Claims

1. System (1) for transmitting liquids, e.g. clean water and wastewater, between a stationary core (2) and a rotatable story (3) of a building (4) in which said rotatable story (3) is arranged substantially circumferentially around said stationary core (2) and is rotatable with respect to said stationary core (2) about a vertical reference axis (5) that is the longitudinal axis of a section of the core (2) at which the story (3) is arranged,

the system (1) comprising an annular buffer duct (6) extending circumferentially around the reference axis (5) of the stationary core (2) and having an annular lower duct portion (7) extending along the entire circumferential length of the buffer duct (6), and an upper duct portion (8) arranged from above in liquid communication with the lower duct portion (7) and slidingly engaging the lower duct portion (7) in at least one interface (9) extending along the entire circumferential length of the buffer duct (6),

one of the lower duct portion (7) and upper duct portion (8) being fixed to the stationary core (2) and the other one of the lower duct portion (7) and upper duct portion (8) being fixed to the rotatable story (3), so that upon rotation of the story (3) with respect to the core (2) about the reference axis (5), the upper and lower duct portions (8, 7) rotate relative to each other about the reference axis (5),

the buffer duct (6) internally defining at least one annular transmission chamber (10) into which the liquid enters from above through one or more inlet ports (11) formed by the upper duct portion (8), and from which the liquid exits through one or more outlet ports (12) formed by the lower duct portion (7),

the transmission chamber (10) being at atmospheric pressure, wherein the system further comprises.

~~**2.** System (1) according to claim 1, comprising:~~

~~–~~transmitted liquid level (15) sensor means for detecting a transmitted liquid level (15) of the liquid in the annular transmission chamber (10), and

~~–~~a control system (16) connected to the transmitted liquid level (15) sensor means and adapted to control one or more inlet valves of the inlet ports (11) in dependency on signals from the transmitted liquid level (15) sensor means.

~~**3**~~**2.** System (1) according to claim ~~2~~1, wherein the transmitted liquid level (15) sensor means comprise one or more of:

~~–~~upper level sensors (17) responsive to the transmitted liquid level (15) exceeding a predetermined upper limit level (14),

~~–~~lower level sensors (18) responsive to the transmitted liquid level (15) dropping below a

predetermined lower limit level (19), and/or

- liquid pressure sensors and/or optical sensors and/or electrical resistance sensors, adapted to detect values representative of the transmitted liquid level (15).

~~43~~. System (1) according to claim ~~2~~ 1 or ~~3~~2, wherein the control system (16) is configured in such a way that the transmitted liquid level (15) inside the transmission chamber (10) is maintained always below the interface/s (9).

~~54~~. System (1) according to any preceding claim, wherein the inlet port/s (11) and the outlet port/s (12) are arranged at a distance from the interface/s (9) and oriented in such a way that the transmitted liquid does not flow over or into the interface/s (9).

~~65~~. System (1) according to any preceding claim, comprising safety overflow apertures (20) positioned in the lower duct portion (7) above an upper limit level (14) and below the interface/s (9) for automatically draining excess transmitted liquid.

~~76~~. System (1) according to any preceding claim, wherein the outlet port/s (12) or additional safety draining apertures (21) in the bottom of the lower duct portion (7) have level- or pressure-controlled safety valves for automatically draining transmitted liquid when the transmitted liquid level (15) exceeds an upper limit level (14), which must be below the interface/s (9).

~~87~~. System (1) according to any preceding claim, wherein the control system (16) is configured in such a way that, in one or more of the buffer ducts (6) which transmit liquid to or from the rotatable story (3), the transmitted liquid level (15) inside the transmission chamber (10) is maintained always at or above a predetermined lower limit level (19).

~~98~~. System (1) according to any preceding claim, wherein the upper duct portion (8) forms an annular upper duct cover extending along the entire circumferential length of the buffer duct (6) and engaging the lower duct portion (7) continuously along two interfaces (9), both extending along the entire circumferential length of the buffer duct (6).

~~**10.** System (1) according to any preceding claim, wherein the lower duct portion (7) forms a nearly closed tubular channel except for a slot (22) formed in a top wall or in an upper side wall of the lower duct portion (7) and extending along the entire circumferential length~~

~~of the lower duct portion (7), the interface (9) being arranged at the slot (22) and the upper duct portion (8) forming a pipe extending through the slot (22) and the interface (9) into the annular transmission chamber (10), so that during rotation of the story (3) only the relatively small pipe moves along the slot (22) while remaining in continuous radial and vertical alignment with the lower duct portion (7).~~

~~11~~**9.** System (1) according to any preceding claim, wherein one of said one or more buffer ducts (6) constitutes a supply duct (25) from the stationary core (2) to the rotatable story (3) and the outlet port/s (12) of said supply duct (25) is/are connected to one or more clean water pressure accumulation tanks (51) with the interposition of one or more clean water pumps (23) for pumping the clean water from the supply duct (25) into the clean water pressure accumulation tanks (51) and for increasing the water pressure in the clean water pressure accumulation tanks (51) to a desired value.

~~12~~**10.** System (1) according to claim ~~11~~9, wherein one or more of the clean water pressure accumulation tanks (51) comprise a hydraulic pressure accumulator for stabilizing the water pressure and compensating non constant water usage in the rotatable story (3).

~~**13.** System (1) according to any preceding claim, wherein one of said one or more buffer ducts (6) constitutes a drain duct (26) from the rotatable story (3) to the stationary core (2) and the outlet port/s (12) of said drain duct (26) is/are connected directly to a wastewater disposal duct of the core (2) so that drained liquid is immediately drained through the outlet port/s (12) of the drain duct (26) into the wastewater disposal duct of the core (2) without accumulating inside the transmission chamber (10) of the drain duct (26).~~

~~**14.** System (1) according to any preceding claim, wherein the buffer duct (6) forms:~~
~~- two or more of said annular transmission chambers (10, 10') separated from each other by one or more internal separation walls (24) formed in and by the lower duct portion (7),~~
~~- one or more separate inlet ports (11) for each one of the transmission chambers (10, 10'),~~
~~- one or more separate outlet ports (12) for each one of the transmission chambers (10, 10').~~

~~**15.** System (1) according to claim 14, wherein at least one additional interface (9') is~~

~~positioned entirely inside the buffer duct (6) and extends along the entire circumferential length of the buffer duct (6), and wherein the upper duct portion (8) slidingly engages the internal separation wall/s (24) in said additional interface/s (9') in order to ensure a separation of the transmission chambers (10, 10').~~

~~16~~**11.** System (1) according to any preceding claim, wherein the interface/s (9) comprise/s a dust proof interface seal which closes the interface/s (9) so as to make the buffer duct (6) of a substantially closed cross-section.

~~**17.** System (1) according to claim 16, wherein the dust proof interface seal comprises one or more of:~~
~~- a single sided or double sided brush seal (27),~~
~~- a liquid seal (28),~~
~~- a labyrinth seal.~~

~~**18.** System (1) according to claim 16 or 17, wherein horizontal surfaces of one or more of the interfaces (9) are covered with damping layers made of shock absorbing material.~~

~~19~~**12.** System (1) according to claim ~~16~~11, wherein the dust proof interface seal comprises a liquid seal (28) having a trough (29) containing a sealing liquid, and a lip or wall or sheet (30) projecting from above into the trough (29) and being immersed in the sealing liquid, wherein the trough (29) forms the lower duct portion (7) face of the interface (9) and the lip or wall or sheet (30) forms the upper duct portion (8) face of the interface (9), or vice versa.

~~20~~**13.** System (1) according to claim ~~19~~12, comprising a drainage system which allows the sealing liquid to flow out of the liquid seal (28), and a replenishing system (38) for feeding sealing liquid into the liquid seal (28).

~~21~~**14.** System (1) according to any preceding claim, wherein at least a portion of a bottom of the annular transmission chamber (10) slopes downwards from one or more locally highest points (32) to one or more locally lowest points (33) where the outlet ports (12) are arranged, thereby driving the flow of liquid towards the outlet ports (12) by means of gravity.

~~22~~15**.** System (1) according to any preceding claim, wherein the lower portion (7) of the wastewater buffer duct (6) of a given rotatable story (3) and the upper portion (8) of the clean water buffer duct (6) of the rotatable story (3) positioned directly beneath said given rotatable story (3) are formed in a same stationary core (2) wall portion.

~~23~~16**.** System (1) according to claim ~~22~~15, wherein the wastewater buffer duct (6) and the clean water buffer duct (6) are positioned at different radial distances from the stationary core (2).

~~24~~17**.** System (1) according to claims ~~21~~ 14 and ~~22~~ 15 or claims ~~21~~ 14 and ~~23~~16, wherein the clean water buffer duct (6) is positioned at a greater radial distance from the stationary core (2) than the radial distance of the wastewater buffer duct (6) from the stationary core (2), and wherein a clean water supply line to the clean water buffer duct (6) is arranged to extend through the core (2) at the circumferential position of and below a locally highest point (32) of the wastewater transmission chamber (10) bottom.

~~25. System (1) according to any preceding claim, comprising flushing means adapted to convey a flushing liquid in the buffer duct (6) through one or more flushing ports (34) opening out into the annular transmission chamber (10) at a distance from the inlet port/s (11).~~

~~26. System (1) according to claim 25, wherein the flushing means comprise pumping means that pump the flushing liquid through the flushing port/s (34).~~

~~27. System (1) according to claim 19 or 20, comprising one or more sealing liquid discharge ducts (35) connecting the liquid seal (28) trough (29) to the transmission chamber (10) and having one or more sealing liquid discharge valves (36).~~

~~28~~18**.** System (1) according to claim ~~19~~ 12 or ~~20~~13, wherein discharge of part of the sealing liquid from the liquid seal (28) into the transmission chamber (10) is accomplished by over-replenishment of sealing liquid into the liquid seal (28) trough (29) and overflow of excess sealing liquid above one or more internal overflow wall sections (37) of the trough (29) having a calibrated height which is lower than an external wall of the trough (29).

~~29. System (1) according to any of claims 25 to 28, controlled by a control system which~~

also allows manual control interventions.

30. System (1) according to any of claims 19, 20, 27, 28, and 29, wherein the control system ensures that the sealing liquid remains between pre-determined minimum and maximum levels within the liquid seal (28) trough (29) to ensure the sealing ability of the liquid seal (28).

31. System (1) according to any preceding claim, comprising compensation means for compensating a relative vertical displacement of the rotatable story (3) with respect to the stationary core (2).

32. System (1) according to claim 31, wherein the compensation means are selected in the group consisting of:
- height adjustment means for adjusting the height of the upper duct portion (8) with respect to the core (2) or with respect to the story (3),
- height adjustment means for adjusting the height of the lower duct portion (7) with respect to the core (2) or with respect to the story (3),
- a configuration of the interface/s (9) such as to allow for relative vertical movements, within predetermined limits, between the upper and lower duct portions (8, 7) without substantially changing their functional relationship.

33. System (1) according to any preceding claim, comprising an upper duct portion (8) sustainment device (45) capable of aligning the lower and upper duct portions (7, 8), said sustainment device (45) comprising first rollers (46) vertically or diagonally engaging one or more first rolling tracks (47) with a rolling direction that is circumferential to the reference axis (5), and/or second rollers (48) horizontally or diagonally engaging one or more second rolling tracks (49) with a rolling direction that is circumferential to the reference axis (5), wherein the first rollers (46) and the first rolling track/s (47) are connected the ones to the upper duct portion (8) and the others to the lower duct portion (7), or vice versa, and the second rollers (48) and the second rolling track/s (49) are connected the ones to the upper duct portion (8) and the others to the lower duct portion (7), or vice versa.

34. System (1) according to any preceding claim, comprising a system for monitoring and adjusting the air pressure inside the transmission chamber (10).

~~**35.** System (1) according to any preceding claim, comprising one or more venting ducts (13) which put the transmission chamber (10) in communication with a venting duct system of the stationary core (2) and/or with ambient air at a façade (50) of the building (4).~~

~~**36.** System (1) according to any preceding claim, comprising a set of flexible hoses adapted to supply clean water from the stationary core (2) to the rotatable story (3) in an emergency.~~

~~37~~19. System (1) according to claim ~~7~~6, comprising a control system to control the level- or pressure-controlled safety valves in dependency on signals from sensors, wherein the control system also allows manual control interventions.

~~38~~20. System (1) according to claim ~~11~~9, comprising a control system to control the clean water pump/s (23) in dependency on signals from sensors, wherein the control system also allows manual control interventions.

~~**39.** System (1) according to claim 1, wherein the interface/s (9) has/have the ability either to seal perfectly the transmission chamber (10) from the space surrounding it, thereby preventing all transmission of liquids between the two environments under normal operative conditions, or to seal it partially, thereby preventing most transmission of liquids between the two environments under normal operative conditions, whilst maintaining, in both cases, the aforementioned capability to let the upper and lower duct portions (8, 7) slidingly engage each other.~~

~~**40.** System (1) according to claim 1, wherein the interface/s (9) is/are different from a solid elastomeric mechanical gasket in the shape of a torus.~~