10/22/01

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF WASHINGTON
AT SEATTLE

STEVEN C SIMS, an individual; and STEVEN SIMS, INC , a Washington corporation,

Plaintiffs,

v

GLOBAL RESOURCE, INC , a Massachusetts corporation,

Defendant

C01-5606 RSB

CIVIL ACTION NO

COMPLAINT AND DEMAND FOR JURY TRIAL

601877 S/155

Plaintiffs STEVEN C SIMS and STEVEN SIMS, INC (collectively "SIMS"), for its Complaint against defendant Global Resource, Inc ("Global") herein, allege as follows

NATURE OF THE ACTION

1 This action is based on the Patent Laws of the United States, 35 U S C § 1 *et seq* , the Lanham Act, 15 U S C § 1125(a) *et seq* , and the Washington Consumer Protection Act, R C W § 19 86 *et seq*

2 This action arises out of defendant's making, using, importing, selling, and/or offering for sale bow string silencers (a copy is attached as *Exhibit 1*), limb-mounted vibrational damping devices (a copy is attached as *Exhibit 2*), and accessory-mounted vibrational

ORIGINAL

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damping devices (a copy is attached as *Exhibit 3*) that infringe valid patents owned by SIMS and actively aiding and abetting such activity

3 This action arises out of defendant's use in commerce of the vibration decay pattern on the back of the limb-mounted vibrational damping devices that contain a false and misleading representation of fact that causes mistake and deception as to the quality of defendant's goods and that constitutes a false and misleading representation

4 This action also arises out of defendant's unfair reference to SIMS on the back of the limb-mounted vibrational damping device The reference to SIMS' products' vibration decay pattern on the back of defendant's limb-mounted vibrational damping device which is sold and advertised in interstate commerce is both false and misleading and constitutes violations of the Washington Consumer Protection Act for unfair competition and unfair and deceptive trade practices and acts

THE PARTIES

5 Plaintiff Steven Sims, Inc , is a corporation organized and existing under the laws of the State of Washington and having a place of business at 150 West William White Way, Shelton, Washington 98584 Plaintiff Steven Sims, Inc , is in the business of designing, developing, manufacturing, and selling bow string silencer devices, vibrational damping devices, and related products used in, *inter alia*, archery devices SIMS has sold, and continues to sell, these systems in Washington and the United States

6 Plaintiff Steven C Sims is a resident of the State of Washington and has a residence in Shelton, Washington Plaintiff Steven C Sims is the president and owner of Steven Sims, Inc

7 Defendant Global is a corporation organized and existing under the laws of the Commonwealth of Massachusetts and having its main place of business at 89 Lucas Drive, Stoughton, Massachusetts 02072 On information and belief, Global is in the business of

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making, marketing, distributing, selling, and/or offering for sale bow string silencers for archery bows, limb-mounted vibrational damping devices, accessory-mounted vibrational damping devices, and related products and conducts business by making, using, advertising, importing, selling, and/or offering to sell infringing bow string silencers, limb-mounted vibrational damping devices, and accessory-mounted vibrational damping devices, *inter alia*, via sending marketing material to actual and potential customers in this Judicial District and via active and interactive e-commerce to SIMS' actual and potential customers in this Judicial District

JURISDICTION AND VENUE

8 This action arises under the Patent Act, 35 U S C § 1 *et seq* , the Lanham Act, 15 U S C § 1125(a), and the Washington Consumer Protection Act, R C W § 19 86 *et seq* The Court has original jurisdiction of such claims pursuant to 15 U S C § 1121, 28 U S C §§ 1331, 1332(a), 1338(a), and the principles of supplemental jurisdiction under 28 U S C § 1367

9 Venue in this Judicial District is proper under 28 U S C §§ 1391(a), (b), and (c), and/or 1400(b), 15 U S C § 1121, 28 U S C §§ 1331, 1332(a), and 1391(b) and (c)

PLAINTIFF AND ITS RIGHTS

10 SIMS was incorporated in or around 1990 to, *inter alia*, design, develop, manufacture, and sell bow string silencer devices, vibrational damping devices, and related products used in, *inter alia*, archery devices SIMS has sold, and continues to sell, these systems in Washington and the United States

11 SIMS has developed innovative technology relating to its bow string silencer devices The United States Patent and Trademark Office ("PTO") has recognized SIMS' innovation by awarding a United States patent covering SIMS' bow string silencer technology On May 29, 2001, the PTO duly and lawfully issued United States Patent No 6,237,584 ("the '584 patent"), entitled *Bow String Silencers for Archery Bows* Steven SIMS, Inc , is the

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assignee and sole owner of the '584 patent, a true and correct copy of which is attached hereto as *Exhibit 4*.

12 SIMS has developed innovative technology relating to its vibrational damping devices The PTO has recognized SIMS' innovation by awarding a United States patent covering SIMS' vibrational damping devices On October 9, 2001, the PTO duly and lawfully issued United States Patent No 6,298,842 ("the '842 patent"), entitled *Archery Bows* Steven C Sims is the assignee and sole owner of the '842 patent, a true and correct copy of which is attached hereto as *Exhibit 5*

13 SIMS has developed innovative technology relating to its vibrational damping devices The PTO has recognized SIMS' innovation by awarding a United States patent covering SIMS' vibrational damping technology On November 8, 1984, the PTO duly and lawfully issued United States Patent No 5,362,046 ("the '046 patent"), entitled *Vibrational Damping* Steven Sims, Inc., is the assignee and sole owner of the '046 patent, a true and correct copy of which is attached hereto as *Exhibit 6*

DEFENDANTS AND THEIR UNLAWFUL ACTIVITIES

14 On information and belief, defendant is presently manufacturing, using, importing, selling, advertising, packaging, promoting, and/or offering to sell bow string silencers, vibrational damping devices, and related products, which directly infringe one or more claims of SIMS' patents

15 On information and belief, defendant is knowingly selling, offering to sell, and/or importing bow string silencer devices, limb-mounted and accessory-mounted vibrational damping devices, and related products which are made or adapted for use as a material part of SIMS' patented bow string silencer and/or vibrational damping invention, knowing that defendant's bow string silencers, limb-mounted vibrational damping devices, and/or accessory-mounted vibrational damping devices are nonstaple articles made or adapted specifically for

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such use and have no substantial noninfringing use, thereby contributing to the direct infringement by others of one or more claims of SIMS' patents

16. On information and belief, defendant is actively and knowingly aiding and abetting the direct infringement of SIMS' patents with knowledge thereof by, *inter alia*, designing bow string silencers, limb-mounted vibrational damping devices, accessory-mounted vibrational damping devices, and related products that infringe SIMS' patents, importing, advertising, and selling infringing bow string silencers, limb-mounted and accessory-mounted vibrational damping devices and related products, and distributing instructions therefore, thereby actively inducing the direct infringement by others of one or more claims of SIMS' patents

17 On information and belief, defendant is advertising a false and deceptive vibration decay pattern on the back of the limb-mounted vibrational damping device in trade and commerce This false and misleading representation of fact misrepresents the quality of SIMS' and defendant's products This false and deceptive representation and act impacts the public interest and SIMS by inducing consumers to purchase defendant's vibrational damping devices over SIMS' devices Therefore, SIMS has been and continues to be injured by defendant's false, misleading, unfair, and deceptive acts

18 Defendant and SIMS are direct competitors On information and belief, defendant is unfairly and deceptively comparing the false and misleading vibration decay pattern to SIMS' devices. Upon information and belief, defendant is displaying a false and misleading vibration decay pattern on its limb-mounted vibrational damping devices in interstate commerce. Such unfair and deceptive acts are targeted toward SIMS and the consuming public and constitutes unfair competition and deceptive trade practices and acts SIMS and the public have been and continue to be injured by defendant's actions

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FIRST COUNT

PATENT INFRINGEMENT

19 SIMS repeats and realleges each of the allegations contained in paragraphs 1 through 18 of this Complaint as if fully set forth herein

20 On information and belief, defendant has been, and is, infringing—directly, contributorily, and/or by inducement—one or more claims of the '584 patent, the '842 patent, and/or the '046 patent by manufacturing, importing, using, selling, and/or offering for sale infringing bow string silencers, limb-mounted and accessory-mounted vibrational damping devices, and related products in the United States and in this Judicial District.

21 By infringing directly, contributorily, and/or by inducement one or more claims of the '584 patent, the '842 patent, and/or the '046 patent defendant has unfairly reaped a substantial commercial advantage and savings in research and development time and cost, all to SIMS' detriment

22 Defendant has actual and constructive notice of SIMS' rights with respect to the '584, '842, and '046 patents

23 Defendant's activities with respect to its bow string silencers and limb-mounted and accessory-mounted vibrational damping devices constitutes willful infringement of one or more claims of the '584 patent, the '842 patent, and the '046 patent Defendant's activities have been directed at SIMS in Washington

24 SIMS has been, and will continue to be, damaged by such direct, contributory, and induced infringement in an amount to be proven at trial and in a manner and amount that cannot be fully measured or compensated in economic terms and for which there is no adequate remedy at law The actions of defendant have damaged, and will continue to damage, SIMS' business, market, reputation, and goodwill Such irreparable damage will

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continue unless the acts of defendant are enjoined during the pendency of this action and thereafter SIMS is, therefore, entitled to the remedies provided by 35 U S C §§ 283-285

SECOND COUNT

FEDERAL FALSE AND MISLEADING ADVERTISING

15 U.S.C. §1125(a)(1) *et. seq.*

25 SIMS repeats and realleges each of the allegations contained in paragraph nos 1 through 24 of this Complaint, as though set forth fully herein

26 Defendant is commercially advertising and promoting a false and misleading vibration decay pattern in connection with the limb-mounted vibrational damping device in interstate commerce (*see Exhibit 2*) Defendant's use of the false and misleading vibration decay pattern constitutes a false and misleading description of fact and/or false and misleading representation of fact in violation of 15 U S C § 1125(a)

27 This false and misleading description and/or representation in connection with defendant's goods in interstate commerce and in commercial advertising and promotion misrepresents the quality and nature of defendant's goods and casts doubt upon the quality of SIMS' device

28 This false and deceptive act impacts the public interest by inducing consumers to purchase defendant's vibrational damping device over SIMS' vibrational damping device The public has been, and continues to be, damaged by defendant's false and misleading description of fact and/or false and misleading representation of fact

29 SIMS has been, and will continue to be, damaged by such false and misleading descriptions and/or representations in an amount to be proven at trial and in a manner and amount that cannot be fully measured or compensated in economic terms and for which there is no adequate remedy at law The actions of defendant have damaged, and will continue to damage, SIMS' business, market, reputation, and goodwill Such irreparable damage will

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continue unless the acts of defendant are enjoined during the pendency of this action and thereafter SIMS is, therefore, entitled to the remedies provided by 15 U S C § 1116 (a)

THIRD COUNT

VIOLATION OF WASHINGTON CONSUMER PROTECTION ACT – UNFAIR COMPETITION

RCWA § 19.86 *et. seq.*

30 SIMS repeats and realleges each of the allegations contained in paragraph nos 1 through 29 of this Complaint, as if fully set forth herein

31 Defendant's unfair and deceptive method of competition with SIMS by reference to SIMS in connection with the vibration decay pattern on defendant's limb-mounted vibrational damping device and by false representations regarding defendant's product, and by false representations regarding SIMS' products, in the conduct of trade and/or commerce are unfair and deceptive acts and practices in interstate commerce that affect the public interest and injure SIMS' business and property Defendant and SIMS are competitors and thus defendant's activities constitute unfair and deceptive methods of competition in violation of the Washington Consumer Protection Act

32 SIMS has been, and will continue to be, damaged by such unfair competition in an amount to be proven at trial and in a manner and amount that cannot be fully measured or compensated in economic terms The actions of defendant have damaged, and will continue to damage, SIMS' business, market, reputation, and goodwill, has discouraged current and potential customers from dealing with SIMS Such irreparable damage will continue unless the acts of the defendant are enjoined during the pendency of this action and thereafter, pursuant to the Revised Code of Washington ("R C W ") §§ 19 86 020 and 19 86 090

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FOURTH COUNT

VIOLATION OF WASHINGTON CONSUMER PROTECTION ACT – UNFAIR AND DECEPTIVE PRACTICES AND ACTS

R.C.W. § 19.86 *et. seq.*

33 SIMS repeats and realleges each of the allegations contained in paragraph nos 1 through 32 of this Complaint, as if fully set forth herein

34 Defendant's repeated and ongoing use of the vibration decay patterns on the back of the limb-mounted vibrational damping device constitutes an unfair and deceptive act or practice which is injurious to SIMS and to the public interest in violation of the Washington Consumer Protection Act, R C W § 19 86 *et seq*

35 Defendant is commercially advertising and promoting a false and misleading vibration decay pattern in connection with the limb-mounted vibrational damping device in interstate commerce, which constitutes an unfair and deceptive act The advertisement and promotion misrepresents the nature and quality of defendant's products and casts doubt upon the quality of SIMS' devices This false and deceptive act impacts the public interest by inducing consumers to purchase defendant's vibrational damping devices over SIMS' vibrational damping devices SIMS has been and continues to be injured by defendant's false, misleading, unfair, and deceptive acts

36 SIMS has been, and will continue to be, damaged by defendant's actions in an amount to be proven at trial and in a manner and amount that cannot be fully measured or compensated in economic terms The actions of defendant have damaged, and will continue to damage, SIMS' business, market, reputation, and goodwill, and has discouraged current and potential customers from dealing with SIMS Such irreparable damage will continue unless the acts of the defendant are enjoined during the pendency of this action and thereafter, pursuant to R C W §§ 19 86 020 and 19 86 090

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PRAYER FOR RELIEF

WHEREFORE, SIMS prays for judgment that

1 Defendant and its officers, agents, servants, employees, attorneys and all other persons in active concert or participation with any of them, be enjoined and restrained during the pendency of this action and permanently thereafter from

a representing in any manner, including words, written or spoken, that its bow string silencers or vibrational damping devices have a superior quality than SIMS' products,

b representing the false and misleading vibration decay pattern on its devices,

c engaging in any further violation of 15 U S C § 1125(a),

d engaging in any further violation of Washington Consumer Protection Act § 19 86 *et seq* ,

e engaging in any further unfair method of competition, unfair act or practice, or deceptive act or practice that is injurious to the public interest and/or to SIMS, and

f infringing any claim of SIMS' '584, '842, and '046 patents

2 Defendant be ordered to pay SIMS such damages as SIMS has sustained and adequate to compensate for the patent infringement, including SIMS' lost profits, but in no event less than a reasonable royalty, as provided by 35 U S C § 284

3 That defendant be required to pay SIMS such damages as SIMS has sustained, or will sustain, in consequence of defendant's false and misleading descriptions and representations, unfair and deceptive acts, and unfair competition, and to account for all gains, profits, and advantages derived by defendant that are attributable to such unlawful acts, and that such damages be trebled as provided by 15 U S C § 1117

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4 That defendant be required to pay SIMS such damages as SIMS has sustained, or will sustain, in consequence of defendant's false and misleading descriptions and representations, unfair and deceptive acts, and unfair competition, and to account for all gains, profits, and advantages derived by defendant that are attributable to such unlawful acts, and that such damages be trebled as provided by R C W § 19 86 090

5 Defendant's infringement of the '584 patent be found to have been willfully committed by defendant and that the damages be increased to three times the amount assessed, as provided by 35 U S C § 284

6 Defendant's infringement of the '842 patent be found to have been willfully committed by defendant and that the damages be increased to three times the amount assessed, as provided by 35 U S C § 284

7 Defendant's infringement of the '046 patent be found to have been willfully committed by defendant and that the damages be increased to three times the amount assessed, as provided by 35 U S C § 284

8 Defendant is ordered to pay SIMS the costs of this action and its reasonable attorneys' fees, and interest, as provided by 35 U S C §§ 284 and 285

9 That this Court adjudge this to be an exceptional case and require defendant to pay over to SIMS the costs of this action, including reasonable attorneys' fees, costs, and interest as provided by 15 U S C § 1117

10 Defendant is ordered to pay SIMS the costs of this action and its reasonable attorneys' fees, and interest, as provided by R C W § 19 86 090

11 That this Court order that defendant recall from its distributors, dealers, customers, and others to whom it delivered any bow string silencers, limb-mounted vibrational damping devices, or accessory-mounted vibrational damping devices that improperly display the false and misleading vibration decay pattern, unfairly compares defendant's devices to

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SIMS, and/or infringes the '584 patent, the '842 patent, and/or the '046 patent, and deliver it to SIMS for destruction

12 That defendant be directed to file with this Court and serve on plaintiff within thirty (30) days after the service of an injunction a report in writing, under oath, setting forth in detail the manner and form in which defendant has complied with the injunction

13 Defendant is ordered to pay SIMS' prejudgment interest on all sums awarded as allowed by law

14 SIMS have such other and further relief as this court may deem just and proper

DEMAND FOR JURY TRIAL

Plaintiff demands a trial by jury as to all issues so triable

DATED this 22 day of October, 2001

Respectfully submitted,

DORSEY & WHITNEY LLP

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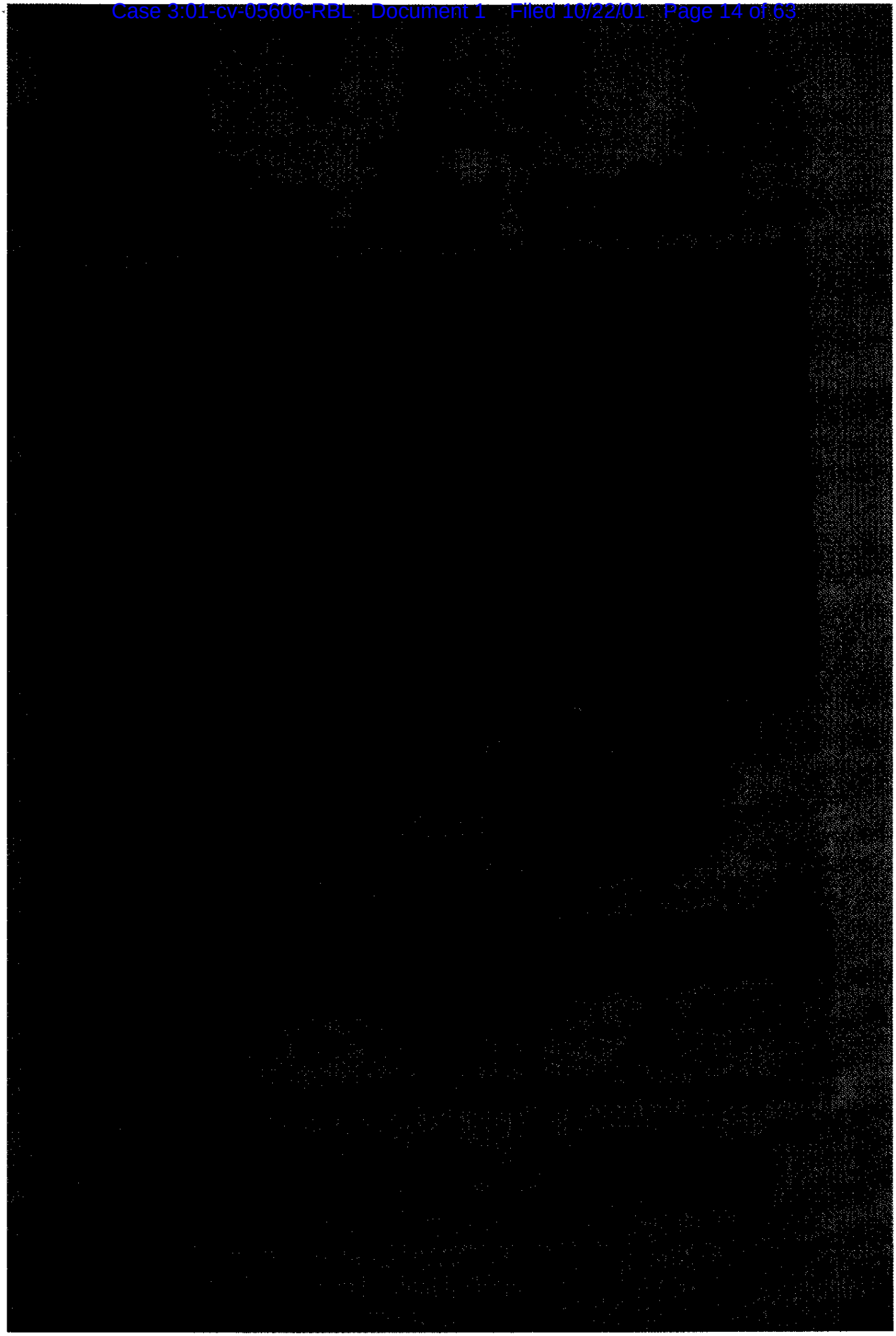


BONUS!
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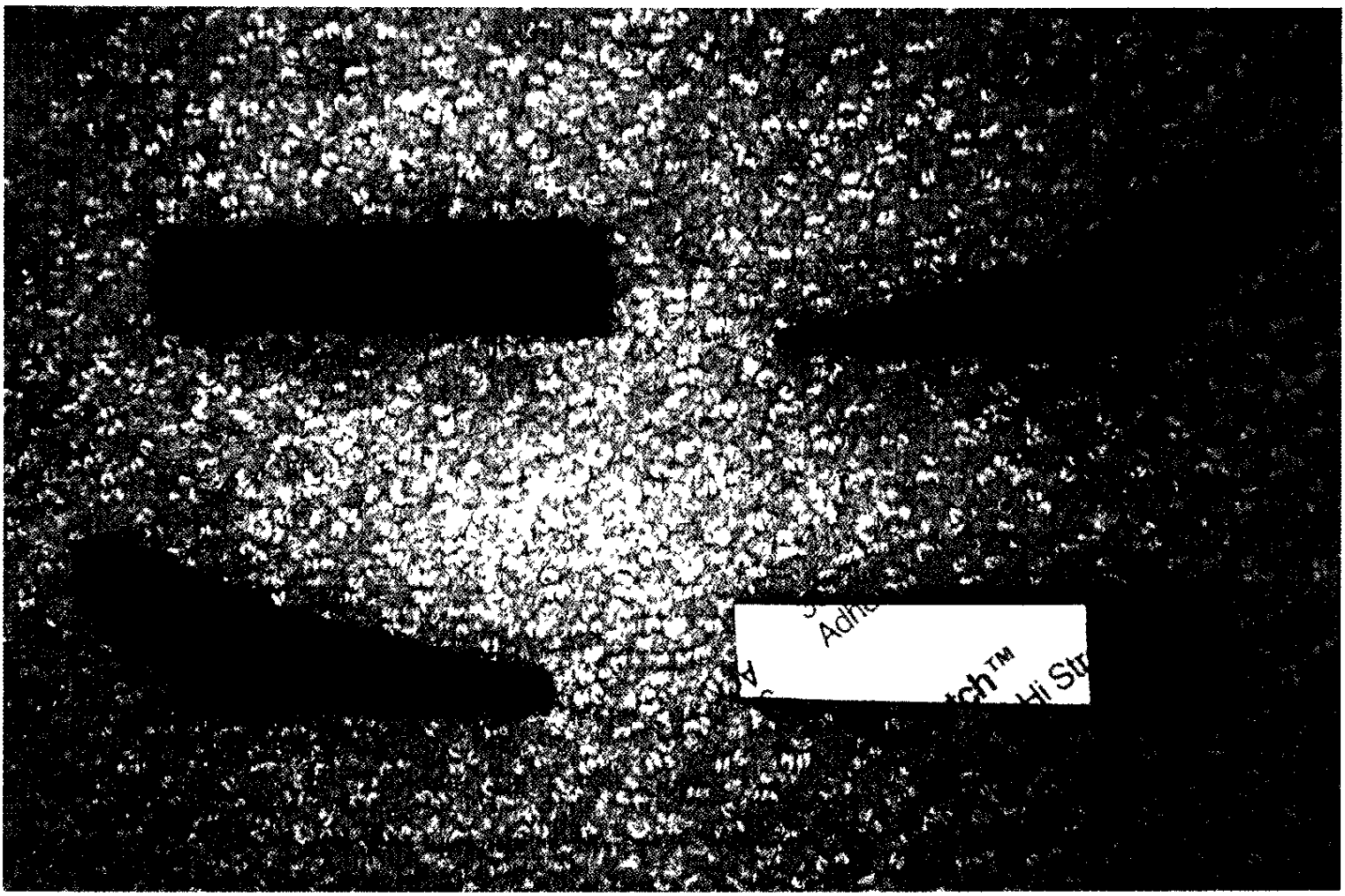

Sights and Accessories

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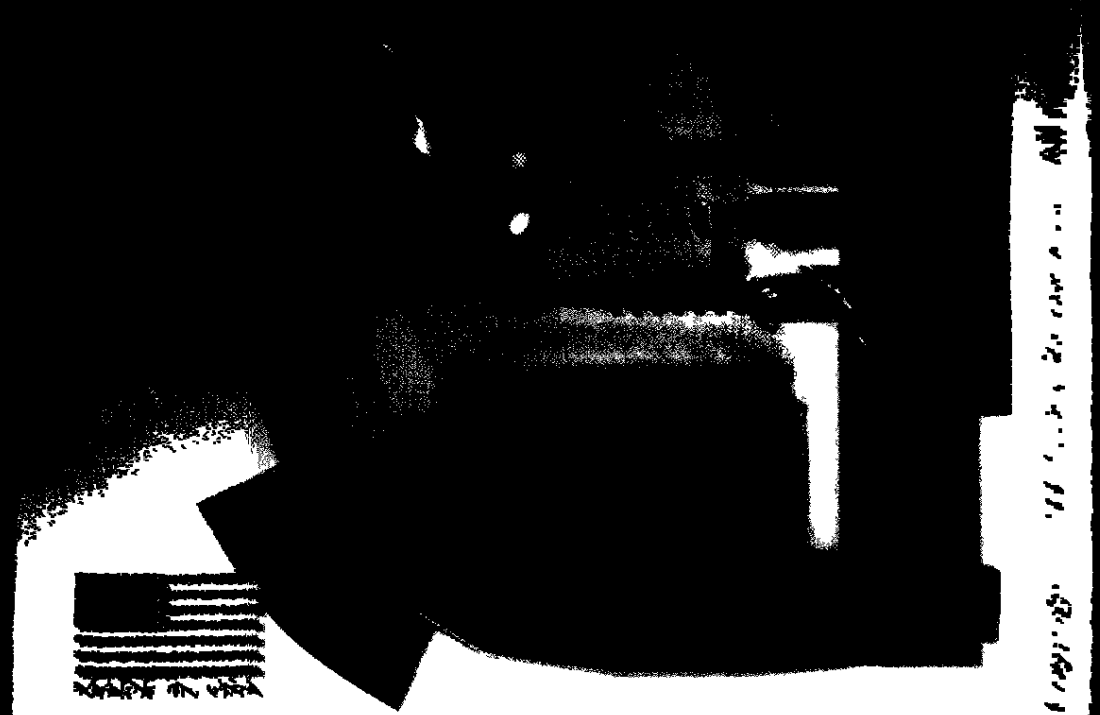

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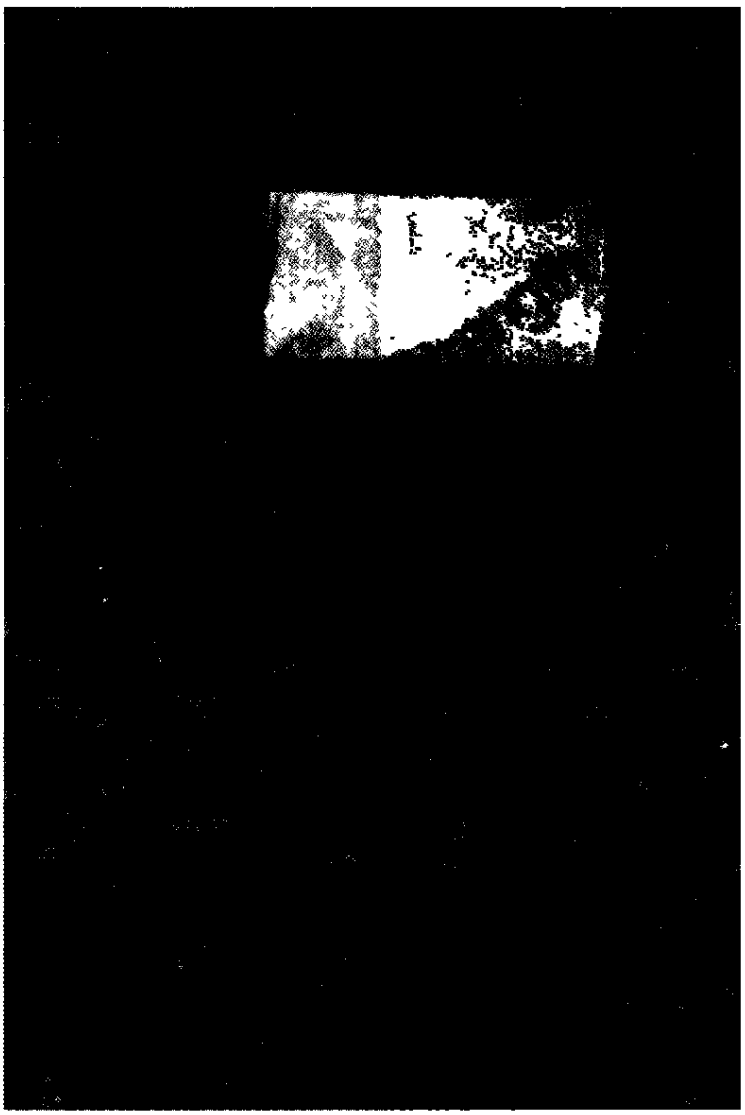

US006237584B1

(12) **United States Patent**
Sims

(10) **Patent No.: US 6,237,584 B1**
(45) **Date of Patent: May 29, 2001**

(54) **BOW STRING SILENCERS FOR ARCHERY BOWS**

(76) Inventor **Steven C. Sims**, 450 Enterprise Rd., Shelton, WA (US) 98054

(*) Notice Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days

(21) Appl. No. **09/466,512**

(22) Filed **Dec. 17, 1999**

(51) **Int. Cl.**[7] **F41B 5/20**
(52) **U.S. Cl.** **124/92**
(58) **Field of Search** 124/90, 92

(56) **References Cited**

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5,016,604	*	5/1991	Tilby	124/92
5,362,046		11/1994	Sims .	

OTHER PUBLICATIONS

String Silencer, shown on p. 31 of Archery magazine, Jan 1978 *

Silencer shown on p. 31 of Bow & Arrow magazine, Jun 1981 *

* cited by examiner

Primary Examiner—John A. Ricci
(74) *Attorney, Agent, or Firm*—Richard D. Multer

(57) **ABSTRACT**

String silencers for reducing the sound made when an arrow is released from a bow. These silencers are made from a material which allows the silencer to freely flex when the arrow is released and the bow string begins to vibrate. Silencers usable with conventional bow strings and with split bow strings are disclosed. Disclosed silencers for conventional bow strings have uniform and necked down configurations, and a representative, disclosed silencer for split bow strings has a center segment and integral arms at opposite ends of the center segment. With the silencer at rest, these arms extend in opposite directions from, and at equal angles to, the center segment.

12 Claims, 5 Drawing Sheets

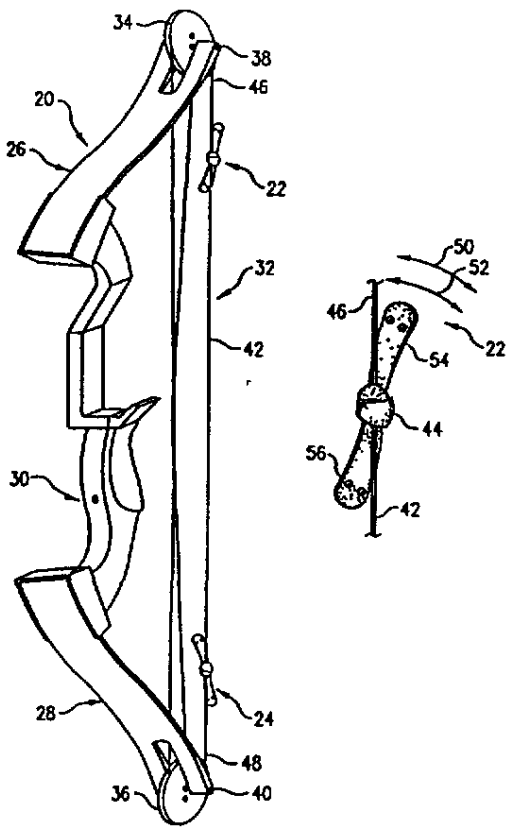

FIG. 1

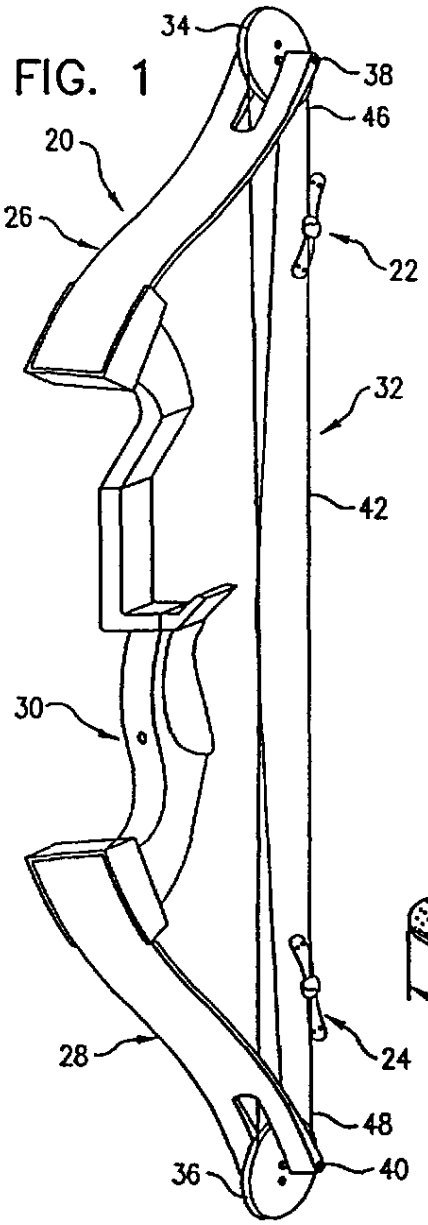

FIG. 2

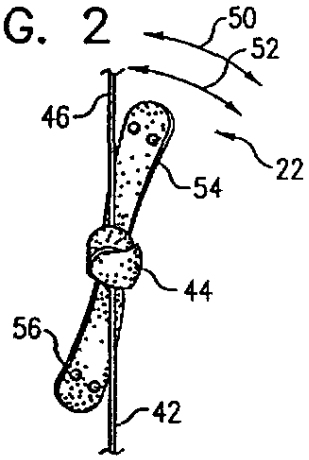

FIG. 4

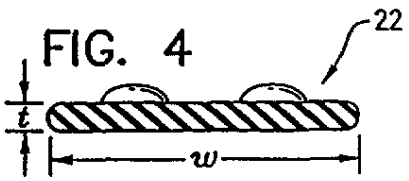

FIG. 3

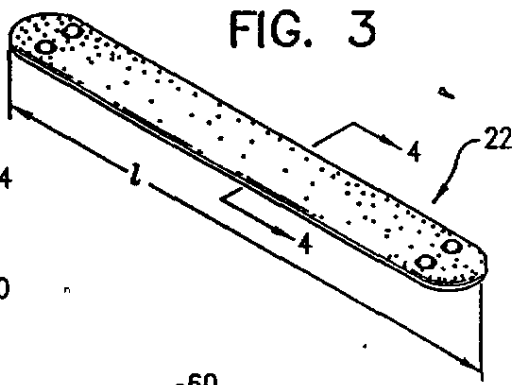

FIG. 5

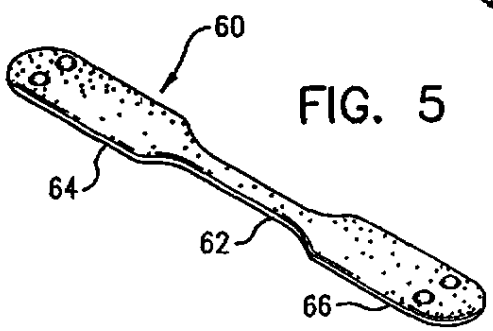

FIG. 6

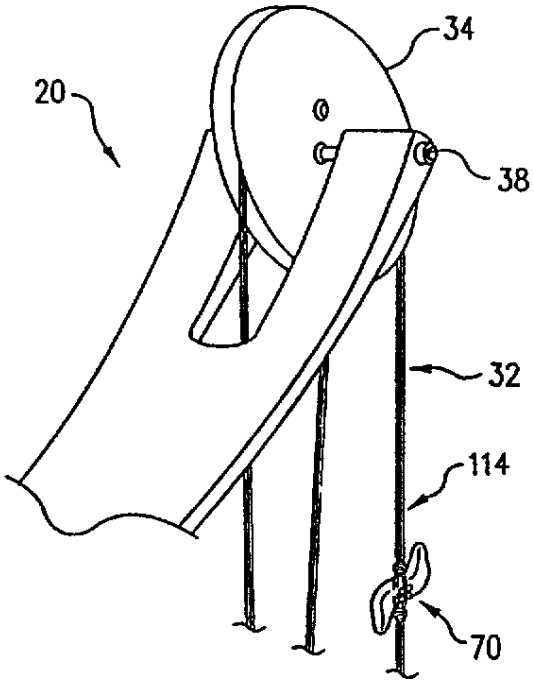
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FIG. 7

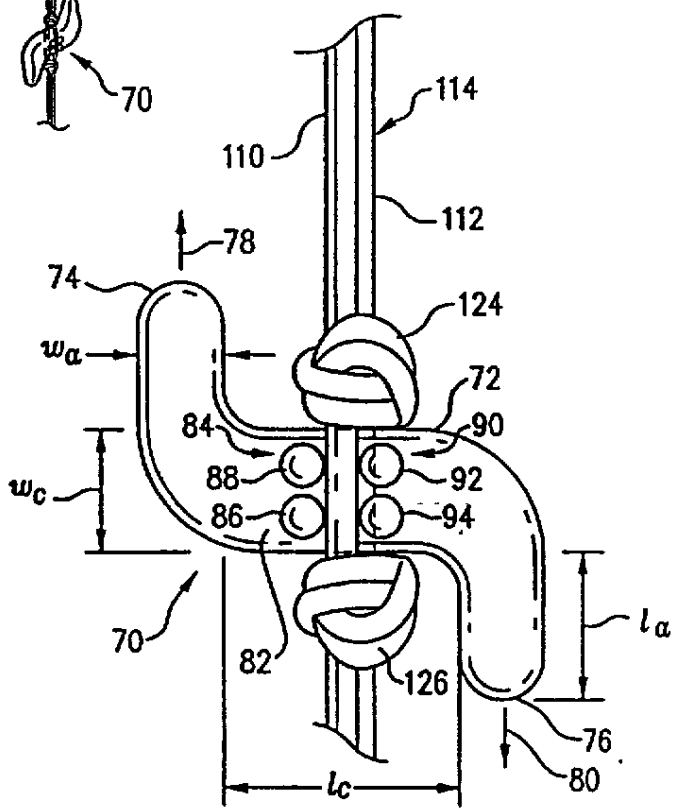
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FIG. 8

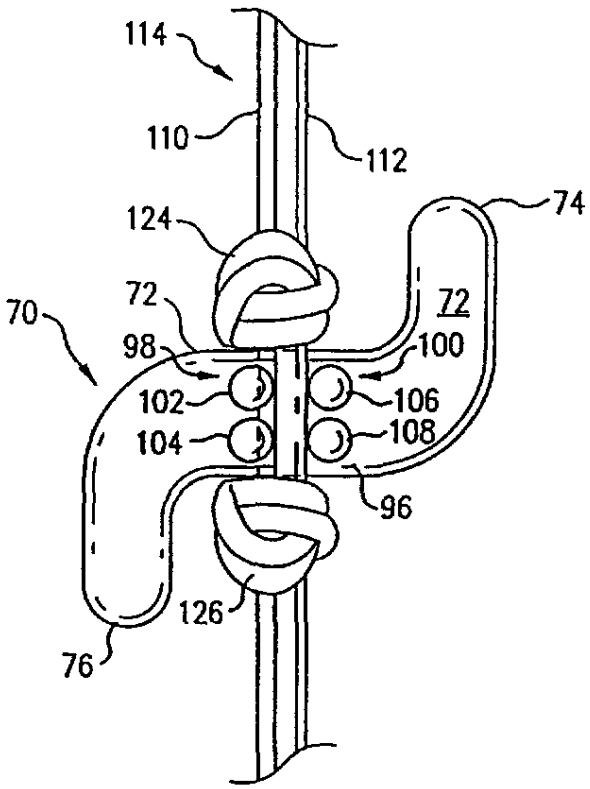


FIG. 9

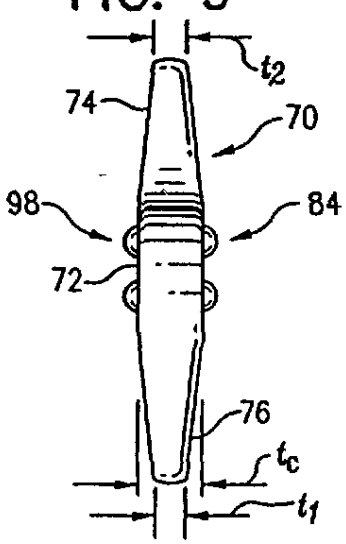


FIG. 10

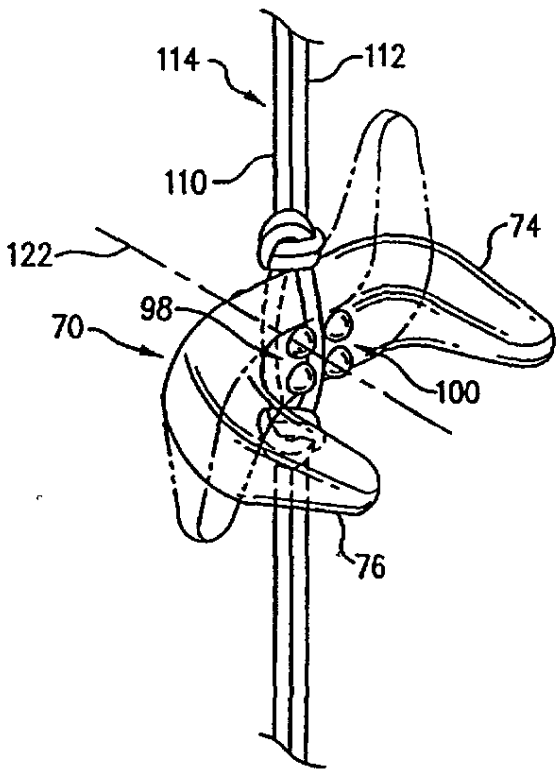


FIG. 11

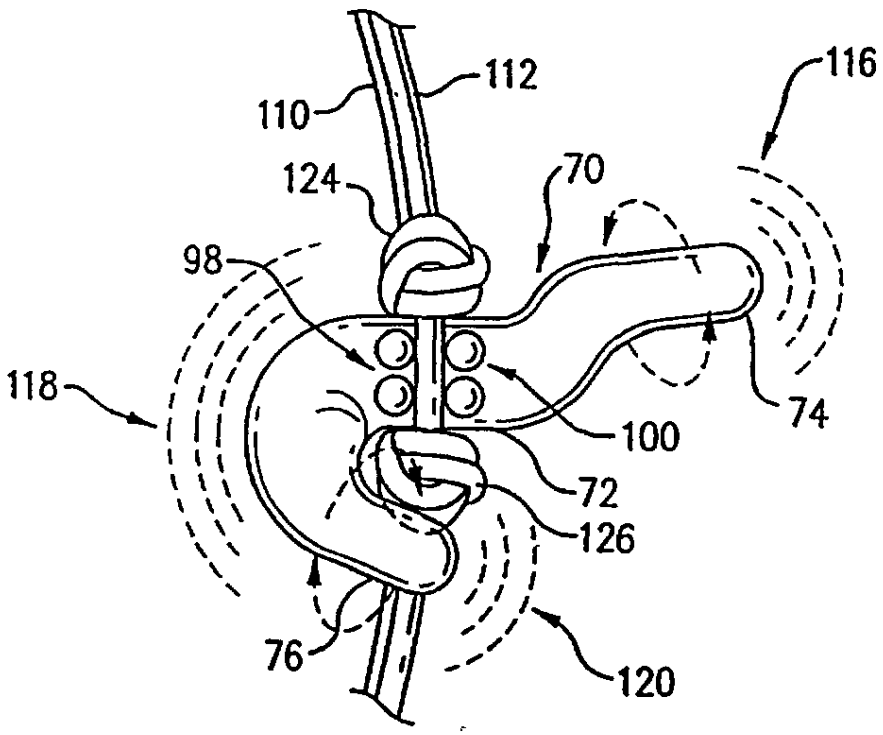
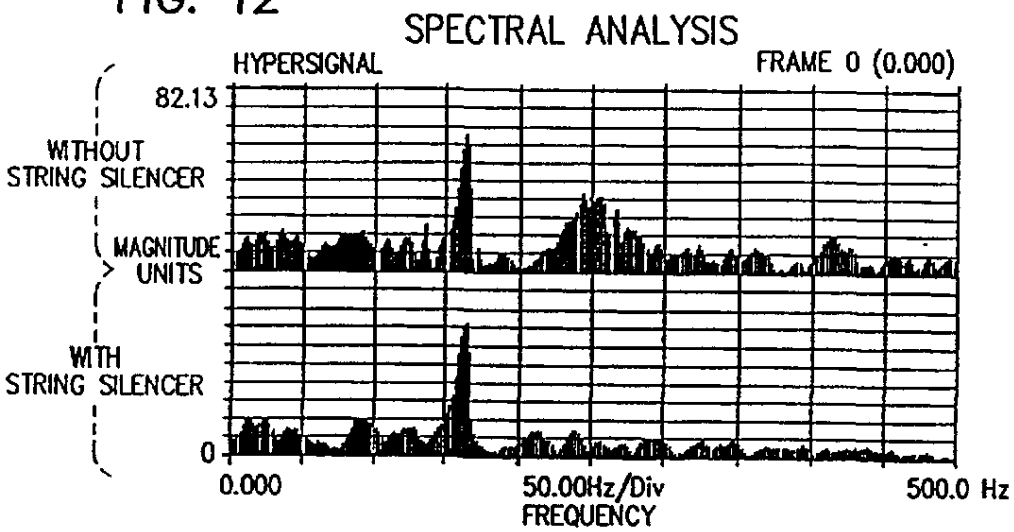


FIG. 12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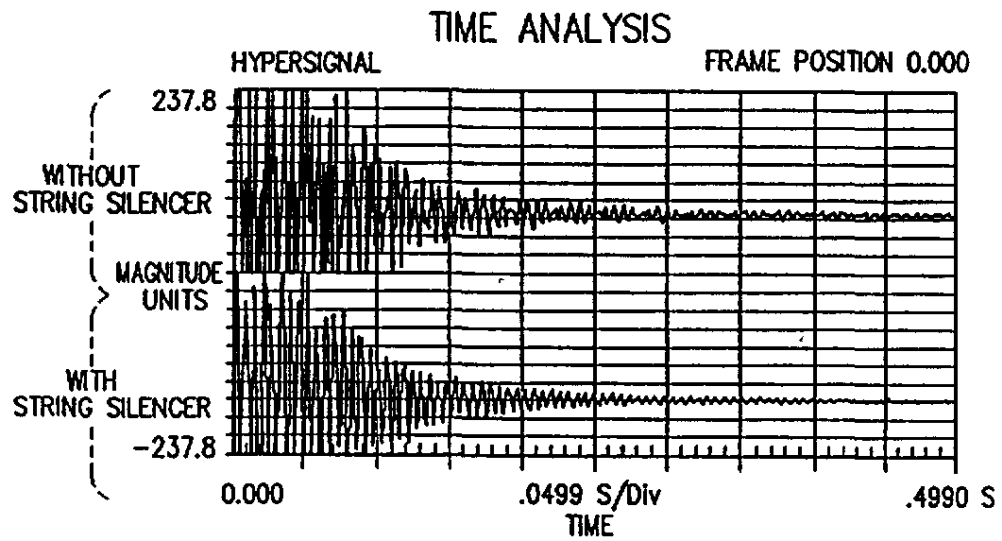
82.13
WITHOUT STRING SILENCER
MAGNITUDE UNITS
WITH STRING SILENCER
0
0.000
50.00Hz/Div
FREQUENCY
500.0 Hz

FIG. 13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BOW STRING SILENCERS FOR ARCHERY BOWS

TECHNICAL FIELD OF THE INVENTION

The present invention relates to archery bows and more, particularly, to novel, improved devices for minimizing the sound generated by a bow string when an arrow is released

BACKGROUND OF THE INVENTION

A bow string makes a relatively loud sound when an arrow is released This is disadvantageous as the sound may be loud enough to frighten away game a hunter is seeking or cause the bowman to flinch and the arrow to consequently go astray

A variety of silencers for bow strings are available from Martin Archery, Cabala's Archery, and other sources Available string savers are of several different types One, due to its shape, is known as a "puff silencer." Puff silencers are typically made of leather and yarn strands.

A second type of silencer is the "whisker silencer," also named for its appearance The whiskers of the silencer are commonly made from a rubber or comparably flexible material

Other commercially available string silencers are made from fleece and such exotic materials as beaver hide.

The available devices, however, are not as effective as one might wish. Therefore, there is a continuing need for a better string saver

SUMMARY OF THE INVENTION

There have now been invented and disclosed herein certain new and novel string silencers which are highly effective. Another advantage of the string silencers disclosed herein is that the reduction in initial arrow velocity, inevitably associated with the use of a string silencer, is very small.

One type of string silencer embodying the principles of the present invention and having the just-discussed advantages is a strip-like device fabricated from vibration damping material. These string silencers are knotted onto the bow string, one at each end of the string

A second type of string silencer also embodying the principles of the present invention, is likewise fabricated from a vibration damping material. This string silencer is installed between the two parts of a split bow string and retained in place by complementary, integrated, silencer bosses. Split bow strings are commercially available, and other bow strings can be split to accommodate the silencers with a conventional string splitter

The objects, novel features, and advantages of the present invention will be apparent to the reader from the foregoing and the appended claims and as the ensuing detailed description and discussion proceeds in conjunction with the accompanying drawing

BRIEF DESCRIPTION OF THE DRAWINGS

FIG 1 is a perspective view of a compound bow equipped with string silencers embodying the principles of the present invention,

FIG 2 is a fragment of FIG 1 drawn to an enlarged scale to better show how a FIG 1 silencer is attached to the string of the FIG 1 bow;

FIG 3 is a perspective view of the silencer;

FIG 4 is a section through the silencer, taken along line 4—4 of FIG 3,

FIG. 5 is a perspective view of a second string silencer embodying the principles of the invention, this silencer differs from the FIG 3 string silencer in that it has a necked down center section,

FIG 6 is a fragmentary view of a compound bow equipped with a third type of flexible string silencer which embodies the principles of the present invention and is designed for use with a split bow string,

FIG 7 is a right-hand side view of the split bow string and string silencer;

FIG. 8 is a left-hand side view of the bow string and silencer;

FIG. 9 is an end view of the string silencer;

FIG 10 shows the configuration assumed by the FIGS 6–9 string silencer in that moment immediately following the release of an arrow; this configuration is effective in reducing the drift of an arrow when the arrow is released

FIG 11 is similar to FIG. 8 but shows how the string silencer might wiggle and jiggle to alter vibration patterns and reduce the sound generated when the bow string is released;

FIG. 12 is a graph showing the significant extent to which the magnitude of sounds in a wide range of frequencies are reduced by employing string silencers as illustrated in FIGS 6–10, and

FIG 13 is a graph showing how string silencers illustrated in FIGS 6–10 significantly reduce the level of the sound (or twang) generated when an arrow is released from a bow equipped with such silencers.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, FIG. 1 depicts a compound bow 20 equipped with string silencers 22 and 24 in accord with the principles of the present invention. Bow 20 has flexible limbs 26 and 28 mounted to the opposite ends of a riser 30 and a bow string 32 The bow string is strung around cams 34 and 36 at the ends of limbs 26 and 28 with the ends of the bow string being anchored to the shafts 38 and 40 which support cams 34 and 36 from the limbs 26 and 28 of bow 20

The two bow string silencers 22 and 24 are duplicates; accordingly, only bow string silencer 22, shown in more detail in FIGS. 2–4, will be described in detail herein.

Bow string silencer 22 is an elongated strip of an elastomeric material. Silencer 22 has a generally rectangular cross-section. This cross-section is uniform over the length of the silencer

One material from which string silencer 22 can be made is NAVCOM. NAVCOM is a soft, amphorous, rubber-like material which contains a mixture of chloroprene and butyl polymers and the following physical properties (representative).

	Shore A hardness- 17–90				
Environment	Shore A	Ultimate Elongation (Percent)	Tensile Strength (PSI)	Compression Set (Percent)	Specific Gravity
	7	1,075	373	6.01	1.014
	12	900	643	7 3	1.025
	20	835	1,069	6 9	1.063

-continued

	30	1,056	1,621	40	1,074
	40	326	1,453	N/A	1 185
	90	175	2,440	N/A	1.379
Oven aged	7	N/A	N/A	56.3	—
For	12	—	—	31 1	—
70 hrs at	20	—	—	30.8	—
212 = 5° F	40	—	—	22.4	—
	90	—	—	18.6	—

Resilience	At room temperature - Medium At high temperature - Fairly high
Heat resistance	Good
Outdoor aging resistance	Excellent
Low temp flexibility	*Good*
Abrasion resistance	Good
Flex life	Good
Solvent resistance	
Hydrocarbons -	Fair to good
Oxygenated -	Fair to good
Air permeability·	Low to moderate
Moisture resistance.	Fair
Useful operating temperature.	−40° to 250° F

The approximate dimensions of a representative string silencer as shown in FIGS 3 and 4 are·

Length (l)	3.25 in
Width (w)	0.38 in
Thickness (t)	0.1 in

As shown in FIGS. 1 and 2, string silencer 22 is attached to that run 42 of bow string 32 in which arrows are nocked as by knotting the silencer around the bow string with the illustrated overhand knot 44

Bow string silencer 22 is thus attached to bow string 32 at one end 46 of run 42 The second bow string silencer 24 is in the same fashion attached to bow string run 42 near its opposite end 48.

As indicated by arrows 50 and 52 in FIG. 2, the just-described method of assembling bow string silencer 22 (and bow string silencer 24) to bow string run 42 leaves the two string silencer segments 54 and 56 on opposite sides of knot 44 free to oscillate,bend, and otherwise flex relative to the knot, and vibrations may also be set up within each of the two string silencer segments 54 and 56 on opposite sides of knot 44. The result of this wiggling and jiggling is an altered pattern of bow string vibration and a marked decrease in the level of sound (or twang) generated when an arrow is released At the same time, and in contrast to typical, heretofore available string silencers, the loss in arrow velocity attributable to the presence of the string silencers is minimal (typically, not more than two feet per second)

Referring still to the drawing, FIG. 5 depicts a second string silencer 60 also fabricated in accord with, and embodying, the principles of the present invention. This string silencer, also employed in pairs with one silencer at each end of the bow string run in which an arrow is nocked, differs from silencer 22 in that it has a necked down center segment 62 located between two integral end segments 64 and 66 This optional necked down section stretches and contracts to keep the string silencer in place when an arrow is released and the bow string vibrates In most cases, however, this enhancement of the string gripping capability of the silencer is not necessary as the NAVCOM or comparable material provides adequate gripping ability due to its softness

As just suggested, string silencer 60 may be fabricated from the same types of materials as string silencers 22 and 24, and it will typically have the same dimensions as those silencers

With continued reference to the drawing, FIG 6 depicts, in fragmentary form, a compound bow equipped with string silencers (only one of which is shown) of the type shown in more detail in FIGS 7–11. The string silencer is identified by reference character 70.

The FIG 6 bow may duplicate the bow shown in FIG. 1. Accordingly, the same reference characters have been employed to identify the two bows and their components

Silencer 70 has a center segment 72 and integral arms 74 and 76, one at each end of the central segment. These arms extend at right angles from central segment 72 and in opposite directions from that segment as indicated by arrows 78 and 80 in FIG 7 From the side, the width w_1 of arms 74 and 76 is uniform (see FIGS 7 and 8) End on, the arms have a wedge shape, being thicker at the ends integrated with center silencer segment 72 than at their outer ends as indicated by t_1 and t_2.

There are two complementary pairs of bosses or protrusions on each side of string silencer central segment 72. On that side 82 of string silencer 70 shown in FIG. 7, one pair of bosses is identified by reference character 84 This pair is composed of bosses 86 and 88

The second, complementary pair of bosses on the same side 82 of string silencer 70 is identified by reference character 90 with reference characters 92 and 94 identifying the bosses per se

The two pairs of bosses on the opposite side 96 of string silencer 70 (see FIG 8) are identified by reference characters 98 and 100 with reference characters 102 and 104 identifying the two bosses in pair 98 and reference characters 106 and 108 identifying the two bosses in pair 100

String silencer 70 (and its companion) may be fabricated from the same NAVCOM material as string silencers 22, 24, and 60 Representative dimensions (approximate) of a string silencer as shown in FIGS 6–11 are:

Center Segment

Length (l_c)	0.44 in
Width (w_c)	0.25 in
Thickness (t_c)	0.19 in

Arms

Length (l_a)	0.34 in
Width (w_a)	0.22 in
Thickness (inner end, t_1)	0 19 in
Thickness (outer end, t_2)	0 13 in

String silencer 70 (and its companion) are installed between the elements 110 and 112 of the split bow string run 114 shown in FIGS 6, 7, 8, 10, and 11 Element 110 is trapped between the two pairs of bosses 84 and 90 on side 82 of string silencer 70 Split bow string element 112 is similarly trapped between the two pairs of bosses 98 and 100 on the opposite side 96 of the string silencer

The just-described arrangement secures string silencer 70 in place on bow string run 114 while leaving the two arms

74 and 76 of the string silencer free to oscillate, bend, and otherwise move relative to the central segment 72 of the string silencer when an arrow is released This is suggested by the three sets 116, 118 and 120 of dotted lines in FIG 11 Vibrations can also be set up in the two arms 74 and 76 of the silencer and, to a lesser extent, in the central segment 72 of the silencer. The result of this wiggling and jiggling is a marked attenuation of the sound generated when an arrow is released

FIG. 10 shows, in solid lines, the relationship between the two arms 74 and 76 of string silencer 70 of the moment immediately following of arrow release In particular, the two arms during that moment assume a parallel relationship with the arms: (a) at equal distances from the bow's (and bow strings) axis of symmetry 122, and (b) trailing center segment 72 This ensures that the weight of the silencer is equal on both sides of axis 20 As a consequence, the drift of an arrow that might occur if the weight of the silencer was unevenly distributed relative to axis 120 is avoided

Gaps between the elements of a split bow string result in a loss of arrow velocity that is directly related to the width of the gap. In applications of the present invention such as that shown in FIGS 6–8, 10, and 11 where the string silencer 70 (or a comparable silencer) is mounted between the two elements of a split bow string, this gap can be essentially eliminated by serving in the run of the bow string in which the silencer is installed. This is done by knotting the two elements 100 and 112 of the bow string run 114 together immediately above and below the silencer (the two knots are identified by reference characters 124 and 126)

FIG. 12 is a spectral analysis of the vibrations set up in the string of a compound bow when an arrow is released. (1) with no string silencers, and (2) with two string silencers as identified by reference character 70 attached to the split string run 114 of bow string 32 This figure shows that the string silencers significantly decrease sound producing bow string vibrations set up in the bow string when an arrow is released

Complementary FIG. 13 shows that there is a marked reduction of bow string vibrations (and, accordingly, sound), particularly in those first milliseconds after an arrow is released when the vibrations are the strongest and sound the loudest.

As will be apparent to the reader, the present invention may be embodied in many forms without departing from the spirit or essential characteristics of the invention. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive. The scope of the invention is indicated by the appended claims rather than by the foregoing description and the drawings; and all changes which come within the meaning and range of equivalency of the claims are intended to be embraced therein

What is claimed is.

1 The combination of

a bow;

a bow string, and

a silencer assembled to the bow string

said silencer being a single elongated strip which is fabricated from an elastomeric material,

said silencer being so configured and related to the bow string that segments of the silencer can flex when an arrow is released and vibrations are consequentially set up in the bow string, and

there being a single overhand knot which is (a) tied in said silencer and around the entire circumference of the bow string, and (b) attaches the silencer to the bow string

2 The combination of

a bow,

a bow string; and

a silencer assembled to the bow string,

said silencer being fabricated from an elastomeric material,

said silencer being so configured and related to the bow string that segments of the silencer can flex when an arrow is released and vibrations are consequentially set up in the bow string,

the bow string being split into elements,

the silencer being installed between the elements of the bow string;

said silencer having a center segment and first and second arms,

said arms being integrated with the center segment at opposite ends of said segment, and

when said silencer is unstressed, said first and second arms extending in opposite directions from, and at equal angles to, said center segment

3 The combination of

a bow;

a bow string, and

a silencer assembled to the bow string;

said silencer being fabricated from an elastomeric material,

said silencer being so configured and related to the bow string that segments of the silencer can flex when an arrow is released and vibrations are consequentially set up in the bow string;

the bow string being split into elements and the silencer being installed between the elements of the bow string, and

there being complementary protrusions on opposite sides of the silencer for trapping the first and second bow string elements on opposite sides of the silencer and thereby securing the silencer between and to said elements

4 The combination of

a bow;

a bow string; and

a silencer assembled to the bow string;

said silencer being fabricated from an elastomeric material;

said silencer being so configured and related to the bow string that segments of the silencer can flex when an arrow is released and vibrations are consequentially set up in the bow string;

the string silencer being an elongated component with a generally rectangular cross section; and

the silencer having first and second end segments and a necked down center segment which is integrated, at opposite ends thereof, with said end segments

5 The combination of

a bow,

a bow string; and

a silencer assembled to the bow string,

said silencer being fabricated from an elastomeric material which is a viscoelastic mixture of choroprene and butyl polymers,

said silencer being so configured and related to the bow string that segments of the silencer can flex when an

arrow is released and vibrations are consequentially set up in the bow string

6 A combination as defined in claim 5 in which the string silencer is an elongated component with a generally rectangular cross section

7 A combination as defined in claim 6 in which the cross-section of the string silencer is essentially the same throughout the length of the silencer

8 A bow string silencer;

said silencer being fabricated from an elastomeric material and being so configured that, when attached to a bow string, segments of the silencer can wiggle and jiggle when an arrow is released to reduce the sound emanating from the bow string upon the release of said arrow,

said silencer having a center segment and first and second arms,

said arms being integrated with the center segment at opposite ends of said segment, and

when said silencer is unstressed, said first and second arms extending in opposite directions from, and at equal angles to, said center segment.

9. A bow string silencer;

said silencer being fabricated from an elastomeric material and being so configured that, when attached to a bow string, segments of the silencer can wiggle and jiggle when an arrow is released to reduce the sound emanating from the bow string upon the release of said arrow; and

there being complementary protrusions on opposite sides of the silencer for trapping said silencer between first and second bow string elements and thereby securing the silencer between and to said elements

10 A bow string silencer;

said silencer being fabricated from an elastomeric material *and being so configured that, when attached to a* bow string, segments of the silencer can wiggle and jiggle when an arrow is released to reduce the sound emanating from the bow string upon the release of said arrow;

said silencer being an elongated, slit and aperture free component with a cross-section which is essentially the same throughout the length of the silencer; and

said silencer being so dimensioned and configured that it can be attached to a bow string by tying a single overhand knot in the silencer

11. A bow string silencer,

said silencer being fabricated from an elastomeric material and being so configured that, when attached to a bow string, segments of the silencer can wiggle and jiggle when an arrow is released to reduce the sound emanating from the bow string upon the release of said *arrow; and*

said silencer having first and second end segments and a necked down center segment which is integral, at opposite ends thereof, with said end segments

12 A bow string silencer,

said silencer being fabricated from an elastomeric material and being so configured that, when attached to a bow string, segments of the silencer can wiggle and jiggle when an arrow is released to reduce the sound emanating from the bow string upon the release of said *arrow;*

said silencer having a center segment and first and second arms;

said arms being integrated with the center segment at opposite ends of said segment,

said first and second arms extending in opposite directions from said center segment, and

said arms being so configured and related to said center segment that, in the moment after an arrow is released, said arms (a) are parallel, (b) at equal distances from, *and on opposite sides of, an axis of symmetry through* the bow and bowstring, and (c) trail the center segment of the silencer

* * * * *

FIG. 1

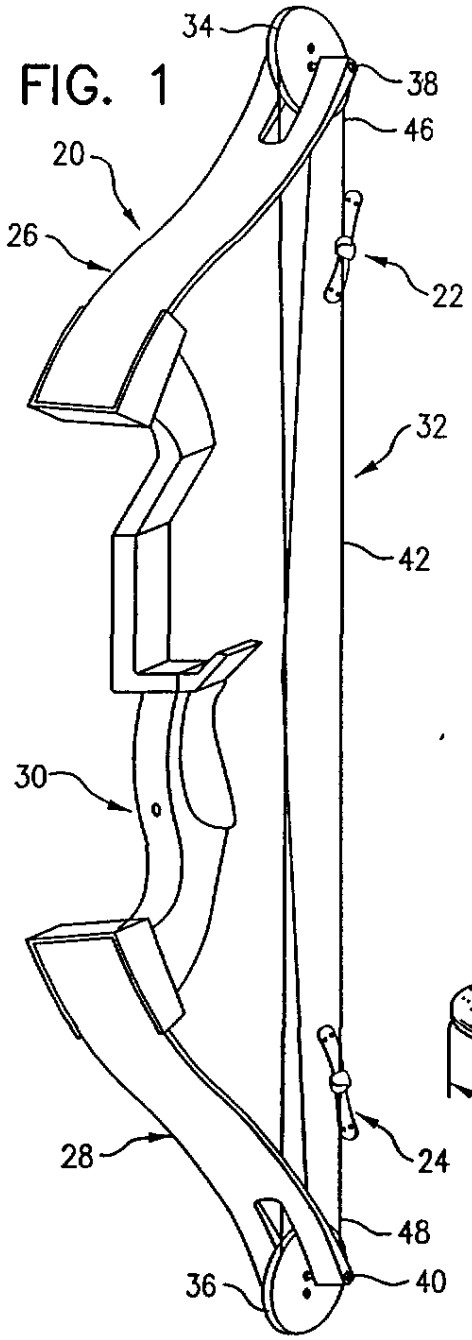


FIG. 2

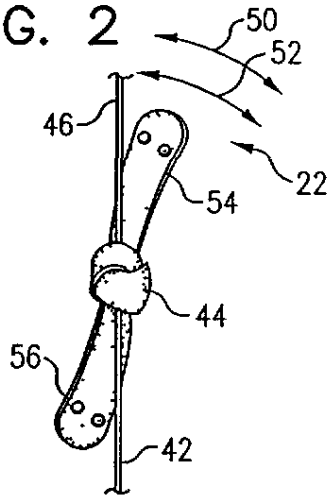


FIG. 4

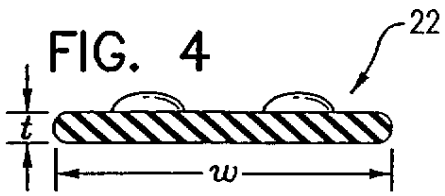


FIG. 3

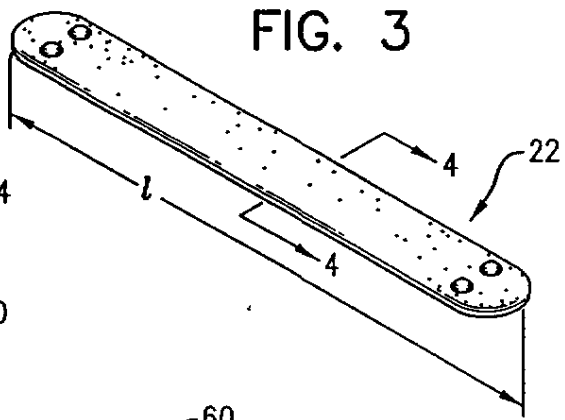


FIG. 5

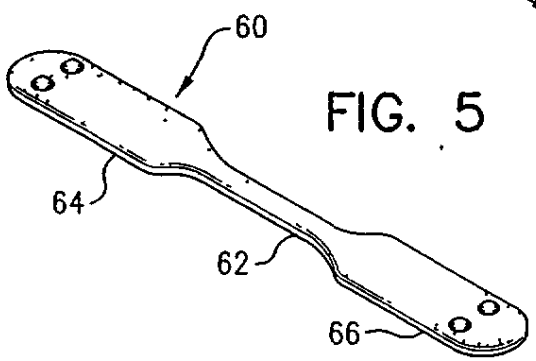
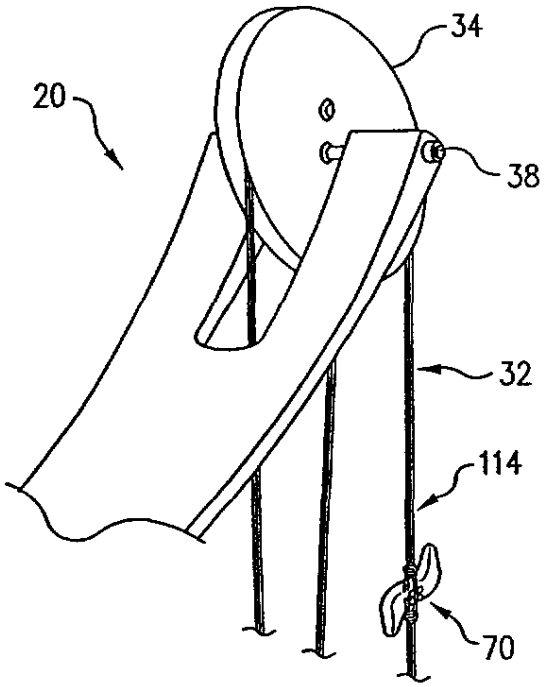


FIG. 6


34
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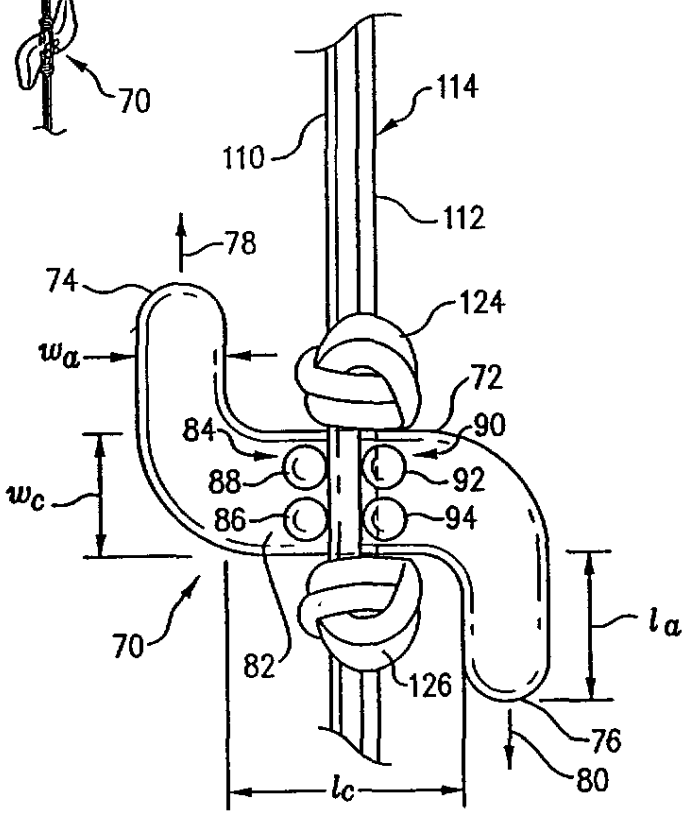
32
114
70

FIG. 7


114
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l_c

FIG. 8

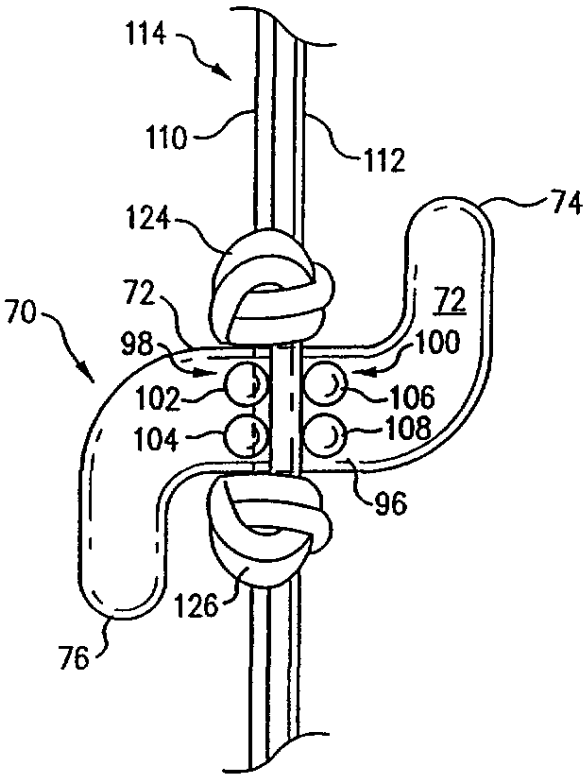

FIG. 9

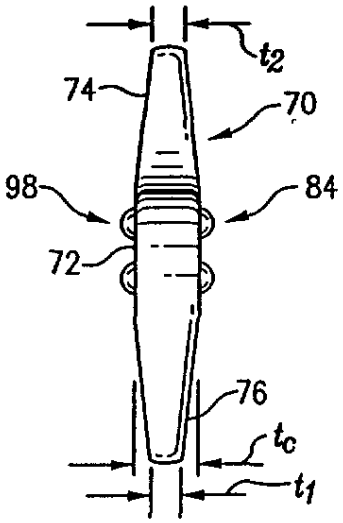

FIG. 10

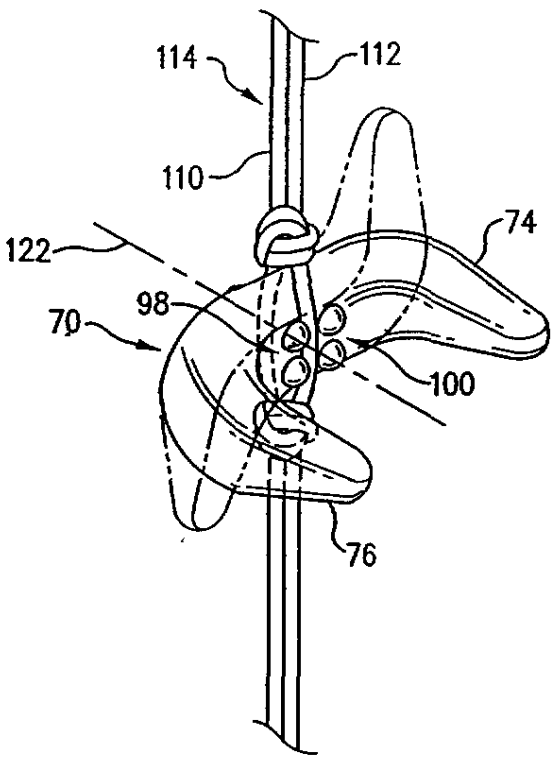

FIG. 11

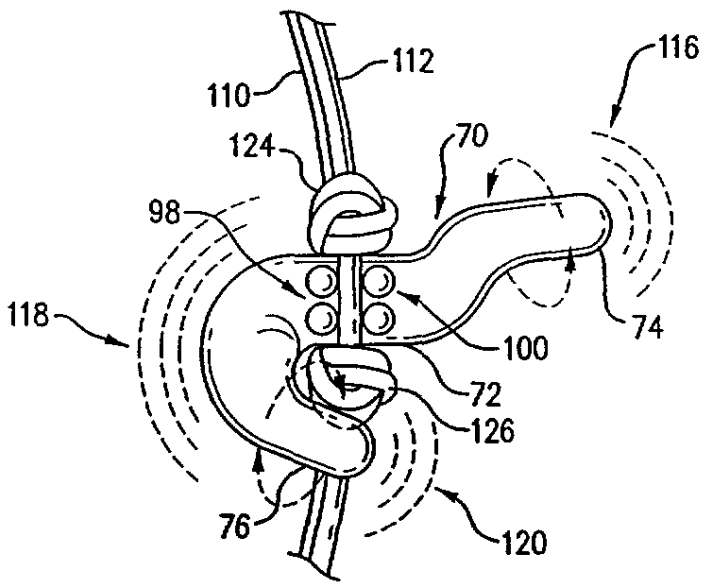

FIG. 12

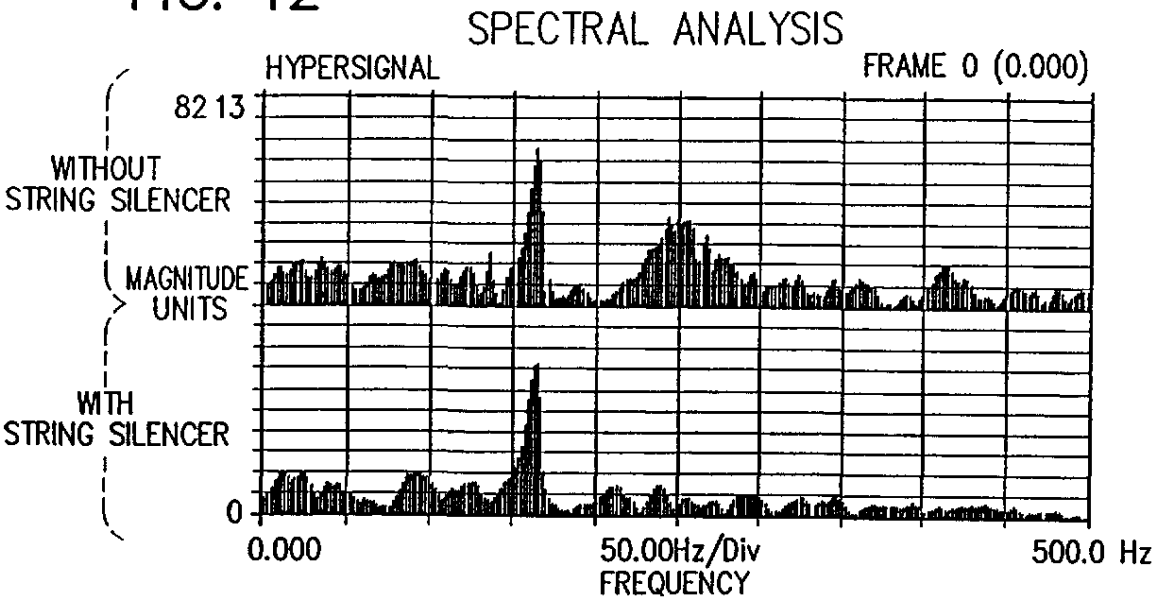
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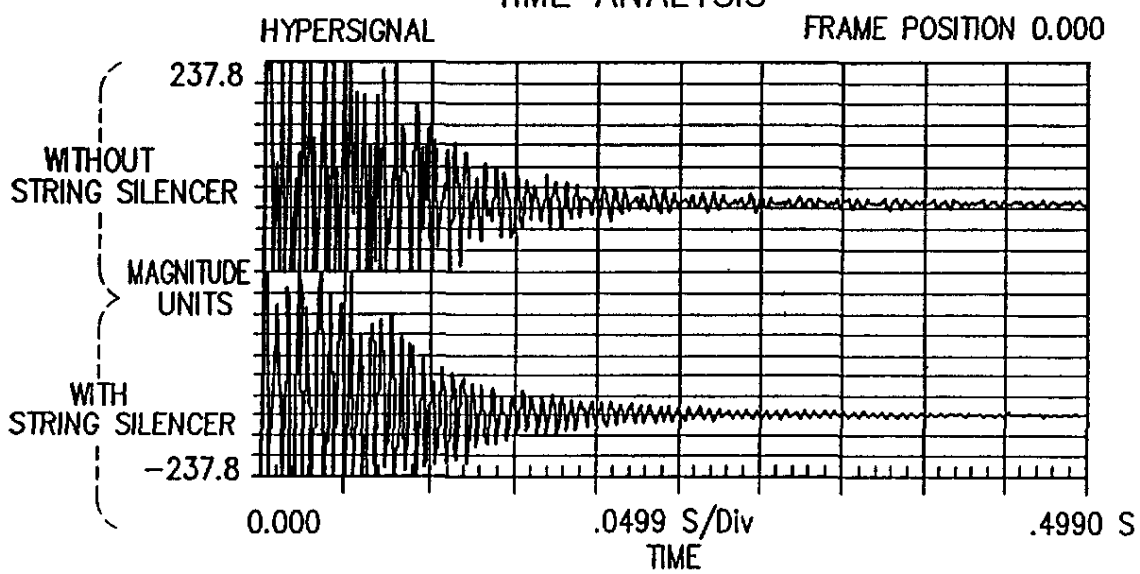
FIG. 13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TIME
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US006298842B1

(12) **United States Patent**
Sims

(10) **Patent No.: US 6,298,842 B1**
(45) **Date of Patent: Oct. 9, 2001**

(54) **ARCHERY BOW ACCESSORIES WITH BOW VIBRATION DECAY PATTERN MODIFIERS FOR IMPROVING ACCURACY**

(76) Inventor **Steven C. Sims**, 450 Enterprise Rd , Shelton, WA (US) 98054

(*) Notice Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U S C 154(b) by 0 days

(21) Appl No **09/478,921**

(22) Filed **Jan. 6, 2000**

Related U.S Application Data

(60) Provisional application No 60/115,007, filed on Jan. 6, 1999

(51) **Int. Cl.**[7] **F41B 5/20**
(52) **U.S. Cl.** **124/89**, 267/136
(58) **Field of Search** 124/23 1, 86, 89, 188/268, 267/136

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Primary Examiner—John A Ricci
(74) *Attorney, Agent, or Firm*—Richard D Multer

(57) **ABSTRACT**

Devices for modifying the pattern of vibrations set up in a bow when an arrow is released These devices have an integral head and stem and are fabricated from an elastomeric material Versions suitable for attachment to bow with solid and split limbs are disclosed as are models designed for attachment to a bow stabilizer

38 Claims, 6 Drawing Sheets

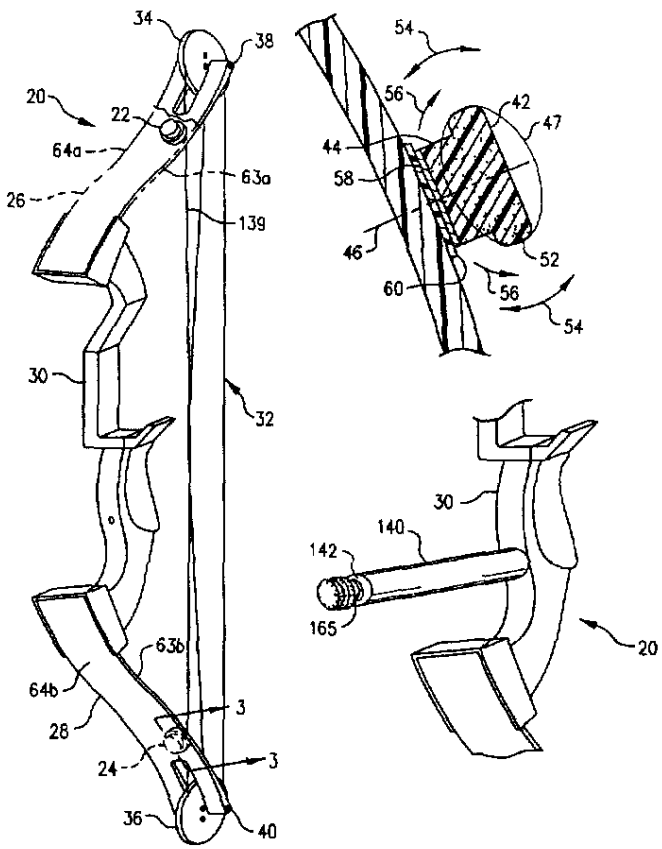


FIG. 1

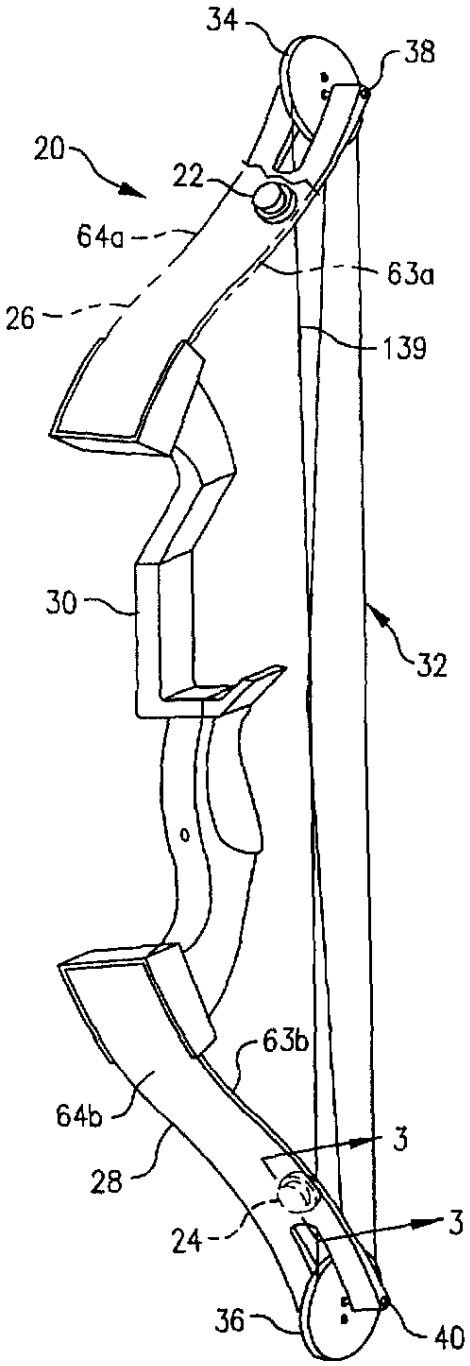


FIG. 2

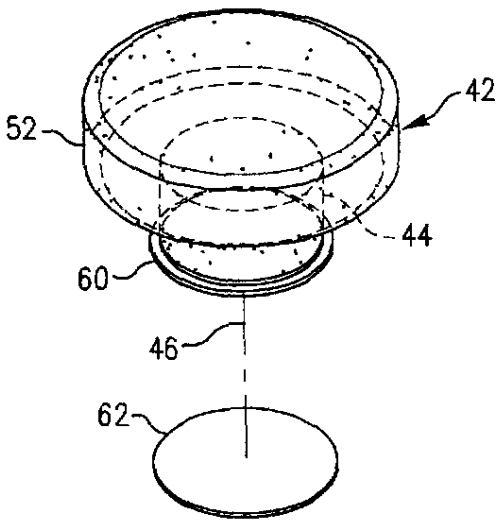


FIG. 3

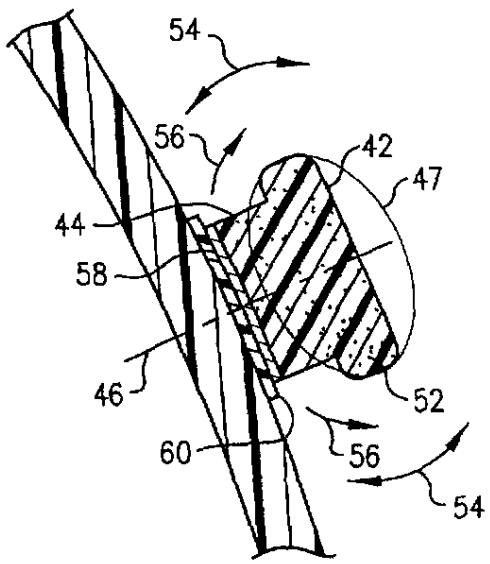


FIG. 4

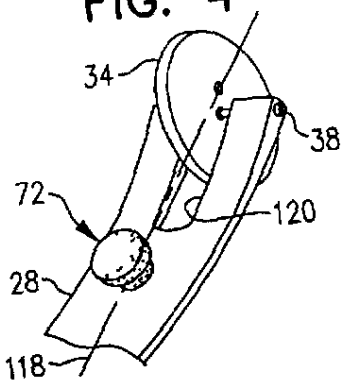


FIG. 5

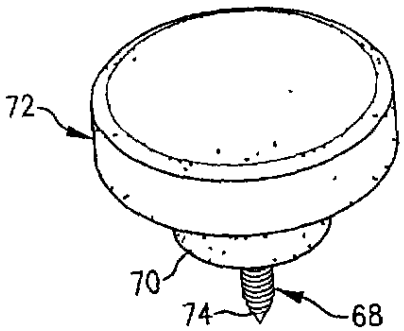


FIG. 6

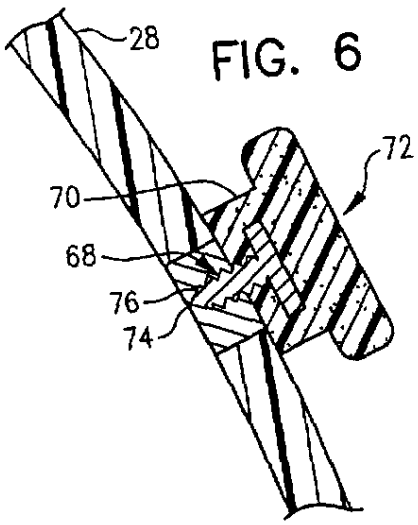


FIG. 7

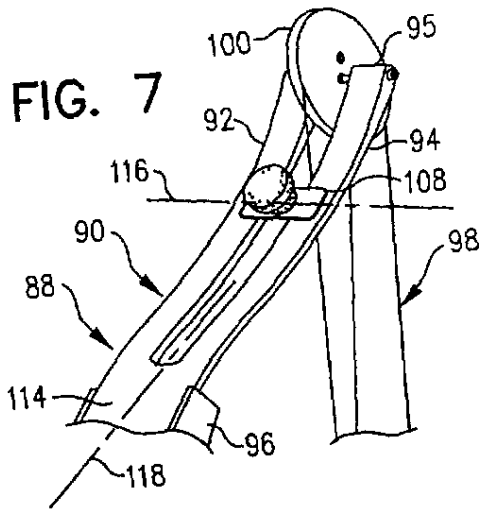


FIG. 8

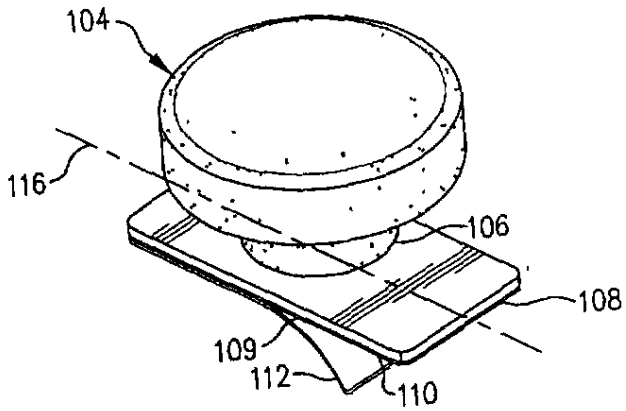


FIG. 9

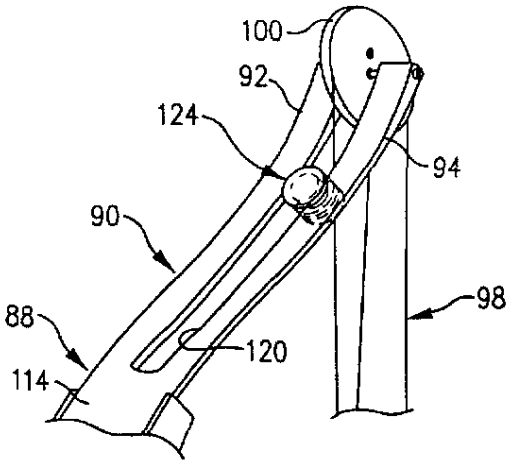


FIG. 10

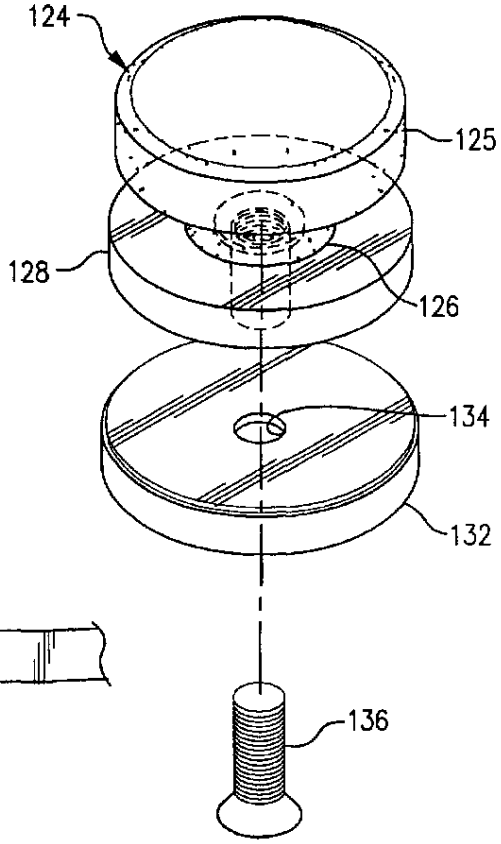


FIG. 11

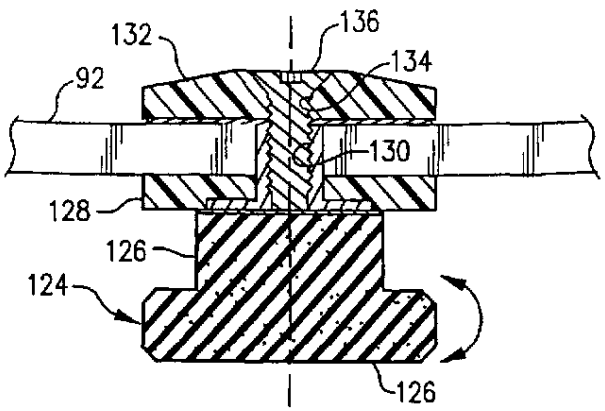


FIG. 14

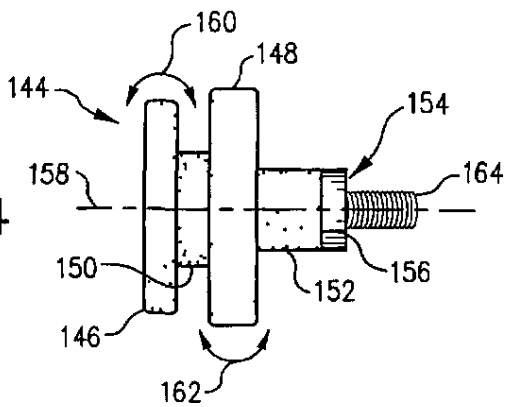


FIG. 12

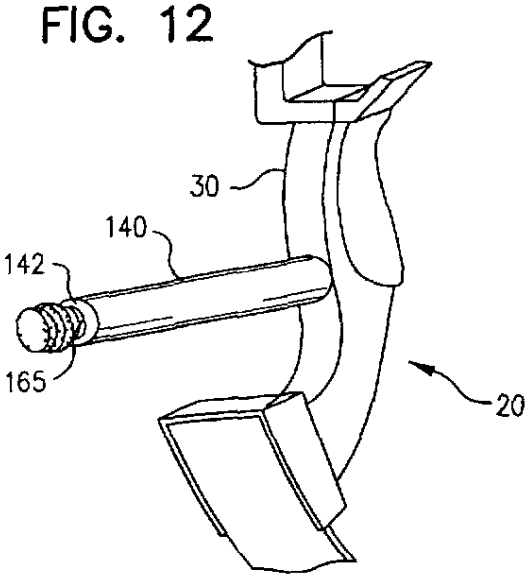


FIG. 13

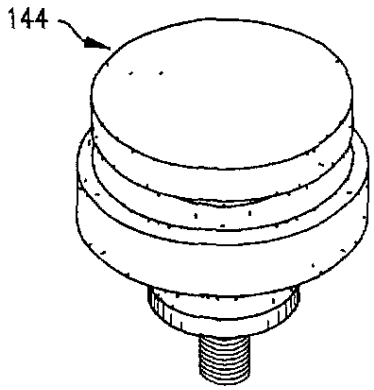


FIG. 15

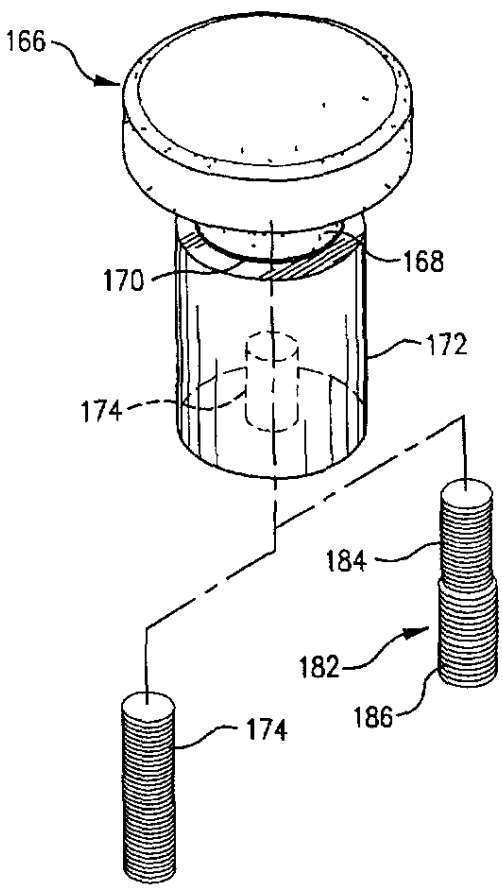


FIG. 16

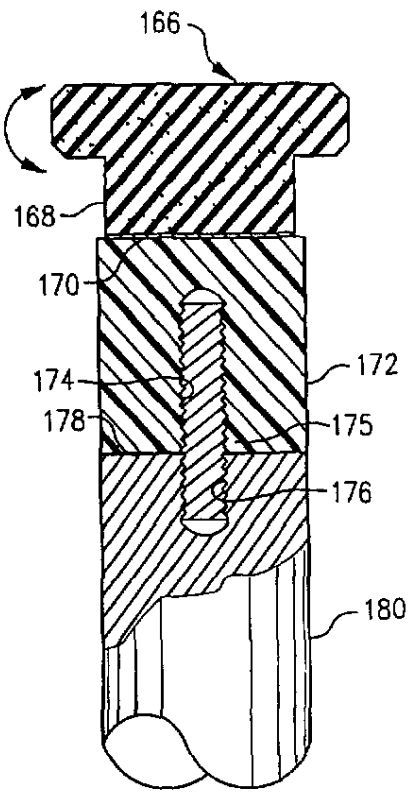


FIG. 17

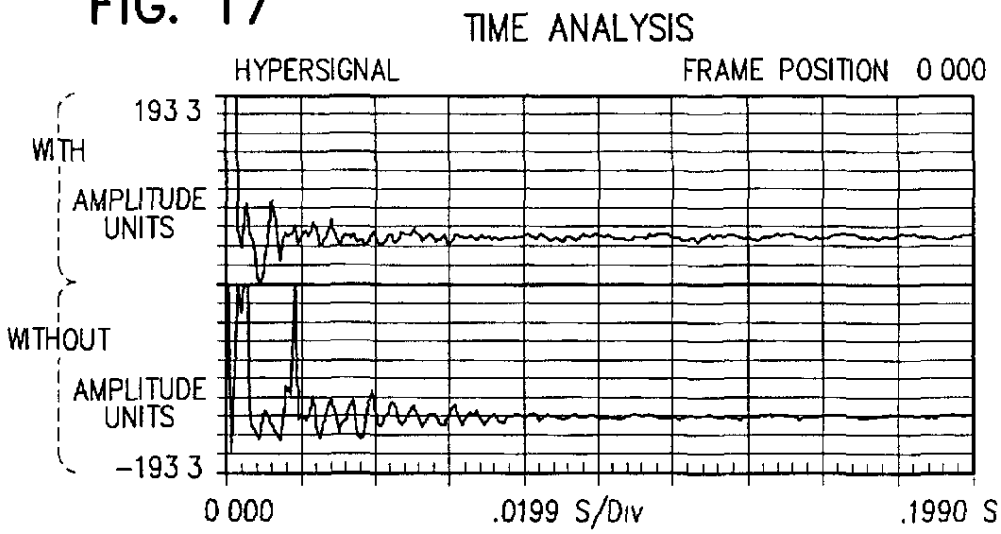

TIME ANALYSIS
HYPERSIGNAL
FRAME POSITION 0 000
193 3
WITH
AMPLITUDE
UNITS
WITHOUT
AMPLITUDE
UNITS
−193 3
0 000
.0199 S/Div
.1990 S

FIG. 18

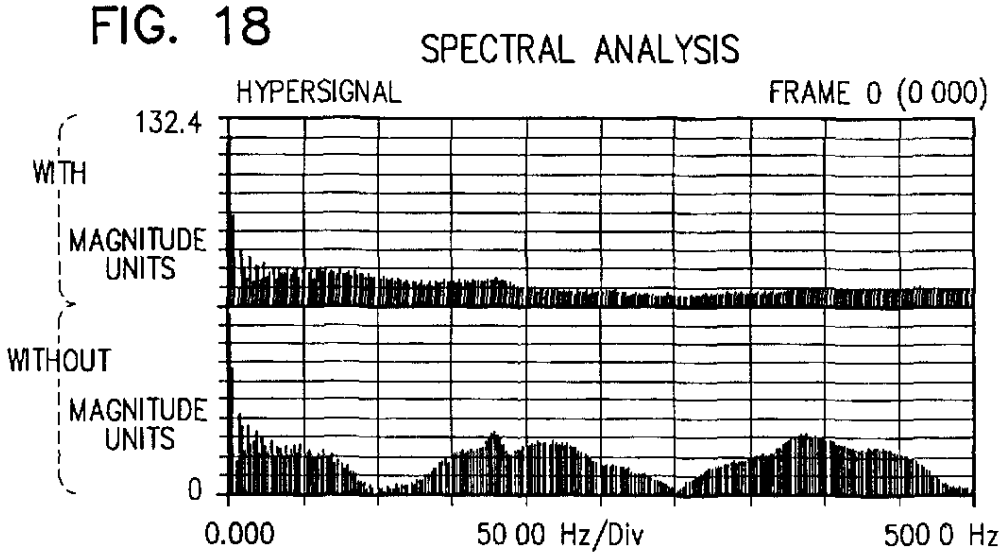

SPECTRAL ANALYSIS
HYPERSIGNAL
FRAME 0 (0 000)
132.4
WITH
MAGNITUDE
UNITS
WITHOUT
MAGNITUDE
UNITS
0
0.000
50 00 Hz/Div
500 0 Hz

FIG. 19

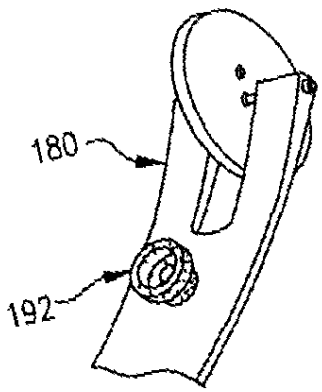


FIG. 20

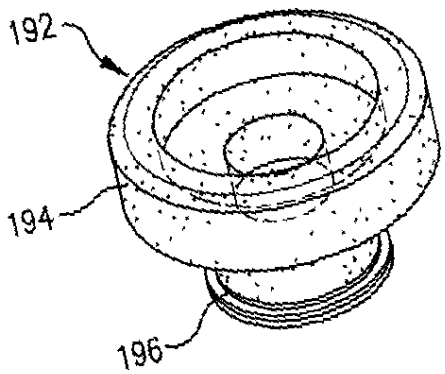
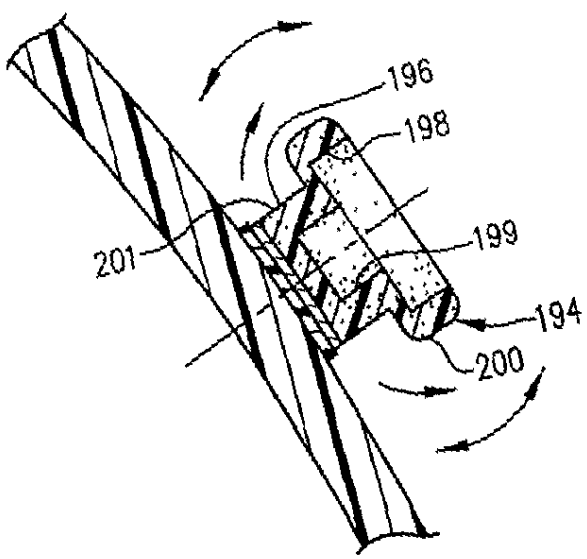


FIG. 21



ARCHERY BOW ACCESSORIES WITH BOW VIBRATION DECAY PATTERN MODIFIERS FOR IMPROVING ACCURACY

This application claims priority from Provisional Application Ser No 60/115,007, filed Jan 6, 1999

TECHNICAL FIELD OF THE INVENTION

The present invention relates to archery bows, and more particularly, to novel, improved bows with accessories which improve accuracy by modifying the decay pattern of the vibrations set up in the bow when an arrow is released

BACKGROUND OF THE INVENTION

The release of an arrow from even a modern bow sets up significant vibrations in the limbs of the bow, and these are in large part transmitted to the riser of the bow and from there to the archer's hand The result is a significant adverse effect on accuracy

A variety of stabilizers have been employed in an effort to reduce the adverse effect of this vibration on the accuracy of the bow At best, such devices have proved to be of limited value

SUMMARY OF THE INVENTION

There have now been invented and disclosed herein certain new and novel vibration decay pattern modifiers which significantly reduce the adverse effect on accuracy of the vibrations generated when an arrow is released Different ones of these decay pattern modifiers are fixed to the limbs of the bow and/or to the end of the hydraulic stabilizer typically attached to the riser of a compound bow

Decay pattern modifiers in accord with the principles of the present invention are fabricated from a soft visco-elastic polymer and have a mushroom-like configuration provided by a head and an integral stem The head and stem of the decay pattern modifiers are so configured and dimensioned that (1) the modifier can vibrate or oscillate toward and away from the longitudinal axis of the modifiers at any and all locations around the 360° circumference of the modifier, and (2) peripheral portions of the decay pattern modifier head can oscillate in directions generally parallel to the longitudinal modifier axis at any (and all) locations around the circumference of the decay pattern modifiers Motions are also set up in the material of the damper The combined result of these motions is a wiggle and jiggle which significantly alters the pattern of vibrations set up in the bow when an arrow is released, effectively minimizing the effect on accuracy of those vibrations

Yet another, particularly important advantage of the present invention is that there is only a small, two foot per second (typical) loss in arrow velocity appurtenant to the use of decay pattern modifiers embodying its principles

Another important attribute of the novel decay pattern modifiers disclosed herein is that they are light and small enough that they do not interfere with the normal drawing of the bow string and subsequent release of an arrow

Other important objects, features, and advantages of the invention will be apparent to the reader from the foregoing and the appended claims and as the ensuing detailed description and discussion of the invention proceeds in conjunction with the accompanying drawing

BRIEF DESCRIPTION OF THE DRAWINGS

FIG 1 is a pictorial view of a compound bow equipped with decay pattern modifiers constructed in accord with the

principles of the present invention, components of the bow which are not relevant to an understanding of the present invention do not appear in FIG 1, these include the bow sight and the often present, built-in quiver,

FIG 2 is an exploded view, to an enlarged scale, of one of two identical decay pattern modifiers with which the bow of FIG 1 is equipped,

FIG 3 is a fragmentary section through one limb of the FIG 1 bow and the decay pattern modifier attached to that limb,

FIG 4 shows an alternate location on the bow link for the decay pattern modifier,

FIG 5 shows a second decay pattern modifier with an alternate mechanism for attaching the decay pattern modifier to the limb of a bow,

FIG 6 is a section through the FIG 5 decay pattern modifier,

FIG 7 is a fragmentary view of a second compound bow which is of the split limb type and which is equipped with decay pattern modifiers in accord with the principles of the present invention,

FIG 8 is an enlarged and isometric view of a decay pattern modifier as shown in FIG 7,

FIG 9 is a view similar to FIG 7 but showing an alternate form of decay pattern modifier designed for use with split limb bows,

FIG 10 is an exploded view of the decay pattern modifier depicted in FIG 9,

FIG 11 is a longitudinal section through the decay pattern modifier of FIG 10,

FIG 12 is a fragmentary view of a bow equipped with (1) a conventional, hydraulic type bow stabilizer, and (2) a stabilizer-associated accessory for modifying vibration decay patterns in accord with the principles of the present invention,

FIG 13 is a perspective view of the decay pattern modifier illustrated in FIG 12,

FIG 14 is a side view of the FIG 12 decay pattern modifier,

FIG 15 is an imploded view of a second type of limb saver which embodies the principles of the present invention and is designed to be attached to a bow stabilizer,

FIG 16 is a section through the FIG 15 decay pattern modifier and the outboard end of a bow stabilizer to which the accessory is attached,

FIGS 17 and 18 are graphs showing the significant effect beneficial alteration of bow vibration pattern that can be realized by employing decay pattern modifiers as illustrated in FIGS 1–3,

FIG 19 is a fragmentary view, similar to FIG 4, of a bow limb and yet another form of decay pattern modifier embodying the principles of the present invention,

FIG 20 is a perspective view of the FIG 19 limb saver, and

FIG 21 is a section through the FIG 20 decay pattern modifier

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, FIG 1 depicts a compound bow 20 equipped with decay pattern modifier 22 and 24 in accord with the principles of the present invention Bow 20 has flexible limbs 26 and 28 mounted to the opposite

ends of a riser **30** and a bow string **32** The bow string is strung around cams **34** and **36** at the ends of limbs **26** and **28** The ends of the bow string are anchored to the shafts **38** and **40** which support cams **34** and **36** from the limbs **26** and **28** of bow **20**

The two decay pattern modifiers **22** and **24** are duplicates, accordingly, only decay pattern modifier **24**, shown in more detail in FIGS **2** and **3**, will be considered in detail herein

Decay pattern modifier **24** has a mushroom-like configuration and a T-like cross-section defined by a cylindrical head **42** and an integral, also cylindrical stem **44** Decay pattern modifier **20** is fabricated from a soft, visco-elastic material, preferably, a visco-elastic material with a Shore A hardness in the range of three to **20** The ratio between the diameter of decay pattern modifier head **42** and the length of stem **44** is preferably kept between 1 1 and 5 1 for optimal effectiveness

One suitable visco-elastic material is NAVCOM NAVCOM is a soft, amorphous, rubber-like material which contains a mixture of chloroprene and butyl polymers and has the following physical properties (representative)

Shore A hardness 17–90					
Environment	Shore A	Ultimate Elongation (Percent)	Tensile Strength (PSI)	Compression Set (Percent)	Specific Gravity
Oven aged	7	1,075	373	6 01	1 014
for	12	900	643	7 3	1 025
70 hrs at	20	835	1,069	6 9	1 063
212 ± 5° F	30	1,056	1,621	4 0	1 074
	40	326	1,453	N/A	1 185
	90	175	2,440	N/A	1 379
	7	N/A	N/A	56 3	—
	12	—	—	31 1	—
	20	—	—	30 8	—
	40	—	—	22 4	—
	90	—	—	18 6	—

Resilience	At room temperature - Medium At high temperature - Fairly high
Heat resistance	Good
Outdoor aging resistance	Excellent
Low temp flexibility	Good
Abrasion resistance	Good
Flex life	*Good*
Solvent resistance	
Hydrocarbons-	Fair to good
Oxygenated	Fair to good
Air permeability	Low to moderate
Moisture resistance	Fair
Useful operating temperature	−40° to 250° F

The nominal dimensions of the exemplary illustrated decay pattern modifier are

Head 42	
Diameter	1 44 in
Width	0 38 in
Stem 44	
Diameter	0 76 in
Length	0 25 in

The stem **44** of decay pattern modifier **24** can vibrate toward and away from the longitudinal axis **46** of the device at any and all directions around the 360° circumference of

modifier as indicated by ellipse **47** in FIG **3** At the same time, the peripheral edge portion **52** of head **42** can oscillate back and forth at any and all locations around the 360° circumference of the head in directions generally paralleling longitudinal axis **46** as indicated by arrows **54** and **56** There may also be otherwise directed movement of the modifier head and stem when and after an arrow is released as well as oscillations set up in the head and stem of the modifier These oscillations and movements in total—herein referred to as "wiggle and jiggle"—produce the beneficial shift in vibration decay patterns realized by employing a vibration decay pattern modifier as just disclosed as well as other such accessories embodying the principles of the present invention including those embodiments disclosed hereafter in this specification and illustrated in the drawings These unique patterns of oscillatory movement have been found to be highly effective in modifying the patterns of vibration set up in a bow when an arrow is released in a positive manner

The dramatic shift in the decay pattern of the vibrations set up in a bow when an arrow is released effected by devices as just described is dramatic as is shown in FIGS **17** and **18** FIG **17** shows that there is a significant reduction in the amplitude of the vibrations beginning at time zero (time of arrow release) The spatial analyses of FIG **18** shows a similar, significant reduction in both the primary frequencies of the vibrations set up in the bow when an arrow is released and in the harmonic frequencies of those vibrations

As shown in FIGS **2** and **3**, the exposed end **58** of decay pattern modifier stem **44** is covered by a layer **60** of adhesive which is protected by a peel-off cover **62** This makes the attachment of the decay pattern modifier to the associated limb of bow **20** a task of the utmost simplicity All that is required is to remove cover **62** and then press the decay pattern modifier onto the limb of the bow at the selected location therealong

In this regard, the decay pattern modifiers **22** and **24** are preferably located near the outer ends of the two limbs **26** and **28** of bow **20** (FIG **1**) The placing of the decay pattern modifiers at these locations has been found to be the most effective in modifying the vibrations set up in bow **20** when an arrow is released in a positive manner

It is also preferred that the decay pattern modifiers **22** and **24** be mounted on the inner sides (**63***a* and **63***b*) of the bow limbs **26** and **28**, i e , on the sides of those limbs facing bow string **32** This keeps the decay pattern modifiers from being snagged as the bowman moves through brush or bushes, for example The same, significant, worthwhile modification in the vibration decay pattern can nevertheless be obtained by mounting the decay pattern modifier on the outer sides **64***a* and **64***b* of the bow limbs This arrangement is depicted in FIG **4** which shows a decay pattern modifier **65** of the character described above mounted on the outer side **64***a* of bow limb **26**

FIGS **4** and **6** of the drawings, to which reference is now made, depict an alternate arrangement for attaching a decay pattern modifier as described above to the limb of a bow, e g , the limb **28** of bow **20** In this case, a threaded fastener **68** is embedded in the stem **70** of decay pattern modifier **72** with the threaded shank **74** of fastener **68** protruding from the stem Shank **74** is screwed into an internally threaded fitting **76** mounted in the limb **28** of the bow as shown in FIG **6** This securely attaches the decay pattern modifier to the limb of the bow

In that exemplary embodiment of the invention illustrated in FIGS **5** and **6**, decay pattern modifier **72** is mounted in the preferred location, i e , on the inner side **63***b* of limb **28** This

is not required, however, and the decay pattern modifier could instead, if desired, be mounted on the outer side 64*b* of the limb

Referring still to the drawings, FIG 7 depicts, in fragmentary form, a compound bow 88 of the split limb type The illustrated limb 90 of this bow has two separate, parallel branches 92 and 94 which extend from the end 95 of limb 90 to a location just short of the riser 96 of the bow

Like the bow 20 depicted in FIG 1, bow 88 also includes a bow string 98 strung over cams at the ends of the bow's two limbs One of these cams is shown in FIG 7 and identified by reference character 100

A decay pattern modifier specifically designed for a bow of the type just described is depicted in FIG 8 and identified by reference character 104 This decay pattern modifier may be of the type discussed above and identified by reference character 24 in FIGS 2 and 3 The stem 106 of decay pattern modifier 104 is fixed to a flat, elongated, generally rigid mount 108 The surface 109 of mount 108 opposite the decay pattern modifier is coated with a layer 110 of adhesive, the adhesive being covered by a peel away strip 112

Decay pattern modifier 104 is mounted to the limb 90 of bow 88 (in this case on the outer side 114 of the limb for purposes of clarity only) by removing protective strip 112 from mounting plate 108 and then pressing the mounting plate onto limb 90 of the bow to fix it in place The mounting plate 108 is oriented (1) with its longitudinal axis 116 at right angles to the longitudinal axis 118 of limb 90, (2) with the mounting plate spanning the gap 120 between the two branches 92 and 94 of limb 90, and (3) with the mounting plate 108 centered on gap 120 to provide equal area contact between the plate and the branches 92 and 94 of the bow limb

An alternate arrangement for attaching a decay pattern modifier as disclosed herein to the limb of a split limb bow is illustrated in FIG 9 The decay pattern modifier is shown in more detail and identified by reference character 124 in FIG 10 The bow shown in FIG 9 may duplicate the bow illustrated in FIG 7 Therefore, the bow and its illustrated components have been identified by the same reference characters in both FIG 7 and FIG 9

Decay pattern modifier 124 has an integral bead 125 and stem 126 providing the same mushroom shape as the decay pattern modifier discussed above and the same patterns of movement as is suggested by ellipse 47 and arcs 54 and 56 in FIG 3

NAVCOM is the preferred material from which stabilizer-associated decay pattern modifier 124 is fabricated The dimensions of decay pattern modifier 124 may essentially duplicate those of the previously described decay pattern modifiers

Decay pattern modifier 124 promotes accuracy in much the same manner as limb-associated decay pattern modifiers 22 and 24 Specifically, when bow string 98 is released, vibrations which have an adverse effect on accuracy are unavoidably set in the bow and are transmitted from the stabilizer through the bow to the archer's hand despite stabilizer 140 Decay pattern modifier 124 alters the decay pattern of these vibrations in a manner which markedly reduces, if it does not entirely eliminate, the accuracy-reducing effect of those vibrations

Referring now specifically to FIGS 10 and 11, the stem 126 of decay pattern modifier 124 is fixed to a flat, circular, generally rigid mount 128, which has a centrally located, internally threaded aperture 130

Employed with decay pattern modifier 124 are (1) a flat, also rigid washer 132 with a central aperture 134, and (2) a machine screw 136 Decay pattern modifier 124 is mounted to the limb 90 of bow 88 by placing the decay pattern modifier on one side of limb 90 (again, the outer side 114 of the limb has been chosen, only for purposes of clarity)

Next, washer 132 is aligned with mount 128 on the opposite side of limb 90 Then, machine screw 136 is displaced through the aperture 134 in washer 132 and the gap 120 between split limb prongs 92 and 94 and threaded into mounting component aperture 130 This clamps split limb prongs 92 and 94 between the mounting component 128 and washer 132, securing decay pattern modifier 124 in place

In those embodiments of the invention depicted in FIGS 4, 7, and 9, the decay pattern modifier is also preferably located toward the outer end of the limb to which it is mounted for maximum effectiveness Decay pattern modifiers mounted on the inside of a bow's limb (see FIGS 1 and 9 as examples) are mounted far enough down the limbs of the bow from the outer ends of the limbs to which they are mounted that the modifiers will not be struck by the inner run 139 of bowstring 32 when an arrow is released This insures that the rebounding run 139 of bowstring 32 in will not knock the decay pattern modifier off the bow when the arrow is released Typically a 0 75 in distance between the inner run at rest and the head of the decay pattern modifier is sufficient

Turning now to FIGS 12–14, compound bows are commonly equipped with a hydraulic stabilizer intended to offset the degradation in accuracy attributable to the vibrations set up in the bow when an arrow is released

A stabilizer of the type in question will typically take the form of an elongated cylinder A stabilizer of that type is depicted in FIG 12 and identified by reference character 140 The stabilizer is mounted to, and extends forwardly from, the riser 30 of bow 20

A significant increase in stability, attributable to a modification of vibration decay pattern, can be gained by assembling a decay pattern modifier of the type disclosed herein to the forward end 142 of stabilizer 140 A decay pattern modifier of the type depicted in FIGS. 2 and 3 can be employed or, alternatively, one may for example use a double headed decay pattern modifier of the type shown in detail in FIGS 12 and 13 and identified by reference character 144 Decay pattern modifier 144 has two integral, disc-shaped heads 146 and 148 separated by an integral stem 150 A second, also integral stem 152 protrudes from the second head 148, and a threaded fitting (or decay pattern modifier mount) 154 is attached to the free end 156 of stem 152

Decay pattern modifier 144 is fabricated from the same types of material as decay pattern modifier 24, and the decay pattern modifier is dimensioned so that stems 150 and 152 can oscillate in a 360° arc about the longitudinal axis 158 of decay pattern modifier 144 with the peripheral edges and of the two heads 146 and 148 of the decay pattern modifier being free to oscillate in 360° arcs generally parallel to axis 158 as indicated by the double headed arrows 160 and 162 in FIG 13, and the decay pattern modifier otherwise being able to wiggle and jiggle in a manner effecting the beneficial decay pattern modification

Decay pattern modifier 144 is assembled to the outer end 142 of stabilizer 140 by threading the stem 164 of damper mount 154 into a drilled and tapped, blind aperture 165 in the outer end of stabilizer 140—i e , that end opposite the riser 30 of the bow

FIGS 15 and 16 show a variant 166 of the stabilizer-associated decay pattern modifier just described The stem 168 of decay pattern modifier 166 is attached as by adhesive 170 to one end of a mount 172 This mount is formed from a polymer with sufficient rigidity that a blind aperture 174 can be drilled and tapped in the opposite end of the mount A fastener threaded into aperture 174 and into a like aperture 176 in the end 178 of stabilizer 180 mounts decay pattern modifier 166 to the stabilizer

As shown in FIG 15, a second threader fastener 182 with two segments 184 and 186 may be supplied with vibration pattern modifier 166 in addition to, or in lieu of fastener 175 This makes the vibration pattern modifier usable with stabilizers having different diameters of accessory accepting recesses

Shown in FIG 19 is the limb 180 of a split limb compound bow which may duplicate the bow 20 illustrated in FIG 1 The bow is, in this case, equipped with yet another type of decay pattern modifier embodying the principles of the present invention One of the two essentially identical vibration pattern modifiers with which the bow is equipped is identified in FIG 19 by reference character 192

Vibration pattern modifier 192, shown in more detail in FIGS 20 and 21, has a head 194, an integral stem 196, and essentially the same overall dimensions as damper 22 Like the latter, vibration pattern modifier 192 is preferably, though not necessarily, fabricated from NAVCOM Vibration pattern modifier 192 differs from its FIG 2 counterpart primarily is that material is eliminated from head 194 and, to a considerable extent, from stem 196, leaving recesses 198 and 199 surrounded by walls 200 and 201 in the head and stem of the vibration pattern modifier

Vibration pattern modifiers with a solid cross section—for example, those shown in FIGS 2, 6, 8, and 10—have in some cases been found to be so effective in damping vibrations set up in a bow when an arrow is released as to overstress the bow limb, causing it to fail Also, in some cases, the vibrations are damped so effectively that the vibration pattern modifier fails The manner in which the vibrations are damped can be so modified as to avoid the just-discussed problems by "hollowing out" the decay pattern modifier as shown in FIGS 20 and 21

Vibration pattern modifier 192 is fastened to the bow limb 190 as by the illustrated adhesive 202 or in any other convenient manner

It will be apparent to the reader that the invention may be *embodied in many forms in addition to those disclosed* herein without departing from the spirit or essential characteristics of the invention The present embodiment is therefore to be considered in all respects as illustrative and not restrictive The scope of the invention is indicated by the appended claims rather than by the foregoing description and the drawings, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein

What is claimed is

1 In combination

a bow which comprises a riser and limbs extending in opposite directions from opposite ends of said riser, and

an elastomeric polymer a component operatively associated with each of said limbs for modifying the decay *pattern of the vibrations set up in the limbs of said bow* when an arrow is released

2 A combination as defined in claim 1 in which the bow has solid limbs

3 A combination as defined in claim 1 in which the bow has split limbs

4 A combination as defined in claim 1 wherein the components associated with the limbs of the bow are alike

5 In combination

an archery bow,

a bow stabilizer, and

a device for modifying the decay pattern of vibrations set up in said bow and said stabilizer when an arrow is released,

said bow comprising a raiser and limbs at opposite ends of said riser,

said stabilizer comprising an elongated member having first and second ends, the first end of the elongated member being fixed to the riser of the bow,

the decay pattern modifying device being fixed to the second end of said member, and

said device comprising or being a member fabricated from an elastomeric material

6 A device for modifying the decay pattern of the vibrations set up in an archery bow when an arrow is released, said device comprising

a vibration pattern modifying component which has an integral head and stem and is fabricated from an elastomeric material, and

a mechanism for attaching said component to a bow limb

7 A device as defined in claim 6 in which the head and stem of the device are so configured and related that

the head and stem of the device are free to wiggle and jiggle when an arrow is released and vibrations are consequently set up in the bow

8 A device as defined in claim 6 in which the elastomeric material from which the decay pattern modifying components are fabricated comprises a mixture of chloroprene and butyl polymers

9 A device as defined in claim 6 in which the component attachment mechanism comprises a layer of adhesive

10 A device as defined in claim 6 in which the component attaching mechanism comprises

a threaded fastener integrated with said component, and

a complementary, internally threaded insert which is of sufficient rigidity to hold said fastener and is adapted to be installed in the limb of a bow with which the decay pattern modifying device is to be associated

11 A device as defined in claim 6

which is designed for a split limb bow, and

has an attachment mechanism comprising a rigid mount which (a) is fixed to an end of said stem, and (b) is dimensioned and configured to span a gap between branches of a split bow and to be fixed to said branches

12 A device as defined in claim 11 in which the attachment mechanism comprises an adhesive for securing the mount to the branches of the split bow limb

13 A device as defined in claim 6 in which the attachment mechanism comprises first and second clamp elements adapted to be seated on opposite sides of a split bow limb having two branches with a gap therebetween,

a threaded fastener so integrated with the first clamp element as to be extendible through a gap between two branches of a split bow limb, and

a fitting integrated with the second clamp element into which the fastener can be threaded,

said vibration pattern modifying component being fixed to the second clamp component

14 A decay pattern modifier for an archery bow stabilizer, said modifier comprising

a first component which has an integral head and stem and is fabricated from an elastomeric material,

a second, internally threaded component which is affixed to the first component, and

a fastener which is threadable into the second modifier component,

the second component of the decay pattern modifier being sufficiently rigid to retain the fastener in said second component of the decay pattern modifier

15 A decay pattern modifier as defined in claim 14 in which the head and stem of the first modifier component are so related that the component can wiggle and jiggle when an arrow is released and thereby modify the decay pattern of vibrations set up in the component of the bow to which the decay pattern modifier is attached

16 A decay pattern modifier as defined in claim 15 in which the head and stem of the first modifier component are so related that

the stem of the first decay pattern modifier component can move in any and all directions in a 360° arc relative to a longitudinal axis of the modifier, and

any and all peripheral portions of the head of the first decay pattern modifier component can oscillate toward and away from the stem of said first component

17 A decay pattern modifier as defined in claim 14 in which the material from which said first component is fabricated comprises a mixture of chloroprene and butyl polymers

18 A decay pattern modifier as defined in claim 11 which has an integral, annular element spaced along said stem from said head,

said annular element being free to wiggle and jiggle with said stem and said head

19 In combination

a bow which comprises a riser and limbs extending in opposite directions from opposite ends of said riser, and

a component operatively associated with each of said limbs for modifying the decay pattern of the vibrations set up in the limbs of said bow when an arrow is released,

each decay pattern modifying component

having a head and a stem integrated with said head, and

being fabricated from an elastomeric material

20 A combination as defined in claim 14 wherein

the stem of each decay pattern modifying component is fixed at an exposed end to that limb of the bow with which it is associated, and

the decay pattern modifying component is so capable of wiggling and jiggling as to effect said modification of vibration-decay pattern

21 A combination as defined in claim 19 wherein each of the decay pattern modifying components comprises an adhesive on an exposed end of the component's stem for attaching the component to the associated bow limb

22 A combination as defined in claim 19 wherein

a rigid element is so fixed to an exposed end of the stem of each decay pattern modifying component to strengthen the union of said component to the associated bow limb

23 A combination as defined in claim 22 in which each of the decay pattern modifying components has an adhesive on an exposed face of the rigid element

24 A combination as defined in claim 19 wherein

each decay pattern modifying component comprises an integral, threaded fastener, and

there is a complementary threaded insert in the associated bow limb and extending through a gap between branches of said limb into which the fastener is threaded

25 A combination as defined in claim 24 which comprises

a first element fixing said one component to said bow limb segment, and

a second element for fixing the decay pattern modifier to said second component

26 A combination as defined in claim 19 in which

each limb of the bow has a split limb segment comprising two parallel branches with a gap therebetween, and

each decay pattern modifier comprises components for clamping the modifier to the split segment of the associated limb

27 A combination as defined in claim 26 wherein the components for securing the modifier to the split limb segment of the associated bow limb comprise

a first component which is fixed to an exposed end of the vibration decay pattern modifier stem and is seated on one side of the split limb segment,

a second, complementary component seated on the opposite side of the split limb segment, and

a fastener arrangement for clamping the first and second branches of the split limb segment between said first and second components

28 A combination as defined in claim 27 wherein said fastener arrangement comprises

an internally threaded component integrated with said first component, and

a complementary, externally threaded element integrated with said second component and threadingly engageable with the first internally threaded component

29 A combination as defined in claim 19 in which the elastomeric material from which the decay pattern modifying components are fabricated comprises a viscoelasticmixture of chloroprene and butyl polymers

30 A combination as defined in claim 19

which includes a bow string, and

wherein each of the bow limbs has an inner side facing the bow string and an outer side

31 A combination as defined in claim 30 wherein each decay pattern modifying component is mounted to the outer side of the associated bow limb

32 A combination as defined in claim 30 wherein,

each decay pattern modifying component is mounted to the inner side of the bow limb with which it is associated, and

the component is so located along the associated bow limb as to space the head of the component sufficiently far from the bow string that said bow string does not interfere with the decay pattern modifying wiggling and jiggling of the component or knock the component off the bow limb when an arrow is released

33 A combination as defined in claim 19

which comprises a fastener for mounting each of the decay pattern modifying components to its associated bow limb, each said fastener having

a head embedded in the stem of the associated decay pattern modifying component, and

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United States Patent [19]

Sims

[11] Patent Number: 5,362,046

[45] Date of Patent: Nov. 8, 1994

[54] **VIBRATION DAMPING**

[75] Inventor **Steven C. Sims**, Shelton, Wash

[73] Assignee. **Steven C. Sims, Inc.**, Renton, Wash

[21] Appl. No. **62,997**

[22] Filed: **May 17, 1993**

[51] **Int. Cl.**[5] **A63B 49/00**

[52] **U.S. Cl.** ..... **273/73 R**; 273/73 J, 273/81 R; 273/67 R

[58] **Field of Search** ..... 273/73 R, 73 J, 75, 273/81 R, 67 R, 16/110 R, 81/20, 22, 489

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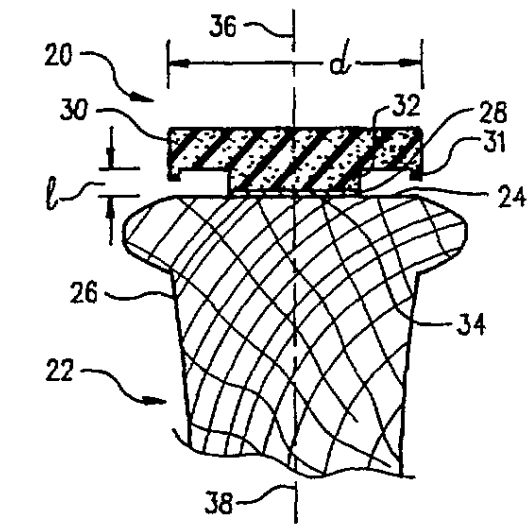
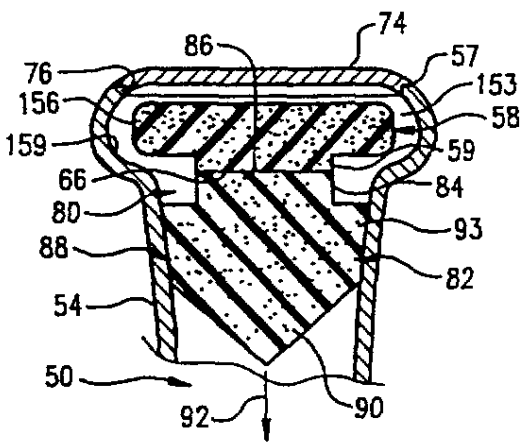
Primary Examiner—Vincent Millin
Assistant Examiner—Raleigh W. Chiu
Attorney, Agent, or Firm—Hughes, Multer & Schacht

[57] **ABSTRACT**

Small, effective, lightweight, vibration damping devices for implements which are subject to impact. These devices have a head and a stem and are fabricated from a soft elastomeric material. The stem is capable of oscillating over a 360° span in directions generally normal to the longitudinal axis of the device. The peripheral part of the head can oscillate around its circumference in directions generally paralleling that axis

13 Claims, 6 Drawing Sheets





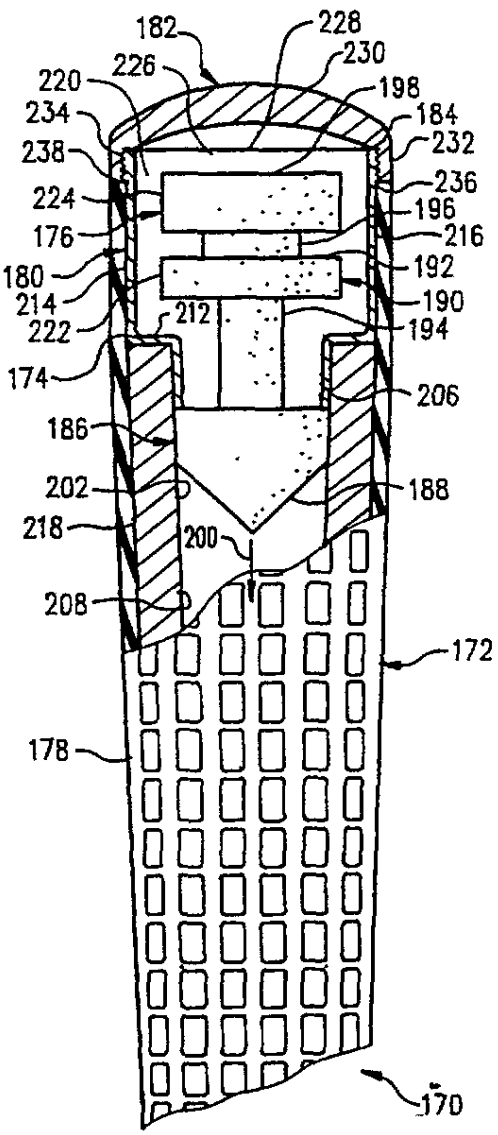


FIG. 1

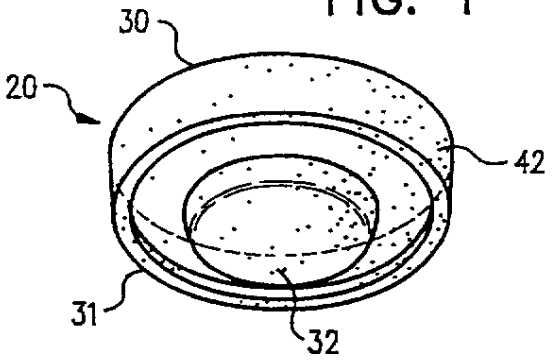


FIG. 2

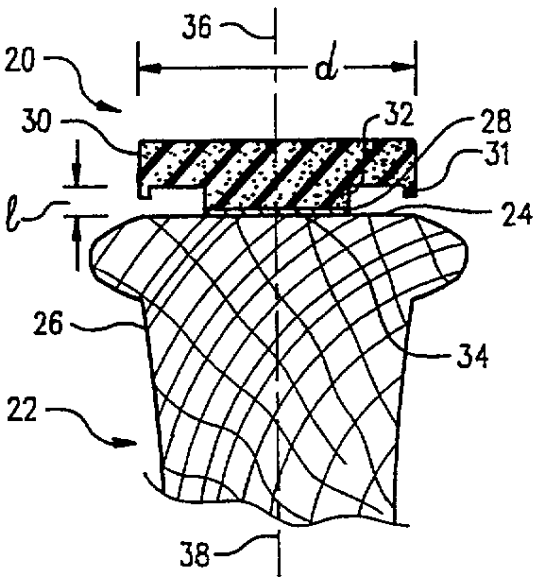
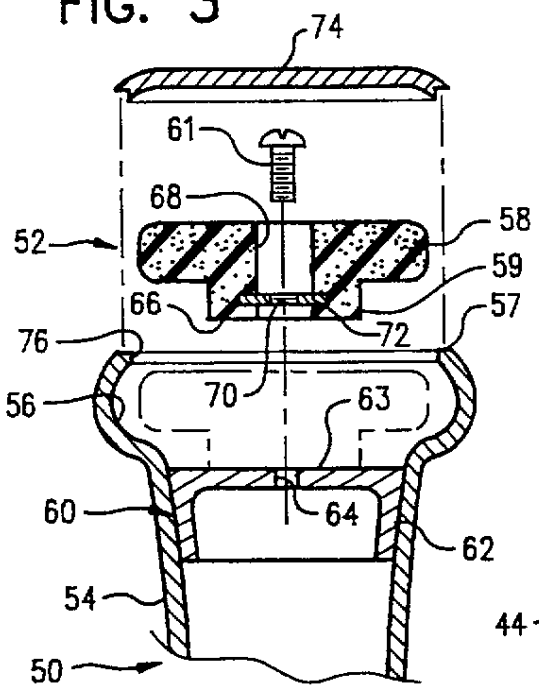


FIG. 3



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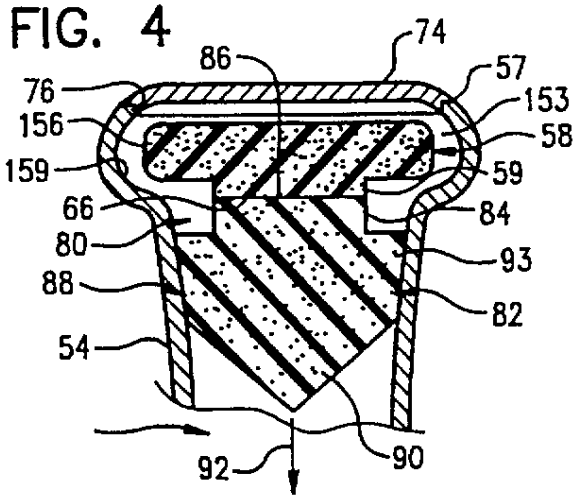

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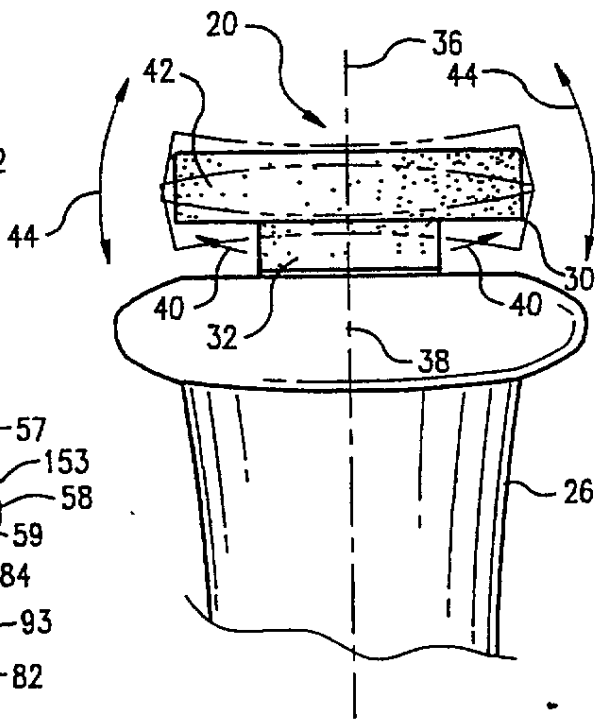


FIG. 5

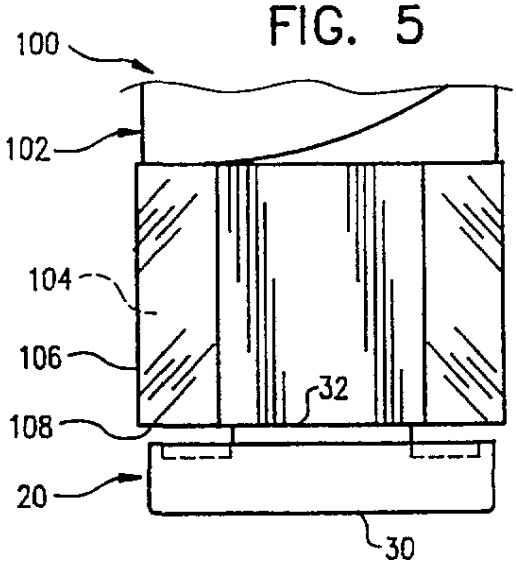
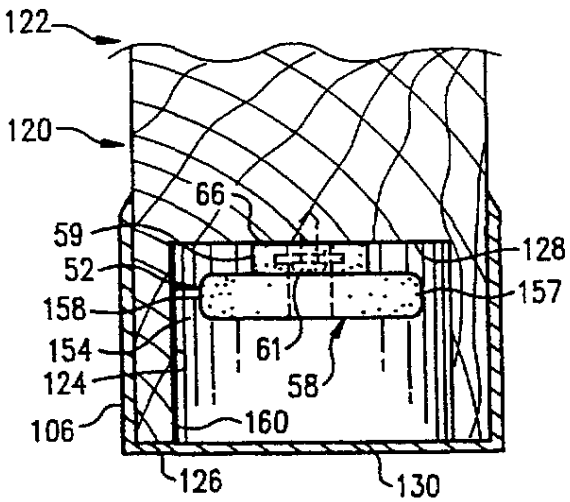


FIG. 6



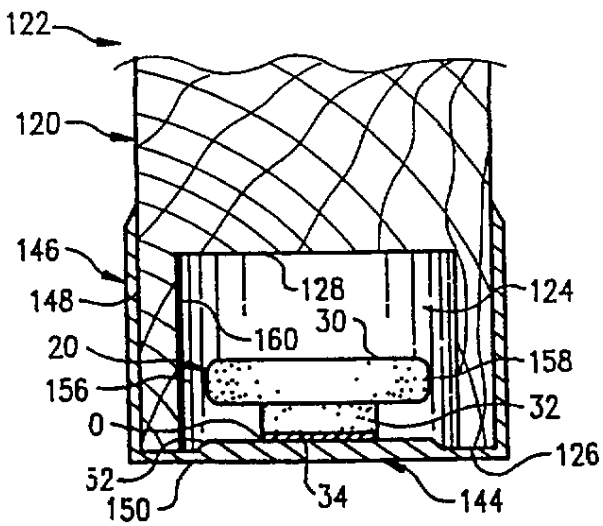


FIG. 8

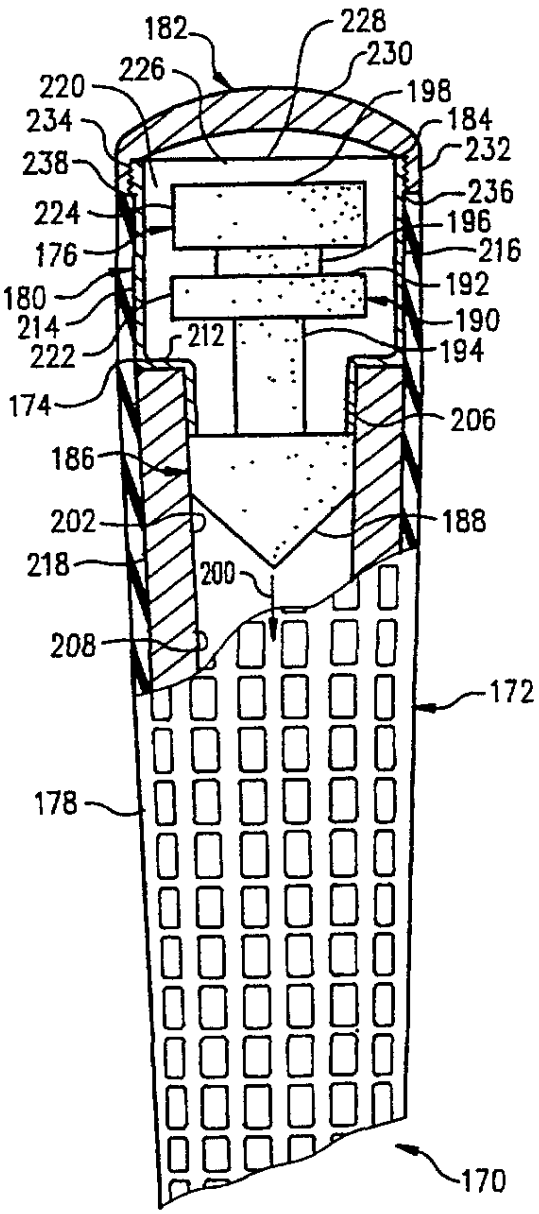
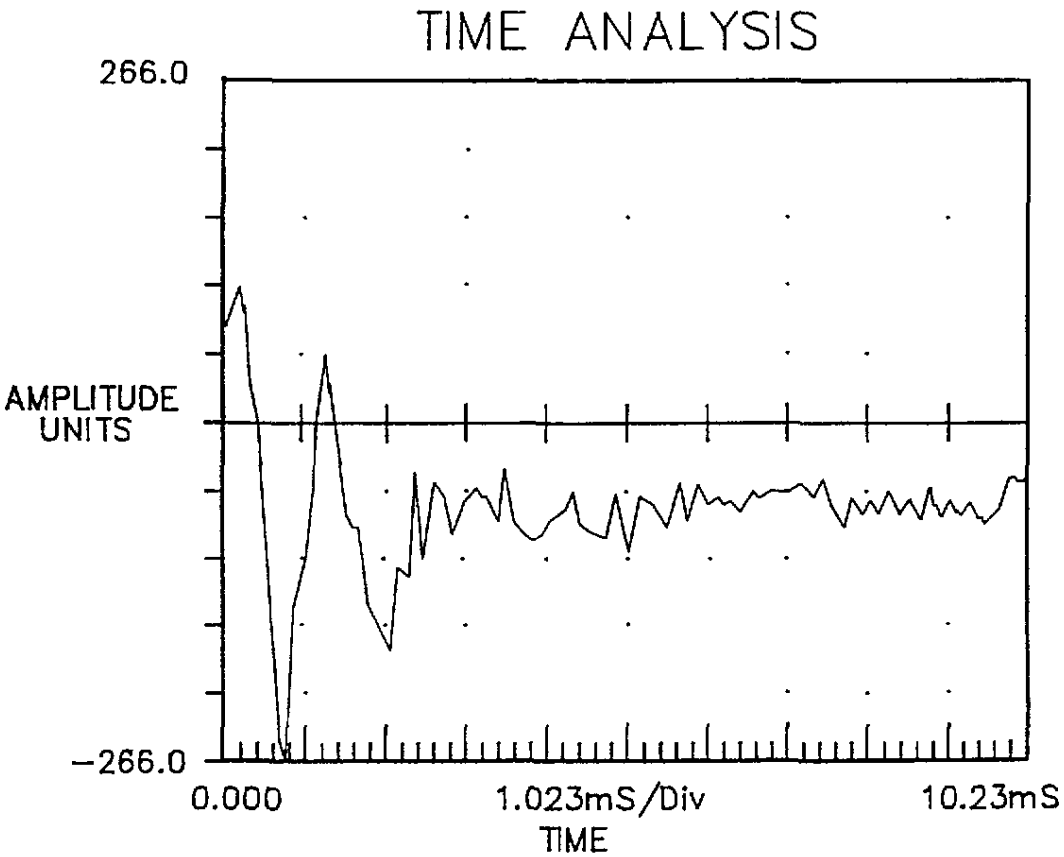


FIG. 7

FIG. 10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TIME

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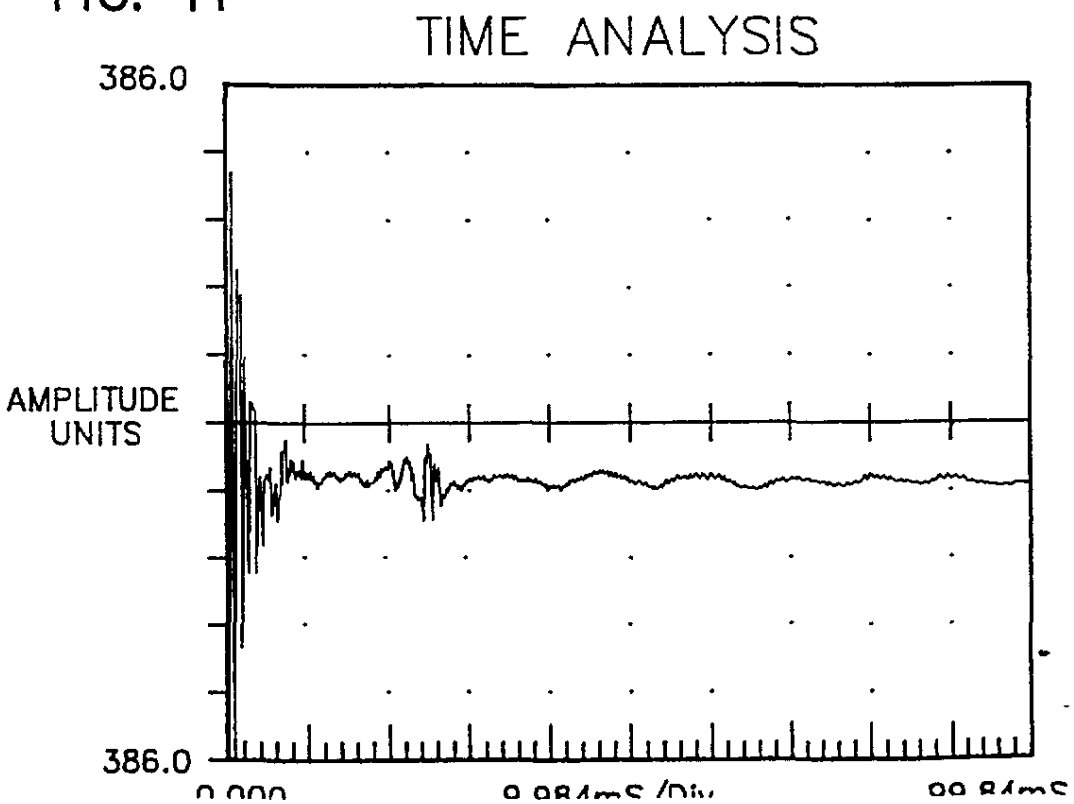
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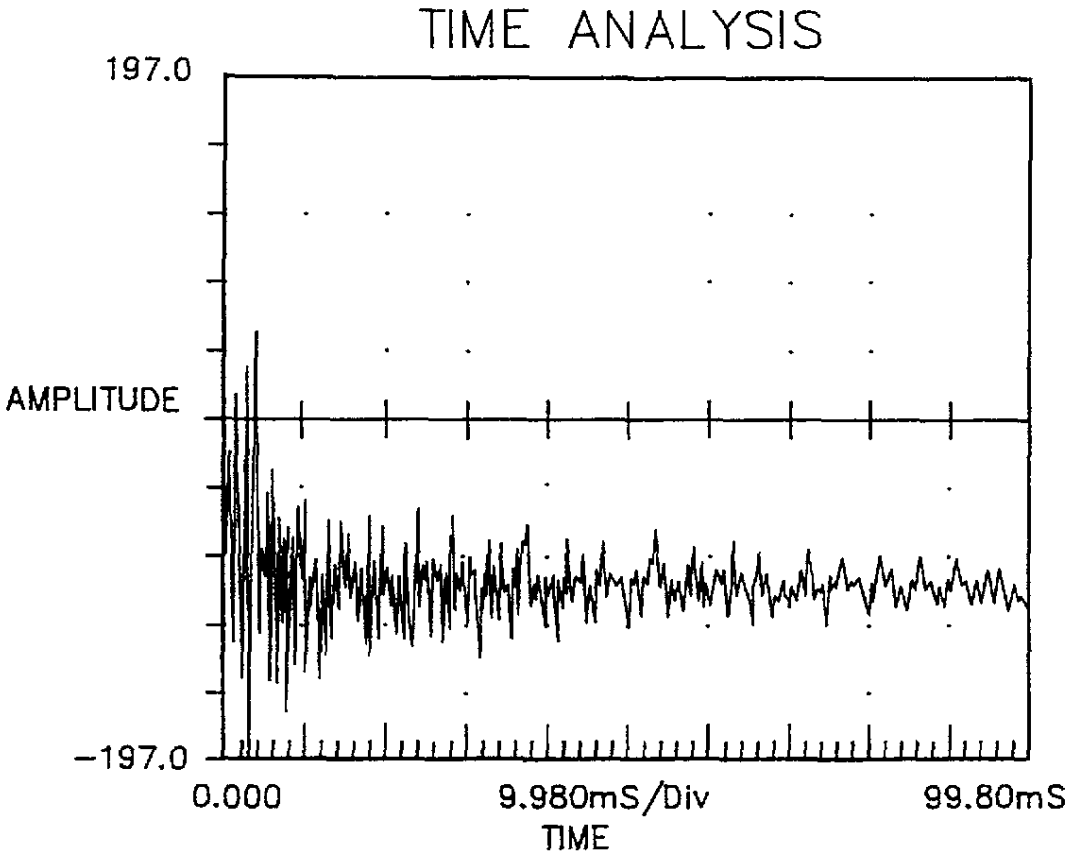
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FIG. 13

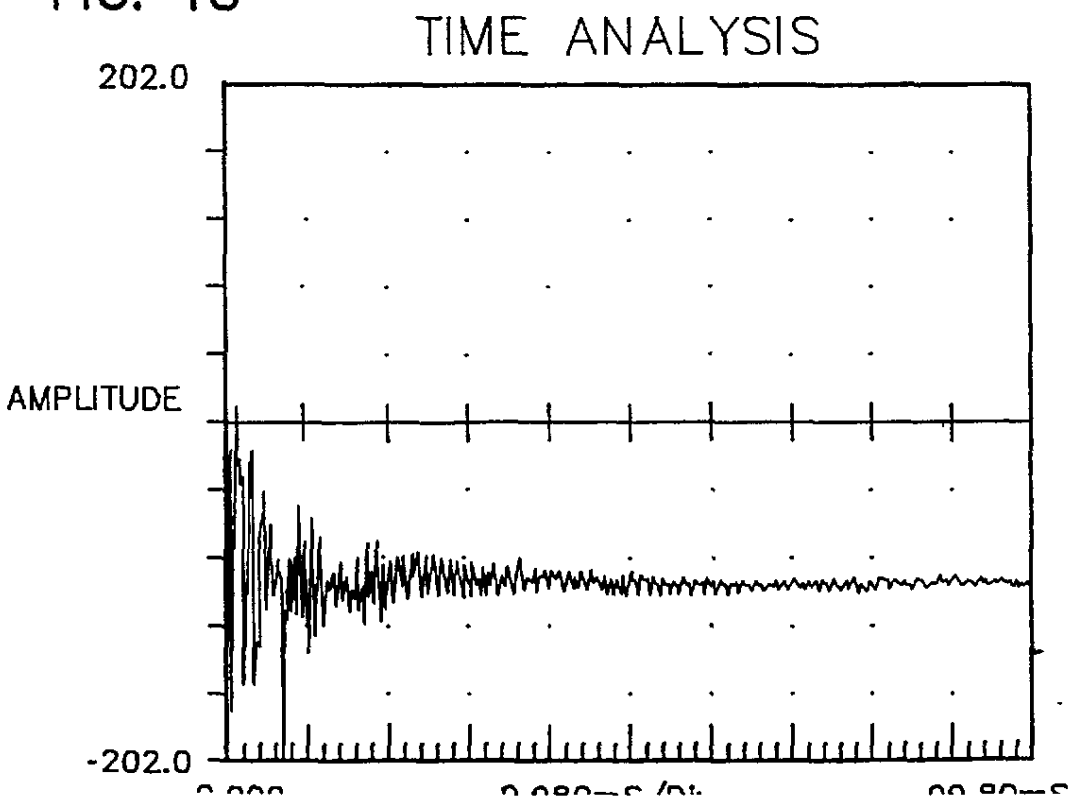
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FIG. 14

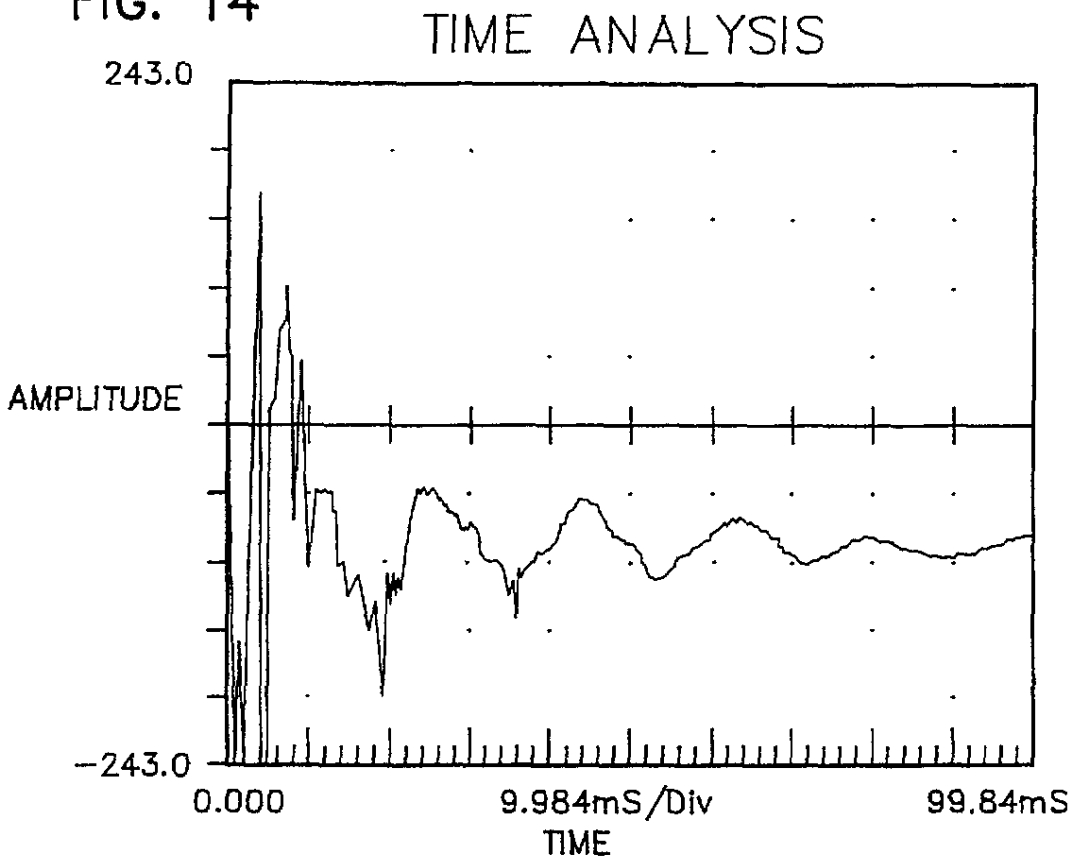
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FIG. 15

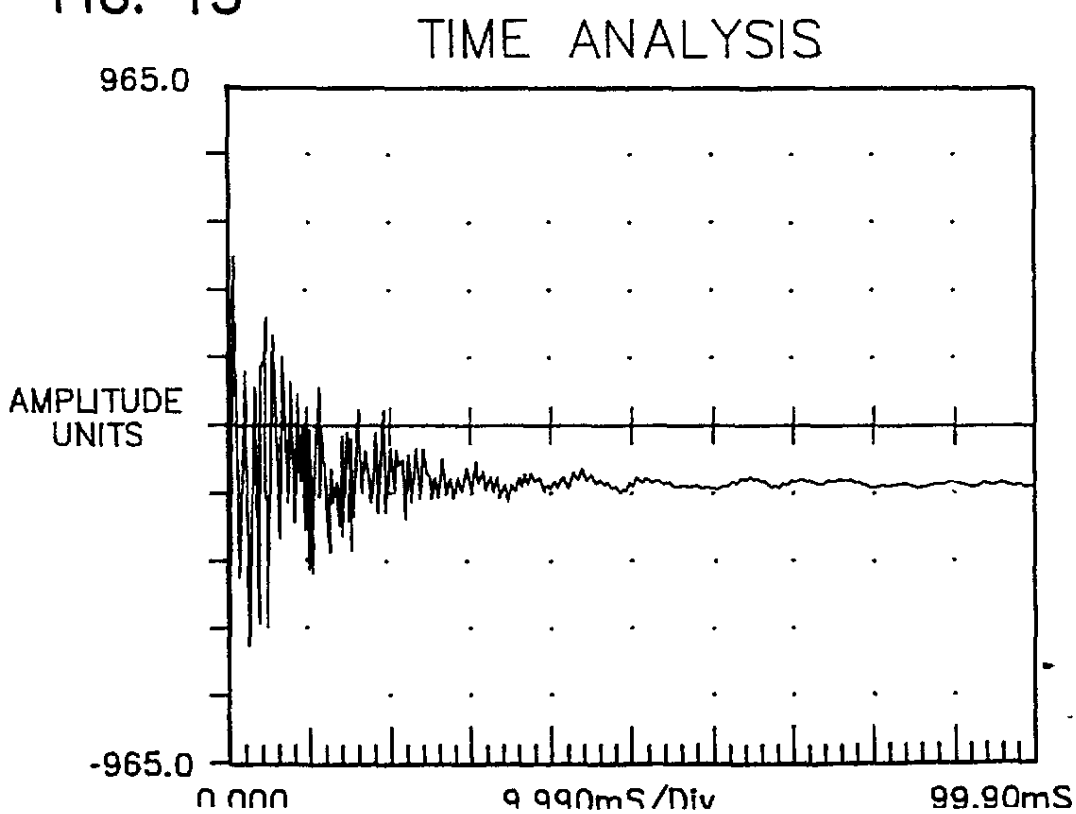
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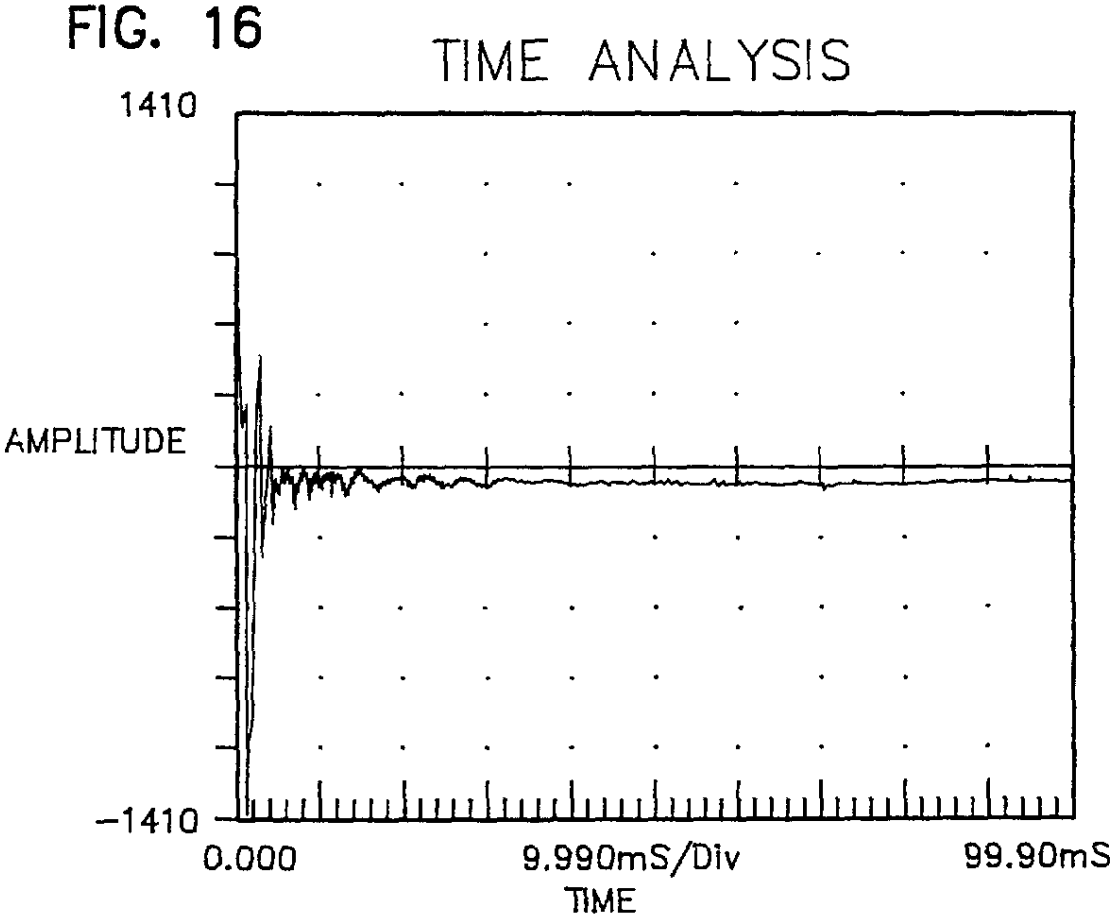
FIG. 16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VIBRATION DAMPING

TECHNICAL FIELD OF THE INVENTION

The present invention relates to novel, improved methods and systems for so damping impact-generated vibrations as to keep those vibrations from discomforting or pairing the wielder of an implement in which the vibration originated

DEFINITION

The term "implement" as employed herein is intended to encompass wielded devices designed to impart and receive impacts including but not limited to golf clubs, baseball and softball bats, tennis rackets, and hammers

BACKGROUND OF THE INVENTION

It is common for the vibrations set up in an implement by impact to sting the wielder's hands. This stinging can lead to flinching, an altered grip, and other phenomena which adversely affect a player's performance.

The vibrations can also cause serious injury For example, the stiff graphite and other high tech handles of modern tennis rackets vibrate at high frequencies, and the result is a higher incidence of debilitating tennis elbow

Others have attempted to solve the problems attributable to impact-generated vibrations with vibration dampers in or attached to the handle of an implement, see U S Pat. No. 3,941,380 issued Mar 2, 1976 to Lacoste One drawback of this prior art approach is that the feel of the implement upon impact is deader This dead feel adversely affects the wielder's performance Another drawback of this prior art approach to offsetting the effect of impact-generated vibrations is that they act too slowly, and the damage is done before the impact is damped.

SUMMARY OF THE INVENTION

There have now been invented and disclosed herein certain new and novel vibration damping systems which have the advantage over those heretofore proposed that they act almost instantaneously and therefore effectively keep unwanted vibrations from being transmitted to the hands of an implement wielder. Instead the energy is advantageously imparted to the object struck by the implement. At the same time, the modus operandi of these novel systems is such that the wielder is unaware of any adverse change in the feel of the implement upon impact.

The novel vibration damping systems of the present invention are fabricated from a soft viscoelastic polymer and have a mushroom-like configuration provided by a head and an integral stem. The vibration damper is attached to or installed in the handle of an implement which can advantageously be subjected to vibration damping The head and stem of the system are so configured and dimensioned that: (1) the stem can vibrate or oscillate generally normal to the longitudinal axis of the implement handle in any radial direction, and (2) peripheral portions of the damper head can oscillate in directions generally parallel to that axis at any location around the circumference of the damper head

ı dampers employing the principles of the
ention have the advantage that harmful vi-
: damped by the dissipation of energy before
transmitted to the wielder of the implement.

This is particularly important when the impact occurs off center or otherwise outside of the sweet spot of the implement as it is impacts in those locations that typically generate the most detrimental vibrations Or, from another viewpoint, the damping devices disclosed herein have the important advantage that they in effect significantly increase the sweet spot areas of the implements to which they are attached.

The novel vibration damping devices disclosed herein also have the advantage that they effect to only a minimal extent the natural resonance frequencies of the implements with which they are employed. This is important The dead and other strange, performance affecting feels attributable to the use of damping devices which do have a significant effect on natural resonance frequencies—for example, those disclosed in the above-cited U.S Pat. No. 3,941,380—are avoided

Another important advantage of the novel dampers disclosed herein is that they are light and small enough that, even if exposed, they do not interfere with the swing of the implements with which they are associated. The damping devices are simple and relatively easy and inexpensive to manufacture The devices also have the advantage of being versatile in that they can be used to advantage to dampen deleterious vibrations set up in a wide variety of implements

The objects, features, and advantages of the invention will be apparent to the reader from the foregoing and the appended claims and as the ensuing detailed description and discussion of the invention proceeds in conjunction with the accompanying claims

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of an energy dissipating, vibration damping device constructed in accord with and embodying the principles of the present invention,

FIG. 2 is a section through the handle end of a wooden bat equipped with an energy dissipating device as illustrated in FIG. 1,

FIG. 3 is an exploded section through the handle end of a hollow bat equipped with a second form of energy dissipating device embodying the principles of the present invention,

FIG. 4 is a section through the handle end of a hollow bat equipped with a third form of energy dissipating device embodying the principles of the present invention,

FIG. 5 is a view of the butt end of a tennis racket equipped with an energy dissipating device embodying the principles of the present invention;

FIG 6 and 7 are sections through the butt ends of tennis rackets equipped with two other forms of energy dissipating devices employing the principles of the present invention,

FIG. 8 is a section through the grip end of a golf club equipped with an energy dissipating device embodying the principles of the invention;

FIG 9 is a view showing the movements made by a device as depicted in FIG. 1 in the course of dissipating energy imparted to a bat equipped with the device,

FIG. 10 is a graph showing the decay of vibrations set up in a conventional, wooden bat by an impact on the bat;

FIG. 11 is a graph of the character presente
10 showing the significant and unexpectedly fa
of-decay of the impact-generated vibrations set up in a

wooden bat equipped with an accessory embodying the principles of the present invention,

FIG. 12 is a graph showing the decay of vibrations set up in a conventional, hollow aluminum bat by an impact on the bat,

FIG 13 is a graph of the character presented as FIG 10 showing the significant and unexpectedly faster rate-of-decay of the impact-generated vibrations set up in a hollow aluminum bat equipped with an accessory embodying the principles of the present invention;

FIG. 14 is a graph showing the decay of vibrations set up in a conventional tennis racket with a graphite handle by an impact on the racket,

FIG 15 is a graph of the character presented as FIG 10 showing the decay of vibrations set up by an impact on a racket of the same type but equipped with a prior art damping device; and

FIG 16 is a graph like those presented in FIGS. 14 and 15 but showing the significant and unexpectedly faster rate-of-decay of the vibrations set up in a like tennis racket equipped with a vibration damping accessory embodying the principles of the present invention

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, FIG. 1 depicts a vibration damping device 20 embodying the principles of the present invention, and FIG 2 depicts a solid, wooden bat 22 of the type used in baseball and softball. This bat is equipped with vibration damping device 20 In this embodiment of the invention, vibration damping device 20 is attached to the exposed end 24 of the bat handle 26 with an appropriate adhesive 28 such as Super Glue or Adcam 728

Vibration damping device 20 has a mushroom-like configuration and a T-like cross-section defined by a cylindrical head 30 with an annular, depending, peripheral lip 31 and an integral, also cylindrical stem 32. Vibration damping device 20 is assembled to bat handle 26 with the exposed end 34 of stem 32 adjacent and bonded to the exposed end 24 of bat handle 26. The longitudinal centerline 36 of the vibration damping device is coincident with the longitudinal axis 38 of bat 22. Vibration damping device stem 32 consequently extends in the same direction as the bat, and head 30 is oriented normally to longitudinal centerline 36 of the bat.

Vibration damping device 20 is fabricated from a soft, viscoelastic material, i e , a viscoelastic material with a Shore A hardness in the range of 3 to 20 The preferred elastomer is NAVCOM, a soft, amphorous, rubberlike viscoelastic material available from Vibration Technology Incorporated, Redmond, Wash NAVCOM contains a mixture of chloroprene and butyl polymers and has the following physical properties

	Shore A hardness 17–90				
Environment	Shore A	Ultimate Elongation, (Percent)	Tensile Strength (PSI)	Compression Set (Percent)	Specific Gravity
	7	1,075	373	6 01	1 014
	12	900	643	7 3	1.025
	20	835	1,069	6 9	1.063
	30	1,056	1,621	4 0	1 074
	40	326	1,453	N/A	1 185
	90	175	2,440	N/A	1 379
	7	N/A	N/A	56 3	—
	12	—	—	31 1	—

-continued

	Shore A hardness 17–90				
Environment	Shore A	Ultimate Elongation, (Percent)	Tensile Strength (PSI)	Compression Set (Percent)	Specific Gravity
70 hrs at	20	—	—	30 8	—
212 ± 5° F	40	—	—	22 4	—
	90	—	—	18 6	—

Resilience	At room temperature - Medium At high temperature - Fairly high
Heat-resistance	Good
Outdoor aging resistance	Excellent
Low temp flexibility	Good
Abrasion resistance	Good
Flex life:	Good
Solvent resistance	
Hydrocarbons -	Fair to good
Oxygenated -	Fair to good
Air permeability	Low to moderate
Moisture resistance.	Fair
Useful operating temperature	−40° to 250° F

Also important is the ratio between the diameter d of vibration damping device head 30 and the length l of the relatively short stem 32. For vibration damping device to function effectively, it is essential that the ratio d l be between 5 1 and 1 1

The illustrated, exemplary vibration damping device 20 is fabricated from the preferred NAVCOM material and has. a head 30 which is 1.6 inch in diameter and 0 25 inch thick, a stem 32 which is 0 178 inch long and 0 5 inch in diameter, and a weight of 4 grams.

The fabricating of vibration damping device 20 from a viscoelastic material with a hardness and the relative proportions specified above produces a device which effectively and rapidly dampens vibrations when bat 22 strikes a ball, particularly if the ball is not struck on the "sweet spot" of the bat and the familiar, stinging sensation is consequently felt. The vibration damping effect is attributable to the dissipation of the energy imparted to bat 22 upon impact by the novel pattern of vibrations thereupon set up in vibration damping device 20 (see FIG. 9)

The stem 32 of vibration damping device 20 can vibrate in directions generally normal to longitudinal axes 36/38 as shown by arrows 40 in any and all directions around the circumference of the stem. At the same time, the peripheral edge portion 42 of vibration damping device stem 30 can vibrate around the circumference of the head in directions generally paralleling axes 36/38 as indicated by arrows 44 This pattern of oscillatory movement is uniquely different from that of prior art vibration dampers such as the pendulum-like devices disclosed in the in the '380 patent and significantly contributes to the superiority of the novel vibration devices of the present invention

The effectiveness of vibration damping device 20 was confirmed in tests in which bat 22 was suspended and then impacted Vibrations were detected with a piezoelectric pickup which had a mass of less than two grams and therefore had a negligible effect on the vi
set up in bat 22 The data acquired by the piez
pickup was processed through a DSP 16 data acqui

tion system comprising a digital spectrum analyzer and an oscilloscope and employing modified hypersignal software

FIG 10 shows that large magnitude vibrations persisted in the undamped bat 22 for a period of 100 milliseconds or longer and that vibrations of significant magnitude were still present after a period of 500 milliseconds In contrast, the large magnitude vibrations in the bat equipped with vibration damping device 22 were gone after a period of 10 milliseconds, and vibrations of the magnitude remaining in the undamped bat after the 100 millisecond test period had disappeared after approximately 25 milliseconds

The damping of the large magnitude vibrations in the confirmed 10 millisecond time period is significant This eliminates the stinging and other unpleasant sensations felt by the user, especially if bat 22 meets a ball outside of the bat's sweet spot. The result is the elimination or at least drastic reduction of the fatigue, flinching, and other movements which make the batter less effective; and of the possibility of injury is minimized. From another viewpoint, vibration damping device 20 has the advantage that it significantly and advantageously increases the area of the bat's sweet spot, again contributing to batting efficiency

As pointed out above, an unlimited variety of devices or implements subjected to impact may advantageously be equipped with vibration damping devices employing the principles of the present invention One of these is of course the wooden bat 22 just discussed.

Another is the widely used, typically aluminum, hollow bat employed in softball and baseball FIG 3 depicts a bat 50 of that character as equipped with a device 52 embodying the principles of the present invention for damping vibrations set up by an impact upon bat 50 The bat shown in FIG 3 has a hollow handle 54, and vibration damping device 52 is installed in the cavity 56 at the exposed end 57 of the handle

Vibration damping device 52 is much like the device 20 of the same character discussed above. It is fabricated of a soft, viscoelastic material such as a NAVCOM; and it has a head 58 and stem 59 with a d l ratio in the range specified above

In this embodiment of the invention, a fitting 60 is installed in the hollow handle 54 of bat 50, and vibration damping device 52 is fixed to that fitting as by the illustrated screw 61.

Fitting 60 has a trapezoidal section That section is defined by (a) a side wall 62 with dimensions and a configuration complementing those of bat handle 54, and (b) a flat, laterally extending, integral support 63 with a centrally located, drilled and tapped, through bore 64 Typically, fitting 60 is press fitted into bat handle 54 and retained in place by friction or dimensioned so that the insert can be retained in place by an appropriate adhesive or in any other suitable manner

Vibration damping device 52 is installed in the handle end cavity 56 with (a) the exposed end 66 of stem 59 seated on the laterally extending component 63 of fitting 60, and (b) a central bore 68 through vibration damping device 52 aligned with the threaded aperture 64 in fitting 60. Screw 61 is then displaced through a central opening 70 in a washerlike reinforcement 72 toward the exposed end 66 of vibration damping device

1 threaded through the aperture 64 in fitting
.e vibration damping device 52 in place.
mbly is completed by attaching a cover 74 to
54 of bat 50 to cover the opening 76 in the exposed end 57 of the bat handle. Threads, an adhesive, friction, or any other appropriate approach may be employed to hold cap 74 in place

The results of hollow bat time analyses conducted as described above are shown graphically in FIGS. 12 and 13. Larger magnitude vibrations were damped in less than 12 milliseconds in the bat as equipped with the device 52 shown in FIG 3 whereas they persisted for over three times that long in the undamped bat Vibrations of significant magnitude persisted over the 100-millisecond duration of the test in the undamped bat but for less than 40 milliseconds in the damper-equipped bat 50 Again, therefore, vibration damping in accord with the principles of the present invention would minimize, if not entirely eliminate, stinging and other unpleasant sensations, reduce fatigue and prevent injury, and make batters more effective by de facto increasing the sweet spot of the bat.

An alternative vibration damper for hollow implements such as softball and baseball bats is depicted in FIG. 4 and identified by reference character 80. In this embodiment of the invention, the vibration damping device 80 is configured and dimensioned like the vibration damping device 52 shown in FIG. 3 but without the central aperture formed in the latter. The vibration damping device is bonded with an appropriate adhesive or in any other suitable manner to a spade-sectioned fitting 82. This fitting has a longitudinally extending stem 84 of essentially the same diameter as vibration damping device stem 59, and it is the exposed ends 66 and 86 of the two stems 59 and 84 which are bonded together

Fitting 82 also has an integral, main body element 88 of circular configuration with a tapered, conical nose section 90. Nose section 90 facilitates the movement of the assembled vibration damper 80 and fitting 82 in the direction indicated by arrow 92 in FIG 4 to install the vibration damper in the depicted location in the hollow handle 54 of bat 50 Otherwise, fitting 82 has an integral segment 93 which, like side wall 62 of the FIG. 3 fitting 60, is dimensioned and configured for retention in bat handle 54 by friction or an adhesive or in any other desired manner

Fitting 82 will typically be made of a harder material than vibration damping device 80 so that the latter will vibrate in the patterns discussed above and shown in FIG 9

As in the FIG 3 application of the invention, the opening 76 in the exposed end 57 of bat handle 54 is covered by a cap 74 after the assembly of vibration damping device 80 and fitting 82 is press fitted or otherwise installed in the bat handle

Referring still to the drawing, FIG 5 depicts a tennis racket 100 with a handle 102 having an exposed end portion 104 surrounded by a conventional cup-like grip 106 typically fabricated from polyurethane. A vibration damping device of the character discussed above and illustrated in FIG 2 and identified by the same reference character 20 is adhesively bonded or otherwise fixed to the end surface 108 of grip 106 Device 20 is provided to dampen vibrations set up in handle 102 when racket 100 strikes a tennis ball

FIGS. 14, 15, and 16 show, in graphical form, the results of time analyses of a graphite racket with: (a) no damping device (FIG. 14), (b) a damping device as disclosed in above-discussed U.S. Pat. No. 3
and (c) damping device 20 adhesively bonde
exposed end surface 108 of the racket. Both devic

proved to have vibration damping capabilities (compare FIGS 15 and 16 with FIG 14) However, a comparison of FIGS 14, 15, and 16 makes it apparent that the damping device 20 employing the principles of the present invention damped large amplitude vibrations in almost one-third of the time required for the prior art damping device to be effective with these large magnitude vibrations being damped in less than 8 milliseconds. This translates directly into major improvements into terms of elimination of stinging and other unpleasant sensations as well as fatigue, in the prevention of injury, and in improved performance by virtue of the de facto increase in the size of the tennis racket's sweet spot.

FIG. 6 depicts yet another specie of the present invention in which impact-attributable vibrations set up in the handle 120 of a tennis racket 122 are damped with a device embodying the principles of the present invention. The particular damping device utilized in this application of the invention generally duplicates the damping device 52 depicted in FIG. 3.

A longitudinal extending cavity 124 opens onto the exposed end surface 126 of tennis racket handle 120 Vibration damping device 52 is installed in cavity 124 with the exposed end 66 of the damping device stem 59 firmly contacting racket handle 120 at the inner end 128 of the cavity.

In this application of the invention, the screw 61 of the damping device is a conventional wood screw. It is threaded into handle 120 to hold the damping device in place against the tennis racket handle A grip 106 like that illustrated in FIG. 5 is then installed on the exposed handle end 126 to cover the open end 130 of the damping device-receiving recess 124 and thereby complete the assembly process

Another, albeit possibly less efficient, arrangement for damping impact-generated vibrations set up in the handle 120 of tennis racket 120 and employing a vibration damper 20 as depicted in FIGS 1 and 2 is illustrated in FIG. 7. In this case, the vibration damping device is fixed by the illustrated band of adhesive 140 to a relatively rigid, cup-shaped damping device support/-grip 144.

Grip 144 is typically fabricated from a material such as vinyl. It has a side wall segment 146 which surrounds the free or exposed end segment 148 of racket handle 120. It also has an integral, laterally extending segment 150 which spans the open end 130 of cavity 124 and has a central pedestal 152. As shown in FIG. 7, adhesive 140 fastens the exposed end 34 of vibration damping device stem 32 to pedestal 152 with the head 30 of the vibration damping device facing the inner end 128 of cavity 124

Referring now to FIGS. 4, 6, and 7, it is important that there be a clearance gap 153 (FIG 4), 154 (FIG. 6), or 155 (FIG. 7) between the periphery 156 (FIG 4), 157 (FIG 6), or 158 (FIG 7) of the vibration damping device head 58 or 30 and the side 159 or 160 of the cavity 56 or 124 in which the vibration damping device is installed. It is also essential that this gap extend around the entire circumference of the damping device head. This is required so that the stem of the involved damping device can oscillate or move in the arrow 40 directions (see FIG. 9) and so that the marginal portions of the damping device heads can oscillate in the arrow 44 directions. Both patterns of movement are required

ping devices to function effectively.

lub 170 depicted in FIG 8 is another imple-

can advantageously be equipped with a device employing the principles of the present invention to rapidly dampen large magnitude vibrations with the significant and advantageous results discussed above Golf club 170 has a conventional, hollow handle 172 The vibration damping device installed in this handle at its exposed or free end 174 is identified by reference character 176 Other major components of the vibration damper-equipped golf club 170 include a conventional grip 178, a grip support 180 which also surrounds and houses vibration damping device 176, and an internally threaded cap or cover 182 at the exposed end 184 of the grip support.

The vibration damper 176 illustrated in FIG. 8 resembles the vibration damper/support assembly 80/82 depicted in FIG. 4 It has: (a) a handle gripping damper support 186 with a tapered or pointed, installation-facilitating nose 188; and (b) an integral damper 190 of mushroom-like configuration. The damper part of the device has a circular head 192 and a stem 194. In the illustrated embodiment of the invention, stem 194 replaces the two separate stems 59 and 84 of the damper/-support system shown in FIG. 4

The integral damper component 190 also has a second, stem 196 longitudinally aligned with stem 194. Stem 196 is capped by a second, laterally extending, circular head 198 disposed in spaced, parallel relationship to head 192. Stems 194 and 196 are both dimensioned and configured for oscillation in the arrow 40 directions (see FIG. 9) Vibration damper heads 192 and 198 are dimensioned and configured for oscillation in the arrow 44 directions This provision of multiple, oscillatable heads and stems makes vibration damper component 190 particularly efficient and effective.

Vibration damper device 176 is assembled to the hollow shaft 172 of golf club 170 by displacing it in the arrow 200 direction. This displacement is continued until support component 186 is seated in the bore 202 through shaft 172 in longitudinally spaced relationship to the exposed end 174 of the shaft with the heads 192 and 198 of the vibration damper component 190 located beyond that shaft end As discussed in conjunction with the FIG. 4 embodiment of the invention, friction, an adhesive, or any other appropriate mechanism can be employed to retain support component 186 in place

The assembling of the vibration damper device 176 to the hollow golf club shaft 172 is followed by the installation of grip support 180. This component, which is fabricated of a relatively stiff material such as sheet steel or nylong, has a necked down segment 206 configured and dimensioned to complement the inner surface 208 of the bore 202 through golf club shaft 172. Grip support 180 also has: (a) an integral, laterally extending flange segment 212 which abuts the outer end 174 of golf club shaft 172; and (b) a second, also longitudinally extending and integral, damper housing segment 214 which protrudes beyond the exposed end 174 of the golf club shaft Integral segment 214 has an outer diameter matching that of the golf club shaft 172, the outer surface 216 of segment 214 consequently constituting an extension of the outer surface 218 of the shaft. This like diameter extension of hollow shaft 172 afforded by the segment 214 of grip support 180 allows grip 178 to transition smoothly from the shaft to the grip support, making the grip "feel right" to the golfer.

As in the FIGS. 4, 6, and 7 embodiments of the invention, an annular gap 220 is provided between the eries 222 and 224 of damping device heads 192 an and the inner, cylindrical surface 226 of suppor

ment 214 This accommodates the FIG 9 depicted patterns of oscillation of the heads and damping component stems 194 and 196

The assembly process is completed by the installation of cover 182 over the exposed, open end 228 of grip support segment 214 The illustrated, exemplary cover 182 has a laterally extending, domed segment 230 and an internally threaded, cylindrical side wall segment 232. Cover 182 is screwed onto the externally threaded, free end segment 234 of grip support segment 214 until the exposed end 236 of cover side wall 232 reaches the exposed end 238 of grip 178 and the domed segment 230 of the cap is seated on the exposed end 184 of the grip support segment 214

The invention may be embodied in many forms without departing from the spirit or essential characteristics of the invention For example, devices with even more than two stems and heads can be employed, and it is not necessary that the device be located at the end of the implement handle. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive The scope of the invention is indicated by the appended claims rather than by the foregoing description All changes which come within the meaning and range of equivalency of the claims are intended to be embraced therein

What is claimed is

1. The combination of an implement and an accessory which keeps deleterious, impact-generated vibrations from being transmitted to a wielder of the implement, said accessory being fabricated from an elastomer and having a mushroom-like configuration defined by a stem and an integral head, said stem being fixed to said implement and being configured for vibration free of contact with said implement in directions which encompass a 360° arc and are generally normal to the longitudinal axis of the accessory, and said head being dimensioned and configured for implement-free vibrational bending of its peripheral edge at all loci around the circumference thereof in first and second, opposite directions generally paralleling the longitudinal axis of the accessory

2. A combination as defined in claim 1 in which the ratio of head width to stem length is in the range of 5.1 to 1.1

3 A combination as defined in claim 1 in which the Shore A hardness of the elastomer from which the damper means is fabricated is in the range of 3 to 20

4 A combination as defined in claim 1 in which the elastomer from which the damper means is fabricated comprises an amorphous mixture of butyl and chloroprene polymers

5 A combination as defined in claim 1 in which the implement has a handle and the combination includes fastener means for attaching said damper means to said handle.

6 A combination as defined in claim 5 in which the implement has a handle with an exposed end, there is a cavity in said exposed end of said handle, said damper means is located in said cavity, and there is sufficient clearance between the head of the damper means and the wall of the cavity that the damper means does not touch said wall during impact-effected displacement of said damper means

7. A combination as defined in claim 1 in which said implement has a handle and the combination includes an adhesive for attaching said damper means to said handle

8 A combination as defined in claim 1 in which the damper means is so constructed and fabricated as to decrease the rate-of-decay of vibrations set up in the implement by the impact

9 A combination as defined in claim 1 in which the implement has a component adapted to strike a game object and a handle and the damper means is located at an exposed end of said handle

10. A combination as defined in claim 9 in which the damper means is located exteriorly of and attached to the handle.

11 A combination as defined in claim 9 in which the damper is installed in said handle

12 The combination of an implement and an accessory which keeps deleterious, impact-generated vibrations from being transmitted to a wielder of the implement

said accessory being fabricated from an elastomer and having a mushroom-like configuration defined by a stem and an integral head,

said stem being fixed to said implement and being configured for vibration in directions which encompass a 360° arc and are generally normal to the longitudinal axis of the accessory;

said head being free of said implement and configured for vibration of its peripheral edge around the circumference thereof in first and second directions generally paralleling the longitudinal axis of the accessory;

said implement having a component adapted to strike a game object and a handle, the accessory being installed in and protruding from an exposed end of said handle;

and said implement comprising a grip which surrounds said handle and a protruding part of the accessory and a cover which cooperates with said grip to envelope the accessory

13 A combination as defined in claim 12 in which the implement comprises a grip support fixed to the exposed end of the handle inside of and in abutting relationship with that part of the grip protruding beyond the handle

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