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Canadian Intellectual Property Office

CA 2953174 C 2023/10/10

(11)(21) 2 953 174

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(86) Date de dépôt PCT/PCT Filing Date: 2015/01/14
(87) Date publication PCT/PCT Publication Date: 2015/08/13
(45) Date de délivrance/Issue Date: 2023/10/10
(85) Entrée phase nationale/National Entry: 2016/12/21
(86) N° demande PCT/PCT Application No.: DE 2015/100021
(87) N° publication PCT/PCT Publication No.: 2015/117595
(30) Priorité/Priority: 2014/02/04 (DE10 2014 101 377.8)

(51) Cl.Int./Int.Cl. *H05B 3/20* (2006.01),
H05B 3/12 (2006.01)

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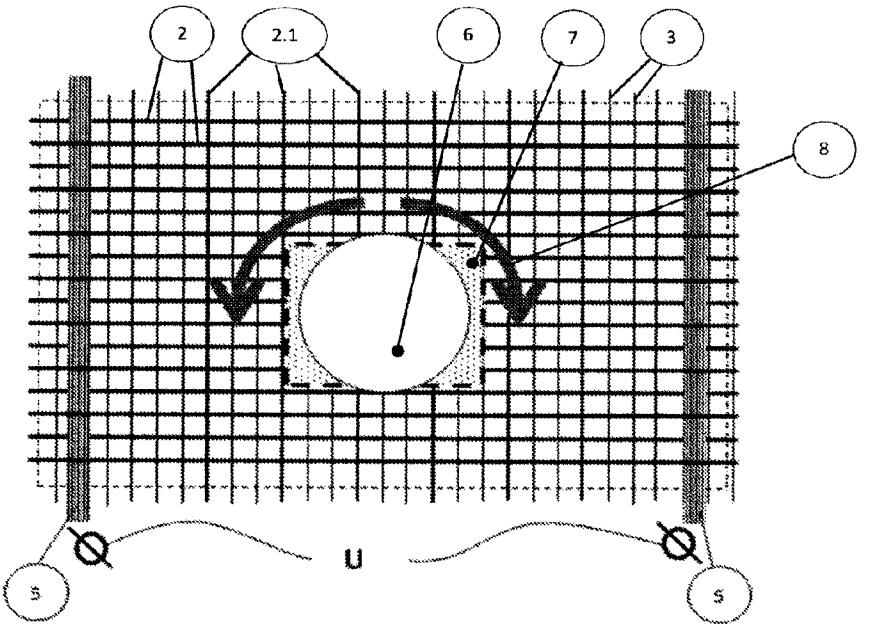
(54) Titre : RESEAU DE CHAUFFAGE AERIEN A RESISTANCE ELECTIQUE
(54) Title: AREAL, ELECTRICAL RESISTANCE HEATING NETWORK



(57) Abrégé/Abstract:
A sheet-like, electrical resistance heating network which is integrated as a floor and wall panel heating element directly on the surface of the plastered structure, and consequently can be used as an infrared heater. The heating network consists of individual heating filaments which are laid in parallel, and insulating filaments that are laid at right angles thereto likewise in parallel. The filaments thereby form a network. At the beginning and the end of the heating network there is an electrode, consisting of a metal wire or metal strip of a low resistance, respectively arranged in the transverse direction over the entire width of the network, and the two electrodes lie parallel to one another and are electrically connected to the underlying filaments. The filaments may have different resistance values. Heat is generated by the heating network or individual portions of the heating panel.

ABSTRACT

A sheet-like, electrical resistance heating network which is integrated as a floor and wall panel heating element directly on the surface of the plastered structure, and consequently can be used as an infrared heater. The heating network consists of individual heating filaments which are laid in parallel, and insulating filaments that are laid at right angles thereto likewise in parallel. The filaments thereby form a network. At the beginning and the end of the heating network there is an electrode, consisting of a metal wire or metal strip of a low resistance, respectively arranged in the transverse direction over the entire width of the network, and the two electrodes lie parallel to one another and are electrically connected to the underlying filaments. The filaments may have different resistance values. Heat is generated by the heating network or individual portions of the heating panel.

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Areal, electrical resistance heating network

Areal, electrical resistance heating network used preferably as surface heating in the building industry.

There are a variety of solutions that already employ electric areal conductors for heating purposes. Thus, document DE 69014841 T2 describes an electrical resistance-heating network made of thin metal wires. This is a heating pane with at least two rigid panes, particularly made of glass. A flexible intermediate layer is located between the two panes. Between each pane and the resilient intermediate layer, the electric resistance-heating network is arranged. Electrical supply strips are arranged as well. The wire-heating network supporting the intermediate layer permits a sliding of the intermediate layer in relation to the underlying rigid pane.

In DE 10 2010 011 102 A1 a heating device for the interior of a vehicle, which has a reticular fabric element is described. The fabric element contains an electrical heating conductor and is configured as a planer radiator.

In document DE 198 16 816 A1 a heatable electric surface-heating element with a non-conductive base fabric, is described. This base fabric is composed of current carrying contact conductors and heat conductors, wherein the heating elements run undulating or in meander shape between the contact conductors which are spaced apart and have a greater length in relation to the spacing of the contact conductors. The heating conductors touch in several places across their length, with adjacent heating conductors, thereby forming a heating network. The heating

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conductors are preferably made of carbon fibers or carbon-coated fibers.

The aim of the invention is to provide an areal, electrical resistance-heating network, which, for example, is integrated as a floor and wall heating surface element directly into the surface of the plaster in the building industry, and can therefor be used as an infrared heating unit.

The inventive design of the resistance heating network ensure its functionality, even in the event of partial destruction, such as drill holes that are penetrating the resistance heating network. Installing the resistance-heating network is possible directly on the plaster surface or concrete surface and can simultaneously be used as a structural surface. The structural assembly of the resistance-heating network with its preferably rectangular openings allows for an exchange between indoor air and masonry.

In case of several electrodes which are resting parallel on the network, different heating surface sections are created, in accordance with an example. This allows for the achievement of different heating effects through different activations.

In accordance to an example, filaments replace the transversely located insulating threads at least partially and/or the lengthwise-located filaments are replaced by insulating threads. This results in a wide variety of various heating strengths. Furthermore, the effectiveness of the heating network in general

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is not affected in case of damage of the heating network, for example in the event of a hole that is penetrating the heating network. This enables ideal processing in the building industry. The electrical connection of the individual filaments result in a current flow around the damaged areas. By omitting individual filaments, which are replaced by insulating threads, more or less wide strips without heating units are generated within the heating network. Via this action, different requirements can be implemented into the heating network.

Due to the arrangement of electrodes described in one example, an advantageous control of heating power is achieved.

The arrangement of the electrodes can be repeated multiple times on the heating network, according to an example. This makes it possible to generate surfaces with different heating power.

According to one example, the electrodes can be made of polymer fiber fabric bands and be woven into the edges of the heating network. This eliminates the time-consuming application and connection of electrodes with the heating network.

By introducing filaments that vary in resistance, different performances of the heating network can be produced, according to an example.

By concealing the heating networks, according to an example, the heating power of the heating network can be increased. The same is achieved during lamination; this however does not offer the benefit of the many breakthroughs in the heating network.

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According to an example, an insulating layer may surround the entire heating network. This protects all sensitive contact points of the electrical conductors, especially against aggressive media in the environment.

The use of the resistance-heating network according to the invention is preferable in the construction industry according to an example. This makes it possible to realize interesting solutions of electrical heating in the floor or wall areas.

Multiple embodiments of the invention are illustrated in the drawings and are described in more detail below.

Figure 1 is an electrical resistance heating network with parallel filaments and insulating threads, which are parallel at right angles, wherein, the filaments and the insulation threads form a square pattern,
Figure 2 is an electrical resistance-heating network with parallel filaments, which are additionally crossed by parallel filaments,
Figure 3 is an electrical resistance heating network with parallel filaments, wherein individual filaments have been omitted and replaced by insulating threads and thus form a surface that does not require heating,
Figure 4, the arrangement of electrodes on a resistance-heating network with parallel filaments and transverse insulation threads
Figure 5 is a possible arrangement of electrodes on a resistance heating network with parallel filaments and insulating threads parallel at a right angle, which form an open grid, and the electrodes at the beginning and end of the heating network, both connected by a connection electrode at the edge of the heating

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network and a centrally located electrode, which has no connection to the other
electrodes and
Figure 6, a heating network with woven electrodes and longitudinal and transverse filaments, wherein the transverse filaments are spaced by two intervening insulation threads and an indicated hole and therefor, the current flowing around it. The areal, electrical resistance-heating network 1 consists of individual filaments, which are parallel spaced in the longitudinal direction 2. in the transverse direction, i.e. at right angles to the filaments 2, are also insulation threads 3 that are located parallel. The filaments 2 are made of polymer carbon threads, silver threads or polymer carbon threads for example. The insulating threads 3 are made of glass threads or polymer threads. The filaments 2 form a grid, which is normally open, with the insulating threads 3. The filaments 2 and the insulation threads 3 have a reticulated structure. The grid preferably has a size of 0.5 cm by 0.5 cm to 1 cm by 1 cm. The grid does not have to be executed in a square. For power supply the heating network contains electrodes 4. Normally, these electrodes 4 are located parallel at the beginning and the end of heating network 1. The electrodes 4 are made of metal wire or a metal strip with good electrical conductivity and have good electrical contact to the filaments 2 located below the electrodes 4.

However, other electrodes 5 are conceivable as well. These electrodes 5 are made of conductive polymer thread fabric bands and can be woven into the heating network.

In a different embodiment of the resistance-heating network 1 that transversely located insulating filaments 3 are replaced or

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partially replaced by filaments 2. This results in a net-like arrangement of the filaments 2. During an installation of this heating network 1 on the surface of masonry or a concrete wall or on a floor surface, the heating network 1 retains its functionality, even when damaged, as for example in the event of perforations. Through arranging the filaments crosswise and the electrical contacts below each other, the current bypasses any defects in the heating network 1. This is a significant advantage of this embodiment.

The arrangement of the electrodes 4 can also deviate from the embodiment described above. For example, a connection electrode 4.1 can be located between the electrode 4 located at the beginning and the electrode 4 located at the end, which is preferably routed along the edge of heating network 1. These three electrodes 4 are interconnected electrically. Centrally located between the electrode 4 at the beginning and the electrode 4 at the end of the heating network, another electrode 4 is located, which however, has no connection to the connection electrode 4. The different electrode patterns may be repeated several times on the heating network 1. With the different arrangement of the electrodes 4, diverse heating effects can be achieved.

According to the desired heating effects of the resistance-heating network 1, filaments 2 with different resistance values may be incorporated into the heating system 1. For example, the resistance-heating network 1 shown in figure 6 has the following resistance values:

the filaments 2 as electrically conductive weft threads of 10 kOhm/lfm to 200 kOhm/lfm at a weight numbering of up to 110 tex,

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the filaments 2.1 as electrically conductive warp threads of 30 Ohm/1fm to 800 Ohm/1fm at a weight numbering of 14 tex to 110 tex and
the electrode 5 with electrically conductive warp and weft threads of 0.5 Ohm/1fm. to 15 Ohm/1fm at a weight numbering of 44 tex tex to 110 tex.

Two or more resistance heating networks 1 can be superimposed and laminated together. But it is also possible to laminate two or more resistance heating networks 1 together. With this measure, the heating power of the resistance heating networks 1 may be increased.

Another advantageous variant of the resistance heating network 1 is evidenced by the fact that the individual filaments 2, insulating filaments 3 and the electrodes 4 are surrounded by an insulating layer, e.g. a rubber layer.
Via the insulating layer in particular, the contact points between the individual filaments 2 and the electrodes 4 are protected. Thus, for example, heating networks 1 without insulation can get faster corrosion of the electrical contact point.

In another embodiment, individual filaments 2 may be omitted in the resistance-heating network 1, and be replaced by insulating filaments 3 and therefor, more or less wide strips are produced in the heating network 1 without filaments 2. This creates areas in the heating network 1, which are without heating capacity.

The resistance heating networks 1, used according to invention, are preferably used in the building industry. Here they can be

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used as surface heating units in floors and wall areas and are preferably used as infrared heating. Their net-like structure creates a good connection between masonry and indoor air.

Summary of reference marks

1 – Resistance heating network. Heating network
2 – Filament
2.1 – Filament
3 – Insulation threads
4 – Electrodes
4. 1 – Connecting electrodes
5 – interwoven electrodes
6 – Gap
7 – non heated area around gap
8 – indicated current flow around the gap

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Claims

1. An areal electrical resistance heating network comprising:

first filaments, selected from one of polymer carbon filaments, polymer silver threads, carbon fibers and metal wires, that are parallelly spaced in a longitudinal direction; and

insulating threads, selected from one of glass threads and polymer threads, that are parallelly spaced in a transverse direction perpendicular to the longitudinal direction,

and thus forming a network with rectangular openings, the network having a square pattern;

wherein the resistance heating network has a beginning and an end in the transverse direction, and at the beginning and at the end an electrode is located comprising one of a metal wire and a metal band across a width of the resistance heating network, and the two electrodes are parallel to each other, and first filaments underlying the two electrodes are electrically connected with each other;

wherein portions of the first filaments located transversely are replaced by second filaments, the first filaments and the second filaments are electrically connected with each other at contact points, and the first filaments and the second filaments have different resistance values; and

wherein the first filaments have a higher resistance value than the second filaments.

2. The resistance heating network according to claim 1, further comprising a sensor selected from one of a temperature sensor and a moisture sensor.

3. The resistance heating network according to any one of claims 1-2, further comprising an additional connection electrode on an edge of the resistance heating network that connects the two electrodes with each other, wherein the additional connection electrode is centrally located between the two electrodes, parallel to the two electrodes, and wherein the two electrodes have no direct contact with the additional connection electrode on the edge, and all the electrodes are electrically connected with the first filaments underlying the electrodes.

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4. The resistance heating network in accordance with claim 1, wherein an electrode pattern according to claim 3 is repeated multiple times on the resistance heating network.

5. The resistance heating network according to any one of claims 1-4 wherein the electrodes are woven into the resistance heating network, and the electrodes comprise conductive polymer threads.

6. The resistance heating network in accordance with any one of claims 1-5 wherein two or more resistance heating networks are laminated together, are superimposed or that two or more superimposed resistance heating networks are laminated.

7. The resistance heating network in accordance with any one of claims 1-6 wherein the resistance heating network is surrounded by an insulation layer.

8. The resistance heating network in accordance with any one of claims 1-7 wherein the resistance heating network is installed in floor and wall areas.

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Fig. 1

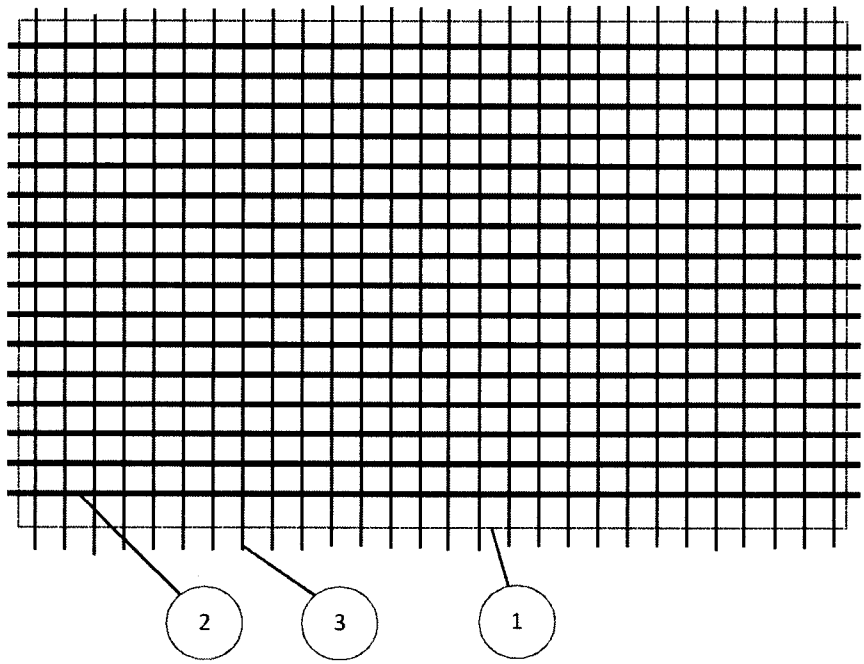


Fig. 2

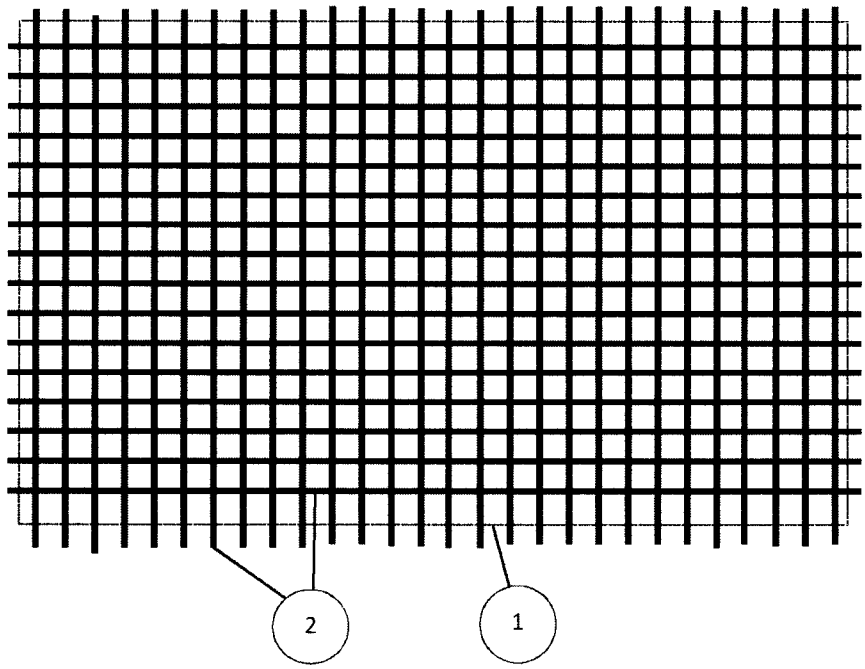


Fig. 3

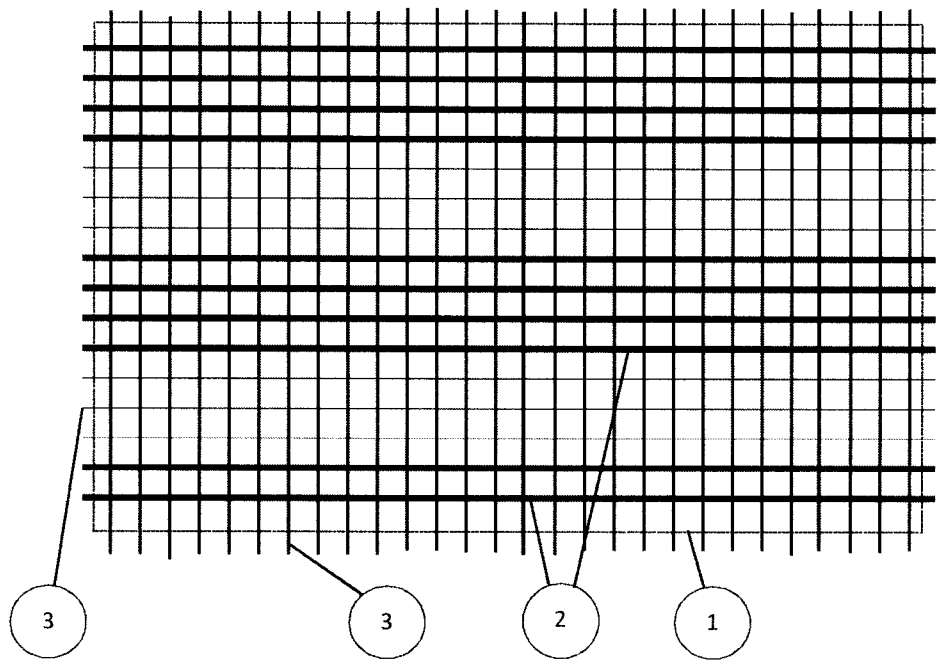


Fig. 4

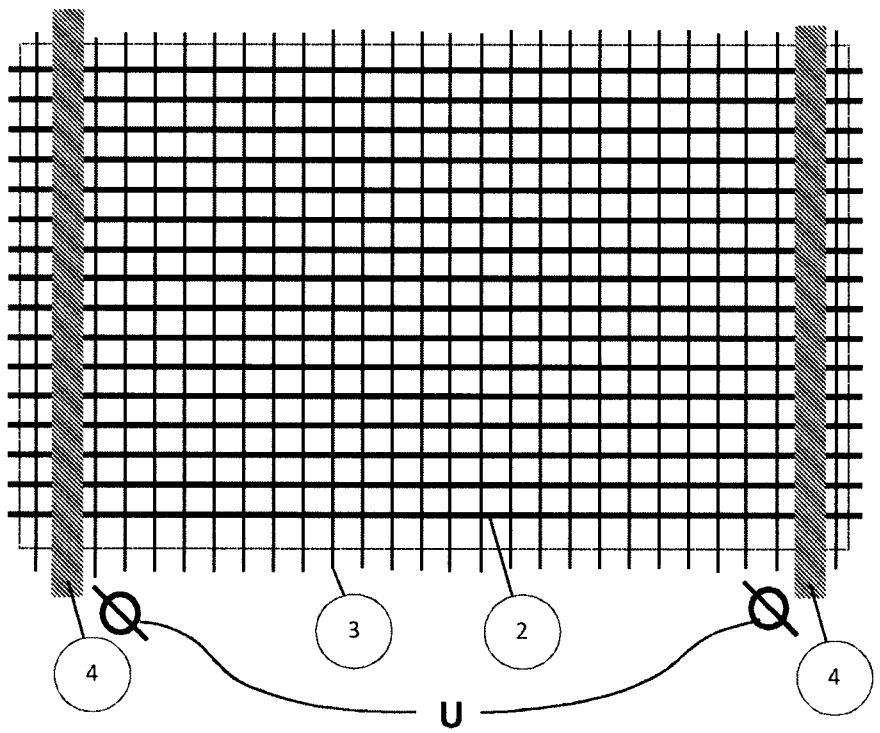


Fig. 5

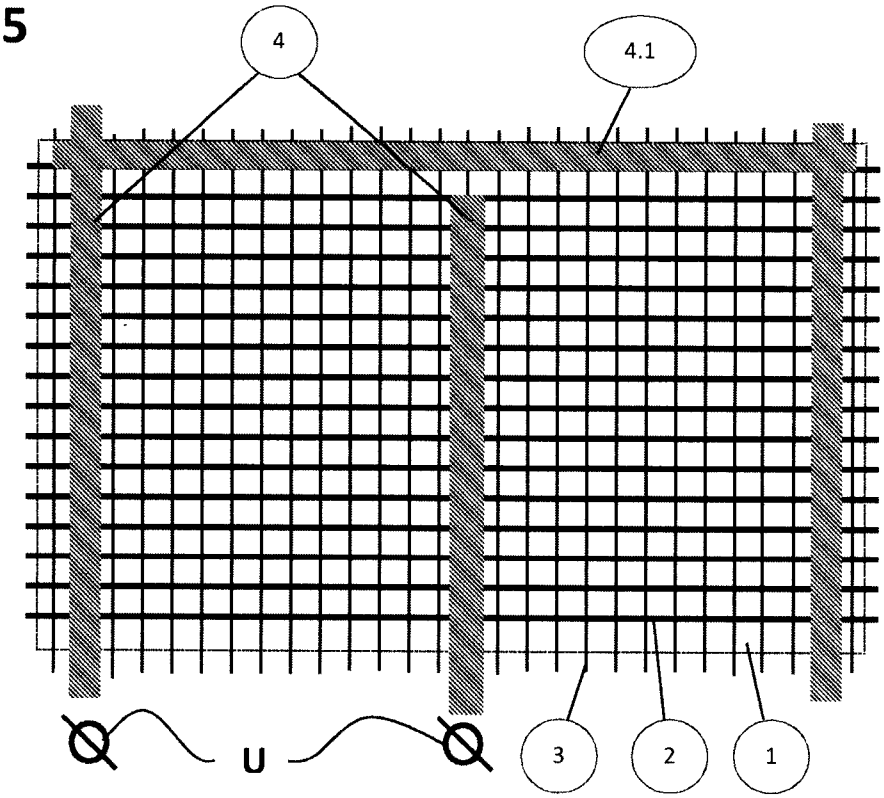
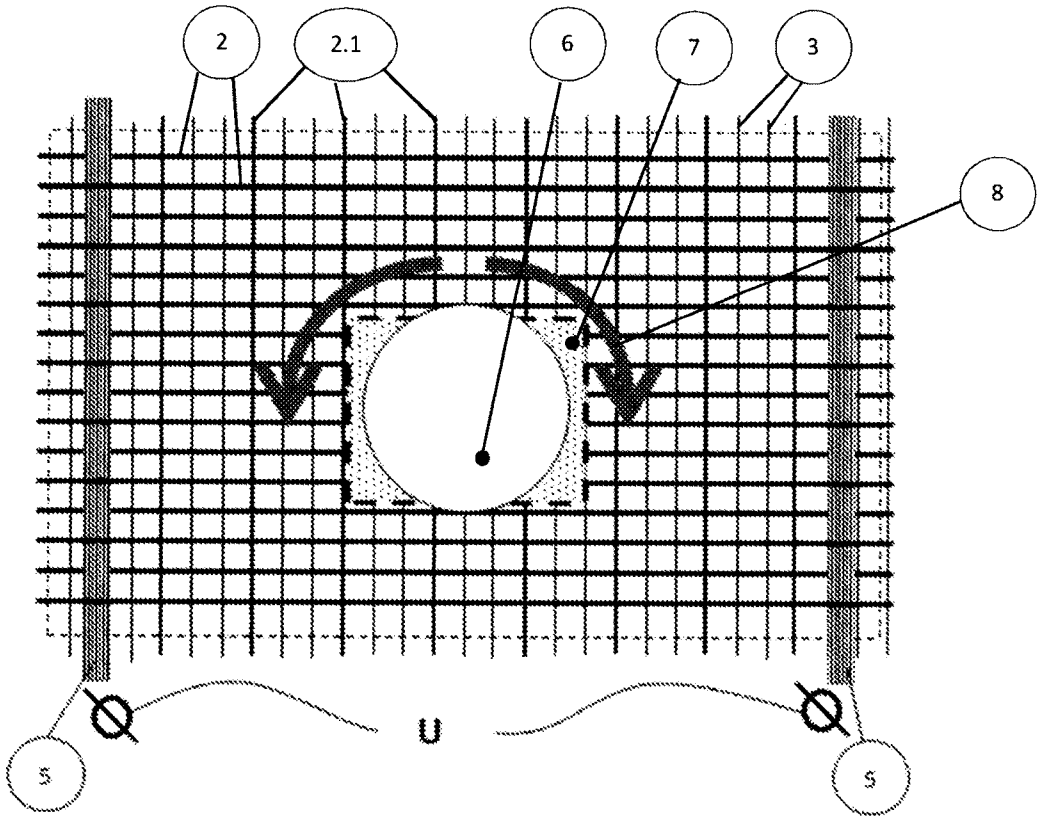
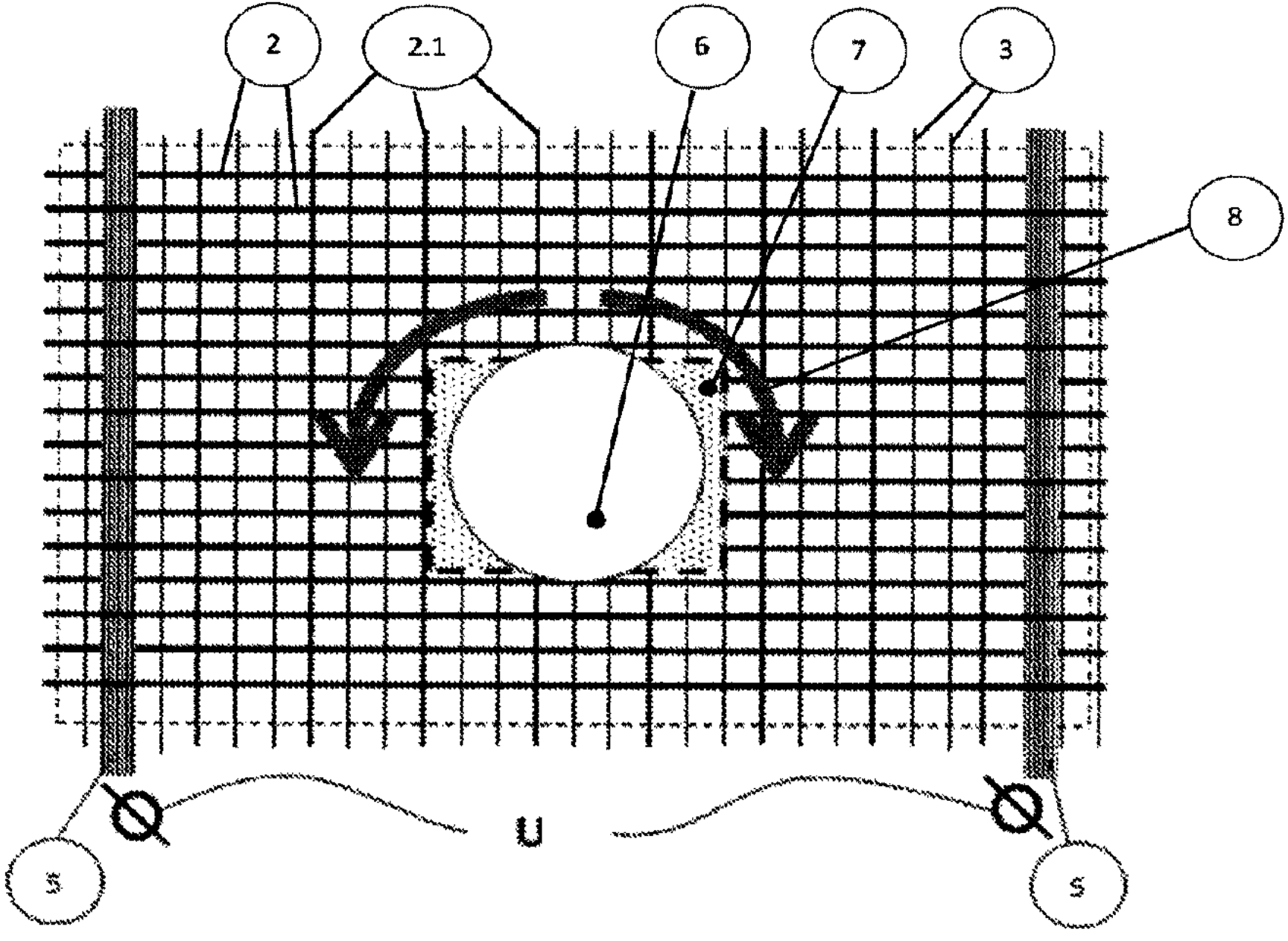


Fig. 6

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