SUMMARY

[0009] In one aspect of the present disclosure, although it need not be the only or indeed the broadest form, there is provided a seafloor mining system comprising at least one concentrating system that processes seafloor materials; at least one reclaimer machine that collects the processed seafloor materials; and at least one haulage system that receives the processed seafloor materials collected by the reclaimer machine and lifts the processed seafloor materials to a surface vessel; wherein the haulage system is a mechanical haulage system that conveys discrete parcels of seafloor material collected by the reclaimer machine to the surface vessel; wherein the concentrating system, reclaimer machine, and haulage system are decoupled from each other; and wherein the at least one concentrating system comprises a nodule collecting apparatus and a position determination device adapted to determine the position of the nodule collecting apparatus.

[0010] Preferably the at least one concentrating system is adapted to arrange processed seafloor materials on the seafloor and the at least one reclaimer machine is adapted to collect the processed seafloor materials from the arranged processed seafloor materials on the seafloor. Preferably the at least one concentrating system is adapted to arrange the processed seafloor materials in windrows on the seafloor.

Preferably the at least one reclaimer machine is adapted to collect the processed seafloor from the windrows on the seafloor.

[0011] Preferably the at least one concentrating system comprises an undersea vehicle. Preferably the undersea vehicle is towed by a tow vessel, preferably located

on the surface. Preferably the undersea vehicle comprises a nodule collecting apparatus located on the seafloor. Preferably the nodule

temporary storage container is a buffer suspended above the seafloor. Preferably the buffer receives the processed seafloor material from the reclaimer machine via a slurry hose. Preferably the buffer further processes the gathered seafloor material.

[0019] Preferably the temporary storage container is configured to transfer the gathered seafloor material to a container of the haulage system. Preferably the container of the haulage system travels to the temporary storage container and is loaded with a discrete parcel of seafloor material from the temporary storage container. Preferably the container then carries that discrete parcel of seafloor material from the temporary storage container towards the surface.

[0020] Preferably a plurality of containers convey gathered seafloor material from at least one temporary storage container to a single surface vessel. Preferably a plurality of reclaimer machines collect processed seafloor material from the seafloor to the at least one temporary storage container.

[0021] In another aspect of the present disclosure, there is provided a method of mining the seafloor, the method comprising the steps of concentrating desirable seafloor materials by processing seafloor materials with a concentrating system having a nodule collecting apparatus; determining a position of the nodule collecting apparatus using a position determination device; collecting the processed seafloor materials with a reclaimer machine that is decoupled from the concentrating system; conveying collected seafloor materials to a surface vessel using a mechanical haulage system, that is decoupled from the reclaimer machine, that conveys discrete parcels of seafloor material collected by the reclaimer machine to the surface vessel.

[0022] Preferably the step of concentrating desirable seafloor materials comprises towing a nodule collecting apparatus behind a tow vessel, preferably

CLAIMS:

1. A seafloor mining system comprising:

at least one concentrating system that processes seafloor materials;

at least one reclaimer machine that collects the processed seafloor materials; and

at least one haulage system that receives the processed seafloor materials collected by the reclaimer machine and lifts the processed seafloor materials to a surface vessel;

wherein the haulage system is a mechanical haulage system that conveys discrete parcels of seafloor material collected by the reclaimer machine to the surface vessel;

wherein the concentrating system, reclaimer machine, and haulage system are decoupled from each other; and

wherein the at least one concentrating system comprises a nodule collecting apparatus and a position determination device adapted to determine the position of the nodule collecting apparatus.

2. The seafloor mining system of claim 1, wherein the at least one concentrating system is adapted to arrange processed seafloor materials on the seafloor and the at least one reclaimer machine is adapted to collect the processed seafloor materials from the arranged processed seafloor materials on the seafloor.

3. The seafloor mining system of claim 2, wherein the at least one concentrating system is adapted to arrange the processed seafloor materials in windrows on the seafloor and

the at least one reclaimer machine is adapted to collect the processed seafloor from the windrows on the seafloor.

4. The seafloor mining system of any one of the preceding claims, wherein the at least one concentrating system comprises an undersea vehicle.

5. The seafloor mining system of claim 4, wherein the undersea vehicle is towed by a tow vessel located on the surface.

6. The seafloor mining system of claim 5, wherein the nodule collecting apparatus, located on the seafloor, is connected to a steering vehicle adapted to be towed by the tow vessel.

7. The seafloor mining system of claim 6, wherein the position determination device communicates position information of the nodule collecting apparatus to the steering vehicle and/or tow vessel.

8. The seafloor mining system of claim 7, wherein the steering vehicle is adapted to alter the direction of the nodule mining apparatus in

response to receiving position information of the nodule collecting apparatus from the position determination device.

9. The seafloor mining system of any one of claims 6 to 8, wherein the nodule collecting apparatus comprises a plurality of nodule collection devices.

10. The seafloor mining system of claim 9, wherein the nodule collection devices are secured to a support member.

11. The seafloor mining system of claim 9 or 10, wherein each nodule collection device is adapted to collect ore nodules from the seafloor adjacent an underside thereof and communicate those nodules to an outlet pipe.

12. The seafloor mining system of claim 11, wherein the nodule collecting apparatus comprises a combined outlet pipe adapted to receive collected ore nodules from the outlet pipe of each nodule collection device and re-deposit the collected nodules on the seafloor in the form of a windrow.

13. The seafloor mining system of any one of the preceding claims, wherein the haulage system comprises one or more containers.

14. The seafloor mining system of claim 13, wherein the containers are connected to at least one line member that extends at least partially between the seafloor and the surface.

15. The seafloor mining system of claim 14, wherein the line member is driven by a winch.

16. The seafloor mining system of claim 14 or 15, wherein at least a substantial portion of the line member is synthetic rope.

17. The seafloor mining system of any one of claims 13 to 16, wherein each container has a steerable element that enables the container to manoeuvre as it is towed in the water.

18. The seafloor mining system of claim 17, wherein the steerable element is controlled, by actively trimming the steerable element, to guide the container along a path.

19. The seafloor mining system of any one of claims 13 to 18, wherein the container comprises a position determination system.

20. The seafloor mining system of any one of the preceding claims, wherein the at least one reclaimer machine comprises a seafloor vehicle that drives on the seafloor over the processed seafloor material.

21. The seafloor mining system of any one of the preceding claims, wherein the reclaimer machine is adapted to collect a windrow of processed seafloor material on the seafloor without collecting a significant proportion of unprocessed seafloor material from the seafloor.

22. The seafloor mining system of any one of the preceding claims, further comprising a temporary storage container located between the at least one reclaimer machine and the at least one haulage system.

23. The seafloor mining system of claim 22, wherein the at least one reclaimer machine comprises a pump to hydraulically pump the processed seafloor material in slurry form to the temporary storage container.

24. The seafloor mining system of claim 22 or 23, wherein the temporary storage container is a buffer suspended above the seafloor.

25. The seafloor mining system of claim 24, wherein the buffer receives the processed seafloor material from the reclaimer machine via a slurry hose.

26. The seafloor mining system of claim 24 or 25, wherein the buffer further processes the gathered seafloor material.

27. The seafloor mining system of any one of claims 22 to 26, wherein the temporary storage container is configured to transfer the gathered seafloor material to a container of the haulage system.

28. The seafloor mining system of claim 27, wherein the container of the haulage system travels to the temporary storage container and is loaded with a discrete parcel of seafloor material from the temporary storage container and the container then carries that discrete parcel of seafloor material from the temporary storage container towards the surface.

29. A method of mining the seafloor, the method comprising the steps of:

concentrating desirable seafloor materials by processing seafloor materials with a concentrating system having a nodule collecting apparatus;

determining a position of the nodule collecting apparatus using a position determination device;

collecting the processed seafloor materials with a reclaimer machine that is decoupled from the concentrating system;

conveying collected seafloor materials to a surface vessel using a mechanical haulage system, that is decoupled from the reclaimer machine, that conveys discrete parcels of seafloor material collected by the reclaimer machine to the surface vessel.

30. The method of claim 29, wherein the step of concentrating desirable seafloor materials comprises towing the nodule collecting apparatus behind a tow vessel.

31. The method of claim 30, wherein the tow vessel is located on the surface and tows the nodule collecting apparatus along the seafloor.

32. The method of claim 30 or 31, wherein an undersea steering vehicle is disposed between the tow vessel and the nodule collecting apparatus and is adapted to alter the direction of the nodule collecting apparatus.

33. The method of any one of claims 29 to 32, wherein the step of determining the position of the nodule collecting apparatus comprises determining when the nodule collecting apparatus deviates from a predetermined path.

34. The method of claim 33, wherein when the nodule collecting apparatus is determined to deviate from a predetermined path the direction of the nodule collecting apparatus is altered to return the nodule collecting apparatus to the predetermined path.

35. The method of any one of claims 29 to 34, wherein the step of conveying collected seafloor materials to a surface vessel comprises transferring collected seafloor material to at least one container located at or near the seafloor.

36. The method of claim 35, wherein the method further comprises the step of towing the container to the surface by at least one line member.

37. The method of claim 36, wherein the step of towing the container to the surface comprises guiding the container using at least one steerable element of the container.

38. The method of any one of claims 35 to 37, wherein the step of collecting the seafloor material comprises transferring the collected seafloor materials from the reclaimer machine to a temporary storage container via a pipe in slurry form.

39. The method of claim 38, wherein the step of transferring collected seafloor material to at least one container located at or near the seafloor comprises transferring collected seafloor material from the temporary storage container to the container.