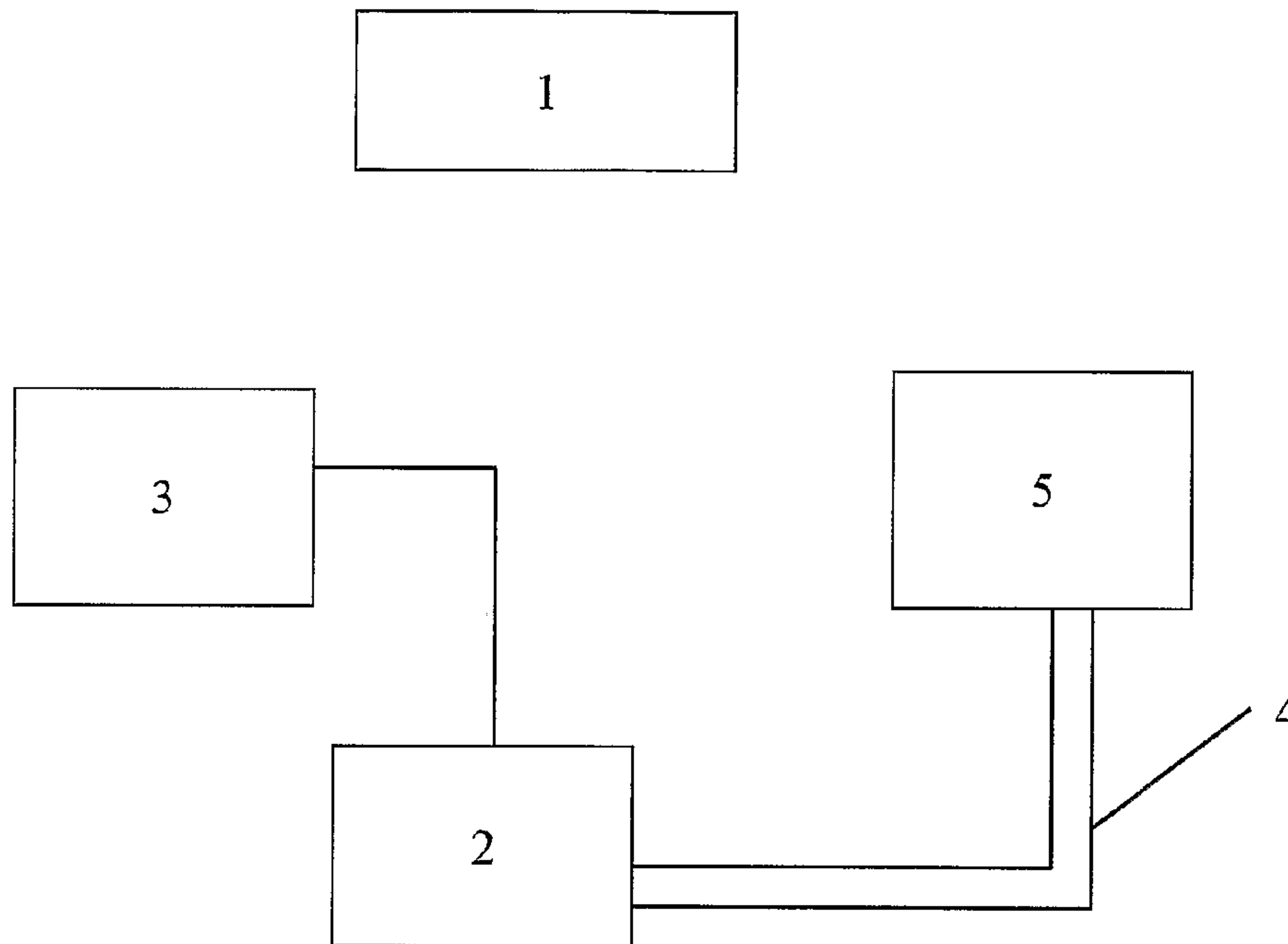




(86) Date de dépôt PCT/PCT Filing Date: 2004/12/14
 (87) Date publication PCT/PCT Publication Date: 2005/11/10
 (85) Entrée phase nationale/National Entry: 2006/12/04
 (86) N° demande PCT/PCT Application No.: RU 2004/000497
 (87) N° publication PCT/PCT Publication No.: 2005/106130
 (30) Priorité/Priority: 2004/05/05 (RU2004113850)

(51) Cl.Int./Int.Cl. *E02B 15/04* (2006.01),
B01J 20/00 (2006.01)
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(54) Titre : PROCEDE DE PURIFICATION D'EAU ET DE DEPOTS DE FOND DE PLANS D'EAU ET SYSTEME DE
PURIFICATION CORRESPONDANT
 (54) Title: METHOD FOR CLEANING WATER AND BOTTOM SEDIMENTS OF WATER RESERVOIRS AND CLEANING
SYSTEM FOR CARRYING OUT SAID METHOD



(57) **Abrégé/Abstract:**

The invention relates to environment protection and can be used for removing oil and petroleum products from water and/or bottom sediments of natural and anthropogenic reservoirs and watercourses where said oil and petroleum products are introduceable into water bodies during production, transport and storage. The inventive method consists in setting a surface cleaning module (1) consisting of active booms pre-filled with cleaning agent on a water surface. Said cleaning agent comprises 2-25 % of alumocilicates, 55-96 % of organic substances and 2-20 % of mineral fertilisers. Simultaneously, a floater (2) is lowered on the reservoir bottom and supplied with a water-air mixture from a unit (3) supplying said mixture. The activation of bottom sediments makes it possible to separate oil and petroleum products therefrom and to transport floated substances through a flexible pipe (4) to a floating container-sediment box (5) where said oil and petroleum products are localised.

ABSTRACT

The invention relates to environment protection and can be used for removing oil and petroleum products from water and/or bottom sediments of natural and anthropogenic reservoirs and watercourses where said oil and petroleum products are introduced into water bodies during production, transport and storage. The inventive method consists in setting a surface cleaning module consisting of active booms pre-filled with cleaning agent on a water surface. Said cleaning agent comprises 2-25 % of aluminosilicates, 55-96 % of organic substances and 2-20 % of mineral fertilisers. Simultaneously, a floater is lowered on the reservoir bottom and supplied with a water-air mixture from a unit supplying said mixture. The activation of bottom sediments makes it possible to separate oil and petroleum products therefrom and to transport floated substances through a flexible pipe to a floating container-sediment box where said oil and petroleum products are localised.

METHOD FOR CLEANING WATER AND BOTTOM SEDIMENTS OF WATER RESERVOIRS AND CLEANING SYSTEM FOR CARRYING OUT SAID METHOD

The invention relates to the environment protection and can be used for removing oil and petroleum products from water and/or bottom sediments of natural and anthropogenic reservoirs and watercourses where said oil and petroleum products hit into natural water objects during oil production, transport and storage.

Method for oil decontamination of waters and soils using application of hydrocarbons-oxidizing bacteria preparation for contaminated area is known (see Patent of Russian Federation № 2104248 MPK C02F 3/34, published 10.01.1998). Before application microbial preparation is cultivated on the medium containing hydrocarbons substrate of contaminated site. The main disadvantage of this method is its high cost because of expensive preparations. Another one is irrationality of microbial preparations application for contaminated sites where these microbes usually inhabit.

Another invention known – the plant containing module for collection and transfer of bottom sediments, primary purification filter, block for feeding of precipitator at the entry of primary purification filter (its exit is communicated with entry of the separator), device for withdrawal of heavy contamination particles, reservoirs for oil and petroleum products collection, sediments and purified water; also the filter and the pump. The first exit of the separator is communicated with the reservoir for sediment collection and the reservoir for water collection through the pump and device for sediment thickening. The second exit is communicated with the reservoir for oil and the petroleum collection through the filter. The third exit is communicated with device for withdrawal of heavy contamination particles, and the fourth one is communicated with the second exit of the reservoir for purified water collection through the acoustic filter. Disadvantage of the plant is its complexity in operation and also high cost. Besides that, the plant doesn't allow cleaning of large water reservoirs, because bottom sediments pumping from distant sites on shore and their processing are of high costs.

Certain method of oil decontamination of water surface was selected as a prototype (Patent of Russian Federation № 2159307 MPK E02B15/04, published 20.11.2000). It contains the application of cotton-comprising sorbent for contaminated surface. This sorbent, shaped as mats, is placed as monolayer to a cassette cover and fixed by holders. An additional

cassette cover allows arrangement of 10-15 separate mats in cassettes. This accelerates either transportation of sorbent to the site of contamination or its removing. Then cassette cover with mats is transported by auxiliary vessel or directly by water surface to the concrete site of oil spill. Disadvantages of the method are low efficiency of oil decontamination of water reservoirs because there is no any cleaning of bottom sediments. Bottom sediments determine water ecosystem production very largely by means of benthos invertebrates, playing important role in fish nutrition.

Another one is that unrefined oil-containing bottom sediments may cause repeated the contamination of surface waters while dismissal of oil and oil products.

The main technical result of present invention is increasing of decontamination efficiency for water reservoirs up to 70 meters depth, because the suggested method and cleaning system allow oil decontamination not for surface waters only, but for bottom sediments. Moreover decontamination process takes place directly in water at the scene of oil spill. Oil and oil products removal from water and bottom sediments accelerate biological natural cleaning and restore qualitative and quantitative parameters of water ecosystems.

Stated technical effect is achieved by some improvements. The method includes placing active booms on the water surface. Active booms realized as mats made of cotton or synthetic material filled with cleansing stuff. In accordance with offered solution aeration and/or flotation of water during decontamination are carried out. The cleansing stuff of active booms contains aluminum silicates, organic substance and mineral fertilizers in followed ratio, %:

- aluminum silicates 2-25;
- organic substance 55-96;
- mineral fertilizers 2-20.

In respect of cleaning system for carrying out the method, technical effect is achieved by including of module for bottom sediments decontamination. This module contains floater, connected with floater with natatory precipitation tank. Besides that, the system contains aeration block.

Example of realizing: Figure 1 presents scheme of the suggested system for carrying out the method. This system includes module for surface decontamination 1, containing of sections of active booms; module for bottom sediments cleaning, implemented as floater 2 with connected block of water-air mixture supply 3. Flexible piping 4 connects floater 2 with natatory precipitation tank 5.

Decontamination of water and bottom sediments using suggested method is accomplished in the following way: Module for surface decontamination 1 (sections of active booms, realized as cotton mats) is placed on the water surface. Active booms should be filled with cleansing stuff preliminary. Cleansing stuff contains aluminum silicates – 2-25%, organic substance – 55-96% and mineral fertilizers – 2-20%. At the same time water-air mixture is supplying to floater 2, lowered to the bottom. As a result of bottom sediments stirring up, oil and oil products separation and floating substance transportation to the precipitation tank 5 by flexible piping 4 occur. Then oil and oil products are concentrated in the tank with no more that 10% of organic-mineral dirt. Natatory precipitation tank 5 is transported to the shore, where oil extraction and transportation to the site of processing take place. Remains of dirt excavated from the bottom are collected with active booms. Increasing of cleaning ability of active booms happens due to activation of their microbial community by action of aluminum silicates, organic substance and mineral fertilizers.

After water reservoir cleaning, active booms are to be getting out to disturbed or contaminated soils, where they start to self-purify. Using of mineral fertilizers allows improvement of nutrient medium and acceleration growth and development of microbes and plants. During purification water analysis for dissolved oil and biogenic elements concentration should be carried out at least 1 time per month.

Efficiency of oil decontamination of water and bottom sediments was checked on heavily contaminated natural lake, situated near the Polar Circle (square of the lake is 4,1 hectares). Initially oil concentration in bottom sediments was 53,3 g/kg an average. The oil concentration after the first step decontamination of bottom sediments (July-August) was decreased several times up to 7,6 g/kg an average. 4 rows of 20 sections (40x80x20 cm) of active booms were placed on the surface of the lake and 20 sections were placed in the mouth of incoming brook. Active booms were filled with aluminum silicates – 3%, peat – 90%, azophoska – 5%, ammonium nitrate – 2%. Water aeration was realizing by means of aerators.

As a result of active work of microbial community dissolved oil concentration in the water mass of the lake was 5 times less than in water of the brook at the upper control point (70 meters upper than active booms of brook mouth).

Thus suggested method and system allow oil and oil products decontamination of water reservoirs (lakes, rivers, marine and oceanic coastal areas) up to 70 meters depth and restoring of their natural productivity. In view of improving parameters of some blocks of the system for decontamination of water and bottom sediments with the help of inventions, the opportunity for cleaning water reservoirs more than 70 meters depth could appear. The system for decontamination of water and bottom sediments is greatly mobile, because it can be rapidly (up to 24 hours) replaced to another working site.

CLAIMS

1. The method for oil and oil products decontamination of water and bottom sediments, including disposal of active booms on the water surface. Active booms realized as mats made of cotton or synthetic material, filled with cleansing stuff. The method is remarkable for carrying out aeration and/or flotation of bottom sediments and for the composition of cleansing stuff namely aluminum silicates, organic substance and mineral fertilizers in following ratio, %:
 - aluminum silicates 2-25,
 - organic substance 55-96,
 - mineral fertilizers 2-20.
2. The cleaning system for realizing of the method, including the module for the water surface decontamination. The system is noted for containing of module for bottom sediments decontamination, including floater, connected with block of water-air mixture supplying and flexible piping, connecting floater with notatory precipitation tank.
3. The system for water reservoirs cleaning in accordance with item 2 is remarkable for aeration block containing.

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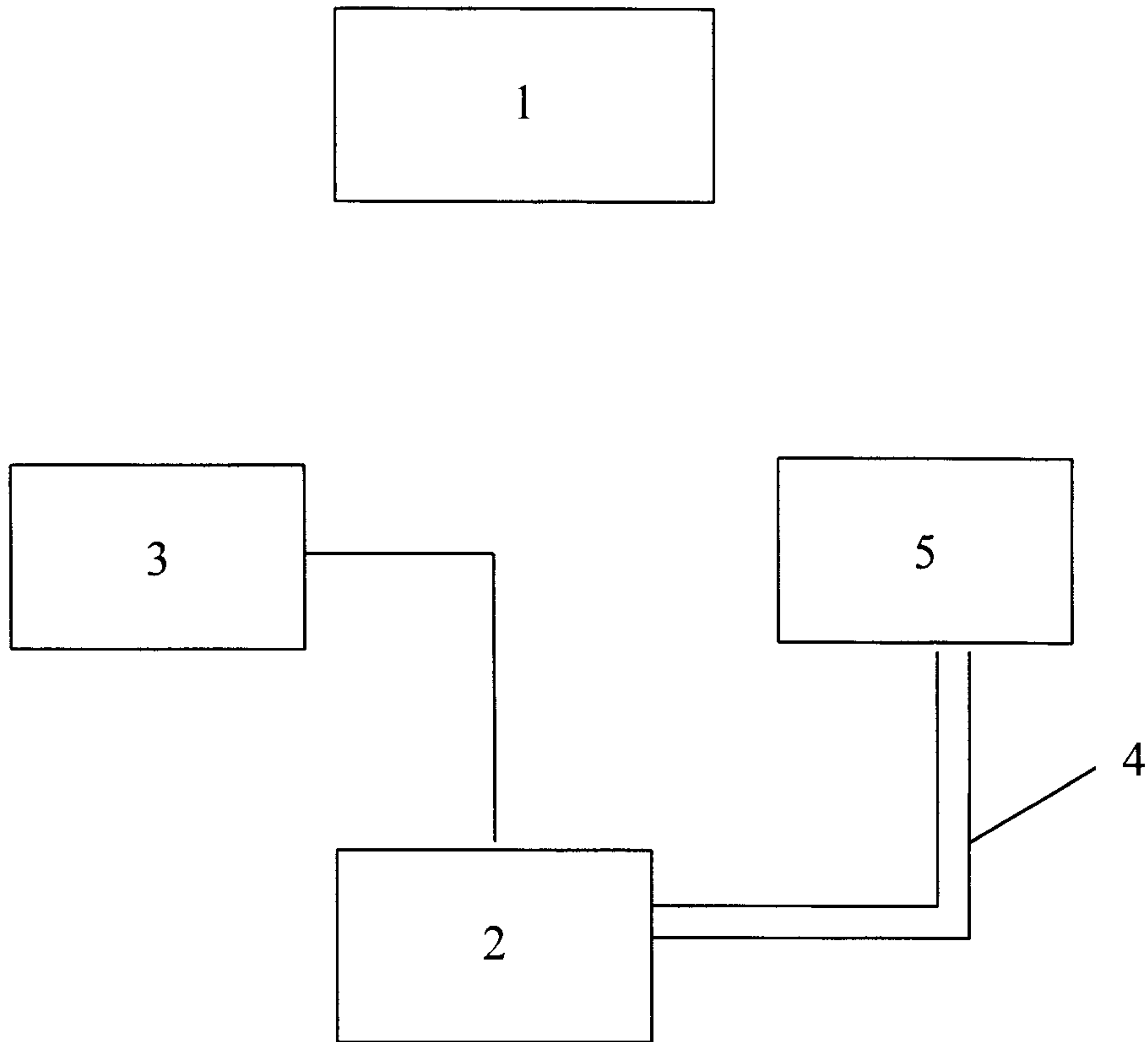


Figure 1

