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(54) Title: BASKETBALL GOAL WITH VIBRATION DAMPING

(57) Abstract: The present disclosure provides a basketball goal vibration damping apparatus for attachment to a basketball goal assembly. In some embodiments the vibration damping apparatus is a tuned mass damper mounted or mountable to a basketball goal assembly. The tuned mass damper may use magnetic damping to accelerate damping of the basketball goal assembly to a normal static state after an impact.

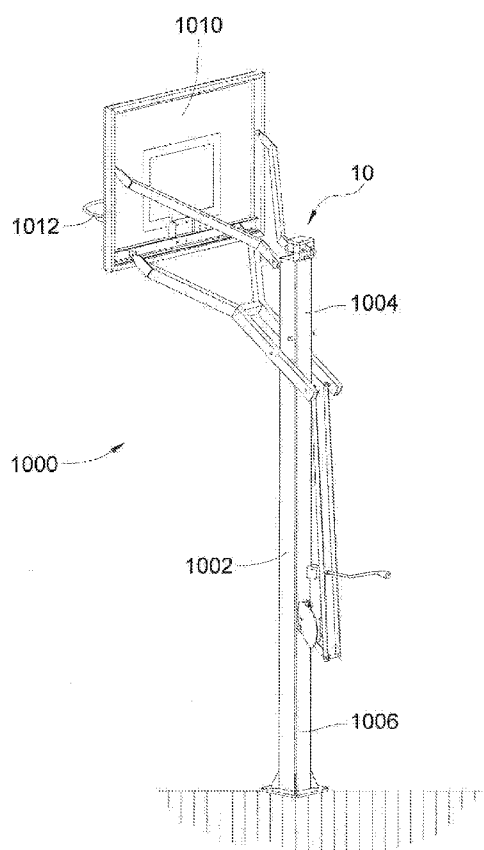


Fig. 1





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BASKETBALL GOAL WITH VIBRATION DAMPING

FIELD OF THE INVENTION

The present disclosure pertains generally to accessories for use in
5 combination with a basketball goal assembly. More particularly, the present invention pertains to devices helpful in damping movement and vibration of a basketball goal assembly.

BACKGROUND

10 In the popular sport of basketball, normal play includes impacts against the basketball goal assembly, primarily the backboard assembly. Impacts can occur from the basketball striking the backboard or rim assembly or from player contact, such as hanging on the rim assembly. Correspondingly, the impact can cause a vibration in the basketball goal structure. Such vibrations can interfere with later
15 shots at the basket and can contribute to wear and tear on the goal assembly. Accordingly, it is desirable for the basketball goal assembly to return to a static, non-vibrating state as soon as possible after an impact. For example, NCAA rules require official competition backboards to return to a static state within four seconds of an impact.

20 The time necessary for a basketball goal system to naturally return or dampen to a static state is a function, among other variables, of its mass and rigidity. Typically the approach to reducing vibrations has been to use a heavier mass and more rigid mountings and materials. However, such an approach adds weight and cost to a basketball goal assembly.

25 The concerns in pole mounted basketball goal assemblies are of especial concern because in pole-based arrangements the basketball backboard assembly functions as a weight mounted at the end of a cantilevered lever arm extending from a base, creating a leveraging effect against the base. Traditional pole mounted systems have correspondingly had to balance a longer natural damping
30 time before the system returns to a static state versus using heavy materials and a secure or heavy base to minimize the goal's natural damping time.

Arrangements to accelerate damping and to minimize the damping time for basketball goal assemblies are desired.

SUMMARY

Certain disclosed embodiments include a basketball goal assembly including a basketball backboard and rim assembly and a tuned mass damper operatively mounted to the backboard and rim assembly to dampen vibration of the assembly. In some embodiments, the tuned mass damper is mounted to a pole having an upper end and a base end, where the pole supports the backboard and rim assembly above a support surface. Optionally, the tuned mass damper is mounted adjacent the upper end of the pole.

Some embodiments of a basketball goal assembly include a basketball backboard and rim assembly and a tuned mass damper operatively mounted to said backboard and rim assembly to dampen vibration of the assembly. An example embodiment of the tuned mass damper includes a conductor plate arranged normal to the plane of the basketball backboard, a pair of flexures arranged on opposing sides of the conductor plate, and a moving mass extending over the conductor plate and mounted to the pair of flexures. The moving mass may comprise a pair of magnets arranged on opposing sides of the conductor plate, with the magnets laterally offset from each other. In some embodiments the pair of flexures may be leaf springs. The moving mass may be formed as a pair of symmetric subassemblies, wherein each subassembly includes a magnet block and a ballast block.

Certain illustrative embodiments include a basketball goal assembly, comprising, a basketball backboard and rim assembly and a tuned mass damper operatively mounted to the backboard and rim assembly to dampen vibration of the assembly. Some arrangements include a pole having an upper end and a base end, wherein the pole supports said backboard and rim assembly above a support surface, and wherein the tuned mass damper is mounted to the pole. In some embodiments, the tuned mass damper uses magnetic damping.

In some embodiments, the basketball backboard defines a planar backboard surface and the tuned mass damper is mounted to be operative along a plane normal to the backboard surface. In certain examples, the tuned mass damper comprises a moving mass arranged on a pair of flexures, such as but not limited to

leaf springs arranged on opposing sides of a conductor plate. The moving mass may include at least one magnet arranged in the moving mass. The moving mass optionally may include a pair of magnets arranged on opposing sides of a conductor plate.

- 5 Certain embodiments incorporate methods for arranging and using a tuned mass damper on a basketball goal assembly to dampen impact forces applied to the basketball goal assembly, thereby minimizing the time to return the basketball goal assembly to a static state.

- 10 Further forms, objects, features, aspects, benefits, advantages, and embodiments of the present invention will become apparent from a detailed description and drawings provided herewith.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of one embodiment of a representative basketball goal assembly and a tuned mass damper according to certain embodiments of the present disclosure.

5 FIG. 2 is a schematic diagram of a tuned mass damper.

FIG. 3 is a perspective view of one embodiment of a tuned mass damper usable in the embodiment of FIG. 1.

FIG. 4 is a side view of the tuned mass damper of FIG. 3.

FIG. 5 is a front view of the tuned mass damper of FIG. 3.

10 FIG. 6 is an exploded view of the tuned mass damper of FIG. 3.

FIG. 7A is a perspective view of a tuned mass damper mounted within a pole of a basketball goal assembly.

FIG. 7B is a perspective view of the embodiment of FIG. 7A with a cover.

15 FIG. 8 is a perspective view of a tuned mass damper mounted within a pole of a basketball goal assembly.

FIG. 9 is an exploded view of portions of an alternate embodiment of a tuned mass damper.

FIG. 10 is a magnetic flux diagram of the tuned mass damper of FIG. 3.

DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

For the purpose of promoting an understanding of the principles of the disclosure, reference will now be made to the embodiments illustrated in the drawings and specific language will be used to describe the same. It will
5 nevertheless be understood that no limitation of the scope is thereby intended. Any alterations and further modifications in the described embodiments, and any further applications of the principles of the disclosure as described herein are contemplated as would normally occur to one skilled in the art to which the disclosure relates.

10 With respect to the specification and claims, it should be noted that the singular forms “a”, “an”, “the”, and the like include plural referents unless expressly discussed otherwise. As an illustration, references to “a device” or “the device” include one or more of such devices and equivalents thereof. It also should be noted that directional terms, such as “up”, “down”, “top”, “bottom”, “front”,
15 “rear” and the like, are used herein solely for the convenience of the reader in order to aid in the reader’s understanding of the illustrated embodiments, and it is not the intent that the use of these directional terms in any manner limit the described, illustrated, and/or claimed features to a specific direction and/or orientation.

In some aspects, the present disclosure provides a damping apparatus such
20 as a tuned mass damper or “TMD” operatively attached or for attachment to a basketball goal assembly.

Embodiments of the disclosure will be described in detail with reference to a representative basketball goal assembly 1000 illustrated in FIG. 1. Specifically, various aspects of the disclosed embodiments will be discussed with reference to a
25 basketball goal assembly 1000 having a support such as a pole or post 1002 with a top end 1004 and a bottom end 1006. A backboard assembly having a backboard 1010 and a rim assembly 1012 attached thereto is coupled to the top end 1004 of the pole or post 1002. The height of the backboard 1010 and rim assembly 1012 may be adjustable relative to the pole 1002. The post 1002 is often perpendicular
30 to the support surface supporting the basketball goal assembly 1000. For example, some basketball goal assemblies have the post 1002 entering a hole in the ground or being bolted to a base in or on the ground. Other basketball goal assemblies

have the post 1002 being supported by a weighted base, such as a sand or water filled container. Sometimes the bases are portable and may have wheels attached thereto. Example backboard sizes may be 54", 60" or 72" and they may be adjustable in height to place the hoop as desired, for example within a range
5 between 7.5' and 10' above the playing surface.

Embodiments of the present disclosure also include basketball goal assemblies with slanted, segmented and/or curvilinear posts and basketball goal assemblies that are not mounted on a post. For example, some basketball goal assemblies are mounted on a wall and/or are suspended from a ceiling. As will be
10 apparent to one of ordinary skill in the art, different arrangements of basketball goal assemblies are contemplated by the inventor(s) of the present disclosure and the embodiments illustrated and described in the present disclosure may be modified for the various arrangements of basketball goal assemblies.

FIG. 1 illustrates representative basketball goal assembly 1000 with an
15 example embodiment of a tuned mass damper 10. Tuned mass damper 10 is mounted adjacent the upper end 1004 of pole 1002. A tuned mass damper or TMD, also known as a harmonic absorber, is typically a relatively small resonant system, including a mass, a spring and a damper or dashpot aspect. A tuned mass damper can be mounted to certain structures to reduce the amplitude and time of
20 the structure's natural vibration frequency as the structure returns to a static state after an external force is applied. The damper is tuned to a frequency so that it resonates out of phase with the structure's motion. Using a tuned mass damper can minimize and/or prevent discomfort, wear and tear, damage, and/or structural failure. Prior art applications of tuned mass dampers have often been in large
25 structures such as buildings or ships. When installed properly a tuned mass damper can draw away vibrational energy and dissipate it internally into heat, reducing the motion of the structure. A simple mechanical schematic of a tuned mass damper on a base structure is illustrated in FIG. 2. A tuned mass damper typically includes a mass (m), a spring with a spring constant (k) and damper
30 aspect (c).

In the present context, a tuned mass damper 10 is added to a basketball goal assembly 1000. External forces in this context, considered to be transient inputs,

include basketball impacts against the basketball backboard, rim or post or forces from a player grabbing and/or hanging on and then releasing the rim or otherwise impacting the basketball goal assembly. Fundamentally, a basketball goal assembly includes the mass of the backboard assembly mounted at the upper end of a vertical cantilever beam. Accordingly, the external forces cause the basic basketball goal assembly 1000 to vibrate/resonate for a period of time after an impact until the assembly returns to a normal, static state. It has been found that incorporating a tuned mass damper 10 into a basketball goal assembly can substantially accelerate the damping and efficiently reduce the time it takes for the basketball goal assembly to return to a normal static state.

An example tuned mass damper 10 usable with a basketball goal assembly is illustrated in detail in FIGS. 3-6. A TMD base or mounting block 20 can be used to mount the tuned mass damper 10 to the basketball goal assembly. In some embodiments, the tuned mass damper 10 can be mounted directly to the backboard and rim assembly. In alternate embodiments, the tuned mass damper 10 can be mounted adjacent an upper end of a supporting pole or post 1002. In certain example embodiments, the tuned mass damper, and specifically the moving mass (m), has a total mass of approximately ten pounds. In comparison, the mass ratio may be calculated considering an example basketball goal assembly of 225 pounds or more.

Extending upward from a base or mounting block 20 is a conductor plate 30. Conductor plate 30 is preferably formed of a magnetic conductor material such as copper or aluminum. In the illustrated embodiment plate 30 is a separate upper portion mounted via fasteners to a lower plate portion 34. Alternately plate 30 and lower plate portion 34 may be an integral, single piece. Still alternately, plate 30 may be secured within the system, typically in a fixed position, without directly extending from mounting block 20. As illustrated, the plane of plate 30 is normal to the plane of backboard 1010. An example plate thickness is within a range of approximately 0.1 – 0.3 inches, with a preferred thickness of approximately 0.2 inches.

Also extending upward from mounting block 20 is a pair of flexures such as leaf springs 40. Flexures 40 are formed as flexible metal plates, but alternate

flexure materials or structures can be used. Flexures 40 are arranged on opposing sides of plate 30 and are arranged to move or bend parallel to plate 30. Lower ends 42 of flexures 40 are secured to mounting block 20, for example with corresponding mounting brackets 24. Upper ends 44 of the flexures 40 are
5 respectively coupled to a movable mass.

The movable mass (m) as illustrated includes magnet blocks 50, magnets 52, ballast blocks 54, and top plate 60, as well as fasteners. The moving mass (m) forms an inverted pendulum and is arranged to extend over the top and across plate 30 and then downward with portions facing opposing faces of plate 30. A gap G is defined within the moving mass parallel to plate 30. Plate 30 is located within the
10 gap, without touching the moving mass. An example gap spacing is approximately 0.03 inches from either side of plate 30. The moving mass is arranged on flexures 40 to be allowed to move forward or rearward relative to plate 30 as the flexures 40 bend. Flexures 40 define a pivot axis adjacent lower ends 42. Flexures 40 are
15 typically perpendicular to plate 30, and aligned with the center of plate 30. The movement of the moving mass is within the limits defined by the radial length and degree of bending in flexures 40. Plate 30 may have an arcuately curved upper edge 32 to accommodate the radial movement of the moving mass (m). The moving mass is arranged with a single degree of freedom normal to the backboard.
20 The moving mass couples the flexures 40 together so that they are synchronized in their movement.

Optionally, bumper pads 65 can be arranged on plate 30. Bumper pads 65 limit the forward and rearward movement of the moving mass and correspondingly the flexures 40. In the illustrated embodiment, pairs of bumper pads 65 are
25 arranged on opposing sides of plate 30 adjacent the upper forward and upper rearward edges of plate 30. As illustrated, each pair of bumper pads includes one bumper pad with a protruding threaded shaft or bolt which extends through plate 30 and is received in a mated threaded fastener or nut in a corresponding bumper pad. Bumper pads 65 can be mounted in alternate ways, such as using different
30 fasteners, clamps, adhesive, material fusion, or welding, to name a few examples. Bumper pads 65 can be formed of rubber, plastic or another material. Preferably, yet optionally, the bumper material is resilient to absorb force and reduce noise.

Moving mass (m) includes a set of magnet blocks 50 and ballast blocks 54 arranged at the upper ends 44 of flexures 40. The blocks are arranged in an alternating pattern, with a ballast block arranged opposing a magnet block on opposing sides of plate 30, and also with a ballast block arranged opposing a magnet block on opposing side of each flexure 40. The magnet blocks 50 and ballast blocks 54 form symmetric subassemblies (s) on opposing sides of plate 30, with each subassembly (s) clamped to a respective flexure 40. Preferably the ballast blocks 54 are made of a material which has high magnetic permeability such as 1010 steel. In some embodiments, the magnet blocks 50 are also made from 1010 steel. Alternately, the magnet blocks 50 are made from a material which has relatively low magnetic permeability such as stainless steel. Magnet blocks 50 may each include an integrated or separate magnet housing.

Top plate 60 couples the subassemblies (s) together. Top plate 60 may be made from a non-magnetic material such as aluminum. The materials preferably are chosen to maximize containment of the magnetic flux within the circuit. Optionally, the material and size of top plate 60 can be chosen or changed to select a desired mass and therefore to tune the performance of the tuned mass damper.

At least one and more preferably a pair of magnets 52 are arranged within the moving mass (m). Specifically, a magnet 52 is arranged in each magnet block 50, and the magnets are offset from each other on opposing sides of plate 30. A face 53 of each magnet is arranged parallel to and facing a corresponding face 33 of plate 30 and is aligned with an opposing ballast block 54. In the illustrated embodiment, the magnetic poles are arranged perpendicular to plate 30. The magnetic poles are arranged to match, for example with the respective north poles of magnets 52 facing plate 30. An example magnet size is 0.75" in diameter by 0.5" long. Example magnets are neodymium iron boron magnets. In certain alternate embodiments, magnets can be mounted to a center plate or separately from the mass, and the moving mass dampens vibration by movement relative to the magnets.

There are various options for mounting a tuned mass damper 10 to a basketball goal assembly such as assembly 1000. In certain embodiments, the tuned mass damper is mounted adjacent an upper end 1004 of a support pole 1002.

In poles which are hollow and which have a sufficient internal diameter, the tuned mass damper 10 can be mounted internally to the pole, optionally with portions protruding upward from the pole, as illustrated in FIG. 7A. By way of example, an inside diameter of approximately five inches or larger may allow the mounting
5 block 20 and portions of conductor plate 30 and flexures 40 to be mounted internally to pole 1002. The moving mass and upper portion of plate 30 may protrude from the pole to allow a larger moving mass and flexure displacement range than may be available within the pole.

As illustrated in FIG. 7B, optionally, yet preferably, the upper end 1004 of
10 pole 1002 and the tuned mass damper 10 may be enclosed within a cover 72 or housing, which may include a portion 74 which extends forward or rearward to accommodate the displacement movement of the moving mass. Cover 72 may provide aesthetic aspects to conceal the tuned mass damper and may also protect the tuned mass damper and pole interior from outdoor weather or other ambient
15 conditions. Cover 72 may be plastic, metal or made of other materials as desired.

In alternate embodiments, the tuned mass damper 10 can be mounted externally to a pole 1002, optionally with portions protruding above the pole, as illustrated in FIG. 8. By way of example, a pole with an inside diameter of less than approximately five inches may require the mounting block 20 to be mounted
20 externally to pole 1002. Optionally a mounting bracket 26 can be used to support and help attach mounting block 20 to upper end 1004 of pole 1002. The moving mass and upper portion of plate 30 may protrude in height above the pole to allow a larger displacement range than may be available if the moving mass height overlaps with the upper end of the pole. Again optionally, a cover or housing may
25 be used to conceal and protect the tuned mass damper and upper pole end.

Portions of an alternate embodiment of a tuned mass damper 110 are illustrated in FIG. 9. The illustrated portion of tuned mass damper 110 includes a base or mounting block 120, a flexure 140 with a lower end 142 and an upper end 144 and a subassembly including a magnet block 150 and a ballast block 156. A
30 magnet 152 is mounted in magnet block 150 within a magnet housing 154. In the illustrated embodiment, the upper end 144 of flexure 140 defines at least one and optionally a pair of mounting slots 146. Fasteners extend through slots 146 to

connect magnet block 150 to ballast block 156 as a subassembly on opposing sides of flexure upper end 144. Slots 146 are arranged to have a vertical length, allowing the fasteners to be selectively placed in height within the range defined by slots 146. Accordingly, the subassembly can be selectively arranged in height and
5 adjusted to a desired height relative to flexure 140 within the defined range. Changing the mass height effectively changes the lever arm length of flexures 140, slightly changing the performance of the tuned mass damper. This allows the tuned mass damper 110 to be further tuned or customized. One base, flexure and subassembly portion of tuned mass damper 110 are shown for purposes of
10 illustration. A symmetric base, flexure and subassembly are arranged on the opposite side of a conductor plate and attached via a top plate, comparable to the arrangement of tuned mass damper 10.

An illustration of the magnetic flux circuit of tuned mass damper 10 is shown in FIG. 10. Specifically, the N poles of the magnets 52 are forwardly and
15 rearwardly offset on opposing sides of conductor plate 30. When an external force is applied to the basketball goal it causes a movement of the backboard assembly and pole and correspondingly imparts movement to the tuned mass damper 10. This causes the moving mass to begin to oscillate rearward and forward relative to plate 30. The mass is arranged as an inverted pendulum above the pivot point.
20 Correspondingly, the movement of the moving mass with magnets 52 creates a flux and eddy currents through conductor plate 30 and ballast blocks 54. The flux moving through the conductor plate 30 creates a drag force, which dissipates energy within the system, damping movement of basketball goal assembly 1000.

Specific advantages to magnetic damping include simple, robust
25 construction of the tuned damper, providing a large damping constant in a relatively compact device. Magnetic damping also provides linear viscous damping. Further, the operation of the magnets and the tuned mass damper efficiency is substantially temperature invariant.

Examples of alternate damping mechanisms which can be used in the
30 disclosed embodiments with appropriate modifications include liquid damping arrangements, wherein a fluid is allowed to travel within a defined pathway to absorb energy. An alternate damping mechanism can incorporate a mass

suspended between springs or a spring or within an elastic type of material, such as a mass suspended or encapsulated within a rubber piece or between rubber cables. In various alternate arrangements, the mass can be supported on rollers, sliders or as a hanging pendulum.

5 Certain embodiments of the present disclosure include methods for mounting a tuned mass damper on a basketball goal assembly. Broadly, the steps include providing a basketball backboard and rim assembly and optionally also providing a support pole to which the basketball backboard and rim assembly can be mounted. The steps include mounting a tuned mass damper assembly to the
10 basketball backboard and rim assembly. Optionally, this includes mounting the tuned mass damper adjacent the upper end of the support pole.

 The method may include mounting a base or mounting block to the basketball goal assembly directly or mounting it adjacent an upper end of a supporting pole. The method includes arranging a conductor plate, typically in a
15 fixed position, and arranging the plane of the plate normal to the plane of the backboard. Flexures are arranged on opposing sides of the conductor plate and are arranged to move or bend parallel to plate 30. A moving mass is coupled to the flexures. The movable mass is arranged to extend over the top and across the conductor plate and then downward with portions facing opposing faces of the
20 plate. The method allows the moving mass to move forward or rearward relative to the plate as the flexures bend. Optionally, movement of the moving mass can be limited by arranging bumper pads on the plate.

 The moving mass may be formed with a set of magnet blocks and ballast blocks, for example arranged in an alternating pattern, with a ballast block
25 arranged opposing a magnet block on opposing sides of the plate, and also with a ballast block arranged opposing a magnet block on opposing sides of each flexure. The magnet blocks and ballast blocks are configured as symmetric subassemblies on opposing sides of the plate, with each subassembly clamped to a respective flexure. The subassemblies are connected via a top plate.

30 The method includes arranging a pair of magnets within the moving mass, with a magnet arranged in each magnet block, and offsetting the magnets from each other on opposing sides of the plate. In certain methods, a face of each

magnet is arranged parallel to and facing a corresponding face of the plate and is aligned with an opposing ballast block. Optionally, the magnetic poles are arranged perpendicular to the plate.

There are various methods for mounting a tuned mass damper to a basketball goal assembly. In certain embodiments, the tuned mass damper is mounted adjacent an upper end of a support pole. In some methods, the tuned mass damper can be mounted internally to the pole, optionally with portions placed to protrude upward from the pole. In certain alternate methods, the tuned mass damper can be mounted externally to a pole and optionally placed with portions protruding above the pole. Optionally, in certain methods, the damper can be tuned by selectively arranging the subassemblies in height relative to the flexures within a defined range.

Once the tuned mass damper is arranged on a basketball goal assembly, with or without a pole, the method includes dissipating energy when an impact force strikes the basketball goal assembly by allowing the moving mass to oscillate forward and rearward on the flexures relative to the conductor plate. The method includes operatively mounting the oscillating mass to create a magnetic flux and correspondingly a drag force to damp movement of the basketball goal assembly.

Case Studies

Testing has found that adding a tuned mass damper to a basketball goal assembly can substantially decrease the median time for the goal assembly to return to a static state after an impact. The goal assemblies tested were based on illustrated basketball goal assembly 1000, with a fixed external force applied to the rim assembly.

Backboard/ Height	Median Undamped End Time (sec)	Median Damped End Time (sec)	Effectiveness
54" backboard at 10'height	25.5	7.0	72%
54" backboard at 9'height	31.6	4.5	86%
54" backboard at 8'height	31.5	4.3	86%
72" backboard at 10'height	11.0	6.2	44%
72" backboard at 9'height	12.9	4.7	64%

72" backboard at 8' height	10.8	5.7	48%
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Appropriate fasteners and fitting are used to assemble and connect the basketball goal assembly and tuned mass dampers disclosed herein, as would be understood by those of skill in the art. For ease of illustration, the fasteners and fittings have not been described and illustrated in complete detail.

The following numbered clauses set out specific embodiments that may be useful in understanding the present invention:

1. A basketball goal assembly, comprising,
 - a basketball backboard and rim assembly; and,
 - a tuned mass damper operatively mounted to said backboard and rim assembly to dampen vibration of said assembly.
2. The basketball goal assembly of clause 1, comprising, a pole having an upper end and a base end, wherein said pole supports said backboard and rim assembly above a support surface, and wherein said tuned mass damper is mounted to said pole.
3. The basketball goal assembly of clause 2, wherein said tuned mass damper is mounted adjacent said upper end of said pole.
4. The basketball goal assembly of clause 3, wherein said tuned mass damper is mounted within said upper end of said pole.
5. The basketball goal assembly of clause 3, wherein said tuned mass damper is mounted outside said upper end of said pole.
6. The basketball goal assembly as in any one of clauses 1-5, wherein said basketball backboard defines a planar backboard surface and said tuned mass damper is mounted to be operative along a plane normal to said backboard surface.
7. The basketball goal assembly as in any one of clauses 1-6, wherein said tuned mass damper uses magnetic damping.
8. The basketball goal assembly as in any of clauses 1-7, wherein said tuned mass damper comprises a moving mass arranged on a pair of flexures.
9. The basketball goal assembly of clause 8, wherein said flexures are leaf springs.

10. The basketball goal assembly of clause 8, wherein said pair of flexures are arranged on opposing sides of a conductor plate.
11. The basketball goal assembly of any one of clauses 8-10, wherein said tuned mass damper comprises at least one magnet arranged in said moving mass.
- 5 12. The basketball goal assembly of any one of clauses 8-11, wherein said tuned mass damper comprises a conductor plate, and stops arranged on said conductor plate limit the travel of said moving mass.
13. The basketball goal assembly of any one of clauses 8-12, wherein the height of said moving mass on said flexures is adjustable.
- 10 14. The basketball goal assembly of any one of clauses 8-13, wherein said moving mass is comprised of a pair of subassemblies arranged on opposing sides of a conductor plate and connected by a top plate.
15. The basketball goal assembly as in any one of clauses 1-14, wherein said tuned mass damper comprises a conductor plate and a pair of magnets arranged on
15 opposing sides of said conductor plate.
16. The basketball goal assembly of clause 15, wherein said pair of magnets are laterally offset from each other.
17. A basketball goal assembly, comprising,
a basketball backboard and rim assembly; and,
20 a tuned mass damper operatively mounted to said backboard and rim assembly to dampen vibration of said assembly;
wherein said tuned mass damper includes
a conductor plate arranged normal to the plane of said basketball
backboard;
25 a pair of flexures arranged on opposing sides of said conductor plate; and
a moving mass extending over said conductor plate and mounted to said pair of flexures to form an inverted pendulum.
18. The basketball goal assembly of clause 17 wherein said moving mass
30 comprises a pair of magnets arranged on opposing sides of said conductor plate, wherein the magnets are laterally offset from each other.

19. The basketball goal assembly of any one of clauses 17 or 18, wherein said pair of flexures comprise leaf springs.

20. The basketball goal assembly of any one of clauses 17-19, wherein said moving mass comprises a pair of symmetric subassemblies on opposing sides of said conductor plate, wherein each subassembly includes a magnet block with a magnet and a ballast block.

21. A method, comprising,
providing a basketball backboard and rim assembly; and,
operatively mounting a tuned mass damper to said backboard and rim assembly to dampen vibration of said assembly.

22. The method of clause 21, comprising mounting said tuned mass damper to a pole supporting said backboard and rim assembly above a support surface.

23. The method as in any one of clauses 21-22, comprising mounting said tuned mass damper to be operative along a plane normal to said backboard surface.

24. The method as in any one of clauses 21-23, comprising arranging at least one magnet within said said tuned mass damper.

25. The method as in any one of clauses 21-24, comprising arranging a moving mass on a pair of flexures within said said tuned mass damper.

26. The method as in any one of clauses 25, comprised arranging a pair of subassemblies arranged on opposing sides of a conductor plate and connected by a top plate within said moving mass.

27. The method as in any one of clauses 21-26, comprising arranging a pair of magnets on opposing sides of a conductor plate within said tuned mass damper

While at least one embodiment has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that preferred embodiments have been shown and described and that all changes, equivalents, and modifications that come within the spirit of the following claims are desired to be protected. It will be evident from the specification that aspects or features discussed in one context or embodiment will be applicable in other contexts or embodiments. All publications, patents, and patent applications cited in this specification are herein incorporated by reference as if each individual publication,

patent, or patent application were specifically and individually indicated to be incorporated by reference and set forth in its entirety herein.

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CLAIMS

What is claimed is:

1. A basketball goal assembly, comprising,
a basketball backboard and rim assembly; and,
5 a tuned mass damper operatively mounted to said backboard and rim
assembly to dampen vibration of said assembly.
2. The basketball goal assembly of claim 1, comprising, a pole having an
upper end and a base end, wherein said pole supports said backboard and rim
10 assembly above a support surface, and wherein said tuned mass damper is mounted
to said pole.
3. The basketball goal assembly of claim 2, wherein said tuned mass damper
is mounted adjacent said upper end of said pole.
15
4. The basketball goal assembly of claim 3, wherein said tuned mass damper
is mounted within said upper end of said pole.
5. The basketball goal assembly of claim 3, wherein said tuned mass damper
20 is mounted to the exterior of said upper end of said pole.
6. The basketball goal assembly of any one of claims 1-5, wherein said
basketball backboard defines a planar backboard surface and said tuned mass
damper is mounted to be operative along a plane normal to said backboard surface.
25
7. The basketball goal assembly of any one of claims 1-5, wherein said tuned
mass damper uses magnetic damping.
8. The basketball goal assembly of any one of claims 1-5, wherein said tuned
30 mass damper comprises a moving mass arranged on a pair of flexures.

9. The basketball goal assembly of claim 8, wherein said tuned mass damper comprises at least one magnet arranged in said moving mass.

10. The basketball goal assembly of claim 9, wherein said tuned mass damper
5 comprises a conductor plate and a pair of magnets arranged on opposing sides of said conductor plate.

11. The basketball goal assembly of claim 9, wherein said pair of magnets are laterally offset from each other.

10

12. The basketball goal assembly of claim 8, wherein said flexures are leaf springs.

13. The basketball goal assembly of claim 8, wherein said pair of flexures are
15 arranged on opposing sides of a conductor plate.

14. The basketball goal assembly of claim 8, wherein said moving mass is comprised of a pair of subassemblies arranged on opposing sides of a conductor plate and connected by a top plate.

20

15. The basketball goal assembly of claim 8, wherein said tuned mass damper comprises a conductor plate, and stops arranged on said conductor plate limit the travel of said moving mass.

25 16. The basketball goal assembly of claim 8, wherein the height of said moving mass on said flexures is adjustable.

30

17. A basketball goal assembly, comprising,
a basketball backboard and rim assembly; and,
a tuned mass damper operatively mounted to said backboard and rim
assembly to dampen vibration of said assembly;
5 wherein said tuned mass damper includes
a conductor plate arranged normal to the plane of said basketball
backboard;
a pair of flexures arranged on opposing sides of said conductor
plate; and
10 a moving mass extending over said conductor plate and mounted to
said pair of flexures to form an inverted pendulum.
18. The basketball goal assembly of claim 17 wherein said moving mass
comprises a pair of magnets arranged on opposing sides of said conductor plate,
15 wherein the magnets are laterally offset from each other.
19. The basketball goal assembly of any one of claims 17-18, wherein said pair
of flexures comprise leaf springs.
20. The basketball goal assembly of any one of claims 17-19, wherein said
moving mass comprises a pair of symmetric subassemblies on opposing sides of
said conductor plate, wherein each subassembly includes a magnet block with a
magnet and a ballast block.

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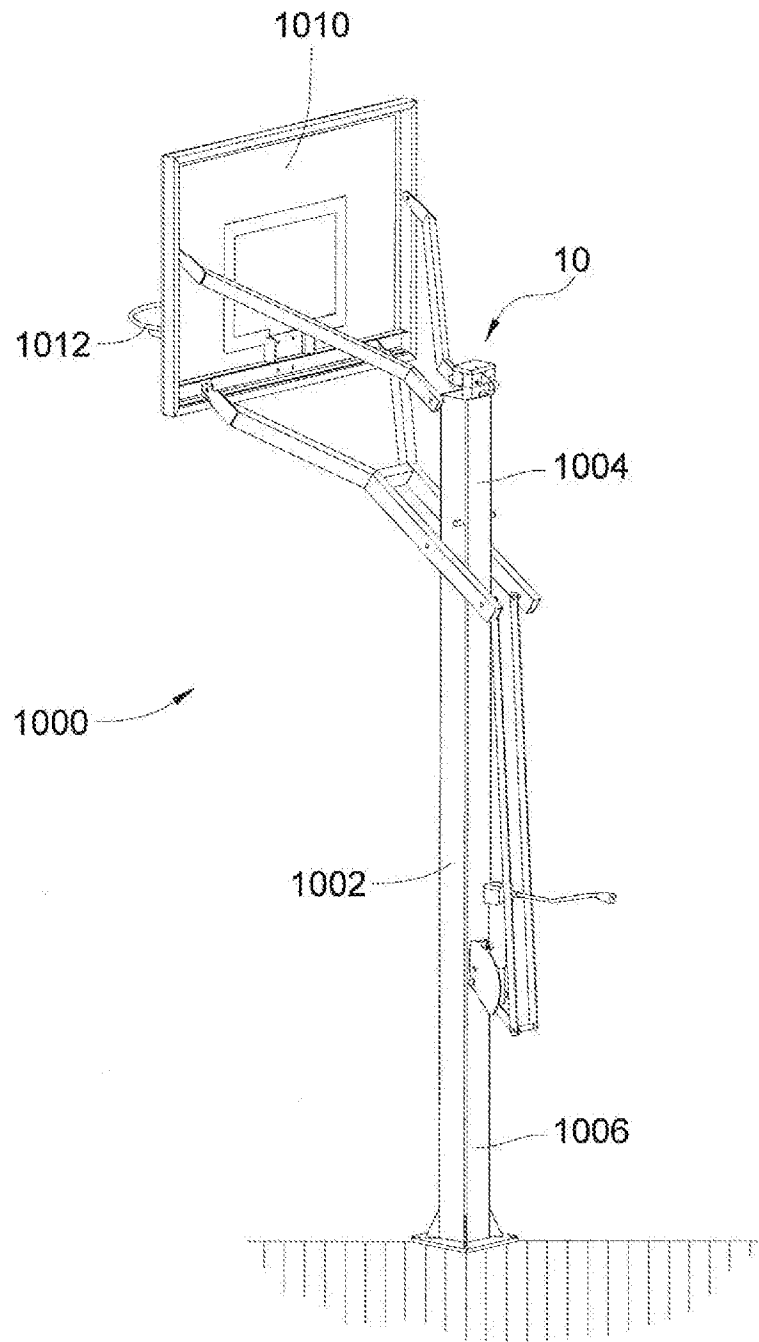
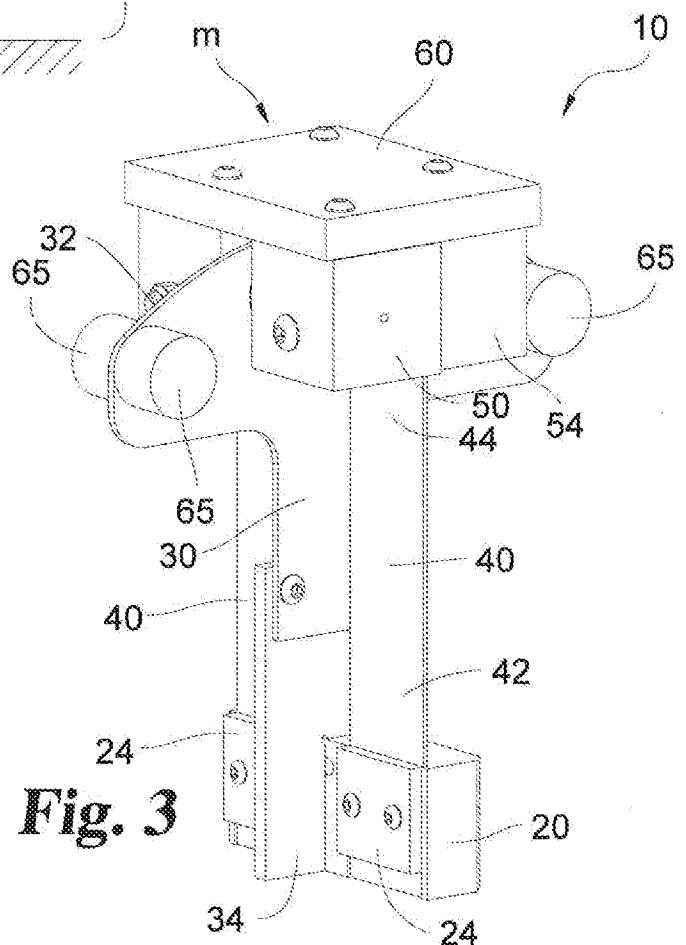
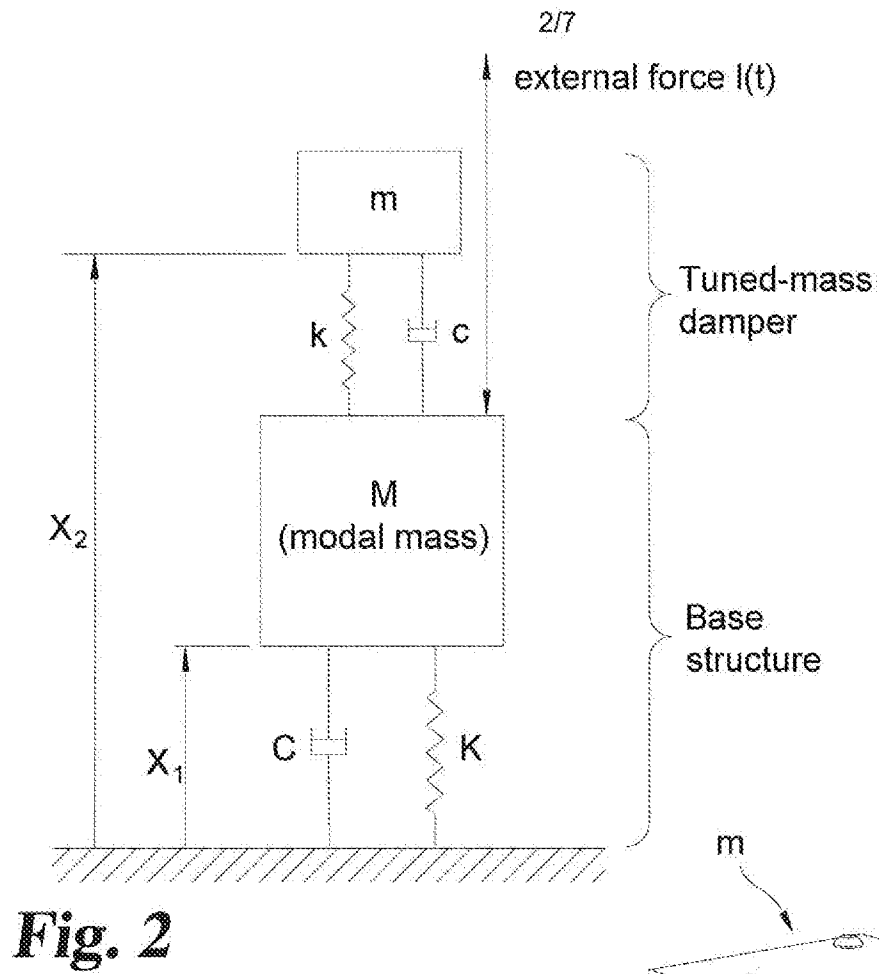


Fig. 1



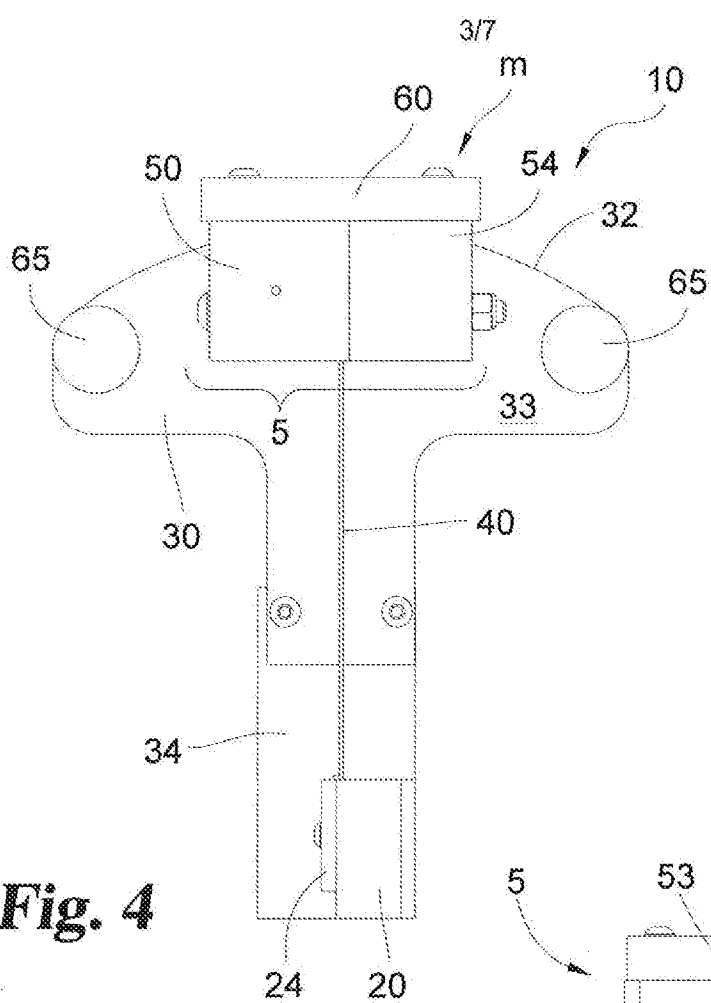


Fig. 4

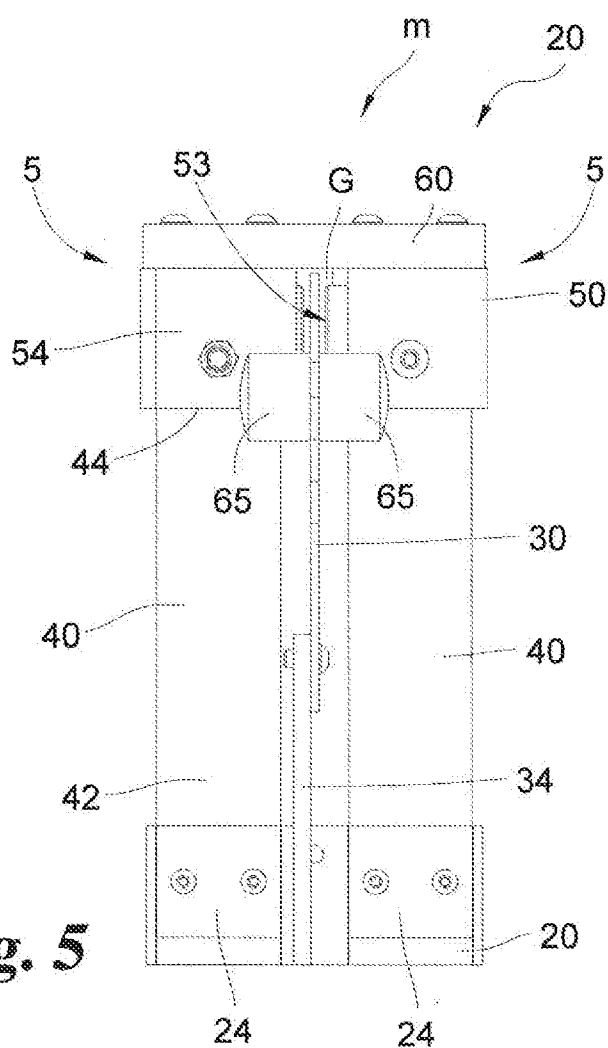


Fig. 5

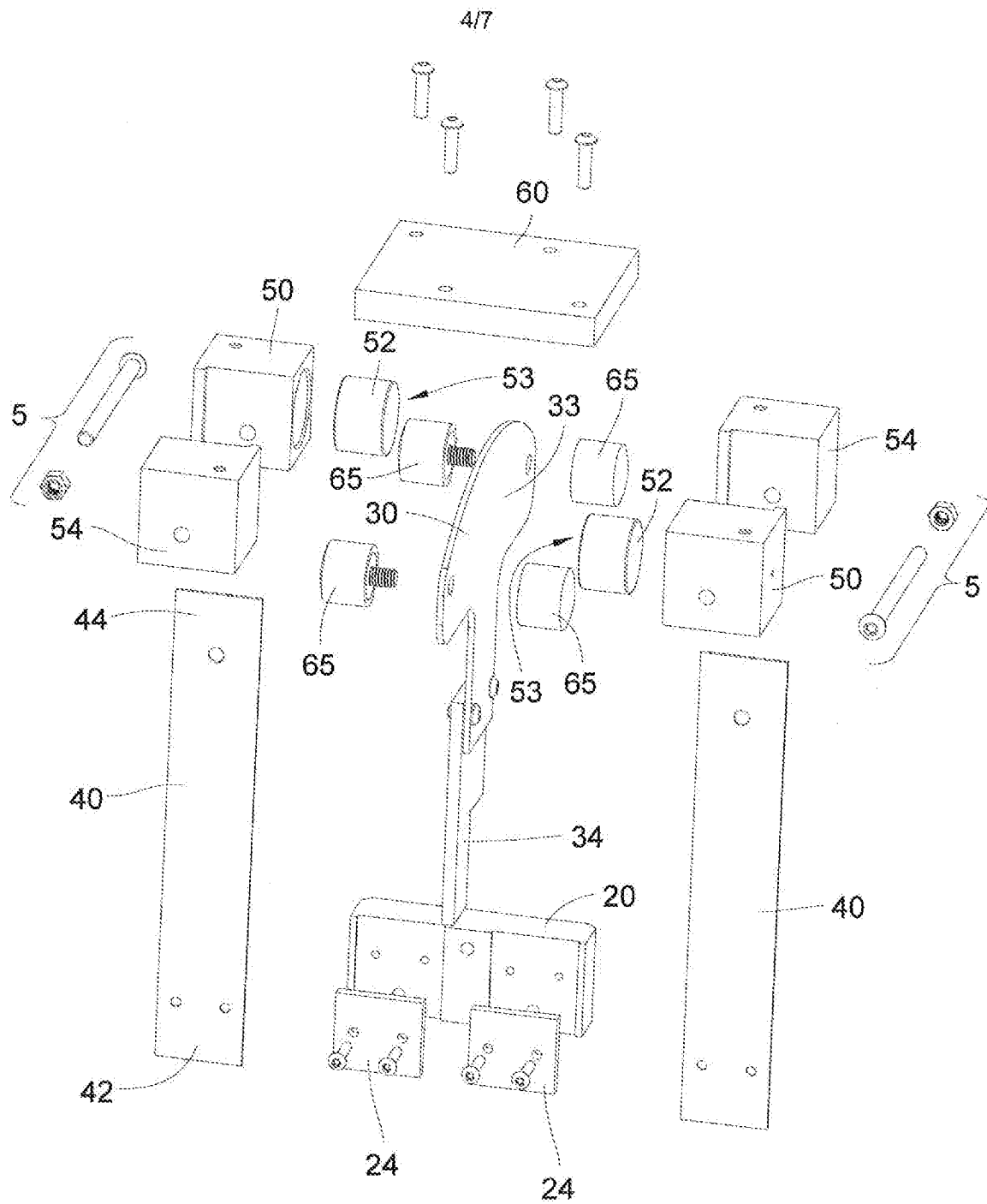


Fig. 6

Fig. 7A

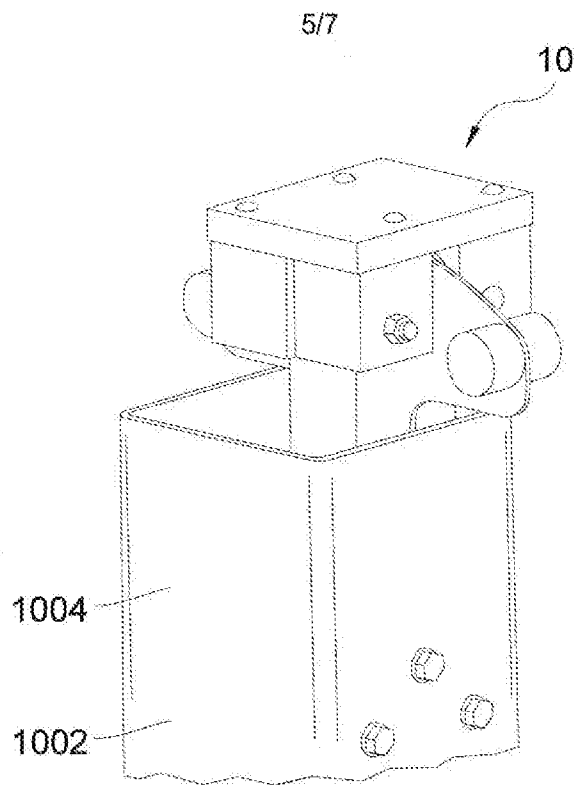


Fig. 7B

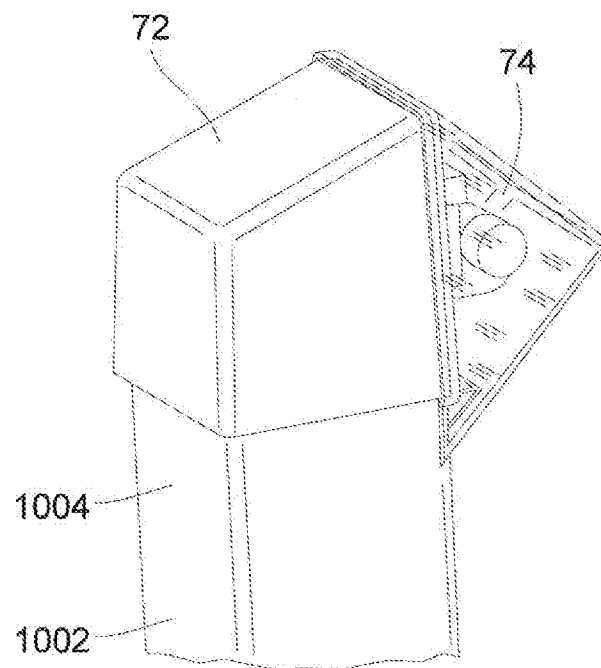


Fig. 8

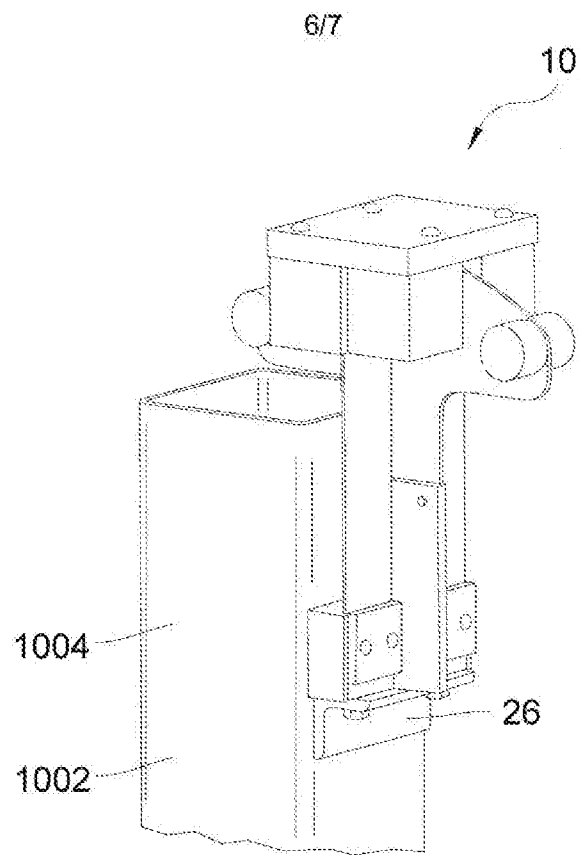


Fig. 9

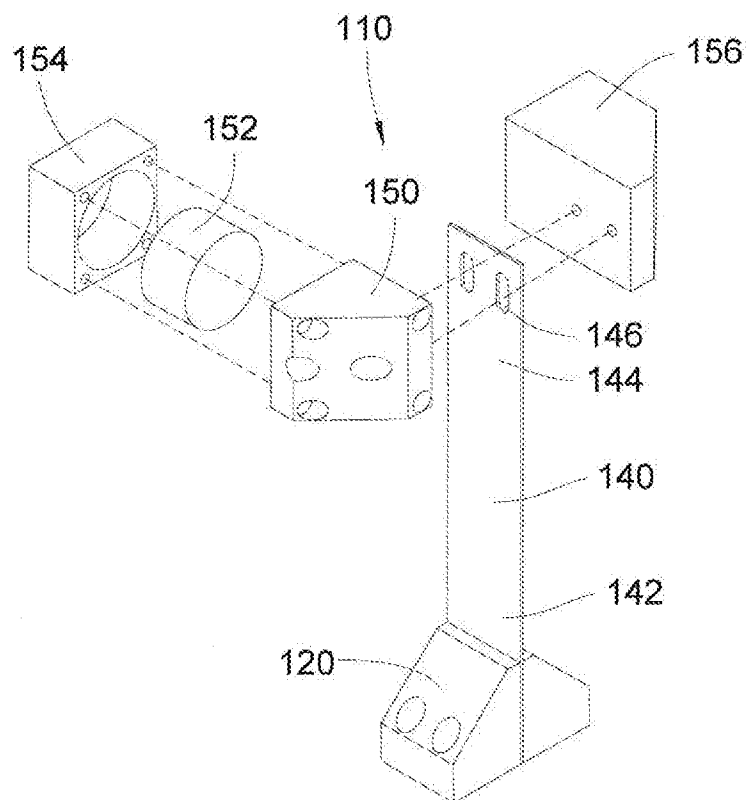
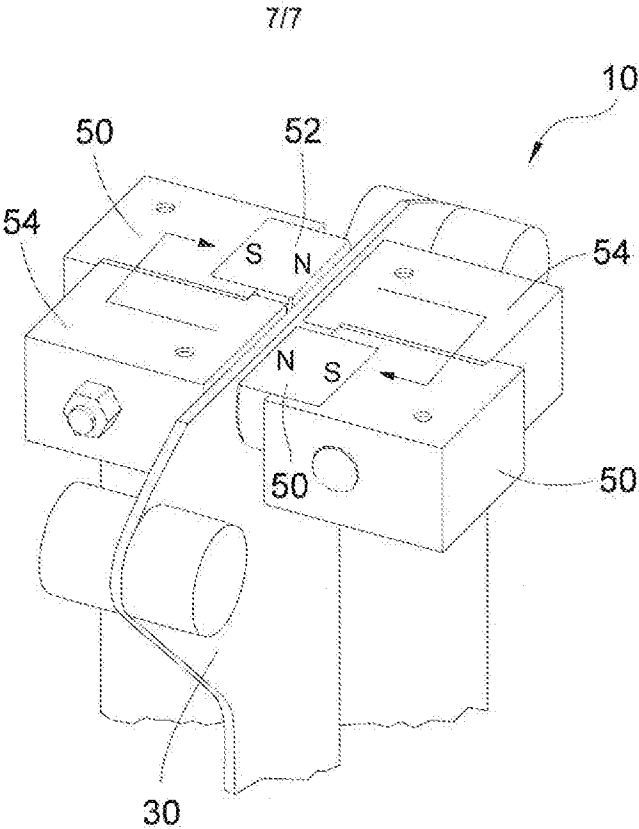


Fig. 10



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/065501**A. CLASSIFICATION OF SUBJECT MATTER****A63B 63/00(2006.01)i, A63B 63/08(2006.01)i, A63B 63/04(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A63B 63/00; A63F 9/24; F16F 7/10; A63B 63/08; A63B 63/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: basketball goal, damper, force, magnetic, flexure

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2007-0131504 A1 (BRONOWICKI et al.) 14 June 2007 See abstract; paragraphs [0003], [0023]; and figures 1-7.	1-19
Y	US 7892118 B1 (KENLEY) 22 February 2011 See abstract; column 5; and figures 1-3.	1-19
A	US 2010-0029390 A1 (WEI) 04 February 2010 See the whole document.	1-19
A	US 5456459 A (GORMAN) 10 October 1995 See the whole document.	1-19
A	US 2013-0143697 A1 (QUINN) 06 June 2013 See the whole document.	1-19



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

06 September 2016 (06.09.2016)

Date of mailing of the international search report

07 September 2016 (07.09.2016)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/065501

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☒ Claims Nos.: 20
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of any additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2015/065501

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007-0131504 A1	14/06/2007	None	
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		US 8371965 B2	12/02/2013
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