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(54) **LEAF REMOVAL SYSTEM**

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(76) **Inventor: Roland John Reeves, Gainesville, GA (US)**

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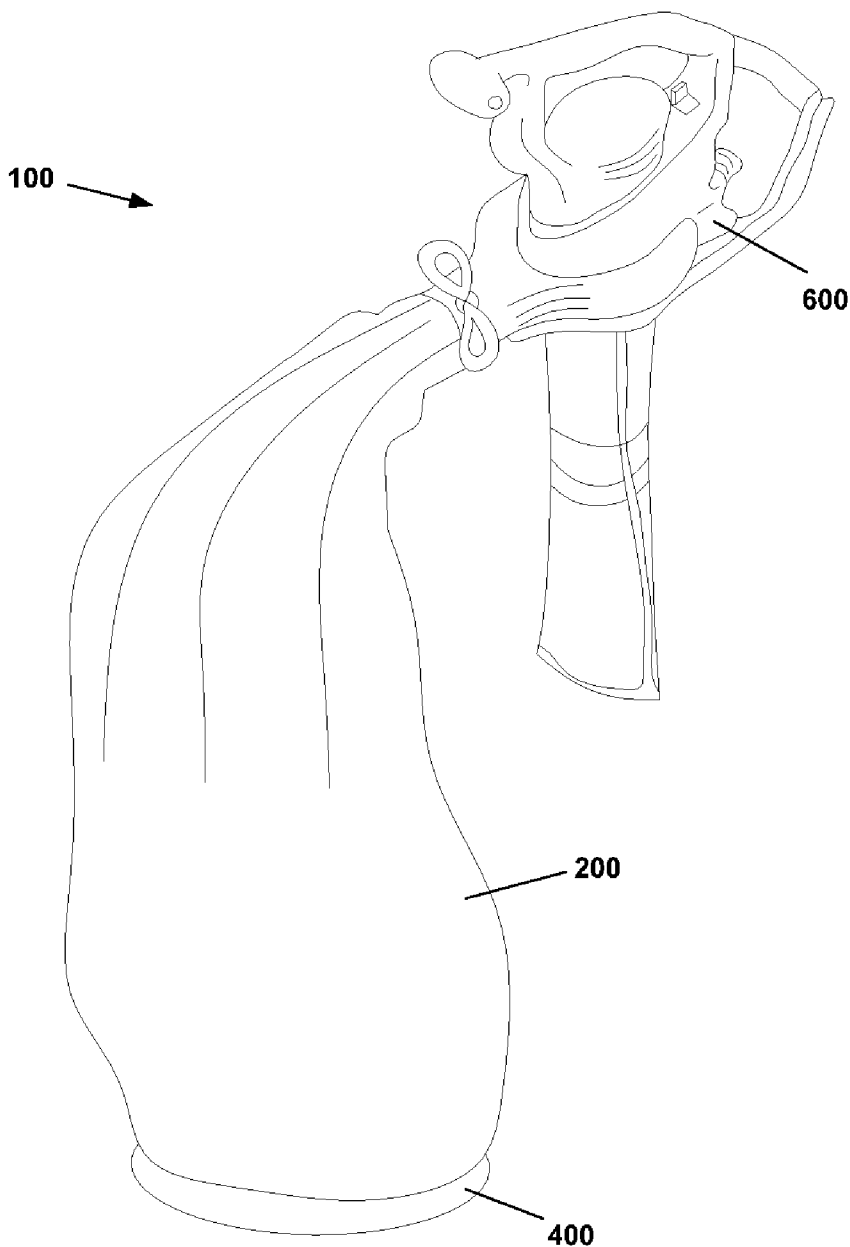
Correspondence Address:  
**GEORGE R. REARDON**  
**3356 STATION COURT**  
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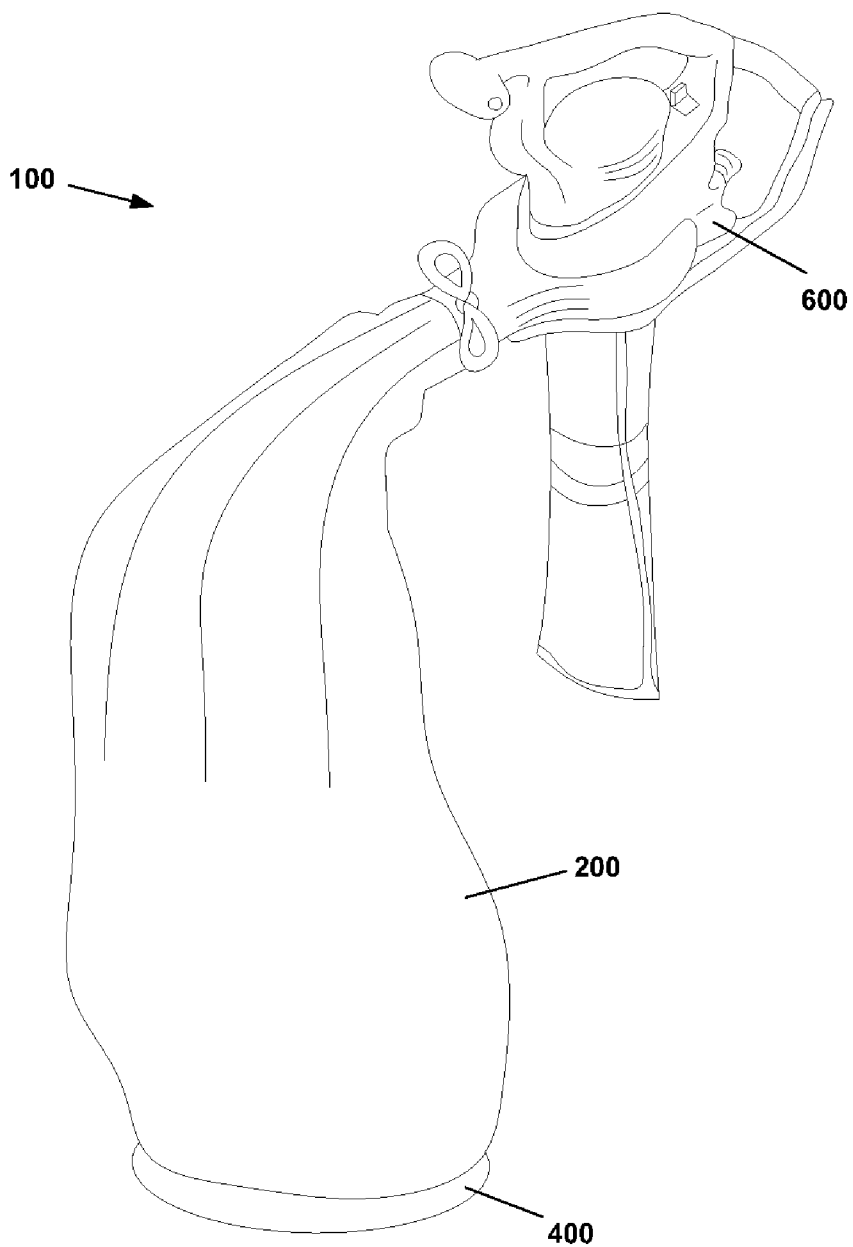
(57) **ABSTRACT**

A leaf removal system of the blower-vac type is disclosed which allows the user to minimize down-time during the process of leaf and debris removal. The user can work productively removing leaves and other debris for a longer time before needing to empty or replace the debris bag.

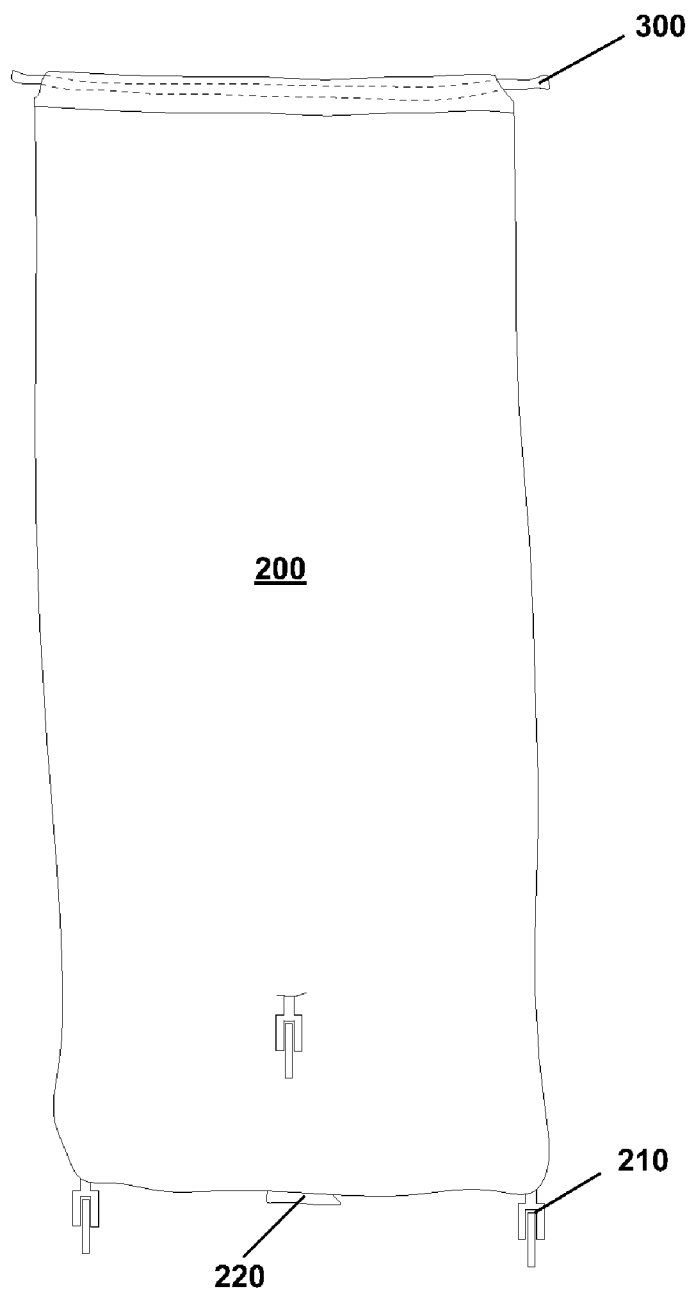
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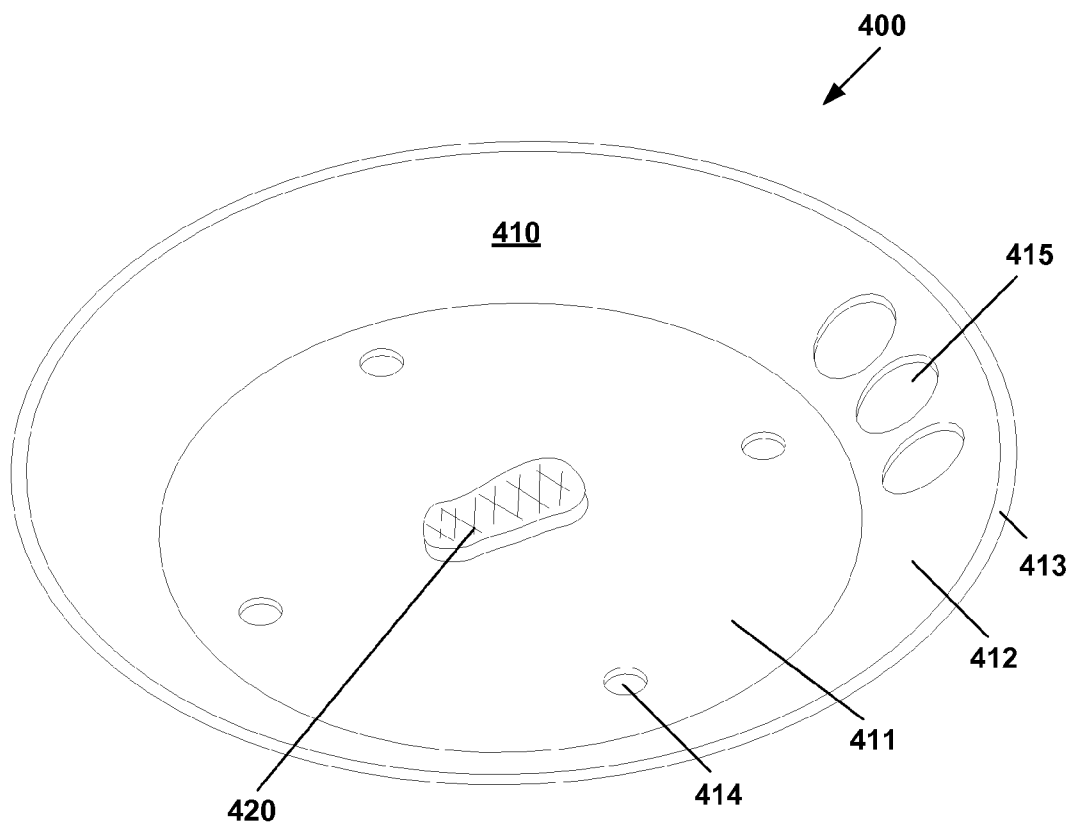




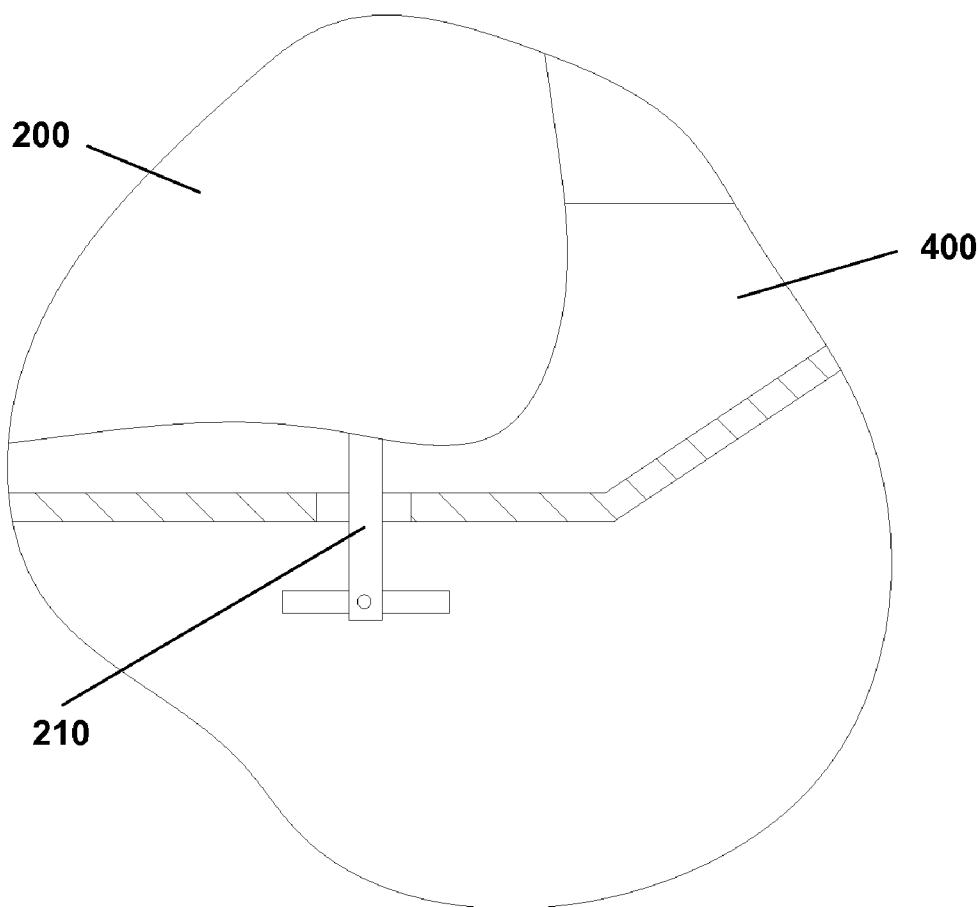
**FIG. 1**



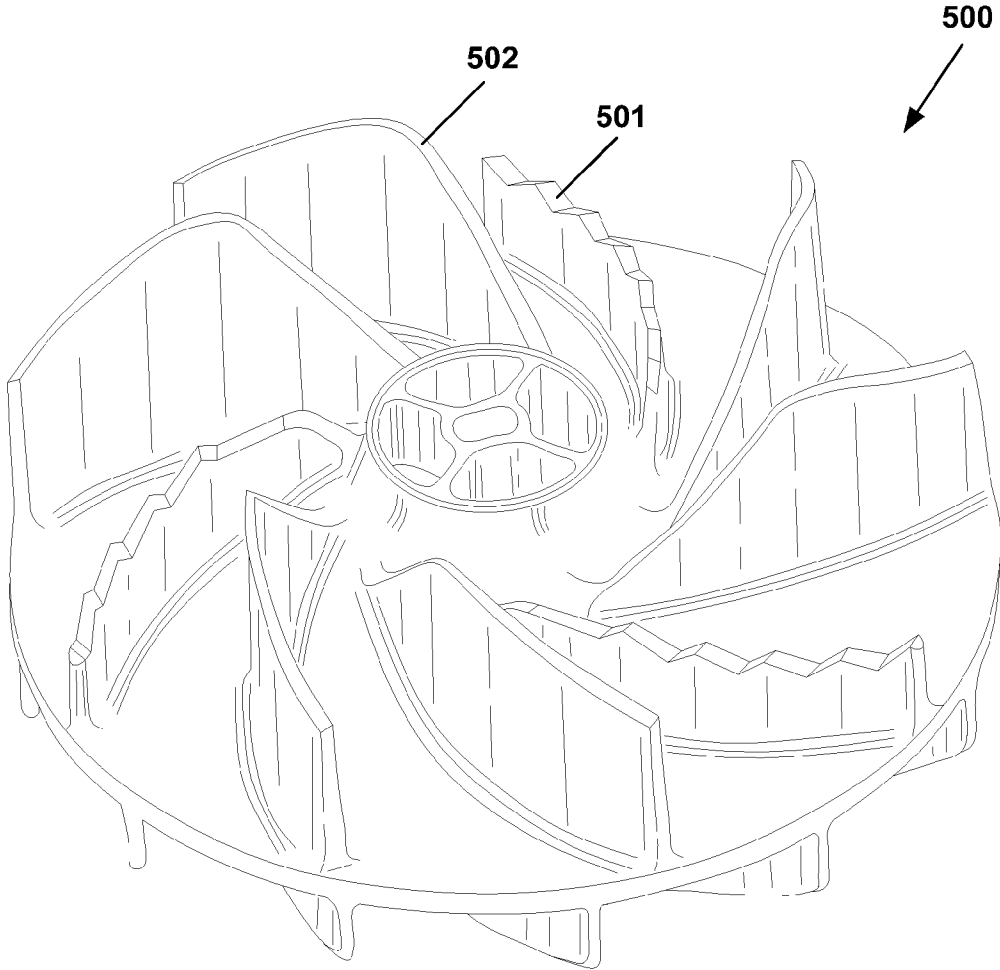
**FIG. 2**



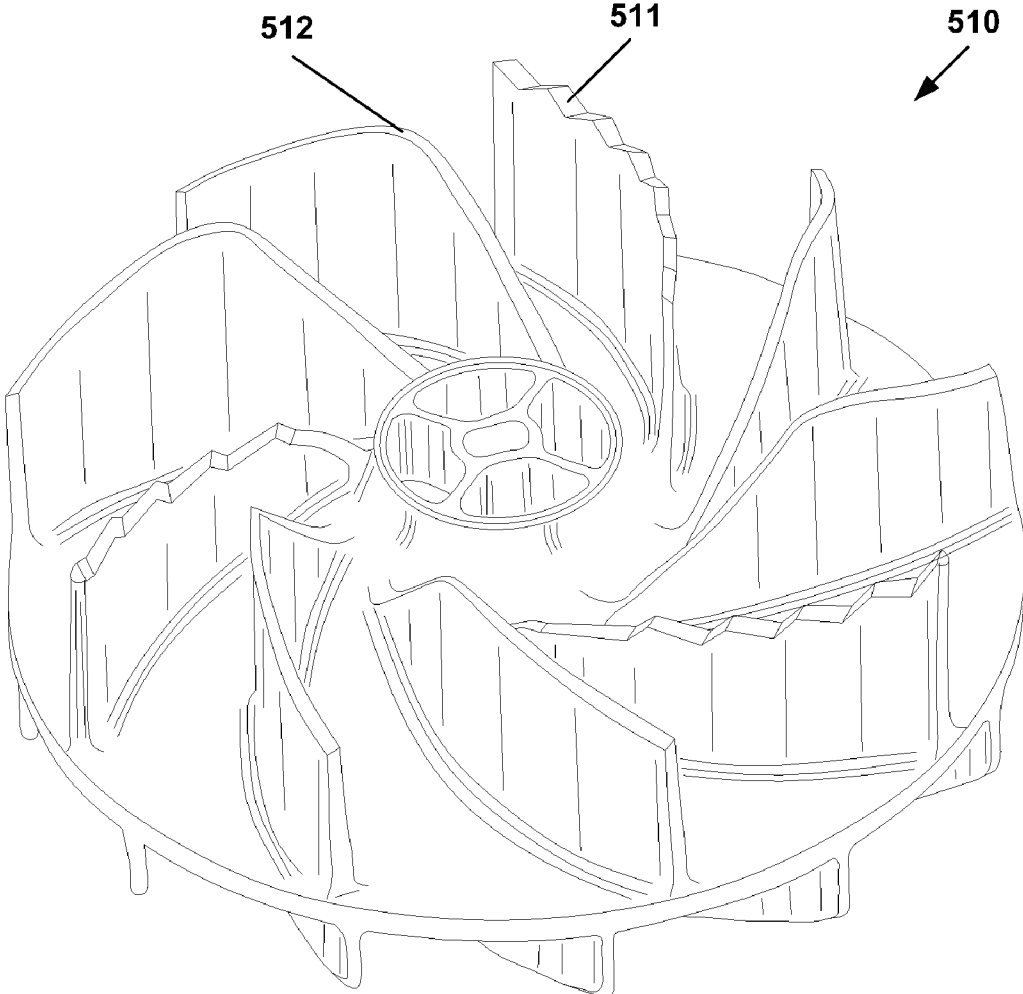
**FIG. 3**



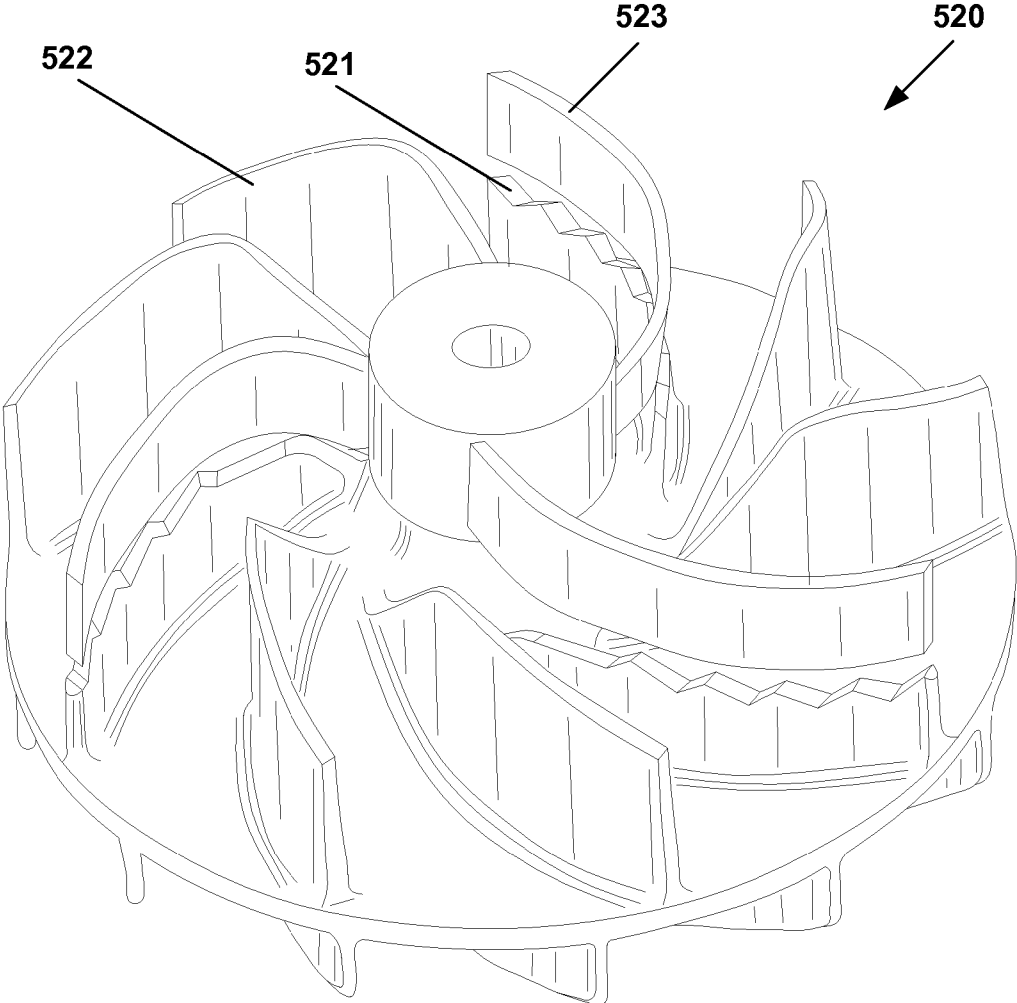
**FIG. 4**



**FIG. 5**



**FIG. 6**



**FIG. 7**



**LEAF REMOVAL SYSTEM**

**FIELD OF THE INVENTION**

[0001] The present invention relates to the field of leaf removal systems of the leaf blower-vacuum type.

**BACKGROUND OF THE INVENTION**

[0002] Leaf blowing systems of the general type described herein are known.

[0003] Leaf blowers have been controversial since they were introduced in 1976 to address a drought in California. The City of Los Angeles mandated their use to prevent gardeners from using water to clean walks and driveways. This was due to the highly cost-effectiveness of a leaf blower. City maintenance crews, professional gardeners, and home owners have all defended blowers to protect their pocketbooks.

[0004] Hand-held blower-vacs are blowers that can work in reverse and suck leaves and debris into a bag that the user can carry to a compost pile or other suitable disposal place. These machines are generally quieter, especially the ones powered by electric motors.

[0005] Hand-held blower-vacs are useful for a variety of tasks. Gathering and shredding leaves is one of the most obvious. Gardeners love the vacuum function for making mulch and compost out of grass and leaves. Used this way, blower-vacs can reduce approximately 16 bags of loosely packed leaves to one mulched blower bag.

[0006] Blower-vacs are particularly useful for clearing out leaves and debris when space is restricted, such as inside basement window wells and around tightly packed plantings. With a special extension attachment, they are also handy for sweeping out gutters, garages, and carports, not to mention cleaning driveways or decks before sealing them. They are also used to sweep pool decks and even dry off cars and their engines.

[0007] Hand-held blowers consist of either a small gasoline-powered engine (usually two-stroke) or an electric motor connected to a plastic fan that pulls in outside air and forces it through a small-diameter tube at high velocities. This velocity is measured two ways: in cubic feet per minute (cfm) and miles per hour (mph). Cfm's can be measured at different points resulting in different numbers.

[0008] Some fans are side-mounted, but on most newer models the fans are bottom-mounted, a design feature that makes for an easier-handling machine because there's no twisting action caused by the spinning fan.

[0009] A reduction ratio of leaves to mulch of at least 10:1 is considered average, but a user needs to use a unit in the vacuum mode to determine if the amount of reduction is acceptable. Most of these units are designed to mulch only leaves and grass, not small twigs and branches.

Commonly found features in blower-vacs include the following:

[0010] 2-speed motor: A 2-speed motor gives flexibility in both blowing and vacuuming modes. In blow mode, the low setting gives better control on hard surfaces or in tight corners. In vacuum mode, the low setting can be used in landscaped areas to avoid vacuuming up garden mulch or landscape rocks. The high setting can be used for the tough lawn chores in both modes.

[0011] Variable speed motor: Same as the 2-speed motor above except that the variable speeds give even more flexibility to match the power level to the task.

[0012] MPH: The miles per hour rating of a blower is an indication of power, but it is not the sole indication of power. Blower power is a function of both air speed and air volume.

[0013] No tools conversion: Some blower/vacs come with a quick release latch conversion system that makes converting between blowing mode and vacuuming mode fast and easy.

[0014] Mulch ratio: All blower/vacs will reduce debris volume as the debris is vacuumed. The debris gets mulched as it passes through the impeller into the collection bag. The exact mulch ratio depends on the design and speed of the impeller. The type of debris being vacuumed will also affect the mulch ratio. Volume reduction will be less on debris that is wet or dense.

[0015] Metal impeller: A metal impeller provides better mulching and better durability. If the blower/vac is to be used for aggressive and/or frequent vacuuming, a metal impeller gives superior performance.

[0016] The nozzle opening of a blower could be reduced to the size of a straw and conceivably blow air at 300 mph. However, a blower like this would be good for clearing out cracks in the driveway because of the high pressure but it would perform poorly blowing leaves in a yard. While such a small opening would increase pressure, i.e., miles per hour, the result would be a dramatic loss in air volume. Many of the tasks a user expects to accomplish with a blower-vac require both air pressure (MPH) and air volume (CFM or cubic feet per minute).

[0017] The nozzle opening of a blower could be as large as a basketball and put out 600 CFM of air. A blower so configured might work well sweeping dust and sand off a driveway but without sufficient pressure, it would have a difficult time moving anything other than the lightest debris.

[0018] The most powerful blower will be one that maximizes both air speed (MPH) and air volume (CFM). In recent years some manufacturers have simply reduced the size of the blower nozzle to achieve higher MPH ratings. In many cases, the result has been blowers with higher MPH ratings but less power. An optimum balance between air speed and air volume is needed to maximize the performance of a blower or a blower-vac.

[0019] One problem with conventional blower-vacs is the frequency with which the bag must be emptied or replaced, either due to the bag becoming full or due to the bag becoming too heavy to transport. Other problems exist.

[0020] There are patents that have addressed leaf removal systems and methods of leaf removal. Related art that addresses the above problems includes the following patents.

[0021] U.S. Pat. No. 3,618,157, issued to C. S. Bassin on Nov. 9, 1971, discloses a blower apparatus for maintaining lawn and related areas which is convertible to a vacuum apparatus by the substitution of a hose or a vacuum snout for a protective cover at the air inlet of the fan housing and by the connection of a refuse collection bag or transfer hose at the air outlet of the fan housing, the fan or blower housing being rotatable about the impeller axis so as to locate the air outlet in any desired position of rotative adjustment.

**[0022]** U.S. Pat. No. 3,903,565, issued to Littleberry T. Hicks on Sep. 9, 1975, discloses a leaf and grass cart bagger adapted for operative connection with a mower, tractor, or other vehicle equipped with a pickup and blower motor, or with a power or manually propelled lawn vacuum and the like, and which includes a wheeled cart pivotally mounting a perforated container into which leaves or grass are deposited and packed through a conduit from the blower of the pickup. The container has a removable lid interconnected to the discharge end of the conduit and the container pivotally mounted on the cart can be readily tilted to discharge material therefrom, preferably into a collection bag operatively engaged over the open top of the container.

**[0023]** U.S. Pat. No. 4,325,163, issued to Charles A. Mattson et al. on Apr. 20, 1982, discloses a portable blower-vacuum unit has an impeller for drawing air axially through a housing air inlet, and for discharging the air centrifugally through a tangential housing air outlet. In a blower mode, a perforate cover plate prevents ingestion of solid material by the impeller. In a vacuum mode, a vacuum conduit connects to the housing in lieu of the cover plate, and a vacuum bag attaches to the air outlet. A mulching blade rotates with the impeller to chop any solid material passing through the housing when the unit is operated in the vacuum mode.

**[0024]** U.S. Pat. No. 4,567,623, issued to John H. Walton on Feb. 4, 1986, discloses an improved leaf and debris collection apparatus is described which features a centrifugal fan mounted on a wagon and driven by an engine, the inlet side of the fan being connected to an inlet head just above ground level and its outlet side connected to an outlet plenum, comprising an outlet port for attachment of a disposable bag. A punch is provided for punching a large number of holes in the disposable bag so that air pressure is not collected within, so that the disposable bag can be used to collect the leaves and debris. In a preferred embodiment, the plenum has holes formed therein for release of air pressure, and the bag is disposed vertically beneath the plenum.

**[0025]** U.S. Pat. No. 4,644,606, issued to Adolf Luerken et al. on Feb. 24, 1987, discloses an internal combustion engine-powered, blower/vacuum device. The device has an air chamber with an axial air inlet and a tangential air outlet. The engine rotatably drives the impeller, and is controlled by a throttle. A handle is located above the air chamber and the motor, and includes a first section having an axis generally parallel to the axis of the air outlet, and an adjoining section having an axis which extends at an angle of about 15.degree. to 60.degree. to the first section. When the first section of the handle is gripped by an operator the device will be in the vacuum position with the air outlet in a generally horizontal position. When the second section of the handle is gripped, the device will be in the blower position with the air outlet facing ahead of the operator at a downward angle. The impeller and housing of the device is designed to minimize debris hangup within the housing. The impeller blades have a front edge facing the air inlet extending at an angle to the impeller blade radial plane from the vicinity of the impeller hub to the vicinity of the air inlet. The portion of the air inlet closest to the front edge of the impeller is separated therefrom by a distance of from 0.15 inches to 0.27 inches, to reduce debris hangup in the inlet while maintaining good impeller efficiency.

**[0026]** U.S. Pat. No. 4,713,858, issued to John D. Kelber on Dec. 22, 1987, discloses a leaf collection apparatus for

use with a blower/vacuum device. An elongated tube is detachably secured at one end with a unique sleeve mechanism to the blower/vacuum and secured at the other end to a shroud or skirt. The shroud or skirt is adapted to fit over and seal the top of a large container. The sleeve mechanism and shroud are attached to the flexible tube with quick-release fastening mechanisms, and the shroud is adapted to be attached to the large container with a similar mechanism.

**[0027]** U.S. Pat. No. 5,245,726, issued to Scott J. Rote et al. on Sep. 21, 1993, discloses an apparatus for shredding/reducing the size of material yard waste and having: a housing defining an intake opening through which yard waste is to be drawn and an outlet opening through which yard waste drawn through the intake opening can be expelled; an impeller having a rotational axis and at least one vane for intercepting yard waste at the intake opening and propelling the yard waste intercepted by the impeller vane centrifugally to be expelled at the outlet opening; and a cutting structure/cutting attachment for reducing the size of yard waste drawn into the intake opening and advancing towards the impeller. The cutting structures includes at least one elongate blade having its length projecting substantially parallel to the rotational axis of the impeller. In one form of the invention, the blade rotates with the impeller.

**[0028]** U.S. Pat. No. 5,445,398, issued to Patrick S. Pierce on Aug. 29, 1995, discloses a utility cart for holding a collection bag. The device comprises a frame, a support ring, and an integral ring clamp for clamping the rim of the bag to the support ring. The cart may additionally comprise wheels for transporting the cart along the ground, and a pivoting handle for grasping the cart. The cart may be folded for convenient storage. An enclosed cover for the cart with an optional hose attachment for connection to an external vacuum or blower is disclosed.

**[0029]** U.S. Pat. No. 5,522,115, issued to Craig D. Webster on Jun. 4, 1996, discloses a blower vacuum unit for selective operation in a blower mode and in a suction mode, comprising a housing having means forming an air inlet and means forming an air outlet; a motor carried within the housing, an impeller rotatably driven by the motor and positioned for drawing air into the housing through the air inlet and discharging the air from the housing through the air outlet; a debris collection conduit one end of which conduit is an operating end and the other end of which conduit is adapted for attachment to a debris collection container and means for generating an entrained air flow, using the air discharged through the air outlet, at the operating end of the debris collection conduit into the debris conduit. The housing and the debris collection conduit comprise separate components and the conduit is adapted to be releasably mounted on the housing so that the operating end of the conduit is located for co-operation with the air outlet of the housing.

**[0030]** U.S. Pat. No. 6,280,532 B1, issued to J. Scott Allen on Aug. 28, 2001, discloses an attachment which converts a standard hand-held lawn vacuum into a wheeled device for precisely cleaning leaves and debris from lawns and other surfaces. Wheels are mounted through an adjusting mechanism to allow the user to selectively vary the height of the nozzle to the lawn and thus the vacuum force applied. Various conventional lawn vacuums can be employed with the attachment which ensures time, energy and labor savings while providing a more precisely vacuumed lawn.

**[0031]** U.S. Pat. No. 6,442,790 B1, issued to Steven J. Svoboda et al. on Sep. 3, 2002, discloses a blower/vacuum having an air inlet cover and a blower tube, both of which attach to a blower housing for operation in a blower mode. The air inlet cover is preferably able to removably attach to the blower housing and the blower tube. Blower/vacuums of the present invention may generally prohibit operation unless both the blower tube and the air inlet cover are first installed. The blower/vacuum is further adapted to operate in a vacuum mode by removing the air inlet cover and blower tube and replacing the same with a vacuum tube assembly and a vacuum collection container, respectively.

**[0032]** U.S. Published Patent Application No. 2003/0131435 A1, inventor Mather N. Madhat on Jul. 17, 2003, discloses a lawn vacuum attachment having a bag with wheels positioned at the opposing sides thereof to allow the attachment to be rolled along a lawn or other surface. With the attachment so connected, the user can manually roll the attachment over the lawn instead of carrying it while holding the lawn vacuum machine as it operates.

**[0033]** U.S. Pat. No. 6,604,716 B1, issued to Edison V. Hoey on Aug. 12, 2003, discloses a lawn and leaf bag holder of one piece, wire rod construction including a triangular frame for positioning the open mouth of a plastic lawn or leaf bag, a handle extending upwardly from an apex of the triangular frame to form a handle for the bag holder and a pair of anchoring loops on each side of the frame adjacent the frame apex. The open mouth of the bag is stretched or tensioned around the triangular frame and secured with one or both of the anchoring loops. One segment of the triangular frame and bag can be positioned against or adjacent a ground surface to enable leaves, lawn debris and the like to be raked or swept into the open end of the bag while the frame and the open end of the bag are oriented in a vertical plane by a user grasping the handle to support the frame and open end of the bag in the vertical position and also enabling the bag to be moved to new positions as desired.

**[0034]** U.S. Pat. No. 6,629,818 B2, issued to Steven J. Svoboda on Oct. 7, 2003, discloses an impeller for generating an air flow, for use in a device such as a blower/vacuum, the impeller having a hub structure for mounting the impeller on a rotatable shaft of the blower/vac and a plurality of air-flow generating vanes coupled to the hub structure in a non-uniform manner wherein the spacing between adjacent vanes is irregular. An impeller having non-uniform spacing between adjacent vanes is provided. Additional features of the impeller may include a plurality of debris engaging structures or serrations for facilitating a finer mulch of air-entrained debris.

**[0035]** U.S. Pat. No. 6,988,293 B2, issued to Joseph K. Ritter on Jan. 24, 2006, discloses a leaf collection system for lawn blower/vacuums is disclosed. The collection system includes a port coupling fitted to the exhaust port of a blower/vacuum, a dust cover, and a unique disposable collection bag. The disposable collection bag is constructed of an environmentally friendly, bio-degradable plastic that will quickly decompose along with the organic leaves and lawn debris collected therein. Both sides of the collection bag has several rows of T-shaped slits and two rows of straight or I-shaped slits that allow air to escape from the bag but retain the leaves and lawn debris deposited therein. The collection bag is shaped to fit inside the dust cover that is fixed to the port coupling. The port coupling includes an elastic lock ring that secures the collection bag to the

coupling. The dust cover envelops of the collection bag and shields the operator from the dust that passes through the collection bag.

**[0036]** While these patents and other previous methods have attempted to solve the problems that they addressed, none have utilized or disclosed a leaf removal system that minimizes down-time, as does embodiments of the present invention.

**[0037]** Therefore, a need exists for a leaf removal system with these attributes and functionalities. The leaf removal system according to embodiments of the invention substantially departs from the conventional concepts and designs of the prior art. It can be appreciated that there exists a continuing need for a new and improved leaf removal system which can be used commercially. In this regard, the present invention substantially fulfills these objectives.

**[0038]** The foregoing patent and other information reflect the state of the art of which the inventors are aware and are tendered with a view toward discharging the inventor's acknowledged duty of candor in disclosing information that may be pertinent to the patentability of the present invention. It is respectfully stipulated, however, that the foregoing patent and other information do not teach or render obvious, singly or when considered in combination, the inventor's claimed invention.

#### BRIEF SUMMARY OF THE INVENTION

**[0039]** The general purpose of the present invention, which will be described subsequently in greater detail, is to provide a leaf removal system. In particular, the present invention relates to a device that allows the user to minimize down-time during the process of leaf and debris removal. The user can work productively for a longer duration between intervals for bag emptying or bag replacement.

**[0040]** The leaf removal system is comprised of a debris bag operably connected to a blower-vac, a bag transport, an attachment system disposed on the debris bag and the bag transport that removably attaches the debris bag to the bag transport. The leaf removal system may be further comprised by a debris reduction impeller within the blower-vac. The debris reduction impeller may have metal reinforced vanes. The metal reinforcement may be on serrated vanes and/or non-serrated vanes.

**[0041]** The material for the debris bag traps most of the debris that enters, yet allows air to escape. These materials include, but are not limited to, mosquito netting, landscape fabric, e.g. burlap, commercial weed barrier. Combinations of these materials may also be used to increase air flow while still retaining the debris, e.g. having a band of mosquito netting at the top of the debris bag with commercial weed barrier for the remainder of the debris bag.

**[0042]** One aspect of the present invention is that it reduces the number of times that a debris bag requires emptying or replacing during the debris removal process.

**[0043]** Another aspect of the present invention is that it improves the ability to store small twigs.

**[0044]** Another aspect of the present invention is that it improves the ability to transport a heavy bag of debris, and a full bag does not exceed 20 pounds.

**[0045]** Another aspect of the present invention is that it can be made to be disposable or reusable.

**[0046]** Another aspect of the present invention is that it can be made inexpensively.

[0047] Another aspect of the present invention is that it can be made of readily available materials.

[0048] Another aspect of the present invention is that it is easy to use.

[0049] These and other features and advantages of the present invention will be presented in more detail in the following specification of the invention and the accompanying figures, which illustrate by way of example the principles of the invention.

[0050] There are additional features of the invention that will be described hereinafter and which will form the subject matter of the claims appended hereto. In this respect, before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and to the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of description and should not be regarded as limiting.

[0051] As such, those skilled in the art will appreciate that the conception, upon which this disclosure is based, may readily be utilized as a basis for the designing of other structures, methods and systems for carrying out the several purposes of the present invention. It is important, therefore, that the claims be regarded as including such equivalent constructions insofar as they do not depart from the spirit and scope of the present invention.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0052] The invention, together with further advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawings in which:

[0053] FIG. 1 illustrates a perspective view of a leaf removal system, according to an embodiment of the present invention.

[0054] FIG. 2 illustrates front plan view of a bag for a leaf removal system, according to an embodiment of the present invention.

[0055] FIG. 3 illustrates a perspective view of a bag transport, according to one embodiment of the present invention.

[0056] FIG. 4 illustrates a partial view of one aspect of an attachment system, according to an embodiment of the present invention.

[0057] FIG. 5 illustrates a perspective view of an impeller, according to an embodiment of the present invention.

[0058] FIG. 6 illustrates perspective view of an impeller, according to another embodiment of the present invention.

[0059] FIG. 7 illustrates a perspective view of an impeller, according to yet another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0060] The present invention will now be described in detail with reference to a few preferred embodiments thereof as illustrated in the accompanying drawings. In the following description, numerous specific details are set forth in

order to provide a thorough understanding of the present invention. It will be apparent, however, to one skilled in the art, that the present invention may be practiced without some or all of these specific details. In other instances, well known operations have not been described in detail so not to unnecessarily obscure the present invention.

[0061] Referring now to FIG. 1 through FIG. 7, a leaf removal system 100 is comprised of a debris bag 200. Debris bag 200 is further comprised of a blower-vac attachment 300 that is used to releasably connect the debris bag 200 to a blower-vac 600. Debris bag 200 is further comprised of a plurality of a transport connector 210 and at least one of a transport attachment 220. The plurality of transport connector 210 and at least one of transport attachment 220 releasably connect to a debris-bag transport 400.

[0062] The material for debris bag 200 traps most of the debris that enters, yet allows air to escape. The material for debris bag 200 may consist solely of mosquito netting, landscape fabric and the like. The material for debris bag 200 may consist of a combination of these materials, e.g. mosquito netting disposed at the top of debris bag 200 and landscape fabric for the remainder of debris bag 200 to increase air flow while still retaining the debris.

[0063] Debris-bag transport 400 is dimensioned such that debris bag 200 may be seated on the top surface of debris-bag transport 400 without any overlapping of debris bag 200. Debris-bag transport 400 is comprised of a transport base 411, from which protrudes a transport rim 410. Transport rim 410 and transport base 411 are preferably formed by injection molded plastic as a single piece; however, other materials may be used. Transport rim 410 is further comprised of transport rim base 412, transport edge 413 and transport gripping holes 415. Transport base 411 is further comprised of a plurality of debris-bag attachment hole 414, which is dimensioned for insertion and releasable locking of a transport connector 210. Transport base 411 is further comprised of at least one of a debris-bag fastener 420, which is operable for releasable attachment to transport attachment 220. Debris-bag fastener 420 and transport attachment 220 are preferably corresponding hook and loop fasteners, e.g. VELCRO.

[0064] Blower-vac 600 may contain impeller 500. In one embodiment, impeller 500 is comprised of a plurality of a non-serrated vane 502 and a plurality of a serrated vane 501. The top of each non-serrated vane 502 is lower than the top of each serrated vane 501 in this exemplary embodiment. In another embodiment, impeller 500 is comprised of a plurality of a serrated vane 511 and a plurality of non-serrated vane 512. In this embodiment the top of each serrated vane 511 is taller than the top of each non-serrated vane 512. In yet another embodiment, impeller 500 is comprised of a plurality of a serrated vane 521, a plurality of a non-serrated vane 522 and a plurality of an accelerator vane 523. Each of serrated vane 521 is lower than non-serrated vane 522. Each of serrated vane 521 is positioned below each accelerator vane 523.

[0065] From the foregoing, it will be appreciated that, although specific embodiments of the invention have been described herein for purposes of illustration, various modifications may be made without deviating from the spirit and scope of the invention. For example, many of the features and components described above in the context of a particular leaf removal system configuration can be incorporated into other configurations in accordance with other embodiments of the invention. Accordingly, the invention is not limited except by the appended claims.

What is claimed is:

1. A leaf removal system comprised of:  
a blower-vac;

a debris bag having a blower-vac attachment releasably attached to the blower-vac, wherein the debris bag is further comprised of a plurality of a transport connector and at least one of a transport fastener; and

a debris-bag transport, wherein the debris-bag transport is further comprised of at least one debris-bag fastener and a plurality of debris-bag connecting openings, wherein each transport connector is releasably connected through each corresponding debris-bag connecting opening, wherein each transport fastener is releasably attached to each corresponding debris-bag fastener.

2. The leaf removal system comprised of:  
means for collecting leaves and debris into a debris bag;  
and  
means for transporting the debris bag.

3. The leaf removal system of claim 2, wherein the means for collecting is comprised of a debris bag releasably attached to a blower-vac, and wherein the means for transporting the debris bag is comprised of a debris-bag transport releasably attached to the debris bag.

4. The leaf removal system of claim 3, wherein the debris bag is further comprised of a plurality of transport connectors and at least one transport attachment, and wherein the debris bag transport is further comprised of a transport base having a transport rim extending from the transport rim.

5. The leaf removal system of claim 4, wherein the transport base is further comprised of a plurality of debris-bag attachment holes and at least one debris-bag attachment, and wherein the transport rim is further comprised of a plurality of transport gripping holes.

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