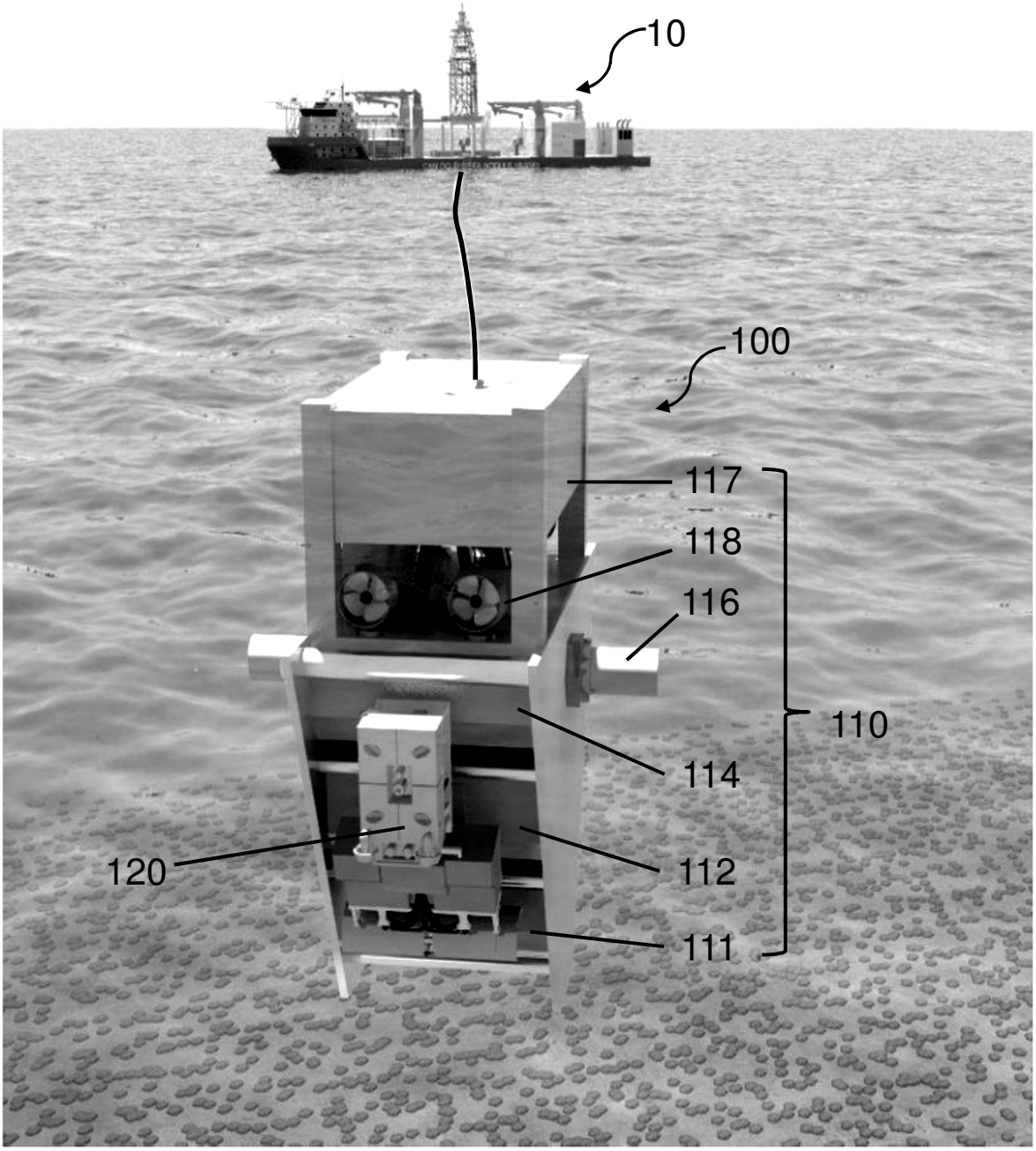


Figure 1A

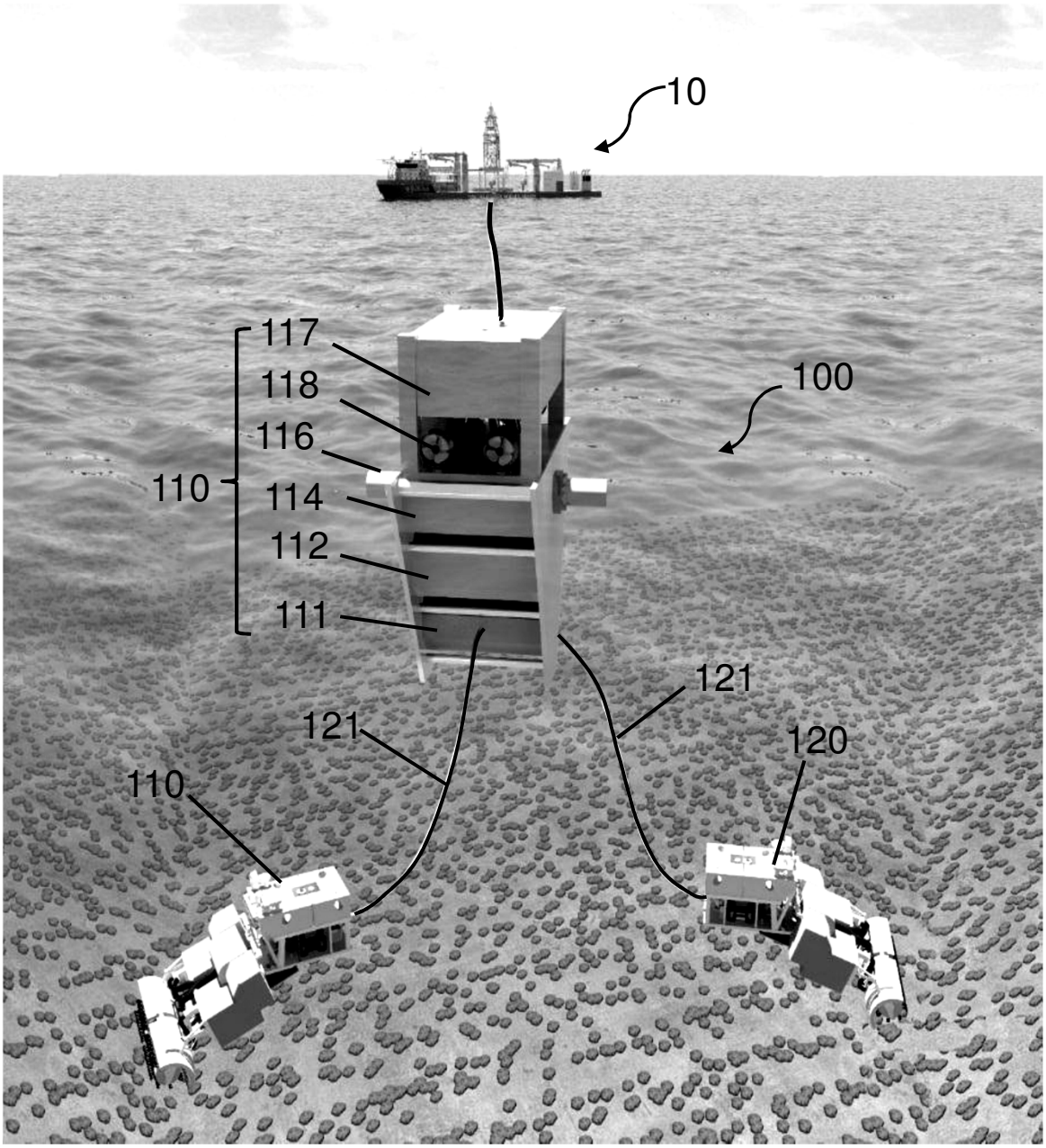


Figure 1B

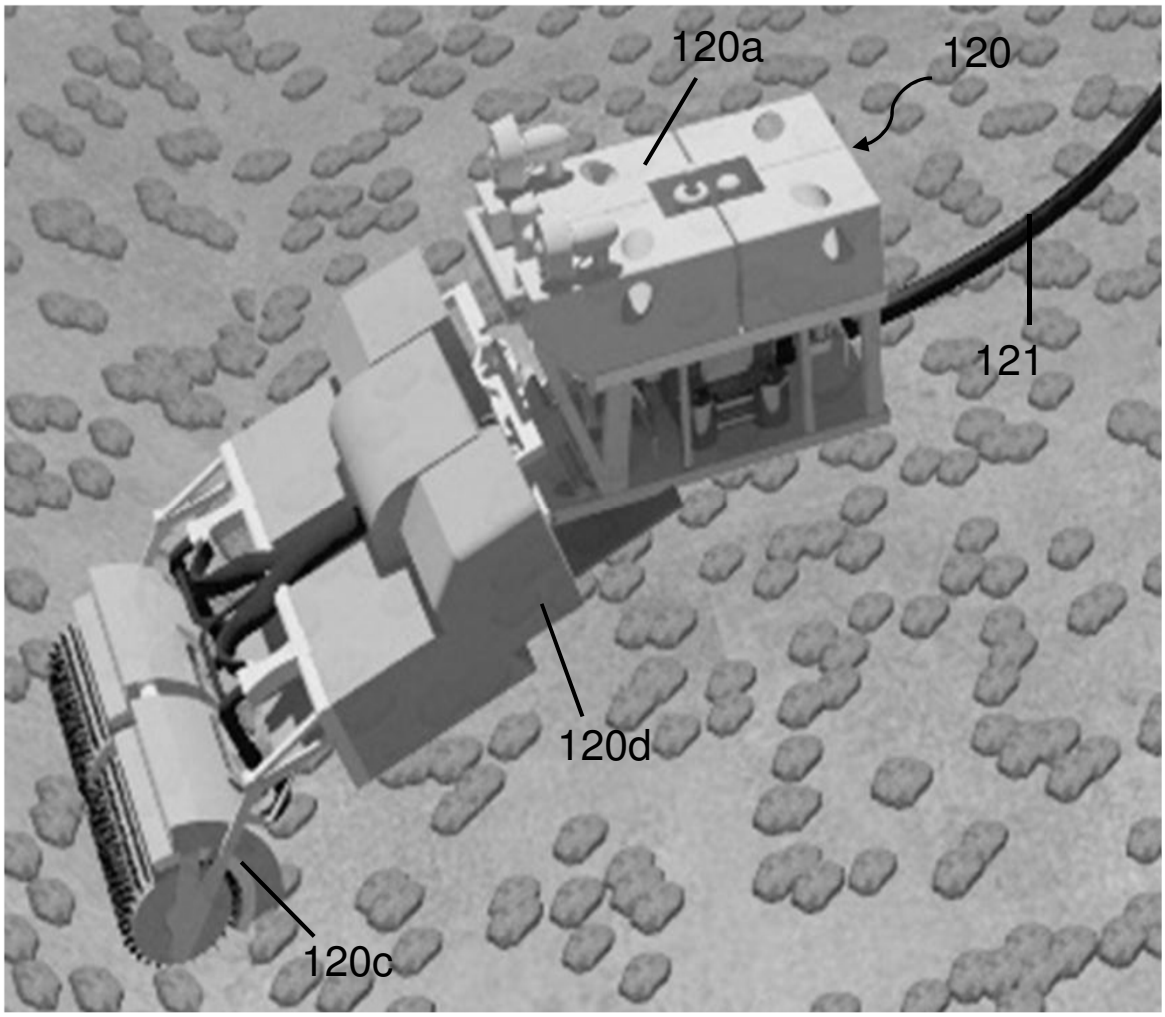


Figure 1C

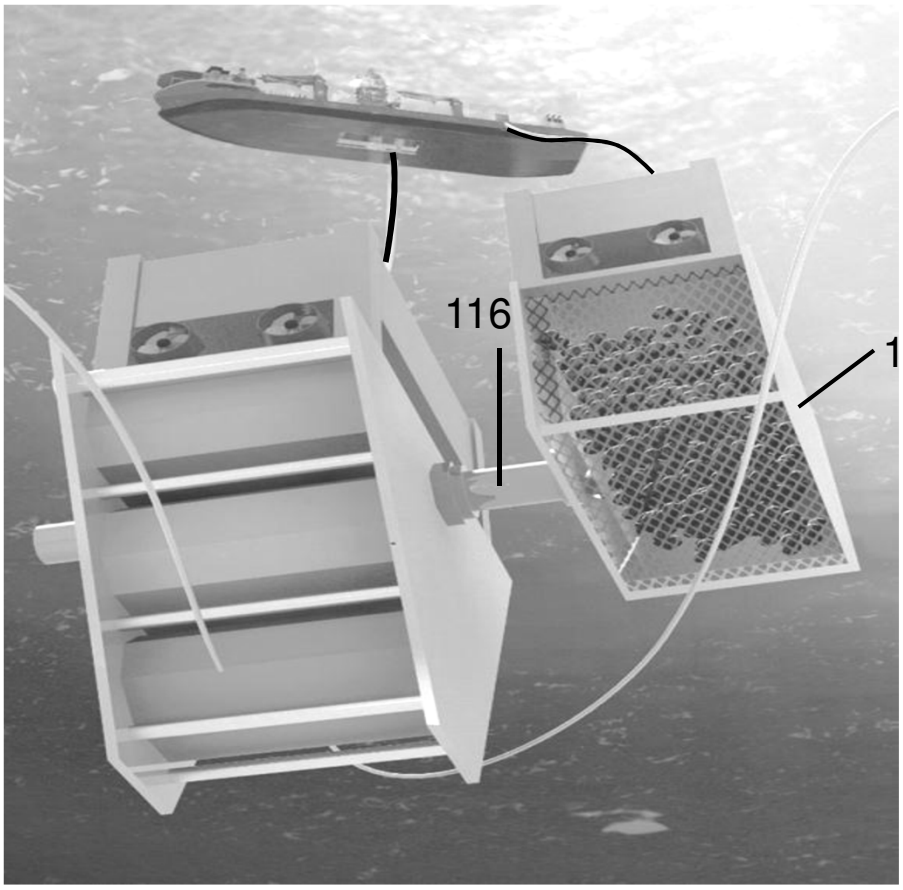


Figure 1D

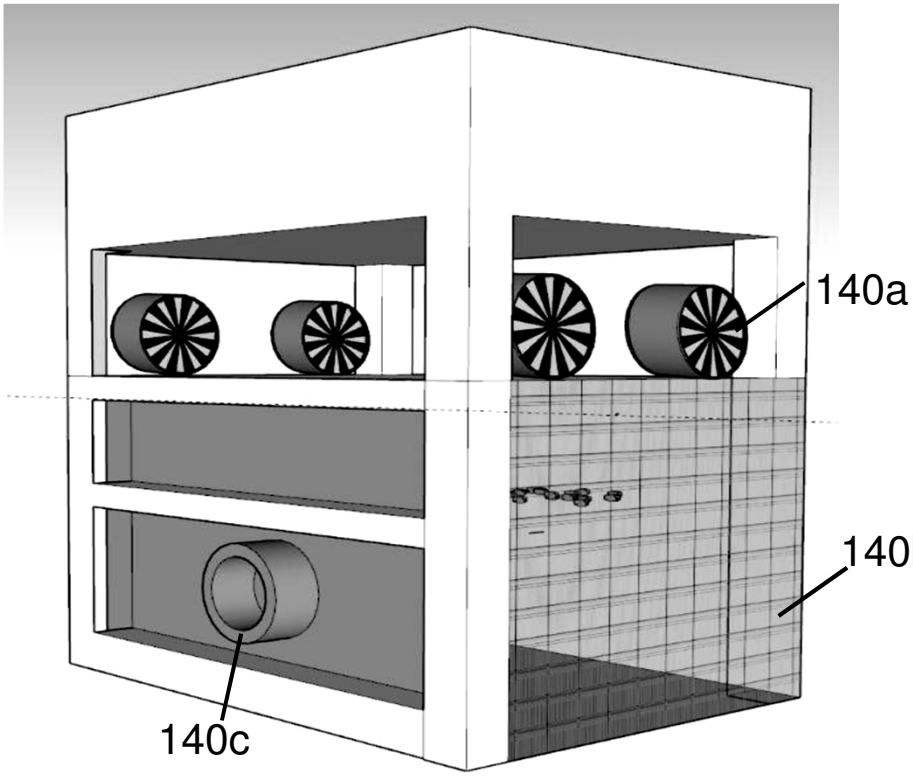


Figure 1E

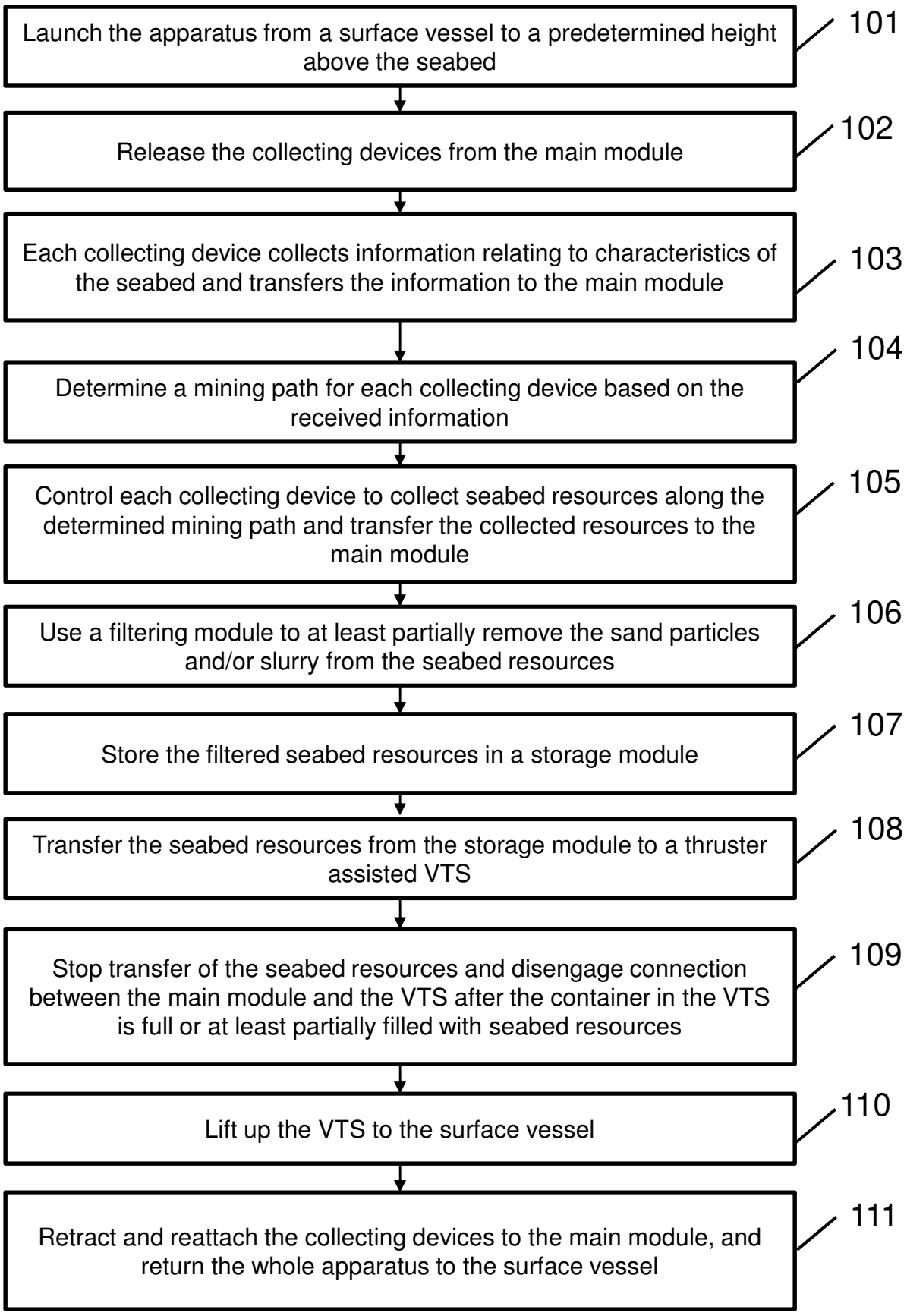

Launch the apparatus from a surface vessel to a predetermined height above the seabed
101
Release the collecting devices from the main module
102
Each collecting device collects information relating to characteristics of the seabed and transfers the information to the main module
103
Determine a mining path for each collecting device based on the received information
104
Control each collecting device to collect seabed resources along the determined mining path and transfer the collected resources to the main module
105
Use a filtering module to at least partially remove the sand particles and/or slurry from the seabed resources
106
Store the filtered seabed resources in a storage module
107
Transfer the seabed resources from the storage module to a thruster assisted VTS
108
Stop transfer of the seabed resources and disengage connection between the main module and the VTS after the container in the VTS is full or at least partially filled with seabed resources
109
Lift up the VTS to the surface vessel
110
Retract and reattach the collecting devices to the main module, and return the whole apparatus to the surface vessel
111

Figure 1F

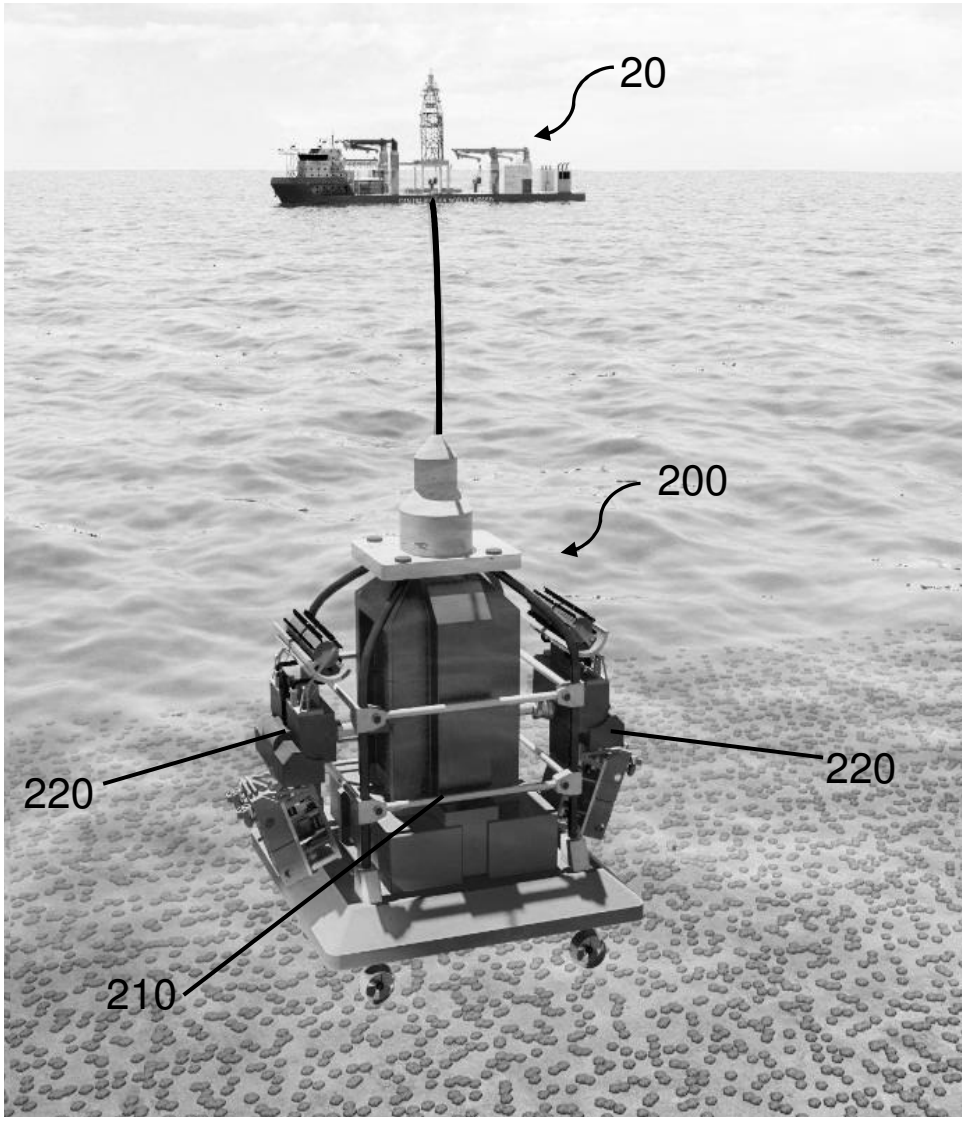


Figure 2A

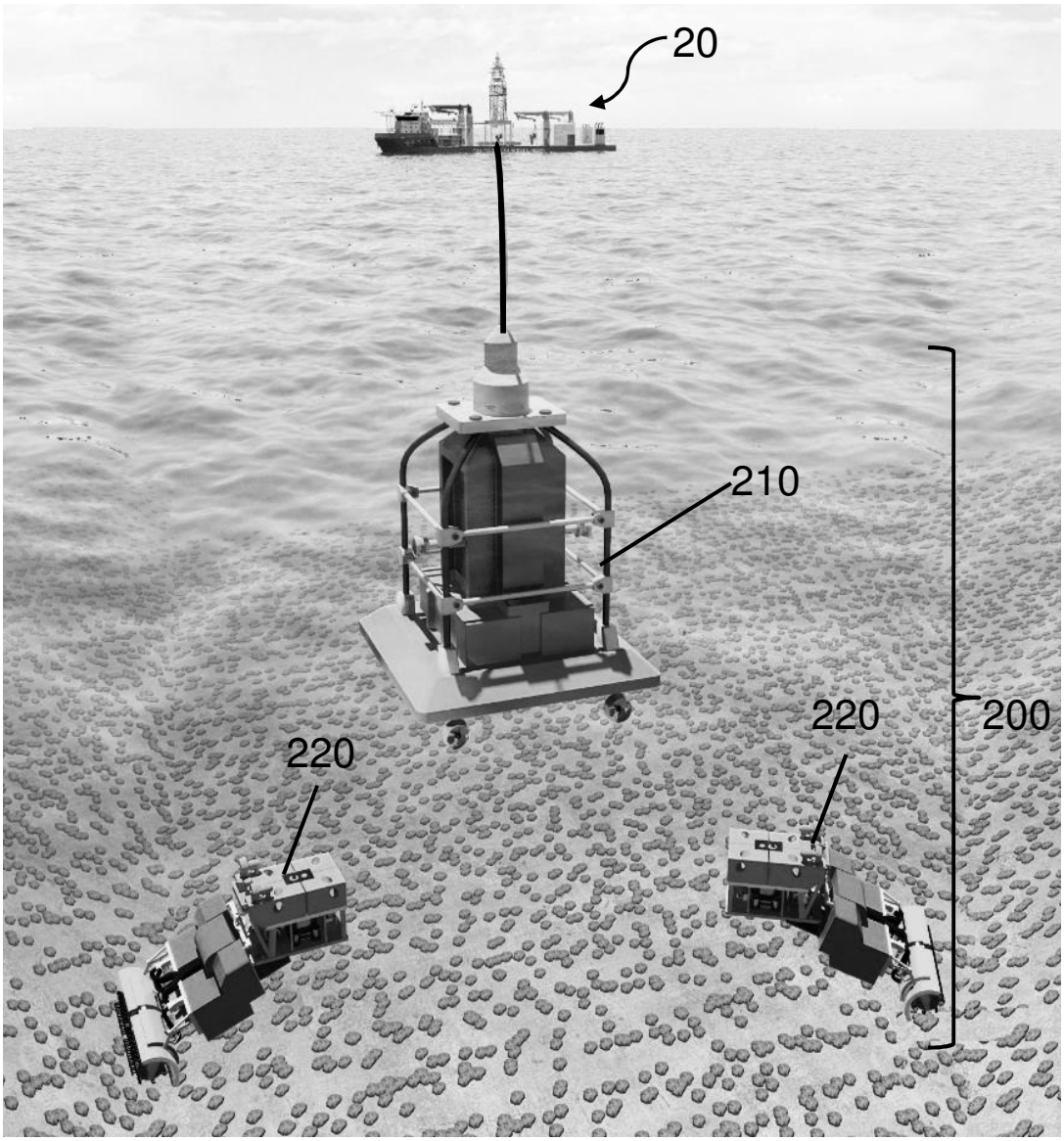


Figure 2B

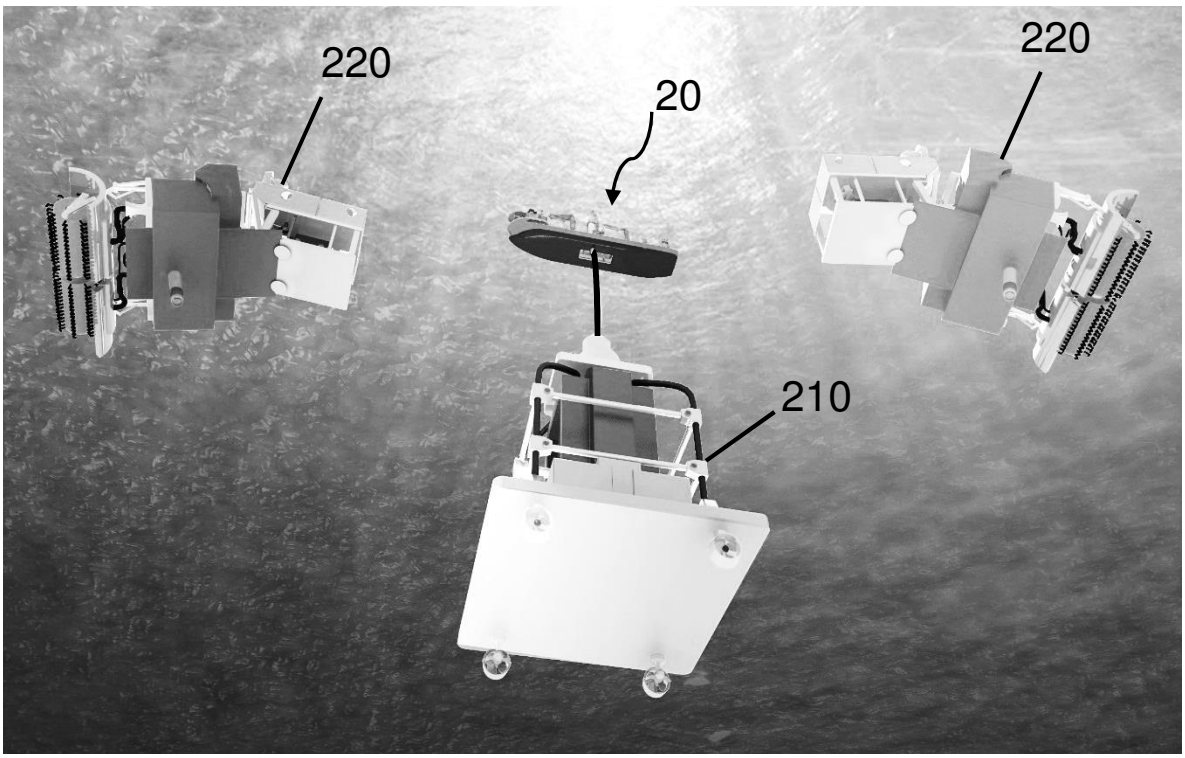


Figure 2C

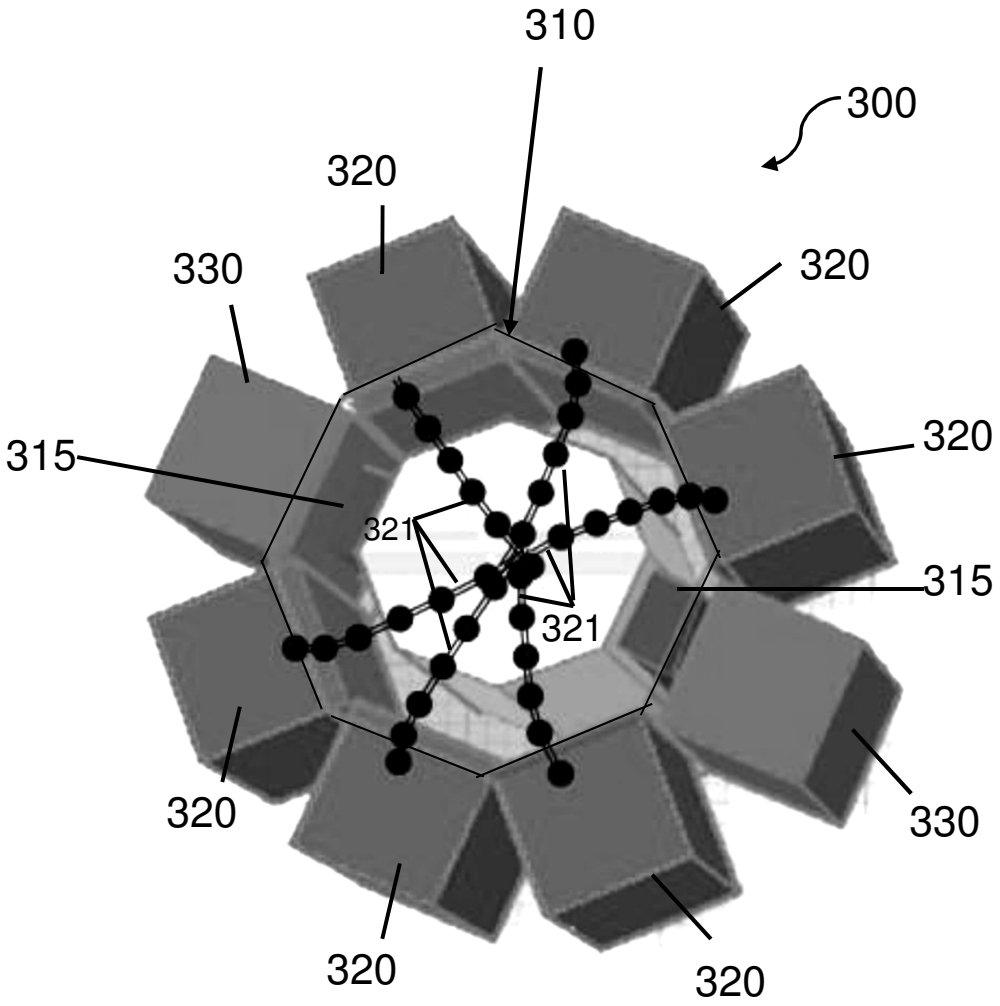


Figure 3A

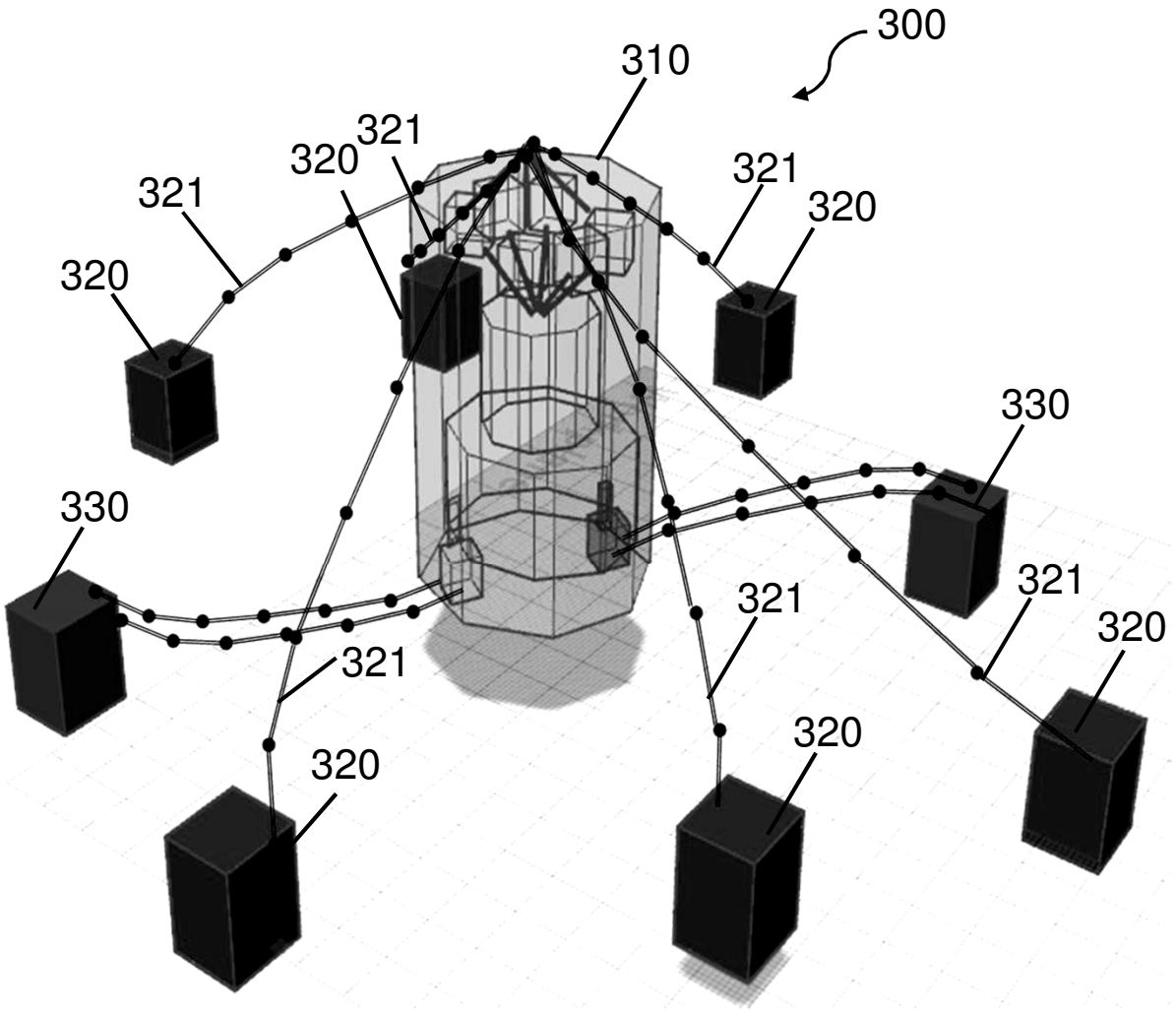


Figure 3B

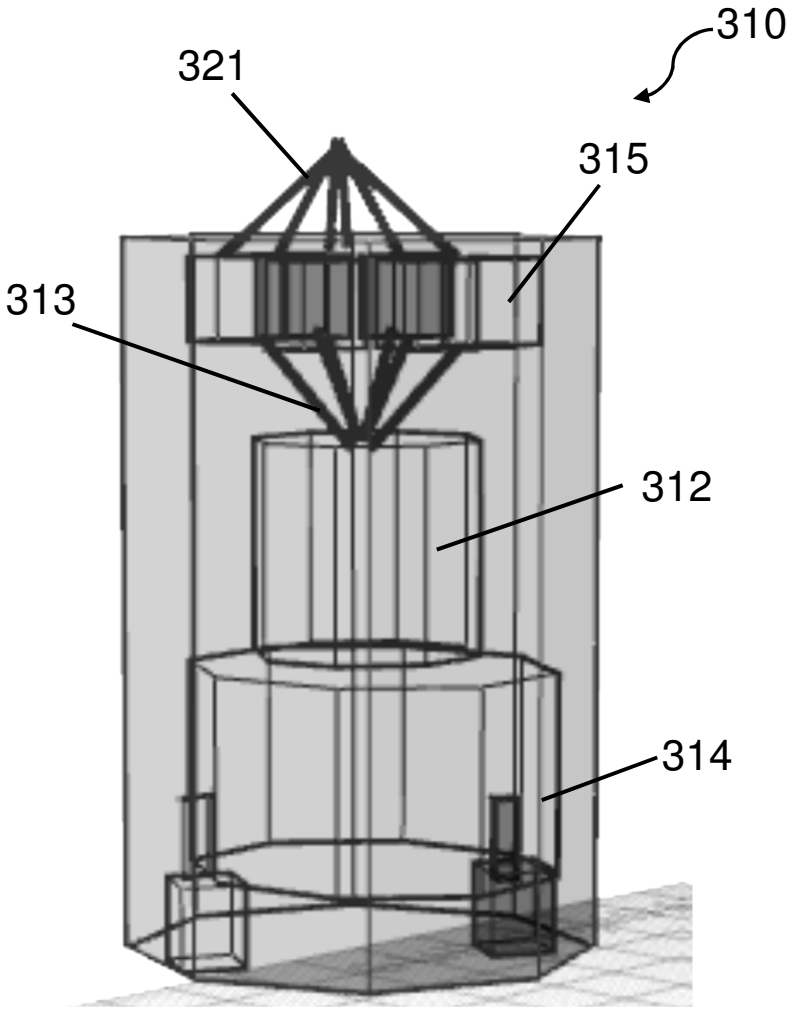


Figure 3C

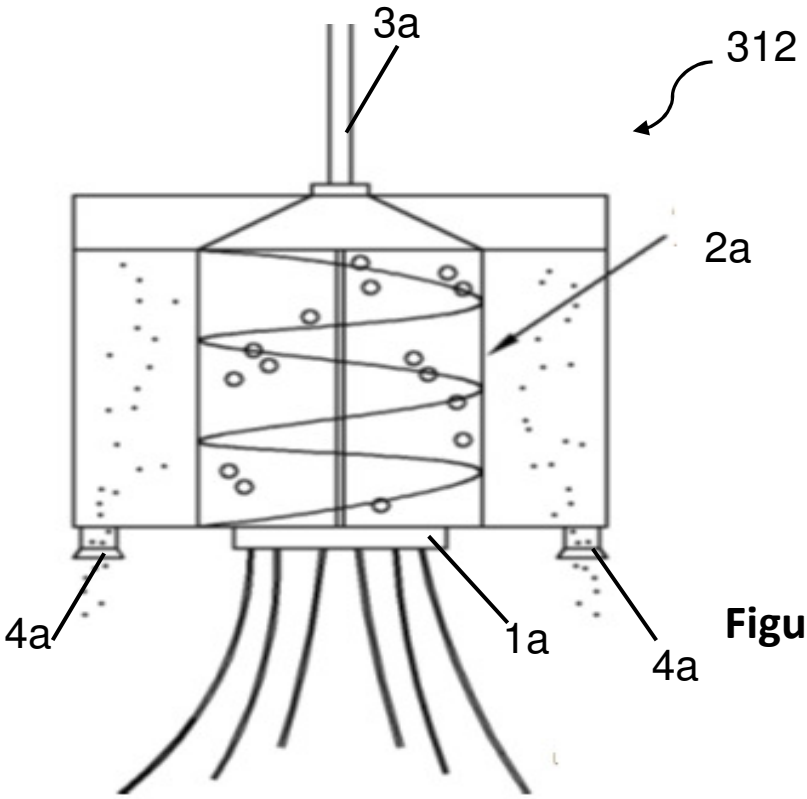


Figure 4A

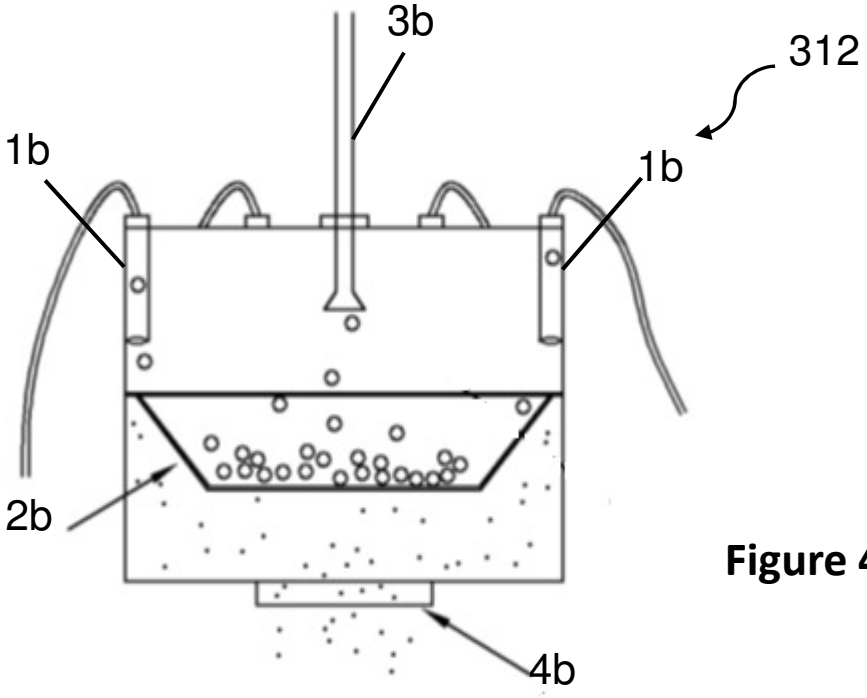


Figure 4B

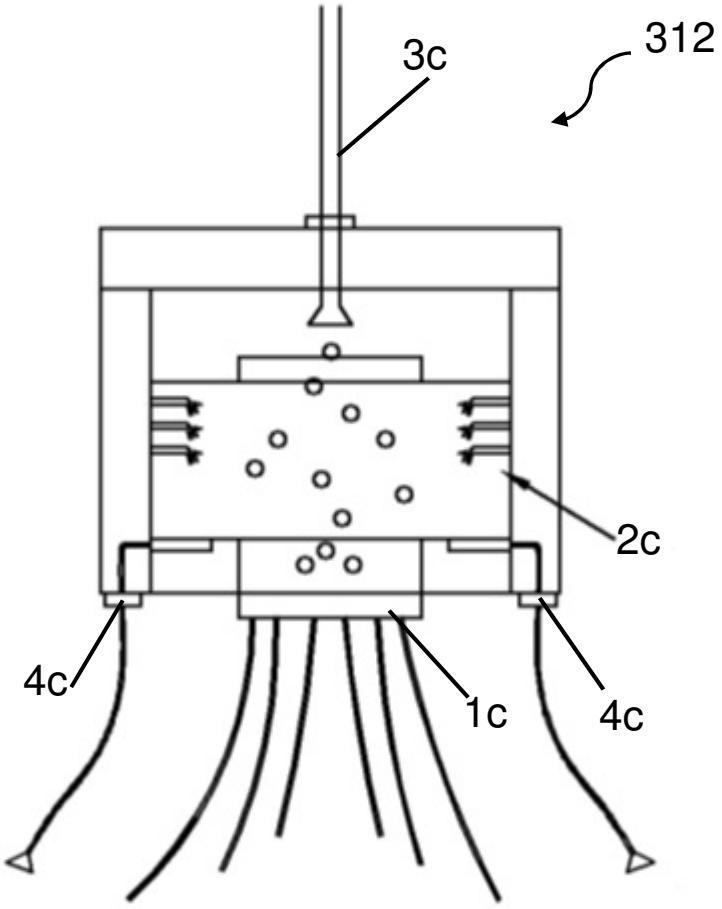


Figure 4C

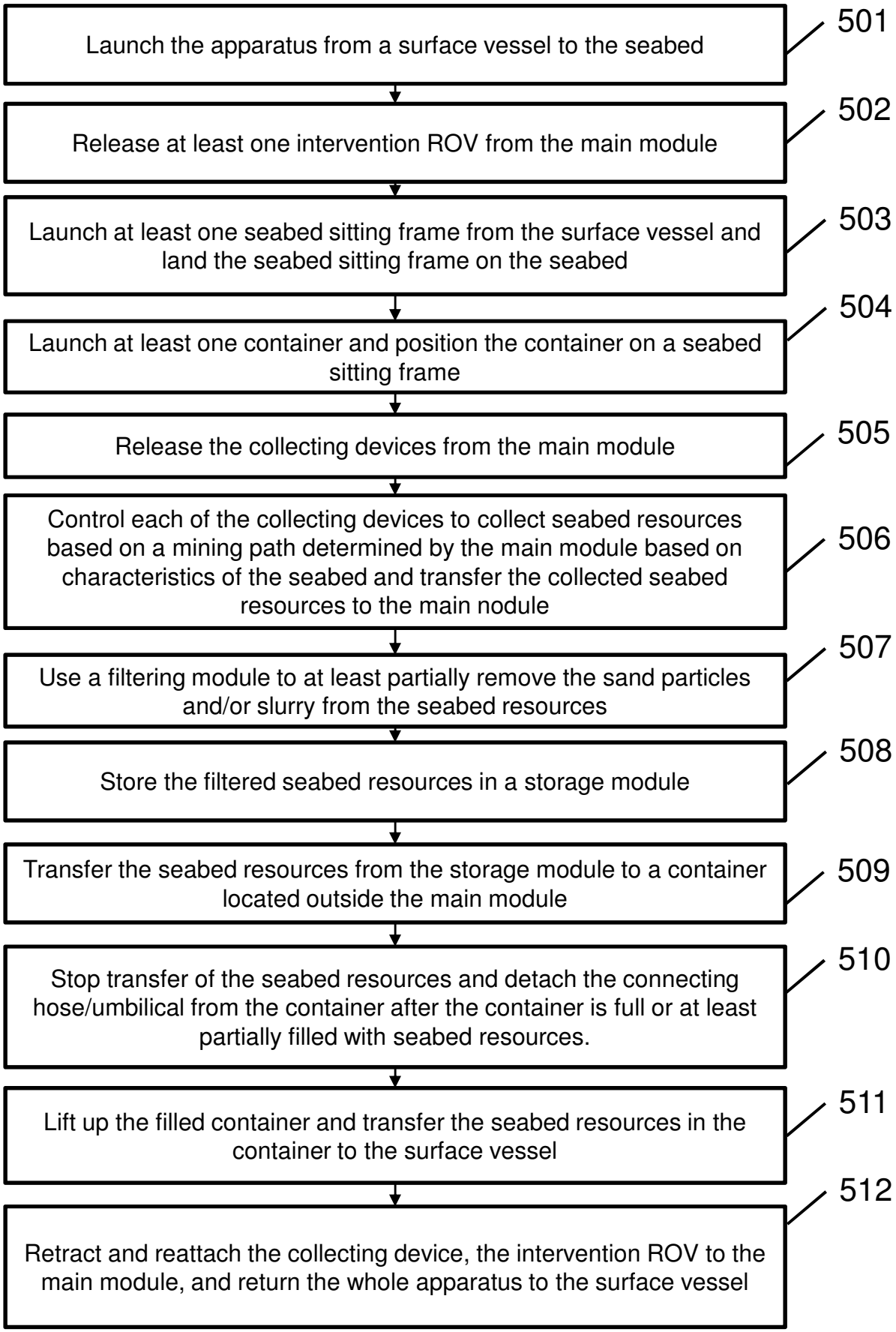

Launch the apparatus from a surface vessel to the seabed
501
Release at least one intervention ROV from the main module
502
Launch at least one seabed sitting frame from the surface vessel and land the seabed sitting frame on the seabed
503
Launch at least one container and position the container on a seabed sitting frame
504
Release the collecting devices from the main module
505
Control each of the collecting devices to collect seabed resources based on a mining path determined by the main module based on characteristics of the seabed and transfer the collected seabed resources to the main nodule
506
Use a filtering module to at least partially remove the sand particles and/or slurry from the seabed resources
507
Store the filtered seabed resources in a storage module
508
Transfer the seabed resources from the storage module to a container located outside the main module
509
Stop transfer of the seabed resources and detach the connecting hose/umbilical from the container after the container is full or at least partially filled with seabed resources.
510
Lift up the filled container and transfer the seabed resources in the container to the surface vessel
511
Retract and reattach the collecting device, the intervention ROV to the main module, and return the whole apparatus to the surface vessel
512

Figure 5

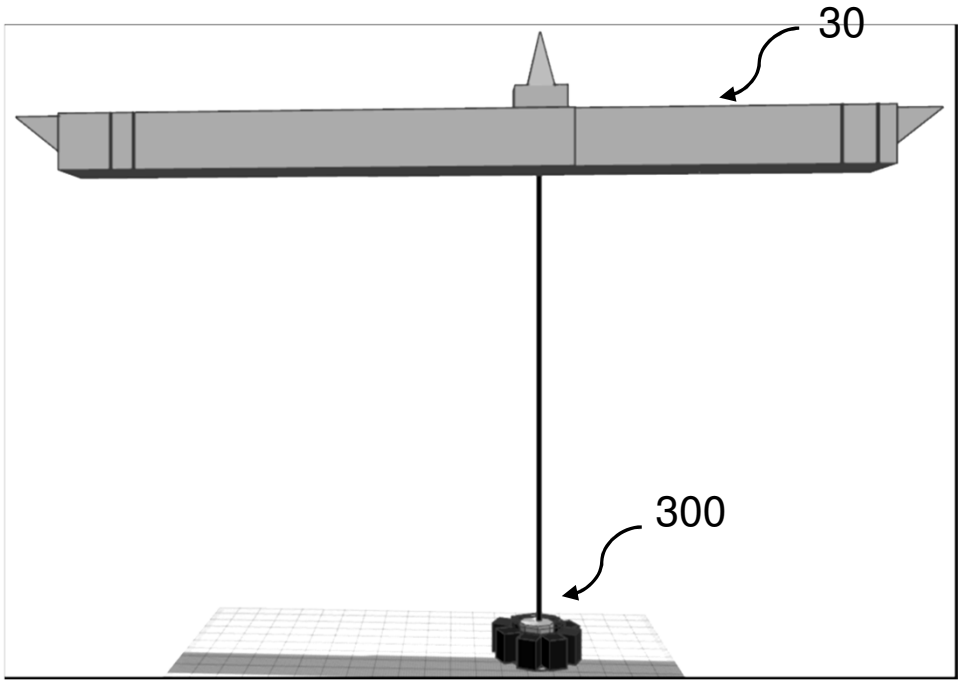


Figure 6A

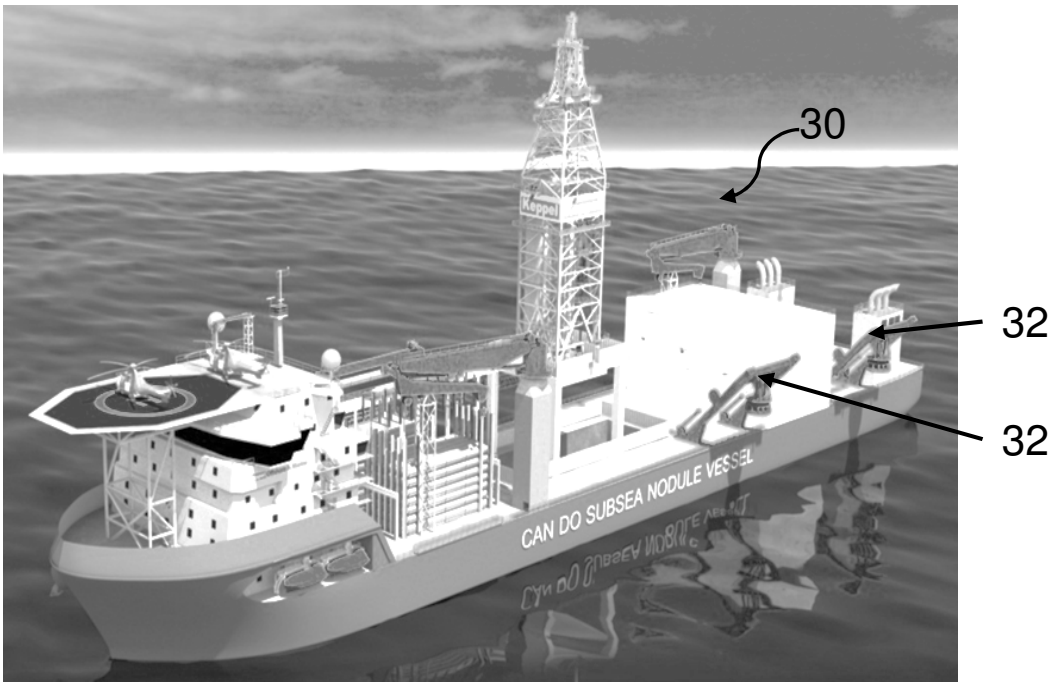


Figure 6B

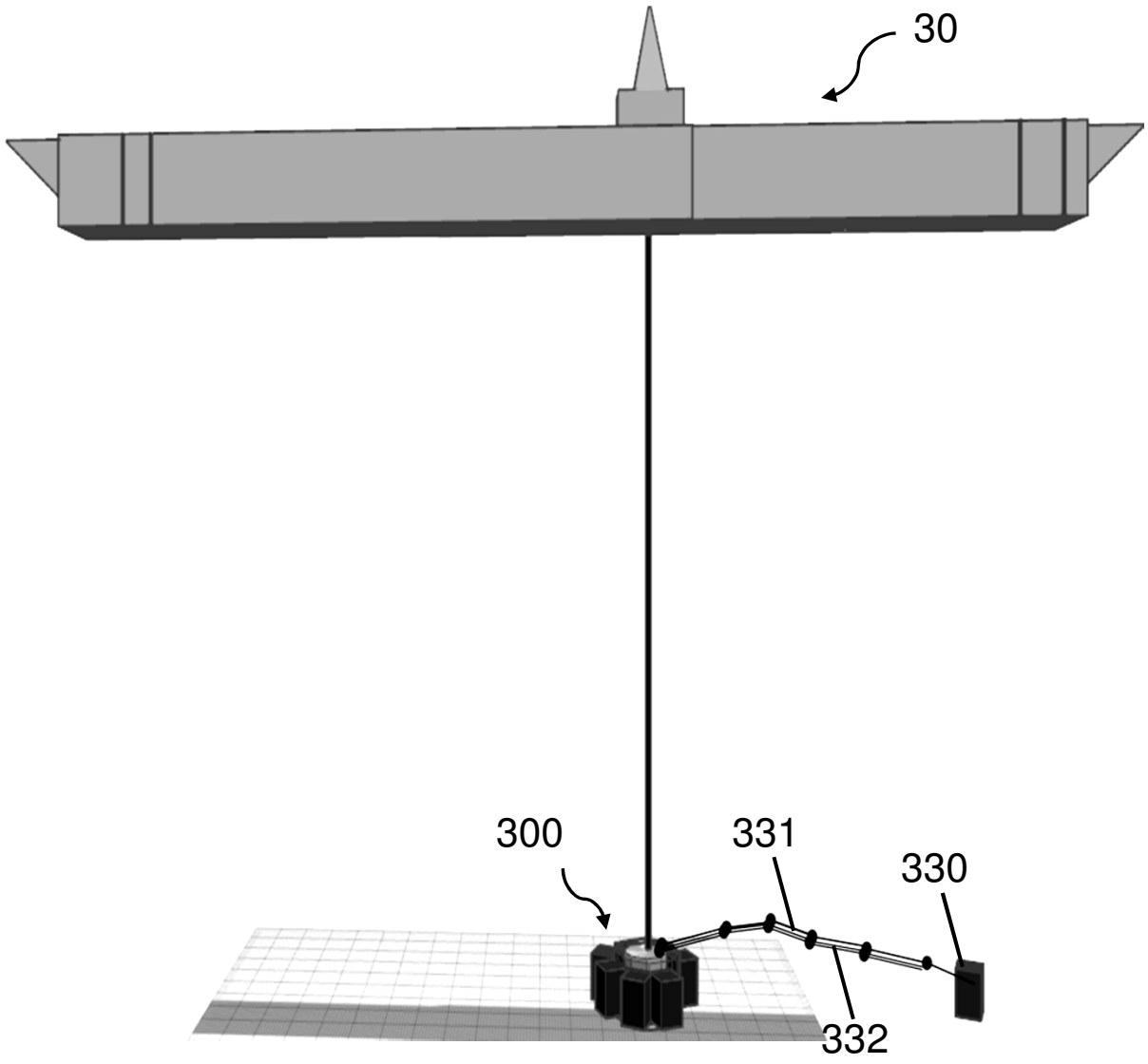


Figure 7

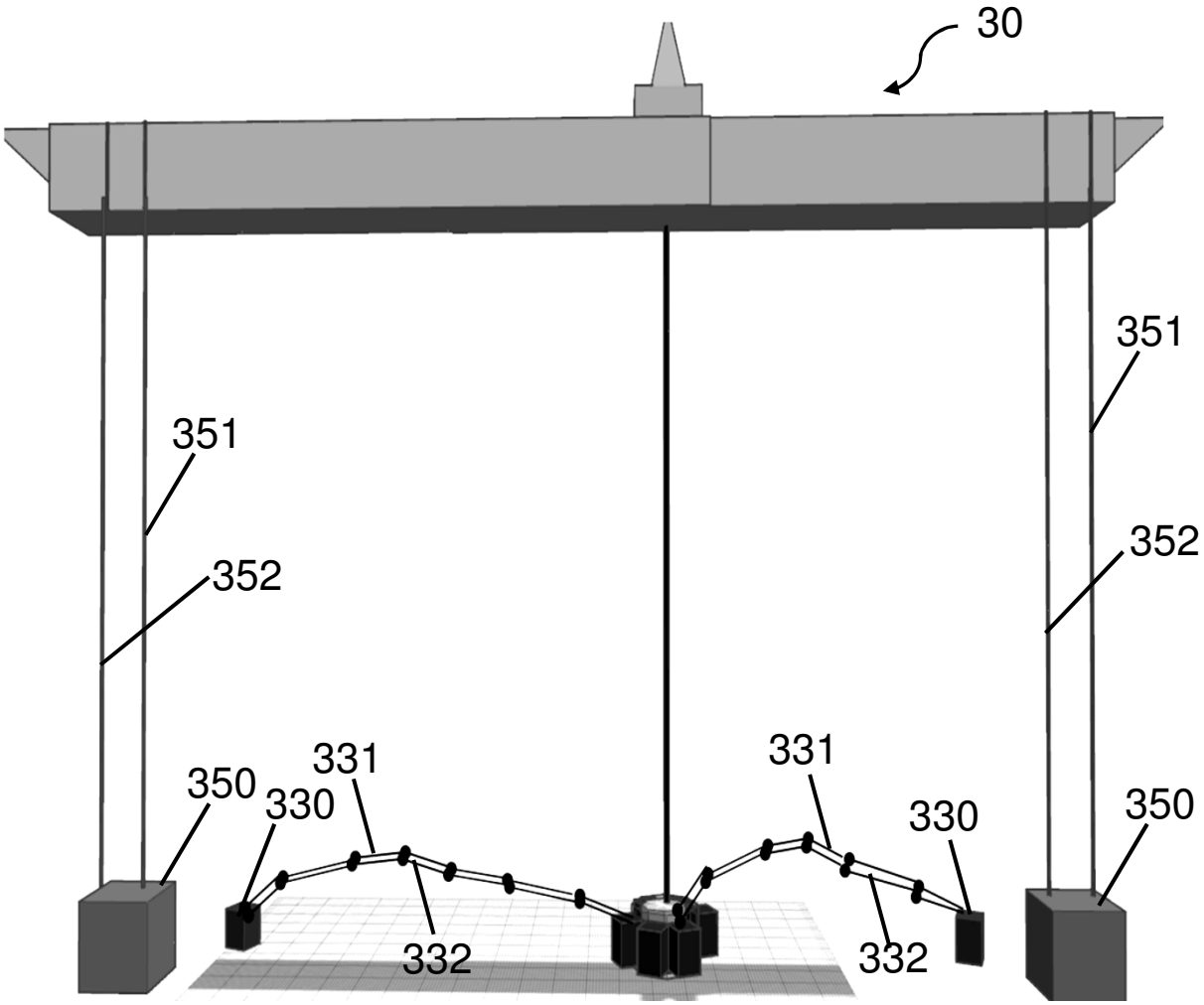


Figure 8

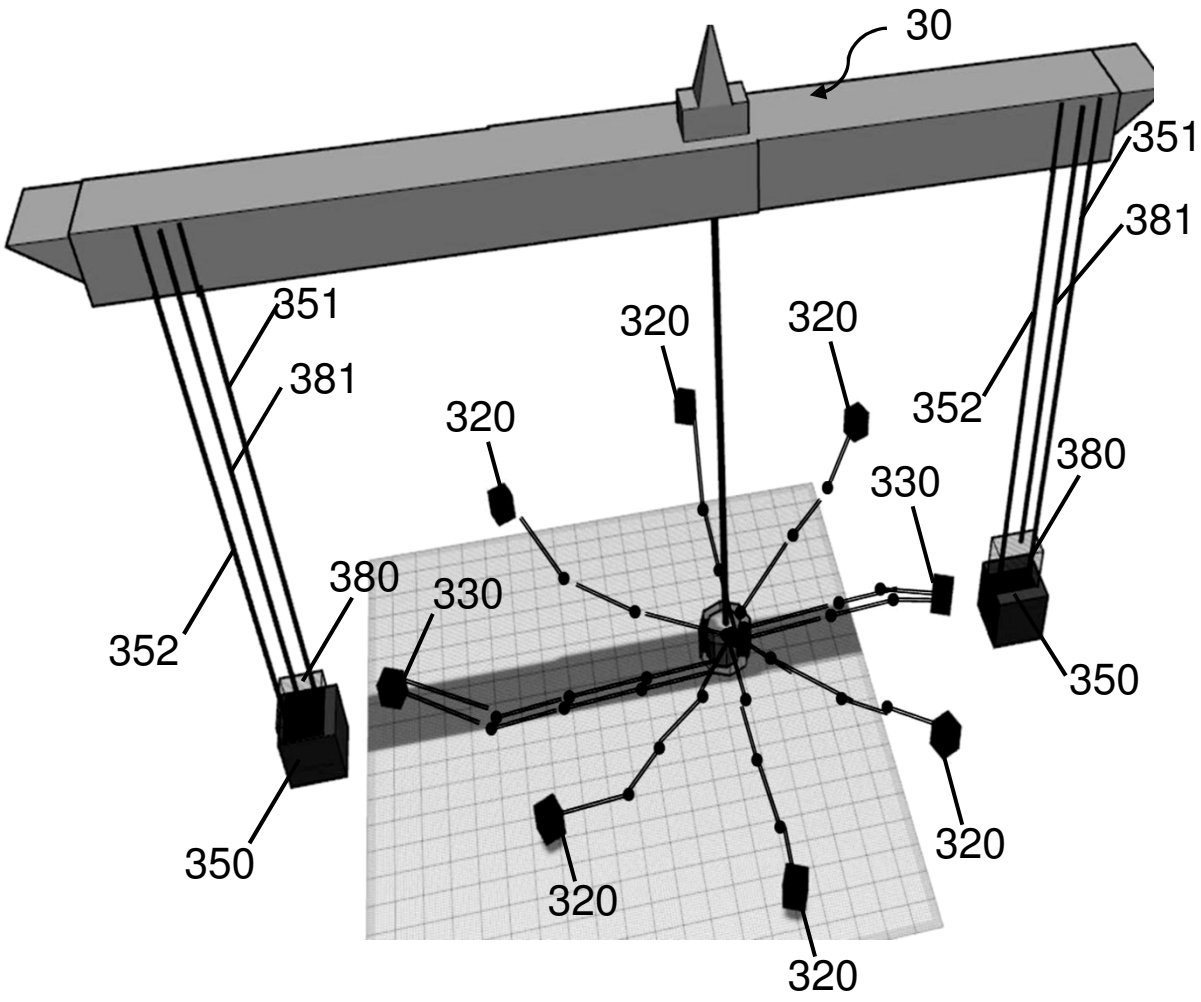

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Figure 9

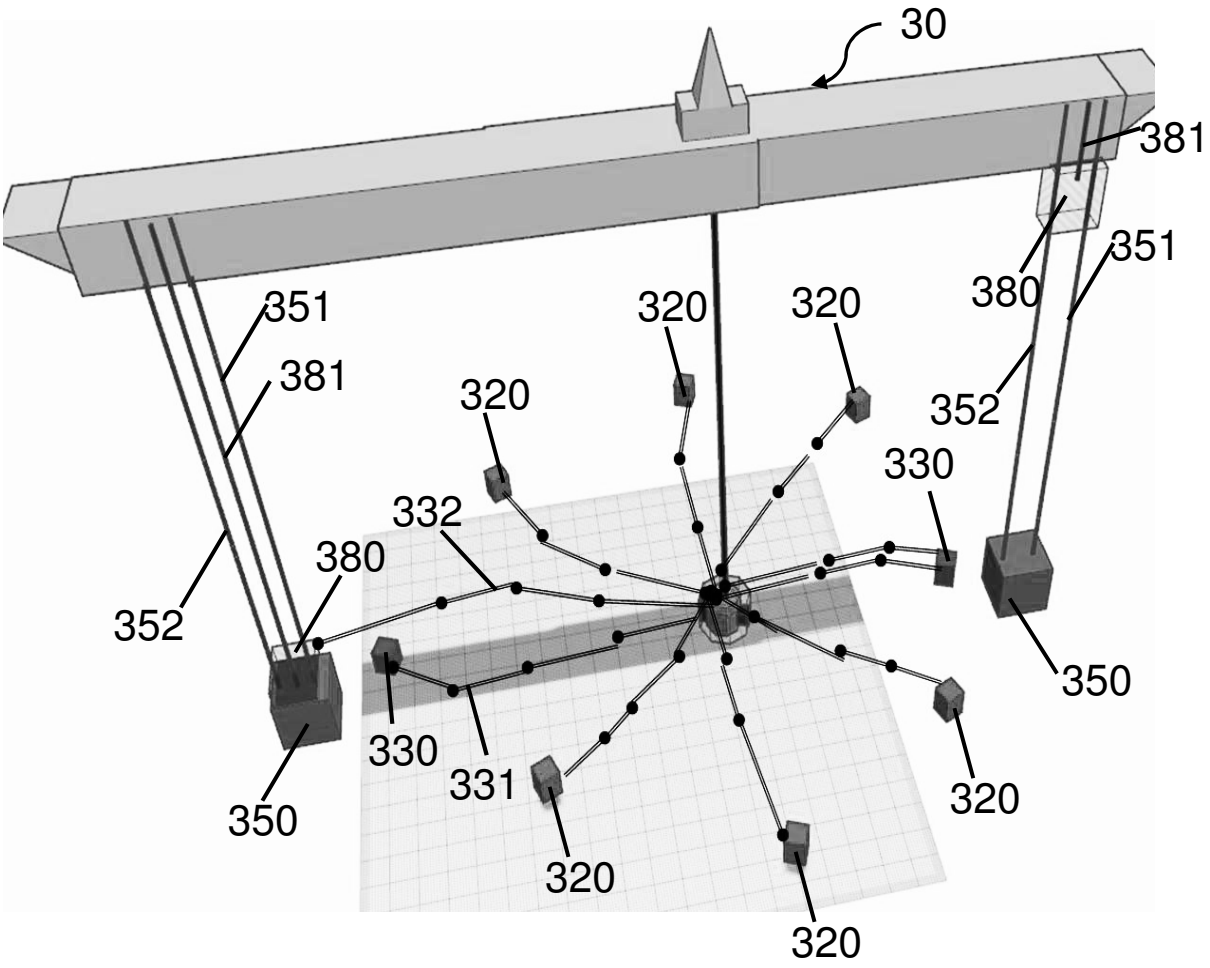

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Figure 10