Liquid Thin Film Technology

New innovative way of enabling gas transfer in/out of liquid with extremely high power efficiency

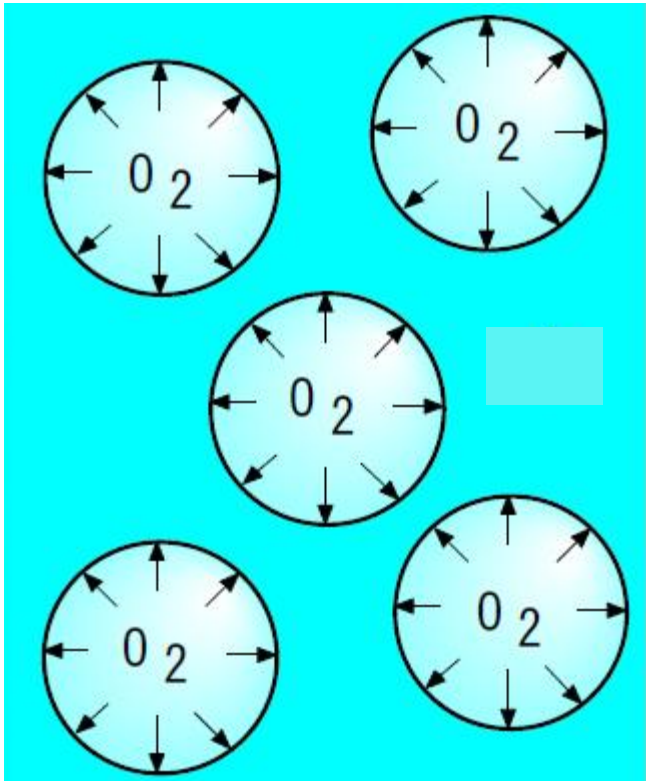
US Patent No. US 8,292,271 B2 and US 7,494,534 B2

Liquid Thin Film (LTF) Concept

LTF technology is a new concept of gas transfer in and out of liquid. Instead of making small bubbles, it makes water all bubbles.

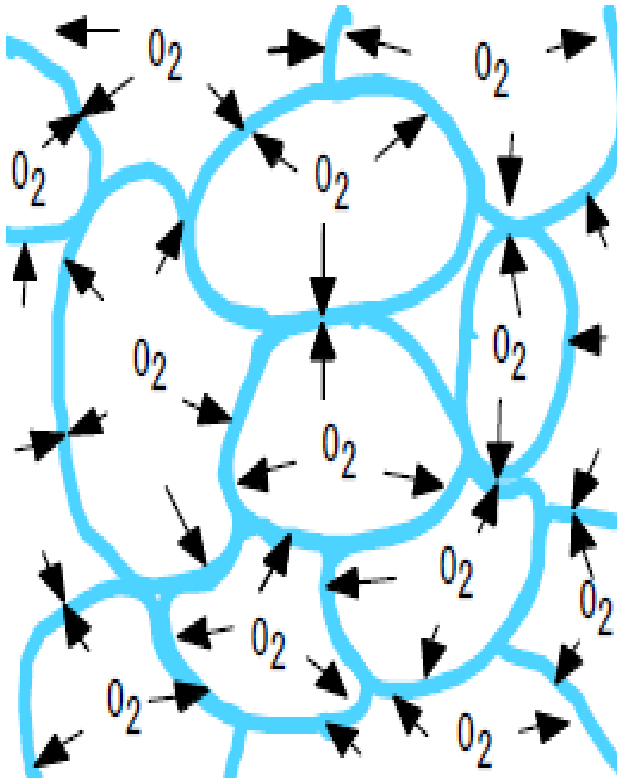
- All liquid to be processed will become numerous number of soap like bubbles, surrounding gas as thin liquid film, which enables the gas transfer extremely efficient.
- Very low power operation. Small footprint with scale up capability.

LTF Gas transfer (case of oxygen)



Conventional aeration

Making bubbles small to increase liquid/gas boundary area



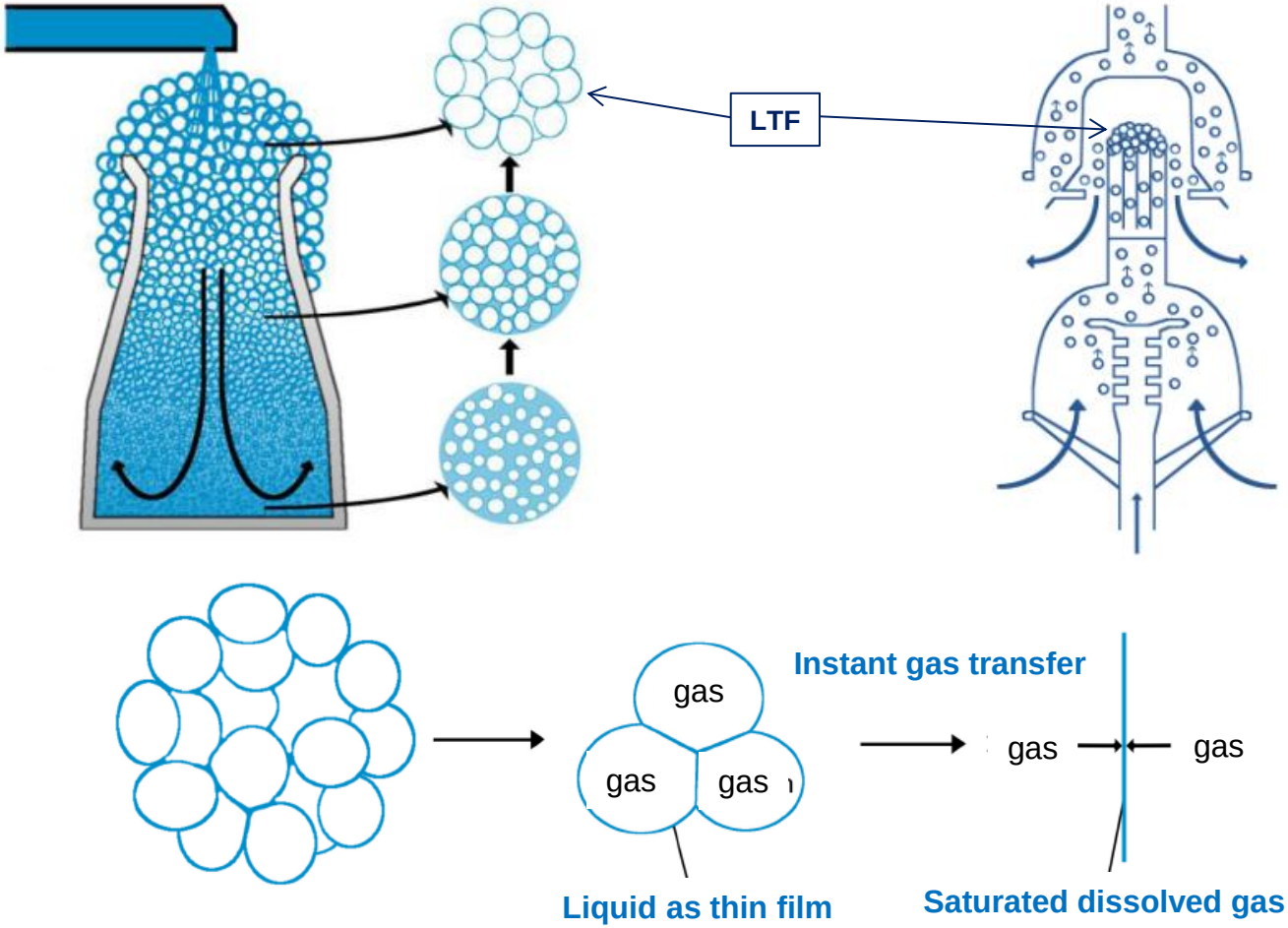
LTF

Making liquid in thin film form around gas to increase the boundary area

LTF production and gas transfer

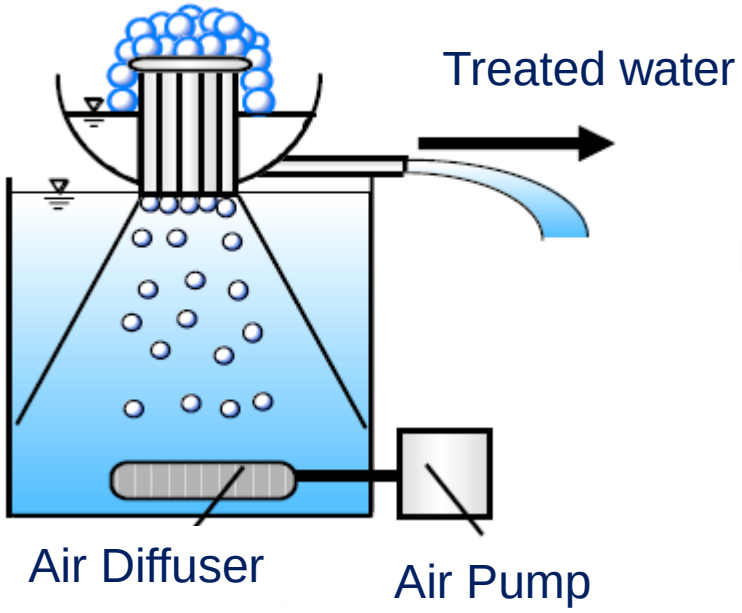
LTF production using pressurized liquid

LTF production using pressurized gas



LTF conceptual structure

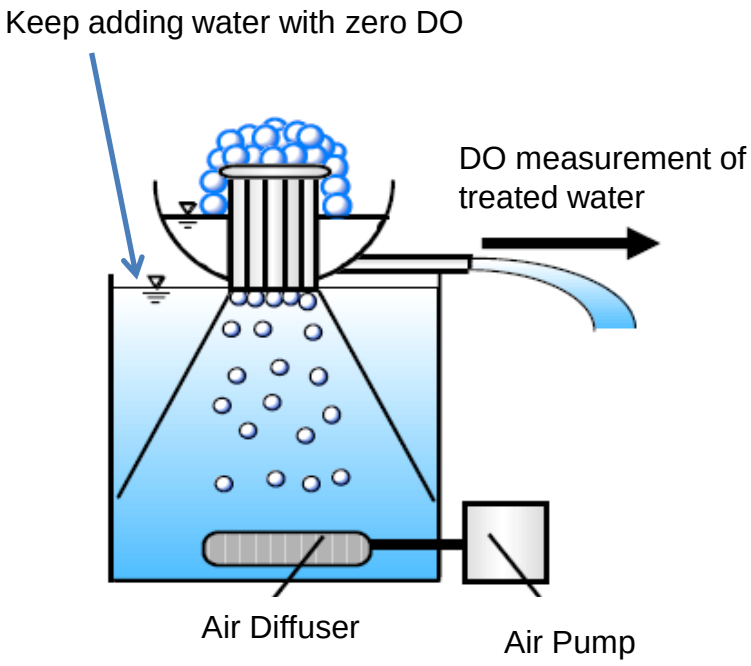
Continuously producing and breaking numerous number of bubbles to enable extremely effective gas transfer in and out.
Water flow is created by unique “LTF air-lift” and atmospheric pressure.

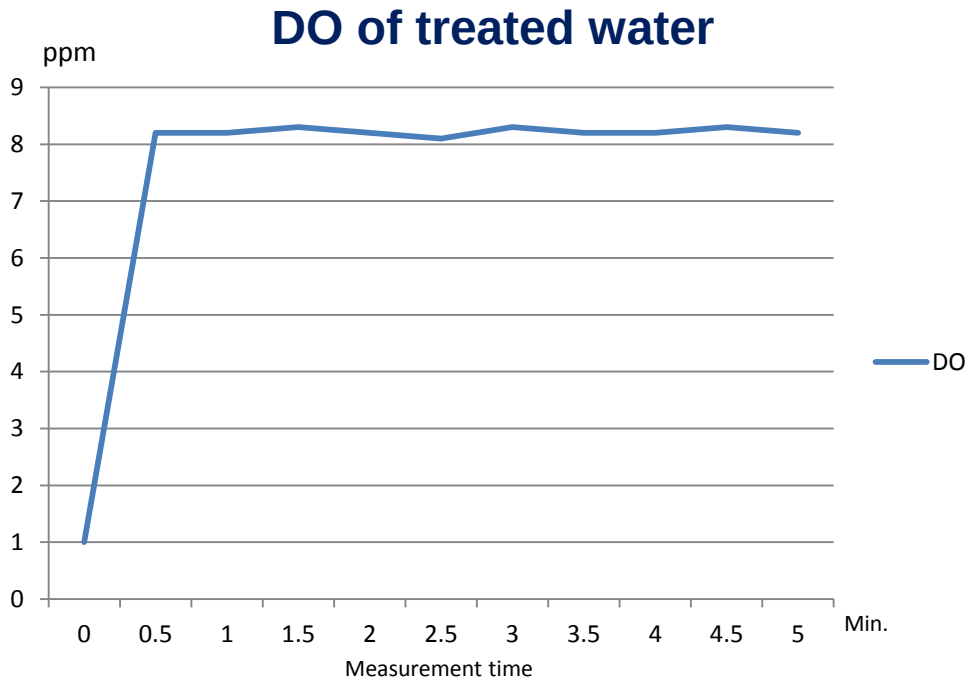


Liquid Thin Film

LTF Oxygen transfer capability

-Single pass through the device-





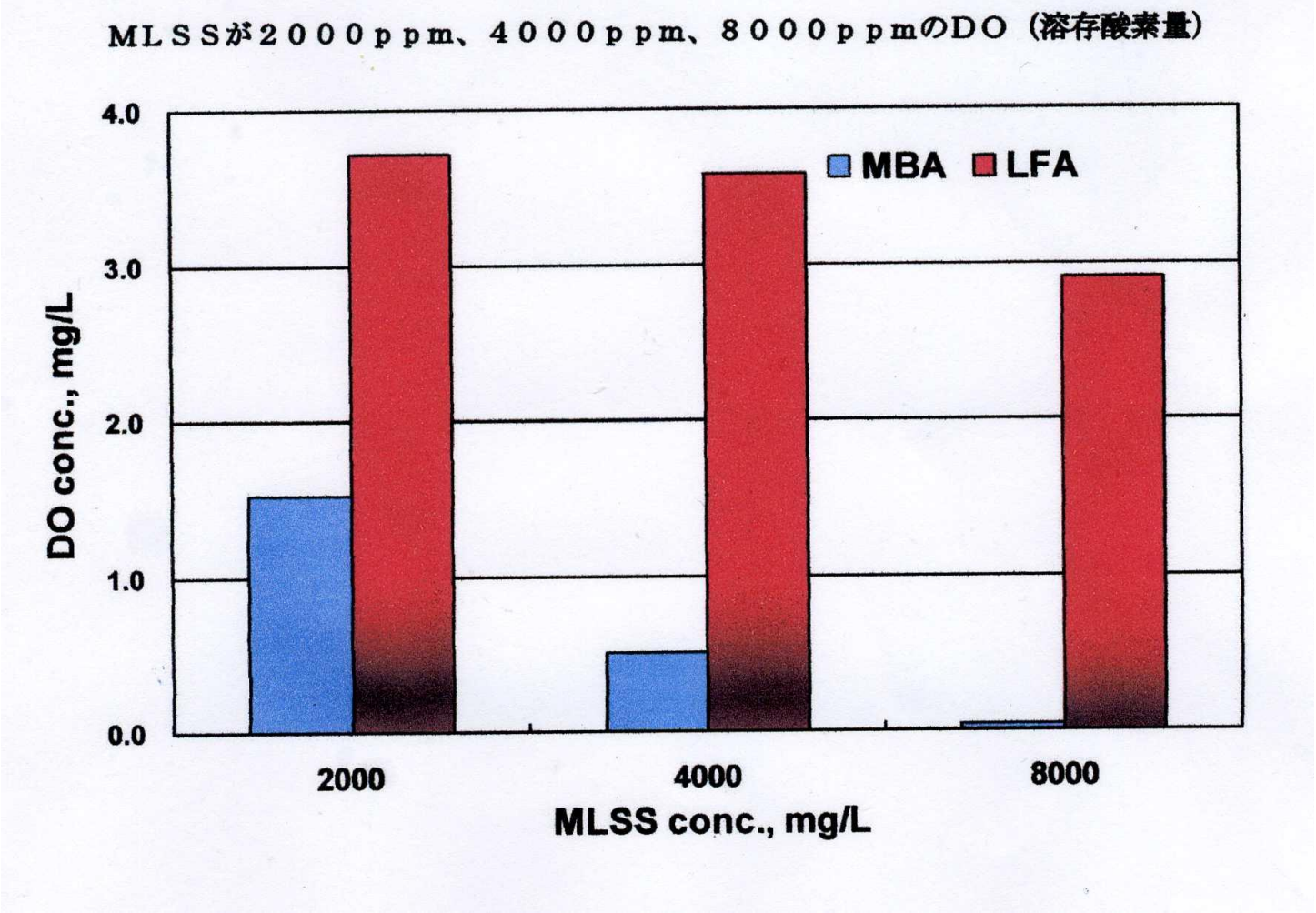
The water passed through LTF system have saturated DO level.

LTF applications and benefits

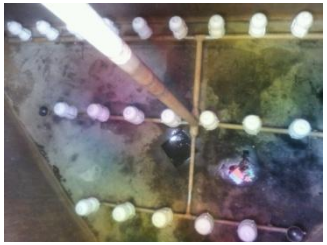
LTF work for various applications including wastewater, drinking water, dam/pond/storm water, aquaculture, hydroponics, bio-reactors, algae growth, gas dissolution/stripping etc.

- Extremely low power consumption
- Operate by gas inlet with low pressure loss
- High gas transfer efficiency
- Large aperture - No clogging, low maintenance
- New construction or retrofit
- Various device configurations – Design flexibility
- Move water and aerate at the same time – FB-50h
- Scale-up capability
- Small foot print

Comparison of the MLDO for different MLSS in case of fine bubble aeration and liquid thin film aeration using AWA-200



Application examples



Wastewater treatment, Aeration

Still water aeration/circulation

Dam/pond water remedy

Aquaculture/Hydroponics

Gas dissolution

Multiple FB-50 aerator/water circulator

Product example 1

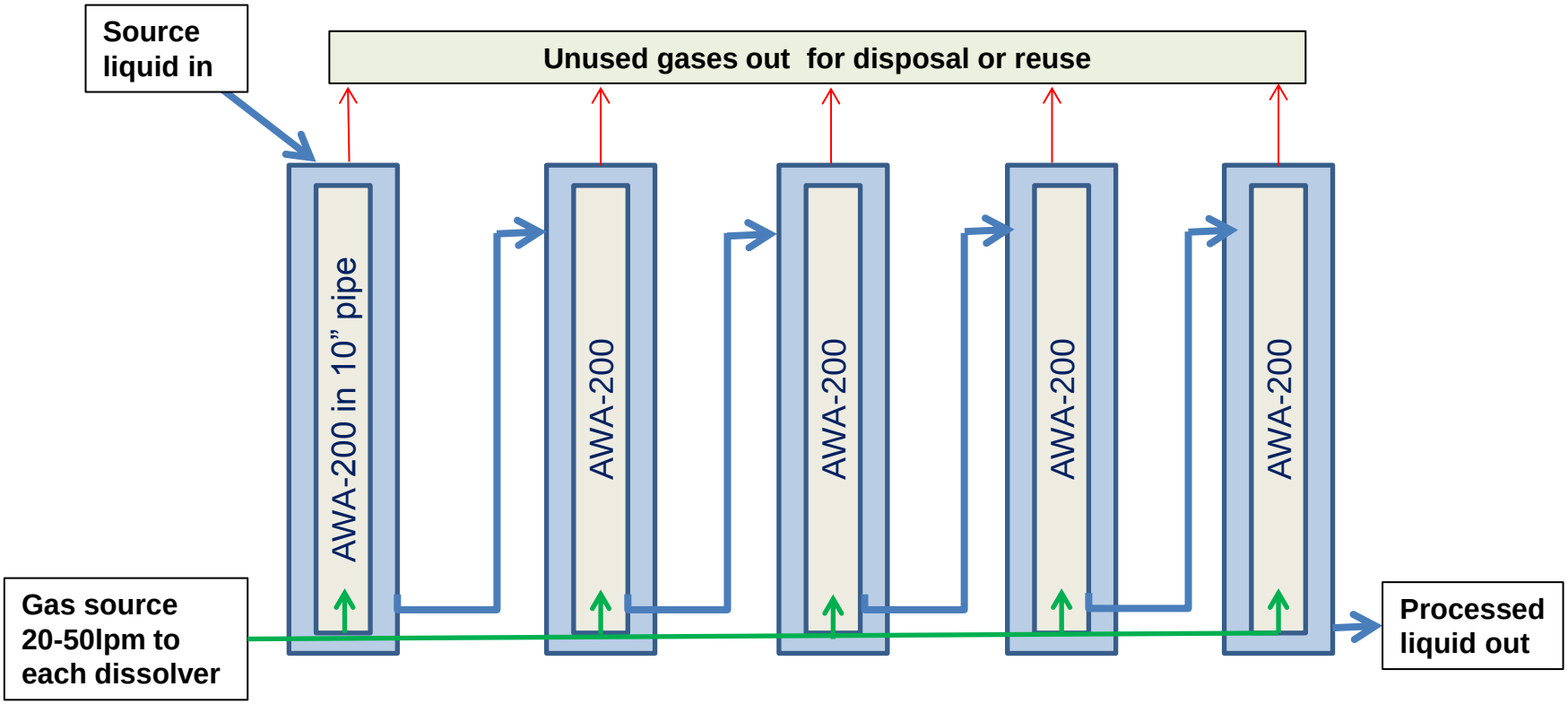
AWA-200
Gas injection/stripping

Extremely power effective

Gas dissolution/stripping device

Operated by low power air pump/blower

AWA-200 Gas dissolver for large volume



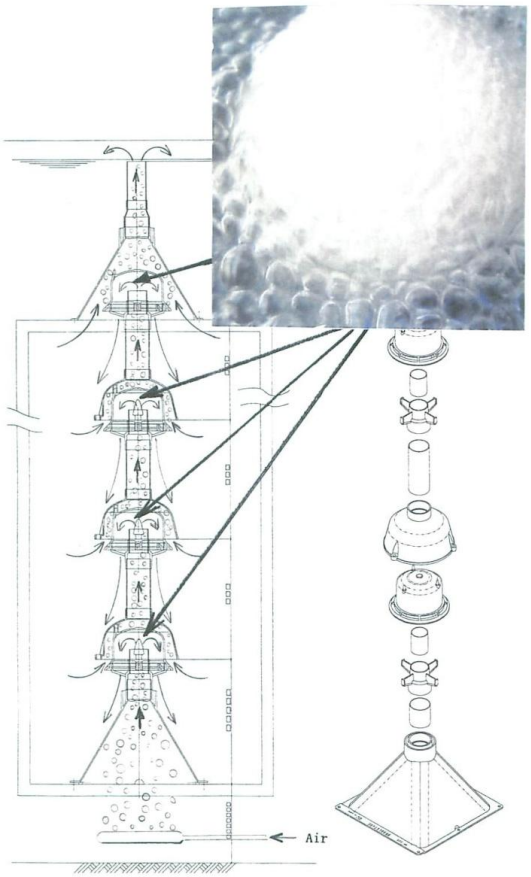
Connect them in series as many as needed to treat required volume of liquid.

AWA-200 Gas stripper for large volume

Connect them in series as needed to treat required volume of liquid.

AWA-200 LTF tower unit

equipped with diffuser at the bottom



AWA200(2 layer) aerator DO increase

Original conditions : 11 units of old fine bubble diffusers
DO : < 0.2ppm
Improved conditions : Replaced all old diffusers with 5 x AWA200 and 6 x new pulse diffusers (mixing of sludge)
DO : > 3ppm

Old fine bubble diffuser

Pulse diffuser

AWA200 (Two layer)

Inside of aeration tank

Product example 2

FB-50h
LTF aerator/pump

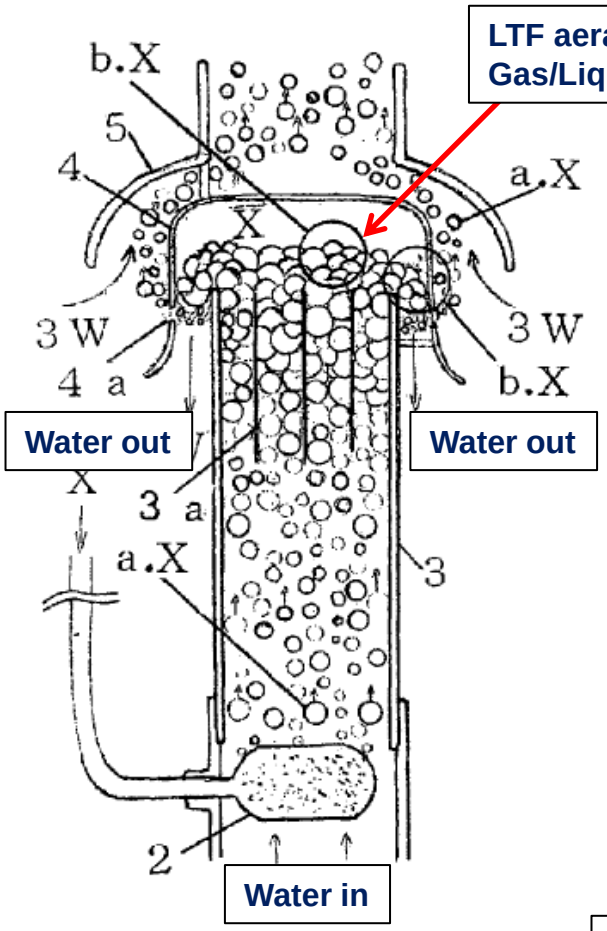
Extremely power effective
water pump and aeration device
Operated by low power air pump/blower

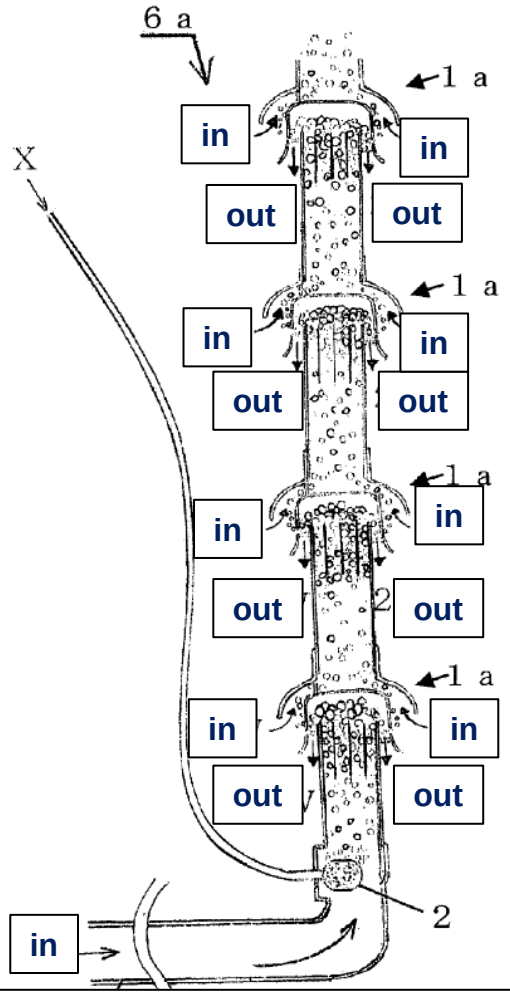
Pump water and aerate at the same time

- Aerate water by making water surface very thin around air.
- Pump water at least the same volume as input air volume on single unit .
  You can increase the pump volume by multiple units connected in series.
  (water volume increases by number of units yet with the same input air volume.)
- Shallow air injection depth reduces power usage.

Based on US patent No. US 8,292,271 B2

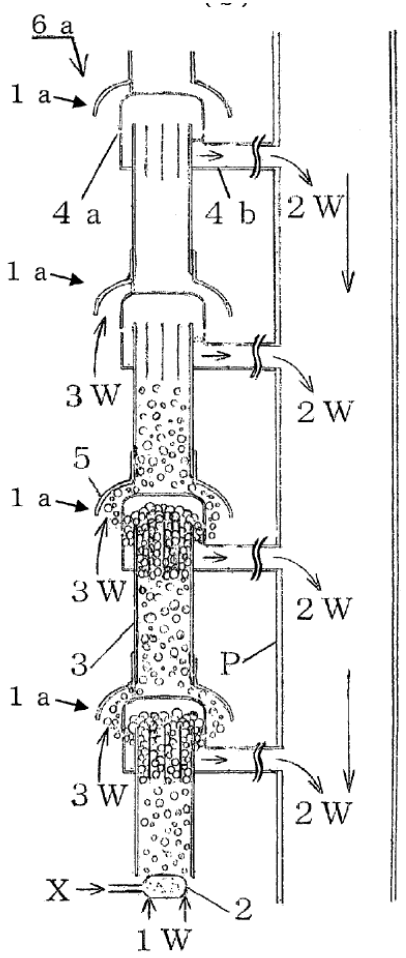
Conceptual Structure of LTF pump (1)



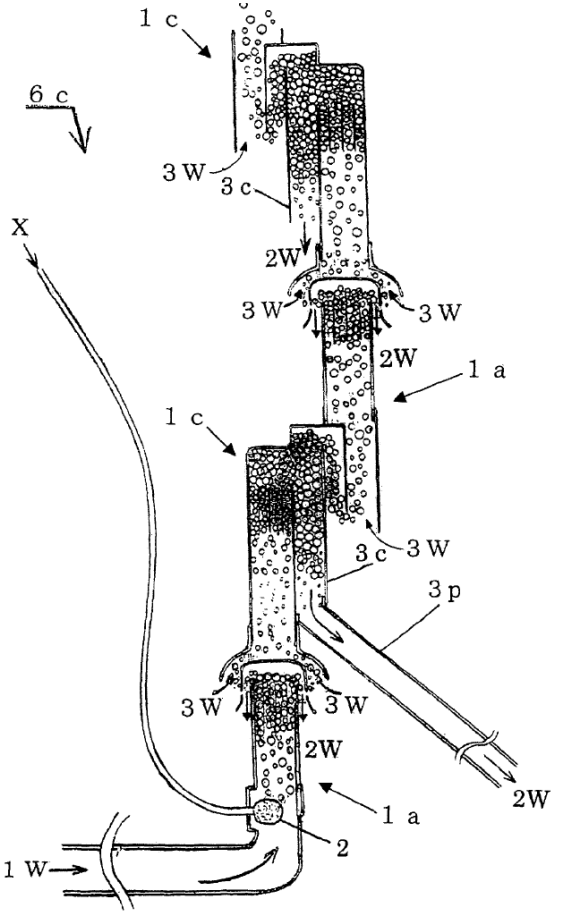


Serial connection to increase water flow with the same air volume

Conceptual Structure of LTF pump (2)



Transfer output water to distant location

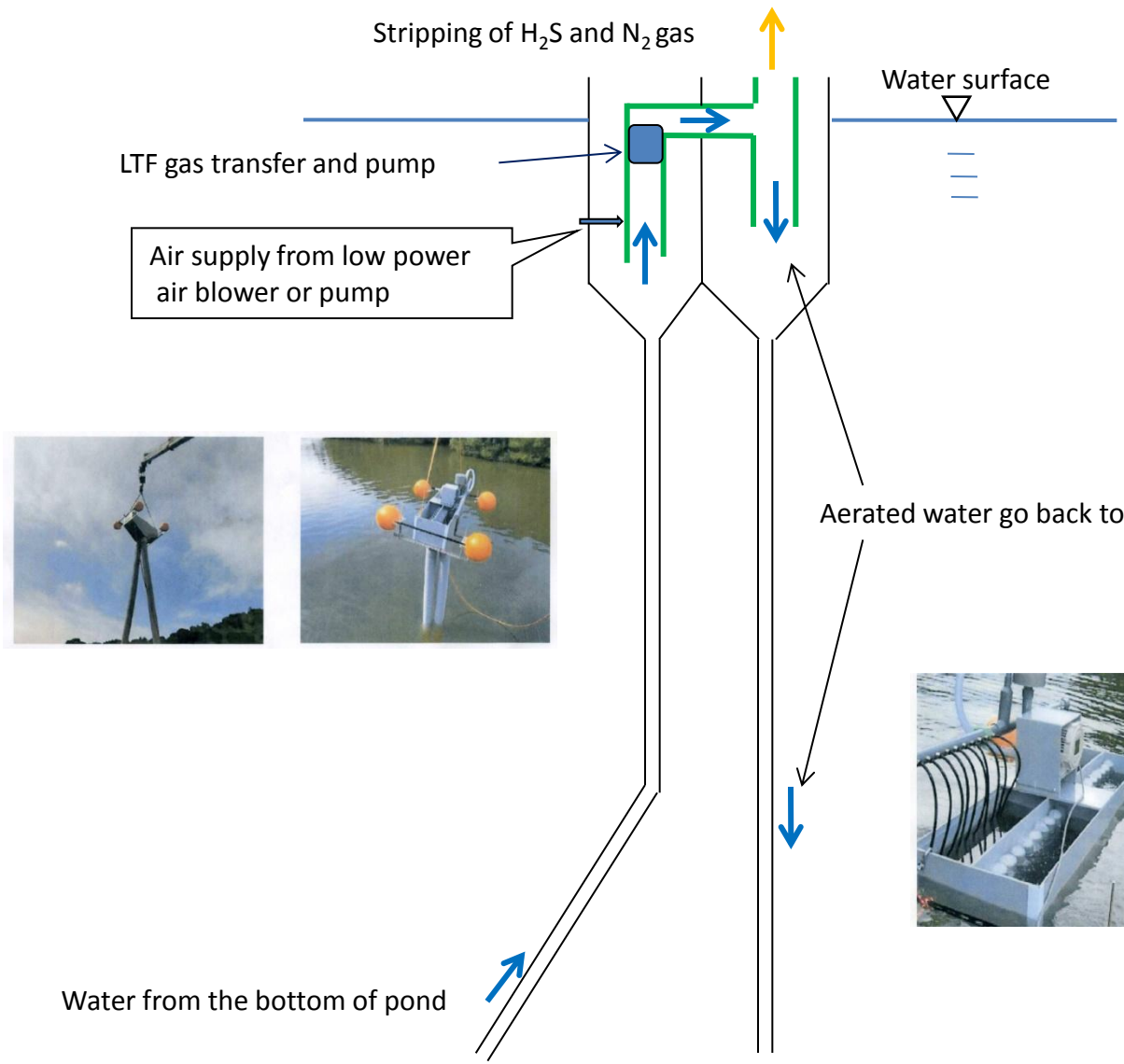


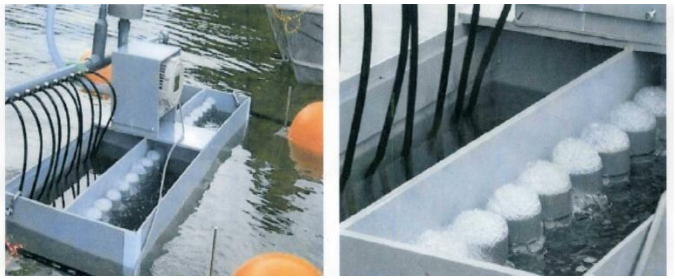
Transfer input water from distant location

Advantages

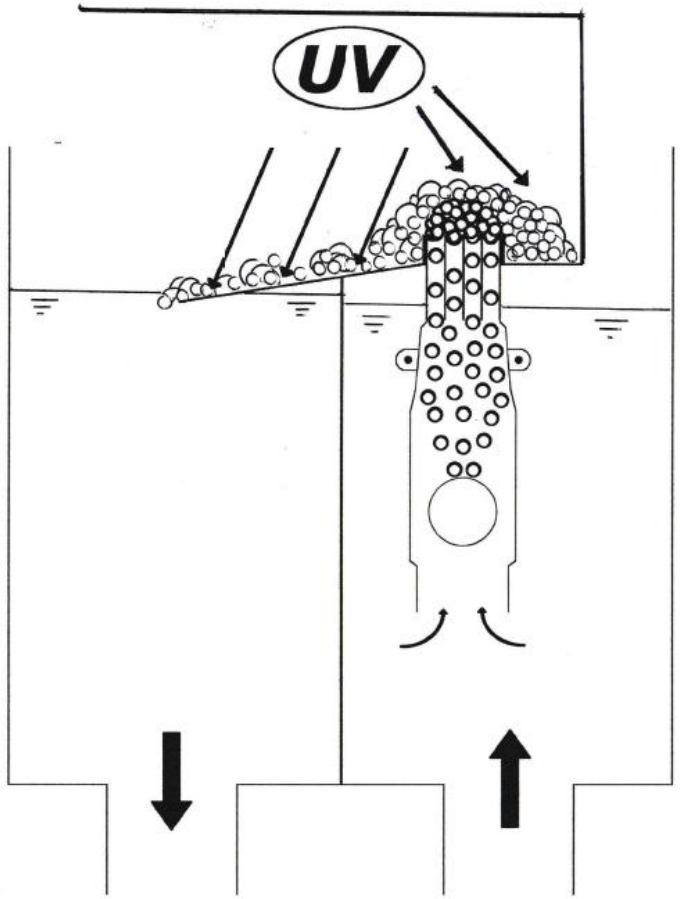
- Extremely power efficient
- Create water movement and aerate water
- Intake/outlet water from distant location
- Intake/outlet water from deep area
- Use of reliable small capacity air pump
- Scale-up capability
- Serial connection to increase capacity
- Simple system configuration
- Small foot print

FB-50h aerator/pump for dam/pond





LTF – improve UV treatment efficiency



Power efficiency and foot print

- **Single FB-50h unit**

  Move and aerate 20L/min of water by 20W

  200mm(W) x 300mm(H) x 80mm(L)

- **6 x 2 layer unit**

  Move and aerate 240L/min of water by 32W

  400mm(Diameter) x 1,800mm(H)

- **6 x 6 Layer unit**

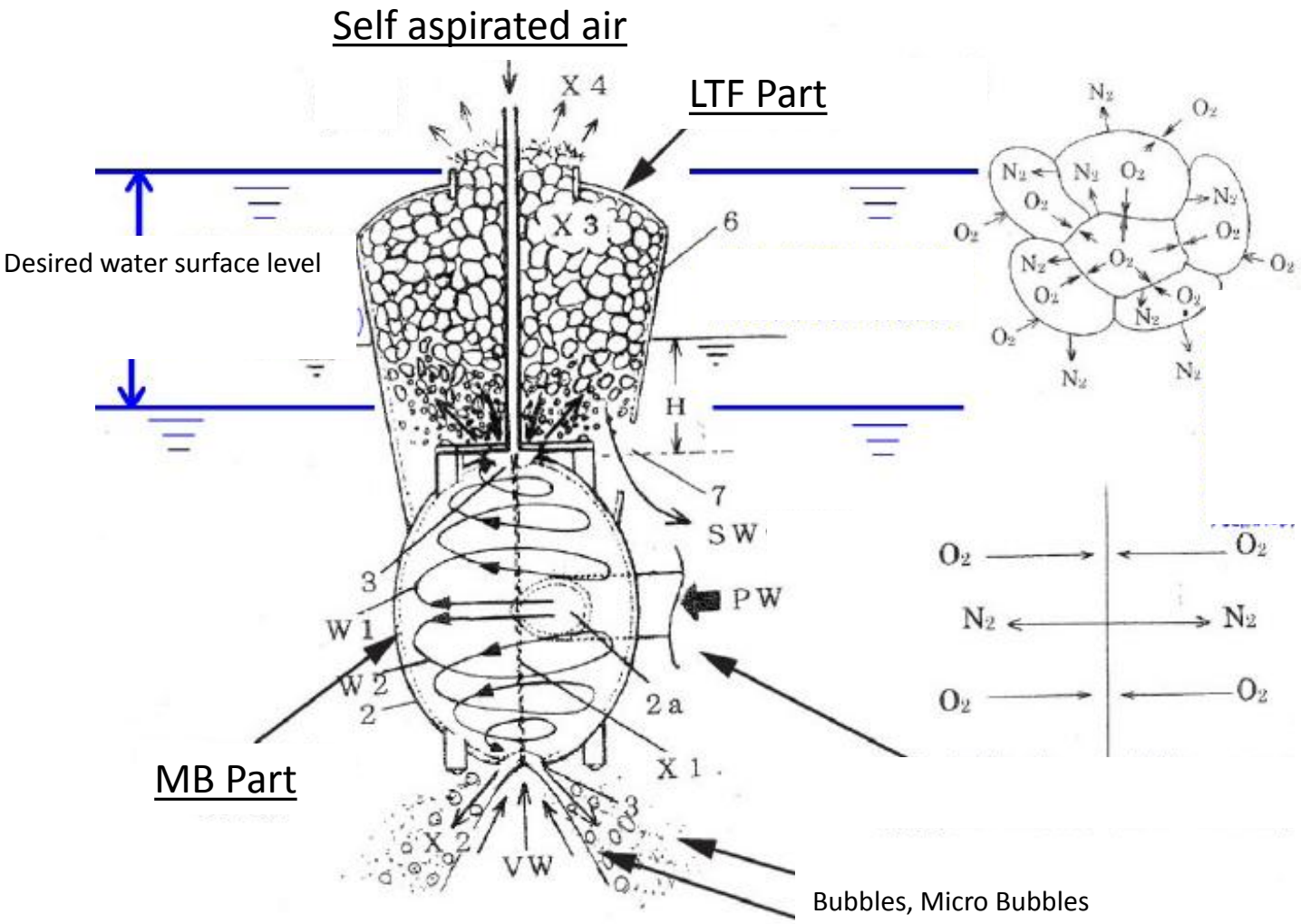
  Move and aerate 720L/min of water by 70W

  600mm(Diameter) x 1,800mm(H)

Product example 3
F.BT-50/F.BT-50W
LTF aerator

Extremely power effective aeration device
Operated by low power water pump

F.BT-50 LTF/MB Nozzle



Unbalanced Nitrogen, CO2, Ammonia etc. are removed and keep oxygen level consistent.

F.BT-50 LTF production

taken by high speed camera

You can see there are so many bubbles in the cup to make water very thin film enabling extremely effective gas transfer.