

- 1 -

## BACK-FLUSH FILTER SYSTEMS AND MECHANISMS THEREFOR

### TECHNOLOGICAL FIELD

This disclosed subject matter relates to fluid filtration systems. More particularly the disclosure is concerned with back-flush filter systems configured with a plurality of filtration units. The term *back-flush* filter is also referred to as *backwash* filter.

5           The disclosed subject matter further relates to a transmission mechanism for such filtration systems.

### PRIOR ART

References considered to be relevant as background to the presently disclosed subject matter are listed below:

- 10           - US4,642,188  
            - US4,906,373  
            - US5,855,799

Acknowledgement of the above references herein is not to be inferred as meaning that these are in any way relevant to the patentability of the presently disclosed  
15   subject matter.

### BACKGROUND

US4,642,188 discloses a multi-element filter unit which includes backwash apparatus and comprises a filter casing with provision for alternative, oppositely directed process liquid and backwash liquid flows therethrough. A plurality of filter  
20   tubes are closely spaced within the filter casing. A flange engages the filter tubes and divides the filter casing into first and second chambers. Apparatus for sequentially backwashing the filter tubes during a backwash interval removes collected solids from between the filter tubes by flow of backwash liquid from one filter tube outward toward the exterior of adjacent filter tubes. The backwash apparatus includes poppet units  
25   aligned with open ends of the filter tubes and selectively actuatable to close the opposed

- 2 -

ends of one of the filter tubes while leaving another open to backwash flow thereinto, such that each filter tube is backwashed in sequence while the others are closed against backwashing liquid flow thereinto, and diffuser structure which apportions, lengthwise of the filter tube, the rate of backwash liquid flow radially out through the wall of each  
5 filter tube.

US4,906,373 discloses a multiple element filter system comprising a filter housing defining a water inlet for water to be filtered, a filtered water outlet, a plurality of cylindrical filter elements, each defining upstream and downstream surfaces, disposed in the filter housing such that the upstream surfaces communicate with the  
10 water inlet and the downstream surfaces communicate with the filtered water outlet, and a flushing assembly which includes a movable flushing communication member arranged for selectable flushing communication with the upstream surfaces of each of the plurality of filter elements and apparatus for selectable coupling of the communication member to a flush drain at atmospheric or relatively low pressure.

15 US5,855,799 discloses a high capacity filter apparatus for removing solids from fluids and includes an opposing filter element defining an internal volume. Fluid to be filtered passes through the filter elements into the internal volume and through an outlet. The filter element is continuously cleaned by backwashing along the outer surface of the elements.

## 20 GENERAL DESCRIPTION

The disclosed subject matter is concerned, according to a first of its aspects, with a filtration system comprising a plurality of filtration units and a cleaning system, wherein one or both of said filtration units and cleaning system is displaceable with respect to the other of said filtration units and cleaning system.

25 According to a second aspect of the disclosed subject matter there is provided a transmission mechanism configured for converting motion from one or more drive units to the plurality of filtration units and cleaning system.

According to yet an aspect of the disclosed subject matter there is provided a filtration system comprising a plurality of filtration units, wherein the plurality of  
30 filtration units are configured as one or more sub-assemblies comprising a plurality of parallelly disposed filtration units. The system further comprises at least one cleaning system configured for cleaning at least one filtration unit of the plurality of filtration

- 3 -

units in the one or more sub-assemblies. Also provided is at least one drive unit associated with each of the one or more sub-assemblies, the at least one drive unit being configured with a transmission mechanism. The at least one drive unit being configured for displacing the one or both of said filtration units and the at least one cleaning system  
5 with respect to the other of said filtration units and said at least one cleaning system within each of the one or more sub-assemblies.

Filtration systems according to the disclosed subject matter can comprise a housing having an inlet port and an outlet port. The housing can be further configured with a drain port adapted to be closed during a filtration process and to be opened  
10 during the cleaning process.

The plurality of filtration units can be parallelly disposed within the housing. The cleaning system in accordance with an embodiment can be received within each of the plurality of the filtration units. The cleaning system is configured for cleaning at least one filtration unit. The filtration system can further comprise at least one drive unit and  
15 a transmission mechanism in conjunction with the at least one drive unit, and configured for displacing one or both of said filtration units and the at least one cleaning system with respect to the other of said filtration units and the at least one cleaning system.

A filtration system in accordance with an aspect of the disclosed subject matter  
20 comprises:

- a filter housing comprising an inlet port and an outlet port;
- a plurality of filtration units disposed within the filter housing;
- at least one cleaning system configured for cleaning at least one filtration unit of the plurality of filtration units; and
- 25 at least one drive unit, wherein the at least one drive unit is configured for displacing one or both of said at least one filtration unit of the filtration units and the at least one cleaning system with respect to the other of said at least one filtration unit of the filtration units and said at least one cleaning system.

A filtration system in accordance with yet an aspect comprises:

- 30 a filter housing comprising an inlet port and an outlet port;
- a plurality of filtration units, wherein the plurality of filtration units are configured as one or more sub-assemblies comprising a plurality of parallelly disposed filtration units;

- 4 -

at least one cleaning system configured for cleaning at least one filtration unit of the plurality of filtration units in the one or more sub-assemblies;

at least one drive unit associated with each of the one or more sub-assemblies, the at least one drive unit being configured with a transmission mechanism, and

5        wherein the at least one drive unit being configured for displacing the one or both of said filtration units and the at least one cleaning system with respect to the other of said filtration units and said at least one cleaning system within each of the one or more sub-assemblies.

Any one or more of the following features and designs can be applied to the  
10    filtration systems or to any one of the other aspects subject of the present application, independently or in combination:

- the displacement of the at least one filtration unit of said plurality of filtration units and the at least one cleaning system can be either or both rotatable and linear motion, imparted to either one or both of the at least one  
15    filtration unit of the plurality of filtration units and the at least one cleaning system, simultaneously or separately;
- the filtration system in accordance with the disclosed subject matter further comprising a transmission mechanism;
- the transmission mechanism is associated with the at least one drive unit;
- 20    - the transmission mechanism can be configured for imparting the at least one cleaning system with linear reciprocal motion and/or combined reciprocal rotary motion;
- the transmission mechanism can be configured for converting motion from said at least one drive unit to the at least one of the plurality of filtration  
25    units and the at least one cleaning system;
- the transmission mechanism can be a planetary gear;

- 5 -

- the transmission mechanism, can be a planetary gear configured with one or more speed reduction stages;
- the transmission mechanism is a planetary (epicyclic) gear system configured with a sun gear mounted on an input shaft articulated to the at least one drive unit, said sun gear being engaged with a plurality of first pinion gears; said pinion gears being each articulated to a rotation shaft of at least one of the plurality of the filtration units or a cleaning system and configured for imparting rotary motion thereto;
- each of the plurality of first pinion gears is engaged with a corresponding second pinion gear coaxially extending and each engaged with third stage gear, each articulated to a rotation shaft of a filtration unit or a cleaning system and configured for imparting rotary motion thereto;
- the first pinion gears are internally engaged with a first, static ring gear and with a second gear ring which in turn is externally engaged second pinion gears, each articulated to a rotation shaft of the at least one of the plurality of filtration units or the at least one of the cleaning system and configured for imparting rotary motion thereto, said first gear ring being fixed;
- the first ring gear constitutes part of a cover member of the transmission mechanism;
- the transmission mechanism can be configured for substantially reducing revolving speed imparted by the drive unit in order to obtain substantially high momentum in order to render the system compatible for operating at substantially rough conditions (e.g. dirt in the filtered fluid), whilst on the other hand obtaining a substantially low transmission ratio in order to cut waste water during a cleaning/rinsing procedure;
- if required revolution reduction ratio takes place in several stages;
- furthermore, gear ratio change can take place manually or automatically;
- according to a particular example the first ring gear constitutes part of a cover member of the transmission mechanism.
- the at least one cleaning system can be configured as a jet system configured for applying jets of fluid against a surface of the filtration units;

- 6 -

- the at least one cleaning system can be configured as a suction system configured for applying suction over a surface of the at least one of the plurality of filtration units;
- either one of the plurality of filtration units and the at last one cleaning  
5 system can be static whilst the other of said plurality of filtration units and at least one cleaning system can displace in rotatable and/or linear motion, or both of the plurality of filtration units and the at least one cleaning system can displace revolvingly and/or linearly;
- at least one of the plurality of filtration units is in the form of a cylindrical  
10 cartridge;
- at least one of the plurality of filtration units comprises disc filters;
- at least one of the plurality of filtration units comprises a thread filter;
- at least one of the plurality of filtration units is a screen filter;
- the plurality of filtration units is parallelly disposed within the housing;
- each of the at least one cleaning system is coaxially disposed within each of  
15 the plurality of filtration units;.
- the at least one drive unit is a power motor or a hydraulic turbine or a hydraulic pump;
- the plurality of filtration units are configured as one or more sub-assemblies  
20 comprising a plurality of parallelly disposed filtration units, each sub-assembly being configured with at least one drive unit and a transmission mechanism in conjunction with the at least one drive unit, and being configured for displacement of one or both of said filtration units and cleaning system with respect to the other of said filtration units and cleaning  
25 system within each of the one or more sub-assemblies;
- displacement of the plurality of filtration units and cleaning system can be either or both rotatable (revolving) and linear motion, imparted to either or both, simultaneously or separately. Accordingly, either or both of the plurality of filtration units and cleaning system can be static whilst the other  
30 of said plurality of filtration units and cleaning system can displace in revolvingly and/or linearly, or both of the plurality of filtration units and cleaning system can displace revolvingly and/or linearly;

- 7 -

- displacement of the filtration units and cleaning system can be reciprocal (linear and revolvingly) or continuous (revolvingly);
- a filtration unit used in conjunction with a filter system according to the disclosed subject matter is of any type e.g. disc filters, thread filters, solid  
5 filters, screen filters, etc., and typically is in the form of a cylindrical cartridge;
- reciprocal motion can be obtained by alternating direction of rotary motion imparted by the drive unit or by a rotary direction inverting mechanism;
- a rotary direction inverting mechanism can be a threaded guide rod  
10 configured with several high pitch threads and a stationary nut mounted thereon. Other direction inverting mechanisms are for example a piston or an ascending gear wheel mechanism.
- The cleaning system (also referred to as a rinsing system) can be a jet system configured for applying jets of fluid against a surface of the filtration units,  
15 or a suction system configured for applying suction (vacuum) over a surface of the filtration units;
- according to a particular example, the cleaning system can be configured for applying the rinsing jets and suction force in combination or alternatingly;
- the filter system can be configured for substantially reducing overall friction  
20 within the system by reducing rotary friction. For that purpose, axial forces on revolving members can be significantly reduced or eliminated, with friction resident substantially in sealing gaskets;
- cleaning of the plurality of filtration units requires efficient screening of a surface of the filtration units, i.e. substantially full surface coverage of the jet  
25 nozzles and/or suction cups over said surfaces;

## BRIEF DESCRIPTION OF THE DRAWINGS

In order to better understand the subject matter that is disclosed herein and to exemplify how it can be carried out in practice, embodiments will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in  
30 which:

**Figs. 1A to 1F** are directed to a filtration system in accordance with an example of the present disclosed subject matter, wherein:

- 8 -

**Fig. 1A** is a top perspective view of the filtration system;

**Fig. 1B** is a horizontal section along line A-A in Fig. 1A;

**Fig. 1C** is a longitudinal section along line B-B in Fig. 1A;

**Fig. 1D** is a longitudinal section along line C-C in Fig. 1A;

5       **Fig. 1E** is a top view illustrating in further detail a drive unit and transmission mechanism used in the filtration system of Figs. 1;

**Fig. 1F** is a detailed view of a sectioned top portion of the filtration system;

**Fig. 1G** illustrates a sectioned top portion of a filtration system according to a modification, directed to a particular transmission mechanism;

10       **Fig. 2A** is a top isometric view of a second example of a filtration system in accordance with another example of the present disclosed subject matter being a so-called partial in-line configuration, wherein a body portion is made translucent for visualization;

15       **Fig. 2B** is a top isometric view of a filtration system being a so-called in-line filtration system, wherein a body portion is made translucent for visualization;

**Fig. 3** is directed to still an example of the filtration system in accordance with the disclosed subject matter, being a top perspective view of which a portion of the housing is made translucent for illustrative purposes;

20       **Figs. 4A to 4D** schematically presents a filtration system in accordance with the disclosed subject matter wherein a liquid drive unit is associated with each filtration unit/cleaning system, wherein:

**Fig. 4A** is a perspective view of the filtration system, at its filtering position;

**Fig. 4B** is a longitudinal planar view of Fig. 4A;

**Fig. 4C** is a perspective view of the filtration system at its cleaning position;

25       **Fig. 4D** is a planar sectioned view of Fig. 4C;

**Fig. 5** is a perspective view illustrating a filtration system in accordance with yet an example of the disclosed subject matter wherein a central turbine is configured for propelling the filtration unit/cleaning system, wherein the system is illustrated at a filtering position;

30       **Fig. 6** is a perspective view illustrating a filtration system in accordance with still an example of the disclosed subject matter wherein each filtration system/cleaning system is configured with a hydraulic turbine, the system being illustrated at a filtering position;

- 9 -

**Figs. 7 to 10** illustrate transmission mechanisms in accordance with examples of the present disclosed subject matter, wherein:

**Figs. 7A and 7B** are a top and bottom perspective view, respectively, of a first transmission mechanism;

5       **Figs. 8A and 8B** are a top and bottom perspective view, respectively, of a second transmission mechanism;

**Figs. 9A and 9B** are a top view and sectioned view along line A-A in Fig. 9A, respectively, of yet an example of a transmission mechanism; and

10       **Figs. 10A and 10B** are top and bottom perspective views, respectively of even yet an example of a transmission mechanism.

## DETAILED DESCRIPTION OF EMBODIMENTS

Attention is first directed to Figs. 1A to 1E of the drawings illustrating a filtration system in accordance with a first example of the present disclosed subject matter, generally designated **20**. The filtration system **20** is a so-called ‘partial in-line’  
15       filtration system, comprising a cylindrical housing **22** mounted over support legs **24** and comprising an inlet port **28** extending into a filter inlet space **30** within the housing **22**, and an outlet port **32** extending from a filtration space **34**. The filter inlet space **30** and the filtration space **34** are partitioned by a first partition member **36**, whilst a second partition member **37** partitions between the filter inlet space **30** and a filtrate drain space  
20       **38** configured with a drain port **39**.

The filtration space **34** accommodates a plurality (six in the present example) of stationary (rotatably fixed) filtration units **40**, being hollow cylindrical filtration cartridges, e.g. solid filtration cartridges, disc cartridges, mesh filtration cartridges, etc. it is however appreciated that, throughout the present disclosure, a filtration unit can be  
25       of any type. Coaxially received within each of the filtration units **40** there is a cleaning system **42**, as will be discussed hereinafter in further detail.

Housing **22** is configured with a top cover **48** secured by a plurality of bolts **50** to a flange **52** configured at a top edge of the housing **22**. Mounted over the top cover **48** there is a drive unit generally designated **54** and a transmission mechanism generally  
30       designated **56**, to be discussed hereinafter with more detail.

In the present examples the drive unit **54** is an electric motor (though other motors are possible too, e.g. a hydraulic motor, pneumatic motor, etc.) coupled via a

- 10 -

transmission gear **62** and extending over a support bridge **64**. The transmission gear **62** is configured for converting rotary motion of the motor axis into rotary motion at a substantially perpendicular axis. Said perpendicular axis being a central input axis **66** extending coaxially into the housing **22** of the filtration system **20** and articulated with  
5 the transmission mechanism **56** for imparting rotary motion to a central gear **70**, the latter engaged with a plurality of pinion gears **72**, each mounted at a top end of a cleaning tube **74** of each of the cleaning systems **42**, as will be discussed hereinafter. The transmission gear **62** is also configured for imparting rotary motion and reciprocal axial motion to the central input axis **66**, and the electric motor is fitted with an electric  
10 circuitry for rotating it alternately in opposite directions during the cleaning stage.

Each cleaning system **42** is configured with a central pipe/tube **80** (also referred to as cleaning pipe/tube) provided with a plurality of jet emitting nozzles **82** spaced along the tube **80** and extending in close proximity to an inside face of the filtration unit, said tube **80** extending through the filter inlet space **30** in a sealed fashion (i.e. the  
15 cleaning tubes **80** sealingly extend through said filter inlet space **30**), wherein the tubes **80** open into the filtrate drain space **38**. The tubes **80** extend out of the filtration unit **40**, through sealed passages within the top cover **48** and are coupled to rinsing fluid supply ducts (not shown) articulated thereto.

The arrangement is such that at a filtration position of the filtration system **20**  
20 raw fluid enters the filter inlet space **30** through inlet port **28** and then enters into the filtration space **33** within each filtration unit **40** whereupon the fluid is filtered and a filtered fluid thus flows into the filtration space **34** from where it is collected through the outlet port **32**. In this position there is no fluid flow through the tubes **80** of the cleaning system and the drain port **39** is sealed.

25 At a cleaning/rinsing position a rinsing fluid is propelled through the top of the cleaning system tubes **80** whilst electric motor **54** rotates. Rotation of the electric motor **54** results in corresponding rotation of the cleaning pipe **80**, though at significantly reduced speed, and with corresponding axial displacement of the entire transmission mechanism **56**, owing to reciprocal linear motion imparted thereto via the gear  
30 mechanism **62**, wherein a jet of rinsing fluid is applied through each of the jet nozzles **82** and impinges against the inside surface of the filtration units **40**, said rinsing jet screening effectively along the inside surface of the filtration units, i.e., covering substantially the entire inside surface thereof, wherein the rinsing fluid together with the

- 11 -

filtrate (waste water together with dirt accumulated over the walls of the filtration unit) drain into the filtrate drain space **38** and are allowed out through the drain port **39**.

It is however appreciated that according to a modification (not shown) of the disclosure referred to in Figs. 1A to 1F, filtration can take place radially into the  
5 filtration units (i.e. in direction from the filtration space **34** into the filtration units **40**), whereupon a cleaning/rinsing procedure takes place by a jet of fluid applied on the inside surface of the filtration unit (i.e. radially outwards).

It is further appreciated that a cleaning/rinsing procedure can take place by a combined jet rinsing and suction applied over the surface of the filtration unit.

10 The illustration of Fig. 1G illustrates a transmission mechanism generally designated **81** and fitted externally, on top of the housing **22**. A power input shaft is coupled to a central input gear **82** axially fixed (i.e. non displaceable in an axial direction, but only free to rotate) which in turn is coupled to three pinion gears **72** (similarly to the configuration disclosed in Fig. 1E). Each of the pinion gears is  
15 rotatably mounted on a threaded axle. However, input gear **82** is significantly thicker (higher) than the pinion gears **72** engaged therewith, and wherein rotation of the pinion gears **72** over the input gear **82** generates a combined axial reciprocal motion of the pinion gears **72** about their axes, as represented by arrows **83**, and reciprocal (or not) revolving motion as represented by arrows **84**. Axial reciprocal displacement of the  
20 pinion gears **72** entails corresponding axial displacement of the cleaning tubes **74** articulated thereto.

The example illustrated in Fig. 2A resembles that illustrated in connection with Figs. 1A to 1F in that it is a so-called partial in-line configuration filter system designated **85**, wherein the inlet port **86** and outlet port **96** are not coaxial. However, in  
25 the present example it comprises only three filtration units, each designated **84** and extending within the housing in a symmetrical fashion.

In a filtration process according to the example of Fig. 2A raw fluid flows through the inlet port **86**, into an inlet space **88**, then into the filtration space within each of the filtration units **84**, wherein the fluid is filtered and whereby filtered fluid now  
30 flows into the filtration space **94** and out through the outlet port **96**.

During a rinsing process the electric motor **100** revolves and imparts alternately rotational motion to the gear system **102** which on the one hand converts rotary motion of the motor **100** into rotary motion about a central axis perpendicular to

- 12 -

that of the motor, and on the other hand imparts reciprocal axial motion to the threaded rod **104** which serves as an input shaft for the transmission mechanism generally designated **110**.

Thus, during a rinsing/cleaning procedure, a rinsing fluid is introduced into the  
5 cleaning tubes (parallelly disposed within the filtration units **84**; not seen) resulting in fluid jets immersing through jet nozzles of the cleaning tubes extending in close proximity with an inside surface of the filtration units **84**, whereby cleaning fluid and dirt drains down to the bottom chamber **88** (now disconnected from a raw fluid supply line and serving as a drain port).

10 As can be seen in Fig. 2A, the transmission mechanism **110** is configured for imparting the rinsing tube with linear reciprocal motion as indicated by arrowed line **126**, and combined reciprocal rotary motion, as illustrated by arrowed lines **128**, thereby reaching optimal rinsing of the filtration units **84** by the fluid jets reaching substantially the entire inside surface of the filtration units **84**. As mentioned hereinabove, rinsing jets  
15 can be replaced, or accompanied by suction cleaning force applied over the surface of the filtration units.

It is appreciated that each of the rinsing tubes (not seen) is received within a support tube **130** extending into the filter inlet space **88** thus isolating the cleaning tube **120** from the filter inlet space **88** and for supporting said cleaning tube whilst  
20 facilitating its reciprocal linear and reciprocal motion about a longitudinal axis thereof.

The example illustrated in Fig. 2B is substantially similar to that disclosed in connection with Fig. 2A, however being a so-called 'in-line' back-flush filtration system **140** wherein the inlet port **142** extends substantially coaxial with the outlet port **144**. Thus, the configuration of Fig. 2B requires suitable fluid flow diverting means  
25 received within the bottom housing compartment **146**, to facilitate fluid flow between the inlet port **142** and outlet port **144**, during the filtration/rinsing procedures. Apart for this difference, the example of Fig. 2B is similar in construction and principle operation to that disclosed in connection with that of Fig. 2A.

The filtration system **149** illustrated in Fig. 3 is based on the principles discussed  
30 hereinabove in connection with the previous examples, however where the filtration units are grouped into sub-assemblies each designated **150** and each composed of a cluster holding three filtration units **152** disposed in a triangular configuration and extending parallel to one another. Furthermore, each sub-assembly **150** is configured

- 13 -

with an independent drive unit, namely motor **156**, each associated with a motion converting gear unit **158** mounted over a domed bridge **160** and articulated to a transmission mechanism **164** as discussed hereinbefore in connection with the previous examples.

5           Operation of the large scale filtration system of Fig. 3 takes place similarly to the disclosure hereinbefore, however in larger volumetric scale.

Turning now to Figs. 4A to 4D there is illustrated a filtration system in accordance with yet a modification of the present disclosed subject matter, generally designated **200**, wherein the housing **202** is configured with an inlet port **204** and an  
10   outlet port **206** and a plurality of filtration units (five in the present example, though only three of which are seen in the sectioned view) and designated **210**, symmetrically disposed within the housing **202** with their longitudinal axis parallelly disposed within the housing **202**.

The housing **202** is configured with a filtration space **214** accommodating said  
15   filtration units **210**, a filter inlet space **216** extending below said filtration space **214**, and a top chamber **220** configured with a drain fluid outlet port **222** and accommodating a drive unit **226**, each associated with a filtration unit **210**. The drive units **226** are so-called hydraulic motors configured for generating rotary motion and further fitted with a central piston assembly **230** reciprocally linearly displaceable within a vented piston  
20   support housing **236** with a venting port **238**.

The piston **230** is for example a hydraulic piston configured with one or two side controls (i.e. retract and/or expand activators).

Extending from the top chamber **220** there are a plurality of cleaning/rinsing units in the form of tubes **240**, each associated with a filtration unit **210**, said cleaning  
25   tubes extending from the top chamber **220** through each of the filtration units **210** and down into the inlet space **216**. Each of the tubes **240** is configured with a plurality of suction cups/nozzles **244** radially extending in close proximity with the inside surface of the filtration units **210**.

The arrangement being such that the cleaning tubes **240** are linearly and  
30   rotatably reciprocal, in a combined motion, within the space of the filtration units **210**, and thus configured for effective and efficient screening and suction of the entire inside surface of the filtration units **210**.

- 14 -

During a filtration mode of the filtration system **200** (Figs. 4A and 4B), raw fluid enters through the inlet port **204** and enters the inside surface of the filtration units **210** where it is filtered and then exits through the filtration space **214** and then exits through the outlet port **206** as illustrated in these drawings by arrowed lines **245**.

5 During a filtration process the drain fluid outlet port **222** is closed and during the rinsing process drain fluid outlet port **222** opens.

In a rinsing/cleaning mode, Figs. 4C and 4D, suction is applied through the inlet port **204** and then into the rinsing tubes **240** resulting in rinsing jets applied through the jet applying nozzles **244** against the inside surface of the filtration units **210**, wherein  
10 the dirty waste fluid (filtration fluid with dirt) exits through the top openings **241** of the tubes **240**, into the top chamber **220** and then egresses through the drain fluid outlet port **222**.

Whilst in the example illustrated with reference to Figs. 4A to 4D the drive unit articulated with the cleaning assembly is a liquid-operated motor ("hydraulic motor"), in  
15 the example illustrated in Fig. 5 the drive unit is a central turbine designated at **280** configured for generating rotary motion and distribution of said rotary motion to each of the rinsing tubes **282** by virtue of a gear system comprising a peripheral geared ring **284** engaged with a plurality of gearings **286** each associated with a cleaning tube **282**. The geared ring **284** extends along a significant portion of the top chamber **290** whereby the  
20 turbine **280** and the articulated gear **286** are free to axially displace therein between a downward position and an uppermost position during the rinsing position.

Apart for this difference, the examples of Figs. 4 and 5 operate in the same manner during a filtering stage and a rinsing/cleaning stage and reference is made to Figs. 4 above for understanding how these stages take place.

25 Likewise, Fig. 6 illustrates yet an example of a filtration system in accordance with the disclosed subject matter generally designated **300** the difference residing in that rather than a central turbine as disclosed in connection with Fig. 5 there is provided a separate turbine unit **302** articulated with each filtration unit **304** and serving as an independent drive unit therefor.

30 Other than this difference, operation of the filtration system **300** is similar to that disclosed in connection with the examples of Figs. 4 and 5 during their filtration stage and rinsing/cleaning stage and reference is made thereto.

- 15 -

Figs. 7 to 10 are directed to different examples of transmission mechanism that are useful in connection with filtration systems in accordance with the present example. Turning first to Figs. 7A and 7B there is illustrated a gear transmission configured with an input gear **350** configured for coupling to an input shaft of a drive unit by cogged  
5 shank portion **352**. The input gear **350** is engaged with a plurality of first pinion gears **356** (five in the present example) each integral with and coaxially extending with a second level of gears **358** which in turn are engaged with second pinion gears **362**. The arrangement is such that input gear **350** has a smaller diameter than that of first pinion gears **356** which have a larger diameter than the engaged gears **358** which in turn are  
10 significantly smaller than the second pinion gears **372**, thereby obtaining significant speed reduction throughout the transmission assembly. Second pinion gears **362** are engaged with the tubular rinsing members (not shown) by virtue of internally geared portion **366**.

In the example of Figs. 8A and 8B there is illustrated a different example  
15 wherein a sun gear **380** is configured for coupling to an input shaft of a drive unit (not shown) which in turn said sun gear **380** is engaged with three first pinioned gears **382**, mounted over a carrying triangular plate **383** at a fixed planetary configuration, engaged for rotation with a geared ring **386** constituting part of a cover portion **390** for said transmission mechanism, i.e. being fixedly articulated and non-rotatable. In turn,  
20 the gears **382** are engaged with an internally and externally geared ring **388** which is engaged, through its external geared portion with second pinion gears **394**, each of which being coupled to a rinsing tube (through an internally cogged portion **396**) for imparting said tube (not shown) rotary motion during a rinsing/cleaning process.

Turning now to Figs. 9A and 9B there is provided a pinion gear **400** configured  
25 for coupling to an input shaft of a drive unit (not shown) and engaged with three first pinions **402** each of which pivotally mounted on an axel **406** projecting from a carrying plate **408**. First pinions **402** are engaged with an inner geared ring **410** which is static, i.e. fixedly secured to a housing component of the filtration unit, with a second gear **412** coaxially extending below each first pinion **402** and engaged in turn with an internally  
30 and externally geared ring **416** which in turn is engaged with a plurality of second planetary gears **420** (5 in the present example) each of said second pinion gears **420** being coupled to a rinsing tube (not shown) for imparting thereto rotary motion.

- 16 -

The example illustrated in connection with Figs. 10A and 10B resembles that of the example of Figs. 9A and 9B and comprises an input sun gear **440** configured for coupling to an input shaft of a drive unit (not shown) and which in turn is engaged with three first planetary gears **442**, each of which being internally engaged with an  
5 internally geared static ring **446** (being part of a cover assembly **448** of the transmission mechanism). Second planetary gears **452** are engaged in turn with a central geared disc **552** carrying the first pinions **452** in a planetary motion.

Whilst several particular examples of gear transmissions have been exemplified, it is to be realized that different configurations and combinations can be designed,  
10 without departing from the scope of the disclosed subject matter. For example, revolution reduction ratio can take place in several stages and furthermore, gear ratio change can take place manually or automatically.

- 17 -

**CLAIMS:**

1. A filtration system comprising:  
a filter housing comprising an inlet port and an outlet port;  
a plurality of filtration units disposed within the filter housing;  
5 at least one cleaning system configured for cleaning at least one filtration unit of the plurality of filtration units; and  
at least one drive unit, wherein the at least one drive unit is configured for displacing one or both of said at least one filtration unit of the filtration units and the at least one cleaning system with respect to the other of said at least one filtration unit of the  
10 filtration units and said at least one cleaning system.
2. A filtration system in accordance with claim 1, wherein displacement of said at least one filtration unit of said plurality of filtration units and said at least one cleaning system can be either or both rotatable and linear motion, imparted to either one or both of the at least one filtration unit of the plurality of filtration units and the at least one  
15 cleaning system, simultaneously or separately.
3. A filtration system in accordance with claim 1, further comprising a transmission mechanism associated with the at least one drive unit.
4. A filtration system in accordance with claim 3, wherein the transmission mechanism is configured for imparting the at least one cleaning system with linear  
20 reciprocal motion and combined reciprocal rotary motion.
5. A filtration system in accordance with claim 3, the transmission mechanism being configured for converting motion from said at least one drive unit to the at least one of the plurality of filtration units and the at least one cleaning system.
6. A filtration system in accordance with claim 3, wherein the transmission  
25 mechanism is a planetary gear configured with one or more speed reduction stages.
7. A filtration system in accordance with claim 1, wherein the at least one cleaning system comprises a central cleaning pipe configured with jet emitting nozzles spaced along the central pipe, the at least one cleaning system being configured to extend in close proximity to an inside face of at an least one filtration unit of the plurality of  
30 filtration units.

- 18 -

8. A filtration system in accordance with claim 1, wherein the at least one cleaning system is configured as a jet system configured for applying jets of fluid against a surface of the filtration units.
9. A filtration system in accordance with claim 1, wherein the at least one cleaning system is configured as a suction system configured for applying suction over a surface of the at least one of the plurality of filtration units.
10. A filtration system in accordance with claim 1, wherein either one of the plurality of filtration units and the at least one cleaning system can be static whilst the other of said plurality of filtration units and at least one cleaning system can displace in rotatable and/or linear motion, or both of the plurality of filtration units and the at least one cleaning system can displace revolvingly and/or linearly.
11. A filtration system in accordance with claim 1, wherein at least one of the plurality of filtration units is in the form of a cylindrical cartridge.
12. A filtration system in accordance with claim 10, wherein at least one of the plurality of filtration units comprises disc filters.
13. A filtration system in accordance with claim 10, wherein at least one of the plurality of filtration units comprises a thread filter.
14. A filtration system in accordance with claim 10, wherein at least one of the plurality of filtration units is a screen filter.
15. A filtration system in accordance with claim 1, wherein the plurality of filtration units is parallelly disposed within the housing.
16. A filtration system in accordance with claim 10, wherein each of the at least one cleaning system is coaxially disposed within one or more of the plurality of filtration units.
17. A filtration system in accordance with claim 1, wherein the at least one drive unit is a power motor or a hydraulic turbine or a hydraulic pump.
18. A filtration system in accordance with any one of the preceding claims, wherein the plurality of filtration units are configured as one or more sub-assemblies comprising a plurality of parallelly disposed filtration units, each sub-assembly being configured with at least one drive unit and a transmission mechanism in conjunction with the at least one drive unit, and being configured for displacement of one or both of said filtration units and cleaning system with respect to the other of said filtration units and cleaning system within each of the one or more sub-assemblies.

- 19 -

19. A filtration system in accordance with claim 3, wherein the transmission mechanism is a planetary gear system configured with a sun gear mounted on an input shaft articulated to the at least one drive unit, said sun gear being engaged with a plurality of first pinion gears; said pinion gears being each articulated to a rotation shaft  
5 of at least one of the plurality of the filtration units or a cleaning system and configured for imparting rotary motion thereto.

20. A filtration system in accordance with claim 17, wherein each of the plurality of first pinion gears is engaged with a corresponding second pinion gear coaxially extending and each engaged with third stage gear, each articulated to a rotation shaft of  
10 a filtration unit or a cleaning system and configured for imparting rotary motion thereto.

21. A filtration system in accordance with claim 17, wherein the first pinion gears are internally engaged with a first, static ring gear and with a second gear ring which in turn is externally engaged second pinion gears, each articulated to a rotation shaft of the at least one of the plurality of filtration units or the at least one of the cleaning system  
15 and configured for imparting rotary motion thereto, said first gear ring being fixed.

22. A filtration system in accordance with claim 19, wherein the first static ring gear constitutes part of a cover member of the transmission mechanism.

23. A filtration system in accordance with claim 1, further comprising a drain port configured to be closed during a filtration process and to be opened during a cleaning  
20 process when the at least one cleaning system is in operation.

24. A filtration system comprising:  
a filter housing comprising an inlet port and an outlet port;  
a plurality of filtration units, wherein the plurality of filtration units are configured as one or more sub-assemblies comprising a plurality of parallelly disposed filtration units;  
25 at least one cleaning system configured for cleaning at least one filtration unit of the plurality of filtration units in the one or more sub-assemblies;  
at least one drive unit associated with each of the one or more sub-assemblies, the at least one drive unit being configured with a transmission mechanism, and  
wherein the at least one drive unit being configured for displacing the one or both of  
30 said filtration units and the at least one cleaning system with respect to the other of said filtration units and said at least one cleaning system within each of the one or more sub-assemblies.

- 20 -

25. A filtration system comprising a plurality of filtration units and at least one cleaning system, wherein one or both of said filtration units and the at least one cleaning system is displaceable with respect to the other of said filtration units and the at least one cleaning system, further comprising a transmission mechanism configured for  
5 converting motion from one or more drive units to the plurality of filtration units and the at least one cleaning system.

26. A transmission mechanism configured for converting motion from one or more drive units to a plurality of filtration units and at least one cleaning system wherein one or both of the plurality of filtration units and the at least one cleaning system is  
10 displaceable with respect to the other of said filtration units and the at least one cleaning system.