interface is located between the resin chambers and defines a zone of water disassociation. A cathode communicates with the cation exchange chamber through a cation exchange membrane. An anode communicates with the anion exchange chamber through an anion exchange membrane. Dilution or flushing water flows through cathode and anode chambers and conveys captured ions to a drain or other waste connection. A baffle may be used in some configurations to divide a resin chamber into an exhausted resin region and a regenerated resin region and causes incoming water to flow through the exhausted resin region first. The exhausted resin region is located near its associated electrode, thus improving the electrical efficiency of the cell. In an alternate design, the apparatus includes a cathode/anode chamber, an anode chamber and an auxiliary electrode chamber disposed between the cathode/anode chamber and a cation exchange media chamber. An anion exchange membrane separates the cathode/anode chamber from the auxiliary electrode chamber. The anode chamber, cathode/anode chamber and auxiliary electrode chamber are energized in predetermined sequences to create both service cycles which produce softened water with reduced ionic content and cleaning cycles to de-scale the auxiliary electrode chamber and/or anion exchange membrane located between the cathode/anode chamber and the auxiliary electrode chamber.

**34 Claims, 7 Drawing Sheets**





US008221616B2

(12) **United States Patent**  
**Lillback**

(10) **Patent No.:** **US 8,221,616 B2**  
(45) **Date of Patent:** **Jul. 17, 2012**

(54) **CONTROL VALVE ASSEMBLY**  
(75) Inventor: **Raymond Lillback**, Streetsboro, OH (US)  
(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

4,889,623 A 12/1989 Prior et al.  
5,022,994 A 6/1991 Avery et al.  
5,234,601 A 8/1993 Janke et al.  
5,256,283 A 10/1993 Buettner  
5,310,488 A 5/1994 Hansen et al.  
6,214,214 B1 4/2001 Hansen et al.  
6,444,127 B1 9/2002 Vaughan et al.

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 280 days.

FOREIGN PATENT DOCUMENTS  
EP 0 934 775 11/1999

(21) Appl. No.: **12/604,809**

OTHER PUBLICATIONS  
International Search Report PCT/US2003-027827; published Mar. 18, 2004.

(22) Filed: **Oct. 23, 2009**

Primary Examiner — Terry Cecil

(65) **Prior Publication Data**  
US 2010/0040454 A1 Feb. 18, 2010

(74) Attorney, Agent, or Firm — Tarolli, Sundheim, Covell & Tummino LLP

**Related U.S. Application Data**

(62) Division of application No. 10/525,543, filed as application No. PCT/US2003/027827 on Oct. 2, 2002, now Pat. No. 7,608,183.

(57) **ABSTRACT**

(51) **Int. Cl.**  
**B01D 24/46** (2006.01)  
**B01J 49/00** (2006.01)  
(52) **U.S. Cl.** ..... **210/88**; 210/98; 210/191; 210/145  
(58) **Field of Classification Search** ..... 210/88, 210/98, 190, 191, 140, 145  
See application file for complete search history.

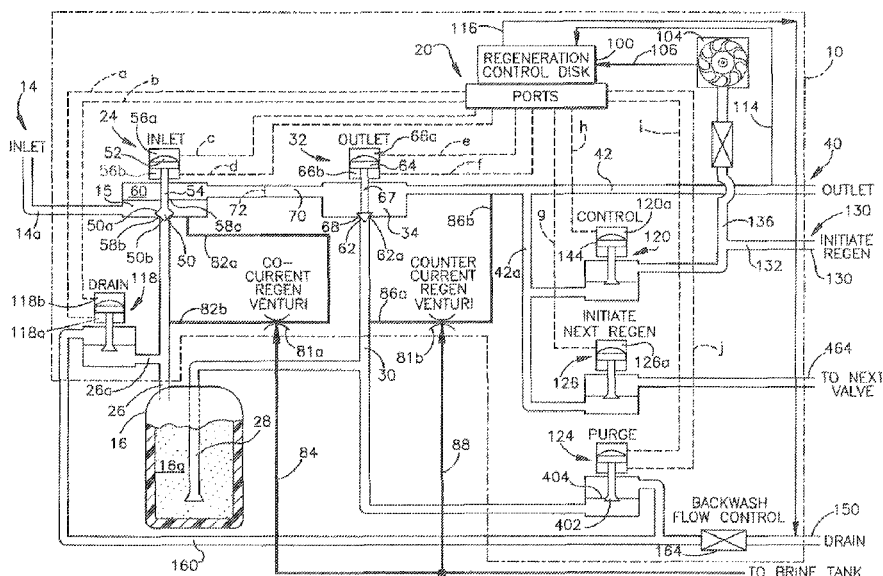
A control valve assembly (10) controls the flow of water to and from a treatment tank (16) and the regeneration of the treatment material therein. A housing of the valve assembly includes connections for a tank inlet and tank outlet. An inlet chamber (60), outlet chamber (34), a pressure-operated inlet valve (24) and an outlet valve (32). A pair of venturi chambers (81a, 81b) are configured to provide co-current and counter-current regeneration. A regeneration control subsystem includes a turbine (104) and a nozzle impinging thereon to produce rotation. An external port (130) receives fluid to provide a driving for the turbine in order to initiate regeneration. A bypass chamber (60) communicates with the inlet chamber (15). The inlet valve (24) has dual seating surfaces for controlling the communication between the inlet chamber, transfer chamber (70) and tank inlet (26).

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

3,891,552 A 6/1975 Prior et al.  
4,298,025 A 11/1981 Prior et al.

**3 Claims, 12 Drawing Sheets**





(12) **United States Patent**  
**Cook et al.**

(10) **Patent No.:** **US 7,864,062 B2**  
(45) **Date of Patent:** **Jan. 4, 2011**

(54) **APPARATUS AND METHOD FOR  
DETECTING A CHANGE IN A SPECIFIC  
GRAVITY OF A FLUID**

(75) Inventors: **Stephen W. Cook**, Chardon, OH (US);  
**Michael A. Hemann**, Newbury, OH  
(US); **Steven M. Hoopes**, Warren, OH  
(US); **Jerome P. Kovach**, Auburn, OH  
(US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH  
(US)

(\* ) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 280 days.

(21) Appl. No.: **11/666,947**  
(22) PCT Filed: **Nov. 4, 2005**  
(86) PCT No.: **PCT/US2005/040179**

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(2), (4) Date: **Apr. 25, 2008**

(87) PCT Pub. No.: **WO2006/052832**

PCT Pub. Date: **May 18, 2006**

(65) **Prior Publication Data**

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(51) **Int. Cl.**  
**G08B 21/00** (2006.01)

(52) **U.S. Cl.** ..... **340/603; 340/500; 340/540;**  
**340/623; 340/627; 73/32 R; 73/440; 73/29.05;**  
**73/30.01; 73/30.04; 137/91; 137/98; 137/125;**  
**137/128; 210/85; 210/86; 210/87; 210/97**

(58) **Field of Classification Search** ..... **340/603,**  
**340/540, 623, 627; 73/440, 32 R, 30.01,**  
**73/30.04, 31.05, 434, 451, 29.05, 437, 447,**  
**73/448, 452; 137/71-76, 551-555, 131,**  
**137/161, 165, 264, 242, 434; 210/97, 171,**  
**210/85-89**

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

1,424,403	A	8/1922	Hartman et al.
2,631,183	A	3/1953	Babis
5,273,070	A	12/1993	Chili et al.
5,623,251	A	4/1997	Clark
6,818,126	B2 *	11/2004	Larson ..... 210/171
7,387,722	B1 *	6/2008	Varner et al. .... 210/97

**OTHER PUBLICATIONS**

International Search Report PCT/US05/40179.  
US 2002/0017495 A1 (Itzuka et al); published Feb. 14, 2002.  
US 2003/0052060 A1 (Teel); published Mar. 20, 2003.

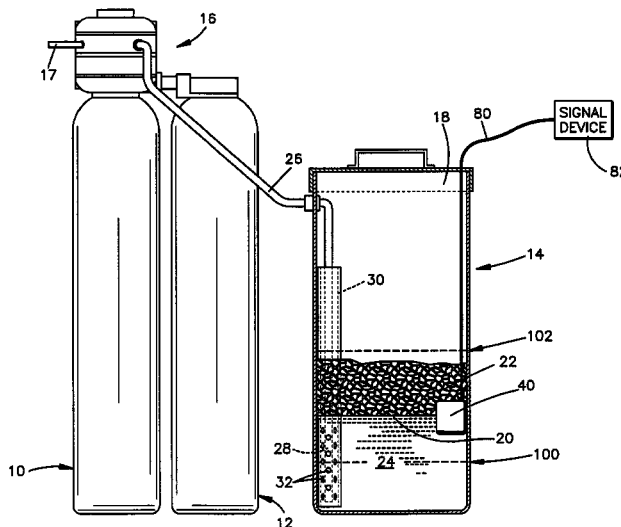
\* cited by examiner

*Primary Examiner*—George A Bugg  
*Assistant Examiner*—Sisay Yacob  
(74) *Attorney, Agent, or Firm*—Tarolli, Sundheim, Covell &  
Tummino LLP

(57) **ABSTRACT**

Provided is an apparatus for detecting a change in a specific gravity of a fluid surrounding the apparatus wherein the fluid moves upwardly and downwardly with respect to the apparatus. The apparatus includes a housing having a top and a plurality of openings for allowing the fluid to enter the housing. A first floatation device is provided having a first specific gravity and being located within the housing. The first floatation device includes a magnet. A second floatation device is provided having a second specific gravity and located within the housing adjacent said first floatation device. The said second floatation device includes a magnet aligned to have the same polarity as the magnet of the first floatation device. A switch fixedly attached to said top, the switch having an open state and a closed state where when one of said magnets is in proximity to the switch, the switch is in a closed state and wherein when both of said magnets are in proximity to said switch, the switch is in an open state. A signaling device is coupled to the switch wherein said signaling device is activated when the switch is in the closed state.

**42 Claims, 6 Drawing Sheets**





US007608183B2

(12) **United States Patent**  
**Lillback**

(10) **Patent No.:** **US 7,608,183 B2**  
(45) **Date of Patent:** **Oct. 27, 2009**

(54) **CONTROL VALVE ASSEMBLY**

(75) Inventor: **Raymond Lillback**, Streetsboro, OH (US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 691 days.

(21) Appl. No.: **10/525,543**

(22) PCT Filed: **Sep. 4, 2003**

(86) PCT No.: **PCT/US03/27827**

§ 371 (c)(1),  
(2), (4) Date: **Aug. 11, 2005**

(87) PCT Pub. No.: **WO2004/022199**

PCT Pub. Date: **Mar. 18, 2004**

(65) **Prior Publication Data**

US 2006/0096899 A1 May 11, 2006

(51) **Int. Cl.**  
**B01D 24/46** (2006.01)

(52) **U.S. Cl.** ..... **210/108**; 210/190; 210/269

(58) **Field of Classification Search** ..... 210/106,  
210/108, 142, 143, 190, 191, 269, 272, 278;  
137/624.18, 624.14

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

3,891,552 A 6/1975 Prior et al.

4,298,025 A	11/1981	Prior et al.	
4,889,623 A *	12/1989	Prior et al.	210/190
5,022,994 A	6/1991	Avery et al.	
5,256,283 A	10/1993	Buettner	
6,214,214 B1	4/2001	Hansen et al.	
6,444,127 B1	9/2002	Vaughan et al.	

**OTHER PUBLICATIONS**

International Search Report PCT/US2003/027827, published Mar. 18, 2004.

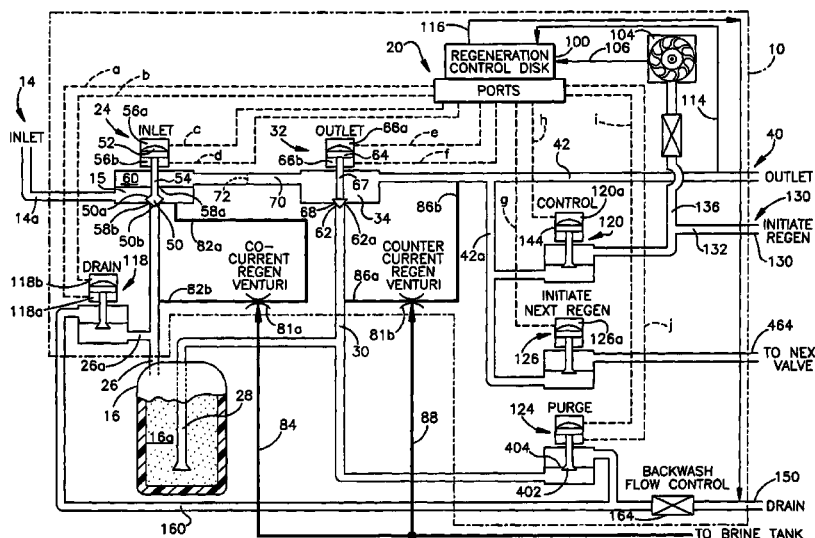
\* cited by examiner

*Primary Examiner*—Terry K Cecil  
(74) *Attorney, Agent, or Firm*—Tarolli, Sundheim, Covell & Tummino, LLP

(57) **ABSTRACT**

A control valve assembly (10) controls the flow of water to and from a treatment tank (16) and the regeneration of the treatment material therein. A housing of the valve assembly includes connections for a tank inlet and tank outlet, an inlet chamber (60), outlet chamber (34), a pressure-operated inlet valve (24) and an outlet valve (32). A pair of venturi chambers (81a, 81b) are configured to provide co-current and counter-current regeneration. A regeneration control subsystem includes a turbine (104) and a nozzle impinging thereon to produce rotation. An external port (130) receives fluid to provide a driving force for the turbine in order to initiate regeneration. A bypass chamber (60) communicates with the inlet chamber (15). The inlet valve (24) has dual seating surfaces for controlling the communication between the inlet chamber, transfer chamber (70) and tank inlet (26).

**18 Claims, 12 Drawing Sheets**





US00D575844S

(12) **United States Design Patent**  
**Park et al.**

(10) **Patent No.:** **US D575,844 S**

(45) **Date of Patent:** **\*\* Aug. 26, 2008**

(54) **HOUSING FOR A WATER TREATMENT UNIT**

(75) Inventors: **Stuart Park**, Chardon, OH (US); **Steven M. Hoopes**, Warren, OH (US); **Jess Carlson**, Chagrin Falls, OH (US); **René Polin, Jr.**, Highland Heights, OH (US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\*\*) Term: **14 Years**

(21) Appl. No.: **29/285,266**

(22) Filed: **Mar. 26, 2007**

(51) **LOC (8) Cl.** ..... **23-01**

(52) **U.S. Cl.** ..... **D23/207**

(58) **Field of Classification Search** ..... D23/207,  
D23/209; 210/241, 435

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

D366,094 S	1/1996	Duncan et al.	
D397,764 S *	9/1998	Strand	D23/209
D412,552 S *	8/1999	Burrows	D23/209
D413,961 S *	9/1999	Bassett	D23/209
D417,254 S	11/1999	Daws et al.	
D421,089 S *	2/2000	Fujita et al.	D23/207
D439,950 S	4/2001	Fletcher et al.	
D446,840 S	8/2001	Strand	
D472,298 S	3/2003	Riddell	
D477,048 S *	7/2003	Yang	D23/207
D482,755 S *	11/2003	Rhinehart et al.	D23/207
D486,883 S *	2/2004	O'Loughlin	D23/209
D502,757 S *	3/2005	Mork et al.	D23/207

**OTHER PUBLICATIONS**

1 page website of Kinetico Incorporated, [www.kinetico.co.uk/blocksfof.htm](http://www.kinetico.co.uk/blocksfof.htm), visited Aug. 15, 2002.

1 page website of Kinetico Incorporated, [www.kinetico.co.uk/residential.htm](http://www.kinetico.co.uk/residential.htm), visited Aug. 15, 2002.

1 page website of Ewatec, [www.ewatec.com/320DC.html](http://www.ewatec.com/320DC.html), visited Aug. 15, 2002.

3 page website of Ewatec, [www.ewatec.com/640DC.html](http://www.ewatec.com/640DC.html), visited Aug. 15, 2002.

1 page website of Twintec, [www.twintec.biz/start.html](http://www.twintec.biz/start.html), visited Aug. 15, 2002.

4 page website of Twintec, [www.twintec.biz/best/bl.html](http://www.twintec.biz/best/bl.html), visited Aug. 15, 2002.

\* cited by examiner

*Primary Examiner*—Robin V Webster

(74) *Attorney, Agent, or Firm*—Tarolli, Sundheim, Covell & Tummino, LLP

(57) **CLAIM**

We claim the ornamental design for a housing for a water treatment unit, as shown and described.

**DESCRIPTION**

FIG. 1 is a front perspective view of a housing for a water treatment unit of the present invention (the broken lines in FIGS. 1–7 are for illustrative purposes only and do not form part of the invention shown in FIGS. 1–7);

FIG. 2 is a rear perspective view of the housing shown in FIG. 1;

FIG. 3 is a left side elevational view of the housing shown in FIG. 1;

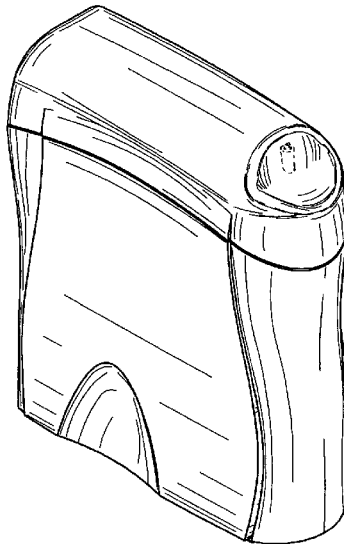
FIG. 4 is a front elevational view of the housing shown in FIG. 1;

FIG. 5 is a top plan view of the housing shown in FIG. 1;

FIG. 6 is a bottom plan view of the housing shown in FIG. 1; and,

FIG. 7 is a rear elevational view of the housing shown in FIG. 1.

**1 Claim, 3 Drawing Sheets**







(12) **United States Patent  
Park**

(10) **Patent No.: US 7,373,949 B2**  
(45) **Date of Patent: May 20, 2008**

(54) **FLUID TREATMENT SYSTEM**  
(75) Inventor: **Stuart Park**, Chardon, OH (US)  
(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)  
(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 103 days.

(58) **Field of Classification Search** ..... 137/624.18, 137/624.14, 624.12; 210/98, 190, 88, 26  
See application file for complete search history.

(56) **References Cited**  
U.S. PATENT DOCUMENTS  
4,298,025 A 11/1981 Prior et al.  
4,427,549 A 1/1984 Brown et al.  
5,022,994 A \* 6/1991 Avery et al. .... 137/624.12  
5,375,768 A 12/1994 Clark  
5,490,932 A 2/1996 Hansen et al.  
6,287,457 B1 \* 9/2001 Van De Moortele ... 137/624.18

(21) Appl. No.: **10/525,542**  
(22) PCT Filed: **Aug. 22, 2003**  
(86) PCT No.: **PCT/US03/26456**  
§ 371 (c)(1),  
(2), (4) Date: **Feb. 16, 2006**  
(87) PCT Pub. No.: **WO2004/020340**  
PCT Pub. Date: **Mar. 11, 2004**

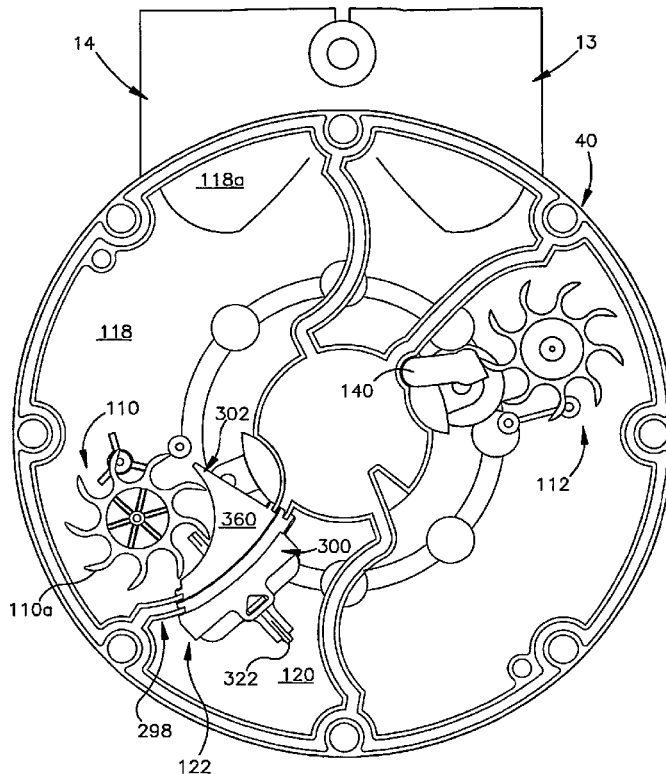
\* cited by examiner  
*Primary Examiner*—Kevin Lee  
(74) *Attorney, Agent, or Firm*—Tarolli, Sundheim, Covell & Tummino, LLP

(65) **Prior Publication Data**  
US 2006/0118182 A1 Jun. 8, 2006

(57) **ABSTRACT**  
A control valve for a water treatment system which includes a turbine (110) rotatably mounted within a water receiving chamber. A nozzle assembly (122) defines first and second fluid paths, one of the flow paths may include a fluid pressure response valve element (320) for controlling fluid flow along the one path. The system also comprises a nozzle assembly (122') defining a throat (302') extending from an inlet and terminating in an arcuate outlet conforming to the periphery of the turbine. A plurality of spaced apart and angled vanes (404) are disposed in the throat.

(51) **Int. Cl.**  
**B01D 17/12** (2006.01)  
**F17D 3/00** (2006.01)  
(52) **U.S. Cl.** ..... **137/624.18; 137/624.14;**  
**210/98; 210/190**

**24 Claims, 11 Drawing Sheets**





US007316774B2

(12) **United States Patent**  
**Halemba et al.**

(10) **Patent No.:** **US 7,316,774 B2**  
(45) **Date of Patent:** **Jan. 8, 2008**

(54) **FLUID TREATMENT SYSTEM**

(75) Inventors: **Peter Halemba**, Russell, OH (US);  
**George Ellis, III**, East Claridon, OH (US);  
**Stuart Park**, Burton, OH (US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 245 days.

(21) Appl. No.: **10/894,213**

(22) Filed: **Jul. 19, 2004**

(65) **Prior Publication Data**  
US 2005/0023198 A1 Feb. 3, 2005

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 10/009,091, filed on Jul. 22, 2002, now Pat. No. 6,764,595.

(51) **Int. Cl.**  
**B01D 61/10** (2006.01)  
**B01D 61/12** (2006.01)  
**B01D 63/00** (2006.01)

(52) **U.S. Cl.** ..... **210/110; 210/106; 210/117;**  
**210/135; 210/321.69**

(58) **Field of Classification Search** ..... None  
See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,579,242 A	4/1986	Ellis, III	
4,585,554 A	4/1986	Burrows	
4,604,194 A	8/1986	Entingh	
4,629,568 A	12/1986	Ellis, III	
4,650,586 A	3/1987	Ellis, III	
4,705,625 A	11/1987	Hart, Jr.	
4,776,952 A	10/1988	Burrows	
4,885,085 A	12/1989	Beall, Jr.	
4,909,934 A *	3/1990	Brown et al. ....	210/110
4,997,553 A	3/1991	Clack	
5,662,793 A	9/1997	Beall, Jr.	
6,110,360 A *	8/2000	Hart, Jr. ....	210/110
2005/0205478 A1 *	9/2005	Kung et al. ....	210/106

\* cited by examiner

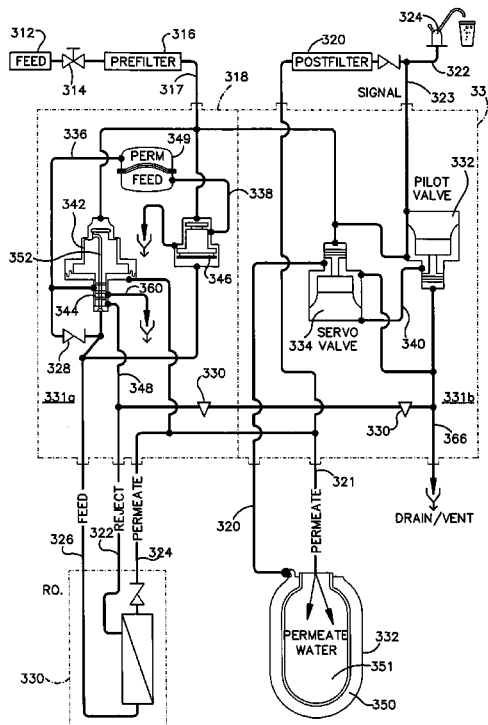
*Primary Examiner*—Krishnan S. Menon

(74) *Attorney, Agent, or Firm*—Tarolli, Sundheim, Covell & Tummino, LLP

(57) **ABSTRACT**

A reverse osmosis water filtration system has a control housing that contains control components for the filtration system. The control housing may include control components for a membrane flushing system and/or feed water pressurization system for a permeate storage tank.

**8 Claims, 9 Drawing Sheets**





US007261819B2

(12) **United States Patent**  
**Jordan et al.**

(10) **Patent No.:** **US 7,261,819 B2**  
(45) **Date of Patent:** **Aug. 28, 2007**

(54) **WATER TREATMENT METHOD**  
(75) Inventors: **George Jordan**, Chardon, OH (US);  
**Christopher Hansen**, Newbury, OH  
(US); **Lisa Heiden**, Chardon, OH (US)  
(73) Assignee: **Kinetico Incorporated**, Newbury, OH  
(US)  
(\* ) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 0 days.

3,684,457 A 8/1972 Pinto et al.  
3,762,550 A 10/1973 Jarr et al.  
3,891,552 A 6/1975 Prior et al.  
4,336,134 A 6/1982 Prior  
4,337,153 A 6/1982 Prior  
4,374,025 A 2/1983 Loke  
4,764,280 A 8/1988 Brown et al.  
4,889,623 A 12/1989 Prior et al.  
5,045,187 A 9/1991 Suchanek  
5,106,543 A 4/1992 Dodds  
5,407,574 A 4/1995 Hensley  
5,544,072 A 8/1996 Zimmerman et al.  
5,589,058 A 12/1996 Bauer  
5,685,975 A 11/1997 Joubert et al.

(21) Appl. No.: **11/240,410**

**FOREIGN PATENT DOCUMENTS**

(22) Filed: **Sep. 30, 2005**

SU 1369786 1/1988

(65) **Prior Publication Data**

\* cited by examiner

US 2006/0081538 A1 Apr. 20, 2006

*Primary Examiner*—Matthew O. Savage  
(74) *Attorney, Agent, or Firm*—Tarolli, Sundheim, Covell &  
Tummino, LLP

**Related U.S. Application Data**

(62) Division of application No. 10/033,355, filed on Nov.  
1, 2001, now Pat. No. 6,962,657.

(60) Provisional application No. 60/244,996, filed on Nov.  
1, 2000.

(57) **ABSTRACT**

A water treatment system for removing hard ions from  
source water. The water treatment system is of the type that  
includes a pair of ion-exchange water softener tanks con-  
nectable to a source of pressurized water and with a water  
system to supply softened water to the water system, the  
tanks each being capable of regeneration by flushing with a  
regeneration solution to replenish depleted ions. A process  
for preventing system failure due to salt crystallization  
includes flowing water during brine replenishment from a  
second nozzle and a first nozzle at a defined ratio. The first  
nozzle diluted the brine in a reservoir after regeneration  
cycle is complete. The second nozzle replenishes brine by  
flowing water directly onto a salt material.

(51) **Int. Cl.**  
**B01J 49/00** (2006.01)

(52) **U.S. Cl.** ..... **210/670; 210/687**

(58) **Field of Classification Search** ..... 210/670,  
210/687

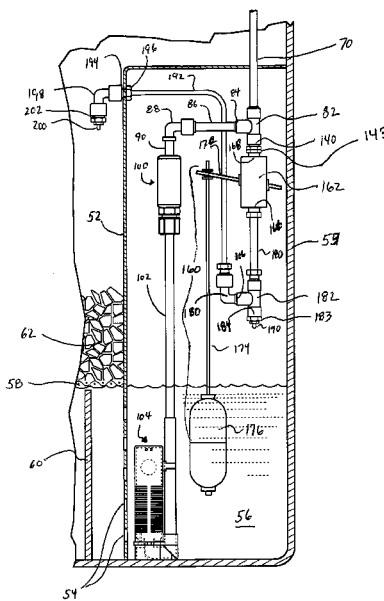
See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

3,351,550 A 11/1967 Kralker, Jr.  
3,574,559 A \* 4/1971 Kryzer et al. .... 422/106

**3 Claims, 3 Drawing Sheets**





(12) **United States Design Patent**  
**Park**

(10) **Patent No.:** **US D538,890 S**  
(45) **Date of Patent:** **\*\* Mar. 20, 2007**

(54) **HOUSING FOR A WATER TREATMENT SYSTEM CONTROL VALVE**

(75) Inventor: **Stuart Park**, Burton, OH (US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\*\*) Term: **14 Years**

(21) Appl. No.: **29/264,582**

(22) Filed: **Aug. 14, 2006**

**Related U.S. Application Data**

(63) Continuation of application No. 29/244,673, filed on Dec. 13, 2005, now abandoned.

(51) **LOC (8) Cl.** ..... **23-01**

(52) **U.S. Cl.** ..... **D23/233**

(58) **Field of Classification Search** ..... D23/233-237, D23/244-249; 137/624.14, 624.18, 332, 137/625.46, 554, 557; 251/59, 30.05; 210/87, 210/88, 98, 190-192, 288, 662  
See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

- 3,208,476 A 9/1965 Clack
- 3,687,269 A 8/1972 Fritz et al.
- 3,891,552 A 6/1975 Prior et al.
- 4,298,025 A 11/1981 Prior et al.
- 4,337,153 A 6/1982 Prior
- D271,421 S \* 11/1983 Fetterman ..... D24/129

- 4,427,549 A 1/1984 Brown et al.
- 4,492,247 A \* 1/1985 Lockwood ..... 137/119.03
- 4,693,814 A 9/1987 Brown
- 5,022,994 A 6/1991 Avery et al.
- 5,490,932 A 2/1996 Hansen et al.
- 5,910,244 A \* 6/1999 Stamos et al. .... 210/138
- 6,189,556 B1 2/2001 Blake et al.
- 6,214,214 B1 4/2001 Hansen et al.
- D495,030 S \* 8/2004 Lillback ..... D23/233
- D522,559 S \* 6/2006 Naito et al. .... D16/219

\* cited by examiner

*Primary Examiner*—Ian Simmons

*Assistant Examiner*—Maurice Stevens

(74) *Attorney, Agent, or Firm*—Tarolli, Sundheim, Covell & Tummino, LLP

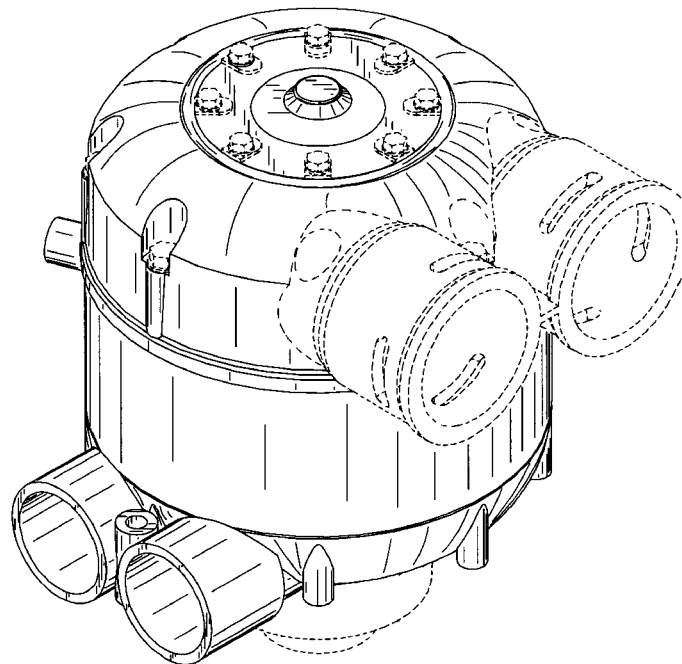
(57) **CLAIM**

I claim the ornamental design for a housing for a water treatment system control valve, as shown and described.

**DESCRIPTION**

FIG. 1 is a perspective view of a housing for a water treatment system control valve showing my new design; FIG. 2 is a top plan thereof; FIG. 3 is a right side elevational view thereof; FIG. 4 is a rear elevational view thereof; FIG. 5 is a bottom plan view thereof; FIG. 6 is a left side elevational view thereof; and, FIG. 7 is a front elevational view thereof. The broken lines in FIGS. 1-7 are for illustrative purposes only and form no part of the claim design.

**1 Claim, 4 Drawing Sheets**





(12) **United States Patent**  
**Brown et al.**

(10) **Patent No.:** **US 7,182,858 B2**  
(45) **Date of Patent:** **Feb. 27, 2007**

- (54) **MULTIPLE BARRIER FILTER APPARATUS**
- (75) Inventors: **Keith E. Brown**, Solon, OH (US); **Paul Peterson**, Cuyahoga Falls, OH (US); **Stuart Park**, Burton, OH (US); **Ron Kindel**, Chardon, OH (US); **Eric Sklar**, Northville, MI (US); **John Miller**, Sunnyside, NY (US); **Ken Weight**, Hampshire (GB)
- (73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 119 days.

(21) Appl. No.: **10/433,495**  
(22) PCT Filed: **Mar. 4, 2003**

(86) PCT No.: **PCT/US03/06419**  
§ 371 (c)(1),  
(2), (4) Date: **May 30, 2003**

(87) PCT Pub. No.: **WO03/076044**  
PCT Pub. Date: **Sep. 18, 2003**

(65) **Prior Publication Data**  
US 2004/0164006 A1 Aug. 26, 2004

(51) **Int. Cl.**  
**B01D 35/153** (2006.01)  
**B01D 35/30** (2006.01)  
**B01D 36/02** (2006.01)  
**B01D 36/04** (2006.01)  
**B01D 35/143** (2006.01)

(52) **U.S. Cl.** ..... **210/117**; 137/597; 137/798;  
137/801; 137/802; 210/87; 210/110; 210/136;  
210/257.2; 210/321.72; 210/335; 210/443;  
210/449; 222/189.06

(58) **Field of Classification Search** ..... 210/87,  
210/109, 110, 117, 136, 257.1, 257.2, 259,  
210/314, 316, 323.2, 335, 340, 424, 440,  
210/443, 444, 449, 460, 641, 650, 652, 321.72,  
210/323.1; 137/445, 801, 343, 597, 798,  
137/802; 222/189.06; 285/120.1  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,570,675 A 3/1971 Pall

(Continued)

FOREIGN PATENT DOCUMENTS

WO WO 98/01207 1/1998  
WO WO 00/71229 11/2000  
WO WO 01/16036 3/2001

OTHER PUBLICATIONS

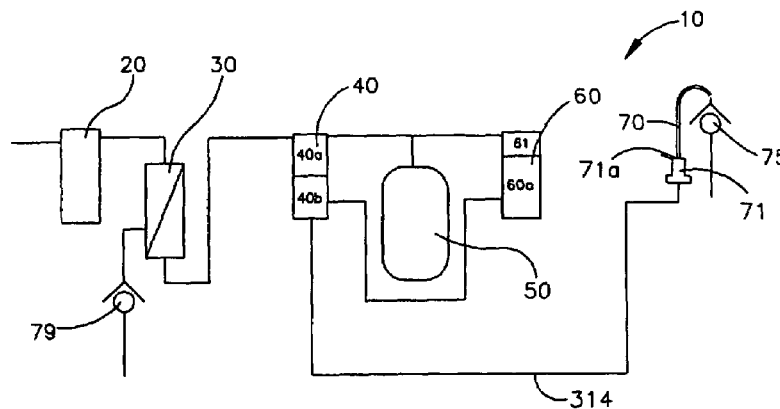
Monroe, PGPUBS Document US 2002/0189985, published Dec. 19, 2002.\*

*Primary Examiner*—Joseph Drodge  
(74) *Attorney, Agent, or Firm*—Tarolli, Sundheim, Covell & Tummino, LLP

(57) **ABSTRACT**

A filter apparatus is provided which includes a first filter membrane element (40a), and a second bacterial filter membrane element. The first viral filter element (40a) is capable of treating water at a first second flow rate and is adapted to remove contaminants which are larger than a first size, while the second bacterial filter element (40b) is capable of treating water at a second higher flow rate and is adapted to remove contaminants which are larger than a second contaminant size. The first and second filter elements (40a), (40b) may be commonly housed within a sealed housing. An accumulating vessel (60) is placed in fluid communication with an outlet of the first filter element (40a) and an outlet of the second filter element (40b). The filter apparatus includes a duck bill type check valve (75) made of an antimicrobial material intermediate the second filter element (40b) and a dispensing faucet (70).

**66 Claims, 10 Drawing Sheets**





US00D518876S

(12) **United States Design Patent**  
**Park**

(10) **Patent No.:** **US D518,876 S**

(45) **Date of Patent:** **\*\* Apr. 11, 2006**

(54) **UPPER HOUSING FOR A WATER  
TREATMENT SYSTEM CONTROL VALVE**

(75) Inventor: **Stuart Park**, Burton, OH (US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH  
(US)

(\*\*) Term: **14 Years**

(21) Appl. No.: **29/215,354**

(22) Filed: **Oct. 18, 2004**

**Related U.S. Application Data**

(62) Division of application No. 29/170,001, filed on Oct. 30,  
2002, now Pat. No. Des. 499,170.

(51) **LOC (8) Cl.** ..... **23-01**

(52) **U.S. Cl.** ..... **D23/233**

(58) **Field of Classification Search** ..... D23/233-249;  
137/624.14, 624.18, 332, 19.06, 625.46,  
137/554, 557; 251/59, 30.05; 210/87, 88,  
210/98, 190-192, 288, 662

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

3,208,476 A	9/1965	Clack
3,687,269 A	8/1972	Fritz et al.
3,891,552 A	6/1975	Prior et al.
4,298,025 A	11/1981	Prior et al.

4,337,153 A	6/1982	Prior	
D271,421 S	* 11/1983	Fetterman	..... D24/129
4,427,549 A	1/1984	Brown et al.	
4,492,247 A	* 1/1985	Lockwood	..... 137/119.03
4,693,814 A	9/1987	Brown	
5,022,994 A	6/1991	Avery et al.	
5,490,932 A	2/1996	Hansen et al.	
6,189,556 B1	2/2001	Blake et al.	
6,214,214 B1	4/2001	Hansen et al.	
D495,030 S	* 8/2004	Lillback	..... D23/233

\* cited by examiner

*Primary Examiner*—Caron D. Veynar

*Assistant Examiner*—Maurice Stevens

(74) *Attorney, Agent, or Firm*—Watts Hoffmann Co., L.P.A.

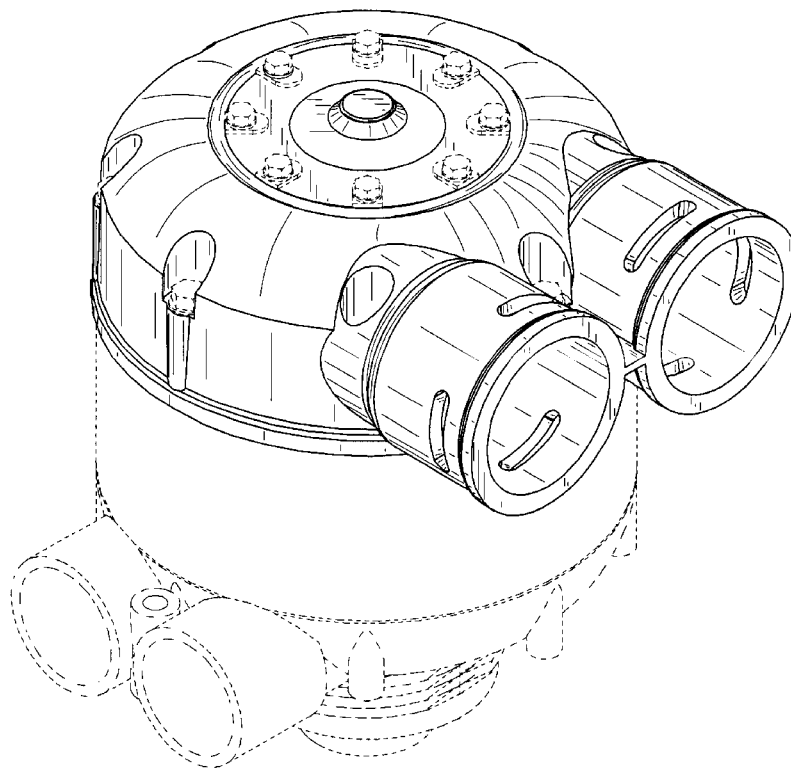
(57) **CLAIM**

The ornamental design for upper housing for a water treatment system control valve, as shown and described.

**DESCRIPTION**

FIG. 1 is a perspective view of an upper housing for a water treatment system control valve of the present invention; FIG. 2 is a top plan thereof; FIG. 3 is a right side elevational view thereof; FIG. 4 is a rear elevational view thereof; FIG. 5 is a bottom plan view thereof; FIG. 6 is a left side elevational view thereof; and, FIG. 7 is a front elevational view thereof. The broken lines in FIGS. 1-7 are for illustrative purposes only and form no part of the claim design.

**1 Claim, 4 Drawing Sheets**





US006994794B2

(12) **United States Patent**  
**Hansen et al.**

(10) **Patent No.:** **US 6,994,794 B2**  
(45) **Date of Patent:** **Feb. 7, 2006**

(54) **MEDIA WITH GERMICIDAL PROPERTIES**

(75) Inventors: **Christopher B. Hansen**, Newbury, OH (US); **Samuel Mason**, Wickliffe, OH (US); **Mohan L. Sanduja**, Flushing, NY (US); **Carl Horowitz**, Brooklyn, NY (US); **Paul Thottathil**, New Hyde Park, NY (US); **Felicia Dragnea**, Forest Hills, NY (US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 142 days.

(21) Appl. No.: **10/432,557**

(22) PCT Filed: **Nov. 27, 2001**

(86) PCT No.: **PCT/US01/44421**

§ 371 (c)(1),  
(2), (4) Date: **May 22, 2003**

(87) PCT Pub. No.: **WO02/42215**

PCT Pub. Date: **May 30, 2002**

(65) **Prior Publication Data**

US 2004/0050799 A1 Mar. 18, 2004

**Related U.S. Application Data**

(63) Continuation-in-part of application No. 09/722,911, filed on Nov. 27, 2000, now Pat. No. 6,471,876.

(51) **Int. Cl.**  
**C02F 1/50** (2006.01)

(52) **U.S. Cl.** ..... **210/764**; 210/502.1; 210/504; 252/175

(58) **Field of Classification Search** ..... 210/764, 210/502, 504; 252/175  
See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,111,713 A \* 9/1978 Beck ..... 106/409  
4,725,390 A \* 2/1988 Laird et al. .... 264/660  
4,996,872 A \* 3/1991 Mueller et al. .... 73/38

\* cited by examiner

*Primary Examiner*—Betsey Morrison Hoey

(74) *Attorney, Agent, or Firm*—Watts Hoffmann Co., L.P.A.

(57) **ABSTRACT**

Filtration media having germicidal for use in filtering particles and deactivating, removing and/or destroying microorganisms from a feed liquid passing through the media. The filtration media includes an effective amount of at least one germicidal agent associated to monomers polymerized and chemically grafted and covalently bonded to the surface of the media. The germicidal filter media is prepared by contacting the media with a grafting solution comprising one or more monomers, a catalyst, a surface agent, a curing agent, at least one graft initiator, and at least one germicide and subsequently curing the media at an elevated temperature to chemically graft the polymerizable monomers onto a surface of the media and associate at least one germicide thereto. Filter media suitable for use in the present invention include ceramic spheroids, hollow glass spheres, polymeric media, thermoset coated glass spheres, and crystalline microporous materials, such as zeolites. The germicidal filter media is effective for deactivating, destroying and/or removing from a feed liquid, such as water, escherichia coli, salmonella choleraesuis, staphylococcus, aspergillus, klebsiella, listeria, clostridium, rotavirus, cysts and other microorganisms. Moreover, the filter media can be used repeatedly without a significant decrease in its germicidal effectiveness.

**31 Claims, No Drawings**



(12) **United States Design Patent**  
**Lillback**

(10) **Patent No.:** **US D511,559 S**  
(45) **Date of Patent:** **\*\* Nov. 15, 2005**

(54) **HOUSING FOR A WATER TREATMENT SYSTEM CONTROL VALVE**

(75) **Inventor:** **Raymond Lillback**, Streetsboro, OH (US)

(73) **Assignee:** **Kinetico Incorporated**, Newbury, OH (US)

(\*\*) **Term:** **14 Years**

(21) **Appl. No.:** **29/208,589**

(22) **Filed:** **Jun. 30, 2004**

**Related U.S. Application Data**

(62) Division of application No. 29/168,470, filed on Oct. 2, 2002, now Pat. No. Des. 495,030.

(51) **LOC (8) Cl.** ..... **23-01**

(52) **U.S. Cl.** ..... **D23/233**

(58) **Field of Search** ..... D23/233-249;  
137/624.14, 624.18; 210/98, 141, 190, 541;  
251/59; 415/150

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

3,208,476 A	*	9/1965	Clack	137/599.15
3,269,410 A	*	8/1966	Alvarado et al.	137/882
3,891,552 A		6/1975	Prior et al.	
4,298,025 A		11/1981	Prior et al.	
4,337,153 A		6/1982	Prior	
4,427,549 A	*	1/1984	Brown et al.	210/662

5,022,994 A		6/1991	Avery et al.	
5,135,168 A	*	8/1992	Wang	239/70
5,490,932 A		2/1996	Hansen et al.	
5,628,899 A	*	5/1997	Vaughan	210/142
6,189,556 B1	*	2/2001	Blake et al.	137/119.07
6,214,214 B1	*	4/2001	Hansen et al.	210/106

\* cited by examiner

*Primary Examiner*—Nelson C. Holtje

(74) *Attorney, Agent, or Firm*—Watts Hoffmann Co., LPA

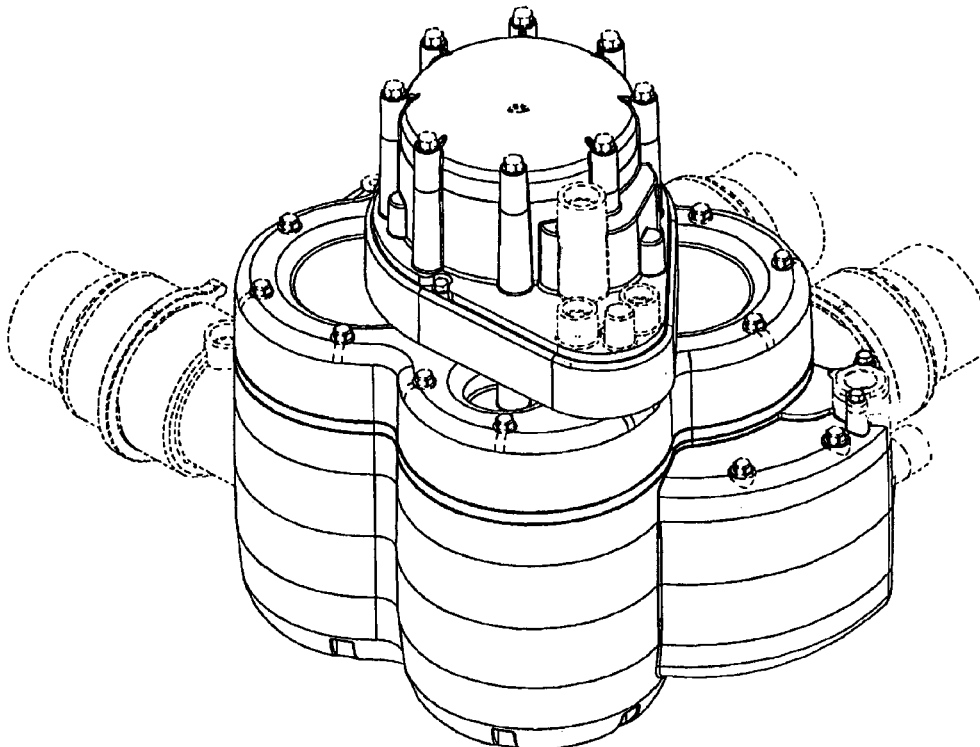
(57) **CLAIM**

I claim the ornamental design for a housing for a water treatment system control valve, as shown and described.

**DESCRIPTION**

FIG. 1 is a front perspective view of a housing for a water treatment system control valve of the present invention (the broken lines in FIGS. 1-7 are for illustrative purposes only and do not form part of the invention shown in FIGS. 1-7); FIG. 2 is a top plan view of the housing shown in FIG. 1; FIG. 3 is a bottom view of the housing shown in FIG. 1; FIG. 4 is a side elevational view of the housing as seen from the plane indicated by the line 4-4 in FIG. 2; FIG. 5 is a side elevational view as seen from the plane indicated by the line 5-5 in FIG. 2; FIG. 6 is a side elevational view of the housing as seen from the plane indicated by the line 6-6 in FIG. 2; and, FIG. 7 is a front elevational view of the housing as seen from the plane indicated by the line 7-7 in FIG. 2.

**1 Claim, 7 Drawing Sheets**







US006962657B2

(12) **United States Patent**  
Jordan et al.

(10) **Patent No.:** US 6,962,657 B2  
(45) **Date of Patent:** Nov. 8, 2005

- (54) **WATER TREATMENT SYSTEM**
- (75) Inventors: **George Jordan**, Chardon, OH (US);  
**Christopher Hansen**, Newbury, OH (US); **Lisa Heiden**, Chardon, OH (US)
- (73) Assignee: **Kinetico, Incorporated**, Newbury, OH (US)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 398 days.

4,336,134 A	6/1982	Prior .....	210/127
4,337,153 A	6/1982	Prior .....	210/288
4,374,025 A	2/1983	Loke .....	210/140
4,764,280 A	8/1988	Brown et al. ....	210/662
4,889,623 A	12/1989	Prior et al. ....	210/190
5,045,187 A	9/1991	Suchanek .....	210/91
5,106,543 A	4/1992	Dodds .....	261/36.1
5,407,574 A	4/1995	Hensley .....	210/269
5,544,072 A	8/1996	Zimmerman et al. ....	700/265
5,589,058 A	12/1996	Bauer .....	210/98
5,685,975 A	11/1997	Joubert et al. ....	210/136

**FOREIGN PATENT DOCUMENTS**

SU 1369786 1/1988

\* cited by examiner

*Primary Examiner*—Ivars C. Cintins  
(74) *Attorney, Agent, or Firm*—Watts Hoffman Co., L.P.A.

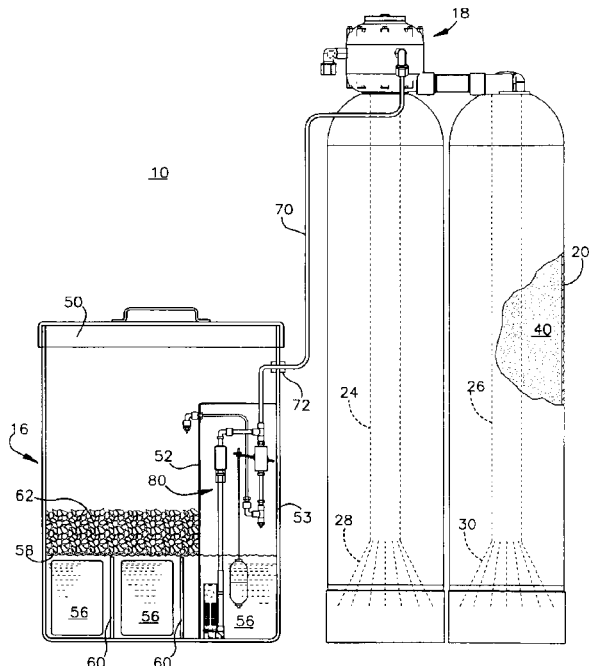
(57) **ABSTRACT**

A water treatment system for removing hard ions from source water. The water treatment system is of the type that includes a pair of ion-exchange water softener tanks connectable to a source of pressurized water and with a water system to supply softened water to the water system, the tanks each being capable of regeneration by flushing with a regeneration solution to replenish depleted ions. A process for preventing system failure due to salt crystallization includes flowing water during brine replenishment from a second nozzle and a first nozzle at a defined ratio. The first nozzle diluted the brine in a reservoir after regeneration cycle is complete. The second nozzle replenishes brine by flowing water directly onto a salt material.

**8 Claims, 3 Drawing Sheets**

- (21) Appl. No.: **10/033,355**
- (22) Filed: **Nov. 1, 2001**
- (65) **Prior Publication Data**  
US 2002/0084226 A1 Jul. 4, 2002
- Related U.S. Application Data**
- (60) Provisional application No. 60/244,996, filed on Nov. 1, 2000.
- (51) **Int. Cl.**<sup>7</sup> ..... **B01D 24/46**
- (52) **U.S. Cl.** ..... **210/191; 422/902**
- (58) **Field of Search** ..... 210/190, 191;  
422/261, 902

- (56) **References Cited**  
**U.S. PATENT DOCUMENTS**
- 3,351,550 A 11/1967 Kraiker, Jr. .... 210/677
- 3,574,559 A \* 4/1971 Kryzer et al. .... 422/106
- 3,684,457 A 8/1972 Pinto et al. .... 422/274
- 3,762,550 A 10/1973 Jarr et al. .... 210/126
- 3,891,552 A 6/1975 Prior et al. .... 210/88





(12) **United States Design Patent**  
**Riddell**

(10) **Patent No.:** **US D501,240 S**  
(45) **Date of Patent:** **\*\* Jan. 25, 2005**

(54) **HOUSING FOR A WATER TREATMENT UNIT**

(75) Inventor: **Erin Riddell**, Lakewood, OH (US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\*\*) Term: **14 Years**

(21) Appl. No.: **29/194,535**

(22) Filed: **Nov. 25, 2003**

**Related U.S. Application Data**

(62) Division of application No. 29/181,216, filed on May 7, 2003, now Pat. No. Des. 486,882.

(51) **LOC (7) Cl.** ..... **23-01**

(52) **U.S. Cl.** ..... **D23/207**

(58) **Field of Search** ..... D23/207, 209;  
210/435, 190

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

D366,094 S	1/1996	Duncan et al.	
D397,764 S	9/1998	Strand	
D417,254 S	11/1999	Daws et al.	
D439,950 S	4/2001	Fletcher et al.	
D446,840 S	8/2001	Strand	
D470,912 S	* 2/2003	Daws et al.	D23/209
D472,298 S	* 3/2003	Riddell	D23/207
D477,856 S	* 7/2003	Riddell	D23/207
D482,755 S	* 11/2003	Rhinehart et al.	D23/207
D486,882 S	* 2/2004	Riddell	D23/207

**OTHER PUBLICATIONS**

1 pg. Website of Kinetico Incorporated, www.kinetico.co.uk/blocksoft.htm, visited Aug. 15, 2002.

1 pg. Website of Kinetico Incorporated, www.kinetico.co.uk/residential.htm, visited Aug. 15, 2002.

1 pg. Website of Ewatec, www.ewatec.com/320DC.html, visited Aug. 15, 2002.

3 pg. Website of Ewatec, www.ewatec.com/640DC.html, visited Aug. 15, 2002.

1 pg. Website of Twintec, www.twintec.biz/start.html, visited Aug. 15, 2002.

4 pg. Website of Twintec, www.twintec.biz/best/b1.html, visited Aug. 15, 2002.

\* cited by examiner

*Primary Examiner*—Robin V. Taylor

(74) *Attorney, Agent, or Firm*—Watts Hoffmann Co., LPA

(57) **CLAIM**

I claim the ornamental design for a housing for a water treatment unit, as shown and described.

**DESCRIPTION**

FIG. 1 is a front perspective view of another embodiment of a housing portion for a water treatment unit of the present invention; (the broken lines in FIGS. 1–8 are for illustrative purposes only and do not form part of the invention shown in FIGS. 1–8);

FIG. 2 is an rear perspective view of the housing portion shown in FIG. 1;

FIG. 3 is a rear elevational view of the housing portion shown in FIG. 1;

FIG. 4 is a front elevational view of the housing portion shown in FIG. 1;

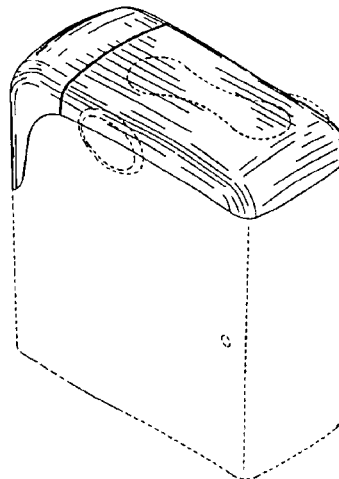
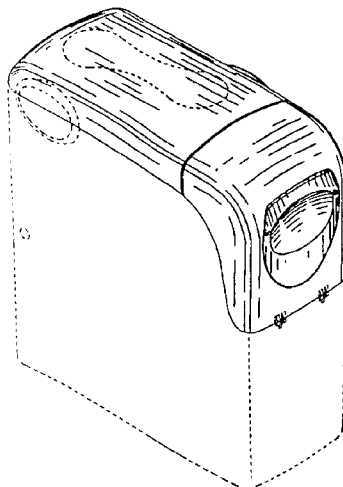
FIG. 5 is a left side elevational view of the housing portion shown in FIG. 1;

FIG. 6 is a right side elevational view of the housing portion shown in FIG. 1;

FIG. 7 is a top plan view of the housing portion shown in FIG. 1; and,

FIG. 8 is a bottom plan view of the housing portion shown in FIG. 1.

**1 Claim, 2 Drawing Sheets**





US00D499170S

(12) **United States Design Patent**  
**Park**

(10) **Patent No.:** **US D499,170 S**

(45) **Date of Patent:** **\*\* Nov. 30, 2004**

(54) **UPPER HOUSING FOR A WATER  
TREATMENT SYSTEM CONTROL VALVE**

5,490,932 A \* 2/1996 Hansen et al. .... 210/541  
6,189,556 B1 \* 2/2001 Blake et al. .... 137/119.07  
6,214,214 B1 \* 4/2001 Hansen et al. .... 210/106

(75) **Inventor:** **Stuart Park**, Burton, OH (US)

\* cited by examiner

(73) **Assignee:** **Kinetico Incorporated**, Newbury, OH (US)

*Primary Examiner*—Nelson C. Holtje

(74) *Attorney, Agent, or Firm*—Watts Hoffmann Co.

(\*\*) **Term:** **14 Years**

(57) **CLAIM**

(21) **Appl. No.:** **29/170,001**

I claim the ornamental design for an upper housing for a water treatment system control valve, as shown and described.

(22) **Filed:** **Oct. 30, 2002**

(51) **LOC (7) Cl.** ..... **23-01**

**DESCRIPTION**

(52) **U.S. Cl.** ..... **D23/233**

(58) **Field of Search** ..... D23/233-249;  
137/624.14, 624.18, 625.46, 554, 557, 119.06;  
210/87-88, 98, 190-192, 288, 104-106,  
662, 541.7; 251/30.05

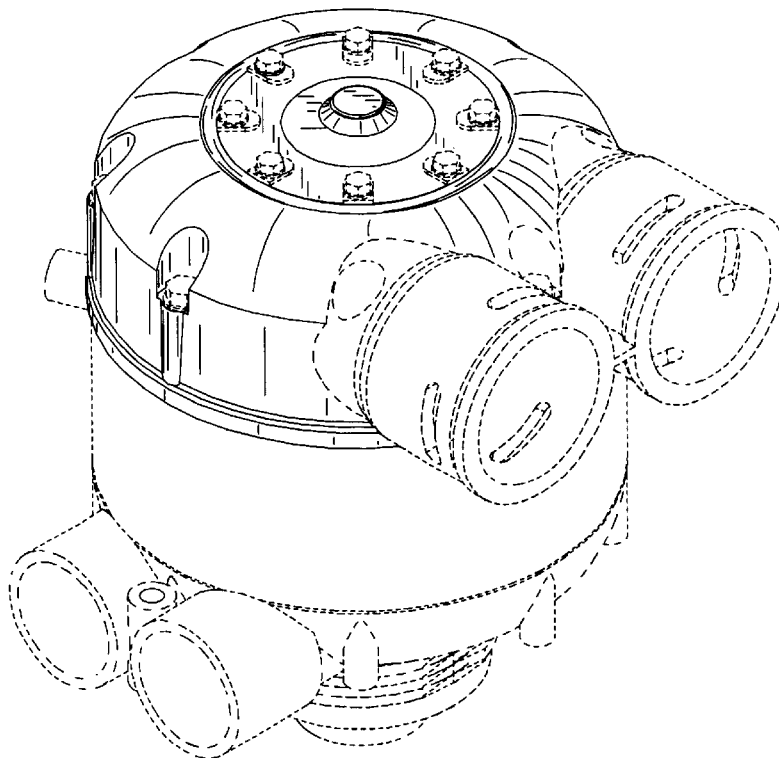
FIG. 1 is a perspective view of an upper housing for a water treatment system control valve of the present invention (the broken lines in FIGS. 1-7 are for illustrative purposes only and do not form part of the invention shown in FIGS. 1-7); FIG. 2 is a top plan view of the housing shown in FIG. 1; FIG. 3 is a side elevational view of the housing as seen from the plane indicated by the line 3-3 in FIG. 2; FIG. 4 is a side elevational view of the housing as seen from the plane indicated by the line 4-4 in FIG. 2; FIG. 5 is a bottom view of the housing as shown in FIG. 1; FIG. 6 is a side elevational view of the housing as seen from the plane indicated by the line 6-6 in FIG. 2; and, FIG. 7 is a side elevational view of the housing as seen from the plane indicated by the line 7-7 in FIG. 2.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

3,208,476	A	*	9/1965	Clack	.....	137/599.15
3,687,269	A	*	8/1972	Fritz et al.	.....	144/250.16
3,891,552	A	*	6/1975	Prior et al.	.....	210/88
4,298,025	A	*	11/1981	Prior et al.	.....	137/624.14
4,337,153	A		6/1982	Prior		
4,427,549	A	*	1/1984	Brown et al.	.....	210/662
4,693,814	A		9/1987	Brown		
5,022,994	A		6/1991	Avery et al.		

**1 Claim, 4 Drawing Sheets**





US00D495030S1

(12) **United States Design Patent**  
**Lillback**

(10) **Patent No.:** **US D495,030 S**

(45) **Date of Patent:** **\*\* Aug. 24, 2004**

(54) **HOUSING FOR A WATER TREATMENT SYSTEM CONTROL VALVE**

(75) **Inventor:** **Raymond Lillback**, Streetsboro, OH (US)

(73) **Assignee:** **Kinetico Incorporated**, Newbury, OH (US)

(\*\*) **Term:** **14 Years**

(21) **Appl. No.:** **29/168,470**

(22) **Filed:** **Oct. 2, 2002**

(51) **LOC (7) Cl. .... 23-01**

(52) **U.S. Cl. .... D23/233**

(58) **Field of Search .... D23/233-249;**  
137/624.14, 614.18, 625.46, 554, 557, 119.06;  
210/541, 98, 141, 190-192, 87-88, 541.7,  
662; 251/59, 30.05; 415/150

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

3,208,476 A	*	9/1965	Clack	210/190
3,269,410 A	*	8/1966	Alvarado et al.	137/882
3,891,552 A		6/1975	Prior et al.	
4,298,025 A		11/1981	Prior et al.	
4,337,153 A		6/1982	Prior	
4,427,549 A	*	1/1984	Brown et al.	210/662
4,693,814 A		9/1987	Brown	
5,022,994 A		6/1991	Avery et al.	

5,135,168 A	*	8/1992	Wang	239/70
5,490,932 A		2/1996	Hansen et al.	
5,628,899 A	*	5/1997	Vaughan	210/142
6,189,556 B1	*	2/2001	Blake et al.	137/119.07
6,214,214 B1	*	4/2001	Hansen et al.	210/106

\* cited by examiner

*Primary Examiner*—Nelson C. Holtje

(74) *Attorney, Agent, or Firm*—Watts Hoffmann Co.

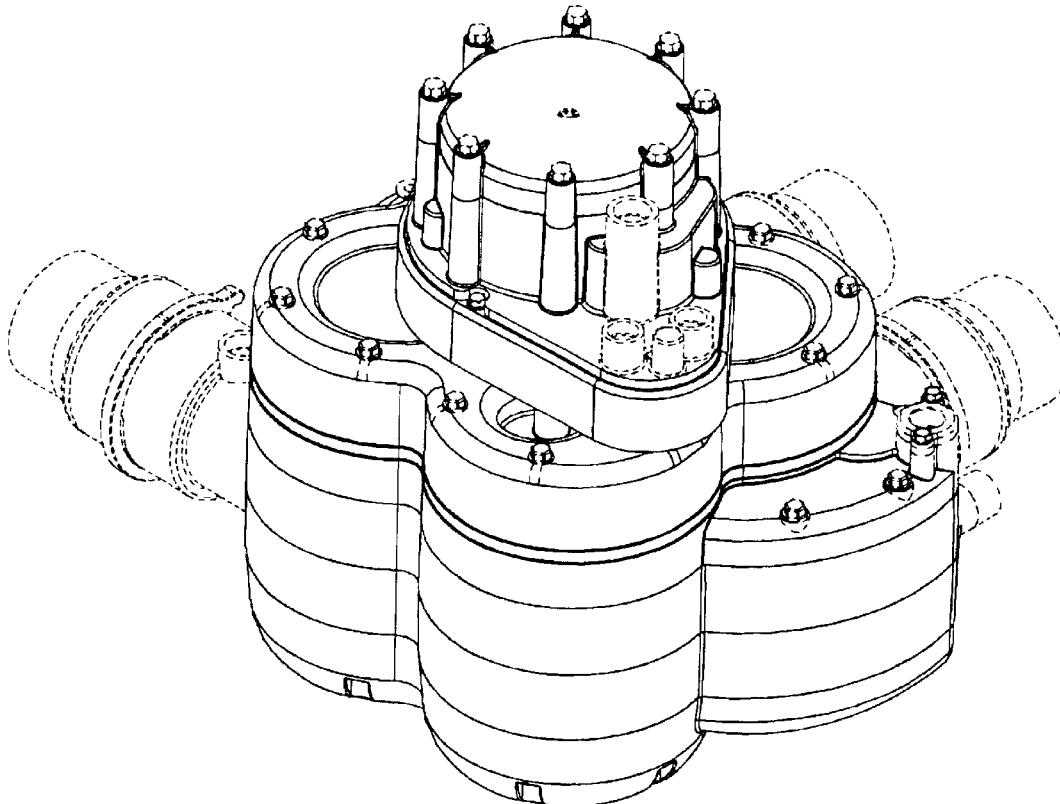
(57) **CLAIM**

I claim the ornamental design for a housing for a water treatment system control valve, as shown and described.

**DESCRIPTION**

FIG. 1 is a front perspective view of a housing for a water treatment system control valve of the present invention (the broken lines in FIGS. 1-7 are for illustrative purposes only and do not form part of the invention shown in FIGS. 1-7); FIG. 2 is a top plan view of the housing shown in FIG. 1; FIG. 3 is a bottom view of the housing shown in FIG. 1; FIG. 4 is a side elevational view of the housing as seen from the plane indicated by the line 4-4 in FIG. 2; FIG. 5 is a side elevational view as seen from the plane indicated by the line 5-5 in FIG. 2; FIG. 6 is a side elevational view of the housing as seen from the plane indicated by the line 6-6 in FIG. 2; and, FIG. 7 is a front elevational view of the housing as seen from the plane indicated by the line 7-7 in FIG. 2.

**1 Claim, 7 Drawing Sheets**





US006764595B1

(12) **United States Patent**  
**Halemba et al.**

(10) **Patent No.:** **US 6,764,595 B1**  
(45) **Date of Patent:** **Jul. 20, 2004**

(54) **FLUID TREATMENT SYSTEM**

(75) Inventors: **Peter Halemba**, Russell, OH (US);  
**George Ellis, III**, East Claridon, OH (US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

4,585,554 A	*	4/1986	Burrows	210/110
4,604,194 A		8/1986	Entingh	210/98
4,629,568 A	*	12/1986	Ellis, III	210/636
4,650,586 A		3/1987	Ellis, III	210/636
4,705,625 A		11/1987	Hart, Jr.	210/110
4,776,952 A		10/1988	Burrows	210/110
4,885,085 A	*	12/1989	Beall, Jr.	210/137
4,997,553 A		3/1991	Clack	210/97
5,662,793 A		9/1997	Beall, Jr.	210/134

\* cited by examiner

*Primary Examiner*—Joseph Drodge  
(74) *Attorney, Agent, or Firm*—Watts Hoffmann Co., LPA

(21) Appl. No.: **10/009,091**

(22) PCT Filed: **Mar. 15, 2000**

(86) PCT No.: **PCT/US00/06848**

§ 371 (c)(1),  
(2), (4) Date: **Jul. 22, 2002**

(87) PCT Pub. No.: **WO01/68227**

PCT Pub. Date: **Sep. 20, 2001**

(51) **Int. Cl.**<sup>7</sup> ..... **B01D 61/10; B01D 61/12**

(52) **U.S. Cl.** ..... **210/110; 137/590; 220/4.12; 220/495.01; 210/134; 210/137; 210/257.2**

(58) **Field of Search** ..... **210/97, 109, 110, 210/116, 134, 137, 257.2, 259, 321.65, 541; 137/386, 395, 590; 220/4.12, 495.01**

(56) **References Cited**

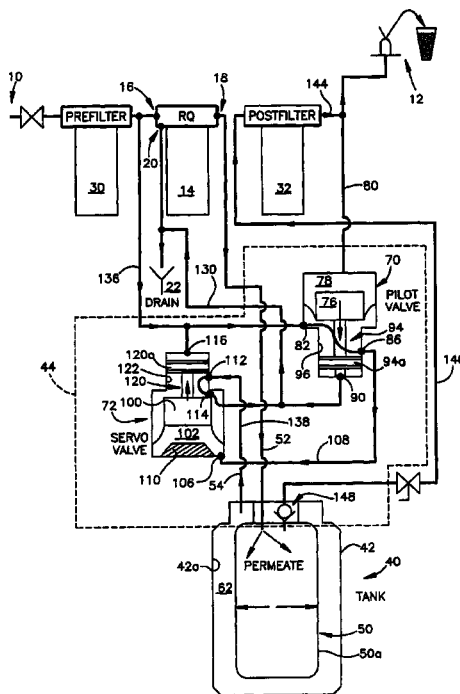
**U.S. PATENT DOCUMENTS**

4,579,242 A 4/1986 Ellis, III

(57) **ABSTRACT**

A water treatment system having a reverse osmosis unit (14) includes a storage tank (40) having an outer tank housing (42) that encloses an expandable bladder (50). A pressurized region (62) is defined between the outside of the bladder (50) and inside of the housing (42). A control valve assembly (44) controls communication of source water under pressure to pressurizing region (62) and communicates the region (62) with a drain (22). The assembly (44) includes a pilot valve (70) that is responsive to a state of dispensing and includes a valve element (76) that moves between a first dispensing position and a second non-dispensing position. A servo valve (72) is responsive to position of the pilot valve (70) and communicates source water under pressure to the region (62) when the pilot valve (70) is in the first position thus applying pressure to bladder (50) to expel treated water and communicates region (62) to the drain (22) when dispensing is not occurring so as to allow bladder (50) to expand as it receives treated water from the reverse osmosis unit (14).

**13 Claims, 7 Drawing Sheets**





US00D486882S

(12) **United States Design Patent**  
**Riddell**

(10) **Patent No.: US D486,882 S**  
(45) **Date of Patent: \*\* Feb. 17, 2004**

(54) **HOUSING FOR A WATER TREATMENT UNIT**

(75) Inventor: **Erin Riddell**, Lakewood, OH (US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\*\*) Term: **14 Years**

(21) Appl. No.: **29/181,216**

(22) Filed: **May 7, 2003**

**Related U.S. Application Data**

(62) Division of application No. 29/167,858, filed on Sep. 23, 2002, now Pat. No. Des. 477,856.

(51) **LOC (7) Cl.** ..... **23-01**

(52) **U.S. Cl.** ..... **D23/207**

(58) **Field of Search** ..... D23/207, 209;  
210/435, 241

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

D366,094 S	*	1/1996	Duncan et al.	.....	D23/209
D397,764 S	*	9/1998	Strand	.....	D23/209
D417,254 S	*	11/1999	Daws et al.	.....	D23/209
D439,950 S	*	4/2001	Fletcher et al.	.....	D23/207
D446,840 S	*	8/2001	Strand	.....	D23/209
D477,856 S	*	7/2003	Riddell	.....	D23/207

**OTHER PUBLICATIONS**

1 pg. Website of Kinetico Incorporated, [www.kinetico.co.uk/blocksoft.htm](http://www.kinetico.co.uk/blocksoft.htm), visited Aug. 15, 2002.

1 pg. Website of Kinetico Incorporated, [www.kinetico.co.uk/residential.htm](http://www.kinetico.co.uk/residential.htm), visited Aug. 15, 2002.

1 pg. Website of Ewatec, [www.ewatec.com/320DC.html](http://www.ewatec.com/320DC.html), visited Aug. 15, 2002.

(List continued on next page.)

*Primary Examiner*—Robin V. Taylor

(74) *Attorney, Agent, or Firm*—Watts Hoffmann Co., LPA

(57) **CLAIM**

I claim the ornamental design for a housing for a water treatment unit, as shown and described.

**DESCRIPTION**

FIG. 1 is a front perspective view of a housing for a water treatment unit of the present invention (the broken lines in FIGS. 1–8 are for illustrative purposes only and do not form part of the invention shown in FIGS. 1–8);

FIG. 2 is an rear perspective view of the housing shown in FIG. 1;

FIG. 3 is a rear elevational view of the housing shown in FIG. 1;

FIG. 4 is a front elevational view of the housing shown in FIG. 1;

FIG. 5 is a left side elevational view of the housing shown in FIG. 1;

FIG. 6 is a right side elevational view of the housing shown in FIG. 1;

FIG. 7 is a top plan view of the housing shown in FIG. 1;

FIG. 8 is a bottom plan view of the housing shown in FIG. 1;

FIG. 9 is a front perspective view of another embodiment of housing for a water treatment unit of the present invention (the broken lines in FIGS. 9–16 are for illustrative purposes only and do not form part of the invention shown in FIGS. 9–16);

FIG. 10 is an rear perspective view of the housing shown in FIG. 9;

FIG. 11 is a rear elevational view of the housing shown in FIG. 9;

FIG. 12 is a front elevational view of the housing shown in FIG. 9;

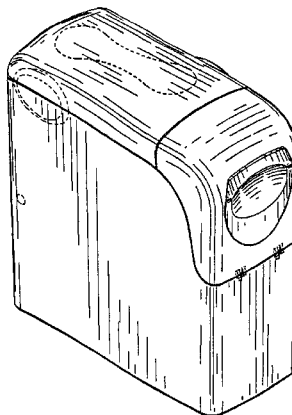
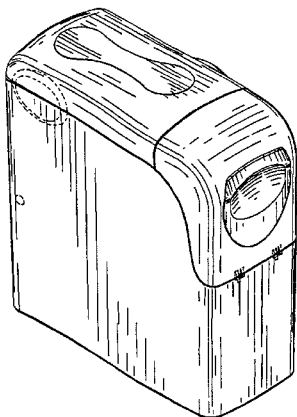
FIG. 13 is a left side elevational view of the housing shown in FIG. 9;

FIG. 14 is a right side elevational view of the housing shown in FIG. 9;

FIG. 15 is a top plan view of the housing shown in FIG. 9; and,

FIG. 16 is a bottom plan view of the housing shown in FIG. 9.

**1 Claim, 4 Drawing Sheets**





US00D477856S

(12) **United States Design Patent**  
**Riddell**

(10) **Patent No.:** **US D477,856 S**

(45) **Date of Patent:** **\*\* Jul. 29, 2003**

(54) **HOUSING FOR A WATER TREATMENT UNIT**

(75) Inventor: **Erin Riddell**, Lakewood, OH (US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\*\*) Term: **14 Years**

(21) Appl. No.: **29/167,858**

(22) Filed: **Sep. 23, 2002**

**Related U.S. Application Data**

(62) Division of application No. 29/158,614, filed on Apr. 5, 2002.

(51) **LOC (7) Cl.** ..... **23-01**

(52) **U.S. Cl.** ..... **D23/207**

(58) **Field of Search** ..... D23/207, 209;  
210/435, 241

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

D366,094 S	*	1/1996	Duncan et al.	.....	D23/209
D397,764 S	*	9/1998	Strand	.....	D23/209
D417,254 S	*	11/1999	Daws et al.	.....	D14/209
D439,950 S	*	4/2001	Fletcher et al.	.....	D23/207
D446,840 S	*	8/2001	Strand	.....	D23/209

\* cited by examiner

*Primary Examiner*—Robin V. Taylor

(74) *Attorney, Agent, or Firm*—Watts, Hoffmann, Fisher & Heinke Co.

(57) **CLAIM**

I claim the ornamental design for a housing for a water treatment unit, as shown and described.

**DESCRIPTION**

FIG. 1 is a front perspective view of a housing for a water

treatment unit of the present invention (the broken lines in FIGS. 1–8 are for illustrative purposes only and do not form part of the invention shown in FIGS. 1–8);

FIG. 2 is a rear perspective view of the housing shown in FIG. 1;

FIG. 3 is a rear elevational view of the housing shown in FIG. 1;

FIG. 4 is a front elevational view of the housing shown in FIG. 1;

FIG. 5 is a left side elevational view of the housing shown in FIG. 1;

FIG. 6 is a right side elevational view of the housing shown in FIG. 1;

FIG. 7 is a top plan view of the housing shown in FIG. 1;

FIG. 8 is a bottom plan view of the housing shown in FIG. 1;

FIG. 9 is a front perspective view of another embodiment of a housing for a water treatment unit of the present invention (the broken lines in FIGS. 9–16 are for illustrative purposes only and do not form part of the invention shown in FIGS. 9–16);

FIG. 10 is a rear perspective view of the housing shown in FIG. 9;

FIG. 11 is a rear elevational view of the housing shown in FIG. 9;

FIG. 12 is a front elevational view of the housing shown in FIG. 9;

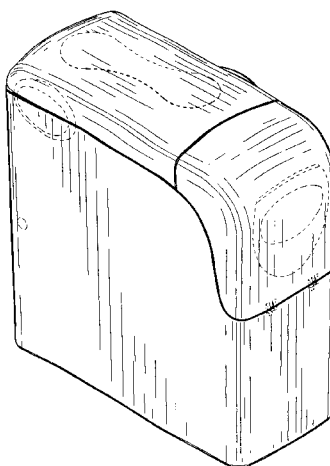
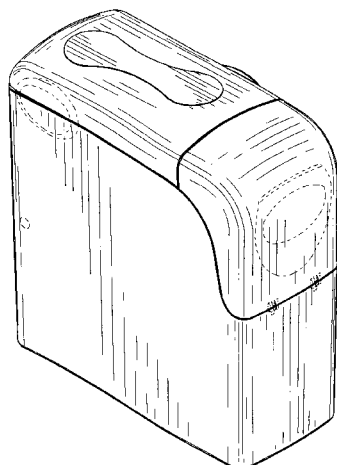
FIG. 13 is a left side elevational view of the housing shown in FIG. 9;

FIG. 14 is a right side elevational view of the housing shown in FIG. 9;

FIG. 15 is a top plan view of the housing shown in FIG. 9; and,

FIG. 16 is a bottom plan view of the housing shown in FIG. 9.

**1 Claim, 4 Drawing Sheets**





US00D472298S

(12) **United States Design Patent**  
**Riddell**

(10) **Patent No.:** **US D472,298 S**  
(45) **Date of Patent:** **\*\* Mar. 25, 2003**

(54) **HOUSING PORTION FOR A WATER TREATMENT UNIT**

(75) Inventor: **Erin Riddell**, Lakewood, OH (US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\*\*) Term: **14 Years**

(21) Appl. No.: **29/158,614**

(22) Filed: **Apr. 5, 2002**

(51) **LOC (7) Cl.** ..... **23-01**

(52) **U.S. Cl.** ..... **D23/207**

(58) **Field of Search** ..... D23/207, 209;  
210/435, 190

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

D366,094 S	*	1/1996	Duncan et al.	.....	D23/209
D397,764 S	*	9/1998	Strand	.....	D23/209
D417,254 S	*	11/1999	Daws et al.	.....	D23/209
D439,950 S	*	4/2001	Fletcher et al.	.....	D23/207
D446,840 S	*	8/2001	Strand	.....	D23/209

**OTHER PUBLICATIONS**

1 page website of Kinetico Incorporated, [www.kinetico.co.uk/blocksfof.htm](http://www.kinetico.co.uk/blocksfof.htm), visited Aug. 15, 2002.

1 page website of Kinetico Incorporated, [www.kinetico.co.uk/residential.htm](http://www.kinetico.co.uk/residential.htm), visited Aug. 15, 2002.

1 page website of Ewatec, [www.ewatec.com/320DC.html](http://www.ewatec.com/320DC.html), visited Aug. 15, 2002.

3 page website of Ewatec, [www.ewatec.com/640DC.html](http://www.ewatec.com/640DC.html), visited Aug. 15, 2002.

1 page website of Twintec, [www.twintec.biz/start.html](http://www.twintec.biz/start.html), visited Aug. 15, 2002.

4 page website of Twintec, [www.twintec.biz/best/bl.html](http://www.twintec.biz/best/bl.html), visited Aug. 15, 2002.

4 page website of Twintec, [www.twintec.biz/bestbl/html](http://www.twintec.biz/bestbl/html), visited Aug. 15, 2002.

\* cited by examiner

*Primary Examiner*—Robin V. Taylor

(74) *Attorney, Agent, or Firm*—Watts, Hoffmann, Fisher & Heinke Co.

(57) **CLAIM**

I claim the ornamental design for a housing portion for a water treatment unit, as shown and described.

**DESCRIPTION**

FIG. 1 is a front perspective view of a housing portion for a water treatment unit of the present invention (the broken lines in FIGS. 1–8 are for illustrative purposes only and do not form part of the invention shown in FIGS. 1–8);

FIG. 2 is a rear perspective view of the housing portion shown in FIG. 1;

FIG. 3 is a rear elevational view of the housing portion shown in FIG. 1;

FIG. 4 is a front elevational view of the housing portion shown in FIG. 1;

FIG. 5 is a left side elevational view of the housing portion shown in FIG. 1;

FIG. 6 is a right side elevational view of the housing portion shown in FIG. 1;

FIG. 7 is a top plan view of the housing portion shown in FIG. 1;

FIG. 8 is a bottom plan view of the housing portion shown in FIG. 1;

FIG. 9 is a front perspective view of another embodiment of a housing portion for a water treatment unit of the present invention (the broken lines in FIGS. 9–16 are for illustrative purposes only and do not form part of the invention shown in FIGS. 9–16);

FIG. 10 is a rear perspective view of the housing portion shown in FIG. 9;

FIG. 11 is a rear elevational view of the housing portion shown in FIG. 9;

FIG. 12 is a front elevational view of the housing portion shown in FIG. 9;

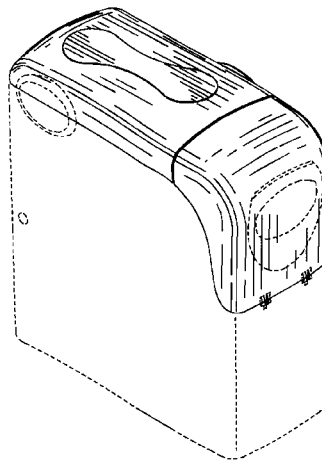
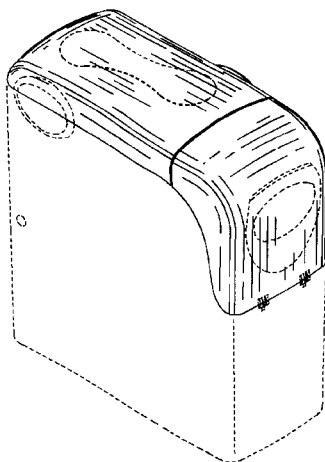
FIG. 13 is a left side elevational view of the housing portion shown in FIG. 9;

FIG. 14 is a right side elevational view of the housing portion shown in FIG. 9;

FIG. 15 is a top plan view of the housing portion shown in FIG. 9 and,

FIG. 16 is a bottom plan view of the housing portion shown in FIG. 9.

**1 Claim, 4 Drawing Sheets**







US006528446B1

(12) **United States Patent**  
**Stensrud**

(10) **Patent No.:** **US 6,528,446 B1**  
(45) **Date of Patent:** **Mar. 4, 2003**

(54) **PROCESS FOR MAKING CLAY SPHEROIDS**

(75) Inventor: **James C. Stensrud**, Grand Rapids, MN (US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/678,583**

(22) Filed: **Oct. 3, 2000**

(51) **Int. Cl.**<sup>7</sup> ..... **C04B 33/04**; C04B 35/01; C04B 35/626; C04B 35/632

(52) **U.S. Cl.** ..... **501/148**; 501/140; 501/142; 501/150; 501/153; 501/154

(58) **Field of Search** ..... 428/402, 331; 501/140, 142, 148, 150, 153, 154

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,039,480	A	*	8/1977	Watson et al.	.....	252/455	R
4,280,845	A	*	7/1981	Matsushisa et al.	.....	106/62	
4,295,892	A	*	10/1981	Matsushisa et al.	.....	501/120	
4,434,239	A	*	2/1984	Aitcin	.....	501/118	
4,632,876	A		12/1986	Laird et al.			
4,725,390	A	*	2/1988	Laird et al.	.....	264/62	
5,512,523	A	*	4/1996	Ono et al.	.....	501/127	
6,210,625	B1	*	4/2001	Matsushita et al.	.....	264/610	

**OTHER PUBLICATIONS**

Oreskovich et al., "Testing of Kittson County Bloating Clays as Lightweight Aggregate In Structural Concrete," Natural Resources Research Institute, University of Minnesota (1993).

Oreskovich et al., "Preliminary Testing and Pilot-Scale Processing of the Kittson County Bloating Clays," National Resources Research Institute, University of Minnesota (1997).

Hauck, "Ceramic Tile and Lightweight Aggregate Product Development Using Minnesota Clays," Natural Resources Research Institute (1993).

\* cited by examiner

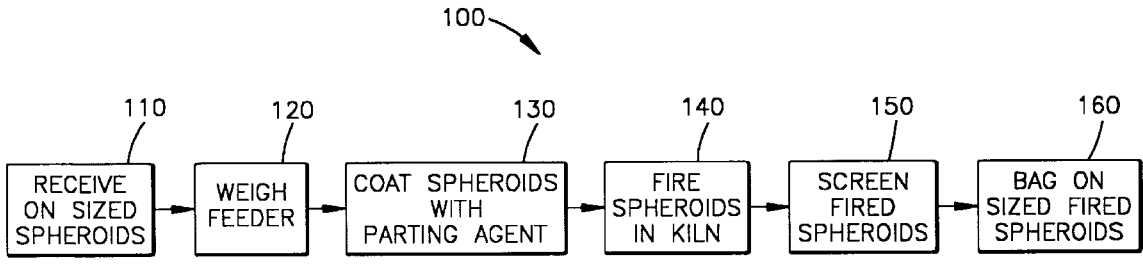
*Primary Examiner*—H. Thi Le

(74) *Attorney, Agent, or Firm*—Watts, Hoffmann, Fisher & Heinke Co.

**ABSTRACT**

(57) A process of making ceramic spheroids by firing clay spheroids comprising by weight percent: FeO (3.22–5.21), Fe<sub>3</sub>O<sub>4</sub> (3.40–5.11), SiO<sub>2</sub> (52.49–59.42), CaO (1.99–7.96), MgO (2.81–4.69), Al<sub>2</sub>O<sub>3</sub> (12.05–17.65), TiO<sub>2</sub> (0.58–0.71), MnO (0.07–0.19), Na<sub>2</sub>O (0.47–0.86), K<sub>2</sub>O (1.70–2.37), P<sub>2</sub>O<sub>3</sub> (0.13–0.19), S (0.03–0.29), CO<sub>2</sub> (0.90–8.23), Organic C (0.22–1.04), H<sub>2</sub>O+ (4.14–7.28), H<sub>2</sub>O– (2.12–5.48) in contact with a particulate parting agent selected from aluminum oxide, magnesium oxide, and their precursors at a sufficiently high temperature and for a sufficiently long time to form a shell. Preferably, the clay spheroids are obtained from a deposit located at Hallock in Kittson County Minn., U.S.A.

**16 Claims, 2 Drawing Sheets**





(12) **United States Patent**  
**Robakowski, Jr. et al.**

(10) **Patent No.:** **US 6,482,372 B2**  
(45) **Date of Patent:** **Nov. 19, 2002**

(54) **PROCESS FOR RECOVERING PALLADIUM FROM A SOLUTION**

(75) Inventors: **Edward Robakowski, Jr.**, Brecksville;  
**Lyle E. Kirman**, Cleveland Heights,  
both of OH (US)

(73) Assignee: **Kinetico Incorporated**, Newbury, OH  
(US)

(\* ) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/747,459**

(22) Filed: **Dec. 22, 2000**

(65) **Prior Publication Data**

US 2002/0119085 A1 Aug. 29, 2002

(51) **Int. Cl.**<sup>7</sup> ..... **C22B 11/00**; C22B 25/00

(52) **U.S. Cl.** ..... **423/22**; 423/92; 210/688

(58) **Field of Search** ..... 423/22, 92, 93;  
75/720; 205/565; 210/688

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

3,656,939 A \* 4/1972 Boehm et al.  
5,332,420 A 7/1994 Cupertino et al.

**FOREIGN PATENT DOCUMENTS**

EP 0224209 B1 3/1993  
JP 1-111825 \* 4/1989  
JP 3-158425 \* 7/1991  
JP 3-277730 \* 12/1991

**OTHER PUBLICATIONS**

Anis et al, "The Basics on Rack Plating of Plastics," 4 pages,  
Journal of the American Electroplaters and Surface Finishers  
Society (1994), no month.

Mandich, "EMI Shielding by Electroless Plating of ABS  
Plastics," pp. 60-63, Plating and Surface Finishing (1994),  
no month.

Snyder, "Direct Metallization System for Decorative Plating  
on Plastics," pp. 807-812, The National Metal Finishing  
Report (date unknown).

Waitz, Jr., "Recovery Of Precious Metals With Amerlite Ion  
Exchange Resins," 3 pages (1984), no month.

Calmon et al., "Ion Exchange for Pollution Control, vol. 1,"  
CRC Press, Inc., 4 pages (1979), no month.

"Reillex™: A New Family of Corsslinked Polyvinylpy-  
ridnes," Report 5, Reilly, 2 pages, author unknown, date  
unknown.

3 pages from Diaion® Ion Exchange Resins Manual II, date  
unknown.

2 page information sheet from Rohm and Haas Company,  
Amberlite Ion Exchange Resins, IE-69-62. 76 78 (1981), no  
month.

31 page patent/application report (1997), no month.

\* cited by examiner

*Primary Examiner*—Steven Bos

(74) *Attorney, Agent, or Firm*—Watts, Hoffmann, Fisher &  
Heinke, Co., LPA

(57) **ABSTRACT**

A method for selectively separating and recovering palla-  
dium from an aqueous palladium/tin catalyst solution. The  
method includes the steps of adjusting the pH of the aqueous  
solution to a specified pH range thereby precipitating the tin,  
and producing a soluble form a palladium. The solution can  
be either pre-filtered or settled and subsequently processed  
through ion exchange resin in a conventional manner, or  
processed in an upflow direction through an at least partially  
fluidized bed of ion exchange resin to remove and concen-  
trate the palladium for recovery.

**12 Claims, No Drawings**



US006471876B1

(12) **United States Patent**  
**Hansen et al.**

(10) **Patent No.:** **US 6,471,876 B1**  
(45) **Date of Patent:** **Oct. 29, 2002**

(54) **FILTER MEDIA WITH GERMICIDAL PROPERTIES**

5,618,762 A \* 4/1997 Shirakawa et al.  
6,287,462 B1 \* 9/2001 Likos

(75) Inventors: **Christopher L. Hansen**, Newbury, OH (US); **Samuel Mason**, Wickliffe, OH (US); **Mohan L. Sanduja**, Flushing, NY (US); **Carl Horowitz**, Brooklyn, NY (US); **Felicia Dragnea**, Forest Hills, NY (US); **Paul Thottathil**, New Hyde Park, NY (US)

\* cited by examiner

*Primary Examiner*—Betsey Morrison Hoey  
(74) *Attorney, Agent, or Firm*—Watts, Hoffmann, Fisher & Heinke, Co., LPA

(73) Assignee: **Kinetico Incorporated**, Newbury, OH (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 88 days.

(57) **ABSTRACT**

Filtration media having germicidal properties for use in filtering particles and deactivating, removing and/or destroying microorganisms from a feed liquid passing therethrough. The filtration media includes an effective amount of a germicidal chemically grafted and covalently bonded to a surface of the media. The germicidal grafted filter media is prepared by contacting the media with a grafting solution comprising an anionic monomer, a catalyst, a graft initiator and a germicide and subsequently curing tile media at an elevated temperature to chemically graft a polymerized salt of the polymerizable anionic monomer and the cationic germicide onto a surface of the media. Filter media suitable for use in the present invention include ceramic spheroids, hollow glass spheres, polymeric type media and thermoset coated glass spheres. The germicidal grafted filter media is effective for deactivating, destroying and/or removing from a feed liquid, such as water, *escherichia coli*, *salmonella choleraesuis*, staphylococcus, aspergillus, klebsiella, *listeria clostridium*, rotavirus, cysts and other microorganisms. Moreover, the filter media can be used repeatedly without a decrease in its germicidal effectiveness.

(21) Appl. No.: **09/722,911**

(22) Filed: **Nov. 27, 2000**

(51) **Int. Cl.**<sup>7</sup> ..... **C02F 1/50**

(52) **U.S. Cl.** ..... **210/764; 210/501; 210/504; 252/175**

(58) **Field of Search** ..... 210/764, 501, 210/504; 252/175

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

- 4,111,713 A \* 9/1978 Beck
- 4,725,390 A \* 2/1988 Laird et al.
- 4,966,872 A \* 10/1990 Horowitz et al.

**22 Claims, No Drawings**



US006428708B1

(12) **United States Patent**  
**Halemba et al.**

(10) **Patent No.:** **US 6,428,708 B1**  
(45) **Date of Patent:** **Aug. 6, 2002**

(54) **FILTER APPARATUS AND METHOD**

(75) Inventors: **Peter Halemba, Russell; Stuart Park,**  
Burton, both of OH (US)

(73) Assignee: **Kinetico Incorporated,** Newbury, OH  
(US)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/520,235**

(22) Filed: **Mar. 7, 2000**

(51) **Int. Cl.<sup>7</sup>** ..... **B01D 35/00**

(52) **U.S. Cl.** ..... **210/739; 210/100; 210/444;**  
210/87

(58) **Field of Search** ..... 210/87, 100, 444,  
210/739

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,431,533 A	2/1984	Wrede
4,555,331 A	11/1985	Thornton et al.
4,698,164 A	10/1987	Ellis
5,527,451 A	6/1996	Hembree et al.

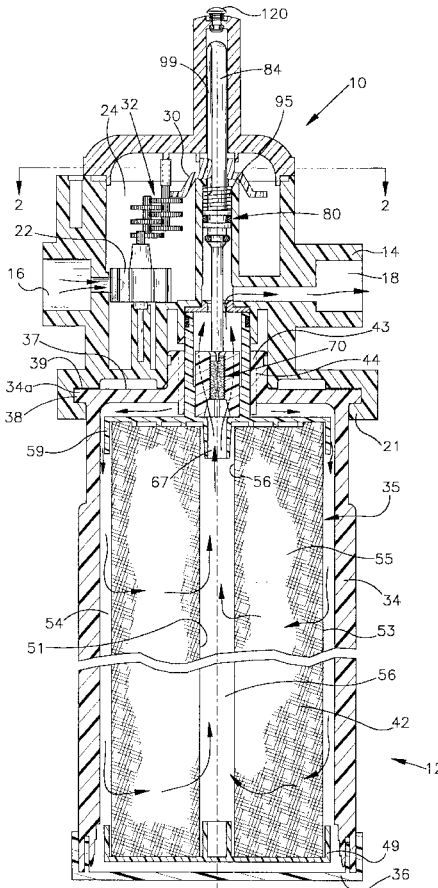
*Primary Examiner*—Chester T. Barry

(74) *Attorney, Agent, or Firm*—Watts, Hoffmann, Fisher &  
Heinke, Co.

(57) **ABSTRACT**

A filtering apparatus including a fluid monitoring head and a replaceable filter cartridge removably fastened to the head. The fluid monitoring head includes a shut off mechanism for interrupting fluid flow through the cartridge when a predetermined quantity of fluid has been treated by the filter. The filter cartridge is releasably coupled to the shutoff mechanism when the filter is installed. The shut off mechanism includes a valve element carried by a shaft that forms part of a driven member forming part of the monitoring head. A biasing element exerts a force on the valve element carrying shaft tending to move the valve to a flow blocking position. The shaft engages a keeper or hold off element threadly retained in the filter cartridge. As the driven member rotates, the keeper element is gradually unthreaded until it separates from the filter cartridge, allowing the force of the biasing element to move the valve member into a flow interrupting position. A pressure relief means in the monitoring head allows for easy removal of the cartridge from the monitoring head.

**33 Claims, 4 Drawing Sheets**





(54) **WATER TREATMENT SYSTEM WITH PURGE VALVE RESPONSIVE TO FLUID SIGNALS**

5,490,932 2/1996 Hansen et al. .  
5,674,403 \* 10/1997 Kinney .  
5,950,244 \* 6/1999 Stamos et al. .

\* cited by examiner

(75) Inventors: **Christopher L. Hansen**, Newbury;  
**Stuart Park**, Burton; **Peter Halemba**,  
Russell, all of OH (US)

*Primary Examiner*—Joseph W. Drodge  
*Assistant Examiner*—Terry K. Cecil  
(74) *Attorney, Agent, or Firm*—Watts, Hoffman, Fisher &  
Heinke Co.

(73) Assignee: **Kinetico Incorporated**, Newbury, OH  
(US)

(57) **ABSTRACT**

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

A water treatment system including a pair of water treatment tanks, each tank defining a flow path extending from a tank inlet to a tank outlet and containing a water treatment material disposed along the flow path for treating water as it travels from the inlet to the outlet. A system controller controls which of the tanks is on-line and which of the tanks is off-line and controls the regeneration of an exhausted tank. The system controller is operative to provide a final rinse in the service direction. This is accomplished by a purge valve which communicates the outlet of a tank being regenerated to a drain under predetermined operating conditions. The operation of the purge valve is responsive to fluid signals applied to an inlet valve and an outlet valve associated with the tank being regenerated. More specifically, the fluid signals that close the outlet valve and open the inlet valve, are utilized to cause the opening of the purge valve in order to communicate the tank outlet with the drain. The invention obviates the need for separate fluid pressure signals for the purge valve. The system controller also includes an improved regeneration control turbine which includes a plurality of vanes extending from a hub and positioned between disc-like members that overlie the edges of the vanes in order to create cavities for receiving fluid emitted by a regeneration control nozzle. The improved turbine reduces water consumption of the system.

(21) Appl. No.: **09/281,989**

(22) Filed: **Mar. 29, 1999**

(51) **Int. Cl.**<sup>7</sup> ..... **B01D 24/26**

(52) **U.S. Cl.** ..... **210/106; 210/143; 210/142;**  
210/190; 210/269; 137/624.18

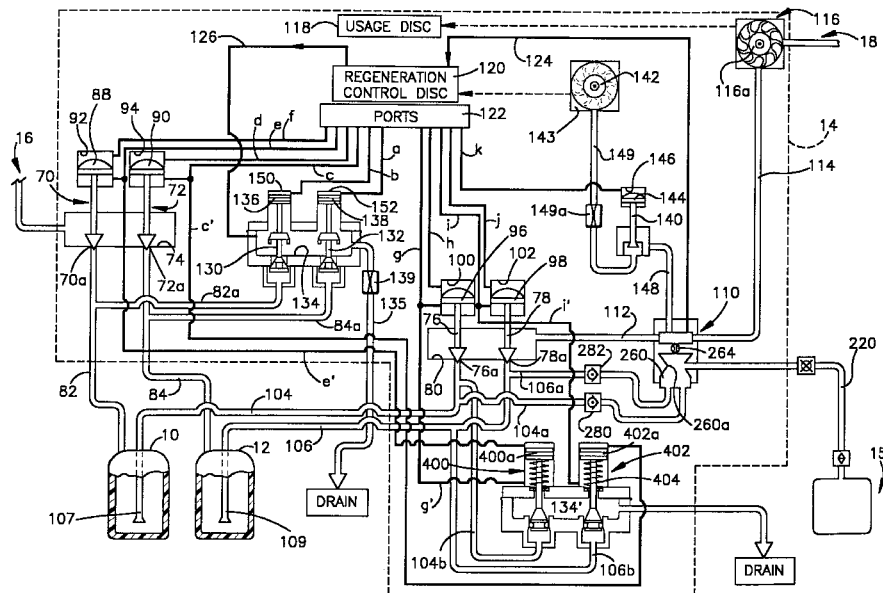
(58) **Field of Search** ..... 210/87, 88, 98,  
210/190, 141, 142, 143, 191, 269, 106,  
85, 108, 275, 277, 279, 278, 333.01, 333.1,  
334, 411, 264; 137/624.14, 624.18

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

- 3,891,552 6/1975 Prior et al. .
- 4,298,025 11/1981 Prior et al. .
- 4,427,549 \* 1/1984 Brown et al. .
- 4,693,814 9/1987 Brown .
- 4,764,280 8/1988 Brown et al. .
- 4,804,465 2/1989 Brown .
- 5,022,994 6/1991 Avery et al. .
- 5,069,779 \* 12/1991 Brown et al. .
- 5,310,488 5/1994 Hansen et al. .
- 5,476,584 \* 12/1995 McDougald .

**7 Claims, 6 Drawing Sheets**





US006106722A

# United States Patent [19]

[11] Patent Number: **6,106,722**

Chew et al.

[45] Date of Patent: **Aug. 22, 2000**

[54] **FILTERING PHOTORESIST-CONTAINING LIQUID**

5,415,765	5/1995	Banham et al. .	
5,543,263	8/1996	Rahman et al. ....	430/168
5,925,255	7/1999	Mukhopadhyay .....	210/652

[75] Inventors: **David H. Chew**, Antioch, Calif.; **Lyle E. Kirman**, Cleveland Heights, Ohio

### FOREIGN PATENT DOCUMENTS

[73] Assignee: **Kinetico Incorporated**, Newbury, Ohio

53-4777	1/1978	Japan .
59-112890	6/1984	Japan .

[21] Appl. No.: **08/910,244**

### OTHER PUBLICATIONS

[22] Filed: **Aug. 12, 1997**

PEM Permased Engineering Manual Du Pont Company/  
Polymer Products Dep, Dec. 1, 1982 Bulletin 203.

[51] **Int. Cl.<sup>7</sup>** ..... **B01D 61/00**

*Primary Examiner*—Ana Fortuna  
*Attorney, Agent, or Firm*—Watts Hoffmann Fisher &  
Heinke, Co L.P.A.

[52] **U.S. Cl.** ..... **210/651; 210/652; 210/660;**  
210/670; 210/681; 210/767; 210/195.2

[58] **Field of Search** ..... 210/651, 652,  
210/660, 661, 670, 681, 900, 167, 767;  
134/10, 11, 102.2

### [57] ABSTRACT

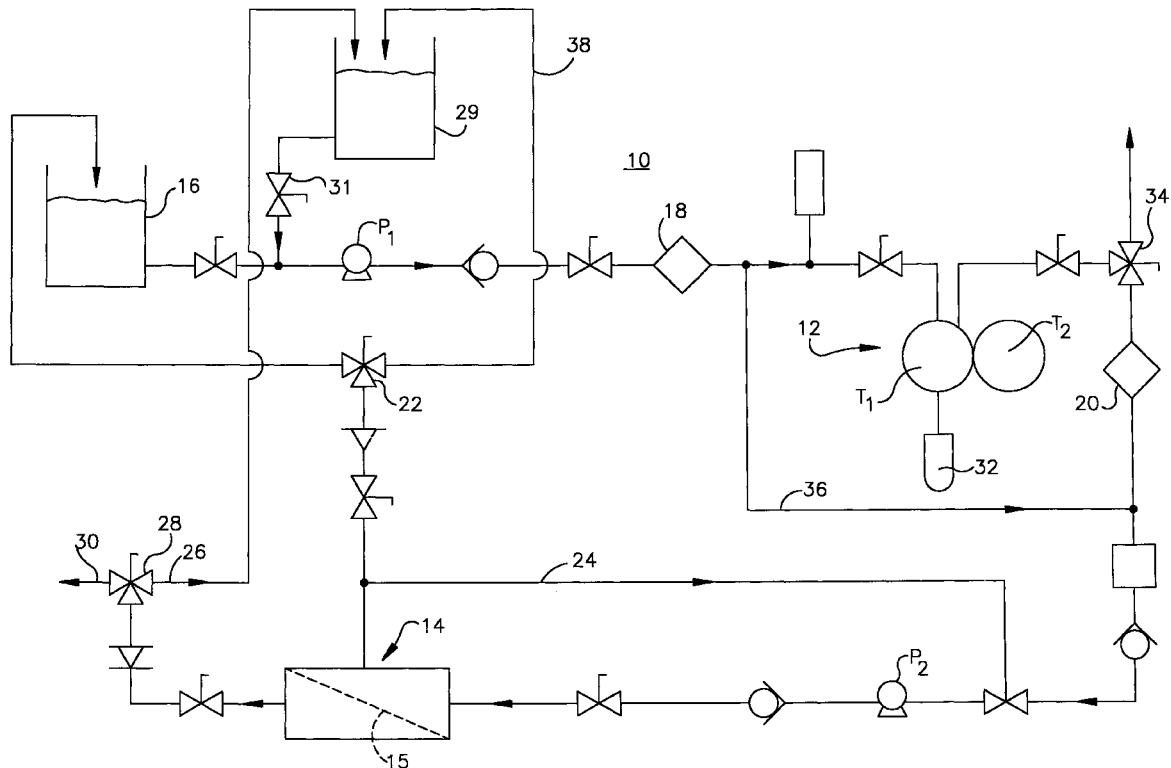
### [56] References Cited

#### U.S. PATENT DOCUMENTS

3,891,552	6/1975	Prior et al. ....	210/87
4,337,153	6/1982	Prior .	
4,427,549	1/1984	Brown et al. .	
4,764,280	8/1988	Brown et al. .	
4,786,417	11/1988	Miki et al. ....	210/651
4,863,612	9/1989	Kirman et al. .	
4,889,623	12/1989	Prior et al. .	
4,917,123	4/1990	McConnel et al. ....	134/95
5,112,491	5/1992	Strantz, Jr. ....	210/651
5,310,488	5/1994	Hansen et al. .	
5,348,588	9/1994	Winston .....	134/10

A method of filtering feed liquid including a photoresist substance comprises removing cations from the feed liquid using an ion exchange material. A fine particle filter filters the feed liquid and, in particular, removes dissolved solids from the feed liquid. The material is regenerated with a solution, e.g., a brine solution, which has a pH effective to avoid fouling of at least one of the filter and the ion exchange material. Another embodiment concerns a filtration apparatus including an ion exchange device containing the ion exchange material. A fine particle filtration device removes dissolved solids from the liquid. A device for regenerating the material includes a supply of the regenerating solution.

**32 Claims, 1 Drawing Sheet**





[54] USE OF A CERAMIC METAL OXIDE FILTER WHOSE SELECTION DEPENDS UPON THE PH OF THE FEED LIQUID AND SUBSEQUENT BACKWASH USING A LIQUID HAVING A DIFFERENT PH

4,923,714 5/1990 Gibb et al. .
4,944,905 7/1990 Gibb et al. .
4,963,257 10/1990 Schulz .
5,032,294 7/1991 Schulz .
5,137,607 8/1992 Anderson et al. .
5,288,399 2/1994 Schulz .
5,308,454 5/1994 Anderson .

[75] Inventors: Glen E. Latimer, Jr., Leavittsburg; Harold L. Fotheringham, Jr., Chardon, both of Ohio; Paul K. T. Liu, Pittsburgh, Pa.

OTHER PUBLICATIONS

Reed, J.S., Introduction to the Principles of Ceramics Processing, text from chapter 10 entitled "Deflocculants and Coagulants", pp. 132-149, (copyright 1988).
Schulz et al., "Evaluating Buoyant Coarse Media Flocculation", pp. 51-63, (1994).
Product literature of Gundle Lining Systems Inc., four pages, copyright 1991.
Schulz, C.R., and Okun, D.A., "Surface Water Treatment for Communities in Developing Countries", pp. 104-125 and 203-213, date unknown.

[73] Assignee: Kinetico Incorporated, Ohio

[21] Appl. No.: 08/807,139

[22] Filed: Feb. 27, 1997

[51] Int. Cl. 7 B01D 37/00; B01D 65/02; B01D 69/02

[52] U.S. Cl. 210/767; 210/772; 210/791; 210/797; 210/798; 210/500.25; 210/321.69

[58] Field of Search 210/409, 410, 210/411, 500.25, 510.1, 767, 772, 791, 792, 793, 794, 797, 798, 321.69

Primary Examiner—Robert J. Popovics
Attorney, Agent, or Firm—Watts, Hoffman, Fisher & Heinke, Co. L.P.A.

[56] References Cited

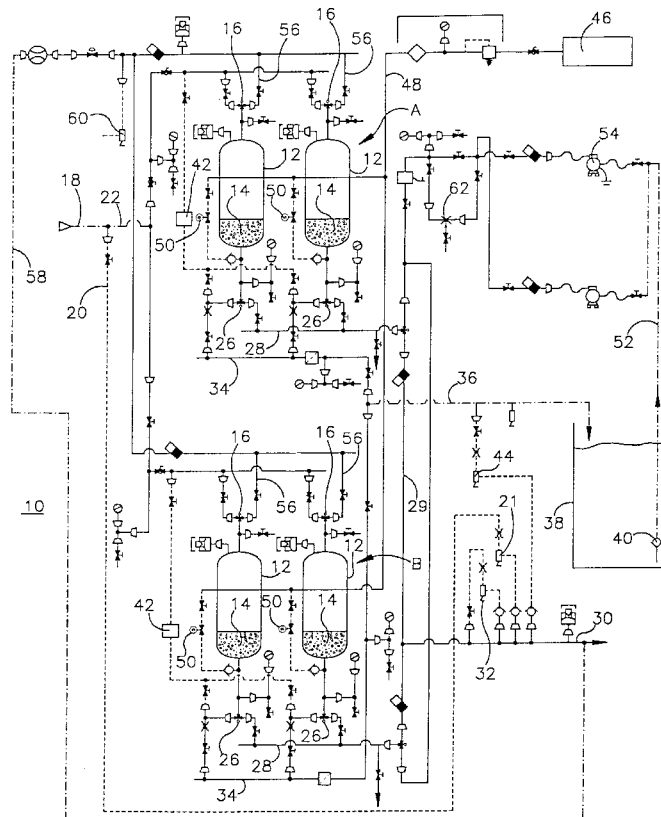
U.S. PATENT DOCUMENTS

4,632,876 12/1986 Laird et al. .
4,680,230 7/1987 Gibb et al. .
4,725,390 2/1988 Laird et al. .
4,865,734 9/1989 Schulz .
4,869,960 9/1989 Gibb et al. .

[57] ABSTRACT

A filter for removing particles from a feed liquid. The filter includes a filtration material having a metal oxide composition selected to provide the material with an affinity for the particles of the feed liquid. The affinity of the material is dependent upon a pH of the feed liquid.

13 Claims, 4 Drawing Sheets





US005827427A

# United States Patent [19]

[11] Patent Number: **5,827,427**

Hansen

[45] Date of Patent: **Oct. 27, 1998**

## [54] TANK ASSEMBLY

[75] Inventor: **Christopher Lee Hansen**, Newbury, Ohio

[73] Assignee: **Kinetico Incorporated**, Newbury, Ohio

[21] Appl. No.: **613,484**

[22] Filed: **Mar. 11, 1996**

[51] Int. Cl.<sup>6</sup> ..... **B01D 25/00**

[52] U.S. Cl. .... **210/232; 210/284; 210/289**

[58] Field of Search ..... **210/282, 284, 210/291, 541, 279, 232, 289**

## [56] References Cited

### U.S. PATENT DOCUMENTS

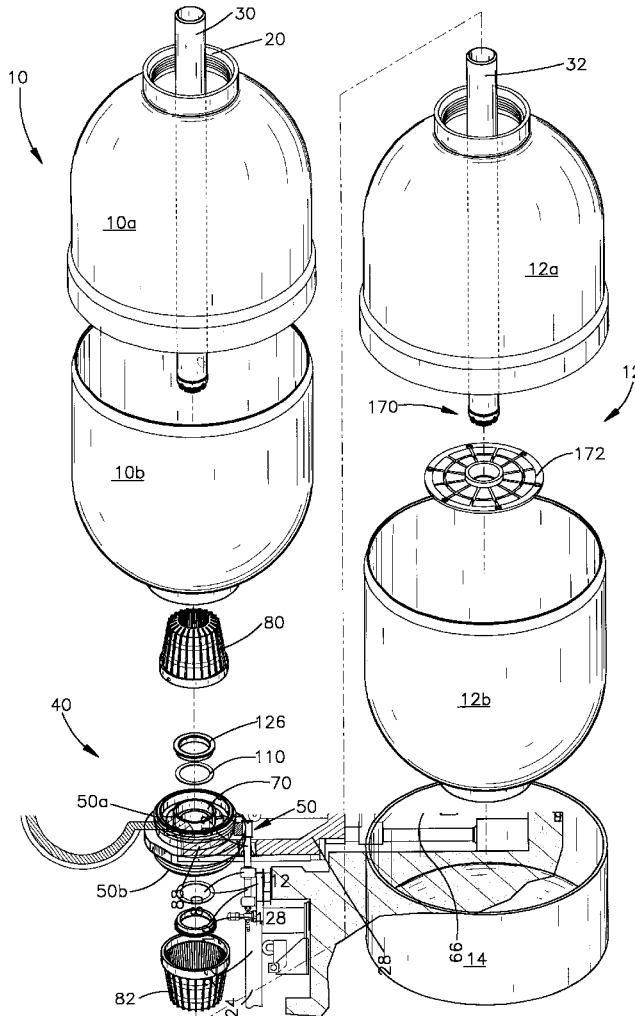
2,370,190	2/1945	Ralston	.....	210/282
4,693,814	9/1987	Brown	.....	210/88
4,804,465	2/1989	Brown	.....	210/136
5,310,488	5/1994	Hansen et al.	.....	210/674

Primary Examiner—Ivars Cintins  
Attorney, Agent, or Firm—Watts, Hoffmann, Fisher & Heinke Co., L.P.A.

## [57] ABSTRACT

A tank coupler for releasably interconnecting serially connected tanks. The tank coupler includes threaded engagement portions which are threadably engageable with ports formed in the tanks. The coupler defines a central fluid passage which receives in a sealing relationship, a riser tube associated with a first tank and a riser tube associated with a second tank. A snap fit mechanism maintains the engagement of one riser tube with the fluid passage in order to control separation of the riser tube from the coupler when the tanks are separated. O-ring seals mounted in grooves forming part of the fluid passage sealingly engage the periphery of the riser tubes and inhibit fluid leakage between the riser tubes and the coupler. The tank coupler also defines a second fluid passage which cross-communicates the interiors of the tanks. Distributors mounted on opposite ends of the second fluid passage inhibit material from moving from one tank to the other while permitting fluid flow.

**18 Claims, 2 Drawing Sheets**







US005639377A

# United States Patent [19]

[11] Patent Number: **5,639,377**

Banham et al.

[45] Date of Patent: **Jun. 17, 1997**

## [54] WATER TREATMENT SYSTEM

[75] Inventors: **William S. Banham**, Garrettsville;  
**Stephen W. Cook**, Chesterland; **Larry W. Stacy**, Mantua, all of Ohio

[73] Assignee: **Kinetico Engineered Systems, Inc.**,  
Newbury, Ohio

[21] Appl. No.: **486,378**

[22] Filed: **Jun. 7, 1995**

3,788,960	1/1974	Patil et al.	210/677
4,039,443	8/1977	Tahara et al.	210/677
4,163,717	8/1979	Blind et al.	210/672
4,220,531	9/1980	Robison	210/189
4,379,855	4/1983	Down et al.	210/677
4,648,976	3/1987	Chen	210/678
5,022,994	6/1991	Avery et al.	210/670
5,069,779	12/1991	Brown et al.	210/269
5,108,616	4/1992	Kunz	210/678
5,116,511	5/1992	Green et al.	210/673
5,346,623	9/1994	Kunz et al.	210/678
5,348,659	9/1994	Kunz et al.	210/678
5,415,765	5/1995	Banham et al.	210/142

### Related U.S. Application Data

[60] Continuation of Ser. No. 392,537, Feb. 23, 1995, abandoned, which is a division of Ser. No. 44,186, Apr. 7, 1993, Pat. No. 5,415,765.

[51] Int. Cl.<sup>6</sup> ..... **C02F 1/42**

[52] U.S. Cl. .... **210/677; 210/142; 210/269; 210/279**

[58] Field of Search ..... 210/677, 678,  
210/670, 673, 278, 277, 279, 269, 672,  
289, 291, 290, 792, 793, 794, 795, 141,  
142, 807

### [56] References Cited

#### U.S. PATENT DOCUMENTS

654,479	7/1900	McNally	210/279
2,692,244	10/1954	Kunin et al.	210/678
2,773,829	12/1956	Hunting	210/279
2,773,830	12/1956	Farmer et al.	210/793
2,973,097	2/1961	Snider	210/279
3,143,500	8/1964	Damgaard	210/279
3,169,110	2/1965	Rudlick	210/141
3,240,699	3/1966	Duff et al.	210/678
3,317,044	5/1967	Marks	210/279
3,402,126	9/1968	Cioffi	210/279
3,517,817	6/1970	Hitzel	210/279
3,617,558	11/1971	Jones	210/279
3,618,589	11/1971	Tavani	210/677
3,655,587	4/1972	Bouchard et al.	210/678
3,711,401	1/1973	Hamilton et al.	210/677

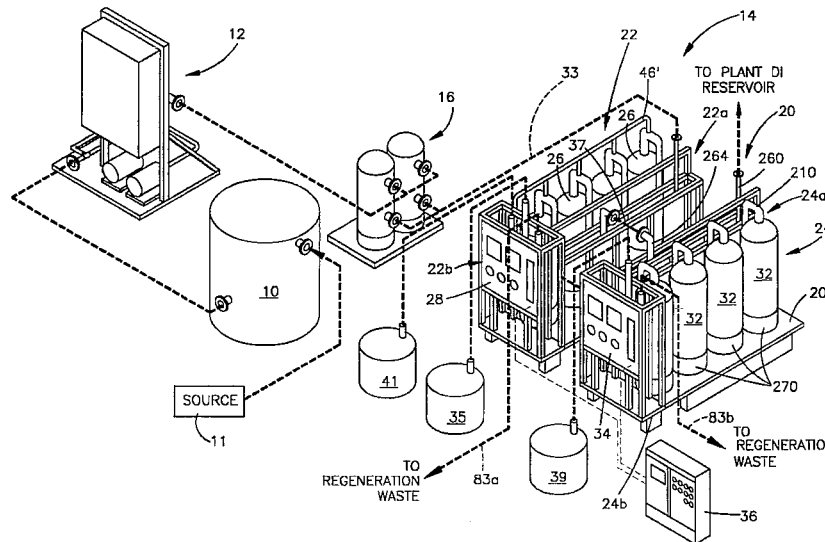
Primary Examiner—Cynthia L. Nessler

Attorney, Agent, or Firm—Watts, Hoffmann, Fisher & Heinke Co.

### [57] ABSTRACT

A method and apparatus for regenerating an ion exchange resin utilizing recycled solution or reused regeneration solution. At least one tank containing an ion exchange material is provided having a spaced first and second ports which define a fluid flow path through the ion exchange media. Water to be treated is introduced at an inlet and flows through the resin bed ultimately being discharged at the outlet. A polishing zone is located at the outlet which includes highly regenerated, uncontaminated resin. The media is regenerated in a multi-step process in which regeneration solution is introduced into the resin bed in two separate steps. In the first step, a first regeneration solution is introduced into the resin bed upstream from the polishing zone, flows in a countercurrent direction and is discharged through the inlet of the tank. A second regeneration fluid is introduced at the outlet of the tank and flows in a countercurrent direction through the entire resin bed. The first solution is introduced by an injection conduit that extends from a fitting located at the tank inlet and terminates in slots that open upstream from the polishing zone. Following the regeneration solution steps, the injection conduit is flushed and the entire bed rinsed, with rinse water, using several rinse steps.

12 Claims, 4 Drawing Sheets





US005490932A

# United States Patent [19]

[11] Patent Number: **5,490,932**

Hansen et al.

[45] Date of Patent: **Feb. 13, 1996**

[54] **FLUID TREATMENT VALVE SYSTEM WITH NOZZLE DRIVEN TURBINE**

4,427,549 1/1984 Brown et al. .... 210/662  
5,022,994 6/1991 Avery et al. .... 210/679

[75] Inventors: **Christopher L. Hansen**, Newbury;  
**Stuart L. Park**, Burton, both of Ohio

*Primary Examiner*—Joseph W. Drodge  
*Attorney, Agent, or Firm*—Watts, Hoffmann, Fisher & Hei-  
nike

[73] Assignee: **Kinetico Incorporated**, Newbury, Ohio

## [57] ABSTRACT

[21] Appl. No.: **222,077**

A control valve for a water treatment system which includes a turbine rotatably mounted within a water receiving chamber. A pair of nozzles communicate water from a water receiving chamber to the turbine in a driving relationship. The nozzles each define a passage, preferably converging slightly in cross-section and defining centerlines that converge and intersect at a region swept by the turbine. Preferably, the intersection of the centerlines occurs intermediate a circle defined by central regions of the turbine blades and a circle defined by peripheral edges of the turbine blades. At least one of the nozzles is slidably held in a slot formed in a dividing wall forming part of the control valve and is replaceable by a plug. A confronting surface defines a uniform gap between an outlet side of the nozzles and a peripheral portion of the turbine. In a further embodiment, the nozzle receiving slot includes a slot extension through which water can flow into the receiving chamber, bypassing the nozzle in proportion to the flow passing the nozzles.

[22] Filed: **Apr. 1, 1994**

[51] Int. Cl.<sup>6</sup> ..... **B01D 17/12**

[52] U.S. Cl. .... **210/541; 137/624.14; 210/98; 210/141; 210/190; 251/59; 415/150**

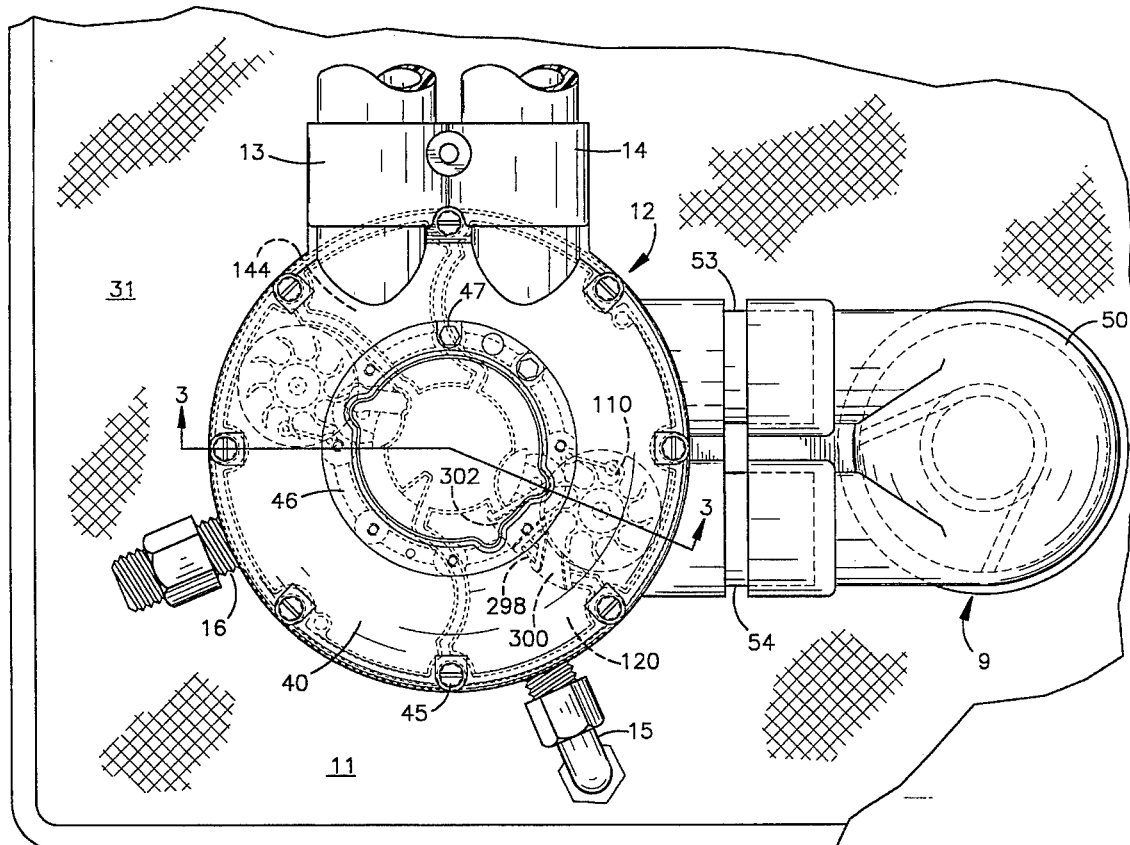
[58] Field of Search ..... 210/98, 141, 190,  
210/269, 418, 662, 137, 541; 251/59; 415/150,  
154.1; 137/624.14, 332

## [56] References Cited

### U.S. PATENT DOCUMENTS

Re. 18,909	8/1933	Turner	.....	251/59
137,171	3/1873	Bloch	.....	415/154.1
337,670	3/1886	Davis et al.	.....	219/98
716,791	12/1902	Upson	.....	415/154.1
894,105	7/1908	Beale et al.	.....	251/59
2,803,310	8/1957	Parsons	.....	251/59
3,891,552	6/1975	Prior et al.	.....	210/88
4,298,025	11/1981	Prior et al.	.....	137/624.14

**22 Claims, 6 Drawing Sheets**





US005415765A

# United States Patent [19]

[11] Patent Number: **5,415,765**

**Banham et al.**

[45] Date of Patent: **May 16, 1995**

- [54] **WATER TREATMENT SYSTEM**
- [75] Inventors: **William S. Banham, Garrettsville; Stephen W. Cook, Chesterland; Larry W. Stacy, Mantua, all of Ohio**
- [73] Assignee: **Kinetic Engineered Systems, Inc., Newbury, Ohio**
- [21] Appl. No.: **44,186**
- [22] Filed: **Apr. 7, 1993**
- [51] Int. Cl.<sup>6</sup> ..... **C02F 1/42**
- [52] U.S. Cl. .... **210/142; 210/269; 210/279**
- [58] Field of Search ..... **210/677, 678, 670, 673, 210/278, 277, 279, 269, 672, 289, 291, 290, 792, 793, 794, 795, 141, 142, 807**

- 5,022,994 6/1991 Avery et al. .... 210/269
- 5,069,779 12/1991 Brown et al. .... 210/269
- 5,116,511 5/1992 Green et al. .... 210/673

*Primary Examiner*—Cynthia L. Nessler  
*Attorney, Agent, or Firm*—Watts, Hoffmann, Fisher & Heinke Co.

## [57] ABSTRACT

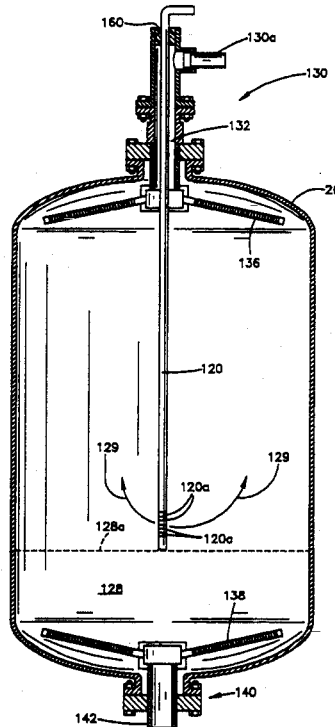
A method and apparatus for regenerating an ion exchange resin utilizing recycled solution or reused regeneration solution. At least one tank containing an ion exchange material is provided having a spaced first and second ports which define a fluid flow path through the ion exchange media. Water to be treated is introduced at an inlet and flows through the resin bed ultimately being discharged at the outlet. A polishing zone is located at the outlet which includes highly regenerated, uncontaminated resin. The media is regenerated in a multi-step process in which regeneration solution is introduced into the resin bed in two separate steps. In the first step, a first regeneration solution is introduced into the resin bed upstream from the polishing zone, flows in a countercurrent direction and is discharged through the inlet of the tank. A second regeneration fluid is introduced at the outlet of the tank and flows in a countercurrent direction through the entire resin bed. The first solution is introduced by an injection conduit that extends from a fitting located at the tank inlet and terminates in slots that open upstream of the polishing zone. Following the regeneration solution steps, the injection conduit is flushed and the entire bed rinsed, with rinse water, using several rinse steps.

## [56] References Cited

### U.S. PATENT DOCUMENTS

654,479	7/1900	McNally	.....	210/279
2,692,244	10/1954	Kunin et al.	.....	210/678
2,773,829	12/1956	Hunting	.....	210/279
2,773,830	12/1956	Farmer et al.	.....	210/793
2,973,097	2/1961	Snider	.....	210/279
3,143,500	8/1964	Damgaard	.....	210/279
3,169,110	2/1965	Rudelick	.....	210/278
3,240,699	3/1966	Duff et al.	.....	210/678
3,317,044	5/1967	Marks	.....	210/279
3,402,126	9/1968	Cioffi	.....	210/279
3,617,558	11/1971	Jones	.....	210/279
3,655,587	4/1972	Bouchard et al.	.....	210/678
3,711,401	1/1973	Hamilton et al.	.....	210/677
4,163,717	8/1979	Blind et al.	.....	210/672
4,220,531	9/1980	Robison	.....	210/291
4,379,855	4/1983	Down et al.	.....	210/677

**16 Claims, 4 Drawing Sheets**





US005310488A

# United States Patent [19]

[11] Patent Number: **5,310,488**

Hansen et al.

[45] Date of Patent: **May 10, 1994**

[54] **WATER TREATMENT METHOD**

[75] Inventors: **Christopher L. Hansen, Newbury; Glen E. Latimer, Jr., Leavittsburg, both of Ohio**

[73] Assignee: **Kinetico Incorporated, Newbury, Ohio**

[21] Appl. No.: **663,251**

[22] Filed: **Mar. 1, 1991**

[51] Int. Cl.<sup>5</sup> ..... **B01J 49/00**

[52] U.S. Cl. .... **210/674; 521/26**

[58] Field of Search ..... **210/674; 521/26**

[56] **References Cited**

**U.S. PATENT DOCUMENTS**

2,769,787	11/1956	Diamond	521/26
4,071,446	1/1978	Kunin	210/32
4,083,782	4/1978	Kunin	210/32
4,116,860	9/1978	Kunin	252/192
4,693,814	9/1987	Brown	210/88
4,764,280	8/1988	Brown et al.	210/662
4,804,465	2/1989	Brown	210/136

*Primary Examiner*—Ivars Cintins  
*Attorney, Agent, or Firm*—Watts, Hoffmann, Fisher & Heinke Co.

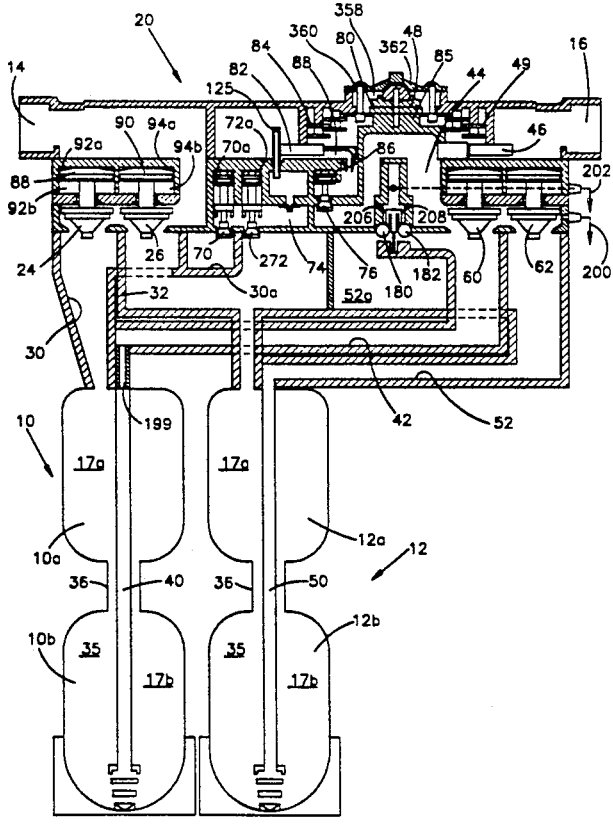
“problem water”. The apparatus includes a pair of treatment tank assemblies, each tank including serially connected filter and ion exchange beds. When a tank assembly requires regeneration, the tank assembly is taken off line and is regenerated using a regenerating apparatus that communicates a mixture of citric acid and brine solution to the ion exchange bed, followed by brine solution alone to form a barrier. A mixture of sodium carbonate and brine solution is then communicated to the ion exchange bed followed by a backwashing step which conveys treated water through both the ion exchange bed and the filter media in a counter flow direction. The regeneration apparatus includes a brine venturi and a chemical draw venturi connected in a parallel flow relationship and solenoid control valves for selectively communicating either a citric acid reservoir or a sodium carbonate reservoir to the chemical draw venturi. A timer or sequencer sequentially activates the control valves for predetermined time intervals. A heater and insulation is provided for the sodium carbonate reservoir to inhibit precipitation of the sodium carbonate out of solution. The regeneration apparatus also includes a flushing arrangement for flushing a fluid path along which the sodium carbonate solution flows during regeneration.

[57]

**ABSTRACT**

A water treatment apparatus and method for softening

**18 Claims, 7 Drawing Sheets**



[54] WATER TREATMENT SYSTEM

[75] Inventors: Keith E. Brown, Solon; Lyle E. Kirman, Cleveland Heights, both of Ohio

[73] Assignee: Kinetico, Incorporated, Newbury, Ohio

[21] Appl. No.: 451,094

[22] Filed: Dec. 15, 1989

[51] Int. Cl.<sup>5</sup> ..... C02F 1/42

[52] U.S. Cl. .... 210/87; 210/96.1; 210/143; 210/190; 210/241; 210/269; 210/284

[58] Field of Search ..... 210/87, 88, 93, 96.1, 210/98, 102, 105, 134, 141-143, 190, 191, 241, 264, 269, 284

[56] References Cited

U.S. PATENT DOCUMENTS

4,104,158	8/1978	Davis	210/139
4,385,357	5/1983	Davis et al.	364/500
4,470,911	9/1984	Reinke	210/143
4,539,106	9/1985	Schwartz	210/143
4,568,465	2/1986	Davis et al.	210/662
4,659,460	4/1987	Muller et al.	210/241

OTHER PUBLICATIONS

Hand-Out published by Water Refining Industrial Describing "Continuoussequence Systems".

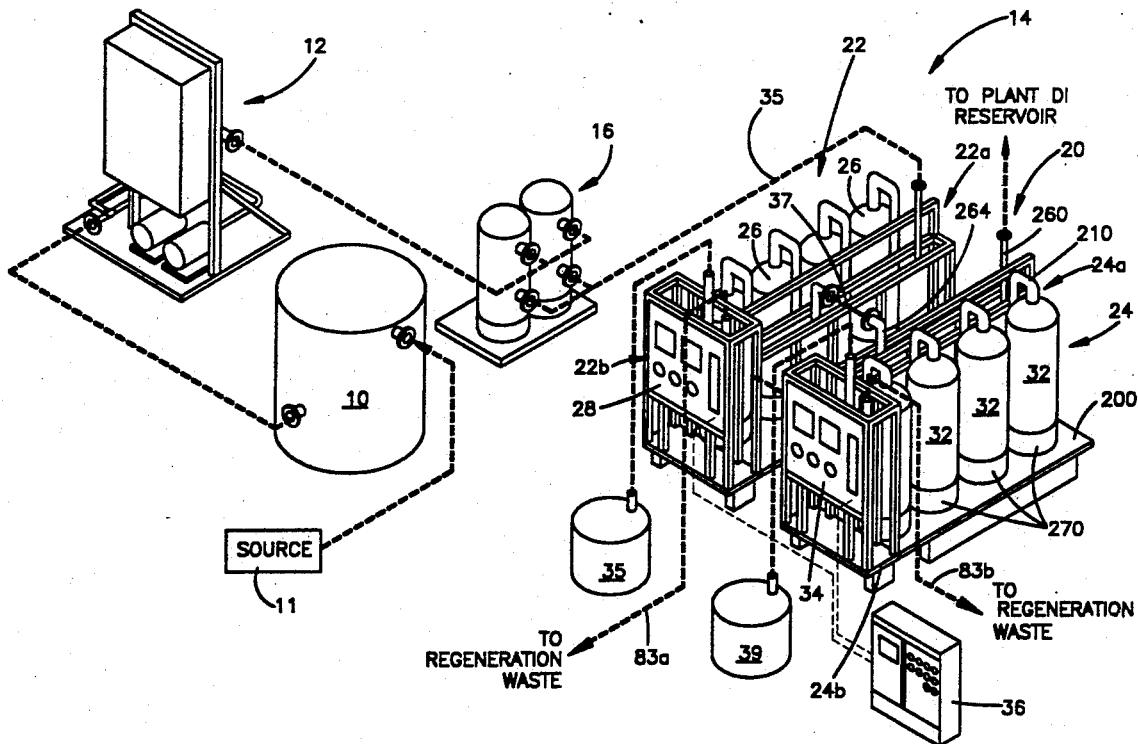
Hand-Out published by Orion Industrial Relating to Management of Cation Exchange Systems.

Primary Examiner—Ivars Cintins  
Attorney, Agent, or Firm—Watts, Hoffmann, Fisher & Heinke Co.

[57] ABSTRACT

A water treatment system including a plurality of treatment tanks containing a water treatment material and defining a fluid flow path through the material extending between a first tank port and a second tank port. A first remotely controlled three way valve associated with the first tank port controls the fluid communication of a source manifold and a regeneration discharge manifold with the first tank port of each tank. A second, remotely controlled three way valve controls the fluid communication of a product receiving manifold and a regeneration chemistry supply manifold with the second port of each tank. A regeneration control monitors the loading of each tank and initiates regeneration in a given tank when that tank reaches a predetermined exhaustion level. A regeneration anticipator is operative to initiate early regeneration of a given tank if it determines that a second tank will reach exhaustion before the first tank completes its regeneration, if the first tank is allowed to proceed to the predetermined exhaustion level. The treatment tanks form part of a subassembly mounted on a common platform which is skid mounted to facilitate movement and service.

26 Claims, 4 Drawing Sheets



[54] FLUID TREATMENT SYSTEM

4,764,280 2/1988 Brown et al. .... 210/662

[75] Inventors: Norman R. Avery, Chesterland; Dale J. Spangenberg, Jr.; Jimmy D. Buth, both of Chardon; Kenneth C. Seuffer, Jr., Middlefield, all of Ohio

Primary Examiner—Richard V. Fisher  
 Assistant Examiner—Christopher Upton  
 Attorney, Agent, or Firm—Watts, Hoffman, Fisher & Heinke Co.

[73] Assignee: Kinetico Incorporated, Newbury, Ohio

[57] ABSTRACT

[21] Appl. No.: 334,453

A method and apparatus for controlling a fluid treatment apparatus that includes a resin tank containing an ion exchange media. A control valve controls the regeneration cycle and includes a regeneration control turbine operatively connected to a regeneration control disk forming part of a servo system. During regeneration, a meter flow of fluid emitted by a regeneration control nozzle produces rotation in the turbine to effect a regeneration sequence. Regeneration is initiated by a regeneration initiating nozzle which emits a stream of fluid at the turbine for a predetermined time interval in order to initiate a regeneration cycle. A control system includes a sensor for monitoring the fluid quality level of the source fluid or the treated fluid and initiates regeneration. When the control system is used with the disclosed control valve, the control system communicates pressurized fluid to the regeneration initiating nozzle upon sensing a predetermined quality level. The control system preferably includes a programmable controller interconnected with a flow sensor and conductivity sensor and periodically samples the conductivity of the influent. Based on the conductivity and volume data provided by the sensors, the programmable controller maintains a running total of "total grains" processed by the ion exchange material. When the total grains processed equals or exceeds a preset value which is related to the capacity of the resin bed, the control system initiates regeneration.

[22] Filed: Apr. 6, 1989

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 156,300, Feb. 16, 1988, abandoned.

[51] Int. Cl.<sup>5</sup> ..... B01D 15/04

[52] U.S. Cl. .... 210/670; 210/746; 210/88; 210/96.1; 210/98; 210/141; 210/143; 210/190; 210/269; 137/624.12; 137/624.14; 251/59

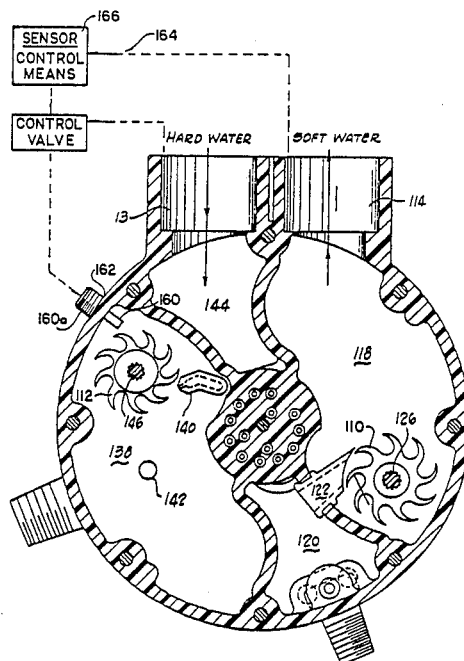
[58] Field of Search ..... 210/140, 141, 142, 143, 210/190, 191, 264, 269, 670, 746, 87, 88, 89, 96.1, 98, 103, 105; 137/624.12, 624.14, 624.18; 251/59

[56] References Cited

U.S. PATENT DOCUMENTS

2,617,766	11/1952	Emmett et al. ....	210/96.1
2,938,868	5/1960	Carlson et al. ....	210/662
3,676,336	7/1972	O'Brien et al. ....	210/87
3,891,552	6/1975	Prior et al. ....	210/88
4,298,025	11/1981	Prior et al. ....	137/624.14
4,426,294	1/1984	Seal .....	210/89
4,427,549	1/1984	Brown et al. ....	210/662
4,469,602	9/1984	Seal .....	210/89
4,470,911	11/1984	Reinke et al. ....	210/89
4,490,249	12/1984	Seal .....	210/89

27 Claims, 9 Drawing Sheets



[54] BYPASS VALVE

[75] Inventors: Peter Halemba, Russell; George S. Ellis, III, Chardon; David W. Crozier, Highland Heights, all of Ohio

[73] Assignee: Kinetico, Inc., Newbury, Ohio

[21] Appl. No.: 426,491

[22] Filed: Oct. 23, 1989

**Related U.S. Application Data**

[63] Continuation of Ser. No. 308,890, Feb. 9, 1989, abandoned.

[51] Int. Cl.<sup>5</sup> ..... F16K 11/085

[52] U.S. Cl. .... 137/625.29; 137/625.43; 137/270

[58] Field of Search ..... 137/625.43, 625.29, 137/270

[56] **References Cited**

**U.S. PATENT DOCUMENTS**

- Re. 30,224 3/1980 Ortega .
- 825,706 7/1906 Dyblie .
- 925,692 6/1909 Gold .
- 1,166,571 1/1916 Bard .
- 2,344,714 3/1944 Martin .
- 2,532,003 11/1950 Wyer .
- 2,907,349 10/1959 White .
- 3,115,160 12/1963 Rogers .
- 3,191,628 6/1965 Kirkwood et al. .
- 3,194,267 7/1965 Lyon et al. .
- 3,307,583 3/1967 Harter .
- 3,339,583 9/1967 Fleckenstein et al. .... 137/625.29
- 3,476,151 11/1969 Hegstad ..... 137/625.29
- 3,669,148 6/1972 Burkhalter, Jr. .
- 3,938,553 2/1976 Ortega .
- 3,973,592 8/1976 Cleaver et al. .... 137/625.43
- 4,313,428 2/1982 Goldenberg .
- 4,318,424 3/1982 Bajka .
- 4,385,746 5/1983 Tomlin et al. .
- 4,470,429 9/1984 Johnson ..... 137/270

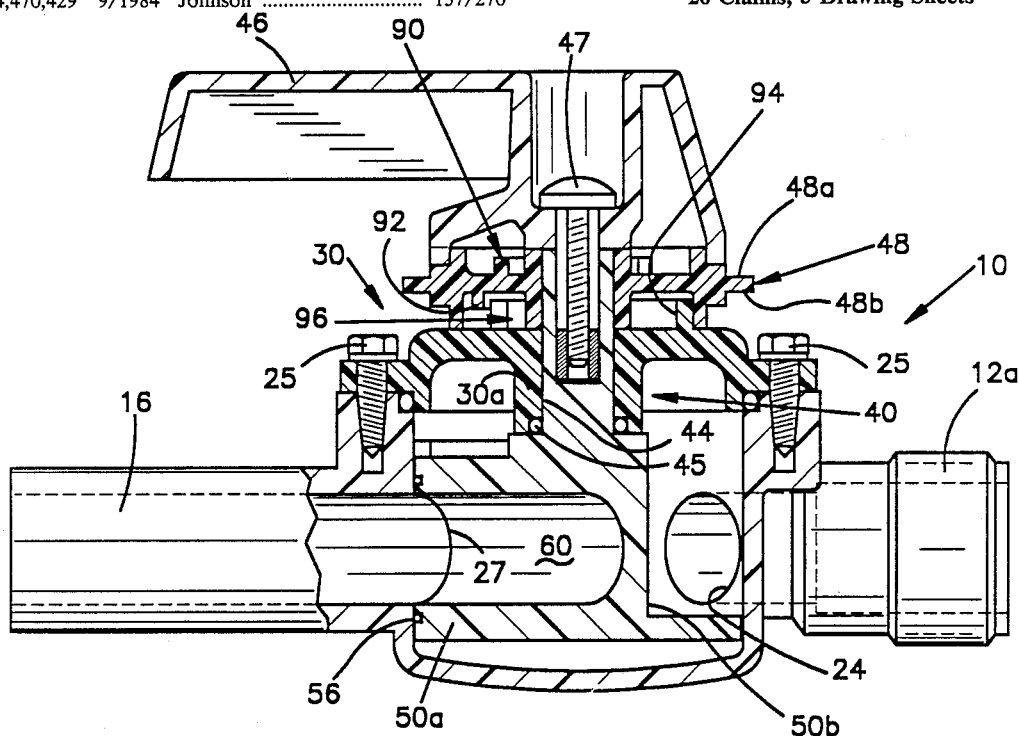
- 4,506,703 3/1985 Baron .
- 4,520,847 6/1985 Baron ..... 137/625.43
- 4,543,996 10/1985 Baron .
- 4,601,307 7/1986 Johnson .

Primary Examiner—Arnold Rosenthal  
 Attorney, Agent, or Firm—Watts, Hoffmann, Fisher & Heinke Co.

[57] **ABSTRACT**

A bypass/diverter valve for controlling the flow of fluid from a source to a fluid treatment device such as a water softener. The valve includes a valve housing defining a circular chamber having a cylindrical wall into which three spaced ports open into. Two of the ports form inlet/outlet ports communicating with connecting conduits. The third port forms an intermediate port that communicates with the input to the water softener. The valve housing also defines a second intermediate port communicating with the output of the water softener and which communicates with the valve chamber through a passage arrangement. A plug-like valving member is rotatable within the chamber and includes a recess which together with the chamber wall defines a passage for selectively communicating one of said inlet/outlet ports with said first intermediate port while concurrently communicating said other inlet/outlet port with the second intermediate port or alternately for communicating said first inlet/outlet port with said second intermediate port while concurrently communicating the second inlet/outlet port with said first intermediate port. The valving member is also positionable to block flow out of either of said inlet/outlet ports. The plug member includes a recess for communicating fluid from the passage to one of the inlet/outlet ports when the valving member is rotated to a predetermined position. A movement control disc delimits the extremes of movement in the valving member and is positionable in two different positions to change the extremes of movement.

20 Claims, 5 Drawing Sheets



[54] BRINING SYSTEM

[75] Inventors: William C. Prior, Chagrin Falls; Ellis, III: George S., Chardon; David W. Crozier, Highland Heights, all of Ohio

[73] Assignee: Kinetico, Inc., Newbury, Ohio

[21] Appl. No.: 115,713

[22] Filed: Nov. 2, 1987

[51] Int. Cl.<sup>4</sup> ..... C02B 1/22

[52] U.S. Cl. .... 210/190; 137/513.5; 137/514; 137/523

[58] Field of Search ..... 210/191, 190; 137/513.5, 514, 523

[56] References Cited

U.S. PATENT DOCUMENTS

3,163,394	12/1964	Downin	251/120
3,185,302	5/1965	Kryzer	210/126
3,326,377	6/1967	Abos	210/126
3,424,311	1/1969	Siedenburg	210/86
3,891,552	6/1975	Prior	210/88
4,147,629	4/1979	Geurtsen	210/104
4,336,134	6/1982	Prior	210/127

Primary Examiner—David L. Lacey

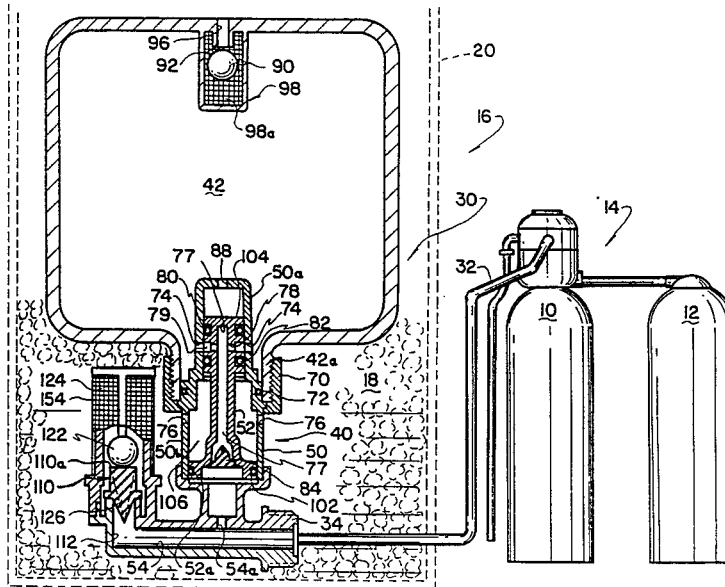
Assistant Examiner—Thi Dang

Attorney, Agent, or Firm—Watts, Hoffmann, Fisher & Heinke Co.

[57] ABSTRACT

A brining system including a brine reservoir containing a supply of salt and a brine valve assembly disposed in the reservoir below the level of the salt and including a vessel for accumulating a predetermined quantity of fluid to be discharged into the reservoir to form a regeneration solution. A control valve forming part of the brine valve assembly includes a spool member shiftable between two positions. In one position a fluid supply line is communicated with the accumulating vessel and in a second position the vessel is communicated with the brine reservoir. The spool includes effective pressure areas for monitoring pressures in the supply line and the vessel. When a predetermined level in the accumulating vessel is reached, a flow of fluid into the vessel is terminated and the resulting change in pressure sensed by the spool causes it to shift to a position at which fluid in the vessel is discharged into the brine reservoir while fluid flow from the supply line is concurrently terminated. During a regeneration cycle, "suction" pressures generated in the supply line cause the spool to return to its first position. In one embodiment, the vessel includes a check ball controlled vent port whereas in an alternate embodiment an adjustable float mechanism controls the final fluid level in the vessel.

13 Claims, 2 Drawing Sheets





- [54] APPARATUS AND METHOD FOR RECOVERING MATERIALS FROM PROCESS BATHS
- [75] Inventors: Lyle E. Kirman, Cleveland Heights; Kenneth C. Seufer, Jr., Middlefield, both of Ohio
- [73] Assignee: Kinetico, Inc., Newbury, Ohio
- [21] Appl. No.: 83,721
- [22] Filed: Aug. 10, 1987
- [51] Int. Cl.<sup>4</sup> ..... C02F 1/42
- [52] U.S. Cl. .... 210/662; 75/101 BE; 210/670; 210/685; 210/96.1; 210/98; 210/269; 210/284; 423/DIG. 14
- [58] Field of Search ..... 210/662, 670, 684, 685, 210/96.1, 98, 269, 284; 75/101 BE; 423/DIG. 14

EPA Document No. 440/1-78/085, Feb. 1978, pp. 206-214.  
 "Control and Treatment Technology for the Metal Finishing Industry", EPA Summary Report, 1979, pp. 37-45.  
 "Amber-Hi-Lites", No. 102, Nov. 1967.  
 "Amber-Hi-Lites", No. 104, Mar. 1968.  
 Amber-Hi-Lites, No. 105, May 1968.  
 Amber-Hi-Lites, No. 162, 1979.  
 "Amberlite® is the Answer" Product Brochure, Apr. 1978.

Primary Examiner—Ivars Cintins  
 Attorney, Agent, or Firm—Watts, Hoffmann, Fisher & Heinke Co.

**ABSTRACT**

[57] A method and apparatus for selectively recovering ions from an aqueous solution and producing deionized water for reuse. When used in a nickel plating process, a rinse water stream is passed through a first cation removing assembly that contains an ion exchange media having a greater affinity for nickel ions than for most or all other ions present in the system. Rinse water processed by the first cation removing assembly is conveyed to a second cation removing assembly and then to an anion removing assembly so that deionized water is produced and is then returned to a rinse bath. Rinse water is passed through the first ion exchange media until substantially all of the ion exchange sites hold a nickel ion. The other cations in the rinse water are captured by the second cation assembly. The first cation assembly is regenerated using a regeneration solution compatible with the plating bath. The regeneration solution after passing through the first cation assembly releases the captured metal ions and the regeneration solution along with the plating ions is returned to the plating bath.

[56] **References Cited**

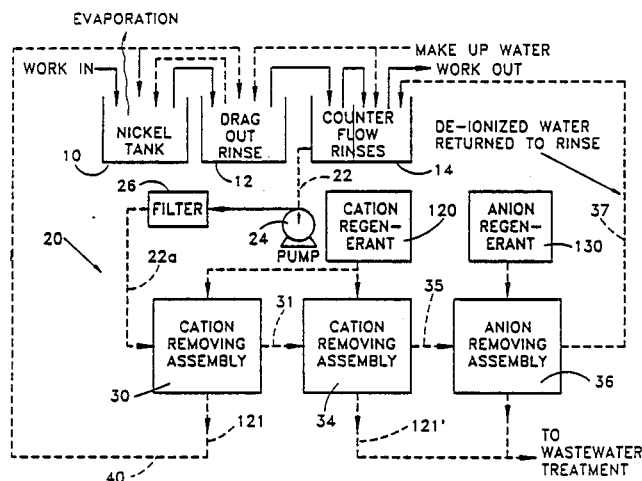
**U.S. PATENT DOCUMENTS**

2,938,868	5/1960	Carlson et al.	210/662
3,033,641	5/1962	Thomas	23/1
3,509,998	5/1970	Pellett et al.	210/98
3,985,648	10/1976	Casolo	210/27
4,009,101	2/1977	Hayashi	75/101 BE
4,049,772	9/1977	Takada et al.	423/54
4,137,290	1/1979	Degenkolb et al.	423/1
4,145,281	3/1979	Weishaar et al.	423/54
4,186,174	1/1980	Hunter et al.	423/54
4,197,167	4/1980	Wright	204/40
4,321,144	3/1982	Huber	210/685
4,517,096	5/1985	Sekine et al.	210/668
4,528,101	7/1985	Burke et al.	210/677

**OTHER PUBLICATIONS**

"Nickel Salt Recovery System", Eco-Tec Product Bulletin.  
 Calmon et al., *Ion Exchange for Pollution Control*, CRC Press, 1979, pp. 173-189.

14 Claims, 2 Drawing Sheets



- [54] WATER TREATMENT APPARATUS
- [75] Inventor: Keith E. Brown, Solon, Ohio
- [73] Assignee: Kinetico, Inc., Newbury, Ohio
- [21] Appl. No.: 65,923
- [22] Filed: Jun. 24, 1987

**Related U.S. Application Data**

- [62] Division of Ser. No. 646,953, Sep. 4, 1984, Pat. No. 4,693,814.
- [51] Int. Cl.<sup>4</sup> ..... B01J 49/00
- [52] U.S. Cl. .... 210/136; 210/191;  
210/284; 210/288; 222/71
- [58] Field of Search ..... 210/661, 190, 191, 284,  
210/288, 416.1, 416.3, 136; 222/71

**References Cited**

**U.S. PATENT DOCUMENTS**

- 3,092,029 6/1963 Hanson et al. .... 222/71
- 3,319,791 5/1967 Horne ..... 210/284
- 4,140,541 2/1979 Popper ..... 210/661

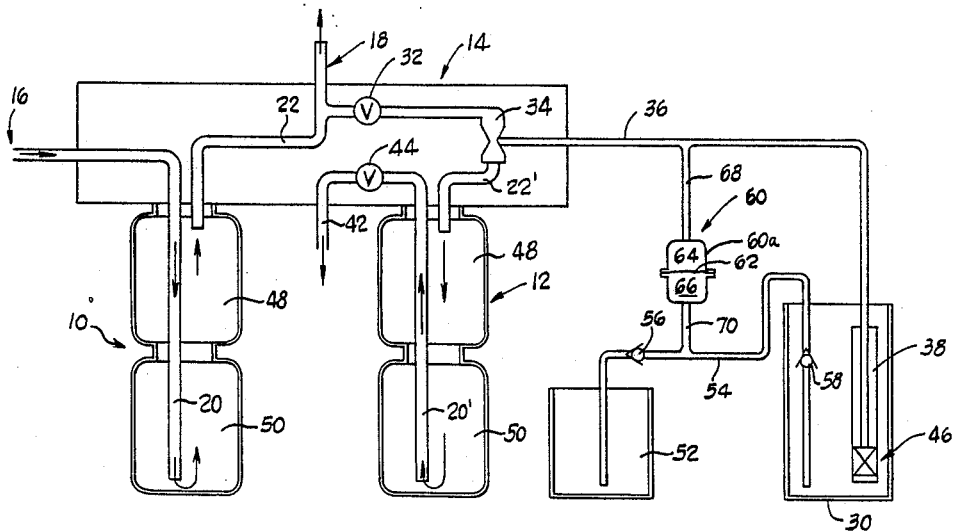
Primary Examiner—Ivars Cintins  
Attorney, Agent, or Firm—Watts, Hoffman, Fisher & Heinke

**ABSTRACT**

[57] A water treatment system including a pair of tank as-

semblies 110, 112 interconnected by a valve module 114 for controlling the communication of water to be treated to an on-line tank and the regeneration of an exhausted tank. Each tank assembly includes a compartment containing a water softening resin 125 and a compartment centering an iron filter media. The valve module is connected to a regeneration solution reservoir 150 by brine conduits 164, 220. A pumping assembly 192 automatically transfers a predetermined amount of a supplemental regenerant fluid from a well 168 into the regeneration solution reservoir at the conclusion of a regeneration cycle. The pumping assembly includes upper and lower chambers 194a, 196a communicating with the supplemental regenerant fluid reservoir 168 and brine supply conduits 164, 220 respectively. The lower chamber 196a contracts and expands in response to the depressurization and pressurization of the brine conduits and produces attendant expansion and contraction in the upper chamber 194a. The upper chamber draws a predetermined amount of regenerant fluid from the reservoir 168 and injects the fluid into the regeneration solution reservoir 150. Check valves 186, 202 control the direction of flow of the regenerant fluid from the regenerant well 168.

3 Claims, 3 Drawing Sheets



- [54] WATER SOFTENING APPARATUS
- [75] Inventors: Keith E. Brown, Solon; Kenneth C. Seufer, Jr.; Jimmy D. Buth, both of Chardon, all of Ohio
- [73] Assignee: Kinetico, Inc., Newbury, Ohio
- [21] Appl. No.: 828,390
- [22] Filed: Feb. 11, 1986

Related U.S. Application Data

- [63] Continuation-in-part of Ser. No. 646,953, Sep. 4, 1984, Pat. No. 4,693,814.
- [51] Int. Cl.<sup>4</sup> ..... B01J 49/00
- [52] U.S. Cl. .... 210/662; 210/672; 210/673; 210/96.1; 210/140; 210/143; 210/191; 521/26
- [58] Field of Search ..... 210/670, 672, 673, 678, 210/687, 140, 143, 190, 191, 269, 275, 277, 278, 284, 662, 96.1, 205; 521/26

References Cited

U.S. PATENT DOCUMENTS

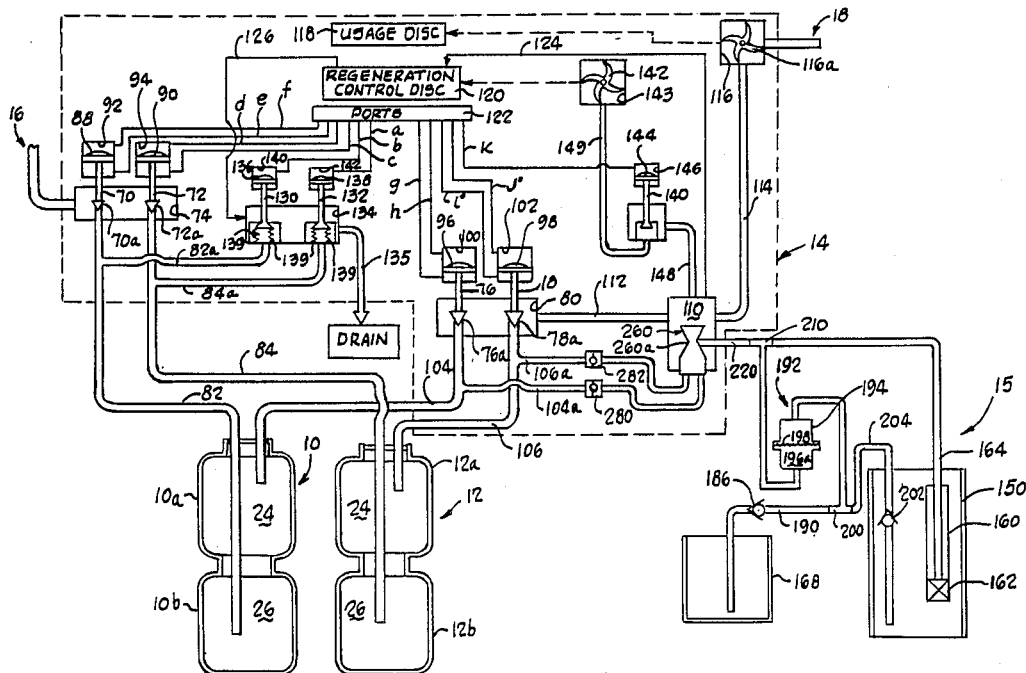
2,145,901	2/1939	Shoemaker	210/23
2,383,422	8/1945	Singleton	103/153
2,902,155	9/1959	Lundeen	210/105
3,216,931	11/1965	Dennis et al.	210/191
3,382,983	5/1968	Stewart	210/266
3,891,552	6/1975	Prior et al.	210/190
4,071,446	1/1978	Kunin	210/32
4,116,860	9/1978	Kunin	252/192
4,196,081	4/1980	Pavia	210/94
4,219,413	8/1980	Jackson et al.	210/96.1
4,228,000	10/1980	Hoeschler	210/673
4,298,025	11/1981	Prior et al.	210/190
4,298,468	11/1981	Heskett	210/136
4,336,134	6/1982	Prior	210/127
4,430,228	2/1984	Paterson	210/665

Primary Examiner—Ivars Cintins  
Attorney, Agent, or Firm—Watts, Hoffmann, Fisher & Heinke Co.

[57] ABSTRACT

A water softening apparatus and method for reducing odor in, and improving the taste of, problem water, including a pair of treatment tanks and a control valve assembly for determining which tank is on-line, and which tank is off-line, and for controlling the regeneration of the off-line tank. An exhausted tank is taken off-line and partially regenerated by communicating a regeneration solution from a reservoir to the tank and passing the solution through a resin compartment after which the solution is discharged to drain. After a predetermined quantity of regeneration solution is passed through the tank, the resin compartment is slowly rinsed using treated water from the on-line tank. Prior to fully rinsing the off-line tank, the fluid flow is terminated leaving a diluted regeneration solution in the off-line tank thereby keeping the off-line tank in a "high solids" condition. Just prior to placing the off-line tank, on-line, treated water from the on-line tank is communicated to the off-line tank and passed through the resin compartment at a flow rate higher than the fluid flow rate during the rinsing step such that the off-line tank is fully backwashed prior to being placed on-line. To further inhibit the propagation of taste and odor degrading bacteria, a growth retarding agent is automatically added to the regeneration solution reservoir prior to initiating a regeneration cycle by a pumping arrangement that operates automatically in response to sensing the flow of regeneration solution to the control valve assembly.

13 Claims, 3 Drawing Sheets



[54] FILTER APPARATUS

[75] Inventor: George S. Ellis, Chardon, Ohio

[73] Assignee: Kinetico, Inc., Newbury, Ohio

[21] Appl. No.: 760,251

[22] Filed: Jul. 29, 1985

[51] Int. Cl.<sup>4</sup> ..... B01D 27/02

[52] U.S. Cl. .... 210/739; 210/807; 210/87; 210/100; 210/282; 210/444

[58] Field of Search ..... 210/100, 807, 739, 87, 210/88, 129, 133, 143, 282, 443, 444, 446-449

[56] References Cited

U.S. PATENT DOCUMENTS

3,349,914	10/1967	Kudlaty	.....	210/133 X
3,570,520	3/1971	Sodi	.....	210/88 X
4,145,285	3/1979	Martin et al.	.....	210/100
4,359,384	11/1982	Brane et al.	.....	210/100
4,431,533	2/1984	Wrede	.....	210/87
4,555,331	11/1985	Thornton et al.	.....	210/100 X

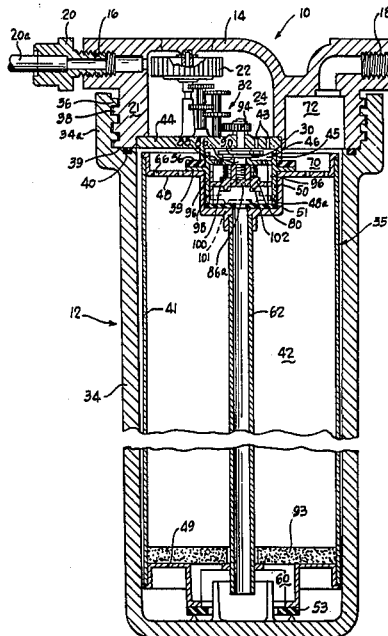
Primary Examiner—Tom Wyse

Attorney, Agent, or Firm—Watts, Hoffmann, Fisher & Heinke

[57] ABSTRACT

A filtering apparatus including a fluid monitoring head and a replaceable filter cartridge removably fastened to said head. The cartridge includes a shut off mechanism for interrupting fluid flow through the cartridge when a predetermined quantity of fluid has been treated by the filter. The fluid monitoring head is releasably coupled to the shutoff mechanism when the filter is installed. The shutoff mechanism includes a valve element threadedly carried by a shaft that forms part of a driven member, operatively connected to a drive member forming part of the monitoring head. As the driven member rotates, the valve element is gradually unthreaded until it separates and is driven to a flow interrupting position by a biasing spring. The coupling between the drive and driven members includes apertures on one of the members which are engaged by resilient tongues formed on the other member.

21 Claims, 6 Drawing Figures



- [54] WATER TREATMENT APPARATUS
- [75] Inventor: Keith E. Brown, Solon, Ohio
- [73] Assignee: Kinetico, Inc., Newbury, Ohio
- [21] Appl. No.: 646,953
- [22] Filed: Sep. 4, 1984
- [51] Int. Cl.<sup>4</sup> ..... C02F 1/42; C02F 9/00; B01J 49/00
- [52] U.S. Cl. .... 210/88; 210/191; 210/284; 210/288
- [58] Field of Search ..... 210/136, 190, 191, 257.1, 210/258, 259, 261, 266, 269, 284, 670, 672, 673, 678, 687, 140, 143, 88, 90, 97, 98, 288; 417/313, 437, 475

Primary Examiner—Ivars Cintins  
 Attorney, Agent, or Firm—Watts, Hoffmann, Fisher & Heinke Co.

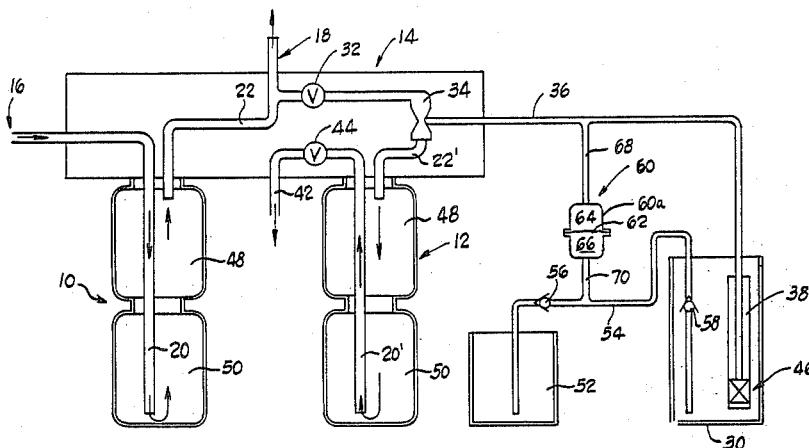
[57] ABSTRACT

A water treatment system including a pair of tank assemblies 110, 112 interconnected by a valve module 114 for controlling the communication of water to be treated to an on-line tank and the regeneration of an exhausted tank. Each tank assembly includes a compartment containing a water softening resing 125 and a compartment centering an iron filter media. The valve module is connected to a regeneration solution reservoir 150 by brine conduits 164, 220. A pumping assembly 192 automatically transfers a predetermined amount of a supplemental regenerant fluid from a well 168 into the regeneration solution reservoir at the conclusion of a regeneration cycle. The pumping assembly includes upper and lower chambers 194a, 196a communicating with the supplemental regenerant fluid reservoir 168 and brine supply conduits 164, 220 respectively. The lower chamber 196a contracts and expands in response to the depressurization and pressurization of the brine conduits and produces attendant expansion and contraction in the upper chamber 194a. The upper chamber draws a predetermined amount of regenerant fluid from the reservoir 168 and injects the fluid into the regeneration solution reservoir 150. Check valves 186, 202 control the direction of flow of the regenerant fluid from the regenerant well 168.

[56] References Cited  
 U.S. PATENT DOCUMENTS

2,145,901	2/1939	Shoemaker	210/722
2,383,422	8/1945	Singleton	417/437
2,902,155	9/1959	Lundeen	210/190
3,216,931	11/1965	Dennis et al.	210/673
3,382,983	5/1968	Stewart	210/266
3,891,552	6/1975	Prior et al.	210/190
4,071,446	1/1978	Kunin	210/670
4,116,860	9/1978	Kunin	252/192
4,196,081	4/1980	Pavia	210/284
4,219,413	8/1980	Jackson et al.	210/96.1
4,228,000	10/1980	Hoeschler	210/190
4,298,025	11/1981	Prior et al.	210/190
4,298,468	11/1981	Heskett	210/190
4,336,134	6/1982	Prior	210/190
4,430,228	2/1984	Paterson	210/665

18 Claims, 3 Drawing Figures



- [54] FLUID TREATMENT SYSTEM
- [75] Inventor: George S. Ellis, III, Chardon, Ohio
- [73] Assignee: Kinetico, Inc., Newbury, Ohio
- [21] Appl. No.: 703,126
- [22] Filed: Feb. 19, 1985

**Related U.S. Application Data**

- [63] Continuation-in-part of Ser. No. 535,996, Sep. 26, 1983.
- [51] Int. Cl.<sup>4</sup> ..... B01D 13/00
- [52] U.S. Cl. .... 210/636; 210/257.2;  
210/409
- [58] Field of Search ..... 210/257.2, 321.1, 321.2,  
210/636, 409

**References Cited**

**U.S. PATENT DOCUMENTS**

- 3,493,495 2/1970 Mendelson ..... 210/321.1 X
- 3,493,496 2/1970 Bray et al. .... 210/321.1 X
- 3,498,910 3/1970 Mendelson ..... 210/321.1 X
- 3,505,215 4/1970 Bray ..... 210/321.1 X
- 3,616,921 11/1971 Bray ..... 210/321.1 X
- 3,746,640 7/1973 Bray ..... 210/321.1 X
- 3,786,924 1/1974 Huffman ..... 210/321.1 X
- 3,846,295 11/1974 Gibbs ..... 210/257.2 X
- 3,849,305 11/1974 Manjikian ..... 210/321.1 X
- 3,939,074 2/1976 Bray ..... 210/321.1 X
- 3,959,146 5/1976 Bray ..... 210/321.1 X
- 3,992,301 11/1976 Shippey et al. .... 210/321.1 X
- 4,124,488 11/1978 Wilson ..... 210/416.1 X
- 4,187,173 2/1980 Keefer ..... 210/416.1 X
- 4,190,537 2/1980 Tondreau et al. .... 210/321.1 X

**FOREIGN PATENT DOCUMENTS**

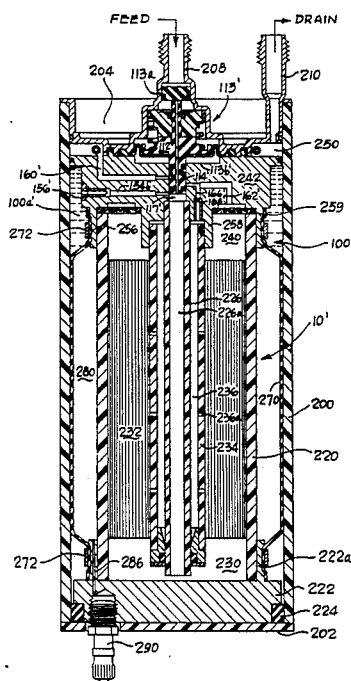
2180436 11/1973 France ..... 210/257.2

*Primary Examiner*—Frank Spear  
*Attorney, Agent, or Firm*—Watts, Hoffmann, Fisher & Heinke Co.

**ABSTRACT**

[57] Apparatus and method for purifying a solvent such as water, using a reverse osmosis process. The apparatus includes a reverse osmosis (R.O.) unit, a storage tank for storing permeate produced by the reverse osmosis unit, and a flushing arrangement for cleansing the concentrate side of a reverse osmosis membrane at the conclusion of a purifying cycle. A flow regulating arrangement 34, 40, 42 maintains one of two pressures at the concentrate output. A system controller controls the communication of feed water to the R.O. unit and the concentrate pressure. A flushing accumulator receives permeate during a purifying cycle. When the cycle is terminated, the permeate stored in the accumulator is transferred to the input side of the R.O. unit and flushes the membrane. The permeate is driven from the accumulator by a feed water generated force exerted on the permeate by an isolated pressurization chamber forming part of the accumulator. According to a feature of this embodiment, the R.O. unit, the flushing accumulator and the system controller are integrated in a unitary package which is relatively maintenance free.

15 Claims, 7 Drawing Figures



- [54] **FLUID TREATMENT SYSTEM**
- [75] **Inventor: George S. Ellis, III, Chardon, Ohio**
- [73] **Assignee: Kinetico, Inc., Newbury, Ohio**
- [21] **Appl. No.: 535,996**
- [22] **Filed: Sep. 26, 1983**
- [51] **Int. Cl.<sup>4</sup> ..... B01D 13/00**
- [52] **U.S. Cl. .... 210/636; 210/136; 210/257.2**
- [58] **Field of Search ..... 210/257.2, 433.2, 321.1, 210/136, 134, 636**

[56] **References Cited**  
**U.S. PATENT DOCUMENTS**

3,493,495	2/1970	Mendelson .....	210/636
3,493,496	2/1970	Bray et al. ....	210/257.2 X
3,498,910	2/1970	Mendelson .....	210/636
3,505,215	4/1970	Bray .....	210/136
3,616,921	11/1971	Bray .....	210/257.2
3,679,055	7/1972	Clark et al. ....	210/257.2 X
3,746,640	7/1973	Bray .....	210/416.1 X
3,786,924	1/1974	Huffman .....	210/257.2
3,846,295	11/1974	Gibbs .....	210/134
3,849,305	11/1974	Mahjikian .....	210/409 X
3,939,074	2/1976	Bray .....	210/257.2
3,959,146	5/1976	Bray .....	210/257.2
3,992,301	11/1976	Shippey et al. ....	210/140 X
4,124,488	11/1978	Wilson .....	210/416.1 X
4,169,789	10/1979	Lerat .....	210/636
4,187,173	2/1980	Keefer .....	210/416.1 X
4,190,537	2/1980	Tondreau et al. ....	210/257.2

**FOREIGN PATENT DOCUMENTS**

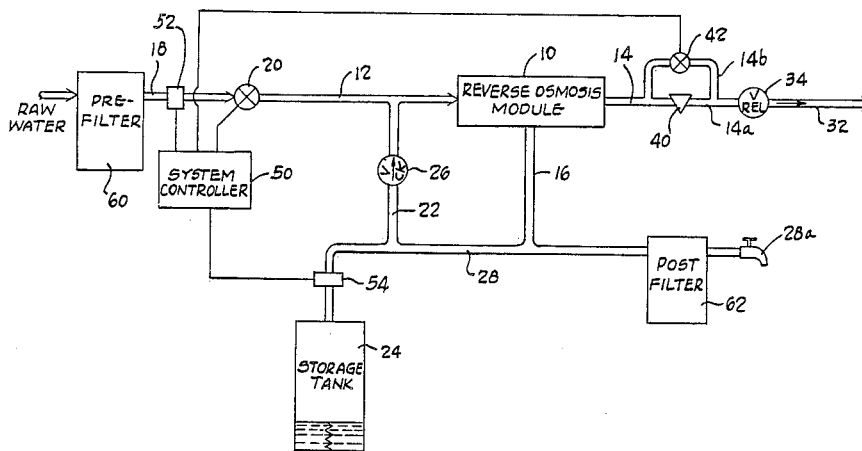
2180436	11/1973	France .....	210/636
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*Primary Examiner*—Frank Spear  
*Attorney, Agent, or Firm*—Watts, Hoffmann, Fisher & Heinke Co.

[57] **ABSTRACT**

Apparatus and method for purifying a solvent such as water, using a reverse osmosis process. The apparatus includes a reverse osmosis (R.O.) unit 10, a storage tank 24 for storing permeate produced by the reverse osmosis unit, and a flushing arrangement for cleansing the concentrate side of a reverse osmosis membrane at the conclusion of a purifying cycle. In one embodiment, the storage tank 24 communicates with the input to the R.O. unit through a check valve 26 which allows permeate flow from the tank into the R.O. unit but prevents reverse flow. A flow regulating arrangement 34, 40, 42 maintains one of two pressures at the concentrate output. A system controller 50 controls the communication of feed water to the R.O. unit and the concentrate pressure. At the conclusion of a purifying cycle, the system controller terminates the flow of feed water and reduces the concentrate output pressure resulting in the flow of a quantity of permeate from the storage tank into the R.O. unit to flush the concentrate's side of the membrane. In another embodiment of the invention, a separate flushing accumulator 100 receives permeate during a purifying cycle. When the cycle is terminated, the permeate stored in the accumulator is transferred to the input side of the R.O. unit and flushes the membrane. According to a feature of this embodiment, the R.O. unit 10', the flushing accumulator 100' and the system controller 110' are integrated in a unitary package which is relatively maintenance free.

**34 Claims, 5 Drawing Figures**



[54] **MOLDED PLASTIC PRESSURE TANK**

[75] **Inventor:** George S. Ellis, III, Chardon, Ohio

[73] **Assignee:** Kinetico, Inc., Newbury, Ohio

[21] **Appl. No.:** 759,957

[22] **Filed:** Jul. 29, 1985

[51] **Int. Cl.<sup>4</sup>** ..... B65D 7/42

[52] **U.S. Cl.** ..... 220/5 A; 220/4 B;  
220/67; 215/1 C

[58] **Field of Search** ..... 220/5 A, 5 R, 4 B, 3,  
220/67, 75, 76, DIG. 29, 4 E; 215/1 C

[56] **References Cited**

**U.S. PATENT DOCUMENTS**

2,720,332	10/1955	Holt	.....	220/4
3,100,172	8/1963	Nier	.....	156/228
3,292,811	12/1966	Lynch	.....	220/4
3,342,365	9/1967	Lux et al.	.....	220/4 B
3,454,179	7/1969	Kerr	.....	220/4
3,574,031	4/1971	Heller, Jr. et al.	.....	156/273
3,706,393	12/1972	Curtis et al.	.....	220/67
4,035,547	7/1977	Heller, Jr. et al.	.....	428/329
4,067,765	1/1978	Heller, Jr. et al.	.....	156/272
4,239,575	12/1980	Leatherman	.....	156/272

**FOREIGN PATENT DOCUMENTS**

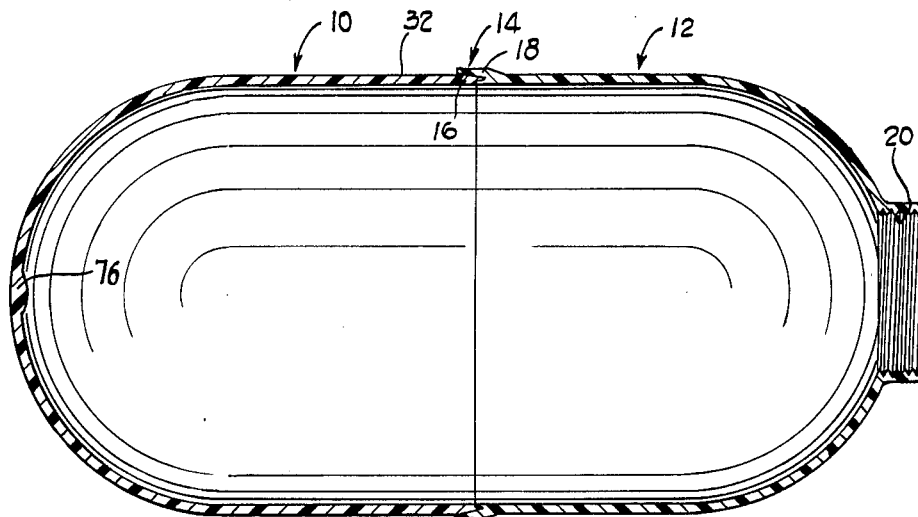
2118863 8/1972 France .  
690644 7/1965 Italy .

*Primary Examiner*—Steven M. Pollard  
*Attorney, Agent, or Firm*—Watts, Hoffmann, Fisher & Heinke Co.

[57] **ABSTRACT**

The improved tank construction includes two injection molded thermoplastic sections having overlapping male and female circumferential wall portions. The male wall portion includes a crowned bonding surface that diverges inwardly towards the central axis of the tank. The bonding surface extends from an external surface of the male tank section and terminates at a radial face that defines the innermost edge of the tank section. The female wall portion defined by the female tank section includes a uniform diameter segment which cooperates with the external surface of the male tank section to facilitate alignment during the spin welding process. A complementally shaped bonding surface forms part of the female wall portion which coacts with the crowned bonding surface of the male wall portion. Contact between the bonding surfaces at the commencement of the spin welding process occurs at a narrow intermediate region.

**5 Claims, 3 Drawing Figures**





- [54] DEIONIZATION METHOD AND APPARATUS
- [75] Inventors: Keith E. Brown, Solon; Jimmy D. Buth, Chardon, both of Ohio
- [73] Assignee: Kinetico, Inc., Newbury, Ohio
- [21] Appl. No.: 409,586
- [22] Filed: Aug. 19, 1982
- [51] Int. Cl.<sup>3</sup> ..... B01J 47/14; B01J 49/00
- [52] U.S. Cl. .... 210/662; 210/678; 210/685; 210/98; 210/264
- [58] Field of Search ..... 210/662, 670, 678, 685, 210/88, 98, 105, 136, 190, 191, 264, 278

[56] References Cited

U.S. PATENT DOCUMENTS

2,841,550	7/1958	Beohner	210/685
3,458,438	7/1969	Smith et al.	210/685
3,876,539	4/1975	Yocum	210/98
3,891,552	6/1975	Prior et al.	210/88
3,960,721	6/1976	Heskett	210/662
4,298,025	11/1981	Prior et al.	210/190

OTHER PUBLICATIONS

- "Autotrol Deionization Control Systems" Technical Bulletin.
- "Two-Bed Deionizers", Aqua Media Technical Bulletin.
- "Ion Exchange is a Versatile Tool", *Water Treatment Power*, Dec. 1958, pp. 96-101.
- "Ion Exchange", *Power*, Sep. 1980, pp. S1-S13.
- "Duolite A-104", Diamond Shamrock Chemical Co. Technical Bulletin.
- "Duolite C-20", Diamond Shamrock Chemical Co. Technical Bulletin.

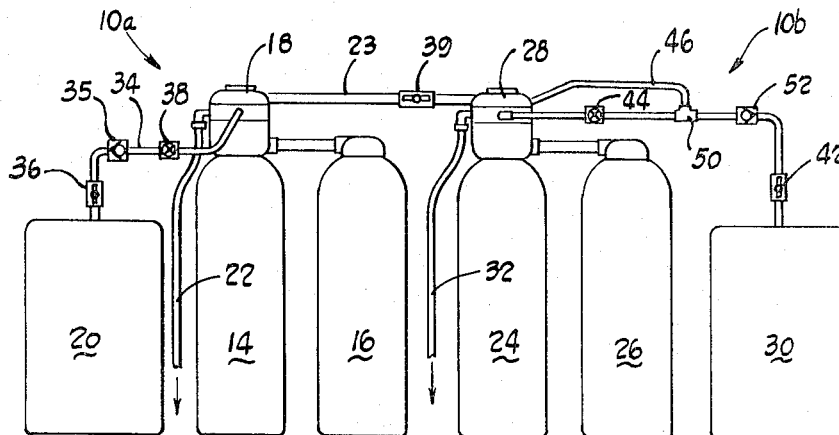
Primary Examiner—Ivars C. Cintins

Attorney, Agent, or Firm—Watts, Hoffmann, Fisher & Heinke Co.

[57] ABSTRACT

A deionization method and apparatus comprising separate cation and anion removing sections 10a, 10b, the cation section having separate tanks 14, 16 and the anion section having separate tanks 24, 26. Respective cation and anion control valve assemblies 18, 28 control the fluid communication between various components of respective sections and control the regeneration cycle of exhausted cation and anion tanks, respectively. Each valve assembly includes independent water usage monitoring devices 118 which, upon sensing a predetermined quantity of water discharge by its respective valve assembly, effects regeneration of an associated tank. An exhausted cation tank is regenerated by feeding cation regeneration fluid by way of the cation control valve assembly into the exhausted cation tank in a counterflow direction for a predetermined time. Decationized water from the on-line cation tank is then passed through the exhausted cation tank in a counterflow direction to effect a counterflow rinse. An exhausted anion tank is similarly regenerated using an anion regeneration fluid and passing it through the exhausted tank in a counterflow direction, followed by a counterflow rinse using deionized water from the on-line anion tank. The anion section also includes a flushing circuit 46 that flushes residual anion regeneration fluid from a supply line 40a and the anion control valve assembly and also effects a counterflow slow rinse prior to a counterflow fast rinse. Water for the flushing step is obtained from a valve operating chamber 102a by way of a restricted passage 218 so that a back pressure in the piston chamber is maintained in order to exert a valve operating force on a valve 78 when necessary.

15 Claims, 7 Drawing Figures



[54] WATER SOFTENING APPARATUS

[75] Inventor: William C. Prior, Newbury, Ohio

[73] Assignee: Kinetico, Inc., Newbury, Ohio

[21] Appl. No.: 180,374

[22] Filed: Aug. 22, 1980

[51] Int. Cl.<sup>3</sup> ..... B01J 47/14

[52] U.S. Cl. .... 210/288; 210/350

[58] Field of Search ..... 210/97, 137, 190, 191,  
210/279, 288, 350, 351

[56] References Cited

U.S. PATENT DOCUMENTS

3,180,825	4/1965	Couvreur et al. ....	210/350
3,891,552	6/1975	Prior et al. ....	210/190
3,965,000	6/1976	Mikule et al. ....	210/351

FOREIGN PATENT DOCUMENTS

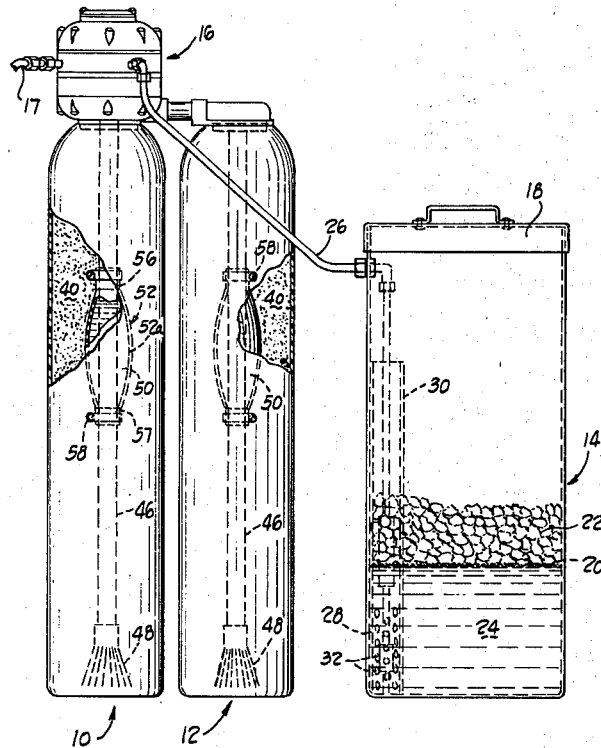
1348973 12/1963 France .

Primary Examiner—Ivars C. Cintins  
Attorney, Agent, or Firm—Watts, Hoffmann, Fisher & Heinke Co.

[57] ABSTRACT

An improved resin tank for a water softening apparatus including an expansible chamber 50 that enlarges during fluid flow through the tank to displace any free space in the tank, thereby maintaining the compactness of the water softening material. The expansible chamber 50 is formed by an elastomeric sleeve 52 that is secured to and surrounds a portion of a downwardly extending fluid conduit 46 and overlies at least one aperture 54 formed in the conduit wall through which fluid communication is established. The pressure drop normally occurring during fluid flow through the tank generates a pressure differential force on the sleeve wall 52a that causes it to enlarge if free space in the tank is present. In an alternate embodiment, the fluid communication between the conduit and the chamber 50 is provided by a pitot tube 62 that is disposed in the conduit fluid flow path and is operative to communicate the velocity pressure of the fluid flowing down the conduit 46 to the chamber 50.

10 Claims, 3 Drawing Figures



- [54] **FLOAT-ACTUATED LEVEL CONTROL VALVE**
- [75] Inventor: **William C. Prior**, Newbury, Ohio
- [73] Assignee: **Kinetico, Inc.**, Newbury, Ohio
- [21] Appl. No.: **146,217**
- [22] Filed: **May 5, 1980**
- [51] Int. Cl.<sup>3</sup> ..... **C02B 1/22**
- [52] U.S. Cl. .... **210/127; 210/136; 210/190; 210/222; 137/513.5; 137/514**
- [58] **Field of Search** ..... **210/104, 126, 127, 190, 210/191, 222, 223, 139, 119, 136; 137/513.5, 514, 523**

3,891,552 6/1975 Prior ..... 210/190 X  
 4,147,629 4/1979 Geurtsen ..... 210/116 X

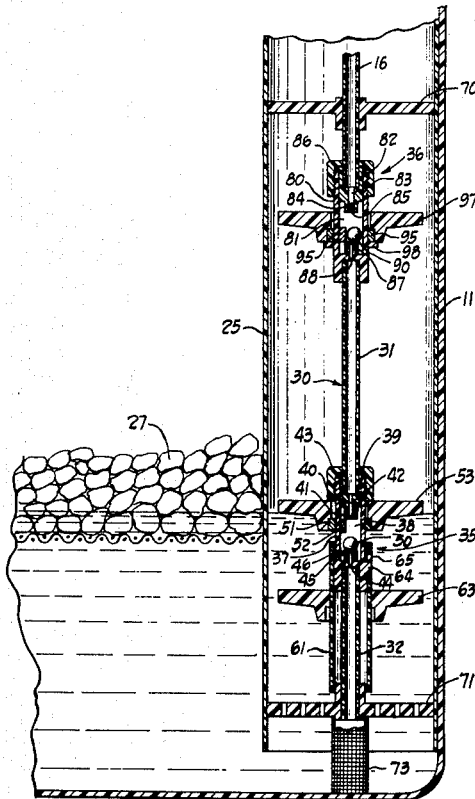
*Primary Examiner*—John Adee  
*Attorney, Agent, or Firm*—Watts, Hoffmann, Fisher & Heinke Co.

[57] **ABSTRACT**

A float-actuated, level control valve especially suited for controlling liquid flow into and out of brine tanks of water softening systems. A magnet-operated ball check inside a flow chamber selectively closes ports of the chamber to interrupt liquid flow. Movement of the magnet and operation of the ball check is controlled by a pair of floats so that the valve is opened and closed in response to changes of liquid level. The relative position of the floats can be adjusted to vary the amount of liquid drawn out of the tank, while maintaining a constant maximum level when the tank is filled.

- [56] **References Cited**  
**U.S. PATENT DOCUMENTS**
- 3,163,394 12/1964 Downin ..... 137/513.5
  - 3,185,302 5/1965 Kryzer ..... 210/126
  - 3,326,377 6/1967 Abos ..... 210/126
  - 3,424,311 1/1969 Siedenburg ..... 210/109

**12 Claims, 4 Drawing Figures**



- [54] CONTROL VALVE FOR WATER SOFTENERS
- [75] Inventors: William C. Prior, Newbury; Keith E. Brown, Solon, both of Ohio
- [73] Assignee: Kinetico, Inc., Newbury, Ohio
- [21] Appl. No.: 146,218
- [22] Filed: May 5, 1980
- [51] Int. Cl.<sup>3</sup> ..... B01J 47/14
- [52] U.S. Cl. .... 137/624.14; 137/624.18; 210/88; 210/98; 210/190
- [58] Field of Search ..... 137/624.14, 624.18; 210/87, 88, 98, 141-143, 190, 191
- [56] References Cited

U.S. PATENT DOCUMENTS

- 3,509,998 5/1970 Pellett et al. .... 137/624.14
- 3,891,552 6/1975 Prior et al. .... 210/190

Primary Examiner—Ivars C. Cintins  
 Attorney, Agent, or Firm—Watts, Hoffmann, Fisher & Heinke Co.

[57] ABSTRACT

An improved water softener control valve having a housing defining a servo-control chamber that encloses concentrically mounted water usage and regeneration control discs. Each disc is incrementally rotatable by ratchet drives that are driven by water usage and regeneration control turbines, respectively, through associated reduction gear trains. The ratchet drive for the water usage disc includes a pawl that is engageable with the regeneration control disc, which upon predetermined movement in the water usage disc effects movement in the regeneration control disc to initiate a regeneration cycle. A rotatable insert is provided in the housing for manually rotating the regeneration control disc.

10 Claims, 5 Drawing Figures

