A floating brake rotor and drum assembly comprising a disc brake rotor and a brake drum and a floating connection of the rotor and the drum with a mounting assembly such as a hat or a hub. A retention ring cooperates with retention ring flanges of a plurality of mounting assembly tabs.
FLOATING ROTOR DISC AND DRUM BRAKE ASSEMBLY

RELATED APPLICATION

[0001] This application claims priority under 35 U.S.C. §119(e) to U.S. Provisional Application No. 62/219,597, filed on Sep. 16, 2015, which is incorporated herein by reference in its entirety.

FIELD

[0002] The present disclosure relates to vehicular disc brake assemblies that include a drum brake component, and more particularly, to vehicular disc brake assemblies that include a floating disc rotor component and a parking brake component.

BACKGROUND

[0003] An integrated one-piece rotor disc and drum-in-hat assembly avoids a need for fasteners between the rotor and the hat. However, the rigid connection between the drum-in-hat and the rotor does not accommodate thermal expansion of the rotor during heavy braking action, which situation may induce extreme stresses at or about the rotor and lead to cracking and/or distortion. Rotor distortion can cause vibration and jerkit across rotor brake surfaces, rough or irregular braking pulsations, a reduced service life and performance of the rotor and increased maintenance costs. In addition, when a damaged or worn rotor requires replacement, the entire integrated assembly must be replaced, which is expensive and time consuming.

[0004] With previous drum-in-hat arrangements, such replacement would necessarily include replacement of both the drum and the rotor disc, exacerbating the waste and expense of the brake repair.

[0005] Being an integrated brake assembly, the entire brake assembly must be constructed from a single, common material, which may not necessarily be the ideal choice for each component. For example, one material for the rotor may comprise cast iron, which when used as the material for the hub and drum components of previous drum-in-hat arrangements, increases the overall weight of the brake assembly unnecessarily.

[0006] There is a need, therefore, to provide a hat or hub and rotor assembly that eliminates bending stresses and promotes uniform torque transfer, so as to minimize bending and fatigue stresses to increase the life and reliability of the brake device. Additionally, there remains an unmet need in the art to optimize and simplify attachment of floating disc brake rotors to wheel hats or hubs which arrangement also includes a parking brake mechanism.

[0007] With previous drum-in-hat arrangements, a need to remove and repair the parking brake will necessarily require removal of the brake rotor, adding to the time, effort and expense of the repair.

[0008] With some vehicles, it is desired to operate the vehicle on public roadways with a parking brake component intact and to race the same vehicle with the parking brake component removed to save weight and enhance performance while racing. The previous drum-in-hat arrangements do not provide a convenience for doing so.

[0009] A need exists to include a parking brake drum with a disc brake rotor in a way that avoids all of the aforementioned deficiencies of the brake assembly.

SUMMARY

[0010] There is also a need to provide a brake drum and wheel hat assembly that promotes service life and reliability of the brake device, while also providing an assembly that is lower in weight and adaptability to racing.

[0011] The teachings herein provide a floating rotor drum assembly comprising a disc brake component, a drum brake component and a mounting component, wherein the disc brake component comprises a rotor having an inner annular edge portion and a plurality of rotor tabs at spaced locations about the annular edge portion. The drum brake component comprises drum body and a plurality of drum tabs at spaced locations about an outer annular portion of the drum body, whereas the mounting component comprises a mounting flange and a plurality of mounting assembly tabs at spaced locations about the mounting flange. Adjacent pairs of the mounting assembly tabs define slots therebetween and preferably each of the mounting assembly tabs comprises a retention ring flange. The slots, the rotor tabs in the drum tabs are mutually arranged such that the rotor tabs and the drum tabs are each received in the slots. A retention ring is arranged to engage with the retention ring flanges of the mounting assembly tabs such that upon engagement, the retention ring spans the slots so as to axially retain the rotor tabs and the drum tabs in the slots.

[0012] In an embodiment, the mounting flange includes a rim portion and the rotor tabs and the drum tabs are axially retained between the retention ring and the rim portion of the mounting flange.

[0013] In an embodiment, the rotor tabs extend radially inwardly and the drum tabs extend radially outwardly, with the drum tabs and the rotor tabs being in a superposed relation while retained in the slots by the retention ring.

[0014] Preferably the retention ring flanges comprise an axially directed flange portion and a radially inwardly directed flange portion.

[0015] In an embodiment, the retention ring is radially yieldable, and the drum body and the retention ring flanges are radially spaced apart to define an annular space therebetween. The annular space is sufficient to receive the retention ring when the ring is in a radially contracted condition, whereinon the contracted retention ring may be released into engagement with the retention ring flanges.

[0016] In an embodiment, the floating rotor and drum brake assembly further comprises a substitute fixture useable as a substitute for the brake drum component which is retainable with the retaining ring. The substitute fixture may comprise a plurality of radially outwardly extending tabs configured like the drum tabs such that upon engagement of the retention ring with the retention ring flanges, the retaining ring spanning the slots axially retains the rotor tabs and radially outwardly extending tabs of the substitute fixture in the slots. In an embodiment, the substitute fixture further comprises a ring and the plurality of radially outwardly extending tabs that are disposed about the ring. In another embodiment, the substitute fixture is a separable portion of the drum brake component, useable in the absence of the drum body.

[0017] The teachings herein also provide a method of combining a brake rotor and a brake drum in a brake assembly, the method comprising: establishing a floating connection between the brake rotor and a mounting flange by locating tabs of the rotor in slots established between
mounting tabs of the mounting flange; supporting a brake drum at the floating connection by superposing tabs of the drum body with the rotor tabs at the slots; and retaining the superposed rotor and drum tabs with a ring.

[0018] Included also is a method of centering a brake drum in a disc brake assembly, comprising: establishing a floating connection between a disc brake rotor and a mounting assembly by locating a plurality of rotor tabs in slots established uniformly about the mounting assembly; and establishing a floating connection between a brake drum and the mounting assembly by locating a plurality of drum tabs in the slots established uniformly about the mounting assembly such that the rotor tabs and the drum tabs are mutually superposed.

[0019] The disclosure includes a method of preparing a vehicle for an event, comprising: removing a brake drum body from a brake assembly by disengaging a ring that in an engaged condition retains the brake drum body in the brake assembly; replacing the brake drum body with a fixture configured to be retainable by the ring when in an engaged condition, the fixture lacking a drum body; and re-engaging the ring so as to retain the fixture in the brake assembly in lieu of the brake drum body. In an embodiment, the method further comprises centering the fixture with a plurality of radially extending tabs disposed about the fixture.

[0020] The disclosure also sets forth an article for preparing a vehicle for an event, wherein a brake drum body is removable from a brake assembly by disengaging a ring that in an engaged condition retains the brake drum body in the brake assembly, the article comprising a fixture configured to replace the brake drum body by being retainable by the ring when the ring is in an engaged condition, with the fixture lacking a drum body. In an embodiment, the fixture comprises a plurality of radially extending tabs disposed about the fixture.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] The present disclosure is susceptible to various modifications and alternative forms, specific exemplary implementations thereof have been shown in the drawings and are herein described in detail. It should be understood, however, that the description herein of specific exemplary implementations is not intended to limit the disclosure to the particular forms disclosed herein. This disclosure is to cover all modifications and equivalents as defined by the appended claims. It should also be understood that the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating principles of exemplary embodiments of the present invention. Moreover, certain dimensions may be exaggerated to help visually convey such principles. Further where considered appropriate, reference numerals may be repeated among the drawings to indicate corresponding or analogous elements. Moreover, two or more blocks or elements depicted as distinct or separate in the drawings may be combined into a single functional block or element. Similarly, a single block or element illustrated in the drawings may be implemented as multiple steps or by multiple elements in cooperation. The forms disclosed herein are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which like reference numerals refer to similar elements and in which:

[0022] FIG. 1 is an exploded, perspective view of components of a floating rotor disc and drum brake assembly constructed in accordance with an embodiment of the present disclosure;

[0023] FIG. 2 is an exploded, cross-sectional, perspective view of the floating disc brake assembly of FIG. 1;

[0024] FIG. 3 is a cross-sectional, perspective view of the assembled disc brake assembly of FIG. 2;

[0025] FIG. 4 is an enlarged cross-sectional detail of the assembled disc brake assembly of FIG. 3 at the place and direction of arrow A in FIG. 3;

[0026] FIG. 5 is an enlarged cross-sectional detail of the assembled disc brake assembly of FIG. 3 at the place and direction of arrow B in FIG. 3;

[0027] FIG. 6 is a partial detail view from FIG. 2;

[0028] FIG. 7 is a partial detail view from FIG. 3;

[0029] FIG. 8 is an exploded, side view of the components shown in FIG. 1;

[0030] FIGS. 9A and 9B are planar frontal views of split ring fastener and a spiral ring fastener, respectively;

[0031] FIG. 10 is an exploded, perspective view of components of a floating rotor disc and drum brake assembly constructed in accordance with another embodiment of the present disclosure;

[0032] FIG. 11 is an enlarged cross-sectional detail of the assembled disc brake assembly of FIG. 10 with a substitute ring element in place instead of the brake drum component, at the place and direction of arrow B in FIG. 3;

[0033] FIGS. 12A-12G show various conformations of retention rings useful with the present disclosure; and

[0034] FIGS. 13A and 13B show retention ring flanges structured to receive inner and outer retention rings, respectively.

DETAILED DESCRIPTION

Terminology

[0035] The words and phrases used herein should be understood and interpreted to have a meaning consistent with the understanding of those words and phrases by those skilled in the relevant art. No special definition of a term or phrase, i.e., a definition that is different from the ordinary and customary meaning as understood by those skilled in the art, is intended to be implied by consistent usage of the term or phrase herein. To the extent that a term or phrase is intended to have a special meaning, i.e., a meaning other than the broadest meaning understood by skilled artisans, such a special or clarifying definition will be expressly set forth in the specification in a definitional manner that provides the special or clarifying definition for the term or phrase.

[0036] For example, the following discussion contains a non-exhaustive list of definitions of several specific terms used in this disclosure (other terms may be defined or clarified in a definitional manner elsewhere herein). These definitions are intended to clarify the meanings of the terms used herein. It is believed that the terms are used in a manner consistent with their ordinary meaning, but the definitions are nonetheless specified here for clarity.

[0037] Each of the following terms written in singular grammatical form: "a," "an," and "the," as used herein, may also refer to, and encompass, a plurality of the stated entity or object, unless otherwise specifically defined or stated herein, or, unless the context clearly dictates otherwise. For
example, the phrases “a device,” “an assembly,” “a mechanism,” “a component,” and “an element,” as used herein, may also refer to, and encompass, a plurality of devices, a plurality of assemblies, a plurality of mechanisms, a plurality of components, and a plurality of elements, respectively. 

Each of the following terms: “includes,” “including,” “has,” “having,” “comprises,” and “comprising,” and their linguistic or grammatical variants, derivatives, and/or conjugates, as used herein, means “including, but not limited to.”

About: As used herein, “about” refers to a degree of deviation based on experimental error typical for the particular property identified. The latitude provided the term “about” will depend on the specific context and particular property and can be readily discerned by those skilled in the art. The term “about” is not intended to either expand or limit the degree of equivalents which may otherwise be afforded a particular value. Further, unless otherwise stated, the term “about” shall expressly include “exactly,” consistent with the discussion below regarding ranges and numerical data.

Above/below: In the following description of the representative embodiments of the invention, directional terms such as “above”, “below”, “upper”, “lower”, etc., are used for convenience in referring to the accompanying drawings. In general, “above”, “upper”, “upward” and similar terms refer to a direction toward the earth’s surface along a wellbore, and “below”, “lower”, “downward” and similar terms refer to a direction away from the earth’s surface along the wellbore. Continuing with the example of relative directions in a wellbore, “upper” and “lower” may also refer to relative positions along the longitudinal dimension of a wellbore rather than relative to the surface, such as in describing both vertical and horizontal wells.

And/or: The term “and/or” placed between a first entity and a second entity means one of (1) the first entity, (2) the second entity, and (3) the first entity and the second entity. Multiple elements listed with “and/or” should be construed in the same fashion, i.e., “one or more” of the elements so conjoined. Other elements may optionally be present other than the elements specifically identified by the “and/or” clause, whether related or unrelated to those elements specifically identified. Thus, as a non-limiting example, a reference to “A and/or B”, when used in conjunction with open-ended language such as “comprising,” can refer, in one embodiment, to A only (optionally including elements other than B); in another embodiment, to B only (optionally including elements other than A); in yet another embodiment, to both A and B (optionally including other elements). As used herein in the specification and in the claims, “or” should be understood to have the same meaning as “and/or” as defined above. For example, when separating items in a list, “or” or “and/or” shall be interpreted as being inclusive, i.e., the inclusion of at least one, but also including more than one, of a number or list of elements, and, optionally, additional unlisted items. Only terms clearly indicated to the contrary, such as “only one of” or “exactly one of,” or, when used in the claims, “consisting of,” will refer to the inclusion of exactly one element of a number or list of elements. In general, the term “or” as used herein shall only be interpreted as indicating exclusive alternatives (i.e. “one or the other but not both”) when preceded by terms of exclusivity, such as “either,” “one of,” “only one of,” or “exactly one of.”

Any: The adjective “any” means one, some, or all indiscriminately of whatever quantity.

At least: As used herein in the specification and in the claims, the phrase “at least one,” in reference to a list of one or more elements, should be understood to mean at least one element selected from any one or more of the elements in the list of elements, but not necessarily including at least one of each and every element specifically listed within the list of elements and not excluding any combinations of elements in the list of elements. This definition also allows that elements may optionally be present other than the elements specifically identified within the list of elements to which the phrase “at least one” refers, whether related or unrelated to those elements specifically identified. Thus, as a non-limiting example, “at least one of A and B” (or equivalently, “at least one of A or B,” or, equivalently “at least one of A and/or B”) can refer, in one embodiment, to at least one, optionally including more than one, A, with no B present (and optionally including elements other than B); in another embodiment, to at least one, optionally including more than one, B, with no A present (and optionally including elements other than A); in yet another embodiment, to at least one, optionally including more than one, A, and at least one, optionally including more than one, B (and optionally including other elements). The phrases “at least one”, “one or more”, and “and/or” are open-ended expressions that are both conjunctive and disjunctive in operation. For example, each of the expressions “at least one of A, B and C”, “at least one of A, B, or C”, “one or more of A, B, and C”, “one or more of A, B, or C” and “A, B, and/or C” means A alone, B alone, C alone, A and B together, A and C together, B and C together, or A, B and C together.

Based on: “Based on” does not mean “based only on,” unless expressly specified otherwise. In other words, the phrase “based on” describes both “based only on,” “based at least on,” and “based at least in part on.”

Couple: Any use of any form of the terms “connect,” “engage,” “couple,” “attach,” or any other term describing an interaction between elements is not meant to limit the interaction to direct interaction between the elements and may also include indirect interaction between the elements described.

Determining: “Determining” encompasses a wide variety of actions and therefore “determining” can include calculating, computing, processing, deriving, investigating, looking up (e.g., looking up in a table, a database or another data structure), ascertaining and the like. Also, “determining” can include receiving (e.g., receiving information), accessing (e.g., accessing data in a memory) and the like. Also, “determining” can include resolving, selecting, choosing, establishing and the like.

Embodiments (Forms): Reference throughout the specification to “one embodiment,” “an embodiment,” “some embodiments,” “one aspect,” “an aspect,” “some aspects,” “some implementations,” “one implementation,” “an implementation,” or similar construction means that a particular component, feature, structure, method, or characteristic described in connection with the embodiment, aspect, or implementation is included in at least one embodiment and/or implementation of the claimed subject matter. Thus, the appearance of the phrases “in one embodiment” or “in an embodiment” or “in some embodiments” (or “aspects” or “implementations”) in various places throughout the specification are not necessarily all referring to the
same embodiment and/or implementation. Furthermore, the particular features, structures, methods, or characteristics may be combined in any suitable manner in one or more embodiments or implementations.

[0048] Exemplary: “Exemplary” is used exclusively herein to mean “serving as an example, instance, or illustration.” Any embodiment described herein as “exemplary” is not necessarily to be construed as preferred or advantageous over other embodiments.

[0049] May: Note that the word “may” is used throughout this application in a permissive sense (i.e., having the potential to, being able to), not a mandatory sense (i.e., must).

[0050] Operatively connected and/or coupled: Operatively connected and/or coupled means directly or indirectly connected for transmitting or conducting information, force, energy, or matter.

[0051] Optimizing: The terms “optimal,” “optimizing,” “optimize,” “optimality,” “optimization” (as well as derivatives and other forms of those terms and linguistically related words and phrases), as used herein, are not intended to be limiting in the sense of requiring the present invention to find the best solution or to make the best decision. Although a mathematically optimal solution may in fact arise at the best of all mathematically available possibilities, real-world embodiments of optimization routines, methods, models, and processes may work towards such a goal without ever actually achieving perfection. Accordingly, one of ordinary skill in the art having benefit of the present disclosure will appreciate that these terms, in the context of the scope of the present invention, are more general. The terms may describe one or more of: 1) working towards a solution which may be the best available solution, a preferred solution, or a solution that offers a specific benefit within a range of constraints; 2) continually improving; 3) refining; 4) searching for a high point or a maximum for an objective; 5) processing to reduce a penalty function; 6) seeking to maximize one or more factors in light of competing and/or cooperative interests in maximizing, minimizing, or otherwise controlling one or more other factors, etc.

[0052] Order of steps: It should also be understood that, unless clearly indicated to the contrary, in any methods claimed herein that include more than one step or act, the order of the steps or acts of the method is not necessarily limited to the order in which the steps or acts of the method are recited.

[0053] Throughout the illustrative description, the examples, and the appended claims, a numerical value of a parameter, feature, object, or dimension, may be stated or described in terms of a numerical range format. It is to be fully understood that the stated numerical range format is provided for illustrating implementation of the forms disclosed herein, and is not to be understood or construed as inflexibly limiting the scope of the forms disclosed herein.

[0054] Moreover, for stating or describing a numerical range, the phrase “in a range of between about a first numerical value and about a second numerical value,” is considered equivalent to, and means the same as, the phrase “in a range of from about a first numerical value to about a second numerical value,” and, thus, the two equivalently meaning phrases may be used interchangeably.

[0055] It is to be understood that the various forms disclosed herein are not limited in their application to the details of the order or sequence, and number, of steps or procedures, and sub-steps or sub-procedures, of operation or implementation of forms of the method or to the details of type, composition, construction, arrangement, order and number of the system, system sub-units, devices, assemblies, sub-assemblies, mechanisms, structures, components, elements, and configurations, and, peripheral equipment, utilities, accessories, and materials of forms of the system, set forth in the following illustrative description, accompanying drawings, and examples, unless otherwise specifically stated herein. The apparatus, systems and methods disclosed herein can be practiced or implemented according to various other alternative forms and in various other alternative ways.

[0056] It is also to be understood that all technical and scientific words, terms, and/or phrases, used herein throughout the present disclosure have either the identical or similar meaning as commonly understood by one of ordinary skill in the art, unless otherwise specifically defined or stated herein. Phraseology, terminology, and, notation, employed herein throughout the present disclosure are for the purpose of description and should not be regarded as limiting.

Description

[0057] Referring to FIG. 1, the disclosure herein provides a floating disc and drum brake assembly 100, which is both light weight and cost effective, and can be used with any of racing vehicles, sporting vehicles, light duty vehicles, heavy duty vehicles, trucks, buses and railway vehicles. Preferably, the brake assembly 100 comprises a mounting component (assembly) 110, a disc brake rotor component 120, a drum brake component 150 and a retention ring 130.

[0058] Referring to FIGS. 1, 2 and 3, in an embodiment, the disc brake rotor component 120 preferably comprises an inner (rearward) rotor disc plate 127, an outer (frontal) rotor disc plate 128 and a plurality of cooling vanes 129 therebetween. It is envisioned that in other embodiments, the rotor component 120 might be constructed differently, such as comprising a single rotor disc plate lacking cooling vanes or other constructions. The disc brake rotor component 120 further comprises an inner circumferential edge portion 123 that defines a central aperture 125 of the rotor 120 and a plurality of radially inwardly extending rotor tabs 124 at spaced locations about the inner circumferential edge portion 123. Preferably, the rotor tabs 124 are spaced uniformly about the inner circumferential edge portion 123 without interruption. In an embodiment, the rotor tabs 124 are uniformly spaced about the inner circumferential edge portion 123 of the inner (rearward) rotor disc plate 127, but could instead be uniformly spaced about the inner circumferential edge portion 123 of the outer (frontal) rotor disc plate 129.

[0059] The brake assembly 100 further includes a mounting component (assembly) 110, which can be a hat or a hub or any other suitable mounting assembly for a floating disc brake rotor. Preferably, the mounting component (assembly) 110 comprises a cylindrical (or frustoconical) axial body 111 having axially opposed first and second ends, a rotor mounting flange 115 which may extend radially at or near the first end of the axial body 111 and a plurality of mounting assembly tabs 112 having retention ring flanges 118. Preferably, the plurality of mounting assembly tabs 112 are uniformly spaced about the rotor mounting flange 115 and
form slots 114 interspersed therebetween. Accordingly, adjacent pairs of mounting assembly tabs 112 define an individual slot 114.

[0060] In an embodiment, the brake component 150 preferably comprises an outer rim 152 and a plurality of drum tabs 154 which extend radially outwardly from the outer rim 152. Preferably, the slots 114 of the mounting assembly 110, the rotor tabs 124 of the brake rotor component 120 and the drum tabs 154 of the brake component 150 are structured and mutually arranged such that the slots 114 receive both the rotor tabs 124 and the drum tabs 154. A retention ring 130 is provided for securing (retaining) the rotor tabs 124 and the drum tabs 154 in the slots 114 located between adjacent pairs of the mounting assembly tabs 112. By such arrangement, a “floating” connection is established between mounting assembly 110 and both the rotor component 120 and the drum component 150, which accommodates thermal expansion in both the rotor 120 and the drum 150, while also alleviating stresses that might otherwise arise in the aforementioned components were they otherwise rigidly connected. By effecting retention with the retention ring 130, and a need for studs or bolted connections between the components are avoided. The known tendencies of bolted connections to exacerbate stresses and cracking in brake connections are also avoided.

[0061] Referring specifically to FIG. 5, preferably at the location of each slot 114, a received rotor tab 124 and a received drum tab 154 are mutually superposed and retained between a portion of the ring 130 and a portion of the rotor mounting flange 115.

[0062] Referring now to FIG. 4, preferably each of the mounting assembly tabs 112 may comprise an axially directed, tab portion (rim) 117 that extends from the mounting flange 115 axially into a gap (represented by arrow G) established between an inner annular edge portion 123 of the rotor component 120 and an adjacent (opposing) portion of the brake component 150. The aforementioned gap G is established by an absence of both rotor tabs 124 and drum tabs 154 along the location of the mounting assembly tabs 112. The mounting assembly tabs 112 further comprise a radially outwardly directed, ring-retention flange 118 that serves as a catch along each mounting tab 112 against axial displacement of the ring 130 away from the mounting assembly 110. Referring now also to FIG. 5, the ring 130, when engaged by the mounting assembly tabs 112, spans across each slot 114 so as to axially retain the drum tabs 154 and rotor tabs 124 between it and the mounting flange 115.

[0063] Referring back to FIG. 4, preferably along each mounting assembly tab 112, an annular space 151 is established between adjacent portions of the drum component 150 and an outer edge portion of the retention ring flanges 118 to accommodate removal and installation of the ring 130 therebetwix. During installation, the ring 130 would be radially contracted and directed through the space 151, whereupon it would be allowed to expand into engagement with the retention ring flanges 118. During disassembly, the retention ring would be radially contracted out of engagement with the retention ring flanges 118 by an amount sufficient to allow its withdrawal through the space 151. Upon removal of the retention ring 130, the brake drum component 150 may be withdrawn from the brake assembly 100 as a unit for repair or replacement separate of any need to remove, repair or replace the rotor component 120. In addition, the rotor component 120 may also be removed for repair and/or replacement, without having to disassemble the brake component 150 beyond its removal.

[0064] Referring now to FIGS. 1, 3 and 8, in an embodiment, the drum brake component 115 comprises a cylindrical body 156 having an inwardly rimmed, end portion 158 and an open, opposite end portion 159. Friction pads of drum brake shoes (not shown) are operative upon an inner working surface 157 of the cylindrical body 156 upon actuation of the drum brake component 115 for purposes such as parking of a vehicle. As a component of a parking brake system, the drum brake component 150 may be deployed only at the rear wheels of a vehicle. Although the drum brake component 150 is particularly suited for applications in parking brake systems, it is also contemplated that the drum brake component 150 could be utilized for braking while the vehicle is moving, such as for emergency or supplemental braking action in lieu of or in addition to the braking action of the disc brake component 120.

[0065] Still referring to FIGS. 1 and 3, in an embodiment, the plurality of drum tabs 154 are located about an intermediate location along the cylindrical drum body 156 such that the inner working surface 157 of the drum body 156 is evenly disposed to either side of the tabs 154 and their connection with the mounting assembly (hat) 110. Preferably, the length of the drum body 156 and the axial location of the drum tabs 154 are selected such that the rimmed end portion 158 locates axially inwardly of the rotor tabs (inwardly of the plane of inner rotor disc 127) and into the confines of the mounting assembly 110 with clearance and the opposite end portion 159 locates approximately coextensively with or within the plane of the outer rotor disc 128. Such relative positioning of the drum body 156 and the rotor 120 may be utilized to assure that any moment, if any, imposed by application of the parking brake upon the floating connection of the drum 150 tends to urge the retention ring 130 into engagement with the retention flanges 118 (see FIGS. 4 and 5).

[0066] Referring now to FIGS. 3 and 4, in an embodiment, the rotor tabs 124 are disposed in between the drum tabs 154 and the mounting flange 115 to establish a floating connection 200 between the of the mounting assembly 110 and both the brake rotor component 120 and the brake drum component 150. The floating connection 200 is such that the brake drum body 156 is in limited thermal contact (communication) with the rotor 120 only at the floating connection 200, which limits heat transfer from the rotor 120 to the drum 150, and in so far as any heat is transferred, the drum may serve as a heat sink. In this embodiment the drum tabs 154 are not in contact with the mounting assembly 110 at the connection 200. In addition, the clearance between the rimmed end portion 158 of the drum body 156 and the mounting assembly 110 further limits thermal transfer and mechanical interference between the drum body 156 and the mounting assembly 110. Accordingly, the drum body 156 may serve as a heat sink for heat generated at the rotor 120 during heavy and/or prolonged braking action, with little opportunity for heat to transfer from the drum body 156 to the mounting assembly 110.

[0067] It is envisioned that in other embodiments, the relative positioning of the drum tabs 154 and the rotor tabs 124 between portions of the ring 130 and the assembly flange 115 could be reversed from that shown in FIG. 5, and/or that the rotor tabs 124 extend from outer disc 128...
instead of or in addition to extending from the inner disc 127 and/or that end portion 158 of the drum body 156 lack a rim.

[0068] Referring now to FIGS. 6 and 7, in an embodiment, the mounting flange 115 may include an axially extending, inner rim 119 that extends axially toward but preferably remains out of contact with an underside of the rim 152 of the drum body 156. The inner rim 152 may serve as a stop against excessive canting of the drum body 156 during assembly of the brake 100. The inner rim 119 also maintains flatness of the mounting flange 115 during and after machining.

[0069] Referring to FIG. 9A an alternative retention ring 130 may comprise a split ring or circlip, having a gap 135 between ends 131 and 132 of the ring. Referring to FIG. 9B another alternative retention ring 130 may comprise a spiral ring having ends 131 and 132 which overlap each other. In all possible forms of the retention ring 130, it is desired that the ring be radially contractible such that in a radially contracted state, it may be directed through the annular space 151 provided between the mounting assembly tabs 112 and adjacent portions of the drum body 156 and then released to radially expand into engagement with the mounting assembly tabs 112.

[0070] As part of the aforementioned “floating” connection, the drum tabs 154 are in a superposed relation to the rotor tabs 124, which accommodates displacement of the rotor and drum tabs 124, 154 relative to one another. Accordingly, as the rotor 120 becomes heated due to heavy or prolonged braking, the rotor component 120 is allowed to thermally expand and its tabs 124 are allowed to dispose relative to the drum tabs 154 and the slots 114 of the mounting assembly 110, as may be required. Such a “floating” arrangement relieves stresses that might otherwise arise with a rigid (integral or bolted) connection. Likewise, any heating and thermal expansion of the drum 150 (or the lack of any relative to the rotor 120) is likewise accommodated.

[0071] The uniform distribution of the drum tabs 154 about the drum body 156 and their floating retention in the slots 114 of the mounting assembly 110 provides a capacity of the drum component 150 to self-center, which feature facilitates and simplifies assembly of the brake assembly 100. Likewise, the uniform distribution of the rotor tabs 124 about the inner circumferential edge portion 123 of the rotor component 120 and their floating retention in the slots 114 of the mounting assembly 110 provides a capacity of the rotor component 120 to self-center, which feature also facilitates and simplifies assembly of the brake assembly 100.

[0072] In an embodiment the mounting component 110 is constructed from an aluminum alloy to save weight, the rotor component 120 is constructed from a cast iron and the drum body 150 is constructed from a suitable iron alloy. Other suitable materials may be utilized depending upon the particular application, vehicle and performance requirements. The modular nature of the brake assembly 100 provides an enhanced degree of freedom in the selection of materials for its various components (the mounting assembly 110, the rotor 110, the drum 150 and the ring 130).

[0073] Referring to FIG. 5, in an embodiment, the ring 130 superposes the drum tabs 154, the drum tabs 154 superpose the rotor tabs 124, and the rotor tabs 124 superpose the mounting flange 115. It is contemplated that the aforementioned elements could be arranged to superpose in a different order. For example, in another embodiment, the ring 130 might superpose the rotor tabs 124 and the rotor tabs 124 might superpose the drum tabs 154.

[0074] Referring to FIG. 1, optionally, the rim 152 of the drum 156 may be provided with shorter, secondary tabs 155 at locations between each adjacent pair of drum tabs 154. The rim 152 (and the secondary tabs 155) provide reinforcement against radial forces exerted upon the drum body 156 by drum shoes. The radial extent of the rim 152 (and the secondary tabs 155) and their axial location along the exterior of the drum body 156 is selected such that a desired amount of reinforcement is achieved while maintaining a clearance between the rim 152 (and the secondary tabs 155) and the mounting component 110. In other embodiments, the drum tabs 154 may connect directly to the exterior of the drum body 156 lacking a rim 152.

[0075] An advantage of the described brake assembly 100 is that it may achieve a floating connection for both its rotor disc component 120 and its drum component 150 without resort to apertures, through holes or studs in either of those components.

[0076] Preferably, each rotor tab 124 and each mounting assembly tab 112 of the mounting assembly 120 subtend substantially equal angles (have substantially the same arcuate extent), whereas the retention ring flanges 118 form an interrupted annular slot sized to receive the retention ring 130 about an axial end of the rotor mounting flange 118.

[0077] The retention ring 130 may comprise a continuous spiral ring having substantially flat or planar axial faces and an inner wave spring portion, the retention ring 130 being structured and arranged to fit within the retention ring flanges 118 of the plurality of mounting assembly tabs 112. The incorporation of the retention ring 130 in combination with the retention ring flanges 118 is advantageous in avoiding the necessity of drilling holes or apertures in either or both of the rotor tabs 124 or the mounting assembly tabs 124 for securing the rotor 120 to the rotor mounting assembly 110 and thus to the hat or hub. In one form the retention ring 130 can be a split ring or circlip, which is a resilient metal ring having an open space between the ends, or a spiral ring having overlapping ends, or an essentially continuous spiral ring having flat axial faces with a wave spring between them. In this context, the ring is continuous in the sense that it has a multiple turn spiral structure, which is not interrupted by a gap in the ring. The spiral springs are advantageous since rotation of the brake assembly during vehicular movement can result in the gap in a split ring moving into alignment with a contact situs between the radial sides of the rotor and mounting assembly tabs. In both forms the spiral rings leave no ring gap for such alignment, making for a more secure engagement.

[0078] Preferably, when the rotor 120 is mounted onto the rotor mounting assembly 110, the rotor tabs 124 and the mounting assembly tabs 112 are substantially coplanar, each having first and second axial surfaces which substantially align. This configuration minimizes the moment arm that would be otherwise created by an axial displacement of first and second axial surfaces, such that torque transfer upon braking is primarily in-plane, and bending stresses within the brake assembly 100 are minimized.

[0079] For purposes of mounting, the mounting assembly 110 may be provided with circumferential series of bolt-receiving apertures 113 or bolts, as desired.

[0080] Preferably, each of the rotor tabs 124 presents a side surface, which extends radially and is driven by match-
ing side surfaces of the mounting assembly tabs 112. The rotor tabs 124 and the mounting assembly tabs 112 have matching radial oriented surfaces which are in substantially direct contact with one another. Preferably, the respective matching side surfaces are precision machined, such that they are in direct contact with one another, resulting in sufficient elastic deformation to substantially equalize the stresses experienced during braking. This direct contact avoids the need for compression deformation of metal plates or spacers which can cause eccentric movement of the parts, causing an out of balance condition and ultimately cracking and failure of the rotor and/or mounting assembly tabs. Preferably, a small clearance between the surfaces permits the rotor disc to “float” to accommodate thermal expansion.

[0081] Referring now to FIGS. 10 and 11, the present disclosure further provides a brake assembly 100 which comprises a mounting assembly 110, a brake rotor component 120, a brake drum component 150 and a retention ring 130 as previously described, together with a substitute, spacer ring element (fixture) 500, which may be used as a substitute for the brake drum component 150 when it is desired to operate the vehicle without the drum brake body 156, such as to save weight for racing. In an embodiment, the substitute ring element 500 may include radially outwardly extending tabs 154 which may be configured to be dimensionally and functionally equivalent to the drum tabs 154 of the embodiments disclosed above. With tabs 154, the substitute ring element 500 is self-centering and becomes part of the floating connection 200 which accommodates thermal expansion of both the rotor 120 and the substitute ring element 500 and allows displacement between the two. As shown in FIG. 11, a portion of the ring 130 retains the tab 124 of the ring 500 in superposed relation to the rotor tab 124 against a portion of the flange 115 of the mounting assembly 110.

[0082] When the substitute ring element 500 is in place, the weight of a substantial portion of the brake drum body 156 is absent. The availability of the substitute ring element 500 allows an operator of a vehicle to readily remove the brake drum body 156, and replace it with the substitute ring element 500 by simple manipulation of the retention ring 130 in the manner previously described. Such replacement provides weight savings for purposes of racing a vehicle that is also qualified for non-racing use where a parking brake is desired or required.

[0083] It is envisioned that the substitute ring element 500 may take various forms beyond what is shown in FIG. 10. For instance it may comprise a simple ring, and the substitute element 500 and a modified drum body 156 may be mutually configured such that they may be joined together or separated by a releasable connection such as a treating 502, a pin, a lock mechanism or the like.

[0084] Amongst the various embodiments described herein, the retention ring 130 can be an inner retention ring, which is radially compressed to be placed into the retention ring flanges and then released to expand into place, or an outer retention ring, which is radially expanded to be placed into the retention ring flanges and then released to contract into place. FIG. 13A illustrates a retention ring flange 118a designed for accommodating an inner retention ring 130, and FIG. 13B illustrates a retention ring flange 118b designed for accommodating an outer retention ring 130.

The arrows show the relative motions of the retention rings upon release, with the location of the rings upon release shown in phantom lines.

[0085] Referring now also to FIG. 12A the inner wave spring portion 130b advantageously provides for axially biasing the planar faces outwardly, thereby securing the retention ring 130 in-place, preventing it not only from rotating around in the retention ring flanges 118, but also reducing or eliminating rattles or judder emanating from the interface between the disc brake rotor 120 and the hub 110. Refering now also to FIG. 12C, the continuous spiral ring 130 should be understood to have terminal ends 134 of either of the flat or planar axial faces 130a which overlap, at least to some extent.

[0086] FIGS. 12B (cross-section) and 12C-12F disclose alternative designs of retention rings 130 which will fit into the retention ring flanges 118 and are suitable for use to hold the rotor 120 against the hub 110. FIG. 12B illustrates a three-piece retention ring set, having an inner wave spring portion 130d sandwiched between two substantially flat or planar rings 130c. FIG. 12C illustrates a split ring which has terminal ends 131 and 132 having a slight gap 135 therebetween. FIG. 12D illustrates a two turn spiral ring having overlapping terminal ends 134. The amount of overlap between the terminal ends can be varied, as desired. In all forms, the retention ring 130 is radially yieldable in the direction of its diameter, such that it can be compressed or expanded to fit into the retention ring flanges 118 on the rotor mounting tabs 112 when assembling the rotor 120 to the hub 110. FIGS. 12E-12G illustrate alternative forms of the retention ring, wherein an axially compressible material is disposed between two substantially flat or planar rings. The axially compressible material can be a wire mesh spring washer 130e or 130f, which can be separate from (FIG. 12E) or bonded to (FIG. 12F) the two substantially flat or planar rings 130c, 130a. Wire mesh spring washers are available from Kinetic Structures of Phoenix, Ariz. Alternatively, the axially compressible material can be a Belleville spring 130f (FIG. 12G), which likewise can either be separate from or bonded to the two substantially flat or planar rings 130c, 130a on either axial side thereof. Similar to the inner wave spring portion 130b, the compressible material advantageously provides for axially biasing the planar faces outwardly, thereby securing the retention ring 130 in-place, preventing it not only from rotating around in the retention ring flanges 118, but also reducing or eliminating rattles or judder emanating from the interface between the disc brake rotor 120 and the hub 110.

[0087] Further illustrative, non-exclusive examples of assemblies and methods according to the present disclosure are presented in the following enumerated paragraphs. It is within the scope of the present disclosure that an individual step of a method recited herein, including in the following enumerated paragraphs, may additionally or alternatively be referred to as a “step for” performing the recited action.

[0088] A floating brake rotor and drum assembly, comprising: a disc brake component comprising: a rotor having an inner annular edge portion; and a plurality of rotor tabs at spaced locations about the inner annular edge portion; a drum brake component comprising a drum body; and a plurality of drum tabs at spaced locations about an outer annular portion of the drum body; a mounting component comprising: a mounting flange; and a plurality of mounting assembly tabs at spaced locations about the mounting flange,
adjacent pairs of the mounting assembly tabs defining slots therebetween, the mounting assembly tabs comprising retention ring flanges; the slots, the rotor tabs and the drum tabs mutually arranged such that the rotor tabs and the drum tabs are each received in the slots; a retention ring arranged to engage with the retention ring flanges, upon engagement with the retention ring flanges, the retention ring spanning the slots so as to axially retain the rotor tabs and the drum tabs in the slots.

[0090] PCT2. The floating brake rotor and drum assembly of paragraph PCT1, wherein the mounting flange includes a rim portion, the rotor tabs and the drum tabs being axially retained between the retention ring and the rim portion of the rotor mounting flange.

[0091] PCT4. The floating brake rotor and drum assembly of paragraph PCT3, wherein the retention ring flanges comprise an axially directed flange portion and a radially inwardly directed flange portion.

[0092] PCT5. The floating rotor and drum brake assembly of paragraph PCT4, wherein the retention ring is radially yieldable, the drum body and the retention ring flanges being radially spaced apart to define an annular space therebetween, the annular space sufficient to receive the retention ring in a radially contracted condition, whereupon the retention ring being releasable into engagement with the retention ring flanges.

[0093] PCT6. The floating rotor and drum brake assembly of paragraph PCT4, wherein the outer annular portion of the drum body is located at an intermediate location along the drum body.

[0094] PCT7. The floating rotor and drum brake assembly of any of paragraphs PCT1-PCT6, wherein the rotor tabs and the mounting assembly tabs are substantially coplanar.

[0095] PCT8. The floating rotor and drum brake assembly of any of paragraphs PCT1-PCT7, wherein the rotor tabs and the mounting assembly tabs are free of apertures and through holes.

[0096] PCT9. The floating rotor and drum brake assembly of any of paragraphs PCT1-PCT8, wherein the rotor tabs and the mounting assembly tabs have matching radial oriented surfaces in direct contact with one another.

[0097] PCT10. The floating rotor and drum brake assembly of any of paragraphs PCT1-PCT9, wherein the retention ring is a split ring.

[0098] PCT11. The floating rotor and drum brake assembly of any of paragraphs PCT1-PCT10, wherein the retention ring is a spiral ring having overlapping terminal ends.

[0099] PCT12. The floating rotor and drum brake assembly of any of paragraphs PCT1-PCT11, wherein the retention ring is a multi-turn spiral ring having substantially flat or planar axial faces and an inner wave spring portion.

[0100] PCT13. The floating rotor and drum brake assembly of any of paragraphs PCT1-PCT12, wherein the retention ring flanges extend axially through slots formed between the plurality of rotor tabs and beyond axial surfaces of the rotor tabs.

[0101] PCT14. The floating rotor and drum brake assembly of any of paragraphs PCT1-PCT13, wherein the retention ring flanges form an interrupted annular slot about an axial end of the rotor mounting flange, the slot sized to receive the retention ring.

[0102] PCT15. The floating rotor and drum brake assembly of any of paragraphs PCT1-PCT14, wherein each rotor tab and each mounting assembly tab subtend angles which are substantially equal.

[0103] PCT16. The floating rotor and drum brake assembly of any of paragraphs PCT1-PCT15, further comprising a substitute fixture useable as a substitute for the brake drum component and retainable with the retaining ring.

[0104] PCT17. The floating rotor and drum brake assembly of paragraph PCT16, wherein the substitute fixture comprises a plurality of radially outwardly extending tabs configured like the drum tabs such that upon engagement of the retention ring with the retention ring flanges, the retention ring spanning the slots axially retains the rotor tabs and the radially outwardly extending tabs of the substitute fixture in the slots.

[0105] PCT18. The floating rotor and drum brake assembly of paragraph PCT17, wherein the substitute fixture further comprises a ring, the plurality of radially outwardly extending tabs being disposed about the ring.

[0106] PCT19. The floating rotor and drum brake assembly of paragraph PCT18, wherein the substitute fixture is a separable portion of the drum brake component, useable in the absence of the drum body.

[0107] PCT20. A method of combining a brake rotor and a brake drum in a brake assembly, the method comprising: establishing a floating connection between the brake rotor and a mounting flange by locating tabs of the rotor in slots established between mounting tabs of the mounting flange; supporting a brake drum at the floating connection by superimposing tabs of the drum body with the rotor tabs at the slots; and retaining the superposed rotor and drum tabs with a ring.

INDUSTRIAL APPLICABILITY

[0108] The apparatus and methods disclosed herein are applicable to the automotive industry.

[0109] It is believed that the disclosure set forth above encompasses multiple distinct embodiments with independent utility. While each of these embodiments has been disclosed in its preferred form, the specific embodiments thereof as disclosed and illustrated herein are not to be considered in a limiting sense as numerous variations are possible. The subject matter of the embodiments includes all novel and non-obvious combinations and subcombinations of the various elements, features, functions and/or properties disclosed herein. Similarly, where the claims recite “a” or “first” element or the equivalent thereof, such claims should be understood to include incorporation of one or more such elements, neither requiring nor excluding two or more such elements.

[0110] It is believed that the following claims particularly point out certain combinations and subcombinations that are directed to one of the disclosed embodiments and are novel and non-obvious. Embodiments of other combinations and subcombinations of features, functions, elements and/or properties may be claimed through amendment of the present claims or presentation of new claims in this or a related application. Such amended or new claims, whether they are directed to a different embodiment or directed to the same embodiment, whether different, broader, narrower, or equal.
in scope to the original claims, are also regarded as included within the subject matter of the present disclosure.

[0111] While the present disclosure has been described and illustrated by reference to particular embodiments, those of ordinary skill in the art will appreciate that the invention lends itself to variations not necessarily illustrated herein. For this reason, then, reference should be made solely to the appended claims for purposes of determining the true scope of the present disclosure.

1. A floating brake rotor and drum assembly, comprising:
   a disc brake component comprising:
   a rotor having an inner annular edge portion; and
   a plurality of rotor tabs at spaced locations about the inner annular edge portion;
   a drum brake component comprising:
   a drum body; and
   a plurality of drum tabs at spaced locations about an outer annular portion of the drum body;
   a mounting component comprising:
   a mounting flange; and
   a plurality of mounting assembly tabs at spaced locations about the mounting flange, adjacent pairs of the mounting assembly tabs defining slots therebetween, the mounting assembly tabs comprising retention ring flanges;
   the slots, the rotor tabs and the drum tabs mutually arranged such that the rotor tabs and the drum tabs are each received in the slots;
   a retention ring arranged to engage with the retention ring flanges, upon engagement with the retention ring flanges, the retention ring spanning the slots so as to axially retain the rotor tabs and the drum tabs in the slots.

2. The floating brake rotor and drum assembly of claim 1, wherein the mounting flange includes a rim portion, the rotor tabs and the drum tabs being axially retained between the retention ring and the rim portion of the rotor mounting flange.

3. The floating brake rotor and drum assembly of claim 1, wherein the rotor tabs extend radially inwardly and the drum tabs extend radially outwardly, the drum tabs and the rotor tabs in a superposed relation while retained in the slots by the retention ring.

4. The floating brake rotor and drum assembly of claim 3, wherein the retention ring flanges comprise an axially directed flange portion and a radially inwardly directed flange portion.

5. The floating rotor and drum brake assembly of claim 4, wherein the retention ring is radially yieldable, the drum body and the retention ring flanges being radially spaced apart to define an annular space therebetween, the annular space sufficient to receive the retention ring in a radially contracted condition, wherein the retention ring being releasable into engagement with the retention ring flanges.

6. The floating rotor and drum brake assembly of claim 4, wherein the outer annular portion of the drum body is located at an intermediate location along the drum body.

7. The floating rotor and drum brake assembly of claim 1, wherein the rotor tabs and the mounting assembly tabs are substantially coplanar.

8. The floating rotor and drum brake assembly of claim 1, wherein the rotor tabs and the mounting assembly tabs are free of apertures and through holes.

9. The floating rotor and drum brake assembly of claim 1, wherein the rotor tabs and the mounting assembly tabs have matching radial oriented surfaces in direct contact with one another.

10. The floating rotor and drum brake assembly of claim 1, wherein the retention ring is a split ring.

11. The floating rotor and drum brake assembly of claim 1, wherein the retention ring is a spiral ring having overlapping terminal ends.

12. The floating rotor and drum brake assembly of claim 1, wherein the retention ring is a multi-turn spiral ring having substantially flat or planar axial faces and an inner wave spring portion.

13. The floating rotor and drum brake assembly of claim 1, wherein the retention ring flanges extend axially through slots formed between the plurality of rotor tabs and beyond axial surfaces of the rotor tabs.

14. The floating rotor and drum brake assembly of claim 1, wherein the retention ring flanges form an interrupted annular slot about an axial end of the rotor mounting flange, the slot sized to receive the retention ring.

15. The floating rotor and drum brake assembly of claim 1, wherein each rotor tab and each mounting assembly tab subtend angles which are substantially equal.

16. The floating rotor and drum brake assembly of claim 1, further comprising a substitute fixture useable as a substitute for the brake drum component and retainable with the retaining ring.

17. The floating rotor and drum brake assembly of claim 16, wherein the substitute fixture comprises a plurality of radially outwardly extending tabs configured like the drum tabs such that upon engagement of the retention ring with the retention ring flanges, the retention ring spanning the slots axially retains the rotor tabs and the radially outwardly extending tabs of the substitute fixture in the slots.

18. The floating rotor and drum brake assembly of claim 16, wherein the substitute fixture further comprises a ring, the plurality of radially outwardly extending tabs being disposed about the ring.

19. The floating rotor and drum brake assembly of claim 18, wherein the substitute fixture is a separable portion of the drum brake component, useable in the absence of the drum body.

20. A method of combining a brake rotor and a brake drum in a brake assembly, the method comprising:
   establishing a floating connection between the brake rotor and a mounting flange by locating tabs of the rotor in slots established between mounting tabs of the mounting flange;
   supporting a brake drum at the floating connection by superimposing tabs of the drum body with the rotor tabs at the slots; and
   retaining the superposed rotor and drum tabs with a ring.

21. The method of claim 20, wherein the retaining with a ring includes engaging the ring with the mounting tabs of the mounting flange such that the ring spans the slots.

22. A method of centering a brake drum in a disc brake assembly, comprising:
   establishing a floating connection between a disc brake rotor and a mounting assembly by locating a plurality of rotor tabs in slots established uniformly about the mounting assembly; and
   establishing a floating connection between a brake drum and the mounting assembly by locating a plurality of
drum tabs in the slots established uniformly about the mounting assembly such that the rotor tabs and the drum tabs are mutually superposed.

23. The method of claim 22, further comprising centering the disc brake rotor by locating the plurality of rotor tabs uniformly about an inner circumferential edge portion of the disc brake rotor, whereby the locating of the plurality of rotor tabs in slots established uniformly about the mounting assembly self-centers the disc brake rotor.

24. The method of claim 22, further comprising retaining the superposed rotor and drum tabs with a ring.

25. A method of preparing a vehicle for an event, comprising:
   - removing a brake drum body from a brake assembly by disengaging a ring that in an engaged condition retains the brake drum body in the brake assembly;
   - replacing the brake drum body with a fixture configured to be retainable by the ring when in an engaged condition, the fixture lacking a drum body;
   - re-engaging the ring so as to retain the fixture in the brake assembly in lieu of the brake drum body.

26. The method of claim 25 further comprising centering the fixture with a plurality of radially extending tabs disposed about the fixture.

27. An article for preparing a vehicle for an event, wherein a brake drum body is removable from a brake assembly by disengaging a ring that in an engaged condition retains the brake drum body in the brake assembly, the article comprising:
   - a fixture configured to replace the brake drum body by being retainable by the ring when the ring is in an engaged condition, the fixture lacking a drum body.

28. The article of claim 27, wherein the fixture comprises a plurality of radially extending tabs disposed about the fixture.

29. The article of claim 28, wherein the fixture further comprises a ring and the plurality of radially extending tabs are disposed about the ring.

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