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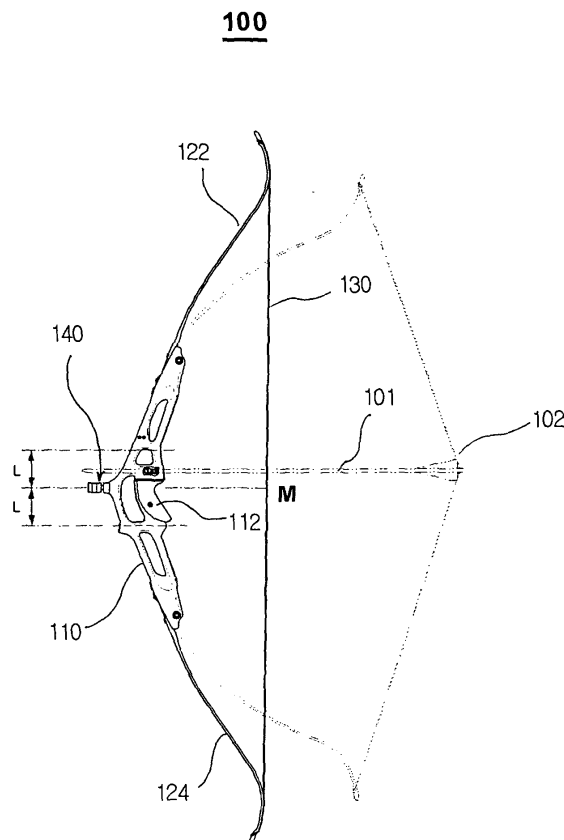
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(54) **Vibration damper for an archery bow**

(57) The present invention relates to a bow (100) capable of mitigating a bad motion occurring in an initial stage of an arrow shooting. A bow (100) according to the present invention comprises a handle (110) gripped by a user's hand; upper (122) and lower (124) limbs respectively coupled to upper and lower portions of the handle; a string (130) having ends coupled to the upper and lower limbs; and a vibration damping means (140) coupled to the handle (110), wherein the vibration damping means (140) is installed within a ± 7 cm distance range in the up-down direction from a distance center point of the handle (110) with the upper and lower limbs (122, 124) coupled thereto and positioned on a front surface of a grip portion of the handle (110).

FIG 2



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a bow removing a torque occurring in an initial stage of an arrow shooting, and more particularly, to a damper capable of removing an initial torque occurring when an arrow leaves a bow-string and a bow having the damper installed thereto.

2. Description of the Related Art

[0002] Generally, as illustrated in FIG. 1, a bow includes a handle which a user grips by his/her hand, limbs coupled to upper and lower portions of the handle, and a string having ends fixed to the upper and lower limbs. In a state where a user fits an arrow onto the string and pulls the arrow to his/her body with full force, when the user instantly releases the arrow toward a front target, the bow makes the arrow fly toward the target by elastic force of the string.

[0003] The archery, which is one of the sports, has been well-known as a sport game requiring very high concentration. In a state where a user fits the arrow onto the string and pulls the arrow with full force, when the user aims the arrow at the front target, he/she trembles the handle of the bow due to many reasons, or is not able to precisely aim the arrow due to mental uneasiness. In order to reduce such a side effect, a stabilizer is coupled to the front of the handle at a position lower than the center of the bow.

[0004] The stabilizer (or balance bar) is generally coupled to a portion lower than a central portion of the handle to thereby maintain total balance of the bow and remove a bad motion occurring after the arrow shooting. The stabilizer is coupled to a portion lower than a grip portion of the handle, so that the gravity center of the bow is formed lower than the grip portion of the handle, which makes the user relaxed after the arrow shooting.

[0005] In addition, the stabilizer serves to lessen still motions such as arrow shaking by wind, unnatural grip, slight muscular trembling and the like in a pre-shooting state where the user pulls the arrow back and balances the force, and also serves to rapidly remove stress applied to the overall bow after the arrow shooting. Particularly, after the user shoots the arrow, while the arrow flies from the bow to the target, the user feels the largest vibration (i.e., post vibration). It has been confirmed that the stabilizer efficiently absorbs a shock of the handle caused by the post vibration.

[0006] Although the stabilizer is coupled to a position lower than the central portion of the handle in order to give stability to the bow and protrudes to the front of the bow by a considerable length, the stabilizer has a limitation in that it absorbs vibration after the arrow is shot, i.e., after the arrow leaves a body (handle) of the bow.

[0007] Meanwhile, precise shooting of an arrow to a target is dependent upon how stable the user can maintain the handle for an extremely short moment (t_2-t_1) from a time t_1 when the user aims the arrow at the target and shoots the arrow to a time t_2 when the arrow leaves the string and its rear feather passes through an arrow holder formed over the grip portion of the handle. Here, it is important to minimize the influence on the arrow when the arrow leaving the string heads for the target.

[0008] However, no prior art has suggested means for removing or mitigating a torque which has been introduced as a bad motion occurring until the feather of the arrow leaves the grip portion of the bow after the arrow leaves the string.

SUMMARY OF THE INVENTION

[0009] Accordingly, an object of the present invention is to provide a bow capable of removing or mitigating a torque occurring until an arrow leaves a string and its feather leaves a grip portion of the bow after a user shoots the arrow.

[0010] In addition, another object of the present invention is to provide a vibration damping means suitable to remove or mitigate a torque occurring until an arrow leaves a string and its feather leaves a grip portion of the bow after a user shoots the arrow.

[0011] A bow according to the present invention comprises a handle gripped by a user's hand; upper and lower limbs respectively coupled to upper and lower portions of the handle; a string having ends coupled to the upper and lower limbs; and a vibration damping means coupled to the handle, wherein the vibration damping means is positioned at a central portion of the handle with the upper and lower limbs coupled thereto and positioned on a front surface of a grip portion of the handle.

[0012] In the present invention, the central portion of the handle is a ± 7 cm distance range L from a distance center point M between the upper and lower limbs coupled to the handle in the up-down direction thereof. Generally, in the most bows, the grip portion of the handle exists at the distance center point M between the upper and lower limbs. However, taking various types of bows into consideration, the grip portion of the handle may not be positioned in the center of the handle. In addition, since various types of stabilizers are coupled to the most bows, it is preferable to select an optimum coupling position in the up-down 7 cm range from the distance center point M in consideration of the shape of the bow and the various stabilizers rather than to precisely couple the damper according to the present invention to the distance center point M between the upper and lower limbs.

[0013] In the present invention, the vibration damping means comprises a fixing portion coupled and fixed to a body of the handle; a vibration absorption portion mounted in the fixing portion to receive vibration occurring in the handle, transfer the vibration to the outside, and absorb and mitigate some of the vibration; a coupling portion

including the vibration absorption portion therein and coupled to the fixing portion; and a weight coupled to the vibration absorption portion.

[0014] According to a preferred aspect of the present invention, in the vibration damping means, the vibration absorption portion may comprise a vibration transfer portion mounted in the fixing portion to receive vibration occurring in the handle and transfer the vibration to the outside; and an elastic portion for absorbing the vibration of the vibration transfer portion to mitigate the vibration.

[0015] In the present invention, the elastic portion preferably comprises a horizontal elastic absorption portion for absorbing and mitigating front-rear vibration of the vibration transfer portion, and a peripheral elastic absorption portion for absorbing up-down-left-right vibration of the vibration transfer portion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

FIG. 1 is a schematic view of a conventional bow; FIG. 2 is a schematic view of a bow according to the present invention;

FIGS. 3a and 3b are a schematic side view and a schematic perspective view of the bow according to the present invention, showing the flow of vibration transferred when shooting an arrow;

FIGS. 4a and 4b are a side view and an exploded view illustrating a preferred embodiment of a vibration damping means according to the present invention;

FIG. 5 is a view illustrating another preferred embodiment of the vibration damping means according to the present invention;

FIGS. 6a to 6c are photographs of equipment by which Example 1 of the present invention is implemented;

FIG. 7 is a graph of measurement data of Example 1 and Comparative Example 1;

FIG. 8 is a photograph of a position, at which an indicator for indicating a left-right vibration is coupled to a handle, when Example 1 and Comparative Example 1 are implemented; and

FIGS. 9a and 9b are photographs of experimental states of Example 2 and Comparative Example 2 from the front, respectively, and graphs of the acquired data.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0017] Hereinafter, the present invention will be described in more detail with reference to the accompanying drawings. The accompanying drawings are only to fully explain the technical spirits of the present invention, and thus the technical spirits of the present invention are not limited thereto.

[0018] FIG. 2 is a schematic view of a bow according

to the present invention, and FIGS. 3a and 3b are a side view and a perspective view showing the flow of vibration transferred at the time of shooting an arrow 101.

[0019] A bow 100 according to the present invention includes a handle 110 which a user grips by his/her hand. The handle 110 is generally made of wood, magnesium, aluminum or carbon. The handle 110 includes a grip portion 112 which the user grips by his/her hand in order to grip the bow 100. A stabilizer 105 for maintaining stability of the bow may be coupled to the handle 110. The bow 100 includes upper and lower limbs 122 and 124 respectively coupled to upper and lower portions of the handle 110. The upper and lower limbs 122 and 124 are formed of a material with strong elasticity, and a string 130 is coupled therebetween. In a state where the user fits the arrow 101 onto the string 130 and pulls the arrow 101 back with full force, when the user releases the arrow 101, the upper and lower limbs 122 and 124 return to their original positions, the string 130 intensely bounces to the front by the returning force and causes the arrow 101 to be shot toward a target by the bouncing force.

[0020] The bow 100 according to the present invention includes a vibration damping means 140 coupled to the handle 110.

[0021] According to the present invention, the vibration damping means 140 is positioned in a ± 7 cm range from a distance center point M between the upper and lower limbs 122 and 124 coupled in the up-down direction of the handle 110, and positioned in front of the grip portion 112 of the handle 110.

[0022] In the present invention, the reason for coupling the vibration damping means 140 to the central portion of the handle 110 is as follows.

[0023] After the user fits the arrow 101 onto the string 130 and pulls the arrow 101 and the string 130 back with full force, when the user aims the arrow 101 at a certain target and releases the arrow 101, the arrow 101 leaves the string 130 and flies fast toward the target. Here, it can be presumed that three types of forces are applied from the time when the arrow 101 leaves the string 130 to the time when a feather 102 attached to the rear of the arrow 101 passes through the grip portion 112 of the handle 110.

[0024] The first force is an adverse influence caused by impulsive forces applied to the upper and lower limbs 122 and 124 at the time of shooting the arrow 101. When the upper and lower limbs 122 and 124 return to their original positions, the respective limbs 122 and 124 are given a considerable shock by the returning force. The respective impulsive forces occurring in the upper and lower limbs 122 and 124 are transferred to respective body portions of the respective limbs 122 and 124 through ends thereof, then transferred to the upper and lower portions of the handle 110, and finally meet at the central portion of the handle 110. In case of a general bow, the respective impulsive forces meeting at the central portion of the handle 110 cause a bad motion before the arrow 101 passes through the grip portion 112 of the

handle 110, and such a bad motion has a detrimental effect on a proceeding direction of the arrow 101.

[0025] The second force is an adverse influence caused by impulsive force applied to the string 130 at the time of shooting the arrow. When the upper and lower limbs 122 and 124 return to their original positions, the string 130 instantly bounces to the front by the returning force, so that the arrow 101 is shot to the front by the bouncing force. However, when the string 130 shoots the arrow, since the arrow 101 is in a still state, the arrow 101, i.e., the still obstacle, instantly disturbs a route of the string 130. Thus, the string 130 is given left-right direction force, thereby causing a slight shaking motion in the left-right direction. Such a shaking motion is transferred to the handle 110 through the upper and lower limbs 122 and 124 and finally concentrates at the central portion of the handle 110.

[0026] The third force is an adverse influence caused by impulsive force applied to the arrow 101 itself at the time of shooting the arrow 101. When the string 130 instantly bounces, since the arrow 101 is generally in a still state, the feather portion 102 at a rear portion of the arrow 101 is instantly given a shock and the impulsive force is gradually transferred to a front portion of the arrow 101, so that the arrow 101 flies to the front. Here, the arrow 101 passes through the handle 110, while being instantly slightly bent and straightened. During this process, it has a detrimental effect on the handle 110. A portion through which the arrow 101 passes is a portion just above the grip portion 112, which corresponds to the central portion of the handle 110.

[0027] As described above, in the present invention, when the arrow 101 is shot, the handle 110 is under the adverse influences caused by at least three types of impulsive forces. Since these adverse influences are concentrated on the central portion of the handle 110, in order to rapidly remove or mitigate the adverse influences, the vibration damping means 140 is coupled to the central portion of the handle 110.

[0028] In the present invention, the vibration damping means 140 is coupled within the ± 7 cm distance L range from the center point M between the upper and lower limbs 122 and 124 coupled to the handle 110 in the up-down direction thereof. Generally, the most bows are designed so that the grip portion 112 of the handle 110 may exist in a position of the distance center point M between the upper and lower limbs 122 and 124 and the arrow 101 may rapidly pass over the grip portion 112 of the handle. Therefore, the vibration damping means 140 may be installed in a position of the grip portion 112. However, taking various types of bows into consideration, the grip portion 112 of the handle 110 may not exist in an exact center of the handle 110. In this case, a coupling position of the vibration damping means 140 may be different from a position of the grip portion 112. Accordingly, in the present invention, the coupling position of the vibration damping means 140 is set in an optimum point within the ± 7 cm distance L range in the up-down direction not

from the grip portion 112 but from the distance center point M between the upper and lower limbs 122 and 124.

[0029] Also, in the present invention, the vibration damping means 140 is coupled to the front surface of the grip portion 112 of the handle 110. When the vibration damping means 140 is positioned at the front surface portion of the handle 110, it is hidden from the user's view by the body of the handle 110. In a case where an archer aims an arrow at a target, since the vibration damping means 140 is hidden from his/her view, the archer can display more concentration.

[0030] In addition, the present invention provides the vibration damping means 140 suitable for removing the initial bad motion occurring in the handle of the bow at the time of shooting an arrow.

[0031] FIGS. 4a and 4b are a side view and an exploded view illustrating a preferred embodiment of the vibration damping means 140 according to the present invention, respectively, and FIG. 5 is an exemplary view illustrating another preferred embodiment of the vibration damping means 140 according to the present invention.

[0032] The vibration damping means 140 according to the present invention includes a fixing portion 142 coupled and fixed to the body of the handle 110. Since the fixing portion 142, which is a portion coupled to the body of the handle 110, is to transfer to another member a bad motion occurring in the handle 110 or transferred from the outside to the handle 110, a coupling configuration thereof is not specially limited. For example, a groove is formed in the body of the handle 110 and then the fixing portion 142 is inserted into the groove, or the fixing portion 142 adheres to the body of the handle 110 by an adhesive or is threadably engaged thereto.

[0033] The vibration damping means 140 according to the present invention includes a vibration absorption portion 144 mounted in the fixing portion 142. The vibration absorption portion 144 serves to receive the vibration or bad motion transferred from the handle 110 through the fixing portion 142, transfer some of the vibration or bad motion to the outside, and absorb and mitigate some of the vibration or bad motion. To this end, the vibration absorption portion 144 may be formed of a material capable of absorbing vibration by itself. More specifically, the vibration absorption portion 144 may be made of an elastic metal, and more preferably comprise a spring.

[0034] According to a preferred embodiment of the present invention, the vibration absorption portion 144 of the vibration damping means 140 is composed of a vibration transfer portion 143 mounted in the fixing portion 142 and an elastic portion 145 for absorbing vibration of the vibration transfer portion 143 to mitigate the vibration. The vibration transfer portion 143 serves to receive the vibration or bad motion occurring in the handle 110 and transfer it to the outside.

[0035] Moreover, in the present invention, preferably, the elastic portion 145 includes a horizontal elastic absorption portion 145a for absorbing and mitigating a front-rear vibration of the vibration transfer portion 143, and a

peripheral elastic absorption portion 145b for absorbing an up-down-left-right vibration of the vibration transfer portion 143. The horizontal elastic absorption portion 145a is preferably formed of an elastic body such as a spring, rubber, urethane, silicone, or the like, more preferably, in the shape of a spherical silicone ball. Also, the peripheral elastic absorption portion 145b is preferably formed of an elastic body such as a rubber, urethane, silicone, or the like, and in the shape of a donut surrounding the vibration transfer portion 143.

[0036] The vibration damping means 140 according to the present invention includes a coupling portion 146 having the vibration absorption portion 144 provided therein. The coupling portion 146 mounts the vibration absorption portion 144 therein, protects the vibration absorption portion 144 from the outside, and prevents the vibration absorption portion 144 from escaping to the outside. To this end, it is preferable to couple the coupling portion 146 to the fixing portion 142. Although a coupling method thereof is not specially limited, a threadably engaging manner is preferably used to firmly couple them.

[0037] The vibration damping means 140 according to the present invention includes a weight 148 coupled to the vibration absorption portion 144. The weight 148 is used to remove a bad motion best, with its weight changed according to a kind of a bow, a physique of an archer, or a shooting style of an archer. The weight 148 is coupled to the vibration absorption portion 144 and receives vibration therefrom, so that it may move mainly in the front-rear direction and move in the up-down-left-right direction according to a kind of the vibration. Here, the weight 148 moves relative to the handle 110 due to the law of action and reaction, the law of inertia and the like, and offsets some of the vibration and the torque (bad motion) during this process. That is, while the weight 148 performs the relative motion, the horizontal elastic absorption portion 145a absorbs the front-rear direction vibration or bad motion, and the peripheral elastic absorption portion 145b absorbs the up-down-left-right direction vibration or bad motion.

[0038] As set forth above, in the bow according to the present invention, since vibration damping means is coupled to a central portion of a handle, it is possible to efficiently remove or mitigate a bad motion occurring in the handle from the time when an arrow is shot from a string to the time when the arrow passes through the body of the handle. In order to confirm such an effect, the front-rear direction vibration occurring in the handle and the left-right direction vibration occurring in the handle were measured as follows.

<Vibration Measurement Example 1>

[0039] In an actual vibration phenomenon of the bow according to the present invention, measured was the front-rear direction vibration occurring in the handle from the time when an archer shoots an arrow to the time when the arrow passes through the handle.

[0040] According to this experiment system, the vibration damping means was mounted to the central portion of the handle, and a vibration measurement sensor was installed to a grip portion behind the mounting portion of the vibration damping means. FIG. 6a is a photograph of the experiment system, and FIG. 6b is a partial enlarged photograph of the grip portion with the vibration measurement sensor installed thereon. At this time, the vibration measurement sensor was a product of Kistler Instrument Corp. (U.S.), and a program that analyzed vibration signals from the vibration measurement sensor into a graph was a product of Signal Link Co. (Republic of Korea). Here, FIG. 6c is a photograph of analysis graphs of the vibrations measured in various types of bows using the program of Signal Link Co.

[0041] Slight vibration of the handle measured by the system of Example 1 was calculated as the amount of acceleration change by means of the program of Signal Link Co. and obtained as a specific graph, which is shown in FIG. 7a. Here, an axis of abscissa indicates a time (unit: second) having passed after the arrow shooting, and an axis of ordinate indicates the acceleration of the handle. Referring to FIG. 7a, slight vibration was intensely applied to the handle after about 0.05 second from the arrow shooting, then gradually reduced, and considerably reduced after about 0.2 second.

<Vibration Measurement Comparative Example 1>

[0042] Slight front-rear direction vibration occurring in the handle was measured under the same conditions as those of Example 1, except that the vibration damping means was not coupled to the handle unlike Example 1.

[0043] Slight vibration of the handle measured by the system of Comparative Example 1 was calculated as the amount of acceleration change by means of the program of Signal Link Co. and obtained as a specific graph, which is shown in FIG. 7b. In this case, slight vibration was intensely applied to the handle after about 0.05 second from the arrow shooting, then gradually reduced, and considerably reduced after about 0.3 second.

[0044] Meanwhile, when Example 1 and Comparative Example 1 were compared with each other, it can be seen that in Example 1, the amplitude of the acceleration was very small and the amount of acceleration change was remarkably reduced in a shorter time.

<Left-right Vibration Measurement Example 2>

[0045] In an actual vibration phenomenon of the bow according to the present invention, measured was the left-right direction vibration occurring in the handle from the time when an archer shoots an arrow to the time when the arrow passes through the handle.

[0046] According to this experiment system, in a state where the vibration damping means was coupled to the central portion of the handle, in order to capture a slight movement of the handle until the arrow leaves the handle

within 0.2 seconds from the arrow shooting, an indicator was installed to the handle, and its position change was photographed by a high performance high speed camera. The position change of the indicator photographed at a high speed was displayed in a graph with the passage of time. Here, the indicator was installed above a position where an arrow flies in the handle, which was shown as a photograph of FIG. 8. The movement of the indicator was photographed at a speed of 4000 sheets per second by means of a high speed camera (Speedcam) of Weinberger AG (Switzerland), and the taken photographs were analyzed by a TEMA program of Image Systems AB (Sweden) and obtained as a series of graphs. FIG. 9a shows, on the upper side, a photograph obtained by photographing this experiment system from the front and on the lower side, a graph obtained by analyzing the data photographed by this experiment system by the TEMA program.

<Left-right Vibration Measurement Comparative Example 2>

[0047] Slight left-right direction vibration occurring in the handle was measured under the same conditions as those of Example 2, except that the vibration damping means was not coupled to the handle unlike Example 2.

[0048] Slight left-right direction vibration of the handle measured by the system of Comparative Example 2 was obtained as a series of graphs using the TEMA program of Image Systems AB, and a related concrete graph was shown in FIG. 9b.

[0049] In the meantime, when Example 2 and Comparative Example 2 were compared with each other, it can be seen that in Example 2, the amplitude and density in the left-right direction were considerably reduced and stabilized within a short time.

[0050] The bow according to the present invention can efficiently mitigate a torque occurring in its handle from the time when a user shoots an arrow to the time when the arrow passes through a grip portion.

[0051] Since the bow according to the present invention considerably mitigates the torque occurring until the arrow passes through the grip portion after it is shot, the bow allows the arrow shot by the user to more precisely fly toward a target which is a first aimed destination.

[0052] In addition, since a damper according to the present invention can absorb front-rear direction stress and up-down-left-right direction stress occurring in an initial stage, it can efficiently remove or mitigate an initial torque.

[0053] Although the bow according to the present invention and the vibration damping means appropriately used for the bow have been explained in detail, it is intended to suggest the most preferred embodiments of the present invention. The present invention is not limited thereto, and its scope is determined and defined by the appended claims.

[0054] In addition, those skilled in the art can make

various modifications and changes to the detailed descriptions of the present invention. It is apparent that such modifications and changes do not depart from the scope of the present invention.

Claims

1. A bow, comprising:

a handle (110) gripped by a user's hand; upper and lower limbs (122, 124) respectively coupled to upper and lower portions of the handle; a string (130) having ends coupled to the upper and lower limbs; and a vibration damping means (140) coupled to the handle,

wherein the vibration damping means (140) is positioned at a central portion of the handle (110) with the upper and lower limbs coupled thereto and positioned on a front surface of a grip portion (112) of the handle.

2. The bow as claimed in claim 1, wherein the vibration damping means (140) is coupled within a ± 7 cm distance range from a distance center point (M) between the upper and lower limbs (122, 124) coupled to the handle in the up-down direction thereof.

3. The bow as claimed in claim 1, wherein the vibration damping means (140) comprises a fixing portion (142) coupled and fixed to a body of the handle; a vibration absorption portion (144) mounted in the fixing portion to receive vibration occurring in the handle, transfer the vibration to the outside, and absorb and mitigate some of the vibration; a coupling portion (146) including the vibration absorption portion therein and coupled to the fixing portion; and a weight (148) coupled to the vibration absorption portion.

4. A damper for a bow coupled to a handle (110) of the bow, comprising:

a fixing portion (142) coupled and fixed to a body of the handle (110); a vibration absorption portion (144) mounted in the fixing portion (142) to receive vibration occurring in the handle, transfer the vibration to the outside, and absorb and mitigate some of the vibration; a coupling portion (146) including the vibration absorption portion therein and coupled to the fixing portion; and a weight (148) coupled to the vibration absorption portion.

5. The damper as claimed in claim 4, wherein the vibration absorption portion comprises a vibration transfer portion (143) mounted in the fixing portion to receive vibration occurring in the handle and transfer the vibration to the outside; and an elastic portion (145) for absorbing the vibration of the vibration transfer portion to mitigate the vibration. 5
6. The damper as claimed in claim 5, wherein the elastic portion (145) is made of an elastic body comprising a spring, rubber, urethane and silicone. 10
7. The damper as claimed in claim 6, wherein the elastic portion (145) comprises a horizontal elastic absorption portion (145a) for absorbing and mitigating front-rear vibration of the vibration transfer portion, and a peripheral elastic absorption portion (145b) for absorbing up-down-left-right vibration of the vibration transfer portion. 15
8. The damper as claimed in claim 7, wherein the horizontal elastic absorption portion (145a) is formed in the shape of a spherical silicone ball, and the horizontal elastic absorption portion (145b) is formed of an elastic body comprising rubber, urethane and silicon and in the shape of a donut surrounding the vibration transfer portion (143). 20
- 25
- 30
- 35
- 40
- 45
- 50
- 55

FIG 1

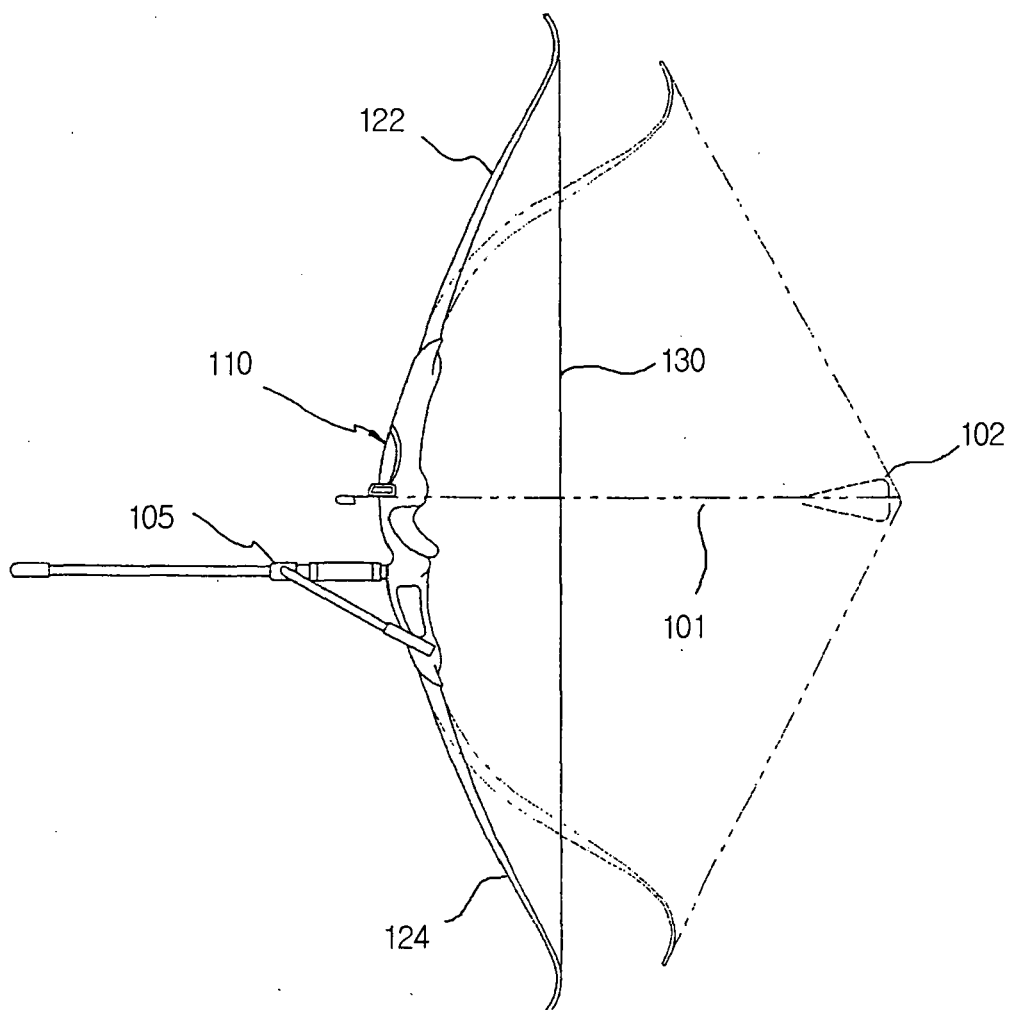


FIG 2

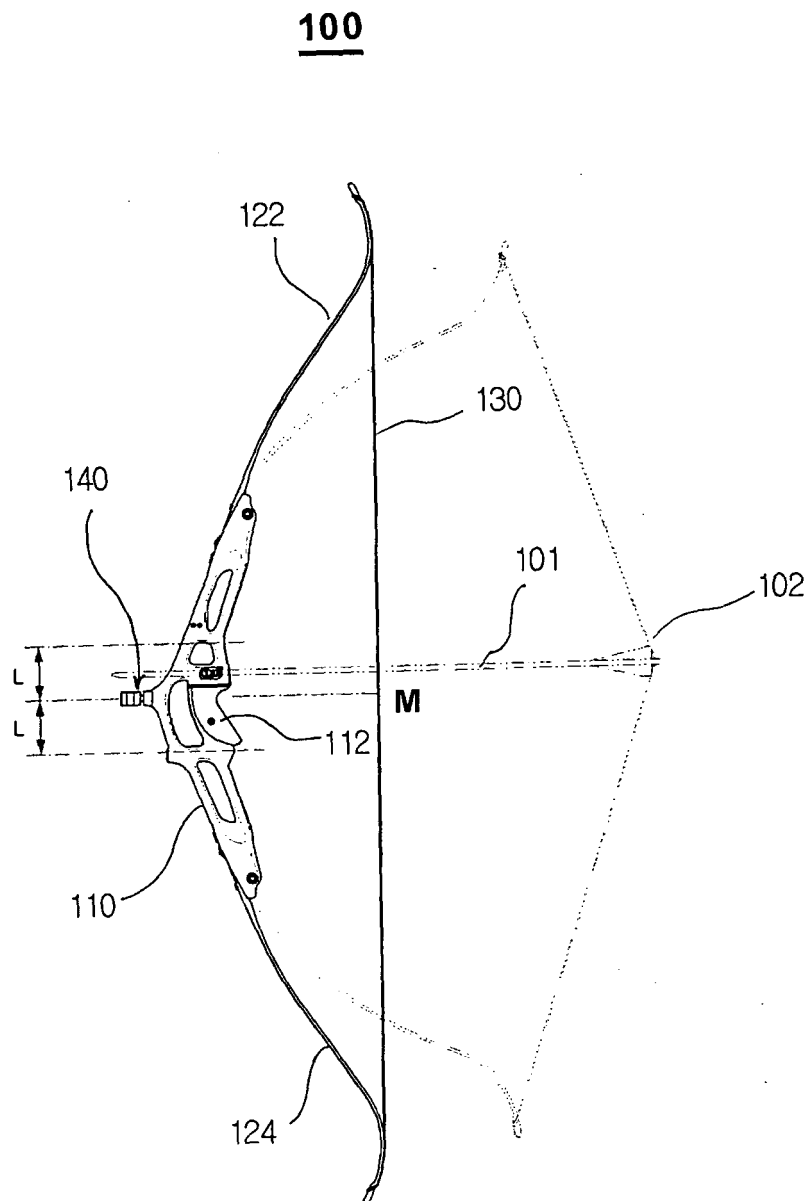


FIG 3a

100

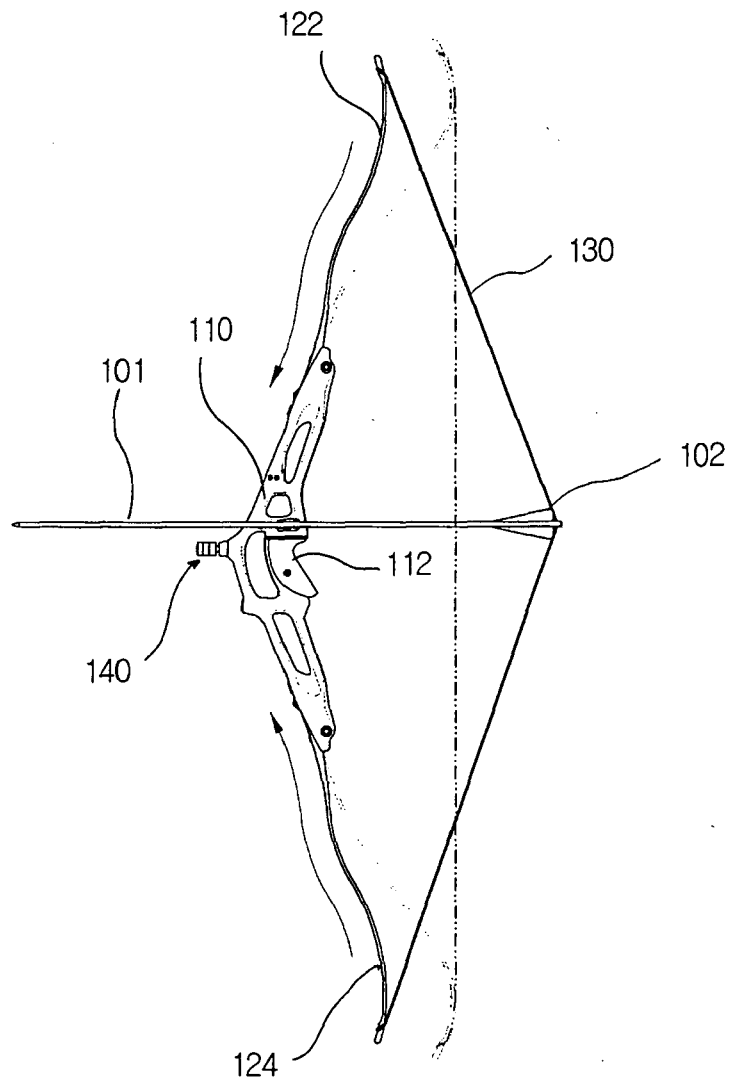


FIG 3b

100

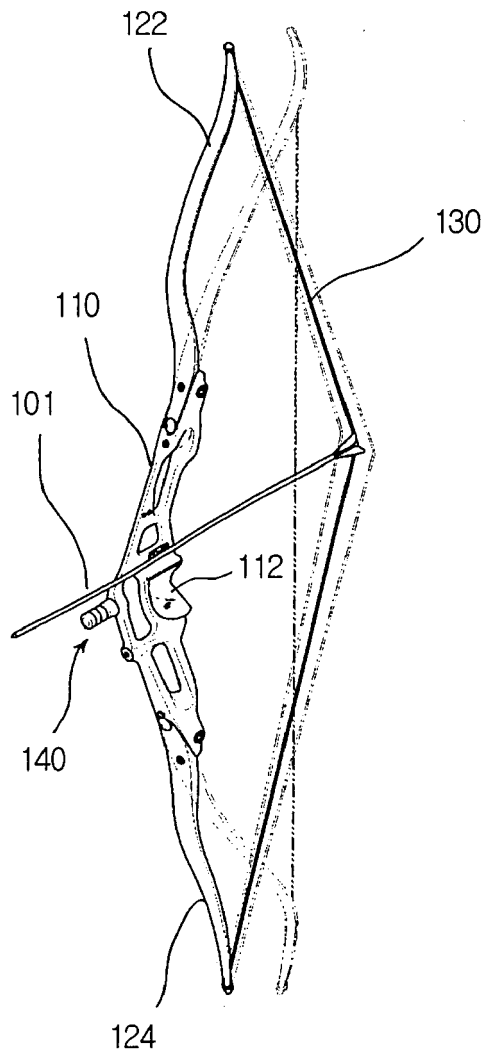


FIG 4a

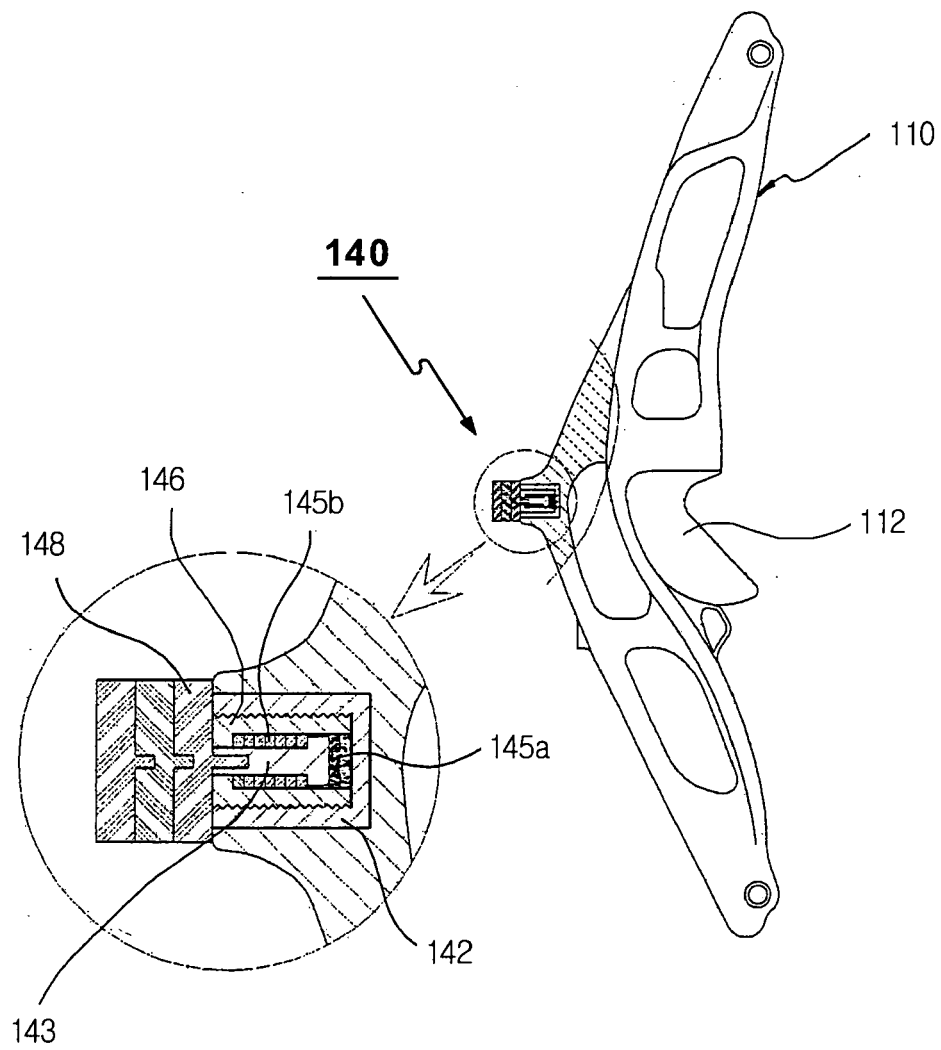


FIG 4b

140

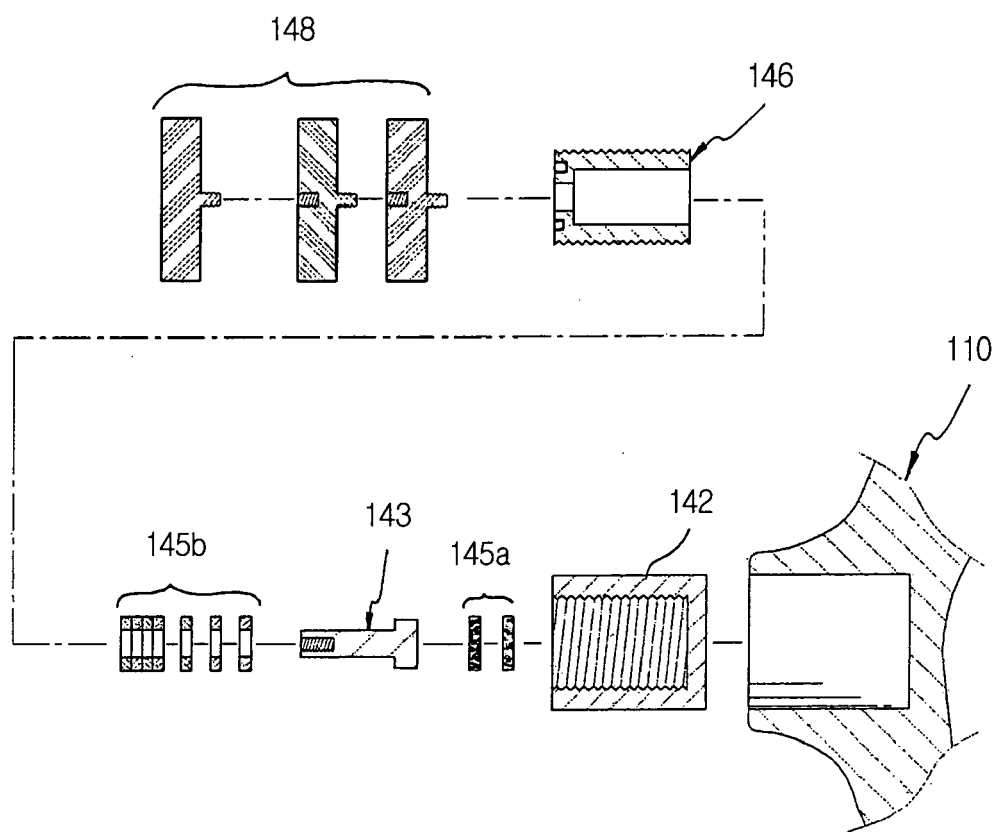


FIG 5a

140

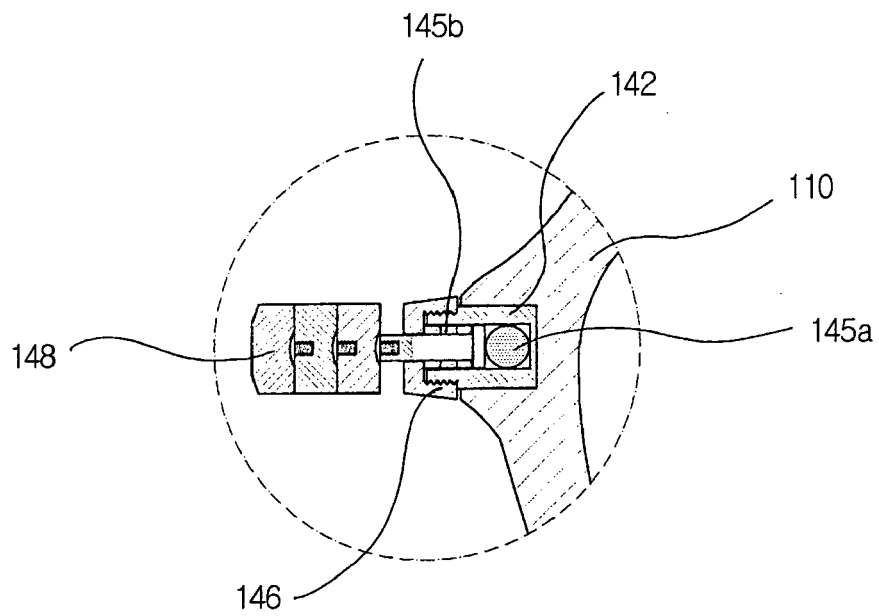


FIG 5b

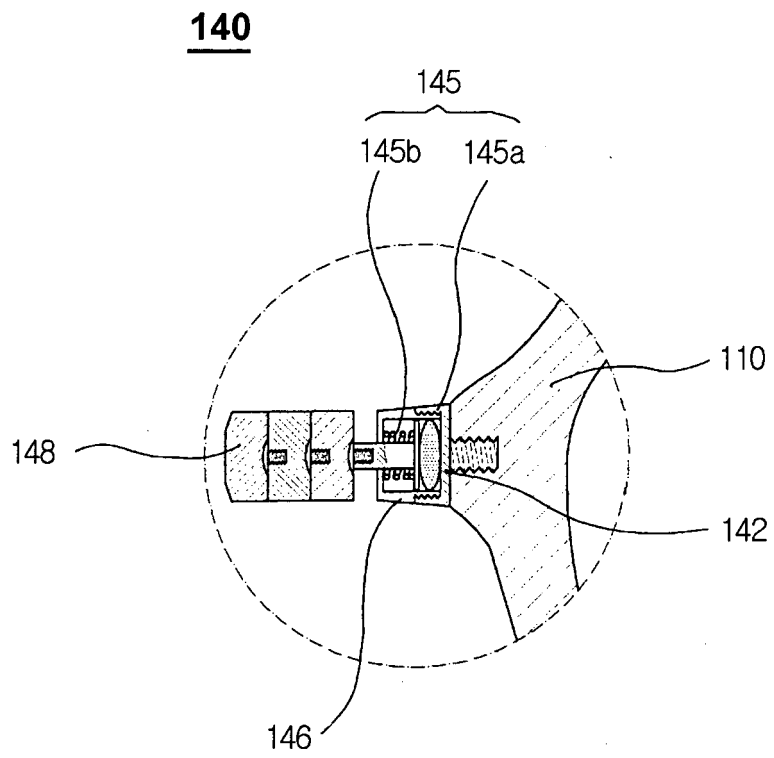


FIG 5c

140

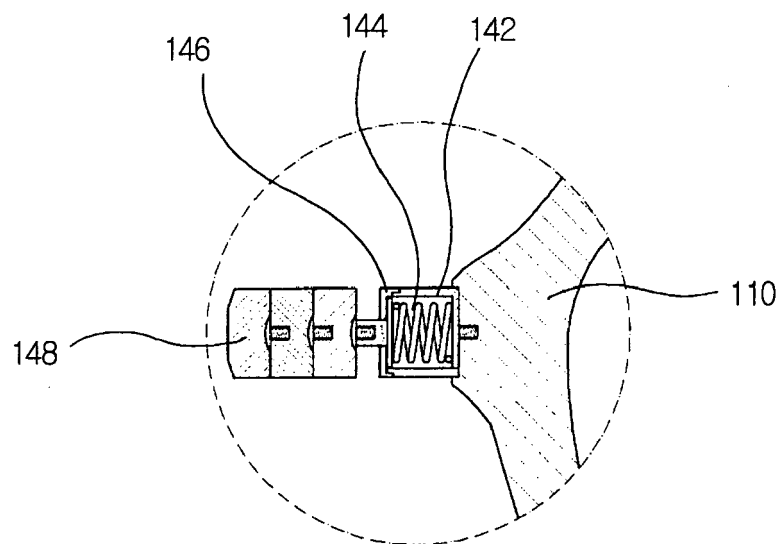


FIG 6a

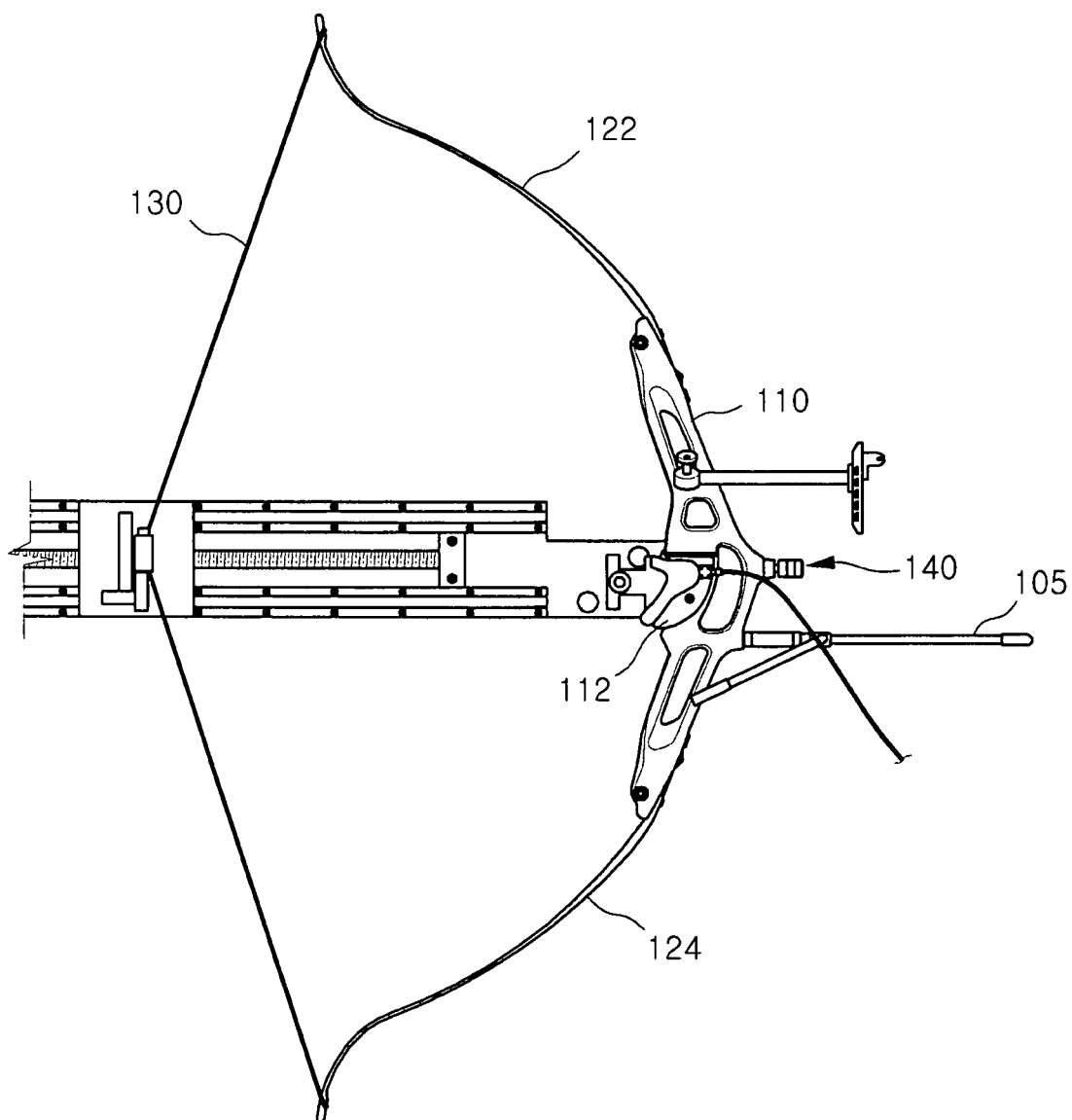
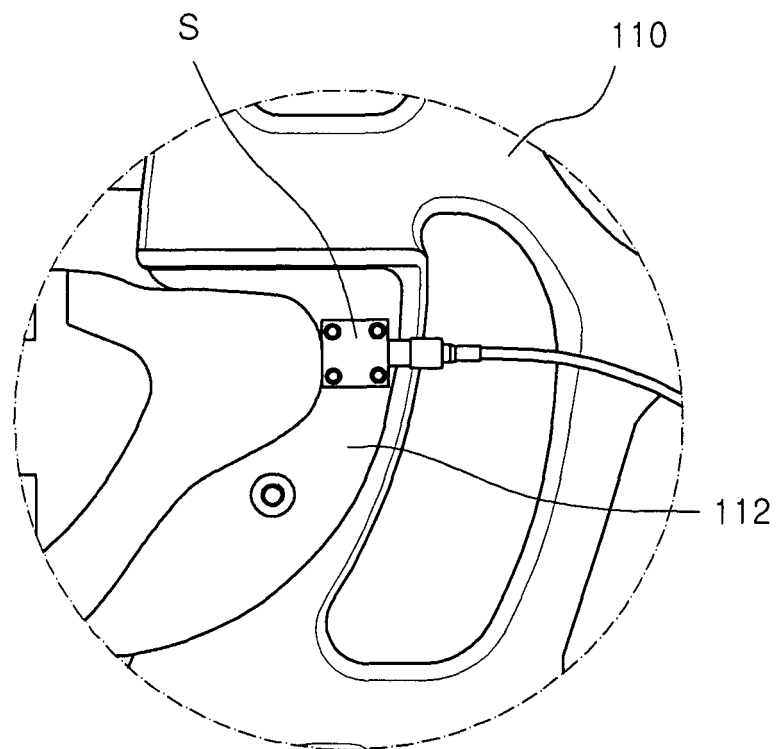


FIG 6b



(S: vibration measurement sensor)

FIG 6c

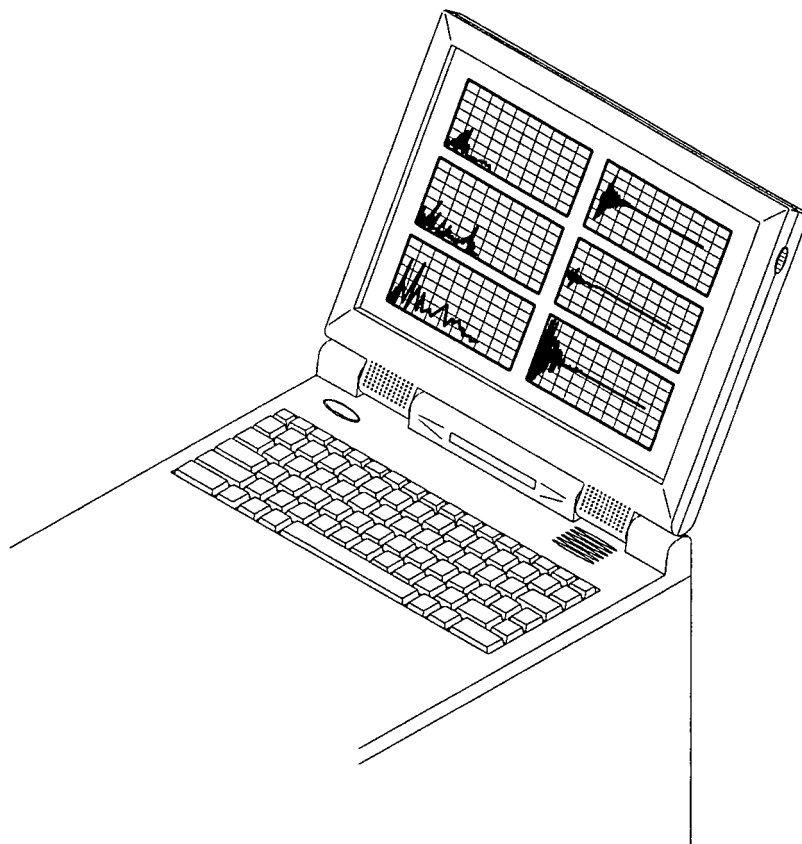


FIG 7a

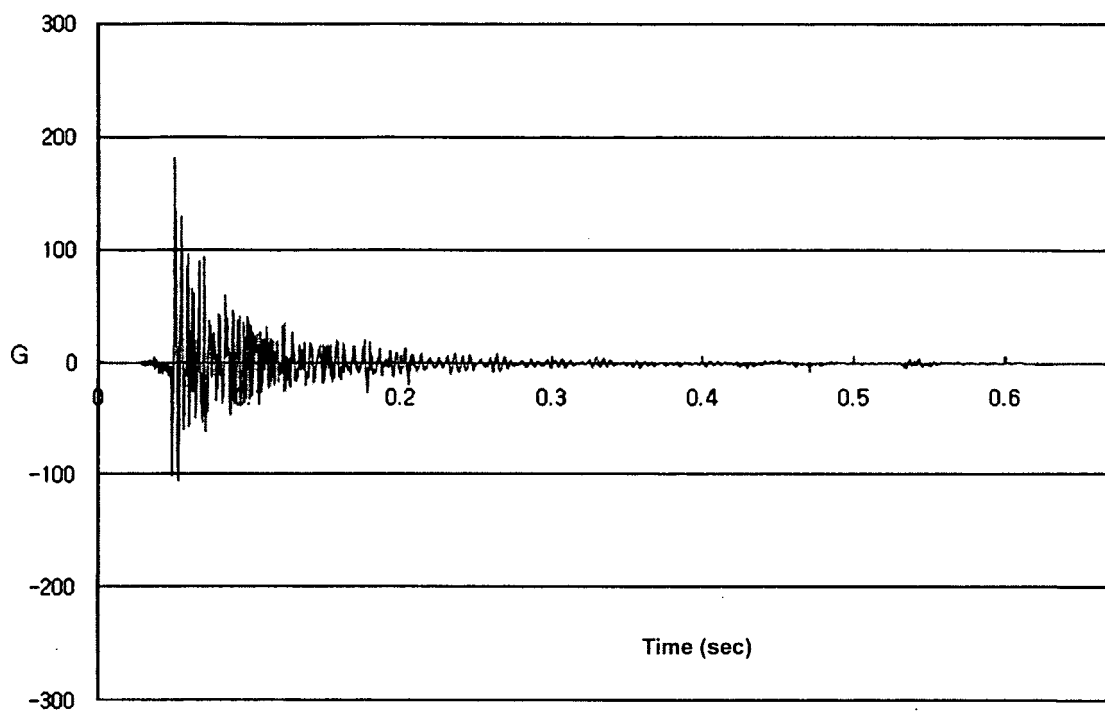


FIG 7b

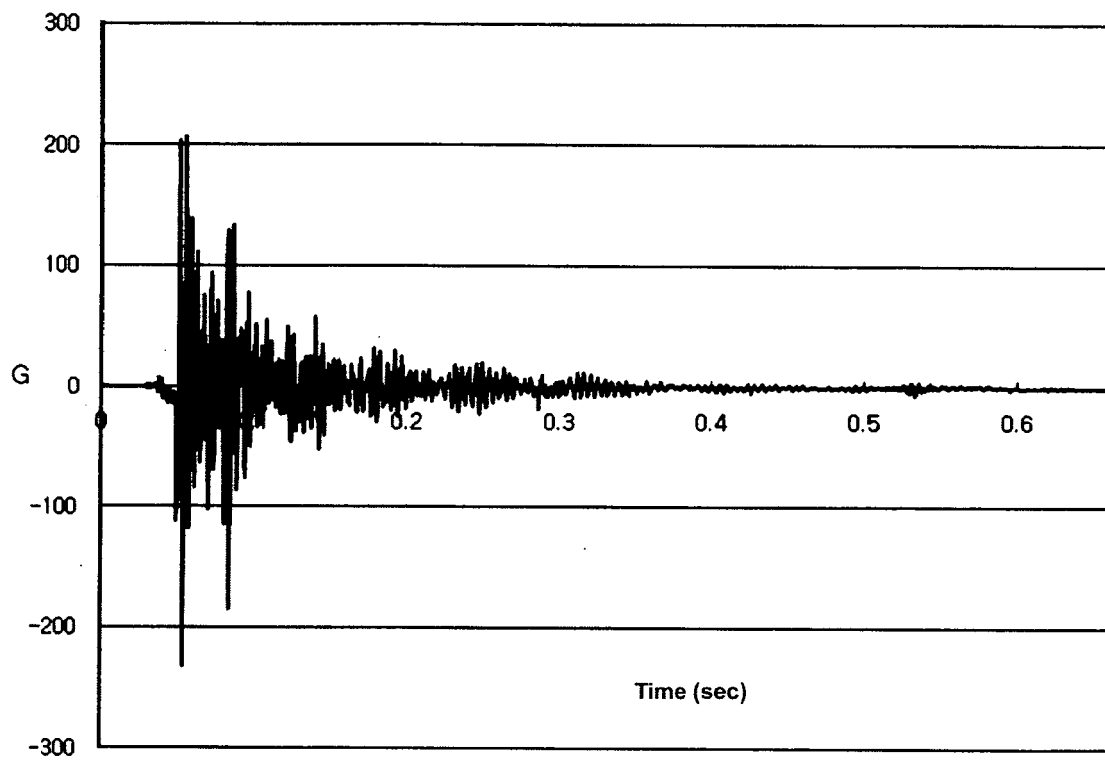


FIG 8

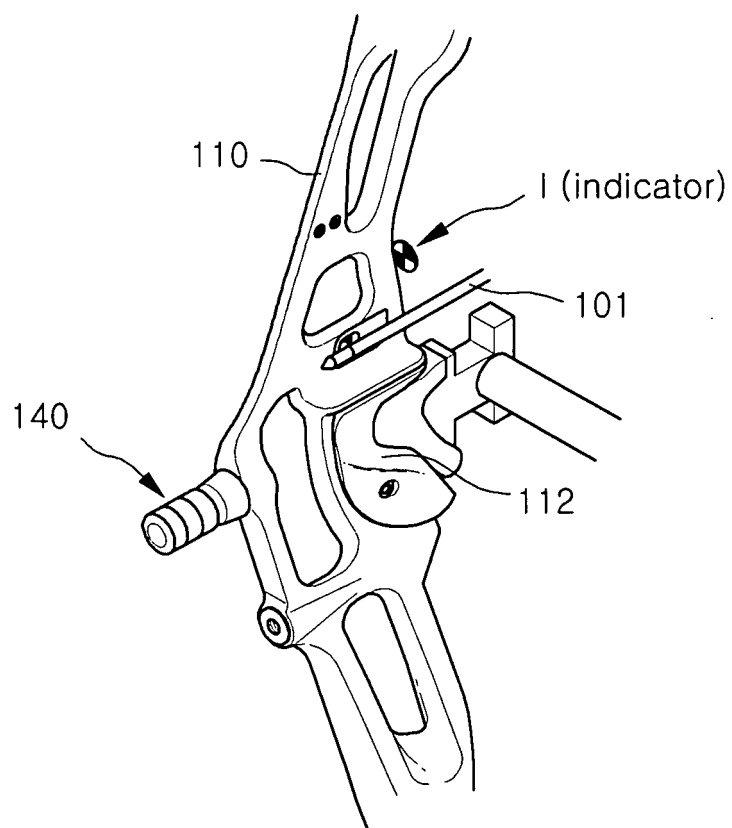


FIG 9a

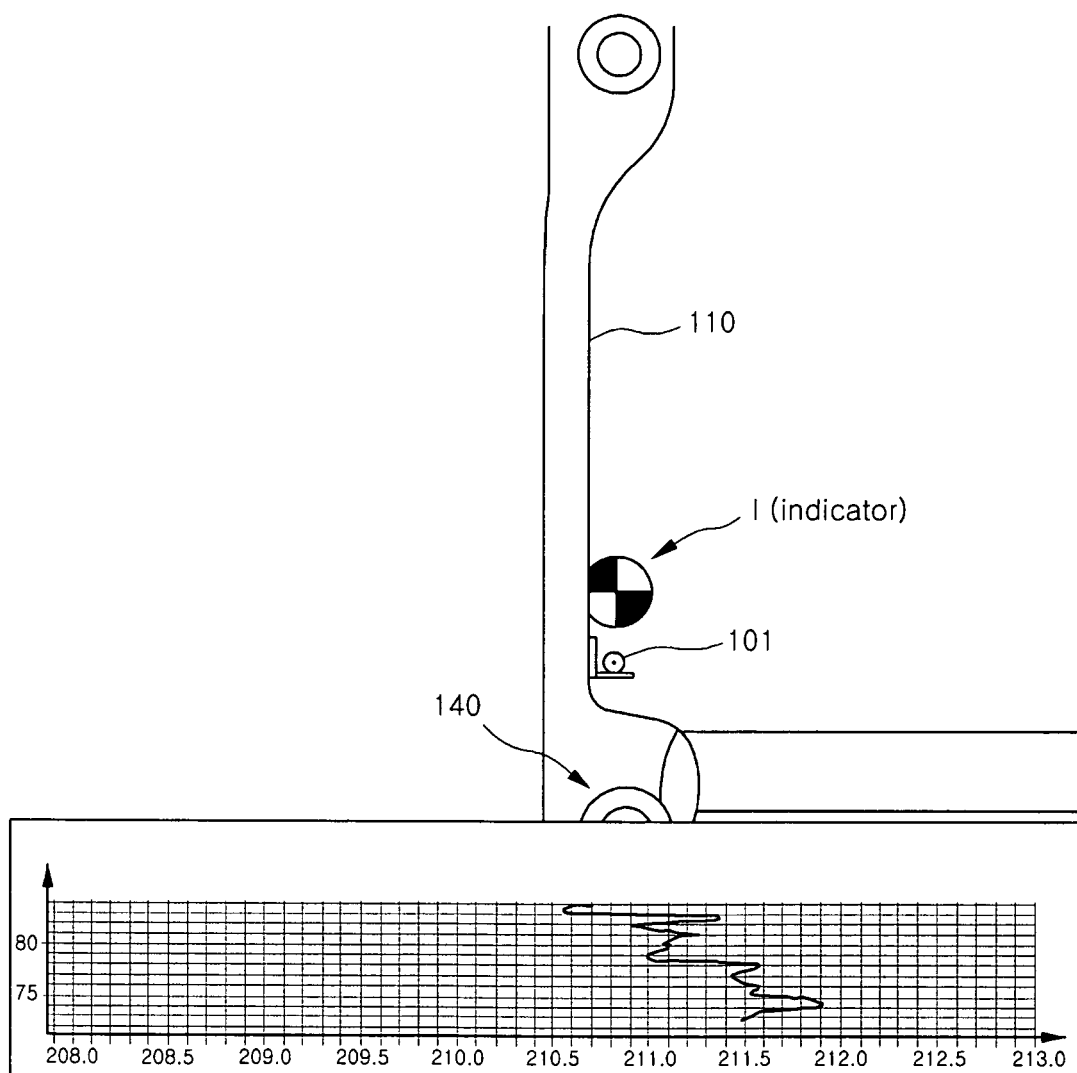


FIG 9b

