[0015a] According to a first aspect of the present invention, there is provided a Hooke's law disobeying spring system, including: a spring assembly interrelating one or more primary and one or more supplemental springs such that loading distortion of the assembly both distorts one or more of the primary springs and rearranges one or more loaded supplemental springs; wherein increasing assembly loading distortion increases the primary springs loading while rearranging the supplemental springs' to decrease their contribution to the assembly loading response, and decreasing overall assembly loading distortion decreases the primary springs loading while rearranging the supplemental springs' to increase their contribution to the assembly loading response.

[0015b] According to a second aspect of the present invention, there is provided a method of structuring a steady force spring-type load resistance, including the steps of: structurally interrelating one or more primary and one or more supplemental springs to meet an overall load with a combined level of resistance force when within their operating ranges; structuring the primary and supplemental springs' with a variable alignment of their respective load resistance force vectors such that the supplemental springs contribute more to the combined distortion resistance force when more aligned with the primary springs; wherein when an overall load increases the primary springs distortion, the also loaded supplemental springs alignments with the primary springs decreases, and when an overall load decreases the primary springs distortion the also loaded supplemental springs alignments with the primary springs increases.

[0015c] According to a third aspect of the present invention, there is provided a pneumatic inflation pressure corrector, suitable for use in a bounded volume of gas to be maintained at a selected level of gas inflation pressure, including: a gas-impermeable expandable envelope enclosing a variable size gas volume; an internal spring assembly, said spring assembly combining primary and supplementary springs in variable alignments to increase and decrease the supplementary springs contribution to the total spring assembly's resistance to loading and wherein when an overall load increases the primary springs distortion, the also loaded supplemental springs alignments with the primary springs decreases, and when an overall load decreases the primary springs distortion the also loaded supplemental springs alignments with the primary springs increases and an internal gas pressure level forcing the envelope surface outward against encountered external gas pressure forcing the envelope surface inward, with the enclosed volume decreasing when there is more inward than outward forcing, the enclosed volume increasing when there is more outward than inward forcing, and the enclosed volume is unchanging when the inward and outward forcing is even; wherein the spring assembly outward forcing level decreases when the enclosed volume decreases and increases when the enclosed volume increases at rates of decreasing and increasing that match in magnitude and oppose in direction the internal gas pressure outward forcing's concurrent rates of increasing and decreasing, respectively, such that their combined outward forcing remains at a steady level as the enclosed volume increases or decreases.

[0015d] According to a fourth aspect of the present invention, there is provided a method of maintaining an inflation pressure level, including the steps of: structuring a gas-impermeable, expandable surface to contain a variable volume; disposing at least a portion of the expandable surface in direct contact with or in gas communication mediated contact with an

inflated space; pressuring the surface outward with one or more spring forces said spring forces produced by an assembly combining primary and supplementary springs in variable alignments to increase and decrease the supplementary springs contribution to the total spring assembly's resistance to loading and wherein, when an overall load increases the primary springs distortion, the also loaded supplemental springs alignments with the primary springs decreases, and when an overall load decreases the primary springs distortion the also loaded supplemental springs alignments with the primary springs increases so that the contained volume, increases when the inflated space pressure level is less than the outward pressure, decreases when the inflated space pressure level is more than the outward pressure, and is steady when the inflated space pressure level is even with the outward pressure.

[0015e] According to a fifth aspect of the present invention, there is provided an airborne infectant/pollutant facial protection system including: a gas-impermeable shield bordered by a resilient inflatable interface that collectively form a continuous seal with a wearer's face when a concave side of the shield faces the wearer and the system is applied to the wearer's face with the wearer's mouth, nose and eyes in a then bounded airspace; said interface inflation pressure corrected to maintain a steady level of pressure against the wearer's face and a steady force spring assembly providing the pressure correcting, said assembly combining primary and supplementary springs in variable alignments to increase and decrease the supplementary springs contribution to the total spring assembly's resistance to loading and wherein, when an overall load increases the primary springs distortion, the also loaded supplemental springs alignments with the primary springs decreases, and when an overall load decreases the primary springs distortion the also loaded supplemental springs alignments with the primary springs increases, and a divided airflow system wherein air enters the bounded airspace via ports in general proximity to the wearer's forehead and leaves the bounded airspace via ports in general proximity to the wearer's jaw and under chin.

[0015f] According to a sixth aspect of the present invention, there is provided a method of protecting a face from airborne infectants or pollutants including the steps of: arranging an at least partially arcuate, transparent, gas-impermeable shield to be bordered by a resilient inflatable interface and collectively configuring the shield and interface to form a continuous seal with a wearer's face such that a concave side of the shield faces the wearer's face and the wearer's mouth, nose and eyes are within an enclosed airspace bounded by the shield, the interface and their skin; correcting the pressure applied by the interface to the wearer's skin so that it is maintained at a steady level by a steady force spring assembly as the wearer's skin moves, said assembly combining primary and supplementary springs in variable alignments to increase and decrease the supplementary springs contribution to the total spring assembly's resistance to loading and wherein, when an overall load increases the primary springs distortion, the also loaded supplemental springs alignments with the primary springs decreases, and when an overall load decreases the primary springs distortion the also loaded supplemental springs alignments with the primary springs increases, and disposing an elastic, resilient soft air dam having a spiral cross-section resting shape with its concave spiral side facing downward and extending from side to side across the interior of the shield, wherein a less curled end of the dam is anchored, from side to side, to a vertical-when-worn-mid-section of the shield with the more curled end of the dam curving tightly enough to at least

double back upon itself such that when the shield and dam are put on by the wearer, the wearer's face contacts the convex side of the dam.

[0015g] According to a seventh aspect of the present invention, there is provided a pressure compensator for maintaining a first inflated space's pneumatic pressure, including: a gas impermeable, size alterable enclosure of a first space, gas transfer ports through the enclosure to/from the first space and one or more force sensitive enclosure portions responsive to external pressure on and internal pressure from the first space's enclosed gas by increasing the first space's size when the internal pressure is greater than the external and decreasing the first space's size when the external pressure is greater than the internal; and a steady force spring assembly that exerts a steady force as it moves through its operating range, said assembly combining primary and supplementary springs in variable alignments to increase and decrease the supplementary springs contribution to the total spring assembly's resistance to loading and wherein, when an overall load increases the primary springs distortion, the also loaded supplemental springs alignments with the primary springs decreases, and when an overall load decreases the primary springs distortion the also loaded supplemental springs alignments with the primary springs increases, and said spring assembly arranged to provide the external pressure on the force sensitive enclosure portions, such that as gas enters and/or exits the enclosure the spring assembly maintains a steady force on the enclosure so that its pneumatic pressure remains steady.

[0015h] There is disclosed an assembly that resists operating range distortion with a steady force level, including: one or more springs interrelated with one or more compensators; one or more interfaces transmitting external loads to the interrelated springs and compensators, said compensators modifying while translating the external loading from the interfaces to the springs; wherein said modifying matches the work done on the springs to the work done on the interface by altering the rate of distortion of the springs in inverse proportion to the rate of change of the force level of the springs' distortion resistance such that their product is steady.

[0015i] There is disclosed an operational range constant force spring assembly, including: a spring assembly integrating one or more primary springs and one or more secondary springs so that their vector sum net loading resistance to overall assembly distortion comprises the assembly's overall loading resistance; wherein aggregate secondary and aggregate primary springs' distortion resistances input to the assembly distortion resistance in opposing directions and when the assembly distortion changes, all the springs' distortions change and the aggregate secondary and aggregate primary springs' distortion resistance changes are of the same sign and magnitude.

[0015j] There is disclosed an operational range constant force spring assembly, including: a spring assembly integrating one or more primary springs and one or more secondary springs so that their vector sum net loading resistance to overall assembly distortion comprises the assembly's overall loading resistance; wherein aggregate secondary and aggregate primary springs' distortion resistances input to the assembly distortion resistance in aligned directions and when the assembly distortion changes, all the springs' distortions change and the aggregate secondary and

aggregate primary springs' distortion resistance changes are of the same magnitude but opposing in direction.

[0016] The variable effective force expression of the variably unsheathed spring is intimately related to the various forms of Hooke's-Law-Disobeying (HLD) springs and spring assemblies disclosed m the present application's embodiments. A number of differing tactics are involved in realizing the embodiments of the present application, including a first tactic wherein one or more main, first, or primary forms of standard spring are interrelated with one or more effectively non-standard performing second, supplementary, or secondary spring elements. The interrelation is such that distortion/un-distortion of the one or more main springs also concurrently either or both distorts and/or undistorts the secondary spring elements and often also alters the effective rebound force being expressed by the secondary elements. Differing combinations of these approaches, as well as differing variations in execution techniques provide a wealth of variation in the number of manners (i.e. number of embodiments) of realizing the present invention.

[0017] Among the techniques which enable the constant (or near constant) force spring assemblies and methods are opposing compressions with extensions, opposing compressions with reversed compressions, arranging for compressions or extensions to become effective (or ineffective) progressively as the distortion progresses, arranging for the direction of expression of a compression (or extension) to be progressively redirected so that differing force components are effective upon the overall distortion of the spring assembly, and other means. While many of the embodiments described herein are referred to as compression springs, spring elements, and/or spring assemblies, it should be understood that the majority of these embodiments, sometimes with relatively modest and well-known modifications, are also able to function as or be replaced by extension springs, spring elements, and/or spring assemblies. Other objects and features will be in part apparent and in part pointed out hereinafter.

[0018] Among the specific uses of the present invention disclosed in the present application are systems and methods of ensuring correct, ongoing pressurization of a pneumatic tire from

CLAIMS

1. A Hooke's law disobeying spring system, comprising:

a spring assembly interrelating one or more primary and one or more supplemental springs such that loading distortion of the assembly both distorts one or more of the primary springs and rearranges one or more loaded supplemental springs;

wherein increasing assembly loading distortion increases the primary springs loading while rearranging the supplemental springs' to decrease their contribution to the assembly loading response, and decreasing overall assembly loading distortion decreases the primary springs loading while rearranging the supplemental springs' to increase their contribution to the assembly loading response.

2. A method of structuring a steady force spring-type load resistance, comprising the steps of:

structurally interrelating one or more primary and one or more supplemental springs to meet an overall load with a combined level of resistance force when within their operating ranges;

structuring the primary and supplemental springs' with a variable alignment of their respective load resistance force vectors such that the supplemental springs contribute more to the combined distortion resistance force when more aligned with the primary springs; wherein

when an overall load increases the primary springs distortion, the also loaded supplemental springs alignments with the primary springs decreases, and

when an overall load decreases the primary springs distortion the also loaded supplemental springs alignments with the primary springs increases.

3. The method of structuring a steady force spring-type load resistance according to claim 2, wherein the varying contribution of the supplemental springs to the overall load resistance is structured to partially or fully offset variations in the primary springs' contribution to the overall load resistance.

4. A pneumatic inflation pressure corrector, suitable for use in a bounded volume of gas to be maintained at a selected level of gas inflation pressure, comprising:

a gas-impermeable expandable envelope enclosing a variable size gas volume;

an internal spring assembly,

said spring assembly combining primary and supplementary springs in variable alignments to increase and decrease the supplementary springs contribution to the total spring assembly's resistance to loading and wherein

when an overall load increases the primary springs distortion, the also loaded supplemental springs alignments with the primary springs decreases, and

when an overall load decreases the primary springs distortion the also loaded supplemental springs alignments with the primary springs increases and an internal gas pressure level forcing the envelope surface outward against encountered external gas pressure forcing the envelope surface inward, with

the enclosed volume decreasing when there is more inward than outward forcing,

the enclosed volume increasing when there is more outward than inward forcing, and

the enclosed volume is unchanging when the inward and outward forcing is even;

wherein the spring assembly outward forcing level decreases when the enclosed volume decreases and increases when the enclosed volume increases at rates of decreasing and increasing that match in magnitude and oppose in direction the internal gas pressure outward forcing's concurrent rates of increasing and decreasing, respectively, such that their combined outward forcing remains at a steady level as the enclosed volume increases or decreases.

5. The pneumatic inflation pressure corrector, according to claim 4, suitable for use in a bounded volume of gas to be maintained at a selected level of gas inflation pressure, further comprising:

a bounded pneumatic space whose boundary includes at least a portion of the envelope, the space's total capacity varying as the envelope expands and contracts until its internal pneumatic pressure is balanced with the outward forcing pressure from the envelope;

wherein when these pressures are balanced the envelope expansion/contraction pauses while the space's internal gas pressure is maintained at a steady level.

6. The pneumatic inflation pressure corrector, according to claim 5, suitable for use in a bounded volume of gas to be maintained at a selected level of gas inflation pressure, wherein the bounded space is an inflated portion of a vehicle tire, is integrated with an inflated portion of a vehicle tire, or is separate from a vehicle tire with its internal gas pressure in gas communication with an inflated portion of a vehicle tire.

7. The pneumatic inflation pressure corrector, according to claim 4, suitable for use in a bounded volume of gas to be maintained at a selected level of gas inflation pressure,

wherein progressive partial disabling or enabling-after-disabling of a portion of the assembly's outward forcing the spring assembly forcing level decreases or increases, respectively;

wherein progressive changes in the effective fraction of one or more of the supplemental springs performs the progressive partial disabling or enabling, with a spring's effective fraction being the fraction of its extent that can operate as a spring contributing to the load response of the assembly.

8. A method of maintaining an inflation pressure level, comprising the steps of:

structuring a gas-impermeable, expandable surface to contain a variable volume;

disposing at least a portion of the expandable surface in direct contact with or in gas communication mediated contact with an inflated space;

pressuring the surface outward with one or more spring forces,

said spring forces produced by an assembly combining primary and supplementary springs in variable alignments to increase and decrease the supplementary springs contribution to the total spring assembly's resistance to loading and wherein,

when an overall load increases the primary springs distortion, the also loaded supplemental springs alignments with the primary springs decreases, and

when an overall load decreases the primary springs distortion the also loaded supplemental springs alignments with the primary springs increases so that the contained volume,

increases when the inflated space pressure level is less than the outward pressure,

decreases when the inflated space pressure level is more than the outward pressure, and

is steady when the inflated space pressure level is even with the outward pressure.

9. An airborne infectant/pollutant facial protection system comprising:

a gas-impermeable shield bordered by a resilient inflatable interface that collectively form a continuous seal with a wearer's face when a concave side of the shield faces the wearer and the system is applied to the wearer's face with the wearer's mouth, nose and eyes in a then bounded airspace;

said interface inflation pressure corrected to maintain a steady level of pressure against the wearer's face and a steady force spring assembly providing the pressure correcting,

said assembly combining primary and supplementary springs in variable alignments to increase and decrease the supplementary springs contribution to the total spring assembly's resistance to loading and wherein,

when an overall load increases the primary springs distortion, the also loaded supplemental springs alignments with the primary springs decreases, and

when an overall load decreases the primary springs distortion the also loaded supplemental springs alignments with the primary springs increases, and

a divided airflow system wherein air enters the bounded airspace via ports in general proximity to the wearer's forehead and leaves the bounded airspace via ports in general proximity to the wearer's jaw and under chin.

10. The airborne infectant/pollutant facial protection system according to claim 9, further comprising:

a resilient soft air dam formed with a spiral cross-section resting shape, disposed with its spiral concave side facing downward and extending from side to side across the interior of the shield,

wherein the dam's outermost border is anchored, from side to side, to a shield mid-section, with its innermost border contacting the wearer's face with the convex side of the spiral cross-section.

11. The airborne infectant/pollutant facial protection system according to claim 9, wherein said interface is disposed to contact the wearer generally above the brow ridge from side to side, along the side of the face around and behind the eye socket, below the cheekbone then forward to mid-cheek and again downward until crossing under mid-jaw.

12. The airborne infectant/pollutant facial protection system according to claim 9, wherein when the system is worn, the interface maintains a steady pressure against the wearer's face as that portion of their face moves, including sufficient interface extent below the wearer's chin to enable the wearer to speak normally with the interface maintaining a steady pressure seal against the wearer's face.

13. A method of protecting a face from airborne infectants or pollutants comprising the steps of:

arranging an at least partially arcuate, transparent, gas-impermeable shield to be bordered by a resilient inflatable interface and collectively configuring the shield and interface to form a continuous seal with a wearer's face such that a concave side of the shield faces the wearer's face and the wearer's mouth, nose and eyes are within an enclosed airspace bounded by the shield, the interface and their skin;

correcting the pressure applied by the interface to the wearer's skin so that it is maintained at a steady level by a steady force spring assembly as the wearer's skin moves,

said assembly combining primary and supplementary springs in variable alignments to increase and decrease the supplementary springs contribution to the total spring assembly's resistance to loading and wherein,

when an overall load increases the primary springs distortion, the also loaded supplemental springs alignments with the primary springs decreases, and

when an overall load decreases the primary springs distortion the also loaded supplemental springs alignments with the primary springs increases, and

disposing an elastic, resilient soft air dam having a spiral cross-section resting shape with its concave spiral side facing downward and extending from side to side across the interior of the shield, wherein a less curled end of the dam is anchored, from side to side, to a vertical-when-worn-mid-section of the shield with the more curled end of the dam curving tightly enough to at least double back upon itself such that when the shield and dam are put on by the wearer, the wearer's face contacts the convex side of the dam.

14. A pressure compensator for maintaining a first inflated space's pneumatic pressure, comprising:

a gas impermeable, size alterable enclosure of a first space, gas transfer ports through the enclosure to/from the first space and one or more force sensitive enclosure portions responsive to external pressure on and internal pressure from the first space's enclosed gas by increasing the first space's size when the internal pressure is greater than the external and decreasing the first space's size when the external pressure is greater than the internal; and

a steady force spring assembly that exerts a steady force as it moves through its operating range,

said assembly combining primary and supplementary springs in variable alignments to increase and decrease the supplementary springs contribution to the total spring assembly's resistance to loading and wherein,

when an overall load increases the primary springs distortion, the also loaded supplemental springs alignments with the primary springs decreases, and

when an overall load decreases the primary springs distortion the also loaded supplemental springs alignments with the primary springs increases, and

said spring assembly arranged to provide the external pressure on the force sensitive enclosure portions, such that as gas enters and/or exits the enclosure the spring assembly maintains a steady force on the enclosure so that its pneumatic pressure remains steady.

15. The pressure compensator for maintaining a first inflated space's pneumatic pressure according to claim 14, wherein said spring assembly comprises one or more springs and pivotally connects ends of first and second arms whose other ends are pivotally connected to first and second force transfer legs, respectively, which are affixed to first and second assembly ends, respectively, such that

relative movement of the first and second assembly ends entails coordinated articulation of the arms as their shared pivot follows a shaped path portion of a platen, with springs distortion altering movements entailing platen movement,

wherein the arms and platen translate the same amount of relative movement of the assembly ends into the same amount of work done on the springs throughout the assembly's operating range.