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(54) AIR CONDITIONER OUTDOOR UNIT AND AIR CONDITIONER

(57) Disclosed are an air conditioner outdoor unit (1) and an air conditioner, the air conditioner outdoor unit (1) comprising a compressor (2); a pipeline, wherein a refrigerant is drawn in or discharged from the compressor (2) by means of the pipeline; and further comprising a balance weight assembly (10). The balance weight assembly is provided with a balance weight block (11) and a first fixing part (13), wherein an elastic accommodating part (12) is formed on the balance weight block (11), and the pipeline passes through the elastic accommodating part (12) and is embedded into the elastic accommodating part (12); the first fixing part (13) is connected to the elastic accommodating part (12) and surrounds part of an outer wall of the pipeline so as to form a first contact point (21) and a second contact point (22) on the outer wall of the pipeline, and there is a height difference between the first contact point (21) and the second contact point (22) so as to form self-locking between the balance weight assembly (10) and the pipeline. By means of the balance weight assembly (10), even if the balance weight block is installed on a vertical pipe section, due to the fact that there is the height difference between the first contact point (21) and the second contact point (22), self-locking between the balance weight assembly (10) and the pipeline can be formed under the gravity of the balance weight block (11), and the balance weight block (11) cannot move downwards in a long-time use process, ensuring that the pipeline and an operation frequency of the compressor (2) cannot generate resonance, thereby improving the stability of the air conditioner.

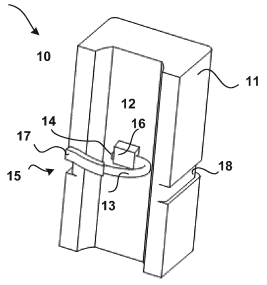

Fig.3

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Description

Technical field

[0001] The invention belongs to the technical field of air conditioning equipment, and in particular relates to an outdoor unit of an air conditioner and an air conditioner.

Background

[0002] The functions of air conditioning system (also referred to air conditioner) is to adjust at least part of parameters of indoor ambient air to their expected ranges in accordance with user's requirements, such as temperature, humidity, flow speed, cleanliness, freshness and the like. An air conditioner mainly includes: a compressor, a cold source or a heat source, an air supply system and an adjustment device. According to different working principles, the air conditioners could be divided into fixed speed air conditioners and inverter air conditioners, wherein the inverter air conditioner is an air conditioning system in which the amount of refrigerant circulated into an indoor unit could be regulated by controlling the amount of refrigerant circulated in the compressor so as to satisfy cooling load or heating load of the air conditioning system in time.

[0003] The amount of refrigerant circulated in the compressor is usually adjusted by controlling the frequency of the compressor; that is to say the compressor may work at different frequencies in a range between 15 Hz to 120Hz. Gaseous refrigerant or gas-liquid refrigerant are flowing in a suction pipeline or in a discharge pipeline of the compressor in which the gaseous portion could be compressed or expanded and become a vibration source with a fixed frequency. However either of the pipelines itself has an inherent vibration frequency, the compressor working at certain frequencies may serve as a vibration source acting on the pipelines and a vibration response may generate when it is superposed on the inherent vibration frequency and further result in low-frequency vibration noise or intense vibration in the air conditioner and affect user's experience.

[0004] In order to solve the problem, rubber blocks are bounded on the pipelines of the compressor by wires to change their inherent vibration frequencies in the prior art. But as the counterweight, the rubber blocks are very likely to fall during the operation of air conditioner and the descent may wrongly change the inherent vibration frequency of the pipelines again resulting in the structure could not able to weaken the vibration.

Summary

[0005] Aiming at solve the problem that as the counterweight, the rubber blocks are very likely to fall during the operation of air conditioner and the descent may wrongly change the inherent vibration frequency of the pipelines again resulting in the structure could not able to weaken the vibration, one aspect of the present invention is to provide an air conditioner outdoor unit.

[0006] To achieve the above-mentioned object, the present invention adopts technical solutions as follows.

[0007] An air conditioner outdoor unit including: a compressor; a pipeline through which refrigerant is sucked into or discharge from the compressor; characterized in that the air conditioner outdoor unit further includes: a counterweight assembly including: a counterweight body, which is provided with an elastic receiving portion through which one of the pipeline passes and embedded therein; and a first fixing portion connected to the elastic receiving portion, which is arranged around a part of an outer wall of the pipeline to form a first contact point and a second contact point thereon; wherein the first contact point and the second contact point has a height difference forming a self-locking between the counterweight assembly and the pipeline.

[0008] Further, the first fixing portion is spiral and made of rigid material, which has: a first end connected to the elastic receiving portion; and a second end provided higher than the first end; when the pipeline is embedded in the elastic receiving portion, the elastic receiving portion deforms to squeeze the first end towards the outer wall of the pipeline forming the first contact point and the first fixing portion deforms to squeeze towards the second end towards the outer wall of the pipeline forming the second contact point.

[0009] In order to protect the outer wall of pipeline, an elastic limited portion is provided in the elastic receiving portion, into which the first end is penetrated; wherein the elastic limited portion elastically deforms to squeeze the first end towards the outer wall of the pipeline to enable the elastic limited portion to abut against the outer wall of the pipeline to form the first contact point.

[0010] Further the first fixing portion further includes: an elastic protection component in which the second end is arranged; wherein the first fixing portion deforms to enable the second end to squeeze the outer wall of the pipeline and the elastic protection component abuts against the outer wall of the pipeline to form the second contact point.

[0011] The counterweight assembly is particularly suitable for a vertical pipeline portion and the selflock could prevent it from sliding down, so preferably the pipeline is vertically arranged and has a continuous outer wall extended vertically.

[0012] In order to ensure the self-locking effect in installation, the height difference h between the first contact point and the second contact point satisfying:

$$\mu > h/2x;$$

wherein μ is the coefficient of friction of the first contact point or the second contact point, x is the distance between the center of gravity of the counterweight body and the center of the pipeline.

[0013] In order to avoid movement caused by collision with people, the air conditioner outdoor unit further includes: a second fixing portion arranged around the outer wall of the pipeline which is arranged below the first fixing portion.

[0014] Further an annular groove is formed on one side of the counterweight body away from the elastic receiving portion and through which the second fixing portion penetrates.

[0015] Another aspect of the present invention provides an air conditioner including: a housing installed indoor in which a compressor and one or more heat exchangers are provided; and a pipeline through which refrigerant is sucked into or discharge from the compressor; the air conditioner outdoor unit further includes: a counterweight assembly including: a counterweight body, which is provided with an elastic receiving portion through which one of the pipeline passes and embedded therein; and a first fixing portion connected to the elastic receiving portion, which is arranged around a part of an outer wall of the pipeline to form a first contact point and a second contact point thereon; wherein the first contact point and the second contact point has a height difference forming a self-locking between the counterweight assembly and the pipeline.

[0016] Further the first fixing portion is spiral and made of rigid material, which has: a first end connected to the elastic receiving portion; and a second end provided higher than the first end; when the pipeline is embedded in the elastic receiving portion, the elastic receiving portion deforms to squeeze the first end towards the outer wall of the pipeline forming the first contact point and the first fixing portion deforms to squeeze towards the second end towards the outer wall of the pipeline forming the second contact point; and the height difference h between the first contact point and the second contact point satisfying:

$$\mu > h/2x;$$

wherein μ is the coefficient of friction of the first contact point or the second contact point, x is the distance between the center of gravity of the counterweight body and the center of the pipeline

[0017] Compared with the prior art, the advantages and positive effects of the present invention are:

Due to the height difference between the first contact point and the second contact point, a self-locking between the counterweight assembly and the pipeline is formed under the weight of the counterweight body and the counterweight body cannot move downwards during operation for a long period of time even being installed on the pipeline section vertically extended, thereby avoiding a resonation between the inherent frequency of the pipeline and that of the operation of the compressor, and the stability performance of the air conditioner is improved.

[0018] After reading the specific embodiments of the present invention in conjunction with the accompanying drawings, other features and advantages of the present invention will become clearer.

Description of the drawings

[0019] In order to clearly explain embodiments of the present invention or technical solutions in the prior art, at first drawings related to description of the embodiments or the prior art will be briefly introduced as follows. It is obvious that the drawings are described here are part of embodiments of the present invention; for those ordinary skill in the art other drawings could be obtained based on these without any creative work.

Fig.1 is a schematic structural diagram of an air conditioner outdoor unit according to one aspect of the present invention;

Fig.2 is a schematic diagram of the structure when the counterweight assembly is arranged on the pipeline;

Fig.3 is a schematic diagram of the counterweight assembly shown in Fig. 2;

Fig.4 is a schematic diagram of the first contact point and the second contact point when the counterweight assembly is arranged on the pipeline shown in Fig.3;

Fig.5 shows a positional relationship between the height difference between the first contact point and the second contact point along the extension of the pipeline, the distance between the center of gravity of the counterweight body and the center of the pipeline when the counterweight assembly is arranged on the pipeline as shown in Fig.4

Fig.6 is a schematic structural diagram of the first fixing part, the second fixing portion and the pipeline in installation;

Fig.7 is a schematic structural diagram of an air conditioner according to another aspect of the present invention.

Detailed Description of Embodiments

[0020] In order to make the objectives, technical solutions, and advantages of the present invention clearer, the following will further describe the present invention in detail with reference to the accompanying drawings and embodiments.

[0021] It should be noted that in the description of the present invention, the terms "upper", "lower", "left", "right", "vertical", "horizontal", "inner", "outer", etc. indi-

cating directions or positions are merely based on the direction or position relationship shown in the drawings, which is only for description, and does not indicate or imply that the device or element must have a specific orientation, be constructed and operated in a specific orientation, and therefore could not be understood as restrictions of the present invention. In addition, the terms "first" and "second" are only used for description and could not be understood as indicating or implying relative importance.

[0022] Fig.1 is a schematic structural diagram of an outdoor unit of an air conditioner according to one aspect of the present invention. The air conditioner outdoor unit 1 includes a compressor 2 and pipelines connected to, wherein the pipelines specifically refer to a suction pipeline 3 and a discharge pipeline 4 which communicate with the compressor 2, refrigerant in the suction pipeline 3 is sucked into the compressor 2 and discharged from the compressor 2 to the discharge pipeline 4. The outdoor unit 1 is provided with an air inlet and an air outlet. The outdoor unit may also be provided with components such as a heat exchanger, an axial flow fan and its motor, a throttling device and a four-way valve. Compressor 2 could be a fixed frequency compressor directly powered by 220V/50Hz mains supply with a theoretical speed 3000r/min and an actual speed 2800r/min due to factors as resistance during operation. More commonly the compressor 2 is an inverter compressor powered by analog three-phase AC output from an inverter module with an allowable frequency range from 15Hz to 120Hz and an allowable voltage range from 30V to 200V, and the compressor speed is in a range from 1500r/min to 9000r/min. Taking a cooling mode as an example, when the compressor speed increases, the cooling capacity increases accordingly and the cooling effect is intensified so that the room temperature drops rapidly; the compressor speeds decreases when the room temperature drops to a point near a target temperature to maintain the room temperature. As peripheral pipelines of the compressor 2, it is necessary to consider a plurality of factors in designing the suction pipeline 3 and the discharge pipeline 4 such as refrigerant resistance, noise, installation of auxiliary filters, arrangement of gas-liquid separator, position of nozzles shape of casing and the like, so the design space for the suction pipeline 3 and the discharge pipeline 4 is strictly restricted and it is better to bend as little as possible. The compressor 2 is provided at the bottom of the air conditioner outdoor unit 1 as shown in Fig.1. It should be noted that the arrangement of the compressor is not limited as shown in Fig.1 and it could be arranged at other positions of the air conditioner outdoor unit 1 by adjusting the suction pipeline 3, the discharge pipeline 4 and the internal layout of the casing.

[0023] Specifically, as shown in Fig.2, a counterweight assembly 10 is provided on a pipeline and the inherent frequency of the pipeline is changed by arranging the counterweight assembly 10 to avoid operating noise or intense vibration caused by specific operating frequencies of the compressor superposed on the inherent frequency of the pipeline. As shown in Fig.3, the counterweight assembly 10 could be disposed at any position of the pipeline and is preferably installed on a section of a pipeline vertically arranged, as a pipeline section 31 shown in Fig.2. The pipeline section, such as the pipeline section 31, has a continuous outer wall extending vertically so that there will be more design space allowing for an elbow pipeline section, and additionally the installation of the counterweight assembly 10 is more flexible, easy to operate, replace and maintain. As shown in Fig.3, the counterweight assembly 10 mainly comprises a counterweight body 11. The counterweight body 11 is made of a soft material with elasticity, or a hard material. If the counterweight body 11 is made of a hard material, a thick soft material should be used to cover its outside to avoid scratching the pipeline. The soft material could be rubber or other composite materials. The weight of the counterweight body 11 is preferably obtained through software simulation according to the type of the compressor 2.

[0024] An elastic receiving portion 12 is formed on the counterweight body 11. The elastic receiving portion 12 is recessed and formed integrally with the counterweight body 11. In an original state, the cross-sectional area of the elastic receiving portion 12 is smaller than an arc area of a corresponding position on the outer wall of the pipe. The pipeline passes through the elastic receiving portion 12 and a part of the outer wall is embedded in the elastic receiving portion 12 in usage. When the counterweight assembly 10 is assembled, on one side of the outer wall of the pipeline, the elastic receiving portion 12 correspondingly expands to restrict a relative movement on the outer wall of the pipeline.

[0025] The counterweight assembly 10 further includes a first fixing portion 13. The first fixing portion 13 is connected to the elastic receiving portion 12. The first fixing portion 13 is arranged around a part of the outer wall of the pipeline to form a first contact point 21 and a second contact point 22 on the outer wall of the pipeline. There is a height difference between the first contact point 21 and the second contact point 22 to form a self-locking between the counterweight assembly 10 and the pipeline.

[0026] Due to the height difference between the first contact point 21 and the second contact point 22, a self-locking between the counterweight assembly 10 and the pipeline is formed under the weight of the counterweight body 11 and the counterweight body 11 cannot move downwards during operation for a long period of time even being installed on the pipeline section 31 vertically extended, thereby avoiding a resonation between the inherent frequency of the pipeline and that of the operation of the compressor, and the stability performance of the air conditioner is improved.

[0027] A preferred structure of the counterweight assembly 10 is further described with reference to Fig.3 to Fig.5 as follows. As shown in Fig.3, the first fixing portion 13 has a spiral shape. The first fixing portion 13 is pref-

erably made of rigid material, such as a metal wire with a smooth surface and an appropriate diameter. The first fixing portion 13 could undergo a certain degree of deformation under an external force exerted by an operator so as to facilitate the installation of the counterweight assembly 10 on the outside of the pipeline. The length of the first fixing portion 13 is approximately 70% of the circumstance of the outer wall of the pipeline and as a body covers 50% of the circumstance of the outer wall of the pipeline as being bent into a spiral shape. The first fixing portion 13 specifically includes a first end 14 and a second end 15 formed higher than the first end 14. The first end 14 is provided in the elastic receiving portion 12. An opening is formed between the first end 14 and the second end 15 through which the pipeline penetrates into the elastic receiving portion 12 and is fitted with the elastic receiving portion 12. When the pipeline is embedded in the elastic receiving portion 12, the elastic receiving portion 12 undergoes elastic deformation and the restoring force of the elastic material making of the elastic receiving portion 12 acts on the first end 14 of the first fixing portion 13 to squeeze the first end 14 towards the outer wall of the pipeline forming the first contact point 21. On the other side, the first fixing portion 13 deforms due to the penetration of the pipeline so that the second end 15 is squeezed towards the outer wall of the pipeline forming the second contact point 22. With this arrangements the two contact points are respectively formed on both sides of the pipeline, so further the self-locking is formed under the weight to ensure the counterweight assembly 10 could not slide down in usage.

[0028] In order to keep the coefficient of friction of the first contact point 21 and the second contact point 22 in a proper range so as to ensure the self-locking reliably functions, and further to protect the outer wall of the pipeline in the meanwhile, an elastic limited portion 16 is provided in the elastic receiving portion 12. The first end 14 penetrates into the elastic limited portion 16 to form a connection therebetween. The elastic receiving portion 12 elastically deforms so as to squeeze the first end 14 towards the outer wall of the pipeline so that the elastic limited portion 16 abuts against the outer wall of the pipeline to form the first contact point 21. At the other end, for the same purpose, the first fixing portion 13 further includes an elastic protection component 17. The second end 15 is arranged in the elastic protection component 17, the first fixing portion 13 is deformed so that the second end 15 squeezes the outer wall of the pipeline and the elastic protection component 17 abuts against the outer wall of the pipeline to form the second contact point 22. The elastic limited portion 16 is preferably formed integrally with the elastic receiving portion 12, and is fixed in a ring shape on a side wall of the elastic receiving portion 12 in contact with the outer wall of the pipeline. The first end 14 protrudes from the elastic receiving portion 12 and is fixed. The elastic protection component 17 is preferably an elastic sheath made of a soft material, and its length is approximately one third of the total length of the first fixing portion 13. Preferably, the elastic protection component 17, the counterweight body 11, and the elastic sheath are made of the same material.

[0029] The relation between three factors including the coefficient of friction of the first contact point 21 and the second contact point 22, the height difference between the first contact point 21 and the second contact point 22 along the extended direction of the pipeline, and a distance between the center of gravity of the counterweight body 11 and the center of the pipeline could ensure the self-locking effect. To be specific, the coefficient of friction of the soft material which is selected to make the elastic protection component 17, the counterweight body 11 and the elastic sheath could be retrieved, namely the coefficient of friction μ of the first contact point 21 and the second contact point 22, and it is further to determine the distance x between the center of gravity of the counterweight body 11 and the center of the pipeline, and it is further to determine the height difference h between the first contact point 21 and the second contact point 22. The three factors satisfy a condition of $\mu > h/2x$. Hence the self-locking effect could be regulated by only adjusting the height difference between the first contact point 21 and the second contact point 22 along the extended direction of the pipeline on the basis of the known coefficient of friction and the distance between the center of gravity of the counterweight body 11 and the center of the pipeline as the counterweight assembly 10 is being arranged. The installation operation is simplified due to there is only one constraint condition which is in a range that the height difference should be satisfied. The center of gravity of the counterweight body 11 could be obtained by computer simulation once the shape and weight of the counterweight body 11 is determined.

[0030] Considering that the packaging of the air conditioner outdoor unit 1 may collide during in transportation or during installation, preferably a second fixing portion 19 is also provided. The second fixing portion 19 is arranged around the outer wall of the pipeline. One side of the counterweight body 11 away from the elastic receiving portion 12 is formed an annular groove 18, and the second fixing portion 19 penetrates through the annular groove 18 to restrict the relative movement of the pipeline and the counterweight assembly 10 as a whole. The second fixing portion 19 is preferably arranged below the first fixing portion 13, and the first fixing portion 13 and the second fixing portion 19 are independent of each other but not interacting. The second fixing portion 19 is preferably a wire.

[0031] Another aspect of the present invention also discloses an air conditioner. The air conditioner includes a housing 5 installed inside a room. The compressor 2 and an indoor heat exchanger 6 are provided in the housing 5. The indoor heat exchanger is configured to exchange heat with air, and alternatively two or more indoor heat exchangers could be disposed and exchange heat with air or other media, such as water and the like. The housing 5 shown in Fig. 7 is only provided with the indoor side

heat exchanger 6 exchanging heat with air. The indoor heat exchanger 6 is arranged at the uppermost of the housing 5, and an indoor fan and the compressor 2 are arranged in sequence from top to bottom. In this type of air conditioner, the space where the compressor 2 is disposed is more compact and the design space for the pipelines is smaller. In order to achieve the effect of shock absorption, the counterweight assembly 10 is installed the suction pipeline 3 or the discharge pipeline 4 of the compressor 2.

[0032] As shown in Fig.3 to Fig. 5, in this type of the air conditioner the counterweight assembly 10 is used to change the inherent frequency of the pipeline so as to avoid the occurrence of running noise or severe vibration caused by the superposition of the inherent frequency of the pipeline and the operating frequency of the compressor 2. The counterweight assembly 10 as shown could be arranged on a pipeline, and is in particular suitable for installing on a pipeline portion extended along the vertical direction. The pipeline section 31 has a continuous outer wall extending vertically so that there will be more design space allowing for an elbow pipeline section, and additionally the installation of the counterweight assembly 10 is more flexible, easy to operate, replace and maintain. As shown in Fig.3, the counterweight assembly 10 mainly comprises a counterweight body 11. The counterweight body 11 is made of a soft material with elasticity, or a hard material. If the counterweight body 11 is made of a hard material, a thick soft material should be used to cover its outside to avoid scratching the pipeline. The soft material could be rubber or other composite materials. The weight of the counterweight body 11 is preferably obtained through software simulation according to the type of the compressor 2.

[0033] An elastic receiving portion 12 is formed on the counterweight body 11. The elastic receiving portion 12 is recessed and formed integrally with the counterweight body 11. In an original state, the cross-sectional area of the elastic receiving portion 12 is smaller than an arc area of a corresponding position on the outer wall of the pipe. The pipeline passes through the elastic receiving portion 12 and a part of the outer wall is embedded in the elastic receiving portion 12 in usage. When the counterweight assembly 10 is assembled, on one side of the outer wall of the pipeline, the elastic receiving portion 12 correspondingly expands to restrict a relative movement on the outer wall of the pipeline.

[0034] The counterweight assembly 10 further includes a first fixing portion 13. The first fixing portion 13 is connected to the elastic receiving portion 12. The first fixing portion 13 is arranged around a part of the outer wall of the pipeline to form a first contact point 21 and a second contact point 22 on the outer wall of the pipeline. There is a height difference between the first contact point 21 and the second contact point 22 to form a self-locking between the counterweight assembly 10 and the pipeline.

[0035] Due to the height difference between the first contact point 21 and the second contact point 22, a self-locking between the counterweight assembly 10 and the pipeline is formed under the weight of the counterweight body 11 and the counterweight body 11 cannot move downwards during operation for a long period of time even being installed on the pipeline section 31 vertically extended, thereby avoiding a resonation between the inherent frequency of the pipeline and that of the operation of the compressor, and the stability performance of the air conditioner is improved.

[0036] The first fixing portion 13 has a spiral shape. The first fixing portion 13 is preferably made of rigid material, such as a metal wire with a smooth surface and an appropriate diameter. The first fixing portion 13 could undergo a certain degree of deformation under an external force exerted by an operator so as to facilitate the installation of the counterweight assembly 10 on the outside of the pipeline. The length of the first fixing portion 13 is approximately 70% of the circumstance of the outer wall of the pipeline and as a body covers 50% of the circumstance of the outer wall of the pipeline as being bent into a spiral shape. The first fixing portion 13 specifically includes a first end 14 and a second end 15 formed higher than the first end 14. The first end 14 is provided in the elastic receiving portion 12. An opening is formed between the first end 14 and the second end 15 through which the pipeline penetrates into the elastic receiving portion 12 and is fitted with the elastic receiving portion 12. When the pipeline is embedded in the elastic receiving portion 12, the elastic receiving portion 12 undergoes elastic deformation and the restoring force of the elastic material making of the elastic receiving portion 12 acts on the first end 14 of the first fixing portion 13 to squeeze the first end 14 toward the outer wall of the pipeline forming the first contact point 21. On the other side, the first fixing portion 13 deforms due to the penetration of the pipeline so that the second end 15 is squeezed towards the outer wall of the pipeline forming the second contact point 22. With this arrangements the two contact points are respectively formed on both sides of the pipeline, so further the self-locking is formed under the weight to ensure the counterweight assembly 10 could not slide down in usage. The outer of the first fixing portion 13 is covered by soft material and the first fixing portion 13 and the counterweight assembly 10 are preferably integrallyformed.

[0037] The relation between three factors including the coefficient of friction of the first contact point 21 and the second contact point 22, the height difference between the first contact point 21 and the second contact point 22 along the extended direction of the pipeline, and a distance between the center of gravity of the counterweight body 11 and the center of the pipeline could ensure the self-locking effect. To be specific, the coefficient of friction of the soft material which is selected to make the elastic protection component 17, the counterweight body 11 and the elastic sheath could be retrieved, namely the coefficient of friction μ of the first contact point 21 or the second

contact point 22, and it is further to determine the distance x between the center of gravity of the counterweight body 11 and the center of the pipeline, and it is further to determine the height difference ***h*** between the first contact point 21 and the second contact point 22. The three factors satisfy a condition of $\mu > h/2x$. Hence the self-locking effect could be regulated by only adjusting the height difference between the first contact point 21 and the second contact point 22 along the extended direction of the pipeline on the basis of the known coefficient of friction and the distance between the center of gravity of the counterweight body 11 and the center of the pipeline as the counterweight assembly 10 is being arranged. The installation operation is simplified due to there is only one constraint condition which is in a range that the height difference should be satisfied. The center of gravity of the counterweight body 11 could be obtained by computer simulation once the shape and weight of the counterweight body 11 is determined.

[0038] The above embodiments are only used to illustrate the technical solutions of the present invention, but not to limit them; although the present invention has been described in detail with reference to the foregoing embodiments, for those of ordinary skill in the art, the technical solutions of the foregoing embodiments can still be described. The recorded technical solutions are modified, or some of the technical features are equivalently replaced; these modifications or replacements do not cause the essence of the corresponding technical solutions to deviate from the spirit and scope of the technical solutions claimed by the present invention.

Claims

1. An air conditioner outdoor unit including:

a compressor;
a pipeline through which refrigerant is sucked into or discharge from the compressor;
characterized in that the air conditioner outdoor unit further includes:

a counterweight assembly including:

a counterweight body, which is provided with an elastic receiving portion through which one of the pipeline passes and embedded therein; and
a first fixing portion connected to the elastic receiving portion, which is arranged around a part of an outer wall of the pipeline to form a first contact point and a second contact point thereon;

wherein the first contact point and the second contact point has a height difference forming a self-locking between the counterweight assembly and the pipeline.

2. The air conditioner outdoor unit according to claim 1, **characterized in that**:
the first fixing portion is spiral and made of rigid material, which has:

a first end connected to the elastic receiving portion; and
a second end provided higher than the first end;
when the pipeline is embedded in the elastic receiving portion, the elastic receiving portion deforms to squeeze the first end towards the outer wall of the pipeline forming the first contact point and the first fixing portion deforms to squeeze towards the second end towards the outer wall of the pipeline forming the second contact point.

3. The air conditioner outdoor unit according to claim 2, **characterized in that**:

an elastic limited portion is provided in the elastic receiving portion, into which the first end is penetrated;
wherein the elastic limited portion elastically deforms to squeeze the first end towards the outer wall of the pipeline to enable the elastic limited portion to abut against the outer wall of the pipeline to form the first contact point.

4. The air conditioner outdoor unit according to claim 3, **characterized in that**:

the first fixing portion further includes:
an elastic protection component in which the second end is arranged;
wherein the first fixing portion deforms to enable the second end to squeeze the outer wall of the pipeline and the elastic protection component abuts against the outer wall of the pipeline to form the second contact point.

5. The air conditioner outdoor unit according to claim 4, **characterized in that**:
the pipeline is vertically arranged and has a continuous outer wall extended vertically.

6. The air conditioner outdoor unit according to claim 5, **characterized in that**:
the height difference ***h*** between the first contact point and the second contact point satisfying:

$$\mu > h/2x;$$

wherein μ is the coefficient of friction of the first contact point or the second contact point, x is the dis-

tance between the center of gravity of the counterweight body and the center of the pipeline.

7. The air conditioner outdoor unit according to any one of claim 1 to 6, **characterized in that**:
the air conditioner outdoor unit further includes:
a second fixing portion arranged around the outer wall of the pipeline which is arranged below the first fixing portion.

8. The air conditioner outdoor unit according to claim 7, **characterized in that**:
an annular groove is formed on one side of the counterweight body away from the elastic receiving portion and through which the second fixing portion penetrates.

9. An air conditioner including:

a housing installed indoor in which a compressor and one or more heat exchangers are provided; and
a pipeline through which refrigerant is sucked into or discharge from the compressor;
characterized in that the air conditioner outdoor unit further includes:

a counterweight assembly including:

a counterweight body, which is provided with an elastic receiving portion through which one of the pipeline passes and embedded therein; and
a first fixing portion connected to the elastic receiving portion, which is arranged around a part of an outer wall of the pipeline to form a first contact point and a second contact point thereon;

wherein the first contact point and the second contact point has a height difference forming a self-locking between the counterweight assembly and the pipeline.

10. An air conditioner according to claim 9, **characterized in that**, the first fixing portion is spiral and made of rigid material, which has:

a first end connected to the elastic receiving portion; and
a second end provided higher than the first end;
when the pipeline is embedded in the elastic receiving portion, the elastic receiving portion deforms to squeeze the first end towards the outer wall of the pipeline forming the first contact point and the first fixing portion deforms to squeeze towards the second end towards the outer wall of the pipeline forming the second contact point; and
the height difference h between the first contact point and the second contact point satisfying:

$$\mu > h/2x;$$

wherein μ is the coefficient of friction of the first contact point or the second contact point, x is the distance between the center of gravity of the counterweight body and the center of the pipeline.

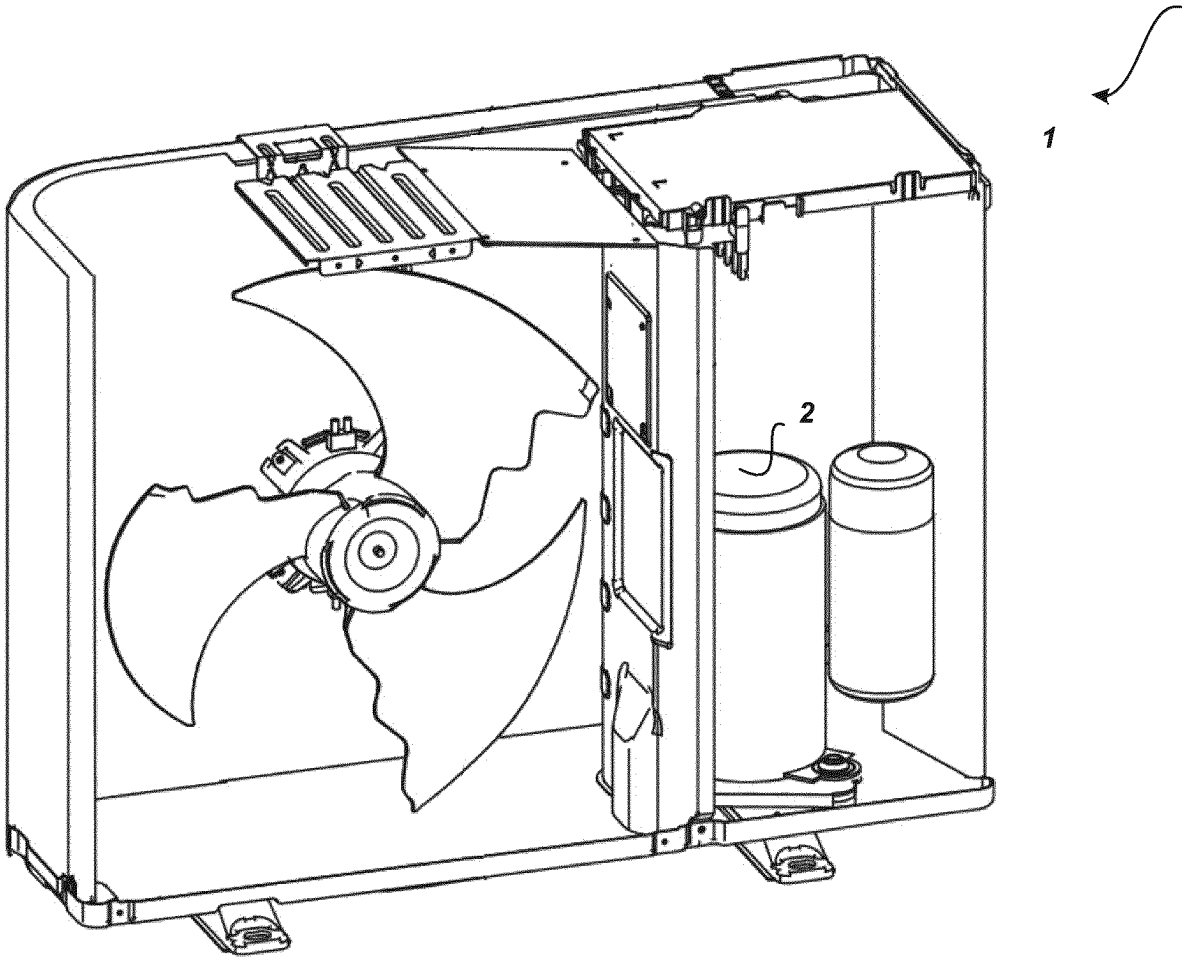

Fig.1

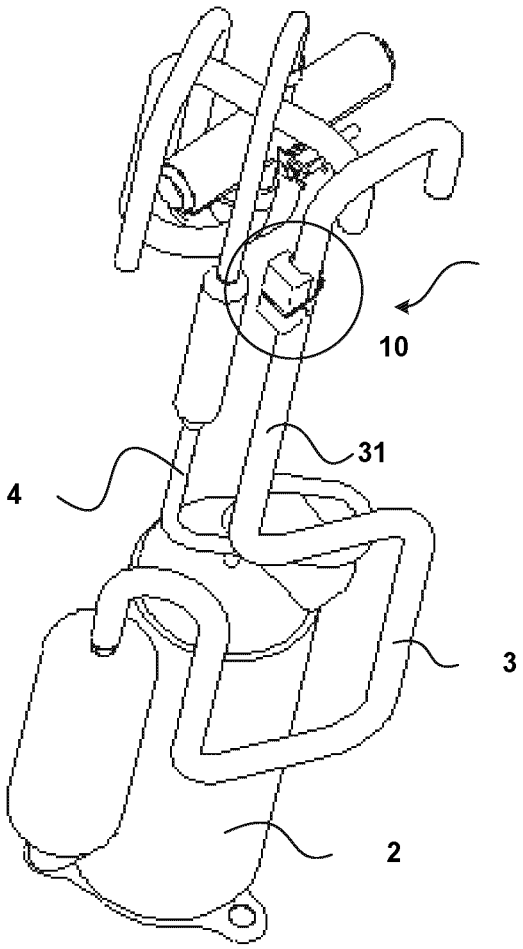

Fig.2

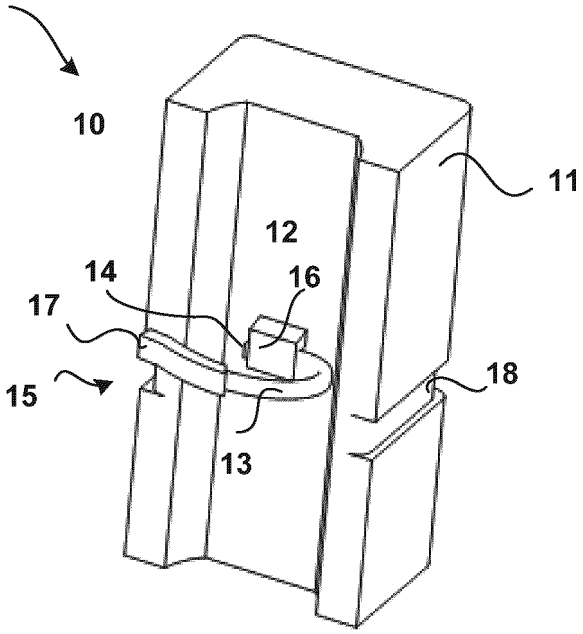

Fig.3

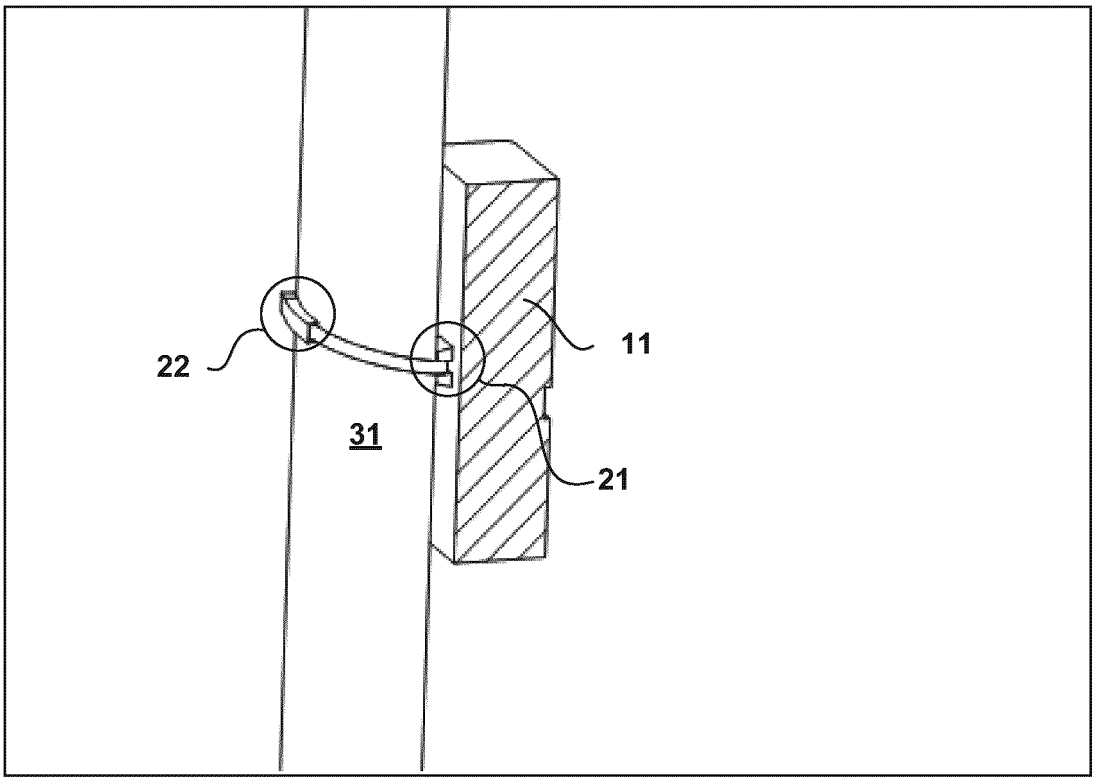

Fig.4

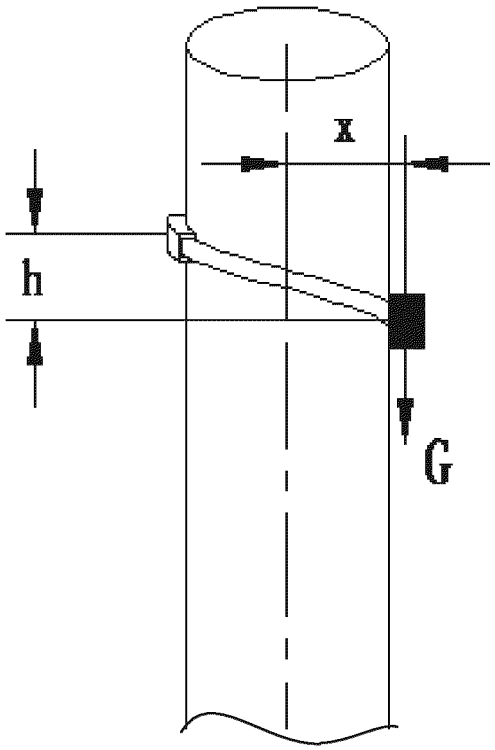

Fig.5

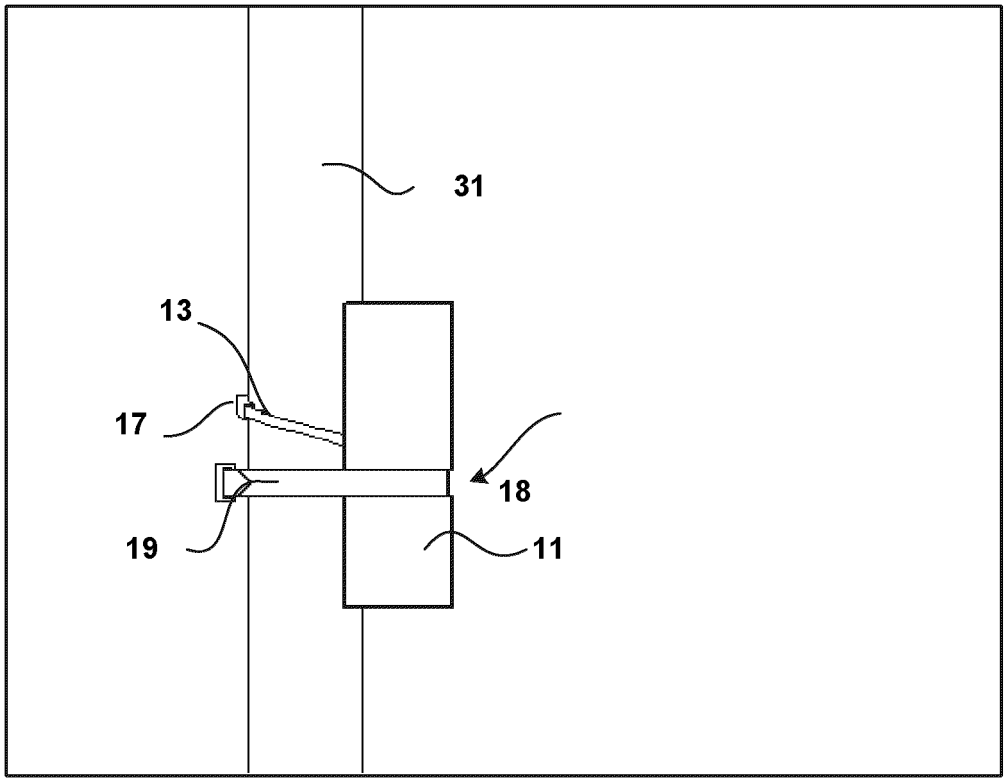

Fig.6

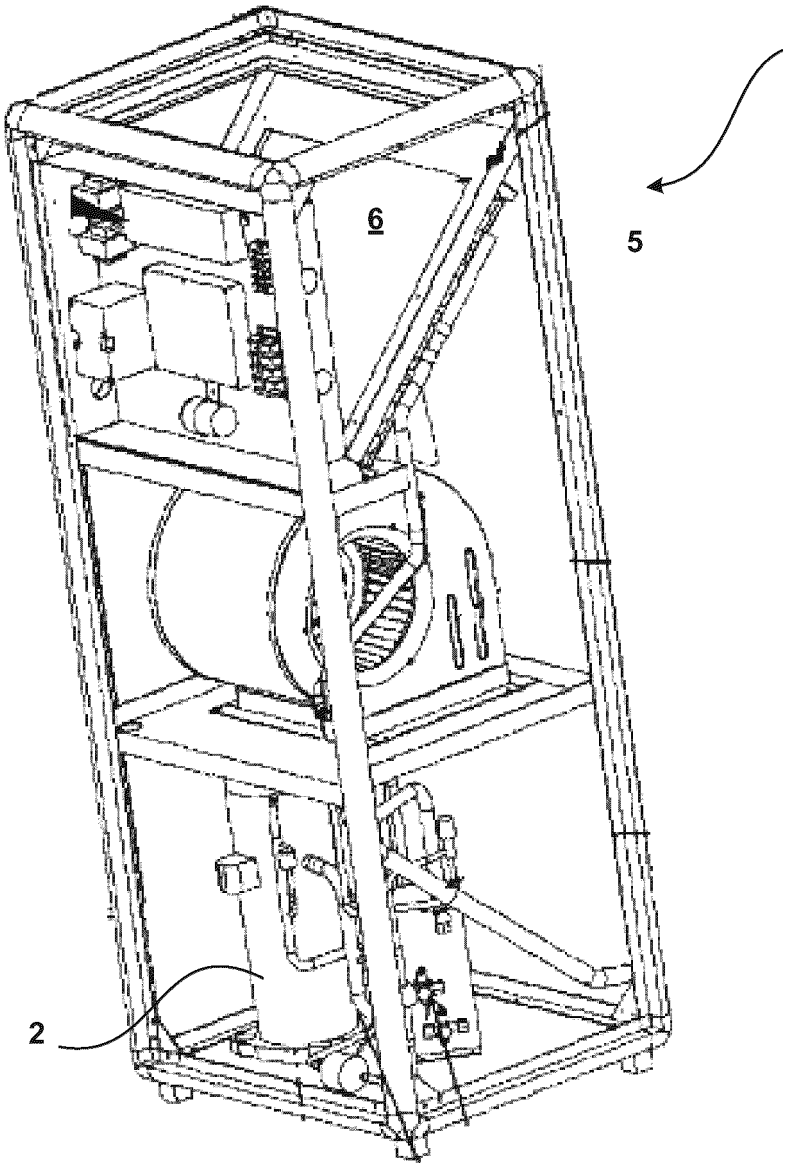

Fig.7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2020/080139

A. CLASSIFICATION OF SUBJECT MATTER

F24F 13/24(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)

F24F13, F16F; F16L

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, SIPOABS, CNKI, CNTXT, VEN: 空调, 空气调节, 空气调和, 室外机, 室外装置, 室外单元, 压缩机, 配重, 管路, 管道, 管段, 管线, 弹性, 弹力, 固定, 接触, 自锁, 锁定, air condition+, outdoor machaine, outdoor apparatus, outdoor unit, compressor, weight, pip+, elastic, fix+, secur+, contact+, lock+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 208804155 U (GUANGDONG MIDEA HEATING & VENTILATION EQUIPMENT CO., LTD. et al.) 30 April 2019 (2019-04-30) description paragraphs [0002], [0034]-[0062], figures 1-6	1, 7-9
A	CN 208804155 U (GUANDONG MIDEA HVAC EQUIPMENT CO., LTD. et al.) 30 April 2019 (2019-04-30) entire document	2-6, 10
A	CN 204063510 U (DONGFENG PEUGEOT AUTOMOBILE COMPANY LTD.) 31 December 2014 (2014-12-31) entire document	1-10
A	CN 102798199 A (LG ELECTRONICS (TIANJIN) ELECTRICAL APPLIANCE CO., LTD.) 28 November 2012 (2012-11-28) entire document	1-10
A	CN 107940710 A (GUANDONG MIDEA HVAC EQUIPMENT CO., LTD. et al.) 20 April 2018 (2018-04-20) entire document	1-10

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
	20 July 2020
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088** **China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2020/080139

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	CN 204628942 U (GUANGDONG MEDIA REFRIGERATION EQUIPMENT CO., LTD. et al.) 09 September 2015 (2015-09-09) entire document	1-10
A	KR 100677887 B1 (SAMSUNG ELECTRONICS CO., LTD.) 05 February 2007 (2007-02-05) entire document	1-10
A	KR 20020006865 A (LG ELECTRONICS INC.) 26 January 2002 (2002-01-26) entire document	1-10

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2020/080139

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 208804155 U	30 April 2019	None	
CN 204063510 U	31 December 2014	None	
CN 102798199 A	28 November 2012	None	
CN 107940710 A	20 April 2018	None	
CN 102080871 A	01 June 2011	None	
CN 204628942 U	09 September 2015	None	
KR 100677887 B1	05 February 2007	None	
KR 20020006865 A	26 January 2002	None	

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