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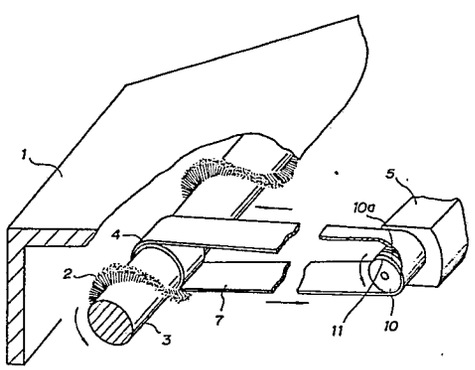
(54) Cleaner.

(57) A cleaner provided with a rotary brush driven by a belt stretched between a driving pulley mounted fixedly to a rotating shaft of a drive assembly and a driven pulley mounted fixedly to the rotary brush, wherein a spiral groove is defined on the circumferential surfaces/surface of the driving pulley and/or the driven pulley, and/or each configuration of the pulleys is formed into a frustoconical configuration a diameter of which becomes smaller in the axial direction extending from an end portion thereof positioned on the support side of the pulley to the side of the other end portion.

FIG. 1



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Description

CLEANER

Background of the Invention

1. Field of the Invention

This invention relates to a cleaner provided with a rotary brush driven by a belt, and particularly to prevention of winding or twining of pieces of thread around a pulley for driving the belt.

2. Description of the Related Art

There are, for example, such types of cleaners as shown in Figs. 13(a) and (b) as conventional cleaners each provided with a rotary brush.

These cleaners are used as a suction means for vacuum cleaners, respectively, wherein in a suction means main body 1 (110) the bottom of which is opened, a driving belt 7 (117) is stretched between a driven pulley 4 (114) mounted fixedly to a rotary brush 3 (113) with which are vertically furnished bristles 2 (112) and which is rotatably journaled and a driving pulley 6 (116) mounted fixedly to a rotating shaft 5 (115a) of a drive assembly 5 (115) such as a motor or the like.

In the above constructions, when the drive assembly 5 (115) is rotated, the rotary brush 3 (113) rotates on a floor 8 (118), whereby dust 9 (119) on the floor 8 (118) is swept up and contained in a dust box (not shown) by means of suction force derived from a sucking means in a cleaner main body (not shown) through a suction pipe 1a (110a). In this case, however, threads, hair, cotton waste and the like (hereinafter referred generically to as "waste thread") are introduced in a cleaner by means of suction air stream or a belt and they twine easily around the circumferential surface of the driving pulley 6 (116), so that the outside diameter of the driving pulley 6 (116) becomes large, and it results in excessive tension with respect to the belt whereby it is broken, or excessive load upon a motor or the like. As a result, there have been such disadvantages that it brings about danger of burning of the motor and the like and that the belt slips off from the driving pulley 6 (116).

Heretofore, as countermeasure for these disadvantages as described above, for example, Japanese Patent Laid-open No. 160935/1985 discloses a mechanism wherein a separate and independent idle pulley is provided adjacent to a pulley, and when waste threads twine around the pulley, a belt transfers to the idle pulley to stop the rotation of a rotary brush. Japanese Utility Model Laid-open No. 171249/1985 discloses a suction means wherein a detection member for detecting a locked state of a belt due to twining of waste threads is provided, and when such twining of waste threads occurrs, it lights a lamp to give warning of such occasion. Moreover, Japanese Utility Model Laid-open No. 12353/1985 discloses a suction means wherein a pulley is fabricated from a shape memory alloy, and the circumferential surface of this pulley has a convex configuration in its section, but the configuration changes into a rectilinear or concave figure in its section with the temperature rise in frictional heat due to twining of waste threads, so that a belt runs idly.

However, any of these suction means has the object of either informing a user of the occurrence of twining of waste threads, or preventing the occurrence of damage to a belt or pulley by ceasing the rotation of a rotary brush in case of occurrence of twining waste threads.

In this connection, a means according to the prior art as described above only informs a user of the occurrence of twining of waste threads and calls user's attention for removing such twine of waste threads, and hence there has been such inconvenience that the user must remove the waste threads twined on all such occasions.

Objects and Summary of the Invention

It is an object of the present invention to provide a suction cleaner provided with a pulley being capable of automatically removing waste threads twined in order that the above-mentioned troublesome maintenance by user is made unnecessary.

For the sake of attaining the above described object, in the suction cleaner according to the present invention, a spiral groove is first defined on the circumferential surface of a driving pulley mounted fixedly to the rotating shaft of a drive assembly.

The fundamental principle of the above construction is to use a relationship between a bolt (male screw) and a nut (female screw). More specifically, a nut screwed in a bolt is held by fingers and when the bolt is turned (rotated), the nut transfers to either right or left direction with respect to the longitudinal direction of the bolt in response to a threaded direction of the spiral groove of the bolt.

The present invention has been contrived from a replacement of the bolt (male screw), the nut (female screw) and the fingers by a driving pulley, waste threads twined and a belt, respectively.

A prerequisite for the above described principle of removing waste threads is that there should be a difference of relative speed between the "waste threads twined" and the "pulley with a spiral groove". If they rotate simultaneously, the waste threads merely remain at an original position, but do not transfer along the spiral groove. As stated in the above fundamental principle, holding the nut by fingers means generation of relative speed between them. However, in the present invention wherein the "fingers" are replaced by the "belt", since the belt itself performs movement corresponding to the "rotation", it is difficult to find a difference of relative speed between the waste threads and the pulley with a spiral groove. In this connection, when as large an amount as that by which the cleaner body is affected of waste threads twine around the pulley, it brings about a situation where threads lie in a clearance between the pulley and the belt, and 100%

of the pulley's rotation cannot necessarily be transmitted to the belt, i.e. there arises a so-called slipping phenomenon.

In other words, even if the pulley rotates, the belt rotates at a slower speed than that of the pulley, and in an extreme case, the belt stops. Accordingly, the waste threads twined transfer to the right or left direction along the spiral groove defined on the circumferential surface of the pulley. A direction along which waste threads transfer is determined by a relationship between a rotating direction of the pulley and a direction of the spiral groove defined on the circumferential surface of the pulley. Hence, a more advantageous direction can be selected from a viewpoint of the design for a cleaner main body. Since the waste threads twined as described above transfer along the spiral groove defined on a pulley, transfer of the waste threads becomes more easy if a configuration of the pulley becomes gradually thinner with progress of the transferring direction.

Based on the principle as described above, waste threads twined which reside in a clearance defined between a belt and the circumferential surface of a pulley are allowed to transfer to the axial direction of the pulley, and at last they can be removed therefrom.

Furthermore, in order to attain the above described objects, a flat belt is preferably used for a driving belt of a rotary brush in the cleaner according to the present invention. Alternatively or in addition to the use of said spiral groove(s), a substantially frustoconical pulley may be used as the driving pulley in this invention.

When a driving pulley is formed as one having a substantially frustoconical configuration and a flat belt is stretched over a rotary brush as in the above described construction, such waste threads twining around the circumferential surface of the pulley transfer gradually to the side of a smaller diametrical portion of the substantially frustoconical pulley, and they are excluded from a region over which the belt extends at last.

Brief Description of the Drawings

Embodiments of the invention will now be described, by way of examples with reference to the accompanying drawings, in which:

Fig. 1 is a schematic perspective view, partly in section, showing the first embodiment of the present invention;

Fig. 2(a) is a schematic perspective view showing the essential part of Fig. 1;

Figs. 2(b) and (c) are schematic perspective views each showing the essential part of Fig. 1 in an operating state;

Figs. 3(a) and (b) illustrate the second embodiment of the present invention wherein Fig. 3(a) is a schematic perspective view showing the essential part of a cleaner, and Fig. 3(b) is an explanatory view showing a schematic arrangement of the cleaner;

Fig. 4 is an explanatory view showing the third embodiment of the present invention;

Fig. 5 is an explanatory view showing the fourth embodiment of the present invention;

Fig. 6 is an explanatory view showing the fifth embodiment of the present invention;

Fig. 7 is an explanatory view showing the sixth embodiment of the present invention;

Fig. 8 is a constructional explanatory view, in vertical section, showing the seventh embodiment;

Fig. 9 is an enlarged perspective view showing the essential part of Fig. 8;

Fig. 10 is a cross-sectional view showing a belt;

Figs. 11(a) to (e), inclusive, are explanatory views each showing an operating state where waste threads are discharged from a driving pulley;

Figs. 12(a) to (c), inclusive, are explanatory views each showing action for discharging waste threads from a clearance defined between a belt and a stepped portion of a pulley; and

Figs. 13(a) and (b) show suction means in conventional cleaners of different types, respectively, wherein Fig. 13 (a) is a schematic side view partly in section, and Fig. 13(b) is a constructional explanatory view in vertical section.

Detailed Description of the Preferred Embodiments

Fig. 1 shows the first embodiment of the present invention, and particularly the one which is obtained by embodying the cleaner claimed in claim 3 wherein the same reference numerals designate like or corresponding parts to those of Fig. 13(a) and accordingly, the overlapping explanation relating thereto will be omitted.

A driving pulley 10 is fixedly mounted on a rotating shaft 5a cantilevered with respect to a drive assembly 5, and on a circumferential surface 10a of the driving pulley 10 is threaded a spiral groove 11.

In Fig. 2, a rotating state of the driving pulley 10 is as illustrated by arrows, and more specifically it means that the rotation is in counterclockwise direction when viewing the drive assembly 5 from the side of the driving pulley 10.

On the circumferential surface 10a of the driving pulley 10, as is apparent from Fig. 2, the spiral groove being in the same threaded direction as that of "left-handed screw" is threaded.

In the above construction, waste threads 9 being in a state where they stay at a position between the circumferential surface of the driving pulley 10 and the driving belt 7 (Fig. 2(b)) become an obstacle for transmitting the rotation of the driving pulley 10 to a driving belt 7, and as a result the belt 7 commences to slip.

When it is assumed that the driving pulley 10 continues to rotate at 5,000 rpm and the belt 7 effects such movement corresponding to the rotation at 4,800 rpm a difference between both relative number of revolutions is as follows.

5,000 rpm - 4,800 rpm = 200 rpm.

This is equivalent to the belt being in a stopped condition, and the driving pulley 10 rotating at 200 rpm, and the belt 7 prevents the rotation of only the waste threads 9 in the case where there is a

tendency of rotating the driving pulley 10 together with the waste threads twining thereabout. Accordingly, the waste threads 9 are pushed out along the spiral groove 11 as shown in Figs. 2(b) and (c), and they transfer in the direction of the arrow so that the waste threads are removed. The waste threads 9 thus removed are contained in a dust box by means of a suction device (not shown).

Meanwhile, when a pitch of the spiral groove 11 is too large, it becomes difficult to remove the waste threads 9, whilst when it is too small, a transfer of the waste threads 9 becomes slow, so that the number of pitch should be appropriately selected. As to the explanation therefor, the above-mentioned theory of male and female screws is applicable, the detailed explanation therefor is omitted.

Furthermore, when a large amount of the waste threads 9 coil round the driving pulley 10 so that the belt 7 slips, tension of the belt 7 increases and it presses strongly the waste threads 9 against the spiral groove 11. While such phenomenon becomes a factor for difficult transfer of the waste threads 9, since the theory of screws is applicable in the principle of the present invention as mentioned above, sufficient power for removing the waste threads is obtained.

As discussed above, the first embodiment of the present invention has been described in the case where the driving pulley 10 is rotated in a counterclockwise direction when the drive assembly 5 is viewed from the side of the driving pulley 10. However, if the driving pulley 10 is rotated in a clockwise direction when the drive assembly 5 is viewed from the side of the driving pulley 10 according to the circumstances such as an arrangement of the drive assembly 5 or establishment of a rotating direction in a rotary brush 3 and the like from viewpoint of the design, it is sufficient that a spiral groove along the same direction as that of right-handed screw is threaded on the circumferential surface 10a of the driving pulley 10. In accordance with this construction, the waste threads 9 twining around the driving pulley are transferred to the opposite side of the drive assembly 5 thereby to be removed as in the same manner as mentioned above. Fig. 3(a) shows the second embodiment of the present invention and particularly the one which illustrates specifically the construction claimed in claim 4 wherein a relationship between the rotating direction of a driving pulley 100 and a spiral groove 11 as well as the fundamental principle thereof are the same as that of the first embodiment, so that the explanation therefor is omitted. As illustrated in Fig. 3(a), the driving pulley 100 has a configuration such that its diameter on the side of the drive assembly 5 is larger than that of the opposite side, a so-called frustoconical configuration, on the circumferential surface of which is threaded a spiral groove 11. Threads twined are removed in the same manner as that of the first embodiment, i.e. the threads are transferred to the side opposite to that of the drive assembly. However, unlike the case where the driving pulley 100 is a cylindrical configuration as in the first embodiment, since the diameter of the driving pulley 100 around which are twined waste threads becomes smaller with the transfer of them, frictional force between the driving pulley 100 and the waste threads becomes weaker so that such waste threads are very easily transferred and removed from the driving pulley 100.

Meanwhile since a belt 7 has such a characteristic that it transfers easily to the side of a larger diameter of the pulley, there arises such a case where the belt 7 transfers to the side of a larger diameter of the driving pulley 100 and it comes off therefrom and towards the side of the rotary shaft 5a at last, when the shaft of the driving pulley 100 is arranged in parallel with the rotating shaft of a driven rotary brush 3, and such is disadvantageous. Fig. 3(b) shows a modification of the one illustrated in Fig. 3(a) wherein the construction is improved in such a manner that an angle β defined between the shaft of the driving pulley 100 and the rotating shaft of the rotary brush 3 is suitably selected in relation to a conical angle α of the driving pulley 100, whereby the belt is positioned at an appropriate point.

Figs. 4 and 5 show further the third and fourth embodiments of the present invention wherein in each driving pulley 101, a flange 102 having a larger diameter than the maximal diameter of the driving pulley 101 is provided on the end portion thereof on the side of the drive assembly 5. An object of the provision of the flange 102 is to cease hindrance of transfer and removal of waste threads as a result of twining an end of the waste threads around the rotating shaft 5a in the case when the waste threads carried by the belt come into contact with the driving pulley 101. Another object of the provision of the flange 102 is to prevent damage of a belt in case of the belt coming off from the driving pulley towards the side of the rotating shaft 5a by any possibility, because there is a fear of damaging the belt.

Similarly, on the side of the rotary brush 3, a spiral groove 21 may be defined on a driven pulley 20 disposed on either an end of or an arbitrary position between the opposite ends of the shaft thereof. Fig. 6 represents the fifth embodiment showing a rotary brush 3 provided with a driven pulley 20 on which is defined a spiral groove 21 at the central portion thereof. Furthermore, Fig. 7 represents the sixth embodiment showing a rotary brush 3 provided with said driven pulley 20 at a side end of the shaft thereof. In these embodiments, it is to be noted that blades 22 are provided in place of bristles 2, but waste threads twining around a pulley can be removed as in the case of the driven pulley 10.

Moreover, Fig. 8 shows the seventh embodiment according to the present invention which is an example wherein a driving pulley is applied to a suction device in a vacuum cleaner and which corresponds to that of Fig. 13(b). In the seventh embodiment, to a drive assembly (fan driving motor) 115 is integrally and coaxially mounted a fan 120 for generating suction air with a driving pulley 122 for driving a rotary brush 113, and an extreme end of the driving pulley is free, in a so-called cantilevered condition. Further, a driven pulley 114 provided on the rotary brush 13 is arranged perpendicular to the driving pulley 122, and a flat belt 124 is stretched between the driven pulley 114 and the driving pulley

122. Dust swept up by the rotary brush 113 is transferred to a duct 130 through the flat belt 124 and its vicinities 126, and then a fan casing 128. In other words, the driving pulley 122 is positioned in a channel for dust.

Next, a construction of a region being the essential part of the present invention will be described in detail hereinbelow. As shown in the schematic constructional diagram of Fig. 9, a driving pulley 122 is formed into a frustoconical configuration (truncated cone) a diameter of which becomes gradually smaller along the axial direction with approaching from the side of a drive assembly (motor) 115 to the opposite side, and in addition a stepped portion an extreme end portion 122a of which having somewhat smaller diameter on the opposite side thereof is formed. Moreover, a truncated conical portion (skirt) 134 is integrally provided with said driving pulley 122 on a fan shaft 132. An extreme end portion 134a of said frustoconical portion 134, which is adjacent to the end surface of a larger diametrical portion 122c on the side of the motor 115 for the driving pulley 122, has a substantially equal diameter to that of the larger diametrical portion 122c of the driving pulley 122. And on the frustoconical portion 134 is formed a taper which expands so as to be gradually a larger diameter towards the direction of the motor 115 at a larger angle than that of the driving pulley 122, and an end portion of which reaches the extreme end of said fan 120. A flat belt 124 stretched between the frustoconical driving pulley 122 and a driven pulley 114 of a rotary brush 113 is formed into a mountain-shape in its section wherein the central portion is flat and each taper is defined inwardly on opposite end portions thereof as shown in Fig. 10.

Furthermore, in the vicinity of the extreme end portion of the driving pulley 122 (a lower position in Fig. 8), a slip-out preventing means 136 for belt is disposed opposite to the edge surface 124a on the side of the belt with some clearance from the extreme end portion 122a of the driving pulley 122 in a condition where the belt 124 extends over the driving pulley 122.

According to the above construction, in the case when waste threads derived from suction air stream or the driving belt 124 twine around the driving pulley 122, the waste threads twined around the pulley transfer to the side of a smaller diameter portion of the substantially frustoconical driving pulley 122 thereby to be discharged from the extreme end portion of the driving pulley 122. The operation therefor will be described in detail hereinbelow by referring to Figs. 11(a) to (e). Fig. 11(a) is an explanatory view showing a moment when a waste thread 140 twines around the driving pulley 122. As is apparent from Fig. 11(a), a substantially semicircular portion of the waste thread 140 composed of portions 140a, 140b and 140d with respect to the driving pulley 122 is restricted in a manner so as to be held between the belt 124 and the driving pulley 122. However, the other approximately semicircular portion 140c is not restricted by the belt 124, i.e. it is in a so-called released condition. Accordingly, this released portion 140c of the waste thread 140 transfers to the smaller diametrical direction at the moment when the waste thread twines around the driving pulley 122. At the following instant (a state where the driving pulley 122 rotates by 90° thereafter as shown in Fig. 11(b)), the portion 140b of the waste thread 140 held between the belt 124 and the driving pulley 122 is also released from the belt 124, so that said portion of the waste thread 140 transfers to the side of the smaller diametrical portion of the driving pulley 122. The waste thread 140 transfers successively to the state shown in Figs. 11(c), (d) and (e) with the rotation of the driving pulley 122. Fig. 11(e) shows a state where the driving pulley has rotated just one revolution from the position shown in Fig. 11(a), and accordingly this means that the waste thread 140 has transferred towards the smaller diametrical direction of the driving pulley 122 by ℓ_1. According to the same operation as that described above, the waste thread 140 transfers further by a distance ℓ_2 in the following one revolution, and at last the waste thread is discharged from a part of the driving pulley 122 over which the belt 124 extends.

It is considered that the reasons for "the semicircular portion of the waste thread 140 in a released state transfers to the smaller diametrical portion of the driving pulley 122" in the above description are derived from interaction of the following and the like factors:

(1) A tapered configuration of the driving pulley 122.

(2) Centrifugal force acting upon a released portion of the waste thread 140.

(3) Coefficient of friction between the waste thread 140 and the driving pulley 122.

(4) Force of twining the waste thread 140 around something.

However, a strict analysis for such reasons is difficult so that it will be omitted herein, but the behavior and phenomenon of waste threads as described above have been confirmed by the present Applicant's experiments.

It is to be noted that the behavior of the waste thread is not limited to that shown in from Figs. 11(a) to (e), but Figs. 11(a) to (e) show the conceptional behavior.

As described above, since the waste threads 140 which have twined around the driving pulley 122 transfer to the side of a smaller diametrical portion of the driving pulley 122, when a cleaner is arranged in such that a motor 115 is disposed on the side of a larger diametrical portion 122c, whilst the side of a smaller diametrical portion is released, i.e. a so-called cantilevered condition, the waste threads 140 which have twined around the driving pulley 122 are removed and discharged therefrom.

However, in the case when a large amount of waste threads have twined around the driving pulley 122 at a time, there is such danger that with frictional force between the driving pulley 122 and the belt 124 decreasing due to a large amount of the waste threads lying between the belt 124 and the driving pulley 122, the belt 124 slips in the smaller diametrical direction of the driving pulley 122, and at last the belt falls off from the driving pulley 122. In order to prevent such danger, the aforesaid slip-out

preventing means 136 for belt has been previously provided on a cleaner, so that when the belt 124 slips in the small diametrical direction of the driving pulley 122 and tends to fall off therefrom, the belt 124 abuts upon the slip-out preventing means 136 for belt, whereby the belt 124 is prevented from slipping out from the driving pulley 122. As shown in Figs. 12(a), (b) and (c), a stepped portion 122b is formed on the extreme end portion of the driving pulley 122 (Fig. 12(b)) so as to easily discharge the waste threads 140 from a clearance between the belt 124 and the driving pulley 122 in the case when the belt 124 threatened to slip out from the driving pulley 122 and abutted on the slip-out preventing means 136 for belt. Furthermore, the side edge portions of the belt 124 are tapered on the inner side of the cleaner, and accordingly the side edge portions of the belt are formed so as not to contact the driving pulley 122. Thus, there is no case where the waste threads 140 are held down by the belt 124 at the extreme end portion 122a of the driving pulley 122, so that the waste threads are more easily discharged outside the driving pulley 122 (Fig. 12(c)). Reasons for the provision of the tapered opposite end portions on the inner side of the belt 124 are also in avoiding such danger as a possibility of cutting the belt 124 from the side edge on the side of the larger diametrical portion 122c of the driving pulley 122 as a result of significant loading on said belt side edge portion on the side of the larger diametrical portion of said driving pulley other than the reason of such effect for easily slipping out waste threads. In the belt 124 used in the driving pulley 122, one side edge portion of the belt 124 is positioned on the side of the smaller diameter of the driving pulley 122, whilst the other side edge portion thereof is positioned on the side of the larger diametrical portion 122c of the driving pulley 122. For this reason, since the belt is required to exhibit appropriate stretchability and flexibility, it is desirable to use a belt made of rubber.

Meanwhile, as described above, when the side of the belt 124 positioned on the larger diametrical portion 122c of the driving pulley 124 is compared with the other side edge thereof, an amount of elongation is larger in the case where the belt extends over the driving pulley 122, so that there is such a fear that cracks appear from the edge portion on the side of the larger diametrical portion 122c and the belt breaks down at last in case of using the same for a long period of time. In this connection, concentration of stress is moderated due to such fact that a region of the belt where the highest degree of elongation is required is biased inwardly, because of the tapered configuration of said belt.

According to such construction of the belt 124 as described above, no significant load is applied to the side edge of the belt 124, and life of the belt 124 has been also remarkably improved. More specifically, tapered portions on the opposite edges of such tapered belt as described above function to effect action of easy slipping out of waste threads together with action of reducing load on the side edge portions, respectively, in case of such construction where a pulley having a frustoconical configuration is applied to both the driving pulley 122 and the driven pulley 114.

Furthermore, a skirt 134 adjacent to the larger diametrical portion 122c of the driving pulley 122 is one for preventing twine of waste threads around a fan shaft 132, and a taper angle of which is made larger than that of the driving pulley 122 such that the waste threads once twined around the skirt 134 are easily transferred to the side of the driving pulley 122 along the taper. While said slip-out preventing means 136 for belt may be formed as a projection extending from the bottom of a cleaner body 110, it may be either a tongue-shaped piece made of a metal plate or the like an end of which is fixed to the cleaner body 110, or a roller-shaped member mounted on a support portion projecting from the cleaner body 110.

In the aforesaid respective embodiments, although the invention has been described as to application to a suction type vacuum cleaner, the present invention can, of course, apply also to a cleaner of the type wherein only a rotary brush is rotated by a motor or an engine, and dust swept up is directly collected in a dust containing chamber, and in this case the same functions and advantages as those of the former cleaner can be attained.

Since the present invention has been constructed as described above, the following advantages are obtained. Waste threads twined about a pulley are sprung out from a clearance defined between the pulley and a driving belt along such direction where a spiral groove defined on a circumferential surface of the pulley proceeds while rotating, whereby the waste threads are positively removed so that cleaning effects are elevated and the maintenance therefor becomes not necessary.

Furthermore, because of the provision of a flange on the end surface on the side of a drive assembly for the pulley, twine of waste threads around a rotating shaft can also be prevented.

Waste threads twined around the pulley transfer so as to slip down to the side of a smaller diametrical portion of the pulley along the taper formed on the circumferential surface of the pulley, and are sprung out from a clearance between the pulley and the driving belt so that they are removed positively from the pulley. Hence, stoppage of a rotary brush a cause of which is derived from entanglement of threads on the pulley and cutting of the driving belt can be avoided. As a result, troublesome maintenance such as removal operation of waste threads from the pulley, exchange of the belt and the like operations become not necessary, so that cleaning work is never interrupted and the workability thereof is also improved, besides such improvement is also advantageous from viewpoint of the cost.

While in the foregoing, preferred embodiments of the invention have been disclosed in considerable detail for purposes of illustration, it will be understood by those skilled in the art that many of these details may be varied without departing from the spirit and scope of the invention.

Claims

1. A cleaner provided with a rotary brush driven by a belt stretched between a driving pulley mounted fixedly to a rotating shaft of a drive assembly and a driven pulley mounted fixedly to the rotary brush, wherein a spiral groove is defined on the circumferential surfaces/surface of the driving pulley and/or the driven pulley, and/or each configuration of the pulleys is formed into a frustoconical configuration a diameter of which becomes smaller in the axial direction extending from an end portion thereof positioned on the support side of the pulley to the side of the other end portion.

2. A cleaner provided with a rotary brush driven by a belt stretched between a driving pulley mounted fixedly to a rotating shaft of a drive assembly and a driven pulley mounted fixedly to the rotary brush, wherein a spiral groove is defined on the circumferential surfaces/surface of the driving pulley and/or the driven pulley.

3. A cleaner as claimed in claim 2 wherein said driving pulley is mounted fixedly to the rotating shaft of said drive assembly at an end portion thereof, the spiral groove on the circumferential surface of said driving pulley being defined in the same threading direction as that of a right-handed screw in the case where the direction of rotation of said rotating shaft is clockwise or the spiral groove being defined in the same threading direction as that of a left-handed screw in the case where the direction of rotation of said rotating shaft is counterclockwise.

4. A cleaner as claimed in claim 2 or 3 wherein said driving pulley has a frustoconical configuration a diameter of which larger on the side of the drive assembly than that of the other end thereof.

5. A cleaner as claimed in any one of claim 2, 3 or 4 wherein a flange having a larger diameter than the maximal diameter of the driving pulley is formed on the end portion of said driving pulley on the side of the drive assembly.

6. A cleaner provided with a rotary brush driven by a belt stretched between a driving pulley mounted fixedly to a rotating shaft of a drive assembly and a driven pulley of the rotary brush, wherein a flat belt is used as the driving belt, and said driving pulley is cantilevered to a drive shaft of said drive assembly and has into a substantially frustoconical configuration in which a diameter thereof becomes gradually smaller in the axial direction extending from the side of said drive assembly to the other side thereof.

7. A cleaner as claimed in claim 6 wherein a stepped portion having a smaller diameter than that of an extreme end portion of said driving pulley is formed on said extreme end portion.

8. A cleaner as claimed in claim 6 wherein a slip-out preventing means for the belt is disposed close to a region of the extreme end of said driving pulley over which the belt extends.

9. A cleaner as claimed in claim 6 wherein a frustoconical member is disposed adjacent to the end portion of said driving pulley on the side of the drive assembly, the extreme end of said frustoconical member has a substantially equal diameter to that of the end portion of said driving pulley on the side of the drive assembly and the diameter thereof becomes gradually larger in the direction towards the drive assembly at a larger expanding angle than that of said driving pulley.

10. A cleaner as claimed in claim 6 wherein either or both of a side edge portion/portions on the inner surface of said driving belt is/are chamfered in a tapered configuration.

FIG. 1

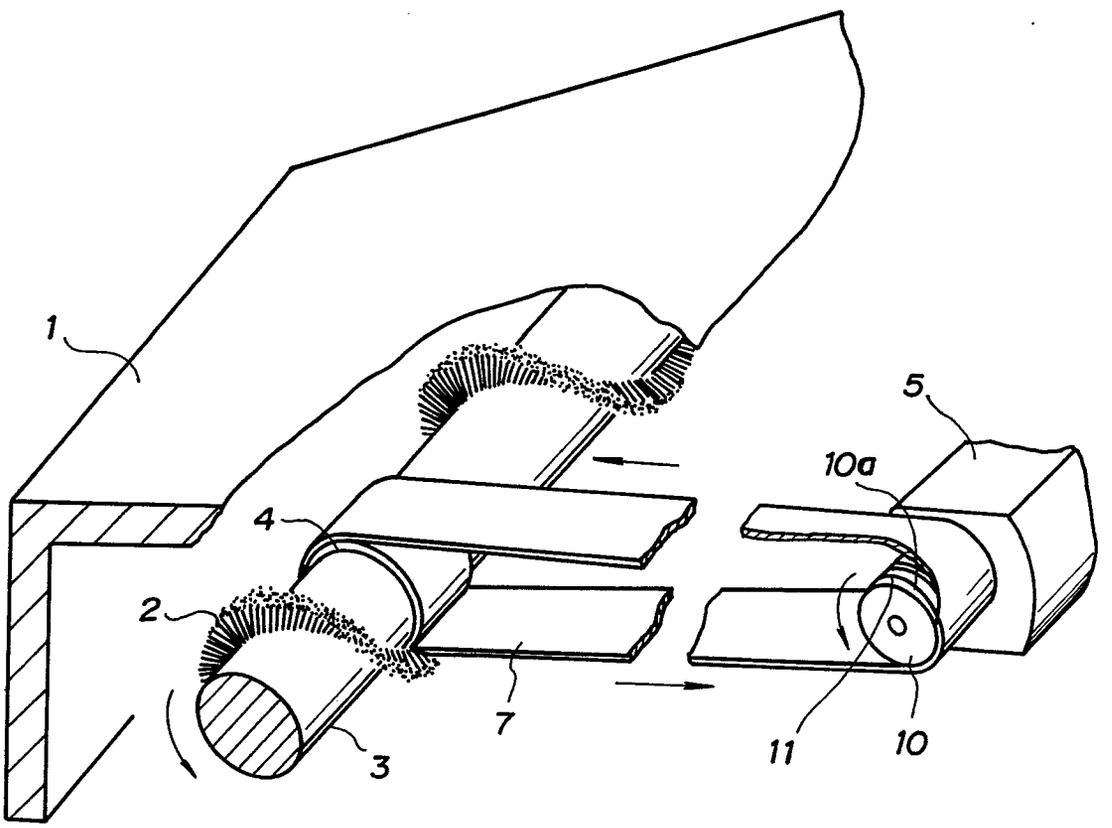


FIG. 2(a)

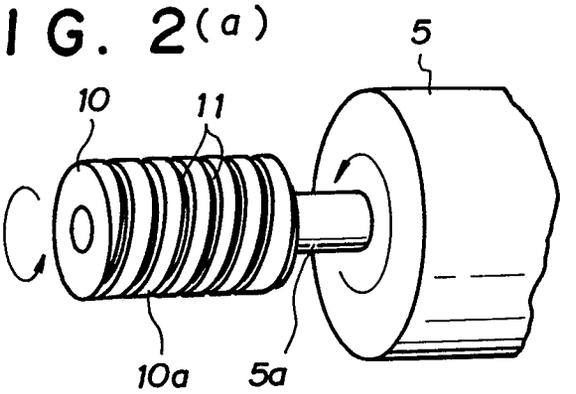


FIG. 2(b)

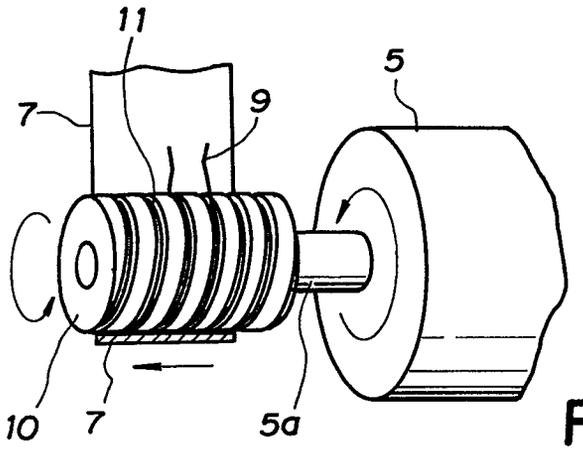


FIG. 2(c)

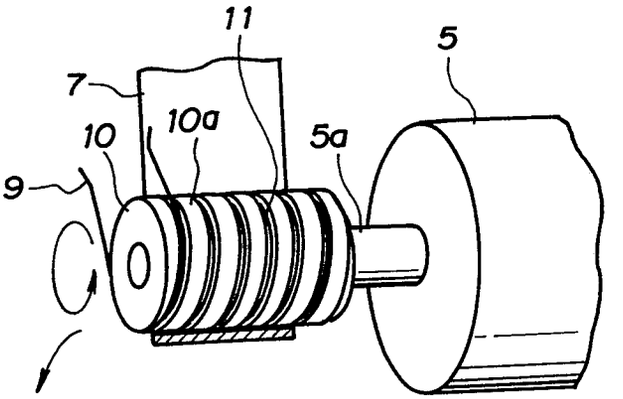


FIG. 3(a)

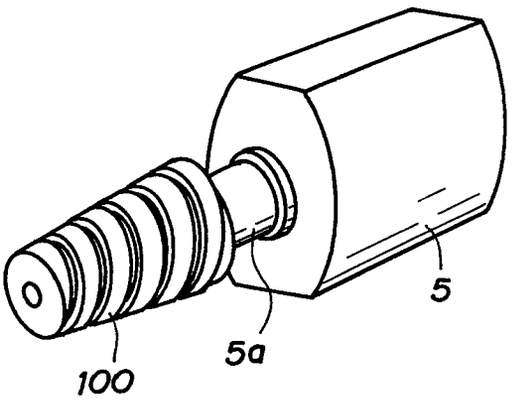


FIG. 3(b)

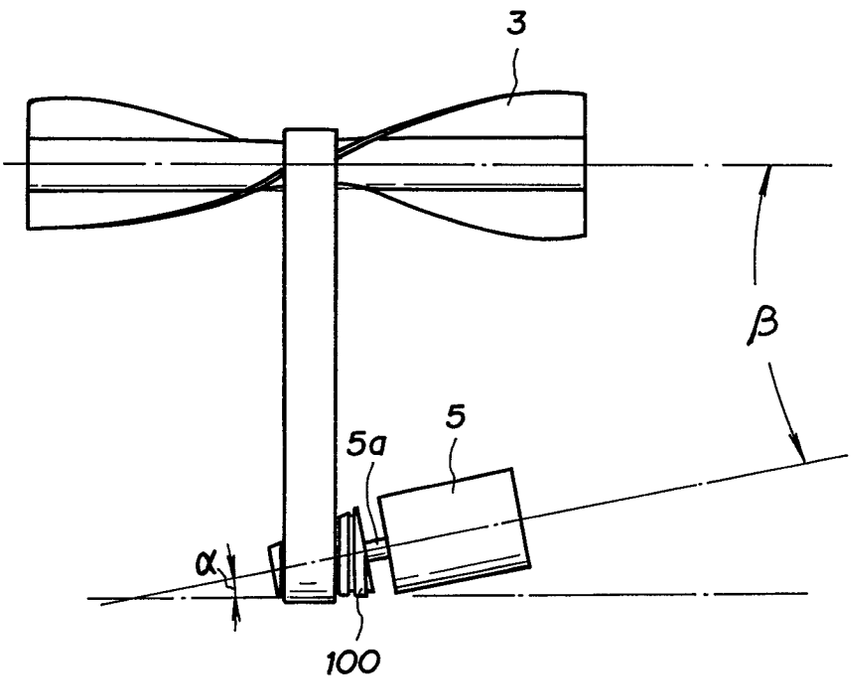


FIG. 4

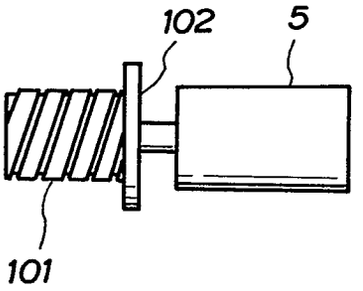


FIG. 5

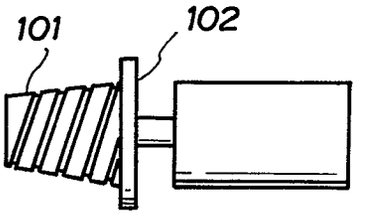


FIG. 6

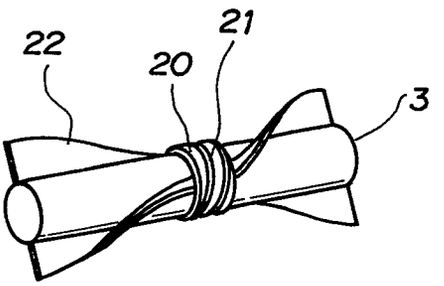


FIG. 7

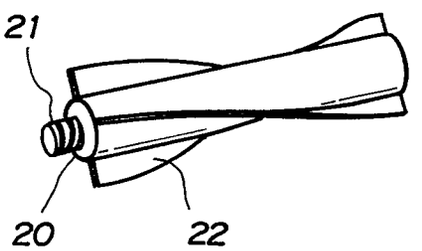


FIG. 8

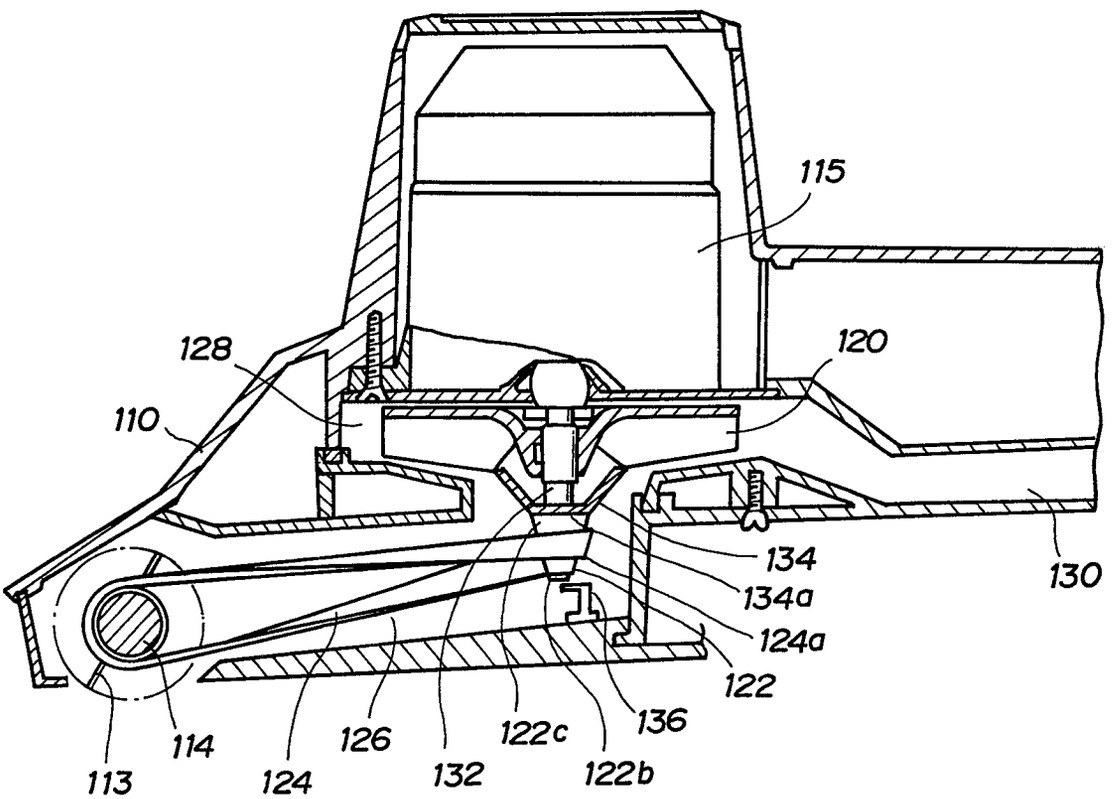

115
128
120
110
134
134a
124a
130
122
136
114
126
122c
113
124
132
122b

FIG. 9

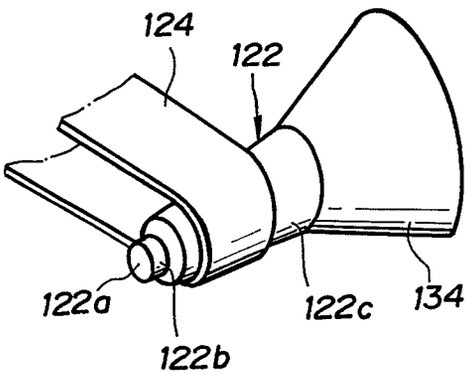
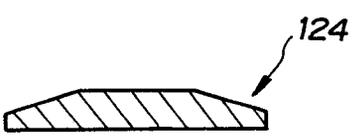


FIG. 10



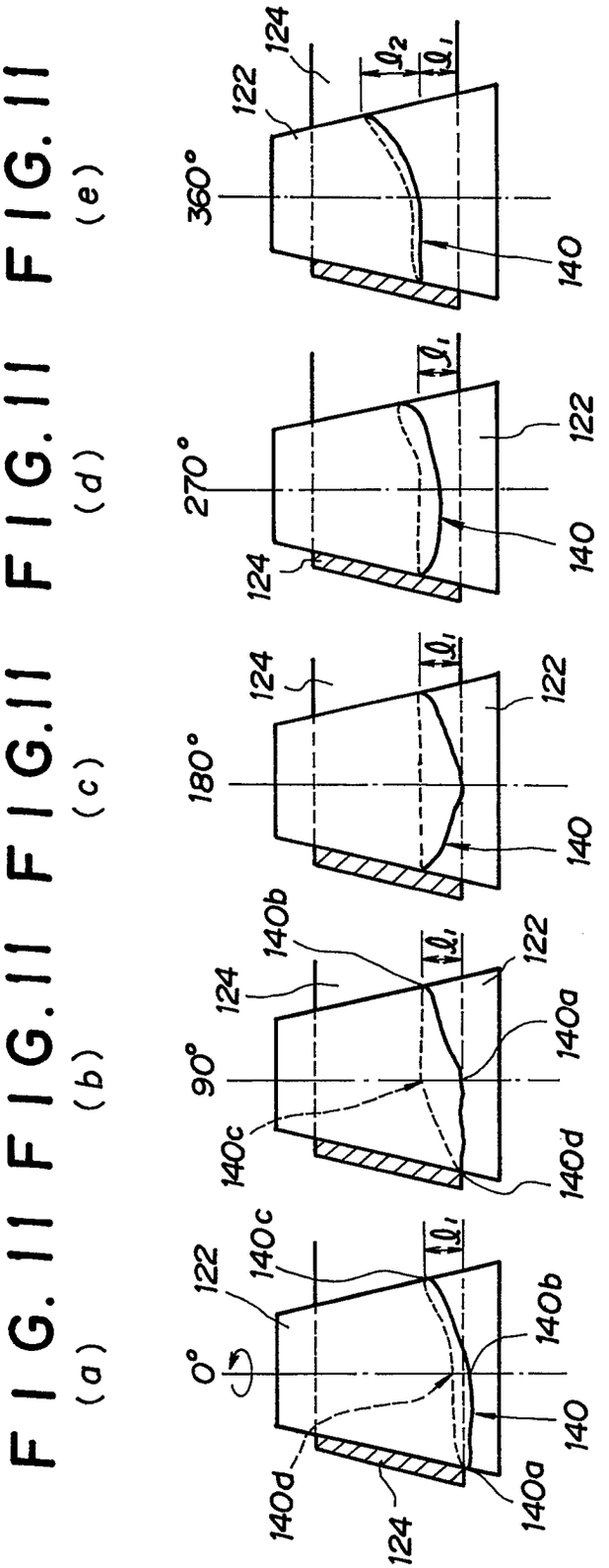


FIG. 11 (a)

FIG. 11 (b)

FIG. 11 (c)

FIG. 11 (d)

FIG. 11 (e)

FIG. 12 (c)

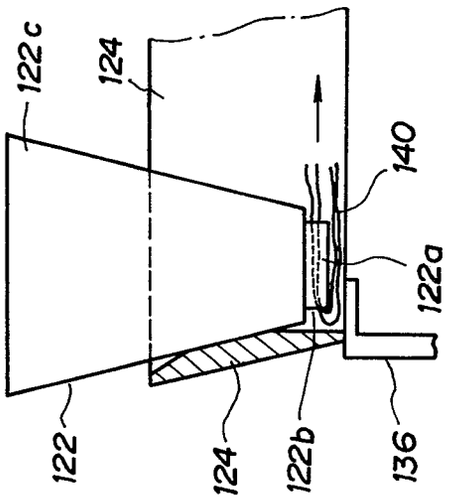


FIG. 12 (b)

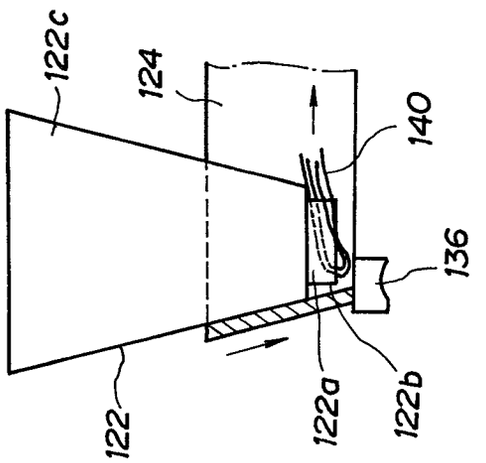


FIG 12 (a)

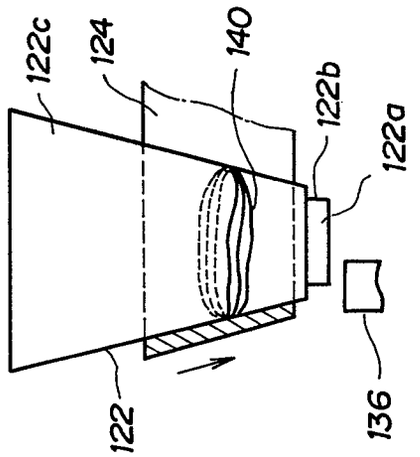


FIG. 13(a)

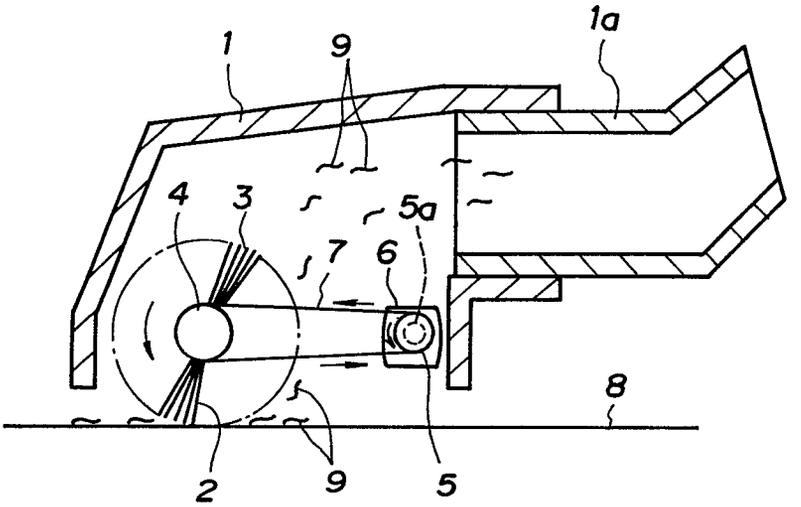


FIG. 13(b)