CLAIMS:

1. An electrodialysis unit comprising:

a plurality of cathodes, a plurality of anodes and a plurality of membranes;

wherein the cathodes and anodes are arranged alternately in an electrode stack, with membranes in between each cathode and anode;

wherein the cathode and the anode are each formed of a single conductive plate such that both surfaces of the cathode plates and anode plates enclosed within the electrode stack are, in use, in conductive contact with the water being treated;

wherein the conductive plates that form electrodes are clamped between and supported by non-conductive separators for separating the fluid flow into and out of the cathode flow paths and anode flow paths; and

wherein the conductive plates are each provided with a seal that is bonded to the conductive plates and forms a shape corresponding to the shape of the outer edge of the separators, with the seal extending beyond the edges of the conductive plate and contacting the separators on either side of the conductive plate in order to form an enclosed electrode chamber around the conductive plate.

2. An electrodialysis unit as claimed in claim 1, wherein the electrode stack comprises multiple sets of electrodes forming multiple membrane cells, with each electrode in a single set connected in parallel, and each set of electrodes connected in series.

3. An electrodialysis unit as claimed in claim 2, wherein the electrodes at the outer ends of each set of electrodes in the electrode stack are both cathodes.

4. An electrodialysis unit as claimed in any preceding claim, wherein the electrical connections for the electrodes are made directly to the conductive material of the conductive plates.

5. An electrodialysis unit as claimed in any preceding claim, wherein the conductive plates extend outside of the reaction area of the electrodialysis unit to provide electrical connection points.

6. An electrodialysis unit as claimed in claim 1, wherein the seal extends beyond the edges of the conductive plates.

7. An electrodialysis unit as claimed in any of claims 2 to 6, wherein the separators include openings exposing the conductive plates in the reaction zones, and wherein the membranes are placed across these openings between anode and cathode to complete the membrane cells.

8. An electrodialysis unit as claimed in any of claims 1 to 7, wherein the separators include inlet flow passages for incoming water and outlet flow passages for outgoing diluate and concentrate.

9. An electrodialysis unit as claimed in any of claims 1 to 8, wherein the separators include flow guide features for providing uniform and/or laminar flow to cathode and/or anode flow paths.

10. An electrodialysis unit as claimed in any of claims 1 to 9, comprising alternate separator designs for the cathode and the anode.

11. An electrodialysis unit as claimed in claim 10, wherein the cathode separators comprise first flow guide features and/or provide for first flow rates for the cathode flow paths and the anode separators comprise second flow guide features which are not the same as the first flow guide features and/or provide for second flow rates for the anode flow paths, the second flow rates not being the same as the first flow rates.~~wherein the alternate cathode and anode separators comprise different flow guide features and/or provide for different flow rates for cathode and the anode flow paths.~~

12. An electrodialysis unit as claimed in claim 10 or 11, wherein the cathode separators support the cathode flow plates at a first position with the leading edge of the cathode flow plates at a first distance from a cathode water inlet and the anode separators support the anode plates at a second, different, position with the leading edges of the cathode plates placed at a second, different, distance from a water inlet for the anodes.~~wherein the different separator designs support of the anode and cathode plates at different positions when assembled in the electrode stack.~~

13. An electrodialysis unit as claimed in any of claims 1 to 12, including cathode chambers comprising first and second cathode separators located on either side of a cathode in the form of a conductive plate and anode chambers comprising first and second anode separators located on either side of an anode in the form of a conductive plate,

wherein the electrodialysis unit comprises a sequence of anode and cathode chambers, with membranes between each chamber.

14. An electrodialysis unit as claimed in any of claims 1 to 13, wherein the separators include through holes that align in the electrode stack to form water inlet and outlet passages.

15. An electrodialysis unit as claimed in claim 14, wherein there are two cathode inlet passages, one anode inlet passage, two cathode outlet passages and one anode outlet passages, each of about the same size in order to provide an increased flow rate through the cathode flow paths.

16. An electrodialysis unit as claimed in claim 14 or 15, wherein seals are provided about the through holes to maintain separation of the anode fluid and cathode fluids.

17. A method comprising use of the electrodialysis unit of any preceding claim for the treatment of sea water, preferably use for treatment of ballast water.

18. A method of manufacturing an electrodialysis unit comprising a plurality of cathodes, a plurality of anodes and a plurality of membranes; the method comprising:

arranging the cathodes and anodes alternately in an electrode stack, with membranes in between each cathode and anode;

wherein the cathode and the anode are each formed of a single conductive plate such that within the electrode stack both surfaces of the cathode plates and anode plates are, in use, in conductive contact with the water being treated;

providing a seal for each conductive plate and bonding the seal to the conductive plate, with the seal extending beyond the edges of the conductive plate and contacting the separators on either side of the conductive plate in order to form an enclosed electrode chamber around the conductive plate; and

clamping each conductive plate and seal between non-conductive separators.

19. A method as claimed in claim 18, wherein a thermosetting or vulcanising rubber is used for the seal, and the method comprises applying the rubber to the electrode prior to heat treatment, and then bonding the rubber to the electrode by performing a thermosetting or vulcanising process whilst it is in contact with the electrode.

20. A method as claimed in claim 18, comprising providing openings in the separators exposing the conductive plates in the reaction zones and placing membranes across these openings between anode and cathode, such that the membranes are sandwiched between adjacent electrodes.

21. A method as claimed in any of claims 18 to 20 comprising providing the electrodialysis unit with features as claimed in any of claims 1 to 16.