Bubble-X

THE FIRST ACTIVE CARDIOTOMY/VENOUS RESERVOIR

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OBJECTIVES

Venous reservoirs are a standard component of ECC systems during CPB operations, acting primarily as blood depots. Since their invention, several decades ago, no significant change in their design and/or function has taken place, apart from the integration of foam structures capable of trapping gas bubbles. Yet the implementation of said foam material introduces an infinitely larger surface, not necessarily of hemocompatible nature. To this end, a compact novel cardiotomy reservoir has been developed, with inherent degassing functionality and enhanced blood treatment capabilities.

MATERIALS & METHODS

With an inverted U shape, Bubble-X consists of two vertical gas exchange chambers equipped with microporous capillary membranes, connected via a quiet-zone compartment, encompassing a microporous flat membrane. Application of negative pressure on the flat membrane permits the elimination of any gas bubbles in the bloodstream, as well as the partial removal of dissolved components (gas molecules). Optionally, the vertical gas exchange chambers can also function under suction, for enhanced performance.

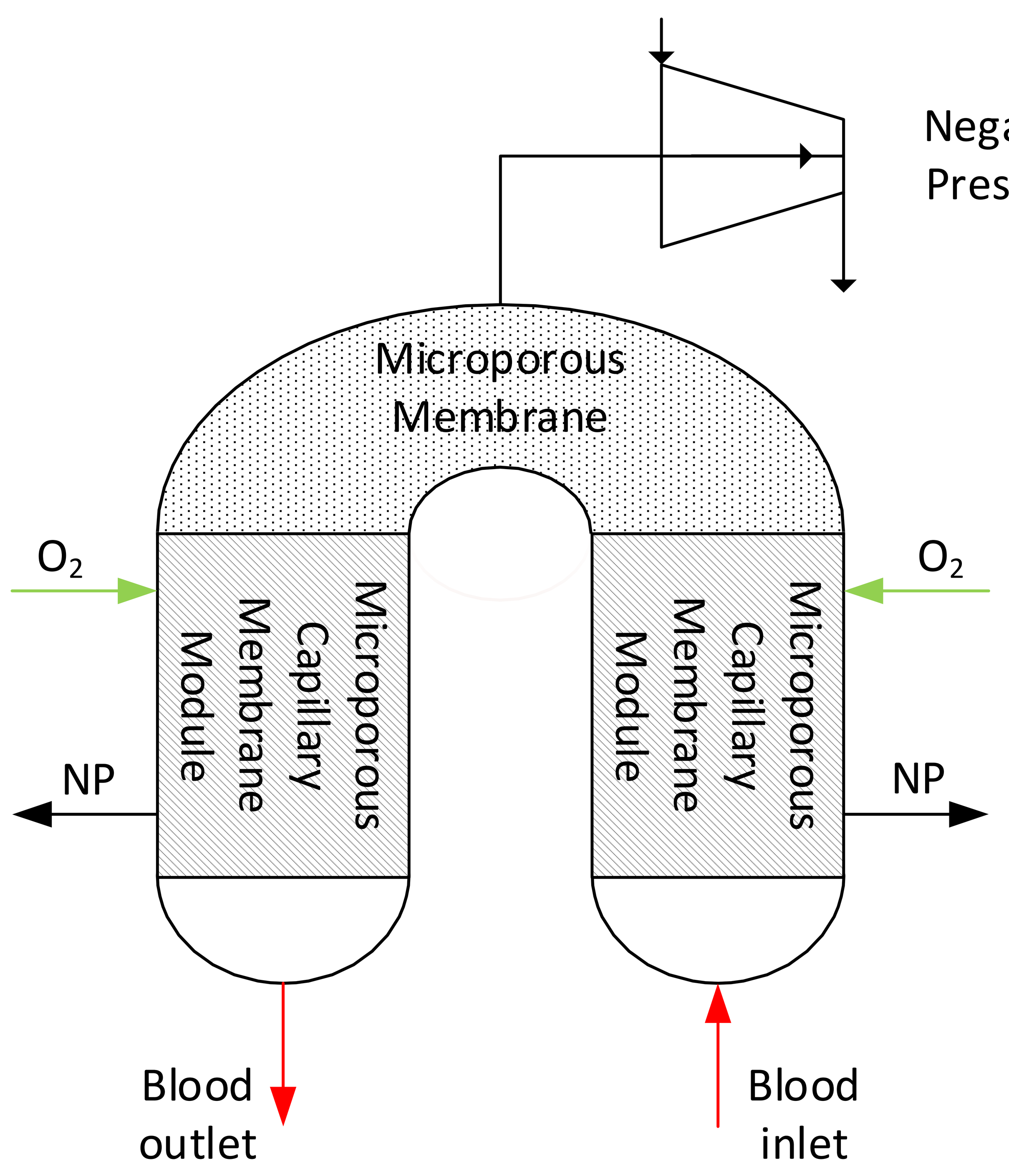

Fig. 1. Schematic representation of the different compartments constituting Bubble-X, enabling its cost-effective materialization.

RESULTS

In vitro investigations carried out with physiological solutions are testament to the device's efficacy, even when the induced gas bubbles reach extremely high concentrations.

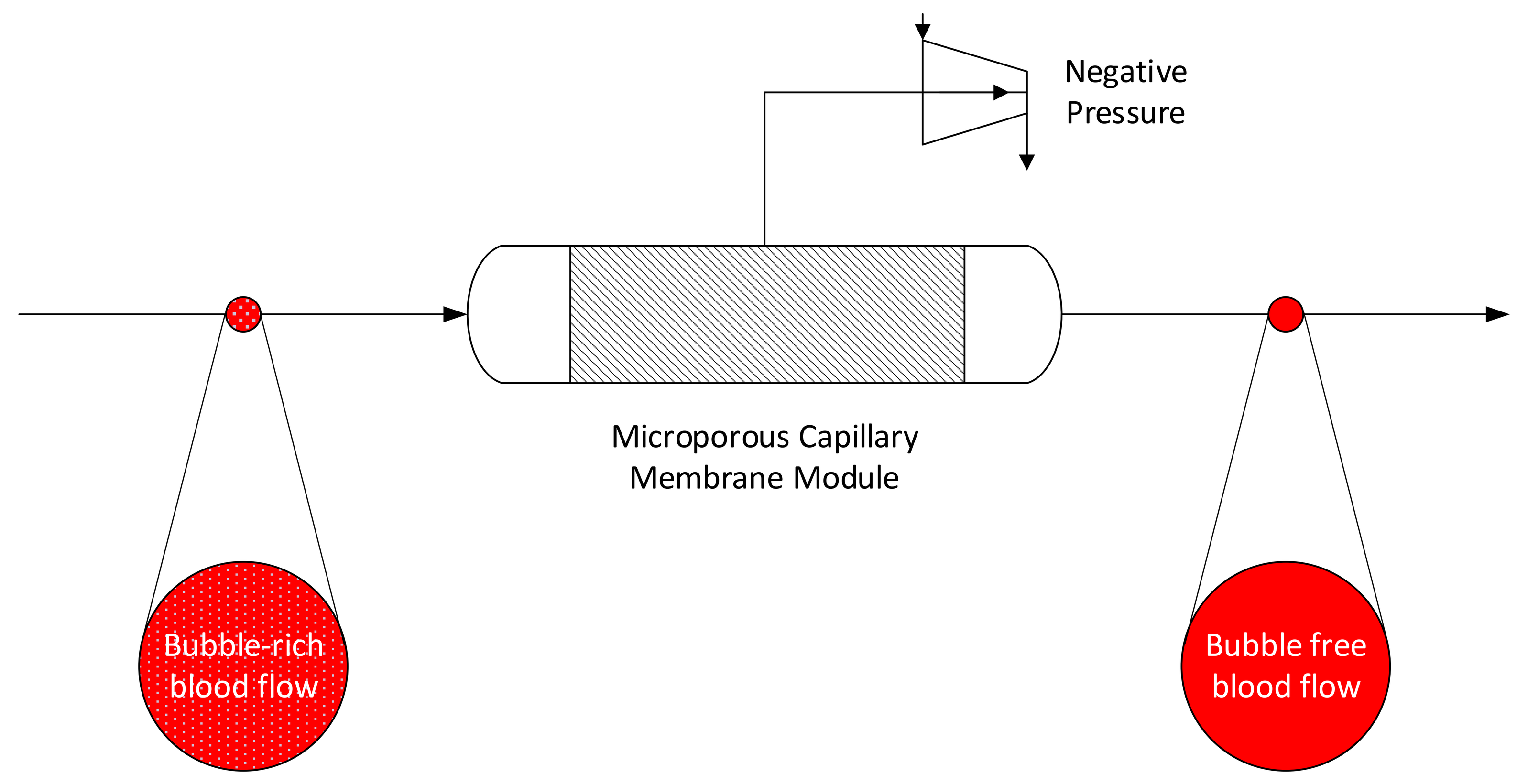

Fig. 2. A straightforward method of testing and validating the bubble elimination principle behind Bubble-X.

CONCLUSION

The combination of eradicating potentially lethal gas bubbles, whilst simultaneously augmenting the ECC's gas exchange performance, renders Bubble-X an invaluable tool in any surgeon's/perfusionist's arsenal. Furthermore, its minute size is beneficial in terms of blood trauma and effectively reduces the circuit's priming volume. Diverse in-vitro/in-vivo investigations with advanced prototypes are being planned for the near future, in order to validate the device's functionality and to improve its ease of use in clinical settings.

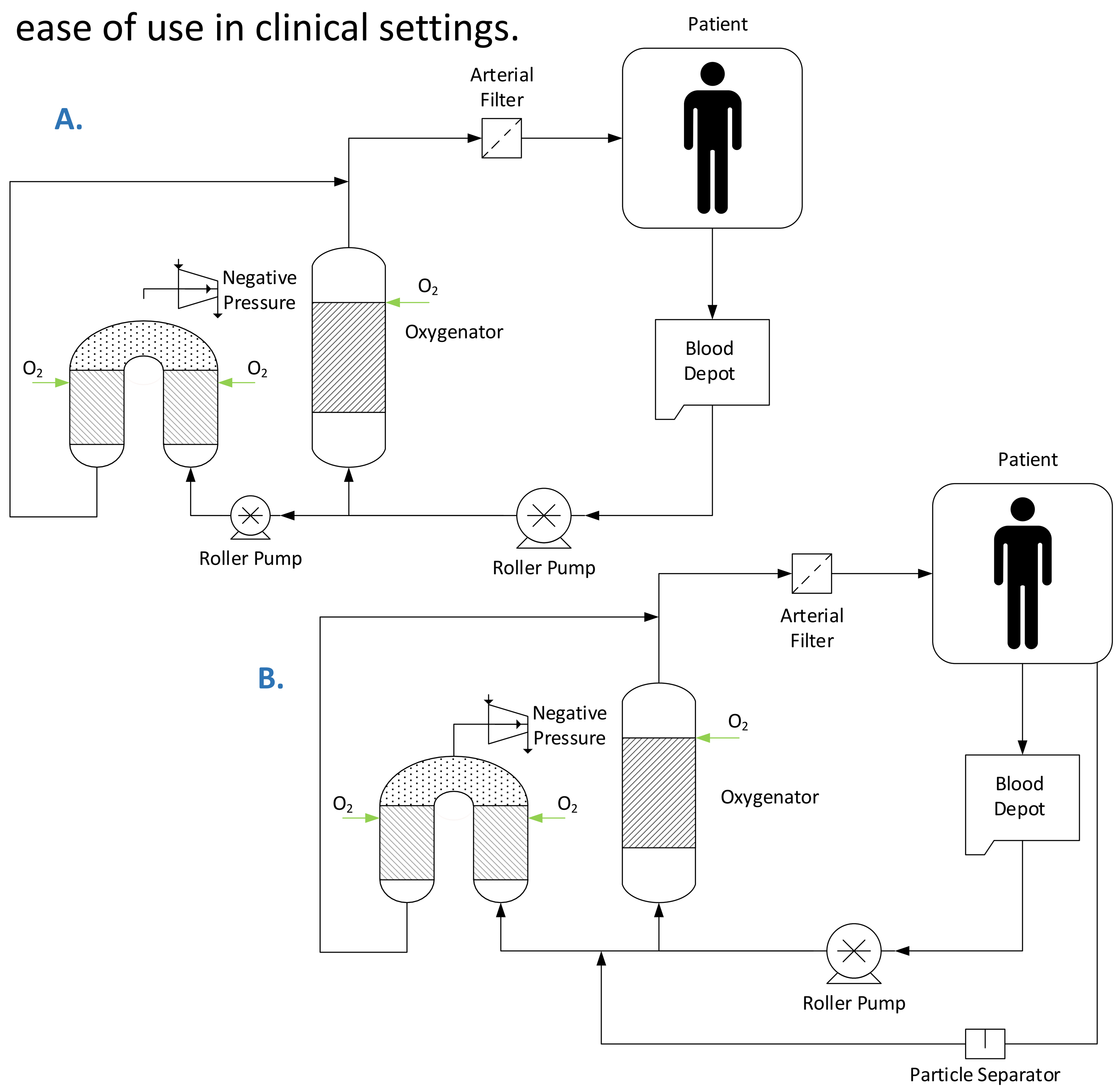

Fig. 3. The fundamental operating modes of Bubble-X: active perfusion (A.) for improved gas exchange performance, vs. passive (B.) perfusion with additional suction function for excellent bubble eradication.

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