German utility model no. DE202024102730U1

Lightweight Monorail on Vignole- or Flat Bottomed Rail

Description

Monorails have been around for a long time. There are various monorail systems that use different technical solutions for stabilization. For example, there is the historical example of Louis Brennan's monorail, which was gyrostabilized and had complex mechanics for stabilization, operating on a single rail. Another development is the Monocab, an interesting but complex and expensive solution, also running on a standard Vignole rail, gyrostabilized and equipped with counterweights. Other monorail systems tend to use either overhead or under-slung constructions that run on specially developed, usually elevated rail tracks. These systems are often highly specialized and tailored to specific applications. Many monorail systems are closely tied to specific vehicle and rail constructions from a single manufacturer, which complicates integration into existing rail networks. Thus, no such system has become widely adopted. Compatibility with existing infrastructure is crucial for implementation.

The present invention relates to the technical field of rail transportation technologies, specifically the use and adaptation of monorail systems on existing standard Vignole rails (flat bottomed rails) to provide an efficient, flexible, and cost-effective transportation solution. This also makes it possible to utilize decommissioned or underutilized railway lines.

Existing monorail systems, such as monorail systems or gyrostabilized trains, often use specially developed, elevated tracks or complex gyroscope-supported stabilization systems that are generally incompatible with traditional rail systems. These systems often require extensive and expensive infrastructure changes and are limited to specific applications. Many systems are complex to install and are not compatible with existing railway tracks, limiting their application to newly built, specialized tracks.

Typical problems with existing monorail systems include high costs for infrastructure modifications, limited compatibility with existing rail networks, and the need for specific, often expensive vehicle technology.

Most existing monorail systems are unsuitable for use on existing rail networks due to their specific rail and vehicle configurations. This significantly restricts their use in existing rail networks and prevents cost-effective expansion of the public transport network. Additionally, these systems are often dependent on a single manufacturer, leading to high maintenance and expansion costs.

The present invention provides an innovative solution to these problems by introducing a monorail system that can be used directly on existing Vignole rails.

The proposed invention also solves these problems in another way by the reversible application of a strong steel strip that can be glued or welded onto the rail head of a Vignole rail. This allows a monorail to use the same infrastructure without requiring major modifications.

The first innovation enables the effective reactivation and modernization of single-track decommissioned or infrequently used railway lines for modern traffic, allowing them to be operated in both directions without compromising existing rail structures. This provides a flexible, cost-effective, and quickly implementable solution for urban and rural transportation needs. The system is designed to be flexibly used on double-track lines as well and allows for high utilization through the use of many small cabins, providing more efficient use of infrastructure and better adaptation to traffic needs. By implementing automated control and monitoring, driverless operation ensures safe and reliable operation, reaching every destination along a railway line. The entire monorail traffic is monitored by a central control system.

Only in the second part of the solutions must specially developed switches be constructed and automatically controlled.

My invention is thus based on the further development of rail and transport systems. There are some solutions related to the invention. The existing solutions fulfill their functions under the circumstances (or are still under development or have been abandoned) but do not have the capabilities of the aforementioned invention.

A universally installable solution is desired. The invention specified in claim 1 of a lightweight monorail on a Vignole or flat-bottomed rail meets these requirements.

Examples of Implementation:

The present invention relates to a simple monorail system designed to operate on existing Vignole rails (flat bottomed rails), as shown in Figures 1 to 7. The basic idea is to efficiently use the existing infrastructure while providing a flexible and cost-effective mobility solution.

The monorail is designed to run either directly on standard Vignole rails or on an additionally attached strong steel strip.

1. First Example of Implementation:

This example allows integration into existing rail networks without major changes. Double-flanged wheels and multiple brackets (Fig. 3) that enclose the rail head, or multiple roller bearing strips / small wheel strips (Figs. 4 to 6) keep the vehicle stable on the rail. The wheels and/or roller bearings mounted around the rail head are small enough not to touch the rail fastenings.

The stabilizers, e.g., 4 roller bearings / wheel strips / fixed brackets (each in front of and behind a large flange wheel), are folded up sequentially at a switch at reduced speed to maintain stability.

If the cabin is secured with brackets, some lateral movement is normal. If this is not desired when stationary, or if there is a risk of tipping over in an accident, automatically extending supports are installed. Alternatively, the brackets/clamps can be automatically tightened when the cabin is stationary and loosened when starting.

If the aforementioned slight tilt when stationary is accepted, automatically leveling seats/seating surfaces can be installed.

The small roller strips/roller bearing strips/small wheels are equipped with strong springs and can optionally rotate at the speed of the cabin (with electric motors or wind drive) to minimize friction.

The abrasion of the wheels, roller bearings (strips), and brackets must not be harmful to the environment.

The wheels with strong springs or roller bearing strips can be installed at different heights behind each other so that they do not interfere with each other.

Wheels, roller bearings (strips), and brackets are installed both in front of and behind the double-flanged wheels. These stabilizers must be constructed (e.g., not too long wheel strips) so that there are no problems in curves or switches.

A chassis without a cabin but with double-flanged wheels, wheels, roller bearings, or brackets can also be constructed with a small platform and attachment points to fix goods or bicycles, for example. Bicycles can be unstrapped at the destination and easily ridden away.

The (double) flange wheels are installed under the seats in cabins for passenger transport to have the lowest possible center of gravity.

In the option of the brackets, superlubrication is possible at the contact surface with the rail (possibly applied in front of the cabin and sucked off at the back). A better alternative would be a material for the contact surface of the stabilizers that is hard, very smooth, and does not require lubrication when it rubs on or against a Vignole rail, such as PTFE (polytetrafluoroethylene, Teflon). PTFE has an extremely low coefficient of friction and is known for not requiring additional lubrication, even under high loads. Another possible material could be PEEK (polyetheretherketone). PEEK is a thermoplastic with excellent mechanical properties, including high hardness and smoothness. It is also very wear-resistant and does not require additional lubrication in many applications. Between PTFE (polytetrafluoroethylene) and PEEK (polyetheretherketone), PEEK tends to have a better environmental footprint in terms of production, recycling, reprocessing, and durability. Additionally, hard natural materials with a low coefficient of friction are possible due to their environmental friendliness.

At switches, the guides/stabilizers of the wheels, roller bearings, and brackets can be mechanically or electrically folded up on one side.

Moderate track changes are also necessary:
- Gaps at level crossings between the roadway and the rail must be widened and deepened on both sides if necessary.
- The burrs between welded rails must be ground off.
- The upper portions of the sides of the Vignole rail with which the wheels, roller bearings, and brackets have contact must be automatically ground smooth if necessary.
- Cables on the rail, position sensors, etc., must be laid deeper or more towards the center of the tracks (or removed if no longer needed).
- Bolted joints between rails must be replaced by welds.
- If the fastening screws of the rails are too high, they must be replaced with lower fastenings, or another example of implementation must be used.

2. Second Example of Implementation:

The basic configuration of this monorail consists of a carriage with at least two flange wheels that run above and below a steel strip applied to the rail head of the Vignole rail (Fig. 7). The steel strip can be fastened either with industrial adhesive or by welding. This provides sufficient stability for the vehicle.

Disadvantages of this example of implementation include the additional installation of the steel strip, special switches, and a corresponding switching mechanism.

In both examples, the monorail's electronics for autonomous operation include sensors and control units that enable driverless navigation. This technology ensures efficient rides and optimizes traffic flow by allowing precise control of the train. This enables precise navigation and control of the vehicle and supports the dynamic route guidance of the monorail.

A specially developed switching mechanism, automatically controlled by the cabin and, if necessary, remotely, allows flexible and efficient switching between rails, which is particularly advantageous on single-track routes.

Due to large leverages, it makes sense to build light and small cabins with a low center of gravity: e.g., one or two seats or several in a row directly over the rail (Fig. 2) or only correspondingly small chassis or cabins for freight transport. This principle is also possible for DE202023103592U1. The drive and other devices can be adopted analogously from these implementations.

Overall, the technology should be as simple as possible with simple mechanics to build inexpensive cabins and have few failures. The (computer) hardware and software used should be optimized in every respect, as the cost share will be low. For example, a smartphone app/program and wireless data transmission (e.g.,

Bluetooth) can be used to request the cabin, enter destinations, and navigate, resulting in an automatic control system.

Compared to other heavy rail vehicles, bridges with light cabins can, under ideal circumstances, consist almost solely of the rails, which may be kept under high voltage.

Every level crossing becomes an additional "Stop" road for cars, trucks, and other vehicles.

Such a small and narrow monorail could even be built along normal rail tracks or highways (also possible for DE202023103592U1).

In summary, the present invention offers a simple solution for using existing railway tracks (Vignole or flat bottomed rails) with a lightweight monorail that impresses with its easy retrofitting and high efficiency. The present invention primarily provides an effective solution for utilizing decommissioned or underutilized railway lines by implementing an adaptable, stable, and autonomous monorail system. The uniqueness of this system lies in its ability to be used without extensive modifications to existing rail infrastructures, as well as its high operational efficiency and flexibility. This invention enables improved use of existing infrastructures and thus supports sustainable transport solutions.

Reference List

1. Monorail cabin
2. Vignole rail
3. Rail head
4. Stabilizers: wheel/roller bearing (strips)/brackets
5. (Double) flange wheel
6. Drive and control unit
7. Steel strip
8. Industrial adhesive / weld for steel strip
9. Contact surface of the bracket

Claims

1. Lightweight monorail on a Vignole or flat bottomed rail,
characterized by
the fact that double-flanged wheels on the rail head and brackets enclosing the rail head and/or multiple small wheels and/or roller bearing strips are mounted around the rail head and do not touch the rail fastenings and other components.

2. Lightweight monorail on a Vignole or flat bottomed rail, according to claim 1,
characterized by
the fact that the stabilizers (roller bearings / wheel strips / brackets) are designed so that they can be folded up sequentially at switches at reduced speed.

3. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that automatically extending supports are installed.

4. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that the brackets/clamps are automatically tightened when the cabin is stationary and loosened for starting.

5. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that automatically leveling seats/seating surfaces are installed.

6. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by

the fact that the small roller strips / roller bearing strips / small wheels are equipped with strong springs and can optionally rotate at the speed of the cabin (with electric motors or wind drive).

7. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that the abrasion of the wheels, roller bearings (strips), and brackets is not harmful to the environment.

8. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that the wheels or roller bearing strips are installed with strong springs at different heights behind each other and optionally combined with brackets.

9. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that wheels, roller bearings (strips), and brackets are installed both in front of and behind the double-flanged wheels. These stabilizers are designed to be compatible with curves and switches (e.g., not too long wheel strips).

10. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that a chassis with double-flanged wheels, wheels, roller bearings, or brackets without a cabin is constructed with a small platform and attachment points.

11. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that the double-flanged wheels are installed under the seats in cabins for passenger transport.

12. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that in the option of brackets, superlubrication, PTFE (polytetrafluoroethylene, Teflon), PEEK (polyetheretherketone), or hard natural materials with a low coefficient of friction are applied.

13. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that devices are constructed to fold up the wheels (strips), roller bearings (strips), and brackets on one side mechanically or electrically.

14. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that flange wheels for guidance are installed above and below a reversible steel strip fixed on the rail head with industrial adhesive or welding.

15. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that for the option with a steel strip, special switches and a corresponding switching mechanism are constructed.

16. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that the autonomous control system includes sensors to monitor rail conditions and control driving dynamics, and the autonomous control system is equipped with environmental sensors to detect objects and obstacles.

17. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that central monitoring units are built or adapted to monitor and control the entire monorail traffic.

18. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that the switching mechanism is automatically controlled by the monorail and, if necessary, by a central control unit.

19. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that light and small cabins with a low center of gravity are built, and one, two, or several seats are constructed in a row directly above the rail, or correspondingly small chassis.

20. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that the drive unit, the (electric) motors, the batteries, the control unit, the charging unit, and optionally the apparatus for the "switch setting" are installed on the chassis. One or two motors (optionally also one motor in front and one motor behind the cabin) with various possible connections to the rail, as well as batteries (optionally an additional battery in the cabin) and driving electronics, are also installed.

21. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that the aerodynamic cabin encloses the chassis with the drive unit.

22. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,

characterized by
the fact that the power requirement of the monorail is met in various ways, e.g., via induction, direct power supply, or batteries.

23. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that a small drive unit and an accumulator are installed in the cabin.

24. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that a vibration damping system is installed in the monorail.

25. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that the (computer) hardware and software used for the driverless monorail are optimized, and programs with smartphone apps communicate with the central control unit, including programs for wireless data transmission (e.g., Bluetooth) and other software that coordinate the cabin request, destination input, navigation, and automatic control.

26. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that bridges consist almost solely of the stabilized rails, which may be kept under massive tension.

27. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that an integrated emergency

braking system is installed to immediately react to obstacles and ensure driving safety, but it can also be triggered manually.

28. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that a communication system for networking with a central traffic control is installed.

29. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that a modular cabin system for passenger and/or cargo configurations is constructed.

30. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that the autonomous control is configured to optimize driving speed and energy consumption.

31. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that the control unit is equipped with artificial intelligence to optimize travel routes and times and to assist with global positioning systems (GPS) and feedback from position sensors for precise navigation and route planning.

32. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that the vehicle system is equipped with advanced anti-collision systems based on laser scanners and ultrasonic sensors.

33. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,

characterized by
the fact that the weight/center of gravity of the cabin is designed eccentrically. Alternatively, the front and rear halves of the cabin floor can each be shifted eccentrically to the left or right and connected in the middle.

34. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that during braking maneuvers and downhill, the motor is used as a generator, i.e., an energy recovery system is installed.

35. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that noise protection is installed, including shielding of the (flange) wheels, optionally with anti-noise / "noise-canceling."

36. Lightweight monorail on a Vignole or flat bottomed rail, according to one of the preceding claims,
characterized by
the fact that the monorail includes devices to scare away animals and warn people. The onboard electronics analyze the movement profiles of people near the tracks and adjust the speed accordingly.

Fig. 1

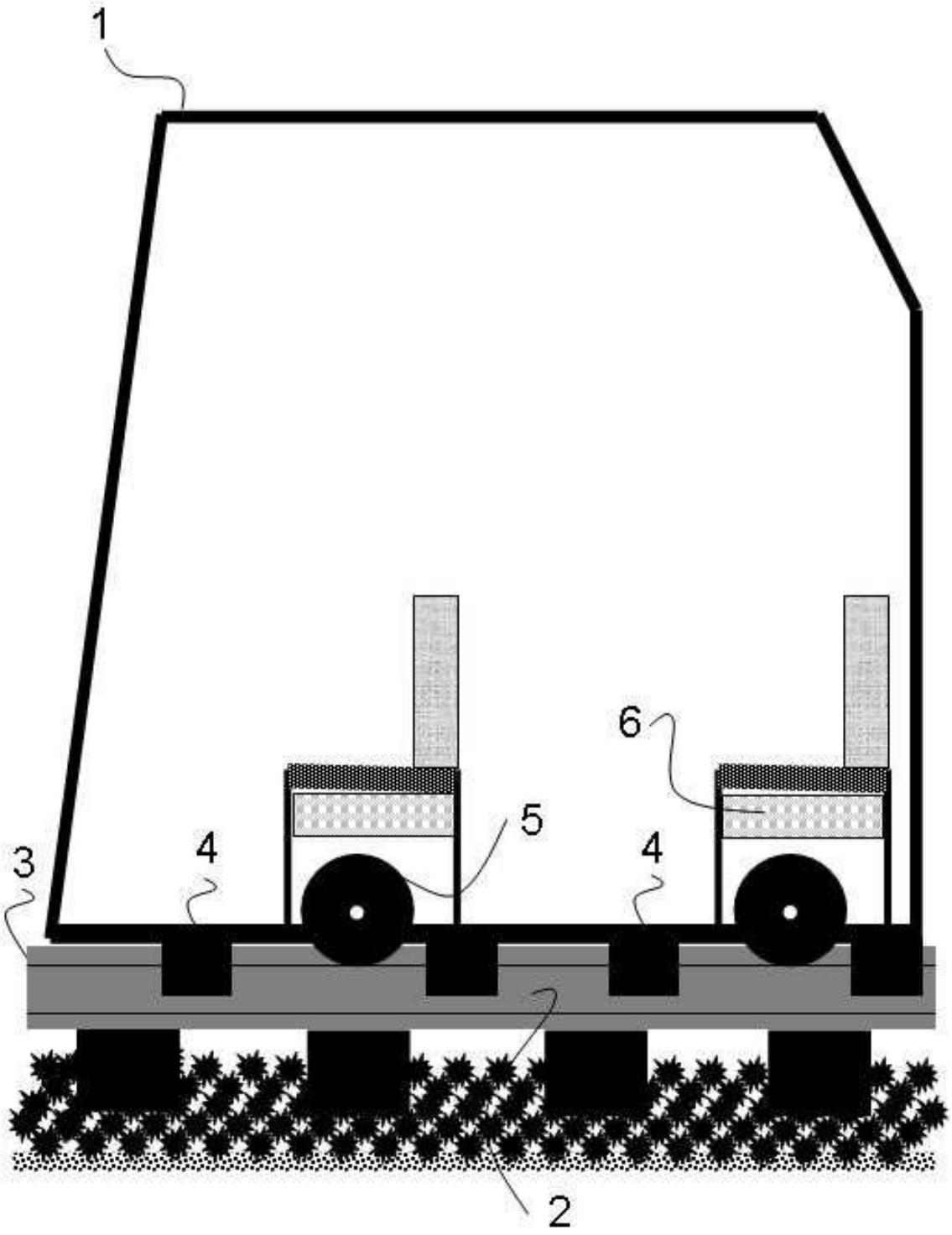

Fig. 2

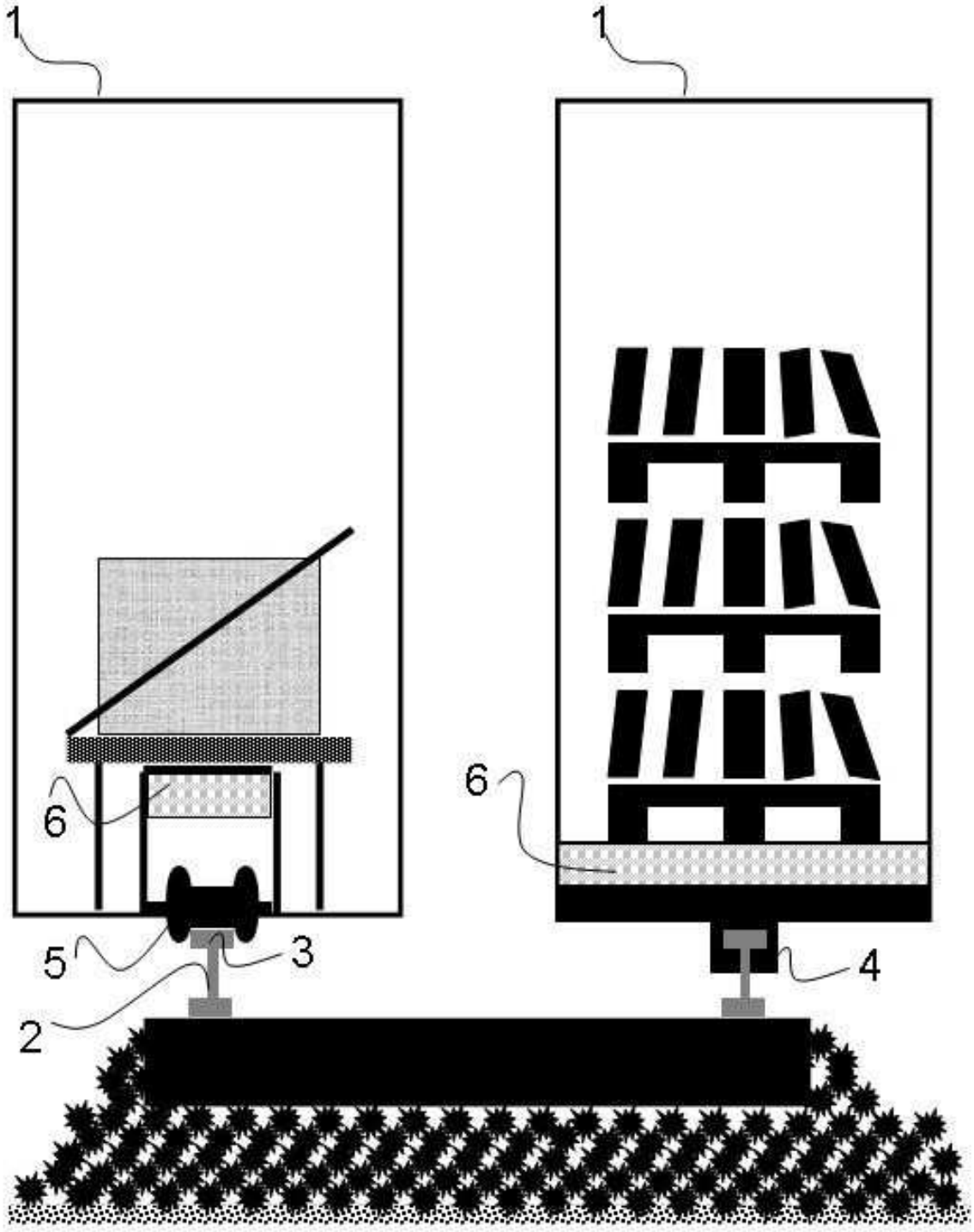

Fig. 3

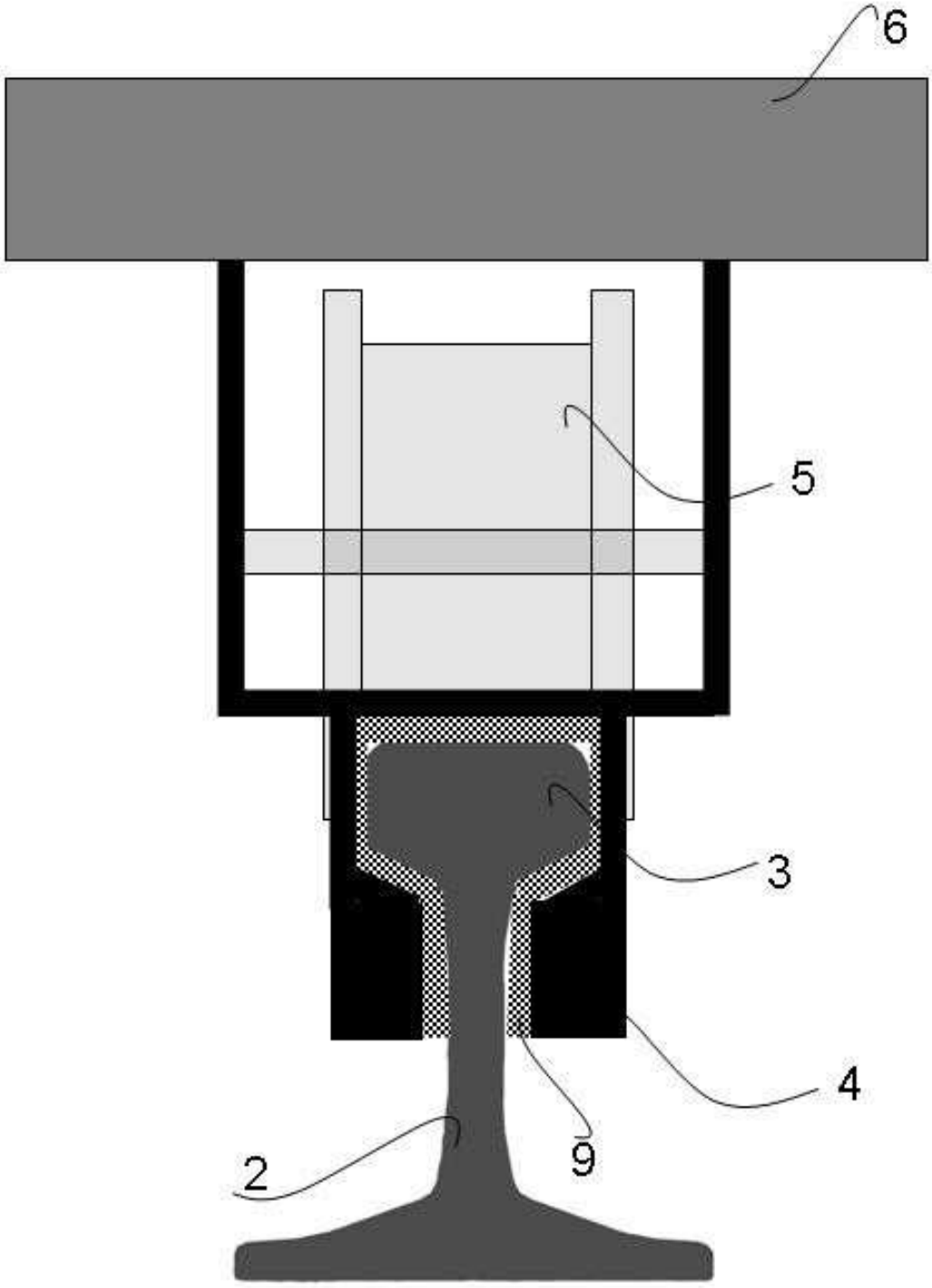

Fig. 4

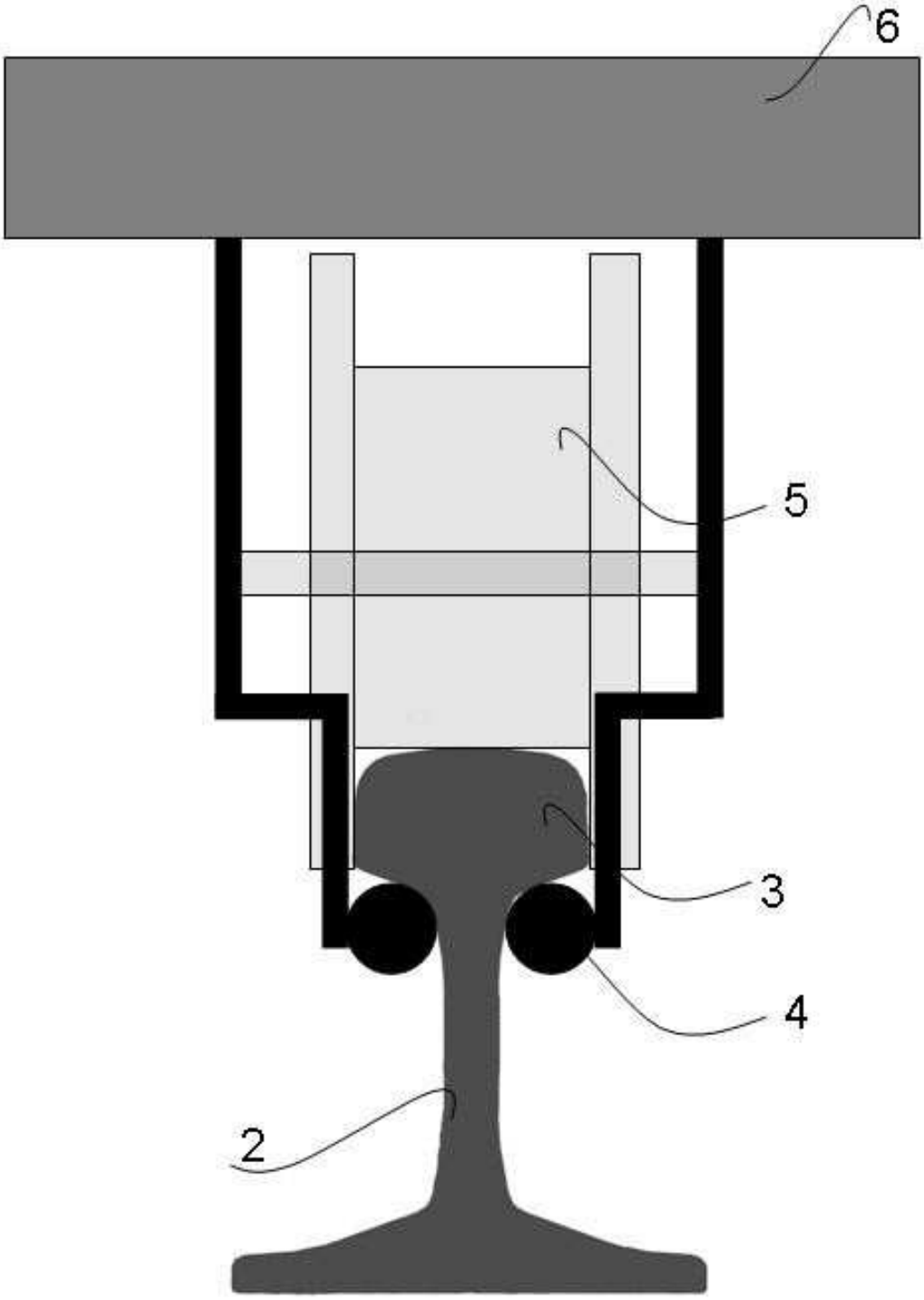

Fig. 5

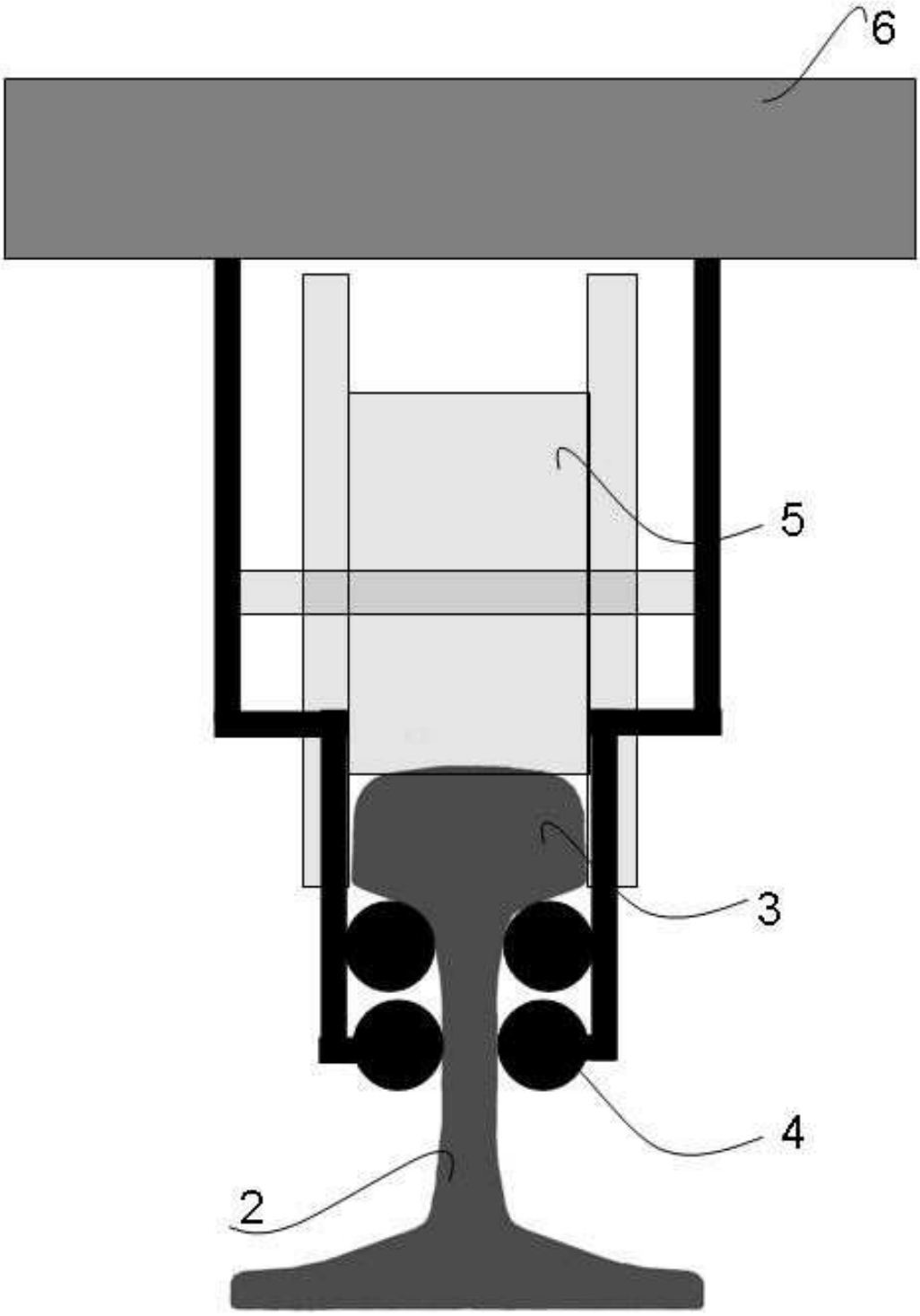

Fig. 6

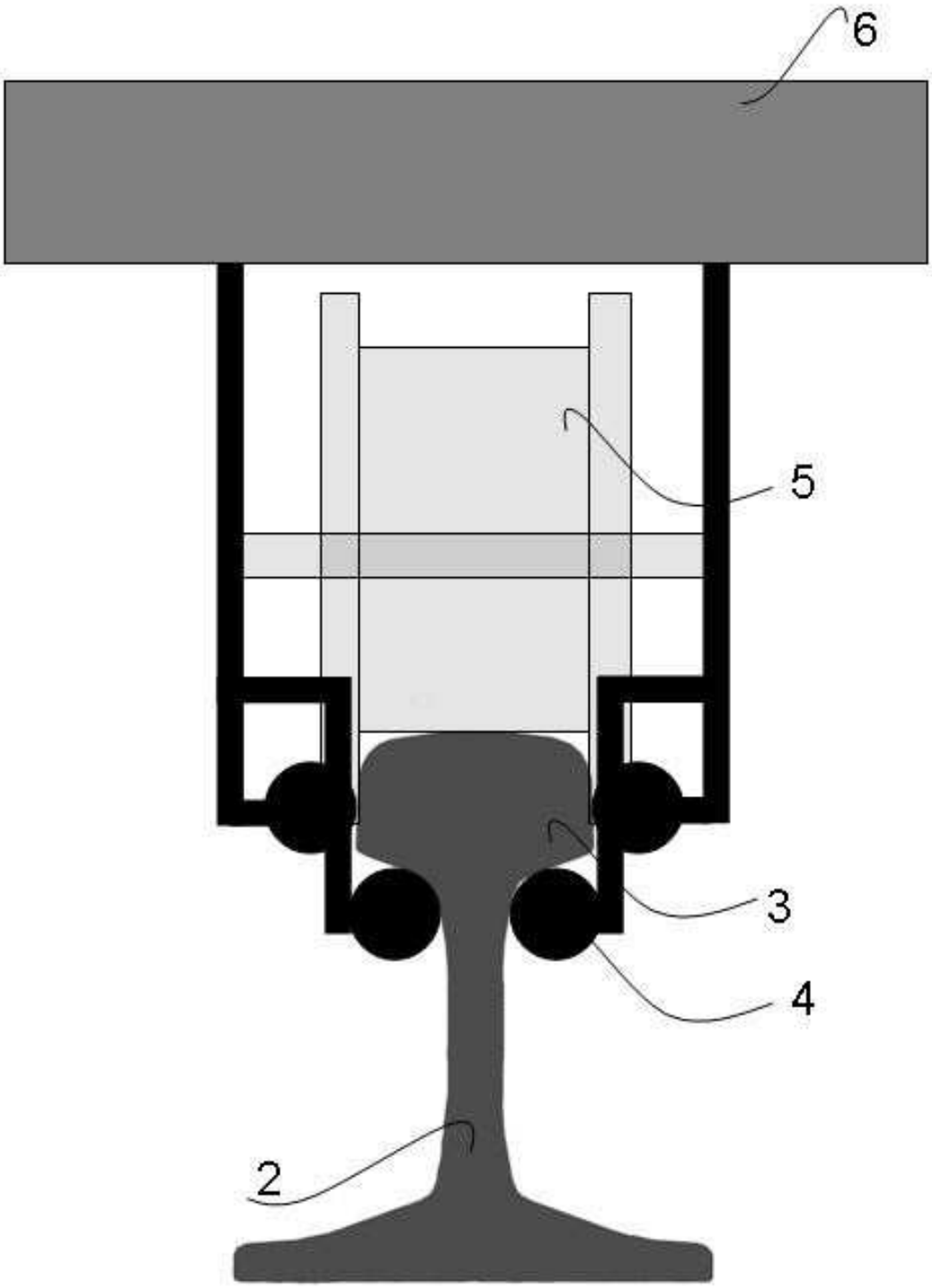

Fig. 7