



US 20040043825A1

(19) **United States**

(12) **Patent Application Publication**

Horwood et al.

(10) **Pub. No.: US 2004/0043825 A1**

(43) **Pub. Date: Mar. 4, 2004**

(54) **GOLF CLUB SHAFT SET**

Publication Classification

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(21) Appl. No.: **10/228,392**

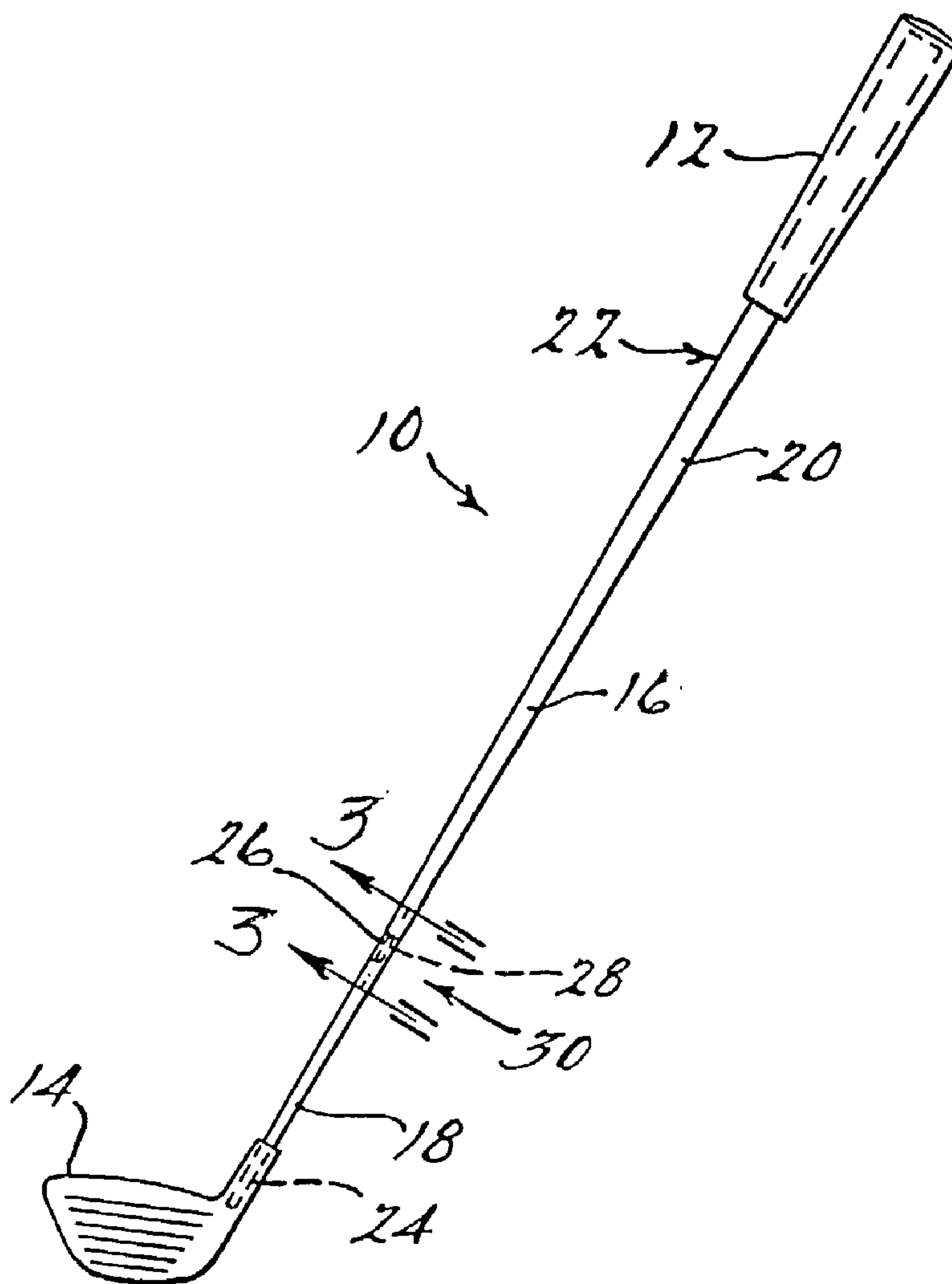
(22) Filed: **Aug. 27, 2002**

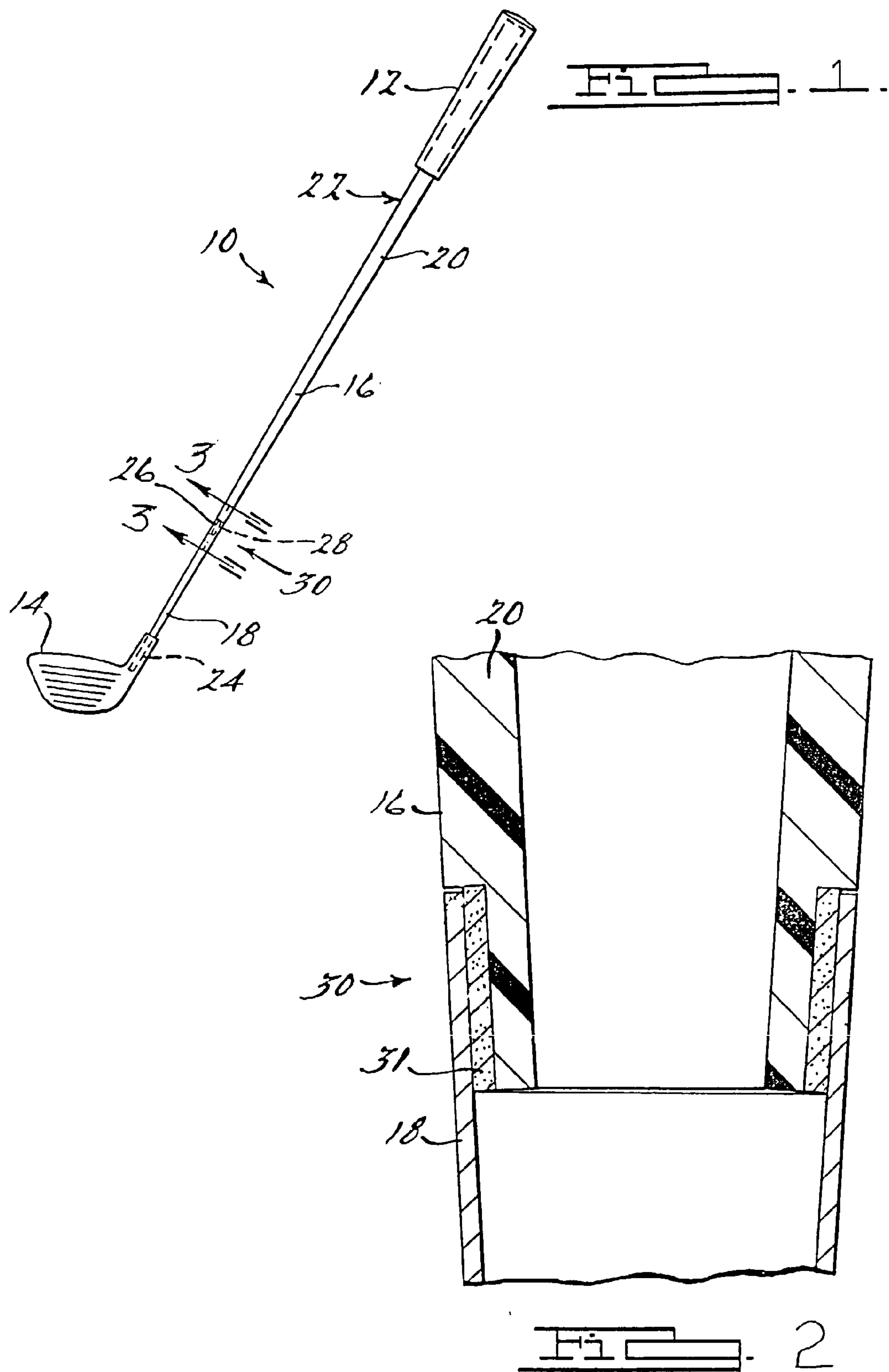
(51) **Int. Cl.⁷** **A63B 53/10; A63B 53/12**

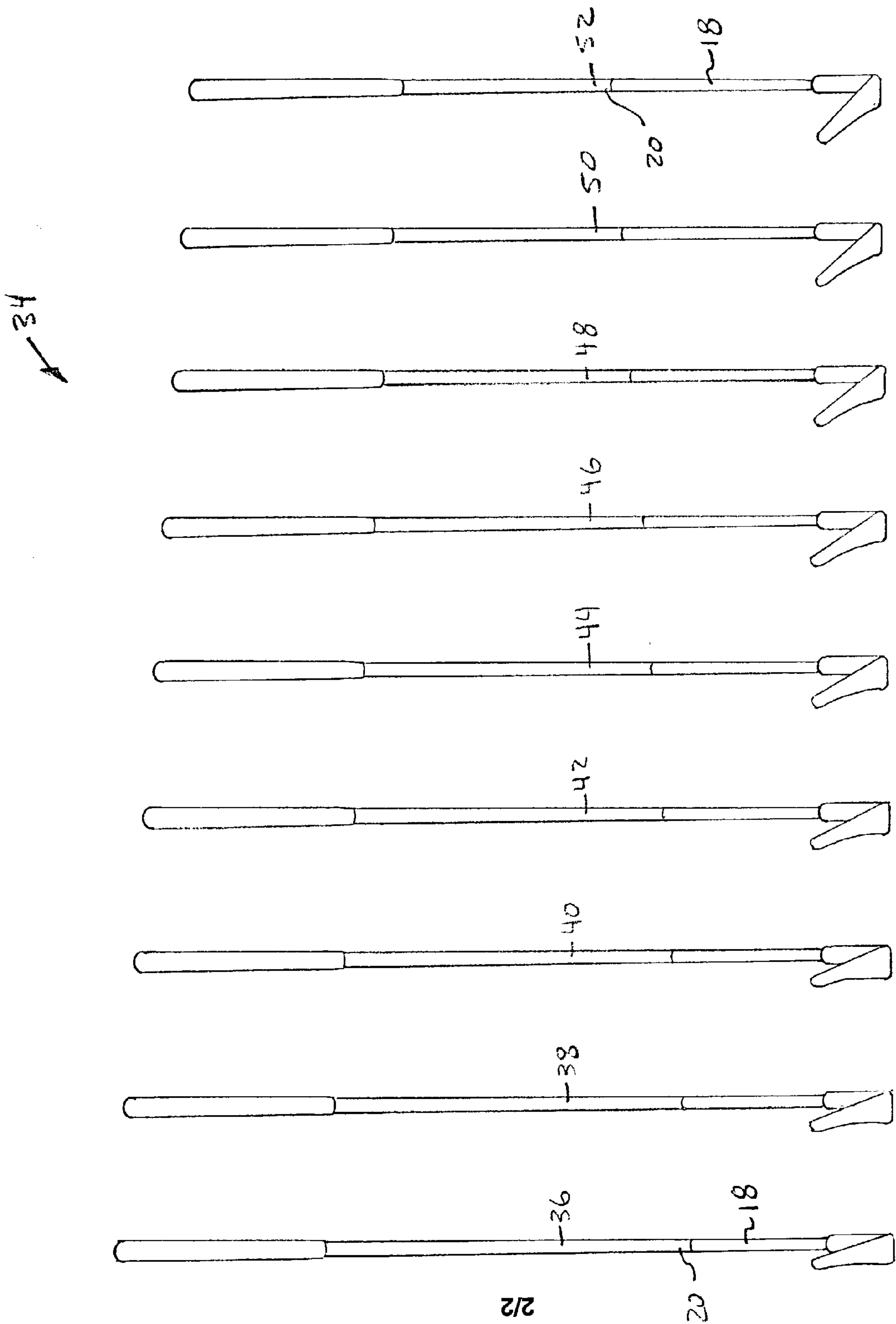
(52) **U.S. Cl.** **473/287**

(57) **ABSTRACT**

A set of golf club shafts is provided including a plurality of shafts progressively increasing in length. Each shaft includes a butt section formed of a first material coupled to a tip section formed of a second, different material. The length of each tip section is inversely proportional to the overall length of the shaft. As such, the tip sections progressively decrease in length as the plurality of shafts progressively increase in length.







GOLF CLUB SHAFT SET

FIELD OF INVENTION

[0001] The present invention relates to golf club shaft sets, and more particularly, to a golf club shaft set including shafts with composite first ends and metal second ends wherein the length of the metal tip end is inversely proportional to the overall length of the shaft.

BACKGROUND OF THE INVENTION

[0002] Two types of shafts dominate the golf club shaft market. The first type of shaft is made entirely of metal such as high strength alloy steel. The second type of shaft is made entirely of a composite such as graphite.

[0003] Metal shafts are generally regarded as being relatively heavy but provide high torsional stiffness. This results in a playability which yields accurate ball control and good feel but may limit club head speed and hence distance. It can also be made difficult to obtain a high tip flexibility with metal shafts compared to composite shafts which can compromise ball trajectory.

[0004] Composite shafts are generally regarded as being relatively light with more flexible tips which can result in a playability which yields higher club head speed and more distance as well as a higher ball trajectory. However, because composite shafts are not torsionally very stiff, composite shafts are also regarded as being somewhat limited in terms of accurate ball control and feel.

[0005] To take advantage of the separate benefits of metal and composite shafts while minimizing their deficiencies, a multiple material golf club shaft has recently been introduced to the market. A multiple material shaft is made partially of metal and partially of composite. In other words, a first portion of the shaft is formed of metal, a second portion of the shaft is made of composite, and the two portions are coupled together.

[0006] Multiple material shafts are generally regarded as being both lightweight and resistant to torque. This enables the generation of more club head speed than an all metal shaft and more accuracy than an all composite shaft. Nonetheless, it is still desirable to balance the need for distance and accuracy against one another across the entire multiple material shaft set.

[0007] For example, lighter and more tip flexible shafts are desirable in the long irons to provide more distance and higher ball trajectory at the expense of a certain degree of accuracy. In contrast, heavier and more torsionally stiff shafts are desirable in the short irons to provide more accuracy and feel at the expense of a certain amount of distance. Medium weight shafts with intermediate torsional stiffness are desirable in the middle irons to provide a compromise between distance and accuracy.

[0008] In view of the foregoing, it would be desirable to provide a multiple material golf club set specifically tailored to provide high club head speed in the long irons, high torsional stiffness in the low irons, and a compromise between the two in the middle irons.

SUMMARY OF THE INVENTION

[0009] A set of golf club shafts is provided including a plurality of shafts progressively increasing in length. Each

shaft includes a butt section formed of a first material coupled to a tip section formed of a second, different material. Preferably, the tip section comprises metal while the butt section comprises composite. The length of each tip section is inversely proportional to the overall length of the shaft. As such, the tip sections progressively decrease in length as the plurality of shafts progressively increase in length. The relationship of tip length to butt length or overall length is maintained both in absolute and relative terms. For example, each tip section preferably decreases in length by about 0.5 inch from one club shaft to the next. The length of the tip section of the shortest shaft may be about 30-34% of the entire length of the shaft whereas the length of the tip section of the longest one of the shafts may be about 18-20% of the entire length of the shaft.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0011] **FIG. 1** is a side elevational view of a golf club shaft incorporating the teachings of the present invention;

[0012] **FIG. 2** is a cross-sectional view of a metal/composite joint of the golf club shaft of **FIG. 1**; and

[0013] **FIG. 3** is a side elevational view of a set of golf clubs incorporating the teachings of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] The following description of the preferred embodiments is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

[0015] The present invention is directed towards a set of golf club shafts wherein each shaft includes a composite butt section coupled to metal tip section. As each shaft of the set increases in length, the corresponding tip section decreases. This provides at least two advantages. First, because of the different specific gravities of composite material and metal, the longer metal tip maintains or even increases the weight of the shaft as the overall length decreases. Secondly, the increasing length of the metal tip provides more torsional stability as the shaft gets shorter.

[0016] Referring to **FIG. 1**, there is shown a golf club **10** having a grip **12**, a head **14** and a tubular shaft **16**. Although the club **10** is illustrated as a wood, it may also be an iron or a putter. The shaft **16** includes a tip section **18** and a butt section **20**. The tip section **18** is preferably formed of a metallic material such as high strength steel while the butt section **20** is preferably formed of a composite material such as graphite. While the shaft **16** has been illustrated as having a smooth, tapered sidewall **22**, it should be appreciated that a parallel or stepped sidewall could substitute therefore.

[0017] The tip section **18** is secured at a lower end **24** to head **14** by sizing it to fit standard club head hosel sockets. The upper end **26** of tip section **18** is telescopically and slidingly fit over the lower end **28** of the butt section **20**. The physical characteristics of the tip section **18** from head **14** to the joint **30** where it meets the butt section **20**, are designed to provide the desired balance of torsional stiffness, bending stiffness (flex), strength, and weight in order to yield the best

playability when combined with the composite butt section. A preferred embodiment of such a joint **30** is described in U.S. patent application Ser. No. 09/745,001 filed Dec. 21, 2000 which is incorporated by reference herein in its entirety.

[0018] Turning now to **FIG. 2**, the joint **30** of **FIG. 1** is illustrated in greater detail. An important aspect affecting the durability of the shaft **16** is the strength of the joint **30** between the metal tip section **18** and the composite butt section **20**. As can be seen, the tip section **18** is in the form of a hollow metal cylinder and the butt section **20** is formed as a hollow composite cylinder. The butt section **20** includes a reduced diameter cylindrical portion or plug **32** for insertion into the tip section **18**. The reduced diameter portion **32** may be formed during the lay-up of the composite butt section **20** or may be formed by grinding away a pre-selected annular amount of the butt material after initial formation. The reduced diameter portion **32** is dimensioned to ensure a sufficient overlap and durable interconnection with the tip section **18**.

[0019] The metal tip section **18** and composite butt section **20** are joined together with an adhesive, such as epoxy bond **31**. The thickness of the adhesive **31** is carefully controlled and the surface area of the tip section **18** and butt section **20** along the adhesive **31** is sufficient to ensure adequate strength. Bond strength is selected such that the joint **30** does not fail in shear from the torsional loads imposed through generally accepted levels of abuse while playing the game of golf. Limiting the maximum thickness of the adhesive **31** and increasing the surface area of the joint **30** also maintains the highest straightness standard for the assembled shaft **16**.

[0020] Turning now to **FIG. 3**, the set of golf clubs **34** includes a 2-iron **36**, 3-iron **38**, 4-iron **40**, 5-iron **42**, 6-iron **44**, 7-iron **46**, 8-iron **48**, 9-iron **50**, and wedge **52**. The set may also include a gap wedge, sand wedge, and lob wedge in addition to other club types. For example, the golf club shaft set could also include a 1 iron and/or one or more woods. The overall length of each shaft increases from the wedge **52** through the 2-iron **36**. For example, the wedge **52** may have an overall length of 36.5 inches whereas the 2-iron **36** may have an overall length of 40.5 inches.

[0021] Each club in the set **34** preferably increases in length over the last consecutive shaft by about 0.5 inch. Conversely, each steel tip section **18** progressively decreases in length as the overall length of the corresponding shaft increases. Accordingly, the steel tip section **18** on the 40.5 inch 2-iron shaft **36** is about 7.5 inches. On the other hand, the steel tip section **18** on the 36.5 inch wedge shaft **52** is approximately 11.5 inches. This inverse relationship of tip length to shaft length continues throughout the shaft set **34**

[0022] In a preferred embodiment of the present invention, each steel tip section **18** decreases in length by about 0.5 inch from the last consecutive tip section. To compensate for the decreasing length of the tip section **18** (and therefore maintain the desired overall length of the corresponding shaft), the length of the butt section **20** progressively increases as the plurality of shafts progressively increase in length. As such, the tip sections are not only inversely proportional (in length) to the overall shaft length, but also to the butt section length. This is true both in absolute and relative terms.

[0023] For example, in the shortest shaft, i.e., the wedge shaft **52**, the tip section **18** accounts for approximately

30-33% of the entire length of the shaft. In contrast, in the longest shaft, i.e., the 2-iron **36**, the tip section **18** accounts for about 17-19% of the entire length of the shaft.

[0024] The length of the tip section **18** not only corresponds to the overall length of the shaft, but also to the loft of the club head **14**. The plurality of club heads **14** in the golf club set **34** progressively decrease in loft from the wedge **52** to the 2-iron **36**. Correspondingly, the length of each tip section **18** progressively decreases as the loft of each club head **14** progressively decreases. In contrast to the inverse relationship described above with respect to club length, the relationship to loft is directly proportional.

[0025] While a full set of golf club shafts **34** is illustrated in **FIG. 3**, it should be appreciated that the term set as used herein could comprise as little as two golf club shafts. The only requirement of the set is that the first shaft is longer than the second shaft. In such a set, the first shaft includes a tip section which is shorter than the tip section of the second shaft.

[0026] The following table includes an exemplary set of golf clubs in a preferred set incorporating the teachings of the present invention:

Iron	Total Shaft Length (inches)	Club Head Loft (degrees)	Tip Section Length
2	40-41	15-19	7.0-8.0
3	39.5-40.5	18-22	7.5-8.5
4	39-40	21-25	8-9
5	38.5-39.5	24-28	8.5-9.5
6	38-39	28-32	9-10
7	37.5-38.5	32-36	9.5-10.5
8	37-38	36-40	10-11
9	36.5-37.5	40-44	10.5-11.5
PW	36-37	44-48	11-12
GW	36-37	48-52	11-12
SW	36-37	53-57	11-12
LW	36-37	58-62	11-12

[0027] The description of the invention is merely exemplary in nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.

What is claimed is:

1. A set of golf club shafts comprising:
 - a plurality of shafts progressively increasing in length, each of said shafts including:
 - a butt section; and
 - a tip section coupled to said butt section, said tip section being formed of a different material than said butt section;
 - wherein a length of each tip section progressively decreases as said plurality of shafts progressively increase in length.
2. The set of golf club shafts of claim 1 wherein a length of said butt section progressively increases as said plurality of shafts progressively increase in length.

3. The set of golf club shafts of claim 1 wherein a length of said tip section of a shortest one of said shafts is about 30-33 percent of an entire length of said shortest one of said shafts.
4. The set of golf club shafts of claim 1 wherein a length of said tip section of a shortest one of said shafts is between about 10.5 and 12.5 inches.
5. The set of golf club shafts of claim 1 wherein a length of said tip section of a longest one of said shafts is about 17-19 percent of an entire length of said longest one of said shafts shaft.
6. The set of golf club shafts of claim 1 wherein a length of said tip section of a longest one of said shafts is between about 6.5 and 8.5 inches.
7. The set of golf club shafts of claim 1 wherein each tip section progressively decreases in length by about 0.5 inch.
8. The set of golf club shafts of claim 1 wherein said butt section further comprises a composite material.
9. The set of golf club shafts of claim 1 wherein said tip section further comprises a metal material.
10. A set of golf clubs comprising:
- a plurality of club heads progressively decreasing in loft;
 - a plurality of shafts independently coupled to said plurality of club heads, each of said shafts including:
 - a butt section; and
 - a tip section coupled to said butt section, said tip section being formed of a different material than said butt section;
- wherein a length of each tip section progressively decreases as said plurality of club heads progressively decrease in loft.
11. The set of golf clubs of claim 10 wherein a length of said butt section progressively increases as said plurality of club heads progressively decrease in loft.

12. The set of golf club shafts of claim 10 wherein a length of said tip section of a shortest one of said shafts is about 30-33 percent of an entire length of said shortest one of said shafts.
13. The set of golf clubs of claim 10 wherein a length of said tip section of a shortest one of said shafts is between about 10.5 and 12.5 inches.
14. The set of golf club shafts of claim 10 wherein a length of said tip section of a longest one of said shafts is about 17-19 percent of an entire length of said longest one of said shafts shaft.
15. The set of golf club shafts of claim 10 wherein a length of said tip section of a longest one of said shafts is between about 6.5 and 8.5 inches.
16. The set of golf club shafts of claim 10 wherein each tip section progressively decreases in length by about 0.5 inch.
17. The set of golf club shafts of claim 10 wherein said butt section further comprises a composite material.
18. The set of golf club shafts of claim 10 wherein said tip section further comprises a metal material.
19. A set of golf club shafts comprising:
- a first shaft having a first length, the first shaft including a first butt section coupled to a first tip section, the first tip section being formed of a different material than said first butt section; and
 - a second shaft having a second length, the second shaft including a second butt section coupled to a second tip section, the second tip section being formed of a different material than said second butt section;
- wherein said first shaft is longer than said second shaft and said first tip section is shorter than said second tip section.

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