German utility model no. DE202023103592U1

Lightweight Monorail as a Universal Transport System

Description

Alternative transport systems such as monorails have existed for decades, or, in the case of the Wuppertal Suspension Railway, even for more than 100 years. However, no such system has been widely adopted. Monorails are used only in a few niches. In addition, simple monorack railways are used in viticulture on hillsides to overcome greater slopes using a rack and pinion on a square tube. Unfortunately, unlike road and truck transport, freight transport by conventional railways has not increased proportionately.

Monorails often run on special tracks, in combination with or solely on tires. However, it is also possible for a monorail to run on a single rail using a gyroscope (such as the Brennan Gyro-Monorail). Alternatively, an "outrigger" can be used on a second rail. Unusual systems included a single rail above and below a locomotive or an air-cushion train (Aérotrain with a concrete guideway).

There are or have been various designs for tracks for alternative single or dual railways, such as the Alweg system, box girder systems, Roll's construction, T-beam systems, suspended designs (suspension railways), or rack railways inspired by roller coasters.

Other transport systems on two rails have also been developed:

For example, the Coaster, a personal transport system and fully automated taxi.
The Cabin Taxi was also a personal transport system in the form of a suspended or elevated railway, meaning that other traffic could pass above and below the rails.
Personal Rapid Transit (PRT) is a concept of a driverless, track-guided personal transport system that takes passengers individually on demand without stops and fully automatically to their destination.

Modern drives are usually electric motors, possibly with batteries or accumulators that are "onboard" and can be charged at stations. In addition, the batteries can be charged wirelessly during the journey, for example, by electromagnetic induction. Batteries can also be recharged during downhill runs or braking maneuvers. In addition, power can be supplied via sliding contacts, or the drive can be provided by systems integrated into the track.

The use is partly on demand and not according to a schedule. The vehicle can be requested via a smartphone app or at a station. A board computer often controls the speed, and a control center monitors the traffic.

Many transport systems have been built, but only a few are still in operation. Other public transport often requires more space than monorails. Several cabins could be coupled to form a larger unit, so the number of transported people increases significantly because no safety distances have to be maintained. Some systems can stop anywhere. Conventional public transport often has large distances between stops.

There are plans, for example, to stretch thin "rails" weighing hundreds of tons like strings in the air, so much less material is needed for the track.
There are other visions: every single household and every company could be reached by a new transport system, so people and goods could be delivered directly on-site.
Cars are to be driven on electric sleds in tunnels under Las Vegas, and the Hyperloop, like a pneumatic tube, is to travel in a vacuum.
A negative example in terms of resource consumption is, besides the Hyperloop, the Transrapid: huge pylons and a complex track (albeit at very high speeds).

Current transport systems are often:

- Too large: including conventional railways, Hyperloop, maglev, etc.
- Too heavy: a conventional train can weigh many hundreds of tons, and a heavy-duty truck is said to cause as much wear on bridges and road surfaces as over 100,000 cars, etc.
- Too fast: immense effort in securing (suspension railways, large pylons), high construction costs, much material, e.g., for the Hyperloop tube
- Prone to malfunction and strikes
- Environmentally damaging: often large structures that disturb visually and affect wildlife. They also consume a lot of energy in production.

- Expensive in terms of repair and maintenance: maintenance-intensive brakes, wheels, rails, etc.

My goal is to combine the advantages of individual systems into a single transport system and, if possible, avoid the disadvantages. From a logical perspective, this results in a small, autonomous, flexible, easily accessible, low-maintenance, environmentally friendly transport system for people and goods, with the smallest possible and quickly installable and inconspicuous track with additional options. Ultimately, there would be no roads, tire wear, emissions, or traffic jams, but more mobility, automatic goods transport, less sealed surfaces, punctuality, low production and maintenance costs, less environmental impact, and lower energy consumption.

My invention is based on the further development of transport systems.
There are many historical and more recent solutions related to the invention, such as:

- AT000000005881B, Monorail around 1900
- CN000101765532A, Monorail on small supports/pylons with two inclined wheels at the top, two from the side, and a double wheel with a guide slot at the top
- DE000000922107B, Monorail 1951, rail and stabilizing wheels at the bottom
- DE000002021834C, MBB maglev train 1970
- DE000002242533C3, Siemens maglev train 1972
- DE000004406198A1, Hyperloop 1994
- DE000010208090A1, e.g., cars on maglev tracks
- DE000019858066A1, maglev or cabin track along highways
- DE000019901495A1, Hyperloop maglev train 1999
- DE102004018308A1, Thyssen maglev train with induction 2004
- EP000000490945B1, maglev train for trucks and possibly cars
- EP000000831000A1, magnetic monorail
- EP000002168837B1, monorail with lateral stabilizer

The existing solutions fulfill their respective function under given circumstances (or are still in development or have been abandoned) but do not offer the possibilities of the above-mentioned invention. A universally installable solution is desired. The invention specified in claim 1 of a lightweight monorail as a universal transport system on a specially designed track with additional technical options meets these requirements.

Examples of Implementation:

The track/rail 3 should be simple and adapted to environmental factors (depending on the city - country or other requirements). There are several possibilities for the crucial combination of track/rail and cabin/container/platform 6 with drive unit(s) 1 for monorails:

1) According to claim 2: In front of and behind or under the cabin, two flanged wheels are attached to a frame 2 at the front and back. A flanged wheel rides on top and another below the flange (upper horizontal part) of a T-beam (or I- or double T-beam) at the front and back. Thus, the flange of the front upper wheel is on the left in the direction of travel, and the flange of the rear upper wheel is on the right in the direction of travel (Fig. 1, left and right). The frame connects the two axles, ensuring a stable structure (Fig. 1 and Fig. 2, Fig. 3, Fig. 4 with a wider running surface). At the front and rear, the other wheel thus "rides" under the upper horizontal part (flange). The lower flanged wheel can be significantly smaller than the other rail wheel (Fig. 2). This has the advantage that the web (vertical part) of the T-beam can be shorter, saving material. The web can also be made of a different material (Fig. 4).

2) According to claim 3: A flanged wheel/rail wheel with a very large flange (Fig. 5, Fig. 6 front and rear - mirrored left and right, Fig. 7) runs on a deep grooved rail (possibly with a cover). Wheels or ball bearings 7 are optionally attached to the outer edge of the flange to prevent movement (Fig. 6, Fig. 7). Optionally, the upper part of the grooved rail can be slightly wider than the lower part. There is also the possibility that the flange does not rotate with the wheel, and the wheels or ball bearings 7 need only be attached to the lower part.

The different solutions can be provided with single- or possibly double-sided balls or small wheels 7, including superlubricity. The phenomenon of so-called superlubricity has been known for some time. The extremely low friction - for example, in the (ball) bearings - is advantageous for the transport system. For lower friction, the balls could rotate at the speed of the vehicle.

3) According to claim 4: A double-sided rolling surface of the flanged wheel is dimensioned to be as wide as the entire grooved rail (Fig. 5, Fig. 7).

4) According to claim 5: A grooved rail possibly with (temporary) cover in Fig. 8 (wheel configuration as in Fig. 1, Fig. 2, Fig. 3, Fig. 4).

5) According to claim 6: Large guide pins/guide plates in the guide groove/guide slot or guide web (Fig. 10 left and right). Optionally, wheels or ball bearings for stabilization are installed at the lower or upper end of the guide pins or guide web, including superlubricity. Optionally, two guide pins/guide plates are installed (e.g., front and rear).

6) According to claim 7: U-, (I- or double-) T-beams, square tubes in combination with an "outrigger" (in Fig. 11, Fig. 12 left and right, Fig. 13, Fig. 14).

7) According to claim 8: All of the above solutions of the universal transport system in combination or as a single solution in the form of wheels with two flanges (Fig. 9, different profiles of the track are possible) can be equipped with an automatic weight balance/center of gravity shift by motor(s) 8 and/or a (Brennan) gyro with gyroscope technology 8. For example, an electronic control circuit with tilt sensors initiates a weight shift (with a gyroscope). A modern gyro in a vacuum is effective and consumes little energy. Extendable supports for emergencies are possible.

Unlike the running surface of the rail 3, the lower part of the rail/track according to claim 9 can be made of a different material to save resources (e.g., Fig. 4, Fig. 5, Fig. 8).

If (during a transition period) roads are still to be maintained, the rail according to claim 10 can also be integrated into roads, requiring even fewer fastenings (possibly also a second rail or an outrigger with wheel). In contrast, the rails of the new monorail can initially be installed on or next to a lane of conventional roads (highways, federal roads, country roads, and district roads). Once roads are no longer needed, the massive sealing of the ground can be reversed.

Because grooved rails (e.g., recessed tram rails) have a higher risk of derailment and solutions with a "slot" are more susceptible to rust, a regular automatic cleaning and possibly (temporary) cover is advisable according to claim 11. A cover could only be pushed aside when passing through, as otherwise water, stones, etc., would accumulate. Alternatively, the lower part of the track can be made of non-rusting materials.

Early rails, e.g., from the 19th century, had only a small rectangular cross-section of the running surface made of metal, and the rest of the rail was made of wood. This rail weighed only a third of today's rails. According to claim 12, with the low weight of the presented cabins/containers/platforms 6, a similarly low metal content is possible, and the wood can be replaced by more durable and harder materials. A positive extreme example can be seen in Fig. 5: minimal metal consumption in the horizontal part of the rail (running surface, possibly also made of other materials). The vertical part of the rail (web for T- and I-beams) can also be made of other materials such as (recycled) plastic, (recycled) concrete, etc. The different parts of the rail can be screwed, glued, riveted, or welded.

With monorails without an "outrigger," unlike conventional trains on two rails, movements of the cabin/platform/container 6 are more likely. These can be reduced by appropriate additional measures, which have already been mentioned above: electronically controlled counterweights, gyro with gyroscope technology 8, etc.

An alternative according to claim 13 would be to design the weight/center of gravity of the cabins fundamentally eccentrically to drive stably on a rail. In this context, another option would be to shift the front and rear halves of the cabins eccentrically to the left and right and connect them movably in the middle.

According to claim 14, the drive unit's 1 supporting frame compactly integrates the motors, batteries, control unit, charging unit, and possibly the apparatus for the "switch setting"/movable guide pins/guide plates. One or better two motors (possibly one motor in front and one motor behind the cabin) with the different possible connections to the rail, as well as batteries (possibly an additional battery in the cabin) and driving electronics, make up the drive unit, among other things.

As already mentioned, it is possible to mount one motor in front and one motor behind the cabin/container/platform. If this is not desired, the cabin mounted on the chassis 2 with the drive unit will have a higher center of gravity and be more unstable (e.g., without a gyro with gyroscope technology). An alternative would be the "lowering" of the aerodynamic cabin, which encloses the chassis with the drive unit, according to claim 15. This bulge into the cabin 6 could serve as a shelf or seat.

According to claim 16, the power demand can be met in various ways, e.g., by induction or direct power supply.

If the universal transport system drives only close to the destination, an accumulator that charges during the journey is needed for the path of the cabin/container to the destination. A platform for other vehicles can be tilted according to claim 17, so a small car or bicycles can reach the destination. It is also possible for a direct ride from the platform that the track is slightly recessed into the ground at destinations or a ramp is installed.

According to claim 18, in solutions with vehicles that simultaneously travel on the monorail and the surrounding area, the guides/pins/plates or the flanged wheels are folded up/retracted when leaving the track. The cabin's departure from and onto the rail is fully automatic.

For a square tube, according to claim 19, lines can be laid inside. All solutions are not completely fixed due to possible thermal expansion, as with bridges. Other measures for material expansion are also necessary. The rail can be roughened or equipped with a rack at steeper gradients. This would require an additionally mounted gearwheel.

According to claim 20, during braking maneuvers and downhill sections, the motor is used as a generator to generate electricity. Additionally, an eddy current brake can be useful at high speeds.

Safety-relevant elements should be installed twice according to claim 21: batteries, motors, computers, sensors, etc. All cabins/containers/platforms 6 automatically and regularly drive to the technical inspection (TÜV). Regularly, maintenance vehicles check the track/route and clean it (including mowing plants, etc.).

Instead of driving the (gear) rods, anchors (including DE202006020418U1 screw anchors, concrete-free foundations), ground anchors (including DE000008622991U1), rods, or similar individually into the ground, it is useful for quick installation to drive, turn, hammer, strike, etc., many corresponding (gear) rods, anchors, ground anchors, rods, or similar simultaneously into the ground. Additionally, the anchor can be shaped like a corkscrew 5 (Fig. 1 to Fig. 13). According to claim 22, this can be done using a threaded sleeve plate with many threads, a guide for rods that pushes the rods apart at depth, etc. The necessary force can only be provided by larger machines, not by handheld devices. If an individual anchor 5, rod, etc., encounters too much resistance, the individual drilling is stopped, but the other drillings are continued. After completing all individual drillings, a strength test is performed. If the strength test is unsatisfactory, drilling must be done elsewhere or differently (at an angle or with a different anchor/ground anchor installation, etc.).

In connection with the semi-automated (spin) anchor installation from the just-created track, it is necessary to work with other machines so that the track can be built quickly: possibly trenchers, strength testers, rail transport, etc.

For construction, the installation vehicles (similar drive and travel units as the cabins/containers/platforms) independently drive fully loaded to the construction end and return empty. At the construction site/end of construction, according to claim 23, a side change is optionally made to the returning track by a crane or temporary switch. Small building materials can be brought or removed in the optionally additionally installed pneumatic tube 9. A (semi-) automatic construction is useful for quick completion. Construction vehicles run on the rails they have laid. Installation vehicles may run on two single-track rails due to the higher weight if available. No access routes for trucks are required, allowing for very fast construction (e.g., 1 km per day). Especially if built on two tracks and from two sides (including rapid transport of prefabricated materials). A quick dismantling would also be possible this way. According to claim 24, all materials used should be recyclable and easy to remove during deinstallation.

Depending on environmental factors, it may make sense to lay tracks 3 at ground level. For other requirements, such as in a city, it may be necessary according to claim 25 to raise or lower the track to ensure that the route is crossing-free. An alternative would be at a crossing to have one side at ground level and the other side on higher stilts/pylons 4. Both solutions are an alternative to crossing control:

At intersections and/or "roundabouts" and tracks on one level, at least triple safeguards are installed: each car monitors the intersection with sensors, including the distances to other vehicles. An intersection/roundabout control manages the speed of individual vehicles in this area, so no collisions can occur.

According to claim 26, it makes sense for the universal transport system to use proven and prefabricated components: e.g., (double) T-, I-, U-beams, square tubes, solar cells/photovoltaics/PV modules along the route but also minerals with natural fibers, environmentally friendly materials, etc. Due to the relatively low loads on the rails, simpler production is also possible. Similar to a T-beam, which must be laboriously rolled, cast, pressed, or drawn, a similar component can be made from two or three screwed simple components. This beam must, of course, meet all safety requirements.

Cameras, sensors, etc., and, if necessary, installations such as water pipes, sewage, electricity, heat, pneumatic tube, mobile data - WLAN 9, etc., are installed immediately or later according to claim 27. Waste disposal, etc., and parcels can be transported in containers (Fig. 10, left and right).

Through mass production of light and similar cabins (maximum total weight, e.g., 500 kg) and transport containers, a comparatively inexpensive transport system can be realized. Prefabricated rails and other track elements/prefabricated parts also provide affordable mobility and transport options.

Unlike conventional public transport, fewer infectious diseases will occur due to individual transport or transporting very small groups within the transport system (lower risk during a pandemic and infection waves). The universal transport system is also suitable for elderly people who cannot (or no longer) drive or use public transport (if there is no barrier-free access). Children and teenagers could use the option of taking a bicycle for longer distances to school or training.

After initial installations and increasing acceptance, there will certainly be optimization opportunities. Subsequently, the universal transport system for passenger and freight traffic can be installed to every doorstep, so all in- and outbound transport is done automatically.

Measures against traffic jams (as shown in claim 28):

- If a reserve motor is available: if the first motor fails, the second motor takes over.
- If two active motors are used, both are dimensioned so that one motor is sufficient for emergency operation, and the cabin automatically drives to the workshop.
- If both motors fail, the following car carefully pushes the cabin to a bypass.
- If the second motor also fails and the cabin is not on support pillars, the cabin can "independently" leave the track with the appropriate motors/devices for a "derailment" and send an emergency call.
- If an accident occurs, the track is defective, or an obstacle is on the track, other cabins are automatically redirected.

There is no real control center that could fail or be "hacked," but according to claim 29, automatic traffic reports are generated by measuring the low or nonexistent speeds of the own and other vehicles so that other cabins automatically bypass/are redirected. This is done by the installed onboard electronics.

The cabins 6 can autonomously leave the track 3 at any point along the routes that are not on support pillars.

According to claim 30, especially in cities/densely populated areas, noise protection is particularly important: including shielding of the (flanged) wheels, possibly with anti-noise/"noise-canceling."

(Infrared) sensors are installed according to claim 31 at certain points along the route and on the cabins/containers/platforms 6 to warn of animals or other dangers not only at night and to scare them away with suitable means or to brake the cabins. Movement profiles of people near the track are analyzed, speed is adjusted, and people are warned with signals if necessary. In rural areas with many small animals, a moderate elevation of the track may be useful. For larger wild animals, it is better to install the rails at ground level.

If the monorail is little used, as in large states or other sparsely populated areas, it can also be installed on a single track with a larger siding, according to claim 32, so many cabins can simultaneously wait for the track to be released. However, in countries with very low population density, it is probably not advisable to install the transport system, and the usual (sand) tracks are much more environmentally friendly.

A temporary use of the existing railway tracks (Vignoles rails of Deutsche Bahn DB, etc.) during a transition period is possible "if necessary with outriggers" (Fig. 14). According to claim 33, a guide rail/support rail would have to be installed in the middle of the track so that two cabins 6 can drive parallel in each direction (Fig. 14). This solution would allow significantly higher speeds on normal railway tracks. However, only a part of the presented monorails/transport systems would be usable. Similar "emergency" solutions for the monorails are shown in Fig. 11, Fig. 12 left and right, and Fig. 13. Better would be, for example, the in-development Monocab monorail on existing DB tracks: self-driving and gyro-stabilized.

Just decommissioned railway lines can be replaced by the new rails/tracks of the invention with significantly less material consumption after the removal and recycling of the Vignoles rails.

According to claim 34, there is the possibility mentioned above to combine already existing vehicles/transport options/modes of transport such as bicycles, very light cars, e-scooters, pedelecs, e-bikes, etc., with the new system by transporting them on a platform with a drive unit and adapters/fixings as well as aerodynamic wind protection (Fig. 13). After a transition phase, new aerodynamic cabin vehicles made of environmentally friendly materials will then run on the monorails.

Goods (Fig. 10 right) and other goods (fixed also on pallets or liquids in tanks, Fig. 10 left, Fig. 11, Fig. 12 right, Fig. 14) can also be transported, and peak traffic times can be avoided.

It is possible to use your cabins/containers/platforms 6, rental, or public vehicles, which can be requested via an app via smartphone or computer. Ideally, the transport with the new transport system should be free of charge for short distances, as is the case with the current public transport (ÖPNV).

The maximum speeds are not comparable with the Transrapid or a Hyperloop. However, a large part of the travel time is required for access to and from the high-speed alternatives (as is already the case with air travel/airplanes). With the new universal transport system, access and departure times are (very) low, often resulting in comparable total travel times with significantly lower speeds: e.g., up to 100 km/h in the city and up to 300 km/h on long-distance routes so that the track/route does not have to be too stable/clunky and material-consuming. At very high speeds, e.g., 90% of the energy is used to overcome air resistance (exception: see Hyperloop). Therefore, especially on long-distance routes, it makes sense for many cabins to be electronically controlled and travel together in a convoy.

The switches of the monorails are, according to claim 35, simpler and less complicated than those of railways with two rails. Depending on the profile and guidance of the rail, different switches are necessary. For (double) T- and I- or other profiles, the switches can consist of one or two parts that are moved horizontally depending on the direction of travel and allow a seamless connection of the rail mechanically or magnetically.

Solutions with a very large flange of the flanged wheel or with a pin or plate (guide webs/guide pins) for guidance can be pulled magnetically or mechanically to the one or other direction of the switch by these components or moved from the driver's cab to the left or right. These switches are rigid and thus low maintenance. In the opening of the target rail, the guide slot can be slightly wider and then taper back to the normal width.

Also, bridges are much lighter, faster, and cheaper to implement with the new transport system.

Instead of a monorail, as shown in claim 36, the other advantageous design features of the above-mentioned universal transport system can naturally also be realized on two rails.

Reference Number List

(1) Drive and control unit

(2) Frame with (flanged) wheels

(3) Track/rail

(4) Pylon

(5) Anchor

(6) Cabin/container/platform

(7) Small wheels/ball bearings

(8) Center of gravity/weight balancing unit/gyro

(9) Additional installations

Claims

1. Lightweight monorail as a universal transport system,
characterized by
a specially designed track and additional technical options combined with aerodynamic cabins, containers, and platforms.

2. Lightweight monorail as a universal transport system, according to claim 1,
characterized in that
two flanged wheels are mounted on a frame 2 at the front and rear, respectively, in front of and behind or under the cabin. One flanged wheel is mounted above and one below the flange (upper horizontal part) of a T-beam (or I- or double T-beam) at the front and rear. Thus, the flange of the front upper wheel is on the left in the direction of travel, and the flange of the rear upper wheel is on the right in the direction of travel. The frame connects the two axles. Optionally, a wider running surface of the wheels, the lower flanged wheel can be significantly smaller than the other rail wheel, and the web can be made of a different material.

3. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
a flanged wheel/rail wheel is mounted at the front and rear with a very large flange mirrored on the left and right, and it runs on a deep grooved rail (possibly with a cover). Wheels or ball bearings 7 are optionally attached to the outer edge of the flange. Optionally, the upper part of the grooved rail can be slightly wider than the lower part. Optionally, the flange does not rotate with the wheel, and the wheels or ball bearings 7 are only attached to the lower part. The different solutions of the monorail can be designed with single- or possibly double-sided balls or small wheels 7, optionally with superlubricity. Optionally, the balls rotate at the speed of the vehicle.

4. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
a double-sided rolling surface of the flanged wheel is as wide as the grooved rail.

5. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
a wide grooved rail with the flanged wheel configuration in claim 2 is designed.

6. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
large guide pins/guide plates are present in the guide groove/guide slot or guide webs. Optionally, wheels or ball bearings for stabilization, including superlubricity, are installed at the lower or upper end of the guide pins or guide webs. Optionally, two guide pins/guide plates are installed per vehicle (e.g., front and rear).

7. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
U-, (I- or double-) T-beams or square tubes are designed in combination with an "outrigger."

8. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
the above-mentioned solutions of the universal transport system in combination or as a single solution with wheels featuring two flanges (optionally with different profiles of the track), an automatic weight balance/center of gravity shift by motor(s) 8, and/or a (Brennan) gyro with gyroscope technology 8. For example, an electronic control circuit with tilt sensors initiates a weight shift (with a gyroscope). Optionally, extendable supports for emergencies are provided.

9. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
unlike the running surface of the track 3, the lower part of the rail/track is resource-saving made of a different material (e.g., Fig. 4, Fig. 5, Fig. 8).

10. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
the rail/track is also installed in roads (optionally on a lane or a second rail or with an outrigger, including a wheel).

11. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
for grooved rails, a (temporary) cover is installed, which is pushed aside when passing through. Optionally, the lower part of the track is made of non-rusting materials.

12. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
the rail/track has a low metal content in the horizontal part (running surface, optionally also made of other materials). The vertical part of the rail (web for T- and I-beams) can optionally be made of other materials such as (recycled) plastic, (recycled) concrete, etc. The different parts of the rail can be screwed, glued, riveted, or welded.

13. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
the weight/center of gravity of the cabin/container/platform is designed to be fundamentally eccentric. Optionally, the front and rear halves of the cabins can be shifted eccentrically to the left and right and connected movably in the middle.

14. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
the drive unit's 1 supporting frame compactly integrates the motors, batteries, control unit, charging unit, and possibly the apparatus for the "switch setting"/movable guide pins/guide plates. One or preferably two motors (optionally one motor in front and one motor behind the

cabin) with the different possible connections to the rail, as well as batteries (optionally an additional battery in the cabin) and driving electronics, make up the drive unit, among other things.

15. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
the aerodynamic cabin encloses the chassis with the drive unit.

16. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
the power demand of the transport system is met in various ways, e.g., by induction or direct power supply.

17. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
a small drive unit and an accumulator are installed in the cabin/container. A platform for other vehicles optionally has a tilting mechanism, the track is slightly recessed into the ground, or a ramp is installed.

18. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
in solutions with vehicles that simultaneously travel on the monorail and the surrounding area, a mechanism is installed that folds up and/or retracts the guides/pins/plates or the flanged wheels. The cabin's departure from and onto the rail is done through a fully automatic mechanism.

19. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that

for a square tube, lines can be laid inside. All solutions are not completely fixed due to possible thermal expansion. Other measures are implemented for material expansion. The rail/track can be roughened or equipped with a rack at steeper gradients, into which an additionally mounted gearwheel engages.

20. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
during braking maneuvers and downhill sections, the motor is used as a generator to generate electricity. Optionally, an eddy current brake is installed at high speeds.

21. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
safety-relevant elements are installed twice: batteries, motors, computers, sensors, etc. All cabins/containers/platforms 6 automatically drive to the technical inspection (TÜV) through programming. Regularly, specially constructed maintenance vehicles drive the route.

22. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
many corresponding (gear) rods, anchors, ground anchors, rods, or similar (different hard materials are possible, such as steel, plastic, carbon fiber, etc.) are semi-automatically and simultaneously driven, turned, hammered, struck, etc., into the ground. Optionally, the anchor can be shaped like a corkscrew 5. The implementation can optionally be done with a threaded sleeve plate with many threads, a guide for rods that pushes the rods apart at depth, etc. The necessary force application is provided by specially constructed larger machines. After completing all individual drillings, a specially built apparatus for strength testing is used. Optionally, the drilling is done elsewhere or differently (at an angle, with a different anchor/ground anchor installation, etc.).

23. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that

for construction, an optional side change is made through a crane or temporary switch. Optionally, an additional pneumatic tube 9 is installed.

24. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
all materials used for the route and the cabins/containers/platforms are designed for recycling and residue-free deinstallation.

25. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
the tracks 3 are laid at ground level or crossing-free higher or lower in the ground. Optionally, there are tracks at ground level on one side and tracks on higher stilts/pylons 4 from the other direction. At intersections and/or "roundabouts" and tracks on one level, at least triple safeguards are installed: at the cabins/containers/platforms and the intersection/roundabout. The electronics of the intersection/roundabout control the speed of individual vehicles.

26. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
proven and prefabricated components are used for the universal transport system: e.g., (double) T-, I-, U-beams, square tubes, solar cells/photovoltaics/PV modules along the route, but also minerals with natural fibers, environmentally friendly materials, etc. Optionally, instead of a T-beam, a rail/track can be designed from two or three screwed (or otherwise connected) simple components.

27. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
cameras, sensors, etc., and optionally installations such as water pipes, sewage, electricity, heat, pneumatic tube, mobile data - WLAN 9, etc., are installed at or under the track.

28. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
an electronic control in case of failure of a motor controls the second motor, in case of failure of a motor automatically drives the cabin/container/platform to the workshop, in case of failure of both motors another cabin carefully pushes it to a bypass, possibly controls the motors/devices for a "derailment," and sends an emergency call. The electronic control is programmed so that if an accident occurs, the track is defective, or an obstacle is on the track, other cabins are redirected.

29. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
no real control center exists, but the installed onboard electronics send automatic traffic reports by measuring the low or nonexistent speeds to other vehicles and change their navigation.

30. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
a noise protection is installed, including shielding of the (flanged) wheels optionally with anti-noise/"noise canceling."

31. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
(infrared) sensors are installed at certain points along the route and on the cabins/containers/platforms 6. The constructions include devices to scare away animals and warn people. The onboard electronics analyze movement profiles of people near the track and adjust speed.

32. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that

the monorail is installed on a single track with (larger) sidings.

33. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
an optional use of existing railway tracks (Vignoles rails of Deutsche Bahn DB, etc.) is realized by installing a guide rail/support rail in the middle of the track and "outriggers."

34. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
already existing vehicles/transport options/means of transport such as bicycles, very light cars, e-scooters, pedelecs, e-bikes, etc., are transported on a designed platform with a drive unit and adapters/fixings as well as aerodynamic wind protection.

35. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
depending on the profile and guidance of the rail, different switches are designed. For (double) T- and I- or other profiles, the switches can consist of one or two parts that are moved horizontally depending on the direction of travel and allow a seamless connection of the rail mechanically or magnetically. Solutions with a very large flange of the flanged wheel or with a pin or plate (guide webs/guide pins) for guidance can be pulled magnetically or mechanically to one or the other direction of the switch by these components or moved from the driver's cab to the left or right. Optionally, the opening of the target rail's guide slot can be slightly wider and then taper back to the normal width.

36. Lightweight monorail as a universal transport system, according to one of the preceding claims,
characterized in that
the above-mentioned design features of the universal transport system can also be implemented in vehicles/routes with two rails.

Fig. 1

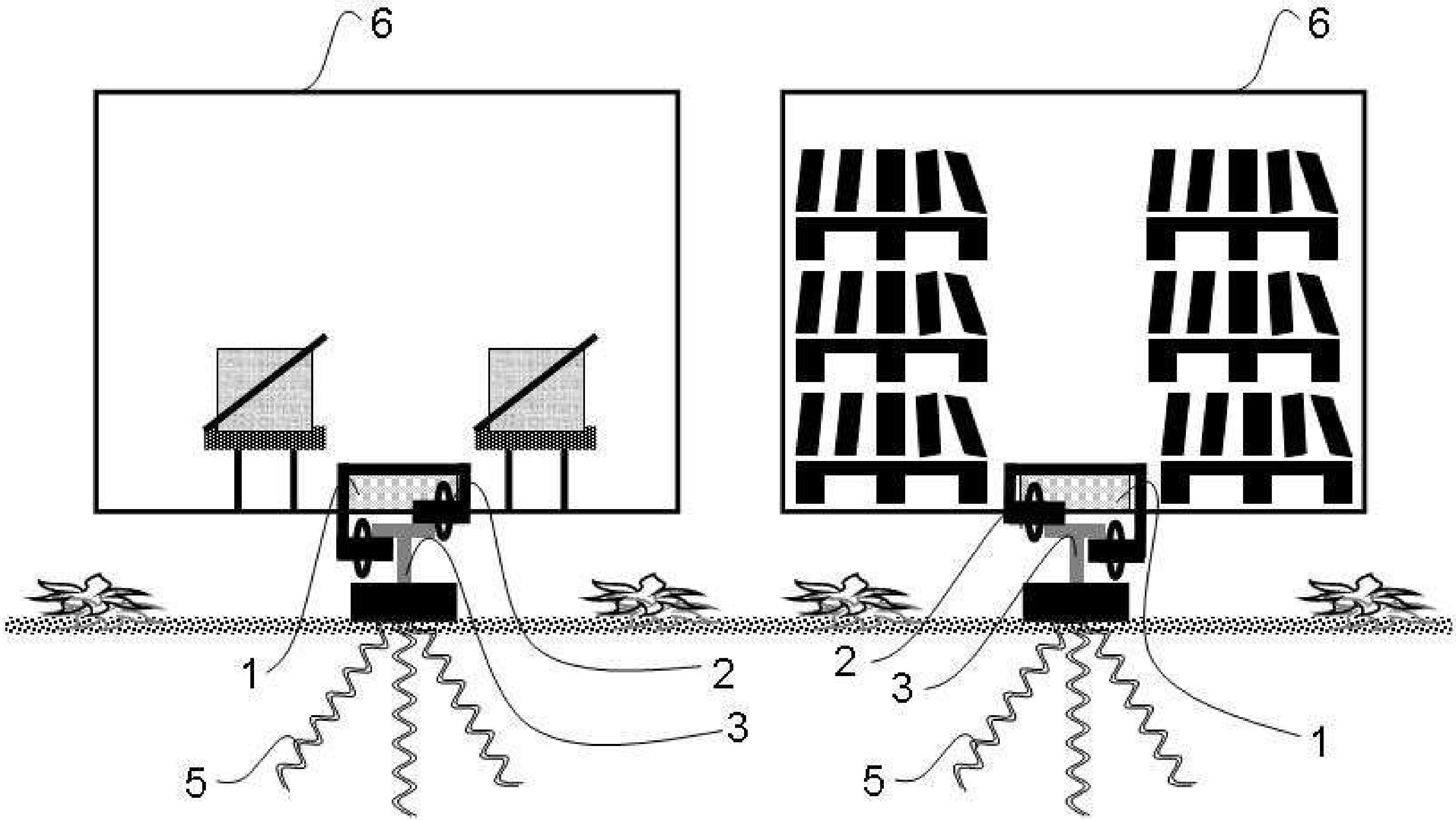

Fig. 2

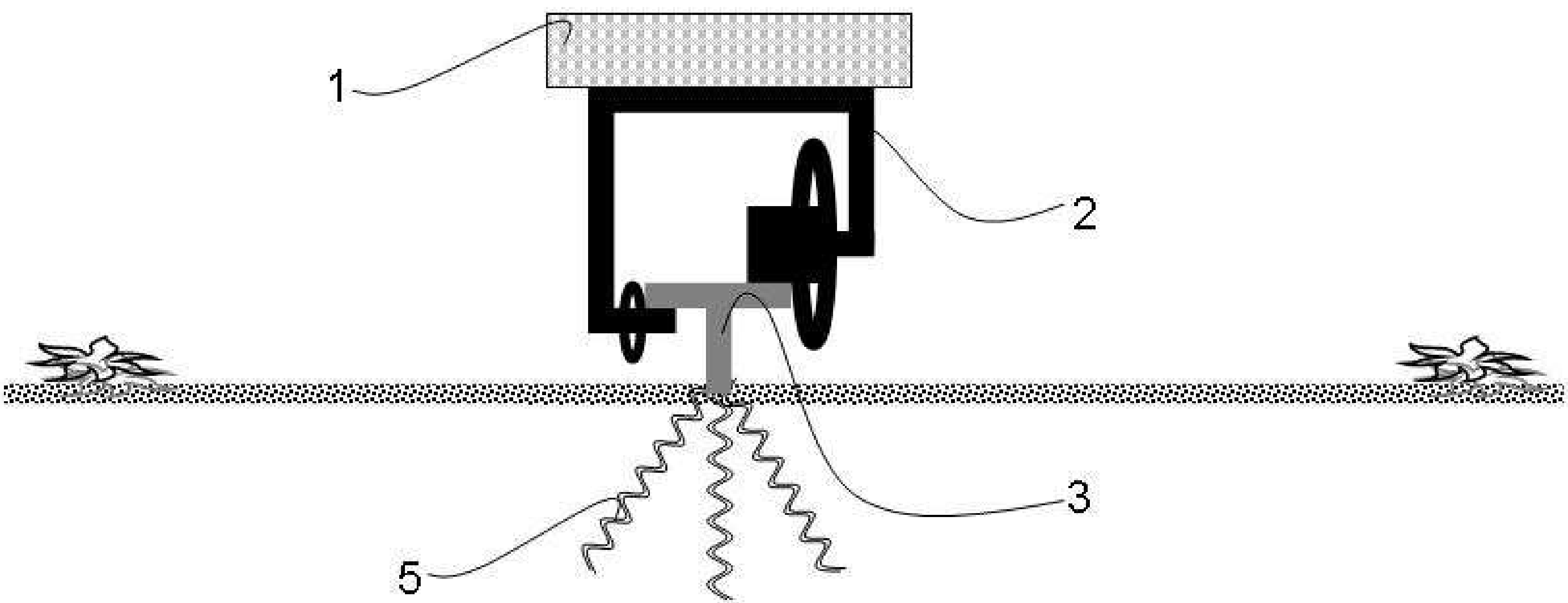

Fig. 3

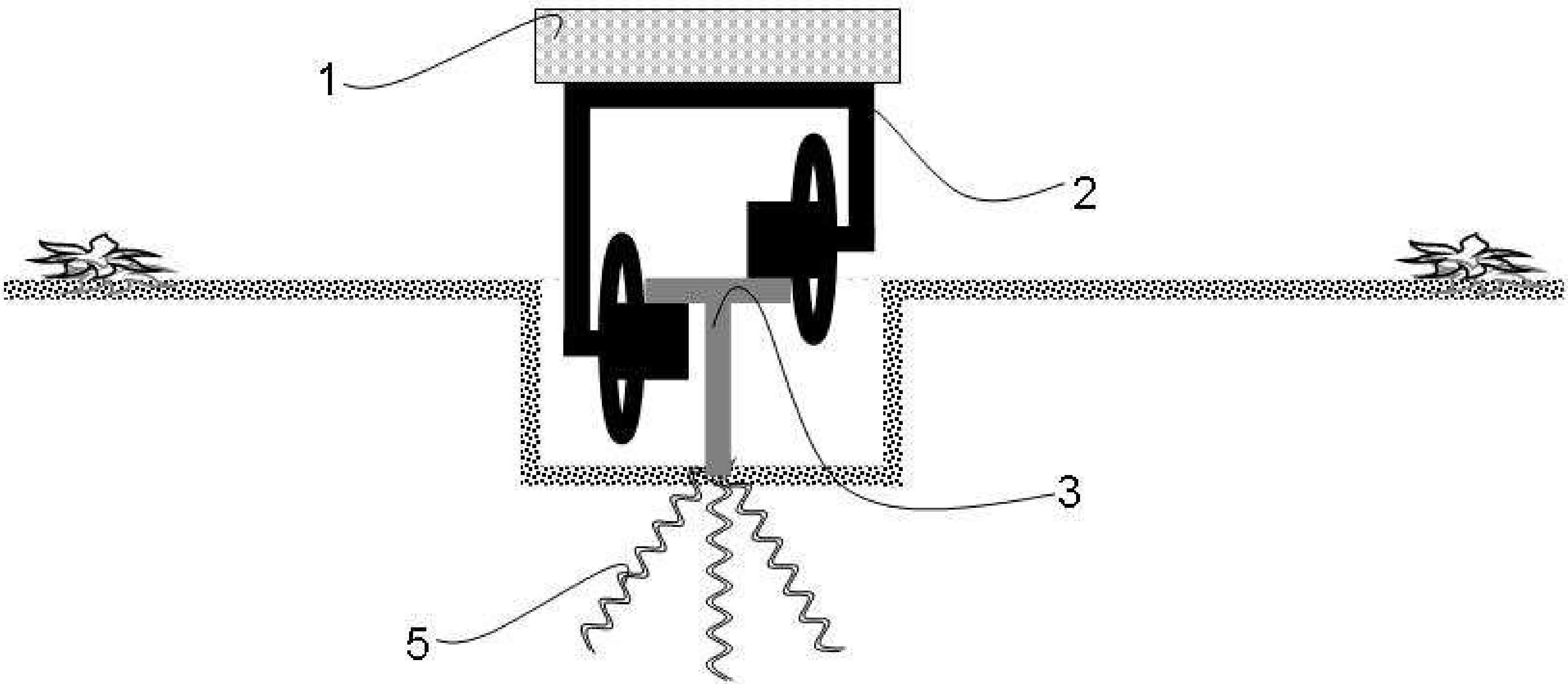

Fig. 4

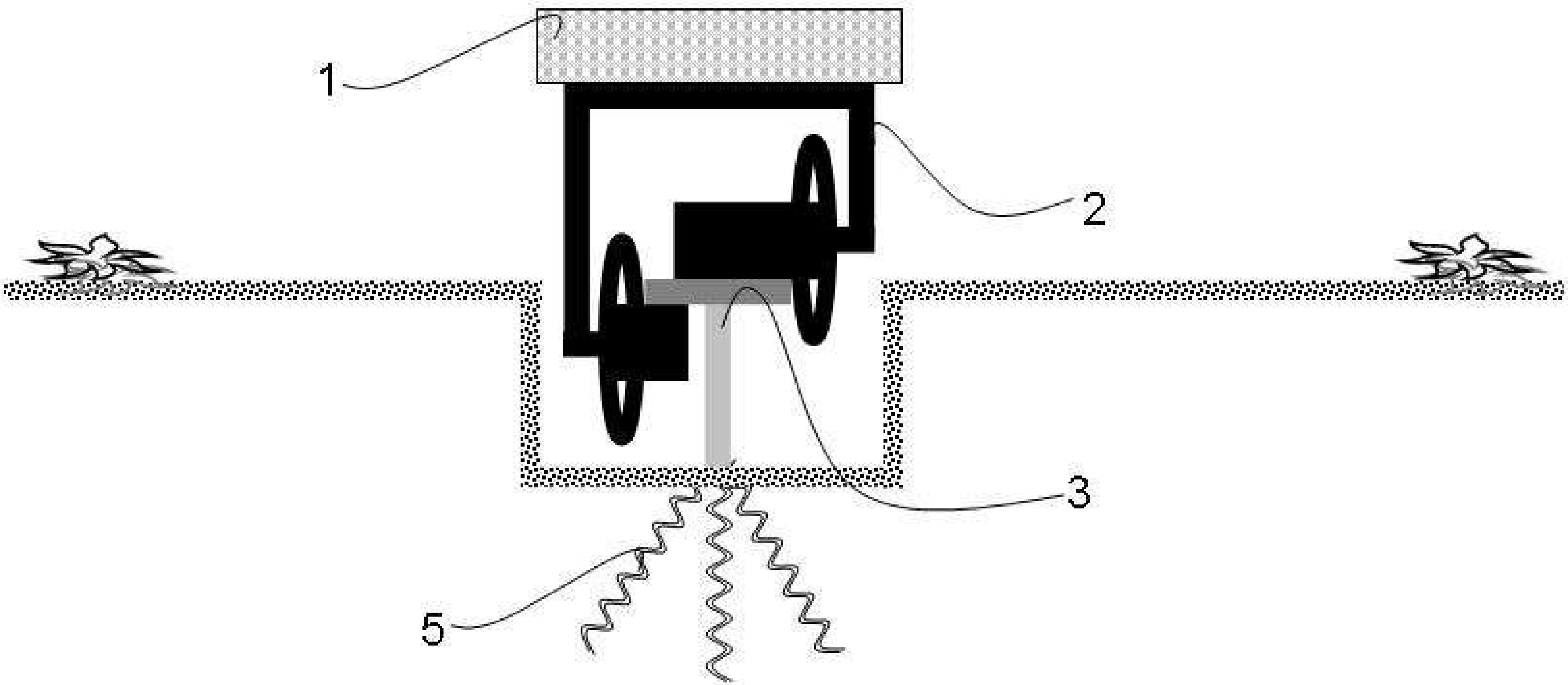

Fig. 5

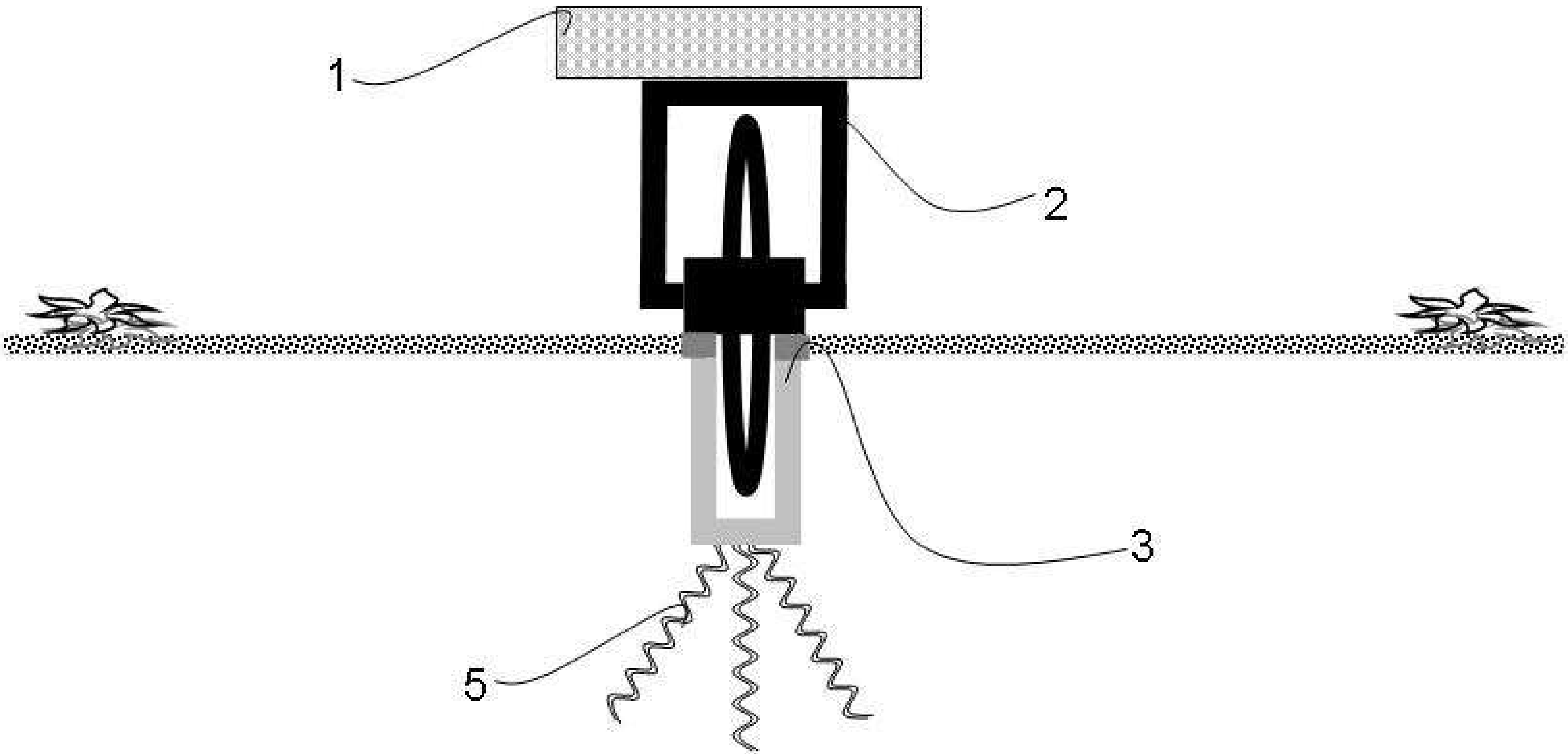

Fig. 6

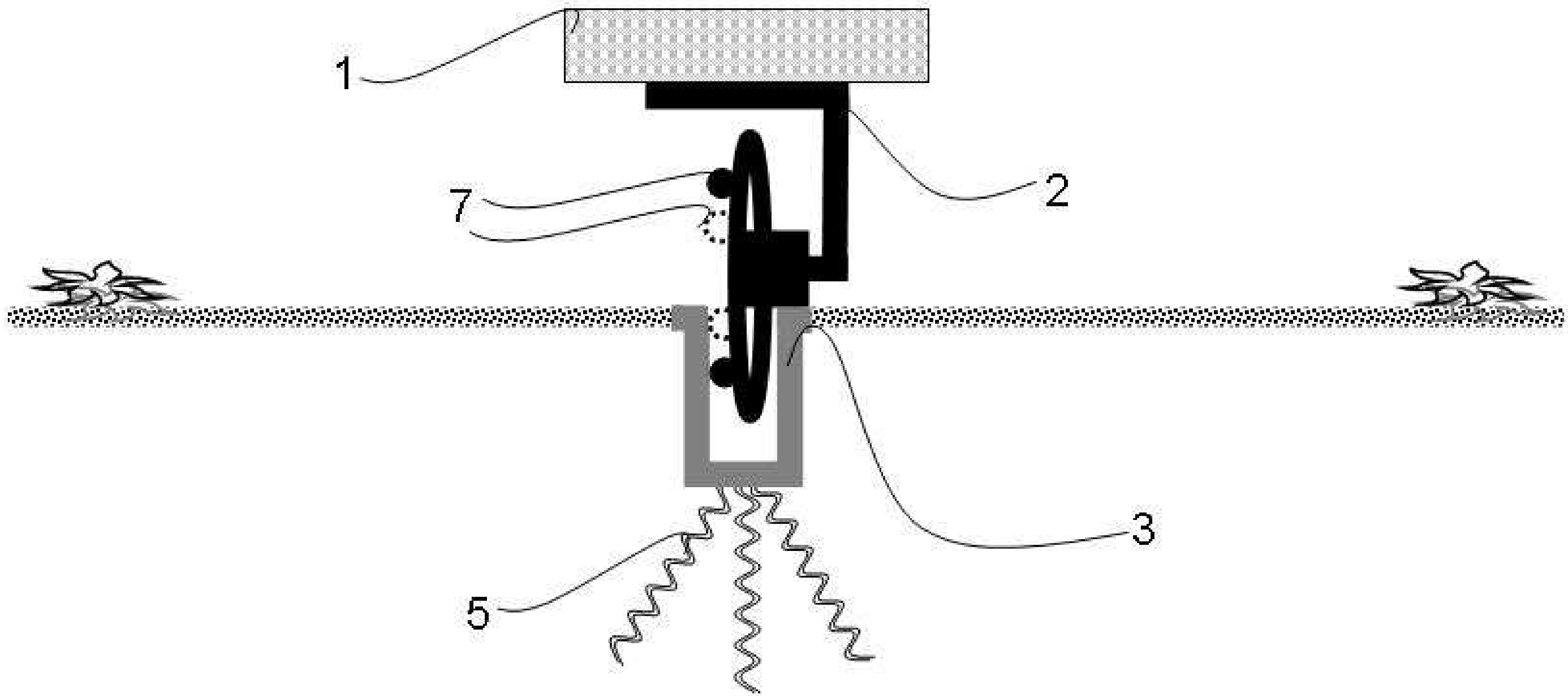

Fig. 7

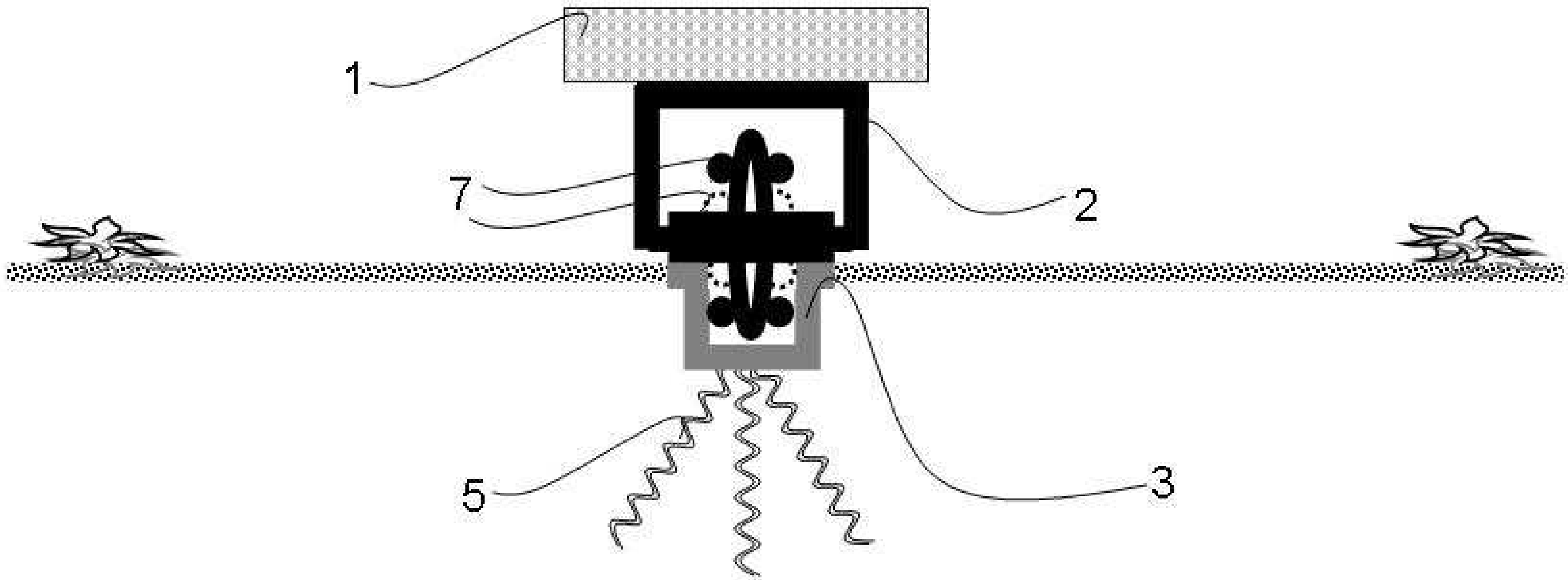

Fig. 8

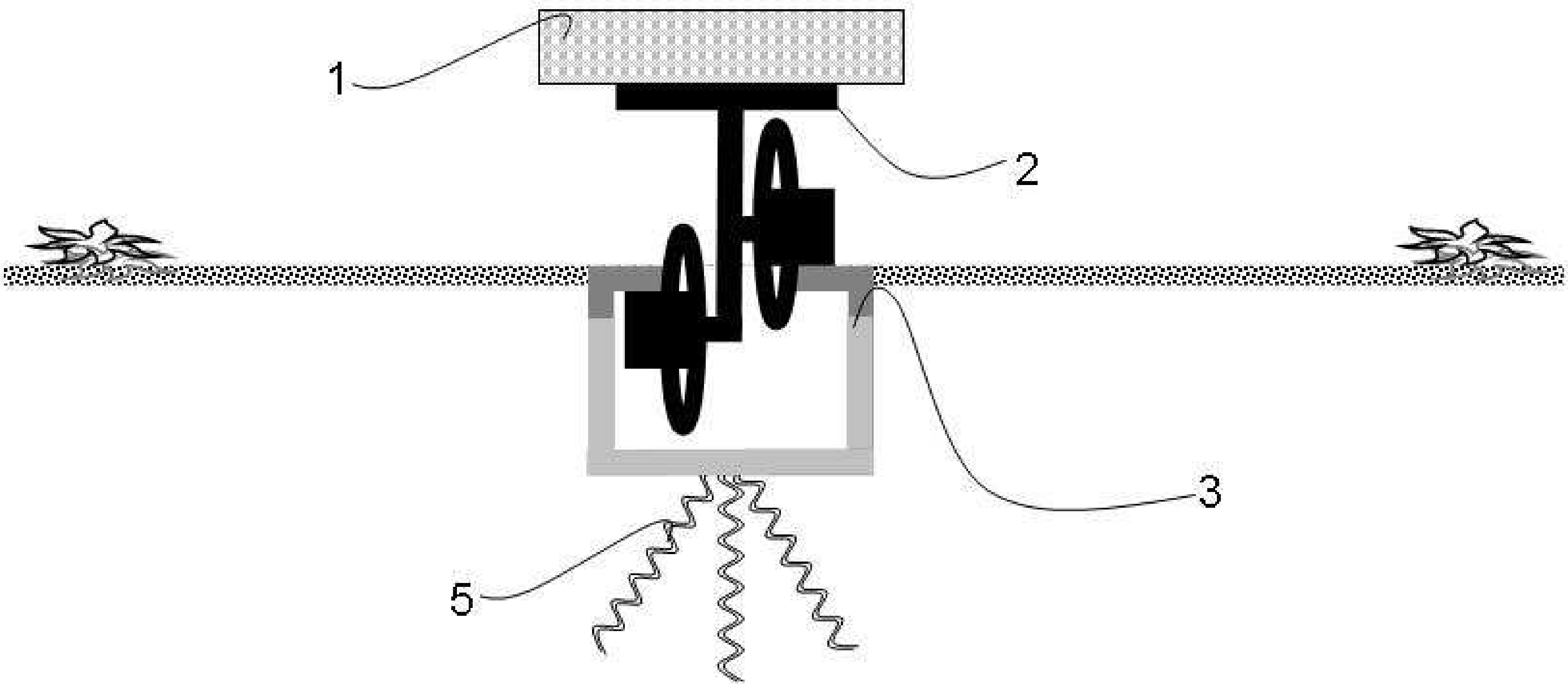

Fig. 9

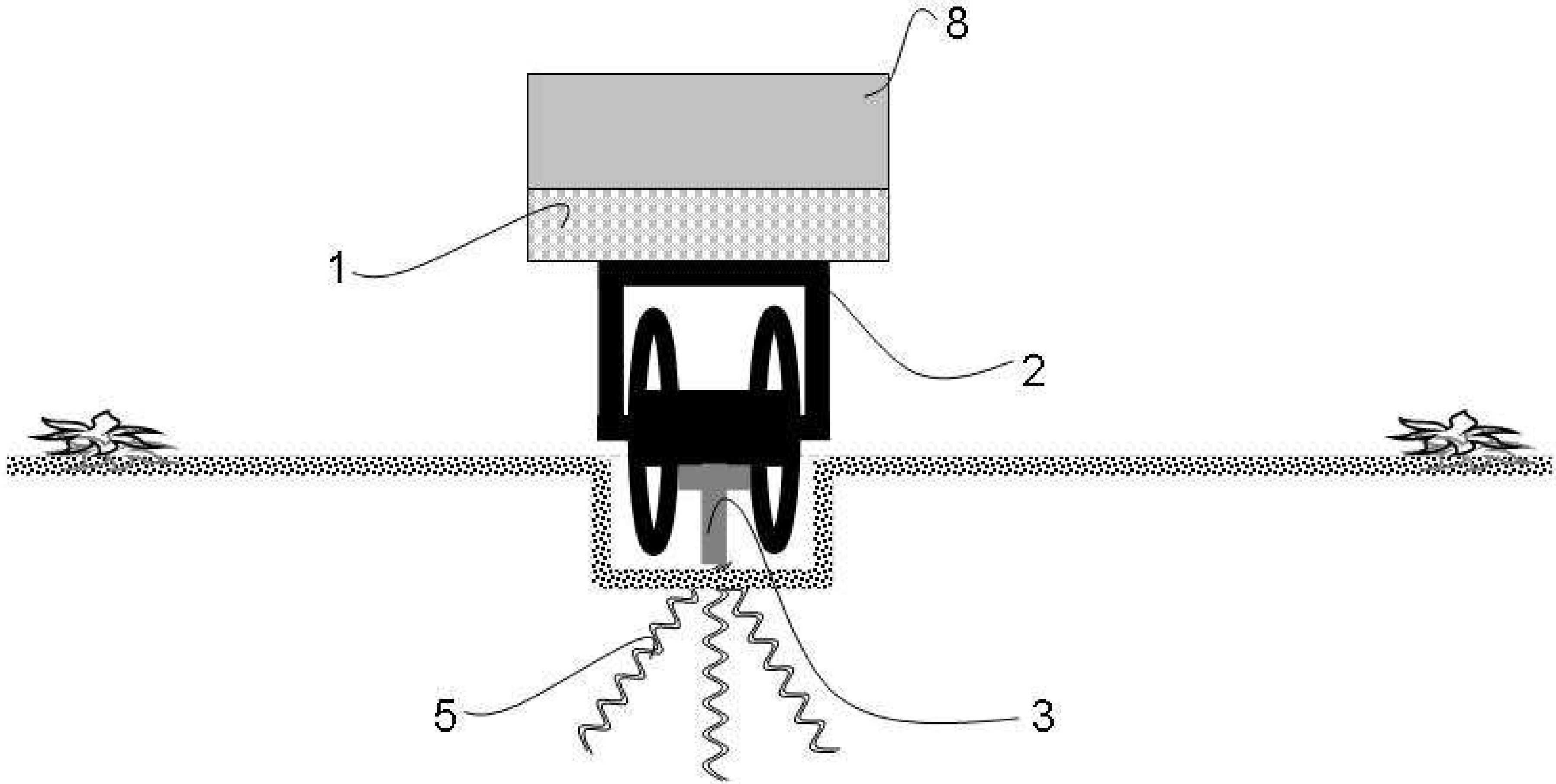

Fig. 10

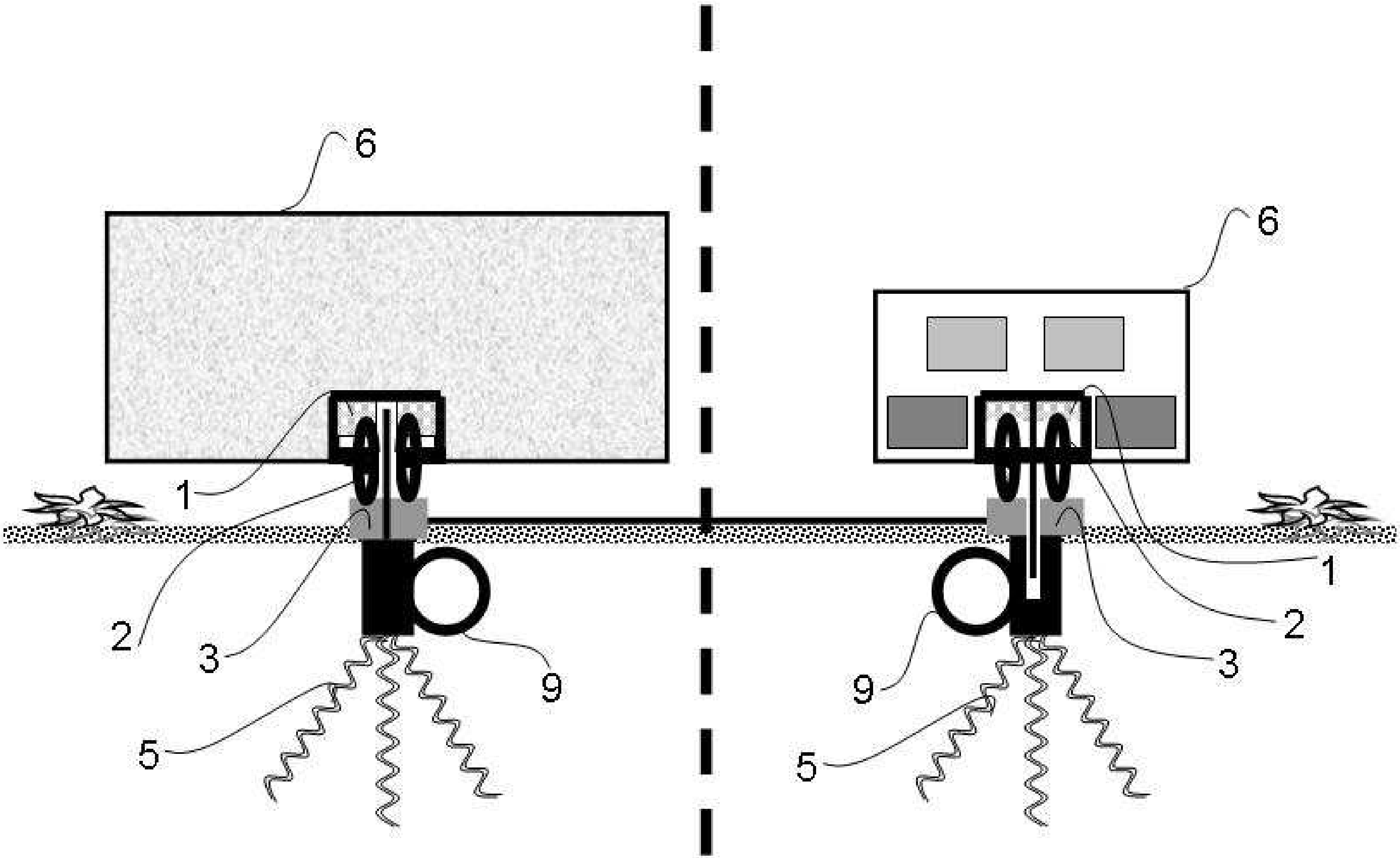

Fig. 11

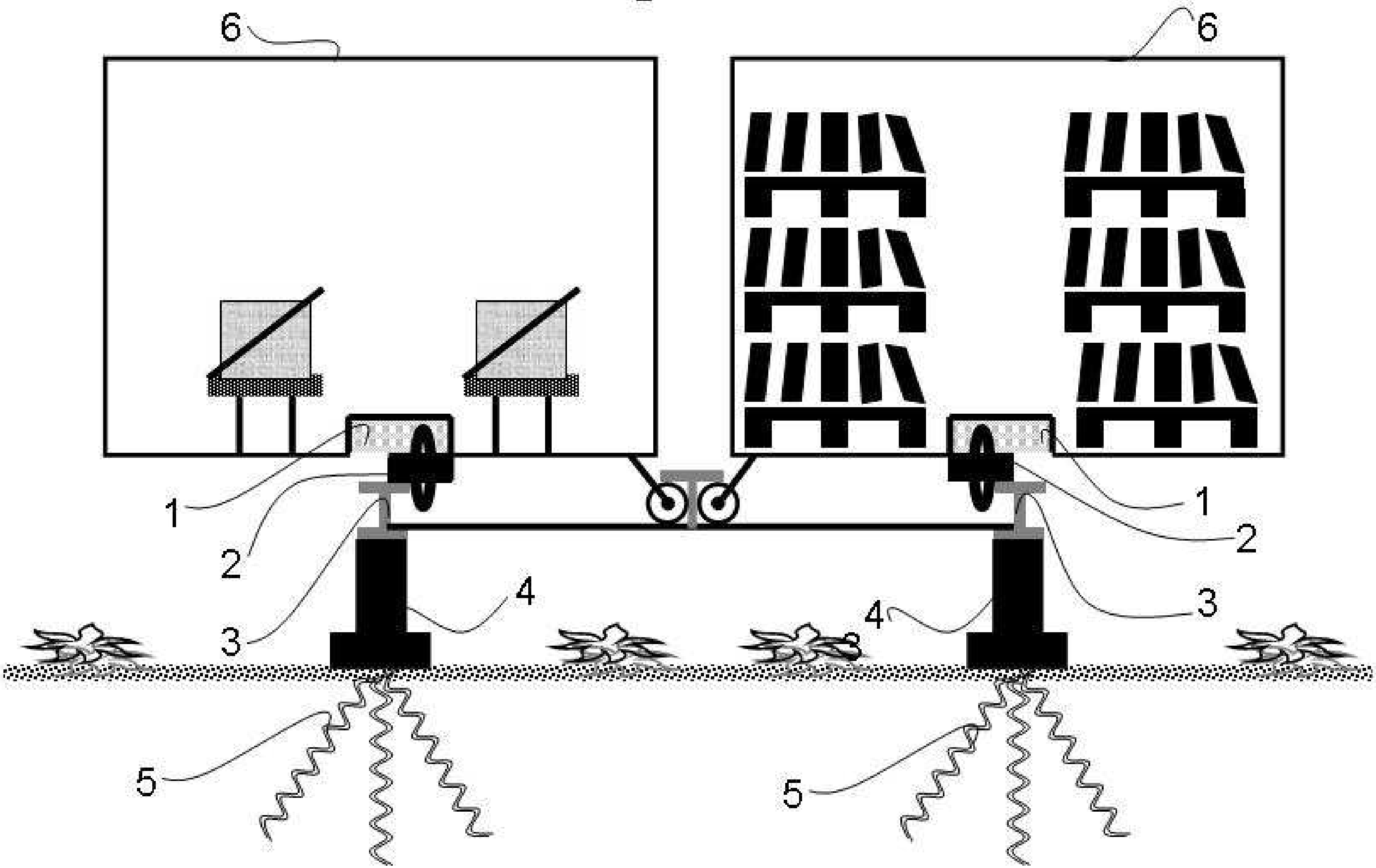

Fig. 12

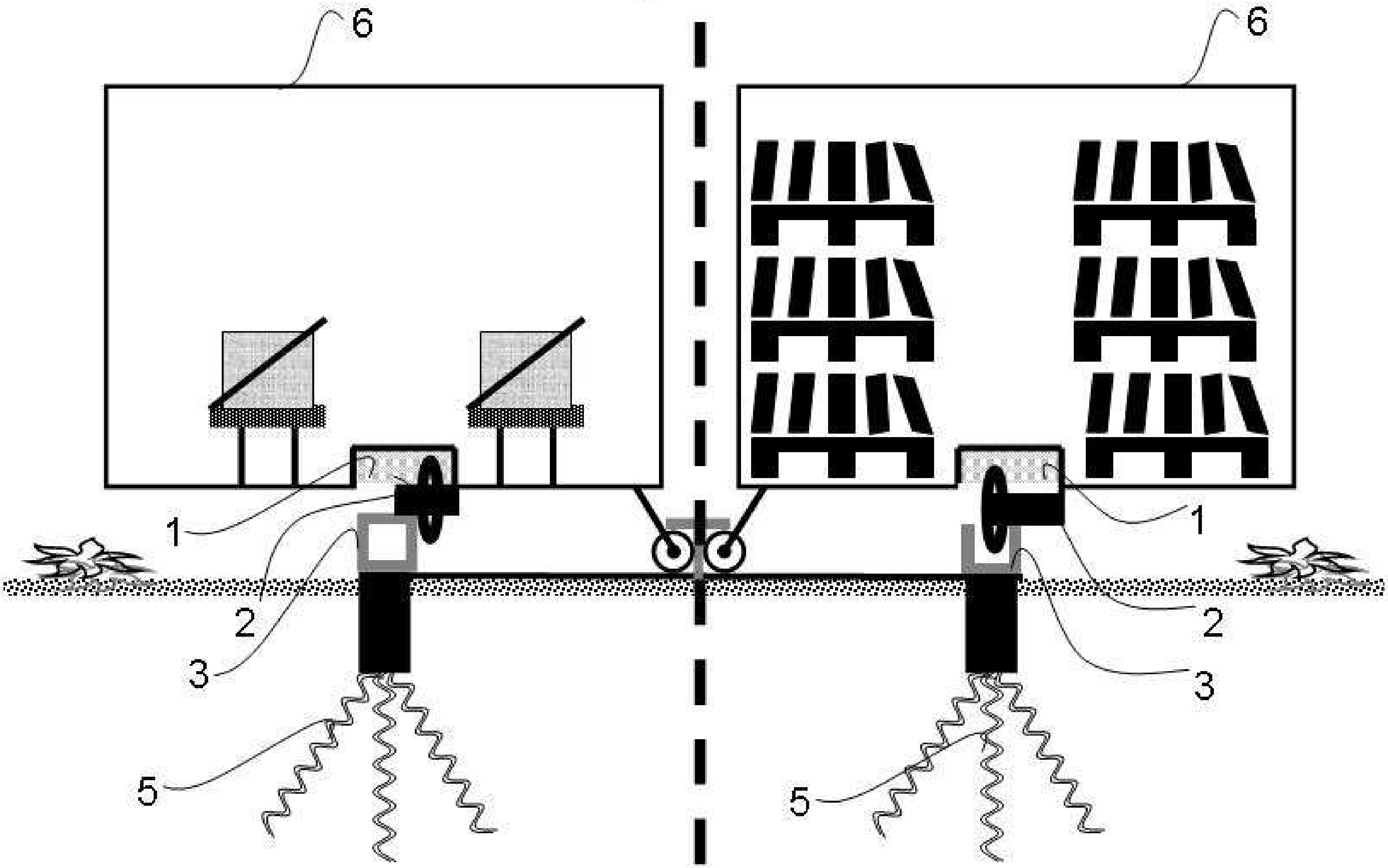

Fig. 13

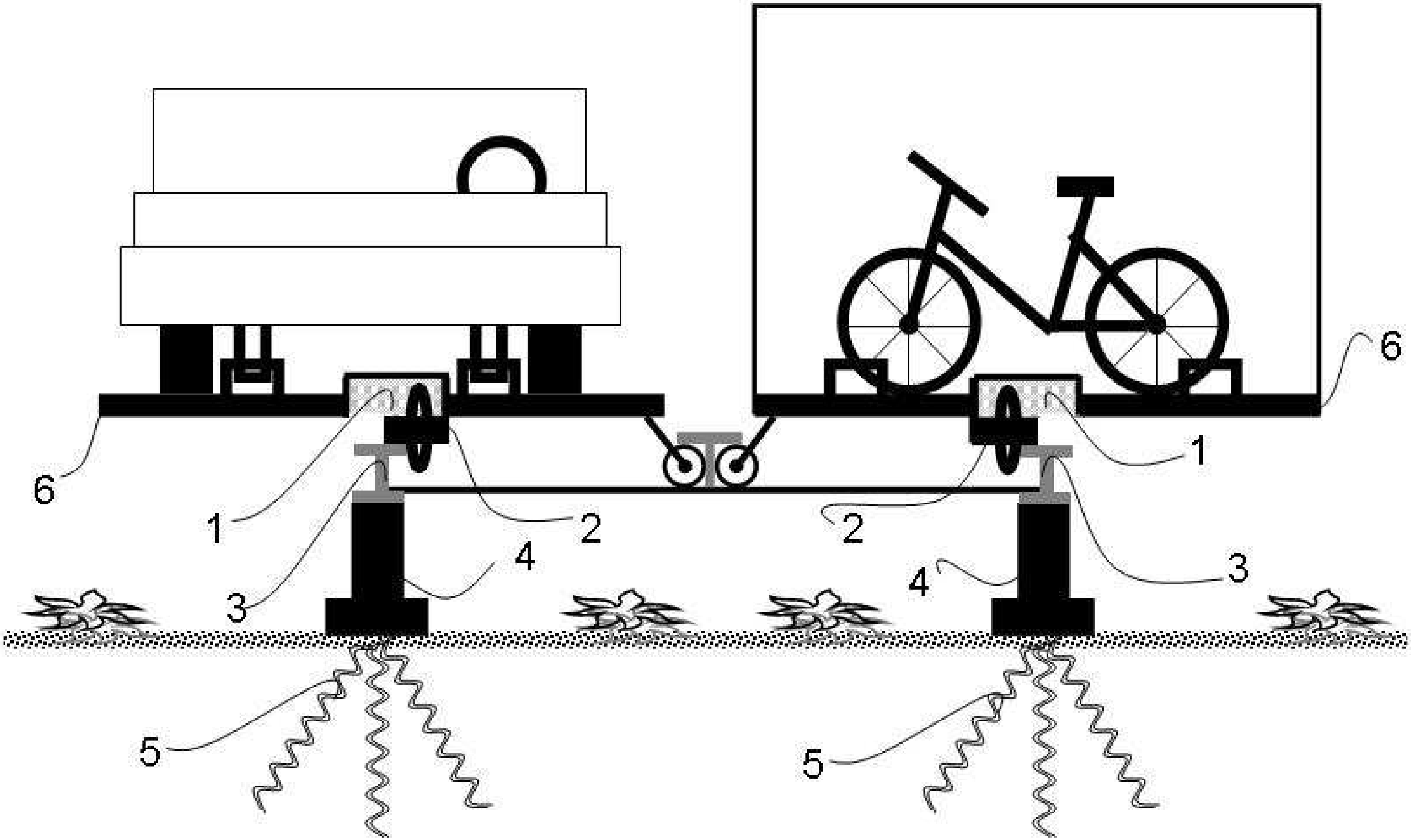

Fig. 14