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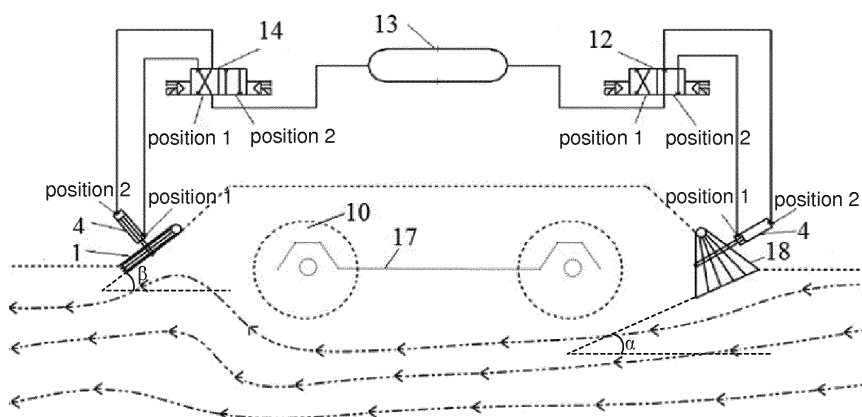
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(54) **SNOW ACCUMULATION PREVENTING DEVICE FOR TRAIN BOGIE AREA**

(57) The disclosure discloses an anti-snow accumulation device for an area of a bogie of a train, comprising first and second executing elements, a sequence of actions of the first and second executing elements is determined according to the running direction of the train. The first and second executing elements are installed respectively on front and rear end plates on the chassis of the train. The bogie is located between the first and second executing elements. The first executing element comprises a first foldable guide plate, and the second executing element comprises a second foldable guide plate.

The first guide plate close to the running direction of the train and the second guide plate away from the running direction are configured to cooperate in a manner that, when the first guide plate is in an unfolded open state, the second guide plate is in a folded closed state towards the chassis of the train. The disclosure can prevent the bogie from snow accumulation in running process, ensure the dynamic performance of the bogie, and improve the running security and transport efficiency in snowy weather.

Fig.4



Description

TECHNICAL FIELD

[0001] The disclosure relates to an assisting functional device for a train, and in particular, to an anti-snow accumulation device to prevent an area of a bogie of a high-speed train from snow accumulation in snowy winter.

BACKGROUND

[0002] When a high-speed train runs in snowy weather in a very cold area, snow on the rails will be rolled up due to the effect of the spoiler of the area of the bogie, and the snow will accumulate on the bogie. The snow will melt into water due to the effect of heating elements, such as motor, gearbox, disc braking and the like on the bogie, and the snow will freeze into ice, and then the snow will melt into water and freeze into ice again and again. Finally, the snow will be formed into large pieces of ice on the bogie. The ice changes the dynamic characteristics of the bogie, and even restrains the movements of the bogie, which may cause a serious accident such as derailment.

[0003] Presently, most of the high-speed trains have not been equipped with anti-snow accumulation device. The ice caused by the snow accumulation on the bogie is serious in snowy winter. The end plate of the area of the bogie of some high-speed trains is equipped with a rubber capsule. The rubber capsule is used to improve the structure of the flow field in the area of the bogie. The structure improves the entrance condition to an extent, and reduces the snow amount in the area of the bogie. Thus, in actual running process, the structure can prevent the train from the snow accumulation to an extent. However, when a high-speed train for long-distance and whole course travels for a long time period in long-time snowy weather, severe snow accumulation will finally occur in the area of the bogie, because of the snow accumulation caused by the symmetrical structure on the tail of the train.

SUMMARY

[0004] The technical problem to be solved by the disclosure is to overcome the shortcomings and defects mentioned in the background, and to provide an anti-snow accumulation device for an area of a bogie of a train, which can prevent the bogie of the train from snow accumulation when the train is running, assure the dynamic performance of the bogie, and improve the security and transport efficiency of the train when the train is running in snowy weather.

[0005] In order to solve the technical problem, the disclosure is intended to provide an anti-snow accumulation device for an area of a bogie of a train. The anti-snow accumulation device installed in the area of the bogie at the bottom of the train includes a first executing element

and a second executing element. A sequence of an action of the first executing element and an action of the second executing element is determined according to running direction of the train. The first executing element and the second executing element are installed respectively on a front end plate and a rear end plate on a chassis of the train. The bogie is located between the first executing element and the second executing element. The first executing element includes a first foldable guide plate, and the second executing element includes a second foldable guide plate. The first guide plate close to the running direction (i.e., the front end) of the train and the second guide plate away from the running direction of the train are configured to cooperate in a manner that, when the first guide plate is in an unfolded open state, the second guide plate is in a folded closed state towards the chassis of the train.

[0006] The anti-snow accumulation device for the area of the bogie of the train of the disclosure effectively guides the air flow at the bottom of the train through a simple, effective and easily controlled structure, reduces the snow amount entering the area of the bogie, avoids the snow accumulation at the end of the area of the bogie, and further reduces the probability of snow accumulation in the bogie area of the train.

[0007] In the anti-snow accumulation device for the area of the bogie of the train, preferably, the first guide plate is in the unfolded open state refers to that the first guide plate unfolds towards the bogie such that the distance between the first guide plate and the front end (i.e., the end close to the running direction of the train) of the bogie is reduced, and the second guide plate is in the folded closed state refers to that the second guide plate folds towards the chassis of the train and closes to the rear end plate. In the preferable solution, the anti-snow accumulation device installed at the bottom of the train can guide the air at the bottom of the train specifically, reduce the snow amount entering the area of the bogie in the front end area of the bogie on one hand, and guide air out at the end of the area of the bogie on the other hand, so as to reduce the snow accumulation.

[0008] In the anti-snow accumulation device for the area of the bogie of the train, preferably, the first guide plate in the unfolded open state is equipped with an inclined plane for guiding the air at the bottom to deviate towards rail surface, and the inclined plane forms an included angle α not larger than 90° with the horizontal plane, the α preferably ranges between 30° and 90° , more preferably, between 30° and 60° (particularly, 45°). The second guide plate in the folded closed state is equipped with an inclined plane for guiding the air in the area of the bogie towards the behind of the rear end plate, and the inclined plane forms an angle β not larger than 90° with the horizontal plane. The included angle β preferably is not greater than 60° , more preferably, ranges between 40° and 60° (particularly, 45°). The distance between the first guide plate and the second guide plate is set to be L. The relation between the designed size parameters can be

determined through testing and simulation calculation.

[0009] In the above preferable solution of the disclosure, snowflake carried in the air can be avoided to enter the area of the bogie maximally through optimized design of the first guide plate, so as to reduce the snow amount entering the area of the bogie. Meanwhile, through the optimized design of the second guide plate, the guide plate close to the rear end of the train is in a folded closed state, which can maximally avoid the air behind the area of the bogie to reflow towards the area of the bogie, so as to maximize the exhausted snow amount.

[0010] In the anti-snow accumulation device for the area of the bogie of the train, preferably, the first guide plate and the second guide plate are driven by a cylinder-type driving mechanism to unfold or fold. The cylinder-type driving mechanism includes a double-acting cylinder and a gasholder connected to the double-acting cylinder, a double-acting solenoid valve is installed in a gas line between the double-acting cylinder and the gasholder. Certainly, the double-acting cylinder can be replaced by a double-acting hydraulic cylinder. Through the cylinder-type driving mechanism, the cooperation between the first guide plate and the second guide plate can be realized with low cost and simple structure, to avoid snow accumulation on the bogie. Moreover, the double-acting solenoid valve can well adapt the forward and backward movements of the train. For example, the first guide plate is unfolded when the train runs forward, and the second guide plate is folded. When the train runs backward, through a simple action of the double-acting solenoid valve, the unfolded first guide plate can become the second guide plate in the backward running state, and the folded second guide plate can become the first guide plate in the backward running state.

[0011] In the anti-snow accumulation device for the area of the bogie of the train, preferably, the first guide plate and the second guide plate are configured to be a cavity-style structure unfolding around a fixed end. An installation frame on one side of the cavity-style structure is installed on and mates with the bottom of the train. An end face on the other side of the cavity-style structure is connected to a driving mechanism for driving the cavity-style structure to unfold or fold. When the driving mechanism is the preferable cylinder-type driving mechanism, the end face is connected to the double-acting cylinder correspondingly. In a further improvement, a reinforced rib frame is installed on the end face of the cavity-style structure, and the driving mechanism (such as the double-acting cylinder of the cylinder-type driving mechanism) is connected to the reinforced rib frame. As such, under the effect of the double-acting cylinder, the end face will not deform, and the other end faces can deform rapidly so as to unfold or fold. For further improvement, the installation frame of the cavity-style structure is connected to the end face through a folded element with wrinkles, the foldable element is made of cold-resistant, impact-resistant, light rubber or fibre material, such as a blend of natural rubber and butadiene rubber, which is high-

elastic, impact-resistant, cold-resistant and can be used normally in an environment of minus 40°.

[0012] The anti-snow accumulation device for the area of the bogie of the train, preferably, the cavity-style structure is open only at the installation frame side of the cavity-style structure, and forms a closed cavity with the bottom structure of the train. Thus, when the first guide plate is in open state, the snowflake can be avoided to enter into the cavity-style structure, so as to ensure the normal operations of the executing elements.

[0013] Compared with existed technology, the advantage of the disclosure is as follows. The disclosure is intended to provide an anti-snow accumulation device for the area of the bogie of the train (especially the high-speed train). The device can guide the air flow at the bottom of the train, which can prevent the bogie of the train from snow accumulation when the train is running, assure that the dynamic performance of the bogie will not change due to the snow accumulation, and improve the security and transport efficiency of the train when the train is running in snowy weather. In the preferable solution, the anti-snow accumulation device can not only reduce the snow amount entering the area of the bogie from the front end area of the bogie, but also reduce the backflow at the tail of bogie area, and drastically reduce the ice caused by the snow accumulation of the bogie. In addition, in a more preferable solution, the anti-snow accumulation device of the disclosure can vary automatically along with the variation of train running direction, and unfold and fold automatically along with the running direction of the train. Thus, the operation of the device is reliable, and the structure of the device is simple and the device is maintenance-free.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] In order to clearly illustrate the embodiments of the disclosure or the technical solutions in existing technologies, drawings used in the description of the embodiments or existing technologies are described briefly below. It is apparent that the following drawings are some of the embodiments of the disclosure, and that for those ordinary skilled in the art, more drawings can be obtained according to these drawings without creative work.

Fig. 1 is a structural diagram of the second guide plate according to the embodiments of the disclosure in a folded closed state.

Fig. 2 is a structural diagram of the first guide plate according to the embodiments of the disclosure in an open unfolded state.

Fig. 3 is a structural diagram of showing the installation of the first guide plate and the second guide plate according to the embodiments of the disclosure in bogie area.

Fig. 4 is a diagram showing the operation principle of the anti-snow accumulation device according to the embodiments of the disclosure when the train runs rightwards.

Fig. 5 is a diagram (which is a perspective view, wherein the bogie is omitted) of the anti-snow accumulation device on the train according to the embodiments of the disclosure.

Legends:

[0015] 1, a second guide plate; 2, an installation base; 3, a pin; 4, a double-acting cylinder; 5, a guide plate pin; 6, a guide plate base; 7, a foldable element; 8, an end face; 9, an installation frame; 10, a wheel set; 11, a rear end plate; 12, a first double-acting solenoid valve; 13, a gasholder; 14, a second double-acting solenoid valve; 15, a reinforced rib frame; 16, a front end plate; 17, a bogie; 18, a first guide plate; 19, a closed cavity.

BRIEF DESCRIPTION OF THE EMBODIMENT

[0016] In order to better understand the disclosure, drawings and preferred embodiments are used to describe the disclosure completely and meticulously below. However, the scope of protection of the disclosure is not limited to the following specific embodiments.

[0017] It is to be noted that when an element is fixed, jointed, linked or connected to another element, said element can be fixed, jointed, linked or connected to said another element directly, or be fixed, jointed, linked or connected to said another element through an intermediate connection element.

[0018] Unless otherwise defined in the disclosure, the meanings of all the terminologies used hereafter are the same as the meanings construed by those skilled in the art. The terminologies used in the disclosure are only used for purpose of describing of specific embodiments, and not for limiting the scope of protection of the disclosure.

[0019] Unless otherwise specified, the raw material, reagent, instrument and device used in the disclosure are available in market, or can be prepared through the existing methods.

Embodiments

[0020] The anti-snow accumulation device for the area of the bogie of the train is shown in Fig. 1 to Fig. 5. The device can avoid the snow accumulation in bogie area of the high-speed train. The anti-snow accumulation device is installed on the front end plate and rear end plate in bogie area at the bottom of the train. The anti-snow accumulation device includes a driving mechanism, and a first executing element and a second executing element. The sequence of an action of the first executing element and an action of the second executing element

is determined according to running direction of the train. The first executing element and the second executing element are installed respectively on a front end plate 16 and a rear end plate 11 of the chassis of the train. The bogie 17 is located between the first executing element and the second executing element (as shown in Fig. 5).

[0021] In the embodiment, the first executing element includes a first foldable guide plate 18 (as shown in Fig. 2), and the second executing element includes a second foldable guide plate 1 (as shown in Fig. 1). The first guide plate 18 is close to the running direction of the train, and the second guide plate 1 is away from the running direction of the train (if the running direction of the train is inversed, then the first guide plate and the second guide plate exchange), the first guide plate 18 and the second guide plate 1 are configured to cooperate in a manner that, when the train runs forwards, the first guide plate 18 is in an unfolded open state towards the bogie 17, and the second guide plate 1 is in a folded closed state towards the chassis of the train.

[0022] As shown in Fig. 4, in the embodiment, the first guide plate 18 is in the unfolded open state towards the bogie 17 refers to that the first guide plate 18 unfolds towards the bogie 17 such that the distance between the first guide plate 18 and the front end of bogie 17 (the end close to the running direction of the train) is reduced. That is, the first guide plate 18 becomes close to front wheel set 10. The first guide plate 18 in the unfolded open state is equipped with an inclined plane for guiding the air at the bottom to deviate towards rail surface. An included angle α is formed between the inclined plane and the horizontal plane is 45° . The second guide plate 1 is in the folded closed state towards the chassis of the train refers to that the second guide plate 1 folds towards the chassis of the train and closes to the rear end plate 11. That is, the second guide plate 1 becomes away from the rear wheel set 10. The second guide plate 1 in the folded closed state is equipped with an inclined plane for guiding the air in the area of the bogie towards the behind of the rear end plate 11. An included angle β formed between the inclined plane and the horizontal plane is 45° . The anti-snow accumulation device according to the present embodiment can guide the air at the bottom of the train specifically. On one hand, the anti-snow accumulation device can reduce the snow amount entering the area of the bogie in the front end area of the bogie on one hand. On the other hand, the anti-snow accumulation device can guide air out at the end of the area of the bogie. As such, the anti-snow accumulation device can avoid the backflow of air in rear area of the bogie to bogie area and reduce the snow accumulation.

[0023] As shown in Figs. 1-3, each of the first guide plate 18 and the second guide plate 1 may be a cavity-style structure (similar to a sector) unfolding around a fixed end. The cavity-style structure includes an installation frame 9 and an end face 8. The installation frame 9 is connected to the end face 8 through a folded element 7 with wrinkles. The foldable element 7 in the embodi-

ment is made of cold-resistant, impact-resistant, light rubber capsule material. The installation frame 9 on one side of the cavity-style structure is installed on and mates with the structure on the bottom of the train through a rectangular frame. A reinforced rib frame 15 is installed on the end face 8 of another side of the cavity-style structure. The reinforced rib frame 15 is connected to a driving mechanism (as shown in Fig. 2) driving the cavity-style structure to unfold or fold. As such, under the effect of the driving mechanism, the end face will not deform, and the other faces can deform rapidly and accordingly unfold or fold. In the embodiment, each of the cavity-style structures of the first guide plate 18 and the second guide plate 1 can be a closed cavity 19, and is open (as shown in Fig. 2) only at the installation frame 9 side. The cavity-style structure forms a folded closed state with the structure on the bottom of the train by using the installation frame 9. Then snowflake can be avoid to enter the executing elements (i.e., the first executing element and the second executing element) in running process, to ensure the stable operation of the executing elements.

[0024] As shown in Fig. 4, the driving mechanism in the embodiment is a cylinder-type driving mechanism. That is, the first guide plate 18 and the second guide plate 1 are driven by a cylinder-type driving mechanism to unfold or fold. The cylinder-type driving mechanism includes double-acting cylinders 4 and a gasholder 13 connected to the double-acting cylinders 4. A double-acting solenoid valve is installed in a gas line between the gasholder 13 and each of the double-acting cylinders 4. A first double-acting solenoid valve 12 is installed in the gas line between the gasholder 13 and the double-acting cylinder 4 for driving the first guide plate 18. A second double-acting solenoid valve 14 is installed in the gas line between the gasholder 13 and the double-acting cylinder 4 for driving the second guide plate 1. One end of the double-acting cylinder 4 for driving the first guide plate 18 is fixed on the trains chassis beam (not shown in the Fig.) in bogie area through an installation base 2 and a pin 3. The other end of the double-acting cylinder 4 for driving the first guide plate 18 is linked to the end face 8 of the first guide plate 18 through a guide plate pin 5 and guide plate base 6. One end of the double-acting cylinder 4 for driving the second guide plate 1 is fixed on the rear end plate 11 in bogie area through an installation base 2 and a pin 3. The other end of the double-acting cylinder 4 for driving the second guide plate 1 is linked to the end face 5 of the second guide plate 1 through a guide plate pin 5 and guide plate base 6. According to the cylinder-type driving mechanism, the cooperation between the first guide plate 18 and the second guide plate 1 can be well realized with low cost and simplified structure, preventing the bogie from snow accumulation. In addition, based on the double-acting solenoid valve, the device can better adapt to forward and backward running of the train.

[0025] In the anti-snow accumulation device for the area of the bogie of the train, the first guide plate 18 ac-

cording to the present embodiment, parameters, such as heights of the first guide plate 18 and the second guide plate 1, included angle α between the inclined plane of the first guide plate 18 and the horizontal plane, included angle β between the inclined plane of the second guide plate 1 and the horizontal plane, and length of the area of the bogie etc. can be determined through testing or simulation calculation.

[0026] As can be seen from the above description, in specific installation and application, it is advantageous that each bogie area is equipped with an anti-snow accumulation device of the disclosure, each anti-snow accumulation device includes two executing elements (i.e., the first executing element and the second executing element), each executing element includes double-acting cylinders and a double-acting solenoid valve, and the power is from common on-board high-pressure air.

[0027] The operation principle of the anti-snow accumulation device for the area of the bogie of the train of the embodiment is shown in Fig. 4. When the train runs rightwards, the position 1 end of the double-acting cylinder 4 on the rear end of the area of the bogie is filled with air by using the high-pressure air in the gasholder 13 via the position 1 end of the second double-acting solenoid valve 14, which drives the double-acting cylinder 4 on rear end to shrink, so as to drive the second guide plate 1 to fold and close to the rear end plate 11. Meanwhile, the position 2 end of the double-acting cylinder 4 on front end of the area of the bogie is filled with air by using the high-pressure air in gasholder 13 via the position 2 end of the first double-acting solenoid valve 12, such that the double-acting cylinder 4 on front end of the area of the bogie extent, so as to drive the first guide plate 18 to unfold towards the bogie 17 and reduce the distance between the first guide plate 18 and the front end of the bogie 17. The inclined plane formed by the first guide plate 18 in the unfolded state forces airflow at the front bottom to deviate towards the rail surface, to avoid airflow enter the area of the bogie. Since the airflow carries snowflake, the snow amount entering the area of the bogie is reduced. The second guide plate 1 is in the folded closed state, the inclined plane formed by the second guide plate 1 forces the bottom airflow scouring to the second guide plate 1 at the rear part of the train to move backwards, to avoid backflow of the airflow to the area of the bogie. Since the airflow carries snowflake, then snowflake entering the area of the bogie from the tail is reduced. The snow accumulation in the area of the bogie is greatly reduced by the cooperation of the first guide plate 18 and the second guide plate 1. When the train runs in an opposite direction, the second double-acting solenoid valve 14 switches to the position 2 end, and the first double-acting solenoid valve 12 switches to the position 1 end. As such, the double-acting cylinders 4 on both sides of the bogie 17 operates oppositely, wherein the operation principle is the same as the operation principle used when train runs forwards, so as to reduce the occurring of snow accumulation. When the train is in ga-

rage or stopped for long time, the first guide plate 18 and the second guide plate 1 on both sides of the bogie 17 are folded by using the double-acting cylinder 4, such that the first guide plate 18 and the second guide plate 1 both recover to a non-work state. In view of this, the installation of the anti-snow accumulation device for the area of the bogie of the train of the disclosure can maximally ensure the running security of the train without reducing the running speed.

Claims

1. An anti-snow accumulation device for an area of a bogie of a train, wherein the anti-snow accumulation device, installed in the area of the bogie at bottom of the train, comprises a first executing element and a second executing element, a sequence of an action of the first executing element and an action of the second executing element is determined according to running direction of the train, the first executing element and the second executing element are installed respectively on a front end plate and a rear end plate on a chassis of the train, the bogie is located between the first executing element and the second executing element, the first executing element comprises a first foldable guide plate, the second executing element comprises a second foldable guide plate, the first guide plate close to the running direction of the train and the second guide plate away from the running direction of the train are configured to cooperate in a manner that, when the first guide plate is in an unfolded open state, the second guide plate is in a folded closed state towards the chassis of the train.
2. The anti-snow accumulation device for the area of the bogie of the train according to claim 1, wherein the first guide plate is in the unfolded open state refers to that the first guide plate unfolds towards the bogie such that the distance between the first guide plate and the front end of bogie is reduced, the second guide plate is in the folded closed state refers to that the second guide plate folds towards the chassis of the train and closes to the rear end plate.
3. The anti-snow accumulation device for the area of the bogie of the train according to claim 1, wherein the first guide plate in the unfolded open state is equipped with an inclined plane for guiding the air at the bottom to deviate towards rail surface, an included angle α , not larger than 90° , is formed between the inclined plane and the horizontal plane; and the second guide plate in the folded closed state is equipped with an inclined plane for guiding the air in the area of the bogie towards the behind of the rear end plate, and an angle β , not larger than 90° , is formed between the inclined plane and the horizontal

plane.

4. The anti-snow accumulation device for the area of the bogie of the train according to claim 3, wherein the angle α ranges between 30° and 60° , and the angle β ranges between 40° and 60° .
5. The anti-snow accumulation device for the area of the bogie of the train according to any one of claims 1-4, wherein the first guide plate and the second guide plate are driven by a cylinder-type driving mechanism to unfold or fold, the cylinder-type driving mechanism comprises a double-acting cylinder and a gasholder connected to the double-acting cylinder, and a double-acting solenoid valve is installed in a gas line between the double-acting cylinder and the gasholder.
6. The anti-snow accumulation device for the area of the bogie of the train according to any one of claims 1-4, wherein each of the first guide plate and the second guide plate is a cavity-style structure made of rubber capsule, an installation frame on one side of the cavity-style structure is installed on and mates with the bottom of the train, an end face on the other side of the cavity-style structure is connected to a driving mechanism driving the cavity-style structure to unfold or fold.
7. The anti-snow accumulation device for the area of the bogie of the train according to claim 6, wherein the driving mechanism is a cylinder-type driving mechanism, the cylinder-type driving mechanism drives the first guide plate or the second guide plate to unfold or fold, the cylinder-type driving mechanism comprises a double-acting cylinder and a gasholder connected to the double-acting cylinder, and a double-acting solenoid valve is installed in a gas line between the double-acting cylinder and the gasholder; a reinforced rib frame is installed on the end face of the cavity-style structure, and the double-acting cylinder is connected to the reinforced rib frame.
8. The anti-snow accumulation device for the area of the bogie of the train according to claim 6, wherein an installation frame of the cavity-style structure is connected to the end face through a folded element with wrinkles, and the foldable element is made of cold-resistant, impact-resistant, light rubber or fibre material.
9. The anti-snow accumulation device for the area of the bogie of the train according to claim 6, wherein the cavity-style structure is open only at the installation frame side of the cavity-style structure, and forms a closed cavity with the bottom structure of the train.

Fig.1

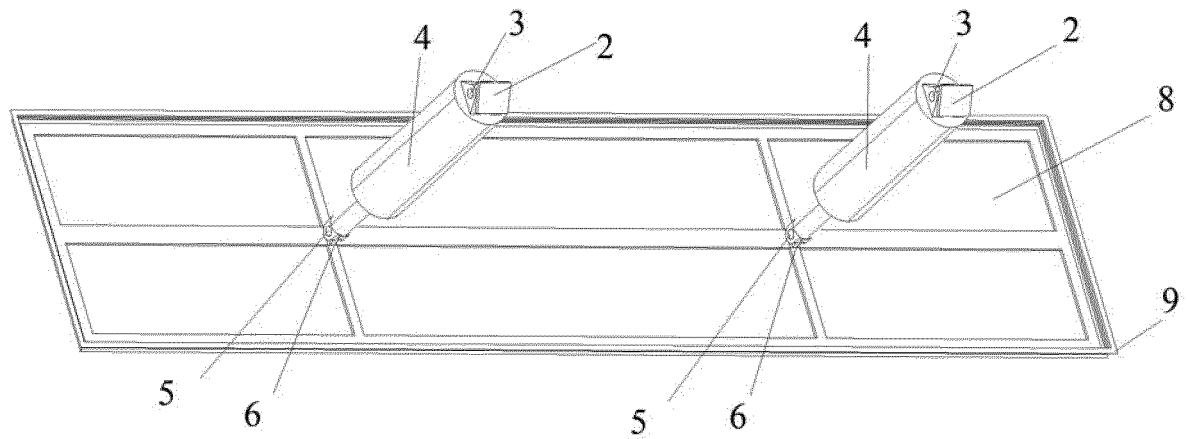


Fig.2

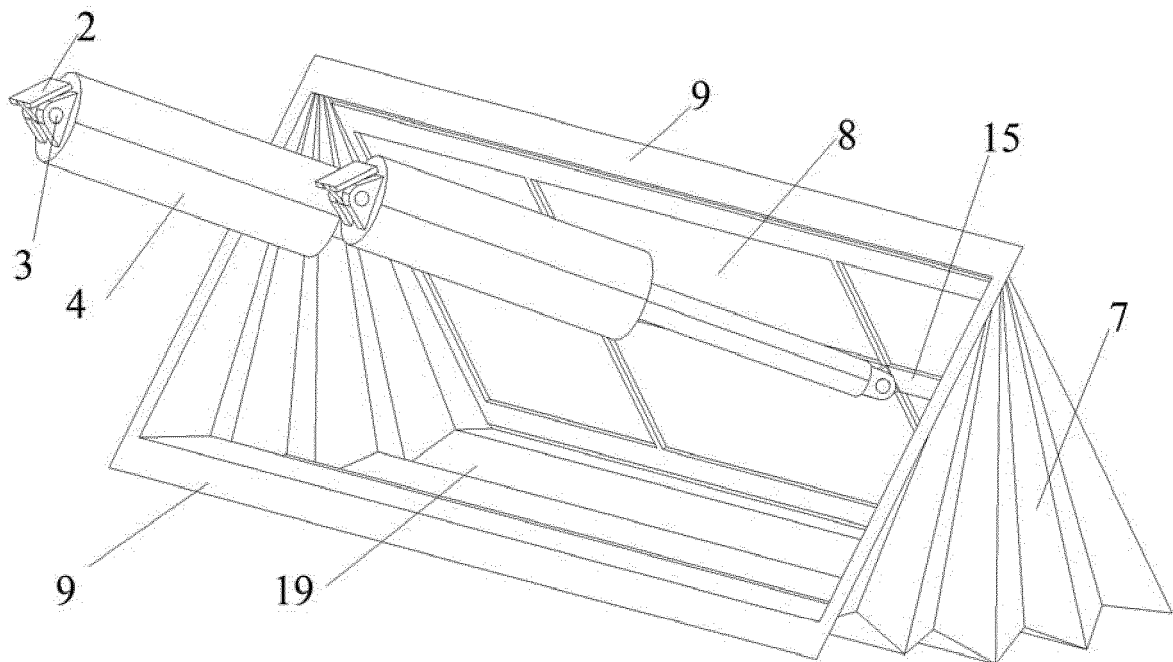


Fig.3

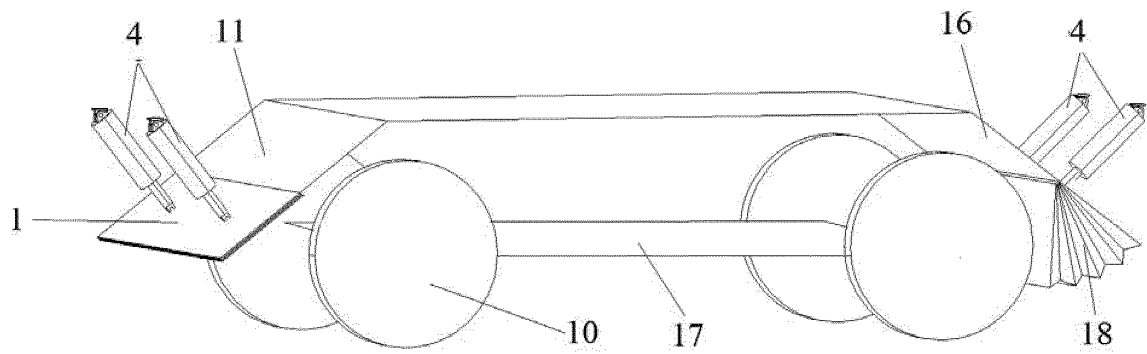


Fig.4

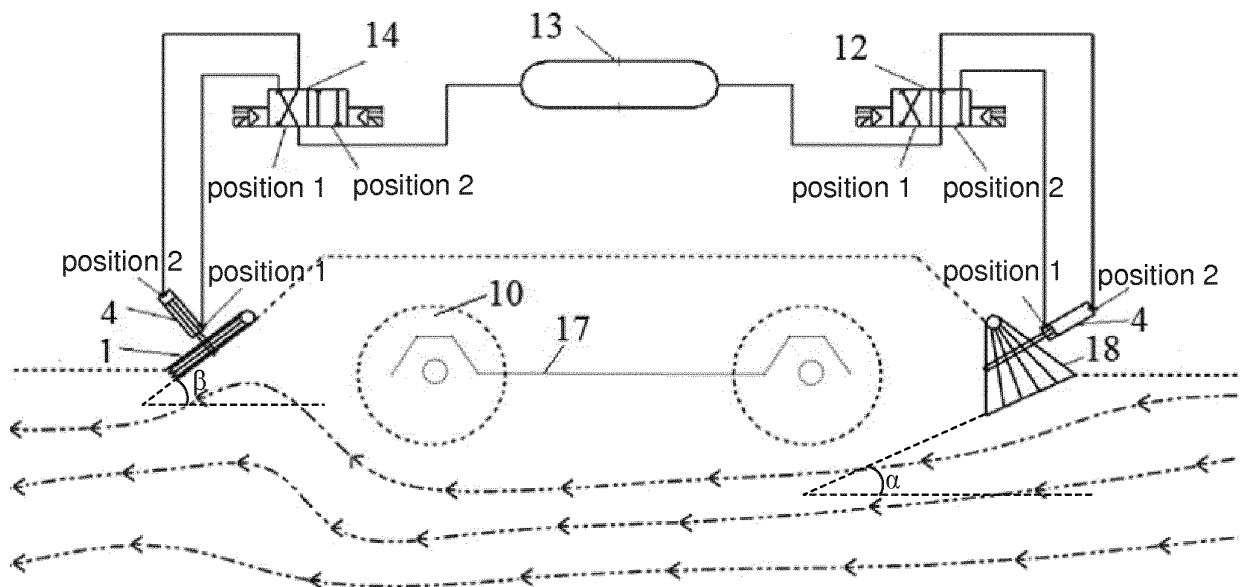
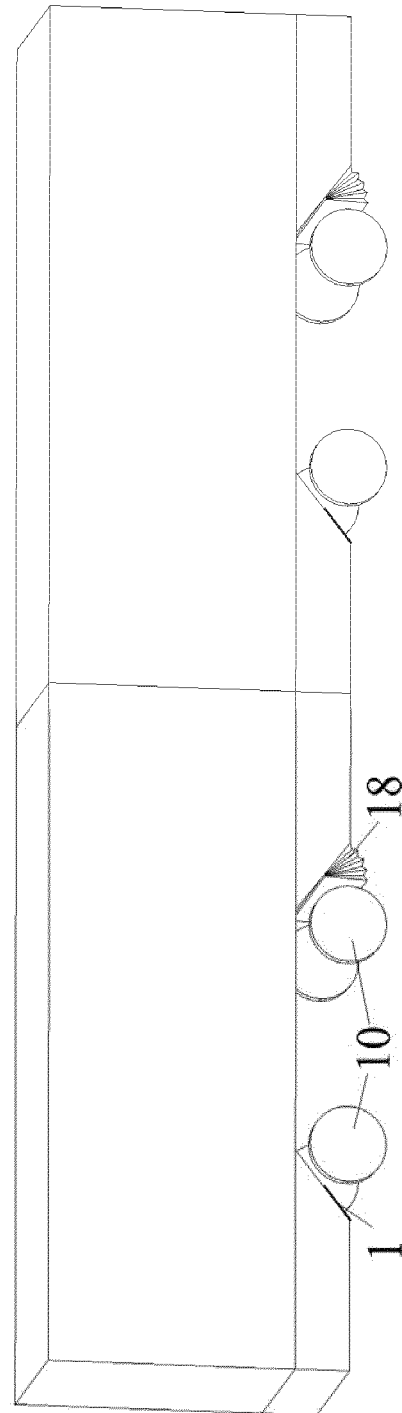


Fig.5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2016/071181

A. CLASSIFICATION OF SUBJECT MATTER

B61F 19/00 (2006.01) i; B61F 5/50 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS; VEN: rail; vehicle, bogie?, bogey?, snow, freez+, prevent+, isolat+, reduce, sand, ice, CSR QINGDAO SIFANG CO LTD

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

01 June 2016

Date of mailing of the international search report

22 June 2016

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