(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
25 January 2001 (25.01.2001)

PCT

(10) International Publication Number
WO 01/05470 A1

(51) International Patent Classification[7]: A63B 53/14

(21) International Application Number: PCT/US00/19262

(22) International Filing Date: 14 July 2000 (14.07.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/357,694 20 July 1999 (20.07.1999) US

(71) Applicant: CALLAWAY GOLF COMPANY [US/US]; 2285 Rutherford Road, Carlsbad, CA 92008-8815 (US).

(72) Inventors: LENHOFF, Konrad; 363 Windy Lane, Vista, CA 92083 (US). BLANKE, Jerry, V.; 40155 Murrieta Hot Springs Road, Murrieta, CA 92563 (US).

(74) Agent: CATANIA, Michael, A.; Callaway Golf Company, 2285 Rutherford Road, Carlsbad, CA 92008-8815 (US).

(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 01/05470 A1

(54) Title: METHOD AND APPARATUS FOR AUTOMATICALLY INSTALLING A GRIP ON A GOLF CLUB SHAFT

(57) Abstract: An automated process and apparatus (30) for installation of a handgrip (42) on a golf club shaft (40) is disclosed herein. The handgrip (42) is installed on the golf club shaft (40) in a dry state. The present invention does not utilize solvents, lubricants or the like for the installation of the handgrip (42) onto the golf club shaft (40). The apparatus (30) has a taping mechanism (36) for automatically wrapping a double-sided tape (70) onto the butt end (64) of the golf club shaft (40). The apparatus (30) also has a gripping mechanism (38) for preparing a grip (42) for automated installation on a shaft (40) while in a dry state. The apparatus (30) also has a shaft shuttle mechanism (34) for transferring the golf club shaft (40) from the taping mechanism (36) to the gripping mechanism (38). The gripping (38) has means for expanding the handgrip (42) prior to placement on the butt end (64) of the golf club shaft (40).

Title

Method And Apparatus For Automatically Installing A Grip On A Golf Club Shaft

Technical Field

The present invention relates to installation of a grip on a golf club shaft. More specifically, the present invention relates to a method and apparatus for automatically placing a handgrip on a golf club shaft without the use of a solvent.

Background Art

Grips have been used on golf clubs to provide a golfer with a greater ability to grasp the golf club during a swing. Grips were used as early as the 1700s when sheepskin grips were the choice of golfers. In the 1800s, leather grips began to appear on a golf clubs, and soon became the dominant grip. In the 1900s, numerous rubber grips were developed mainly by rubber manufacturers. Presently, grips are composed of synthetic rubbers, plastics, and the like.

Handgrips are usually placed on the butt end of a golf club shaft at the club manufacturer. This process has for the most part been a manual process, with very little automation. A golf club shaft is manually wrapped with a double-sided tape at its butt end. Next, a solvent or lubricant is sprayed into the hollow interior of the handgrip, through an open end, in order to place the handgrip over the wrapped butt end without deterring from the adhesiveness of the tape. The handgrip is pulled over the shaft until the closed end of the handgrip is flush with the butt end of the shaft. The solvent eventually evaporates allowing for the tape to adhere to the surface of the hollow interior of the handgrip. Thus, it is obvious

that this is a highly repetitious process may lead to injuries to some laborers unless remedial steps are taken by the manufacturer. Further, the use of certain solvents and lubricants may be an environmentally unfriendly means of manufacturing. Yet further, the spraying of a solvent or lubricant is an undesirable step which increases the production time.

The golf industry, and those associated with it, have attempted to automate some of the processes to increase production and lessen injury to laborers. One example is Hsu, U.S. Patent Number 4,899,428 ("the '428 Patent") for a Golf Club Handle Sleeve Assembling Mechanism. The '428 Patent discloses an assembling mechanism that includes slidable tables, triple acutators with hooks for expanding the front end of the handgrip, an air blower for blowing air into the rear of the handgrip and a fluid hose for delivering a solvent or lubricant to the handgrip for facilitating insertion of the shaft into the handgrip. Another example is Vald'via, U.S. Patent Number 5,407,026 ("the '026 Patent") for a Golf Club Grip Installing Apparatus. The '026 Patent discloses the use of a grip lubricating device and a golf club shaft lubricating device. The '026 Patent allows for a controlled amount of lubricant to be applied for facilitated insertion of the shaft into the grip. Another example is Cresse et al., U.S. Patent Number 5,429,706 ("the'706 Patent") for a System And Method For Installing A Hollow Handgrip Over An Elongated Shaft End. The '706 discloses a system and method for applying a liquid adhesive to an interior surface of the handgrip in substitution for the use of tape on the shaft to adhere the grip. The '706 patent inflates the handgrip prior to insertion of the shaft into the grip. Another example is U.S. Patent Number 5,870,815 (the '815 Patent") for an Apparatus And Method For Aligning A Golf Club For Attaching A Handle Grip. The '815 Patent discloses an alignment assembly for positioning of a club head attached to a shaft

prior to placement of a handgrip on the butt end of the shaft.

The above-mentioned patents fail to provide a fully automated installation of handgrips to golf club shafts, and also still require the need for a solvent or lubricant. Further, the above-mentioned patents require that a club head is attached to the shaft or that shaft is blocked. There still remains a need for a more automated method, one that can grip an open shaft, and one that does not utilize solvents or lubricants.

Disclosure Of The Invention

The present invention fulfills the needs of the golf industry by providing a better automated process and apparatus for installation of a handgrip onto a golf club shaft. The present invention is able to accomplish this while maintaining the handgrip and the butt end of the golf club shaft in a dry state. That is, the present invention does not utilize solvents, lubricants or the like for installation of a handgrip on a golf club shaft.

One aspect of the present invention is a process for automatically installing a handgrip on a golf club shaft. The handgrip has a hollow interior with a first diameter. The process generally includes maintaining a butt end of a golf club shaft and the hollow interior of the handgrip in a dry state throughout the installation process. The next step of the process is flowing a gaseous medium into the handgrip to expand the hollow interior of the handgrip from the first diameter to a second diameter. The next step is mating the butt end of the golf club shaft with the expanded hollow interior of the handgrip.

Another aspect of the present invention is an apparatus for automatically applying a handgrip to a butt end of a golf club shaft. The apparatus includes a frame, a tape

mechanism, a handgrip assembly and a shaft movement mechanism. The tape mechanism is mounted to the frame. The handgrip assembly is also mounted to the frame. The handgrip assembly has an air injector disposed on a handgrip receiving sleeve, a plurality of jaws movable from a closed position to an expanded position, and a drive mechanism. The shaft movement mechanism is capable of movement from a position on the frame in-line with the tape mechanism to a position on the frame in-line with the handgrip assembly.

It is a primary object of the present invention to provide a process and apparatus for applying a handgrip to a golf club shaft while maintaining the handgrip and the shaft in a dry state.

It is an additional object of the present invention to provide a process and apparatus for automatically applying a handgrip to a golf club shaft.

Brief Description Of The Drawings

FIG. 1 is a top plan view of the automatic grip installation apparatus of the present invention.

FIG. 2 is an isolated view of a golf club handgrip that may be utilized in conjunction with the present invention.

FIG. 3 is an isolated view of an ungripped golf club shaft with a head thereon that may be utilized in conjunction with the present invention.

FIG. 4 is an isolated side view of an ungripped golf club shaft engaged within the tape mechanism of the apparatus of the present invention at a first point in time.

FIG. 5 is an isolated side view of an ungripped golf club shaft engaged within the tape

mechanism of the apparatus of the present invention at a second point in time.

FIG. 6 is an isolated top plan view of an ungripped golf club shaft engaged within the tape mechanism of the apparatus of the present invention at an initial adhesion of the tape to the shaft.

FIG. 6A is a front cross-sectional plan view of FIG. 6.

FIG. 7 is an isolated top plan view of an ungripped golf club shaft engaged within the tape mechanism of the apparatus of the present invention at a later adhesion of the tape to the shaft.

FIG. 7A is a front cross-sectional plan view of FIG. 7.

FIG. 8 is an isolated top plan view of an ungripped golf club shaft engaged within the tape mechanism of the apparatus of the present invention at a final adhesion of the tape to the shaft.

FIG. 8A is a front cross-sectional plan view of FIG. 8.

FIG. 9 is an isolated top plan view of the shaft orientation mechanism of the apparatus of the present invention.

FIG. 10 is an isolated rear view of the grip mechanism of the apparatus of the present invention.

FIG. 11 is a top plan view of the grip mechanism of the apparatus of the present invention.

FIG. 12 is a front view of the jaw assembly of the grip mechanism of the apparatus of the present invention.

FIG. 13 is an isolated front view of an alternative embodiment of the jaw assembly of the apparatus of the present invention engaging a handgrip.

FIG. 14 is an isolated front view of a jaw of the apparatus of the present invention.

FIG. 15 is an isolated top plan view of a jaw of the apparatus of the present invention.

FIG. 16 is an isolated side view of a jaw of the apparatus of the present invention.

FIG. 17 is a top plan view of the grip mechanism with a handgrip being installed on a golf club shaft.

FIG. 18 is a top plan view of the grip mechanism immediately after a handgrip has been installed on a golf club shaft.

FIG. 19 is a schematic side view of a handgrip being installed on a golf club shaft at a first point in time.

FIG. 20 is a schematic side view of a handgrip being installed on a golf club shaft at a second point in time.

FIG. 21 is a schematic side view of a handgrip being installed on a golf club shaft at a third point in time.

FIG. 22 is a schematic side view of a handgrip installed on a golf club shaft immediately after installation.

Best Mode(s) For Carrying Out The Invention

The apparatus and method of the present invention is directed at a installing a hand grip onto a golf club shaft while maintaining the handgrip and the butt end of the golf club shaft in a dry state. As shown in FIG. 1, the automatic grip installation apparatus of the present invention is generally designated 30. The apparatus 30 generally includes a frame 32,

a shaft shuttle mechanism 34, a taping mechanism 36 and a grip mechanism 38. The shaft shuttle mechanism 34, the taping mechanism 36 and the grip mechanism 38 are all mounted to the frame 32 at specific locations relative to each other. The taping mechanism 36 and the grip mechanism 38 are adjacent each other at one end of the frame 32 while the shaft shuttle mechanism 34 is mounted at the other end of the frame 32. The shaft shuttle mechanism 34 will transport a shaft 40 from one position in-line with the taping mechanism 36 to another position in-line with the grip mechanism.

Shafts are fed to the apparatus 30 from a source through conventional means such as a conveyor or the like. The shaft 40 is placed on the shaft shuttle mechanism 34 and transported to the taping mechanism 36 for placement of tape on the shaft 40. The taped shaft 40 is then transported by the shaft shuttle mechanism to a position in-line with the grip mechanism for installation of a handgrip 42 thereon (without the need of a solvent) and orientation of the shaft 40 by a shaft orientation device 44.

As shown in FIG. 2, a handgrip 42 generally has an open end 46 that allows access to a hollow interior 48. Opposite of the open end 46 is a closed end 50 that has an aperture 52 for additional access to the hollow interior 48 of the handgrip 42. On a body 54 of the handgrip 42 may be an alignment notch 56 for proper alignment of the handgrip 42 on the shaft 40. Although one type of handgrip 42 has been illustrated and described, those skilled in the pertinent art will recognize that most if not all types of handgrips may be utilized in conjunction with the present invention.

As shown in FIG. 3, the shaft 40 has a golf club head 58 attached thereon at a tip end 60 of the shaft 40. The tip end 60 is inserted through a bore 62 of the golf club head 58. The

handgrip 42 is placed over a butt end 64 of the shaft 40. At the butt end 64 is an opening 66 to a hollow interior 68 of the shaft 40. Generally, the butt end 64 has a greater circumference than the tip end 60. The shaft 40 may be composed of a graphite material, a steel material or the like. The shaft may come in various lengths depending on the golf club. The golf club may be an iron, a wood, a driver or a putter. Although one type of shaft 40 has been illustrated and described, those skilled in the pertinent art will recognize that most if not all types of shafts may be utilized in conjunction with the present invention.

The application of a double-sided tape (adhesive on both sides) to the butt end 64 of a shaft 40 at the taping mechanism 36 is illustrated in FIGS. 4-8 (including 6A, 7A and 8A). A shaft 40 is positioned at the taping mechanism 36 by the shaft shuttle mechanism 34. The butt end 64 of the shaft 40 is positioned in relation to a length of tape 70 that is dispensed from a roll of tape 72 on a tape dispenser 74. The tape 70 is positioned by a tape shuttle 76 over the butt end 64 of a shaft 40. The tape shuttle 76 also assists in the removal of a backing 78 of the double-sided tape 70. The tape shuttle 76 moves from an extended position as shown in FIG. 4 to a retracted position as shown in FIG. 5.

The tape 70 is partitioned at a tape cutting assembly 80. The tape cutting assembly 80 generally includes a blade 82 and a drive mechanism 84. The drive mechanism 84 may be any conventional means such as a pneumatic cylinder or a servomotor. The blade 82 cuts the tape 70 to a predetermined length that has a portion extending further than the butt end 64 of the shaft 40. However, a tape roller 86 first presses the tape 70 against the butt end 64 of the shaft 40 for adhesion of one side of the tape 70 thereto. Then, the blade 82 cuts the tape to a predetermined length. The tape roller 86 may have a silicone rubber surface which does not

adhere to the tape 70, thus allowing for the application of one side of the tape 70 to the butt end 64 of shaft 40 while maintaining the adhesiveness of the other side of the tape 70. The tape roller 86 may alternatively have a surface composed of a material with similar non-adhesive properties. During the application of the tape to the butt end 64 of the shaft 40, the shaft 40 is held in place by a plurality of shaft guides 90a-d, and the shaft is rotated by a plurality of shaft rollers 88a-b.

The application process is generally performed in following steps. First, as shown in FIGS. 6 and 6A, the middle 70a of the length of the tape 70 is applied to butt end 64 of the shaft 40. Next, the blade 82 cuts the tape to the predetermined length. Next, as shown in FIGS. 7 and 7A, a first side region 70b of the length of the tape 70 is applied by rotating the shaft 40 by the shaft rollers 88a-b. In a preferred embodiment, a shaft 40 is rotated approximately one-hundred ninety degrees. The shaft 40 is rotated in a reverse direction, and a second side region 70c of the tape 70 is applied to the butt end 64 of the shaft 40 which an end portion of the second side region 70c overwrapping an end portion of the first side region 70b. A wheel, not shown, larger than the tape roller 86 and located in proximity to a butt end of the tape roller 86, rolls the end of the tape 70 over the butt end 64 of the shaft 40 to provide a leading edge to assist in placing the handgrip 42 over the shaft 40. The tape roller 86 applies the tape 70 at a uniform pressure to conform the tape 70 to possible uneven surfaces of the shaft 40.

Once the butt end 64 of the shaft 40 is wrapped with the tape 70, the wrapped shaft 40 is transported to a position in-line with the grip mechanism 38. In a preferred embodiment, the transport of the shaft 40 is along a horizontal plane. However, the transport

of the shaft 40 may take other non-horizontal paths. In addition to being in-line with the grip mechanism 38, the shaft 40 is also in-line with the shaft orientation device 44 which is opposite the grip mechanism 38.

As shown in FIG. 9, the shaft orientation device 44 generally includes a shaft gas injector 92 having a tip 94, and an optional head to shaft alignment member 96. The shaft orientation device 44 may be moved toward the shaft 40, or alternatively, the shaft 40 may be moved toward the shaft orientation device 44. In one embodiment, the club head 58 is placed on the shaft 40 subsequent to the installation of the grip 42 on the shaft 40. In an alternative embodiment, the club head 58 is placed on the shaft 40 prior to the shaft 40 being fed to the apparatus 30. Yet, in a further embodiment, the club head 58 is placed on the shaft 40 at the shaft orientation device 44. As mentioned previously, the shaft 40 is placed through a bore 62 of the club head 58.

With or without a club head 58, the shaft orientation device 44 orients the shaft 40 for placement of the handgrip 42 thereon. The tip 94 of the shaft gas injector 92 is inserted through the opening of the tip end 60 of the shaft 40. The tip 94, along with the alignment member 96, positions the shaft 40. If air is not flowed through the tip end 60 of the shaft 40, then the tip end 60 may be blocked to maintain the air pressure inside the handgrip 42 as further described below.

Referring now to the grip mechanism 38, handgrips 42 are fed to the apparatus 30 from a source through conventional means such as a conveyor or the like. Each handgrip 42 is placed on a receiving sleeve 100 of the grip mechanism 38 as shown in FIG. 10. The handgrip 42 is actually placed in a channel 101 of the receiving sleeve 100. The closed end

52 of the handgrip 42 is facing outward while the open end 46 is facing toward a grip mechanism housing 102. Once in the receiving sleeve 100, the handgrip 42 is oriented by a handgrip orientation device 104. The orientation of the handgrip 42 may be performed simultaneously with the wrapping of tape 70 on the butt end 64 of the shaft 40. The handgrip orientation device 104 generally includes a grip rotator 106 and a notch lever 108 with an engagement tip 110. The grip rotator 106 rotates the handgrip 42 within the channel 101 until the engagement tip 110 engages the notch 56 of the handgrip 42. Although the handgrip orientation device 104 as described may be applicable to many handgrips, those skilled in the art will recognize that other orientation devices such as laser alignment devices could be used for other handgrips that do not have a notch 56.

Once the handgrip 42 is oriented properly, a grip gas injector 112 having a tip 114 engages the handgrip 42 through the aperture 52 of the closed end 50 of the handgrip 42. The grip gas injector 112 is moved toward the handgrip 42 by a drive mechanism 116. The drive mechanism 116 may be a pneumatic cylinder, a servomotor, or the like. The grip gas injector 112, with the tip 114 inserted through the aperture 52, pushes the handgrip 42 into the grip mechanism housing 102 for the expansion process. Once in the grip mechanism housing 102, the handgrip 42 is ready for expansion. The grip mechanism housing 102 has a chamber 103 with a predetermined volume that limits the amount of expansion of the handgrip 42. The chamber 103 ensures that the handgrip is not over expanded which might result in damage to the handgrip.

As shown in FIG. 12, a jaw assembly 120 is located on the opposite side of the grip mechanism housing 102. The jaw assembly 120 generally includes a plurality of jaws 124a-f

which have individual drive mechanisms 122a-f. The individual jaw drive mechanisms 122a-f may be pneumatic cylinders, servomotors, or the like. In FIG. 12, the jaw assembly 120 has six jaws 124a-f while in FIG. 13 an alternative jaw assembly 120' has three jaws 124a'-c'. As shown in FIG. 13, the jaws 124a'-c' engage the open end 46 of the handgrip 42 to expand the open end 46 for placement of the shaft 40 therein.

As shown in FIGS. 14-16, each jaw 124 has an elongated body 126 and an engagement member 128. The engagement member 128 enters the hollow interior 48 of the handgrip 42 through the open end 46 in order to exert an outward force on the interior of the handgrip 42 for expansion of the open end 46.

As shown in FIGS. 17 and 18, the grip mechanism 38, with a handgrip 42 therein, is moved by a drive mechanism 130, not shown, toward the shaft 40 which has previously been aligned by the shaft orientation device 44. The drive mechanism 130 may be a pneumatic cylinder, a servomotor, or the like. Alternatively, the shaft 40 may be moved by the shaft shuttle mechanism 34 toward the grip mechanism 38. Once the wrapped butt end 64 of the shaft 40 engages the open end 46 of the handgrip 42, the grip gas injector 112 flows a gaseous medium, preferably air, into the hollow interior 48 of the handgrip 42 to expand the hollow interior 48 from a first diameter to a second diameter. While the handgrip 42 is placed over the shaft 40, the jaws 124a-f engage the open end 46 of the handgrip 42 in an expanded state. The expansion of the open end 46 and the hollow interior 48 allows for the handgrip to be placed over the butt end 64 of the shaft 40 in a dry, solventless state. More specifically, there is no need for a solvent, an aqueous medium or lubricant in order to place the handgrip 42 onto the butt end of the shaft 40. Thus, the entire operation may be

performed in a dry state which is beneficial for a safe and environmentally friendly workplace. The dry state operation is also provides a tremendous costs savings.

Once the handgrip 42 is in place on the shaft 40, the plurality of jaws 124a-f move forward from the open end 46 of the handgrip 42. This allows the open end 46 to fit tightly on the shaft 40.

FIGS. 19-22 schematically illustrate the installation process. As shown in FIG. 19, the wrapped butt end 64 (wrapped with tape 70) of the shaft 40 is moved toward the open end 46 of the handgrip 42. The plurality of jaws 124a-f expand the open end 46 of the handgrip 42. As shown in FIG. 20, the wrapped butt end 64 of the shaft 40 meets the open end 46 of the handgrip 42 and acts as a barrier to the outward flow of the gaseous medium from the hollow interior 48. The hollow interior 48 is receiving the gaseous medium from tip 114 of the grip gas injector 112 which is inserted through the aperture 52 of the closed end 50 of the handgrip 42. The gaseous medium may also be flowing through the hollow interior 68 of the shaft 42 from the tip 94 of the shaft gas injector 92 which is inserted through the tip end 60 of the shaft 42. The counter-flow of the gaseous medium from the shaft gas injector 92 also acts as a barrier to flow of the gaseous medium from the grip gas injector 112. The blockage of flow of the gaseous medium results in the expansion of the hollow interior 48 of the handgrip 42 from a first diameter to a second diameter. For example, the first diameter may be 1.3 cm while the second diameter is 3.0 cm. The second diameter must be large enough to accommodate the wrapped butt end 64 of the shaft 40 without substantial contact between the interior surface of the handgrip 42 and the tape 70. It is the expansion that allows for the installation process to occur in a dry state. Alternatively, instead of a counter-flow of gaseous

medium, the tip end 60 of the shaft 40 may be blocked to prevent the outflow of the gaseous medium from the grip gas injector 112. The gaseous medium is preferably air, however, those skilled in the art will recognize that other gaseous mediums such as nitrogen, helium, and the like may be used as the gaseous medium for the present invention. Yet another alternative would have a grip mechanism housing 102 that evacuates air within it to create a vacuum to allow for the outward pressure and expansion of the hollow interior 48 of the handgrip 42.

As shown in FIG. 21, the wrapped butt end 64 of the shaft has engaged the interior of the closed end 50 of the handgrip 42 resulting in the cessation of the flow of the gaseous medium into the hollow interior 48 and thereby resulting in the cessation of the expansion of the hollow interior 48. Thus, the interior surface of the hollow interior 48 of the handgrip 42 contacts the tape 70 wrapped on the butt end 64 of the shaft 40. As shown in FIG. 22, the jaws 124a-f move forward from the open end 46 of the handgrip 42, and the gas injectors 112 and 92 disengage from contact with the newly gripped golf club shaft 40. The gripped shaft 40 is then discharged from the apparatus for further processing.

CLAIMS

1. A process for automatically installing a handgrip (42) on a golf club shaft (40), the handgrip (42) having a hollow interior with a first diameter, the process comprising:

maintaining a butt end (64) of a golf club shaft (40) and the hollow interior (48) of the handgrip (42) in a dry state throughout the installation process;

flowing a gaseous medium into the handgrip (42) to expand the hollow interior (48) of the handgrip (42) from the first diameter to a second diameter; and

mating the butt end (64) of the golf club shaft (40) with the expanded hollow interior (48) of the handgrip (42).

2. The process according to claim 1 further comprising expanding an open end (46) of the handgrip (42) with a plurality of jaws (124) prior to mating the butt end (64) of the golf club shaft (40) with the expanded hollow interior (48) of the handgrip (42).

3. The process according to claim 1 further comprising wrapping a double-sided tape (70) over the butt end (64) of the golf club shaft (40) through adhering a middle region (70a) of the tape (70) to the butt end (64), then adhering a first side region (70b) of the tape (70) to the butt end (64), and then adhering a second side region (70c) of the tape (70) to the butt end (64) with an end portion of the second side region (70b) of the tape (70) overlapping the first side region (70b).

4. The process according to claim 2 further comprising moving the plurality of jaws (124) forward for release from the open end (46) of the handgrip (42) after mating the butt end (64) of the golf club shaft (40) with the hollow interior (48) of the handgrip (42).

5. The process according to claim 3 further comprising transferring the golf club shaft (40) with the taped butt end (64) from an automatic taping station (36) to an automatic handgrip attachment station (38) for mating of the taped butt end (64) of the golf club shaft (40) with the hollow interior (48) of the handgrip (42).

6. An apparatus (30) for automatically applying a handgrip (42) to a butt end (64) of a golf club shaft (40), the apparatus (30) comprising:

a frame (32);

a tape mechanism (36) mounted to the frame (32);

a handgrip assembly (38) mounted to the frame, the handgrip assembly (38) having an air injector (92) disposed on a handgrip receiving sleeve (100), a plurality of jaws (124) movable from a closed position to an expanded position, and a drive mechanism (116);

a shaft movement mechanism (34) capable of movement from a position on the frame (32) in-line with the tape mechanism (36) to a position on the frame (32) in-line with the handgrip assembly (38).

7. The apparatus (30) according to claim 12 further comprising a handgrip orientation device (104) disposed on the handgrip assembly (38), the handgrip orientation device (104) capable of orienting a handgrip (42) to a predetermined position.

8. The apparatus (30) according to claim 12 wherein the tape mechanism (36) further comprises a tape dispenser (74), a tape cutter (80) disposed in proximity to the tape dispenser (74), a tape roller (86) rotatable about a fixed axis, and a shaft rotation roller (88) disposed in relation to the tape roller (86).

9. The apparatus (30) according to claim 12 wherein the shaft movement mechanism (34) further comprises a plurality of shaft guides (90) for retention of a shaft (40) therein during application of a handgrip (42) to the shaft (40).

10. The apparatus (30) according to claim 12 further comprising a shaft orientation device (44) mounted on the frame (32) and in-line with the handgrip assembly (38), the shaft orientation device (44) comprising a shaft aligner (96) and a second air injector (92).

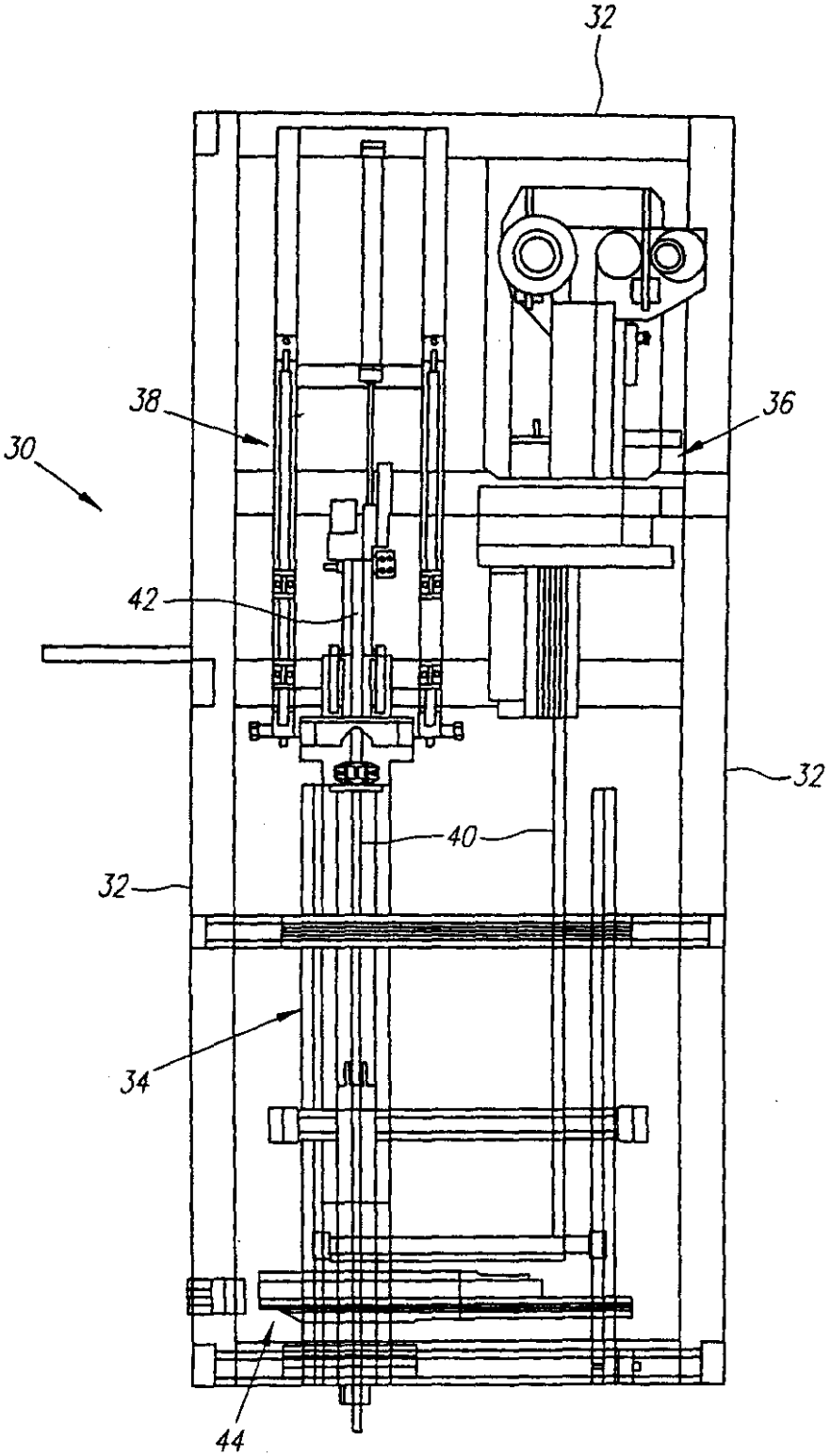


FIG. 1

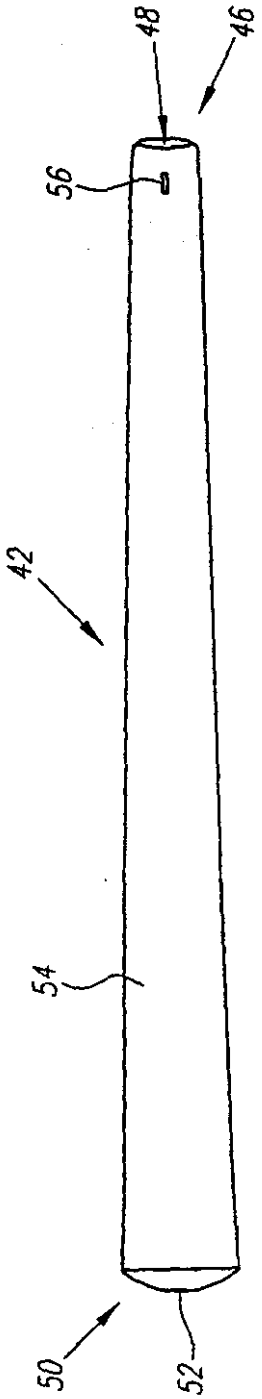


FIG. 2

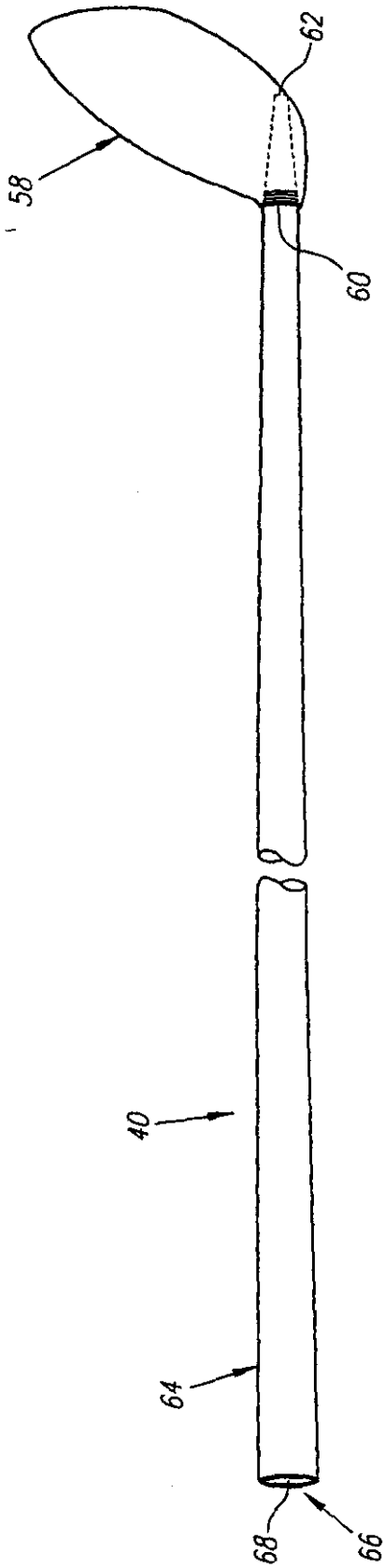


FIG. 3

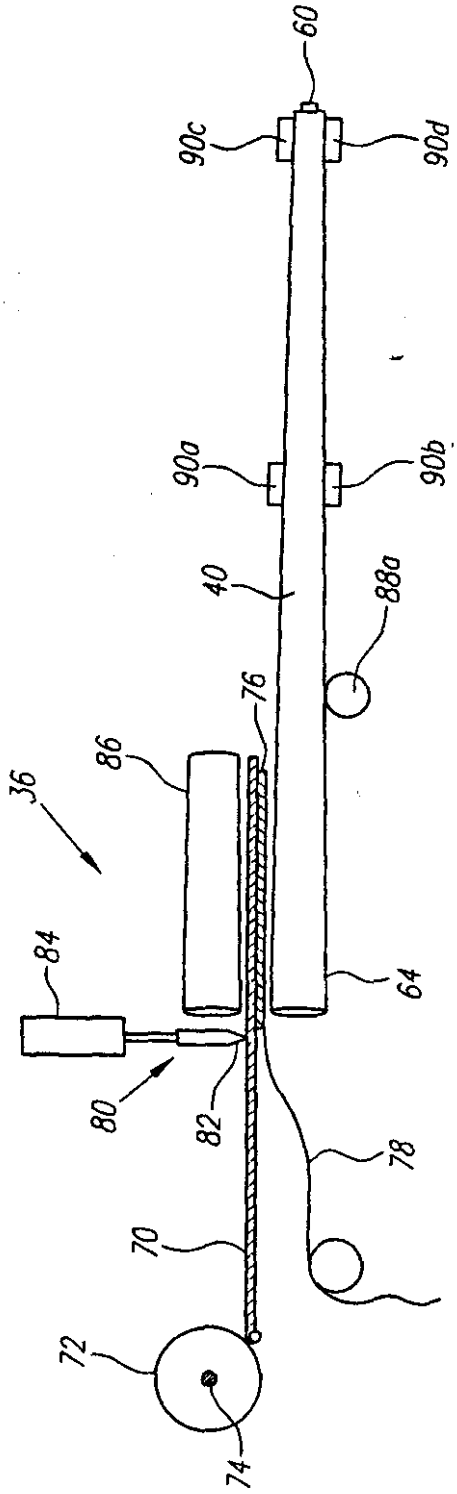

60
90c
90d
90a
90b
40
88a
76
86
36
84
64
80
82
78
70
72
74

FIG. 4

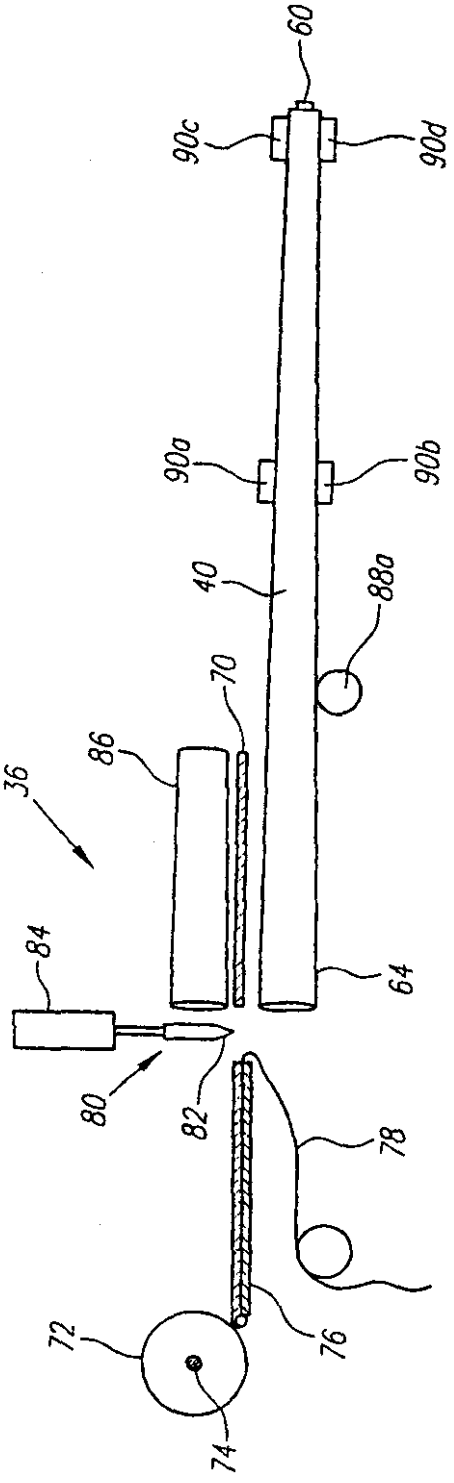

60
90c
90d
90a
90b
40
88a
70
86
36
84
64
80
82
78
72
76
74

FIG. 5

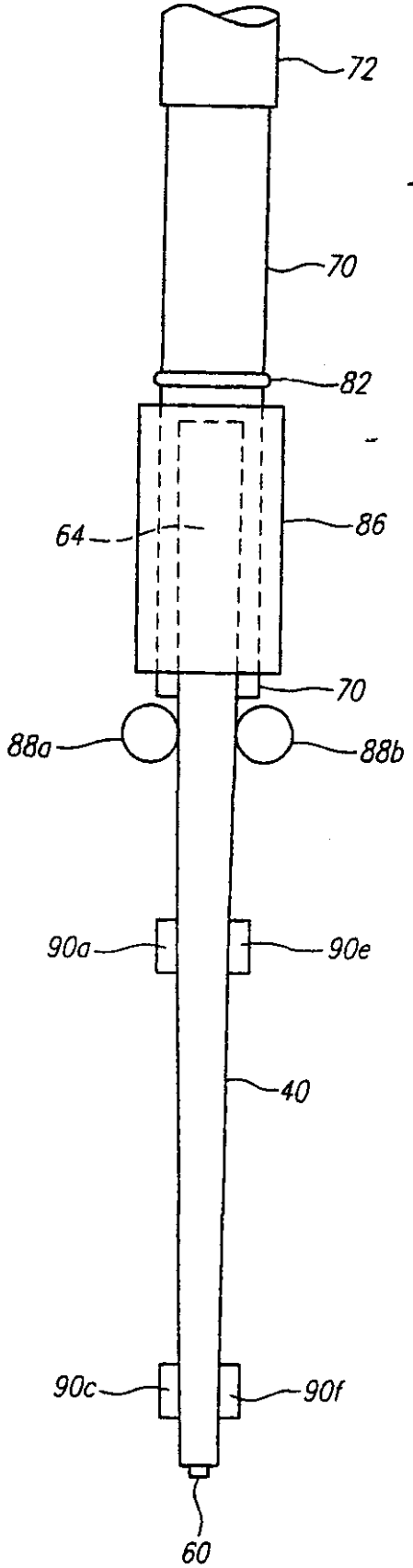

72
70
82
64
86
70
88a
88b
90a
90e
40
90c
90f
60

FIG. 6

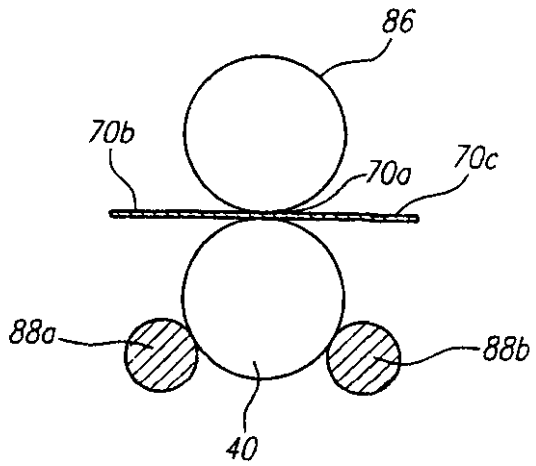

86
70b
70a
70c
88a
88b
40

FIG. 6A

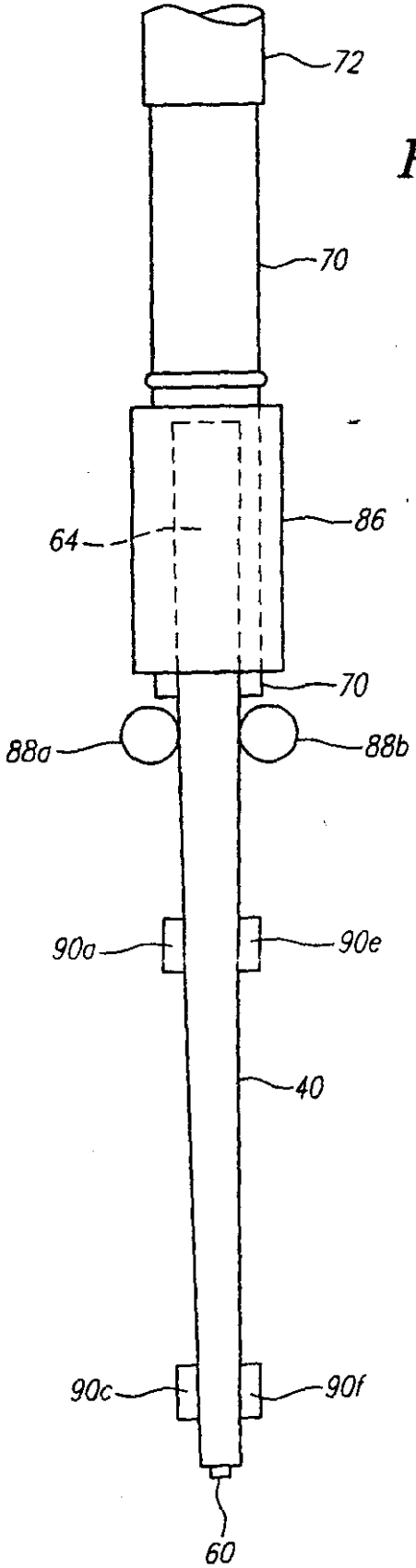

72
70
64
86
70
88a
88b
90a
90e
40
90c
90f
60

FIG. 7

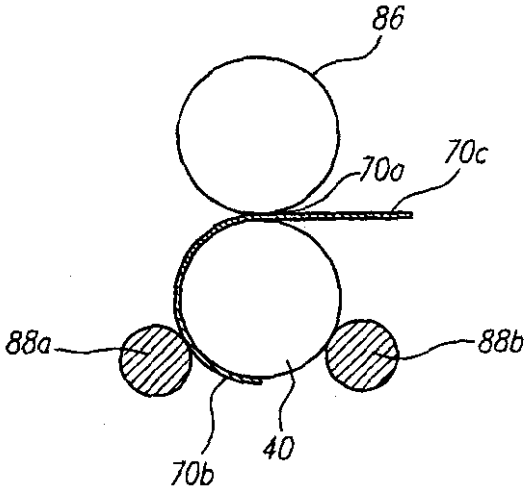

86
70a
70c
88a
88b
70b
40

FIG. 7A

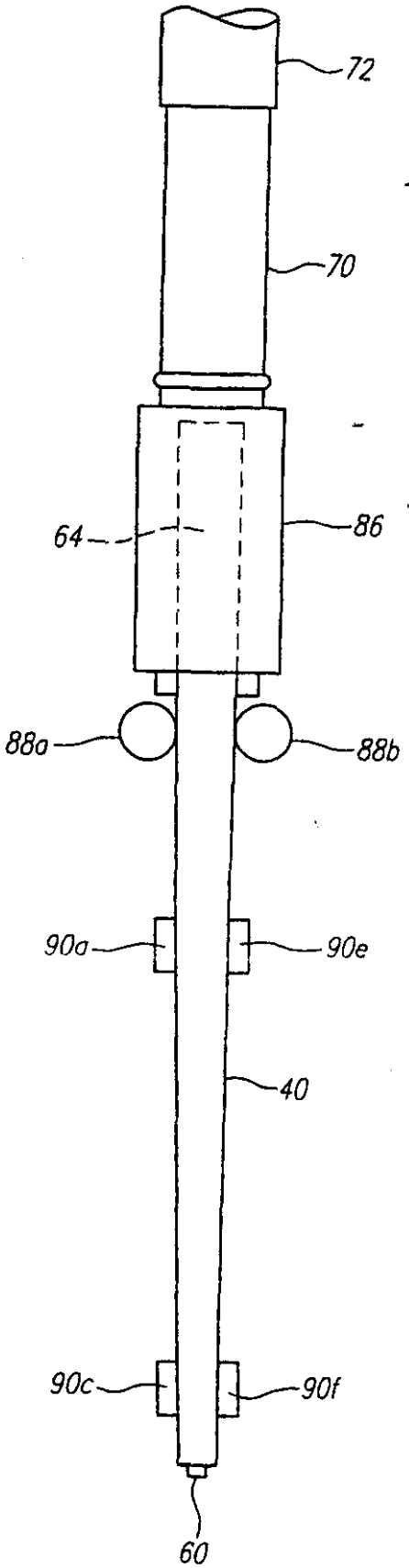


FIG. 8

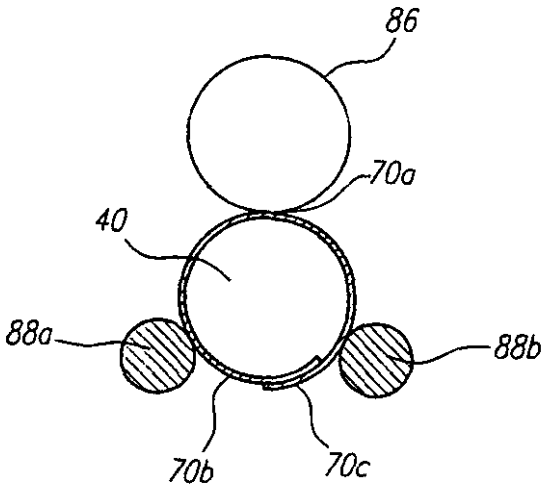


FIG. 8A

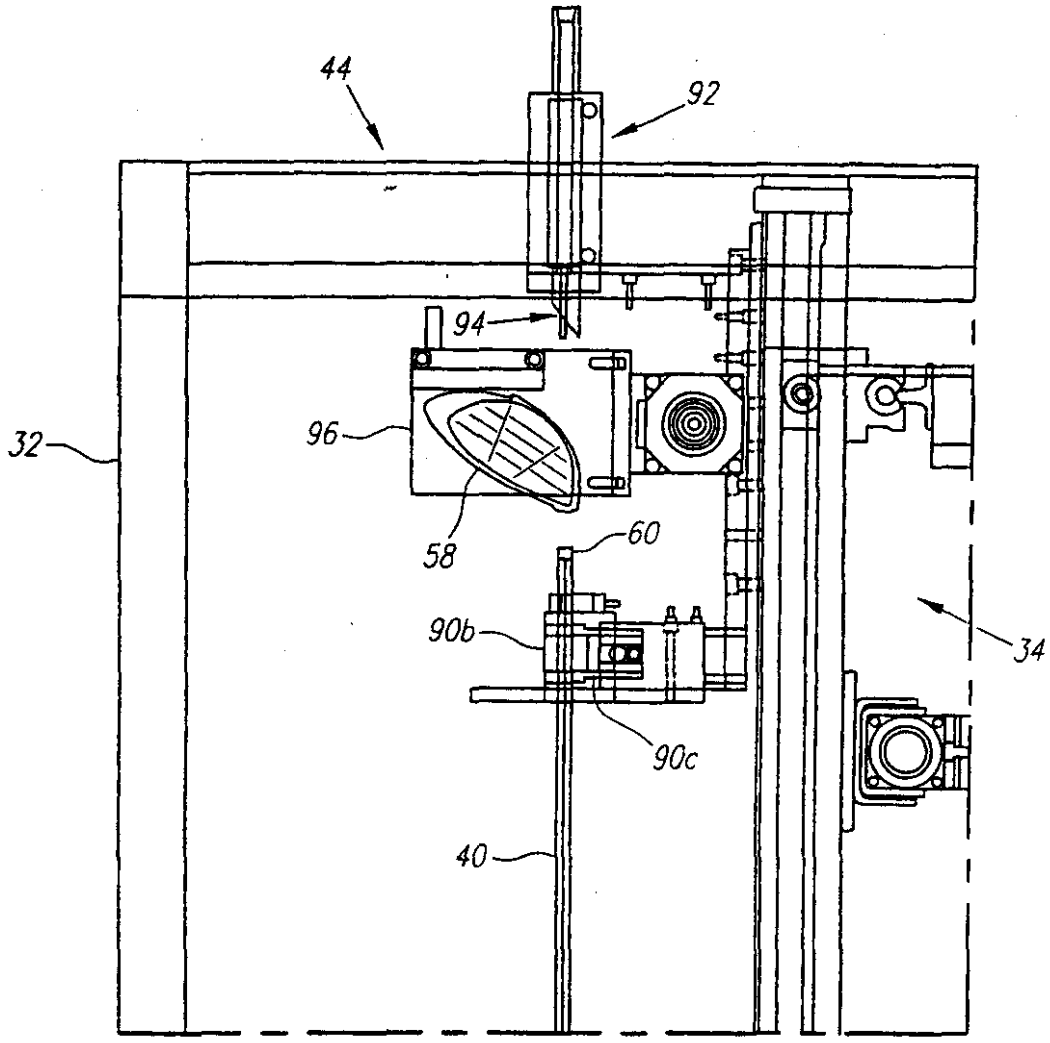


FIG. 9

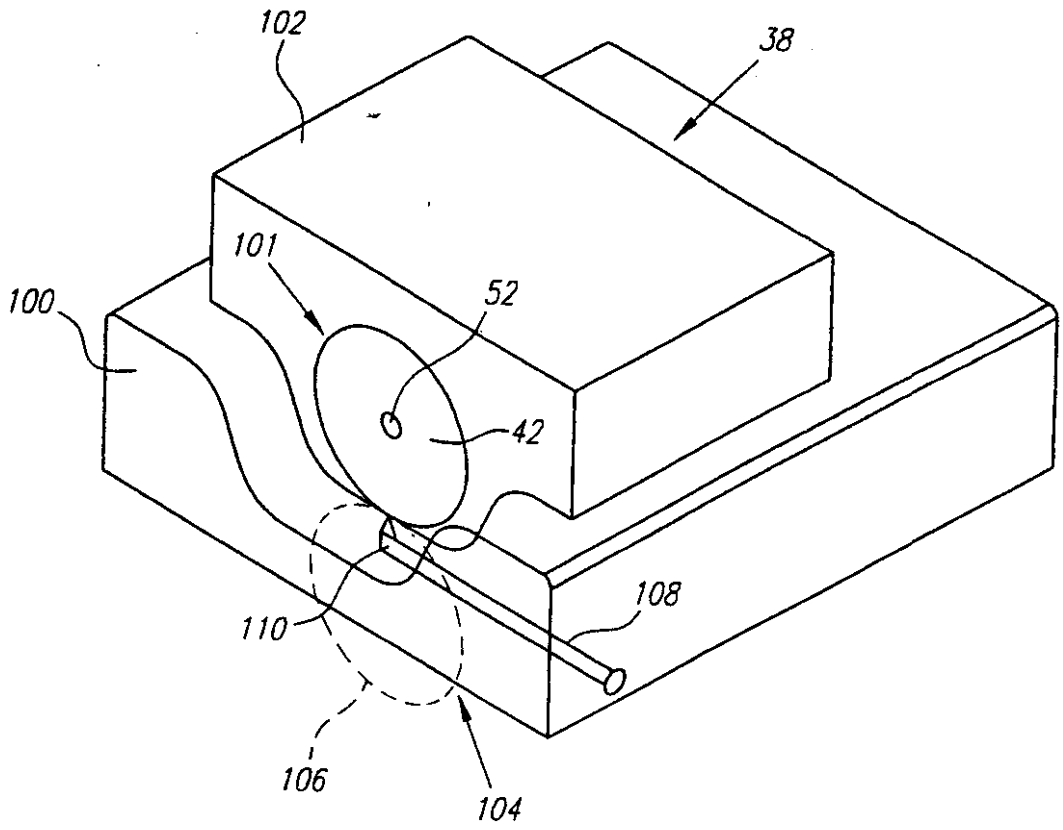


FIG. 10

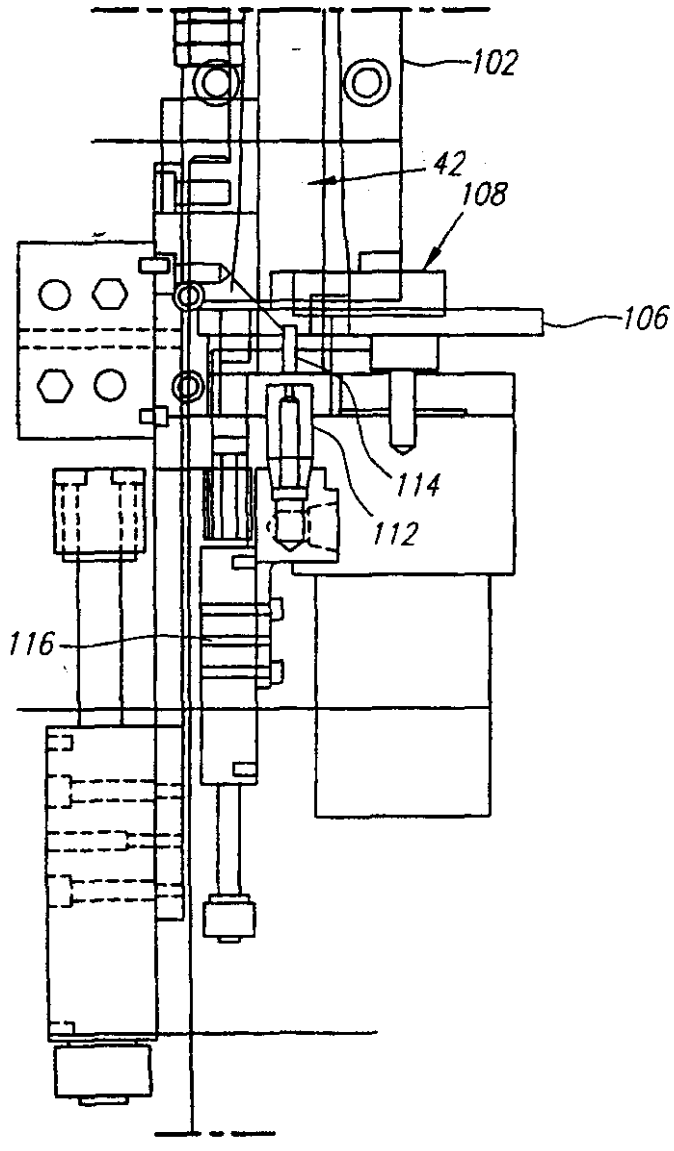


FIG. 11

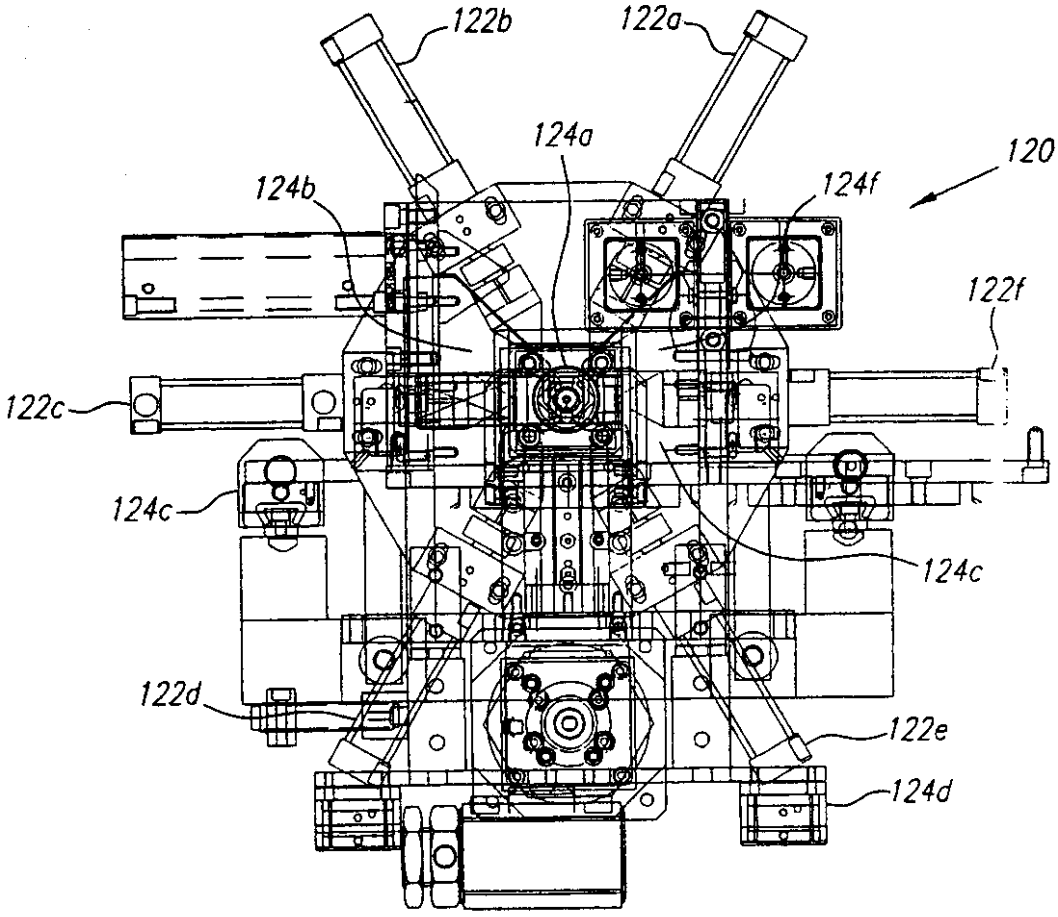

122b
122a
124a
120
124b
124f
122f
122c
124c
124c
122d
122e
124d

FIG. 12

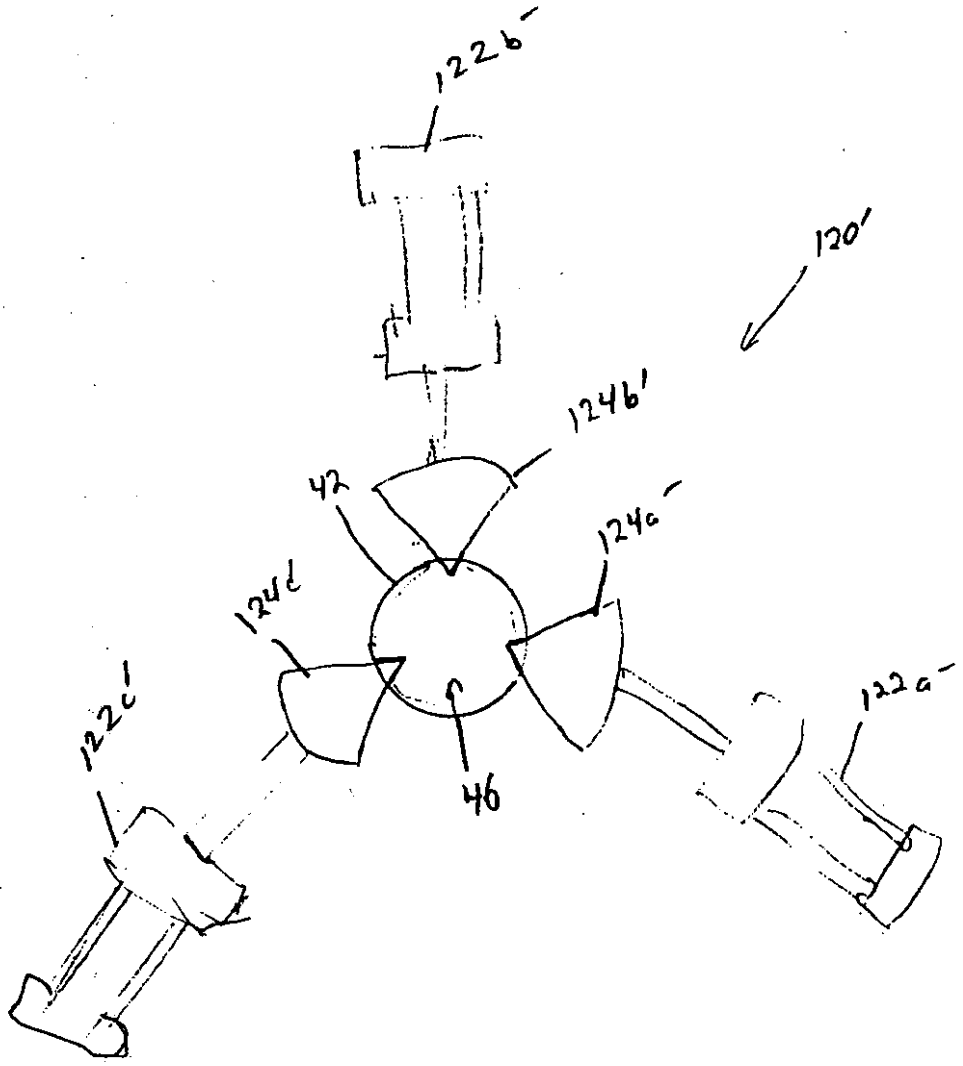


FIG. 13

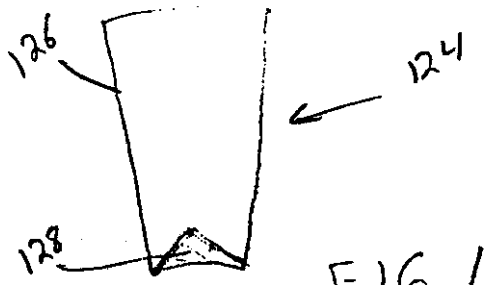


FIG. 14

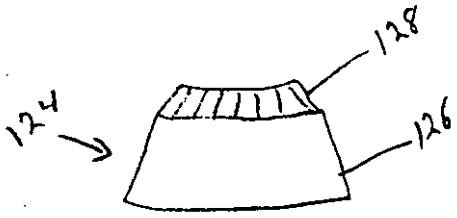


FIG. 15

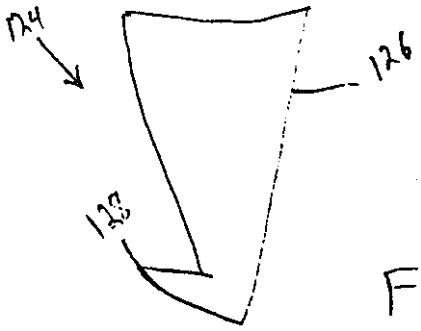


FIG. 16

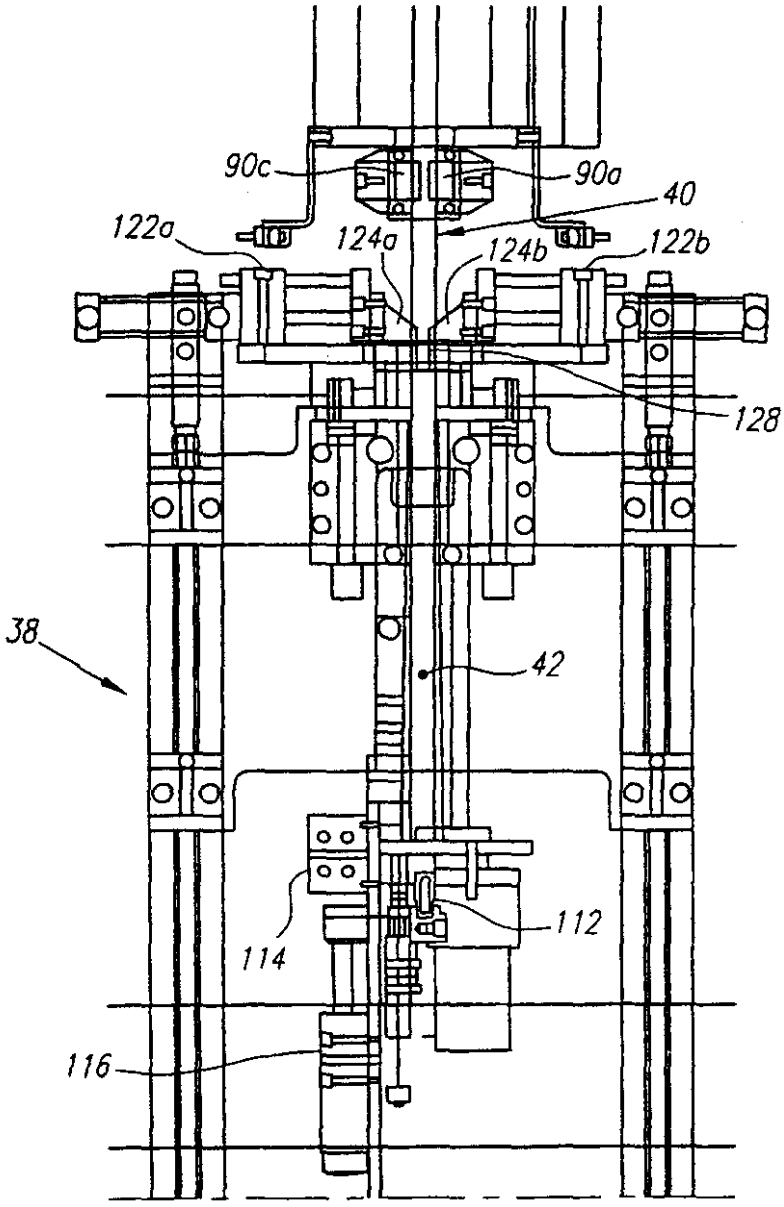


FIG. 17

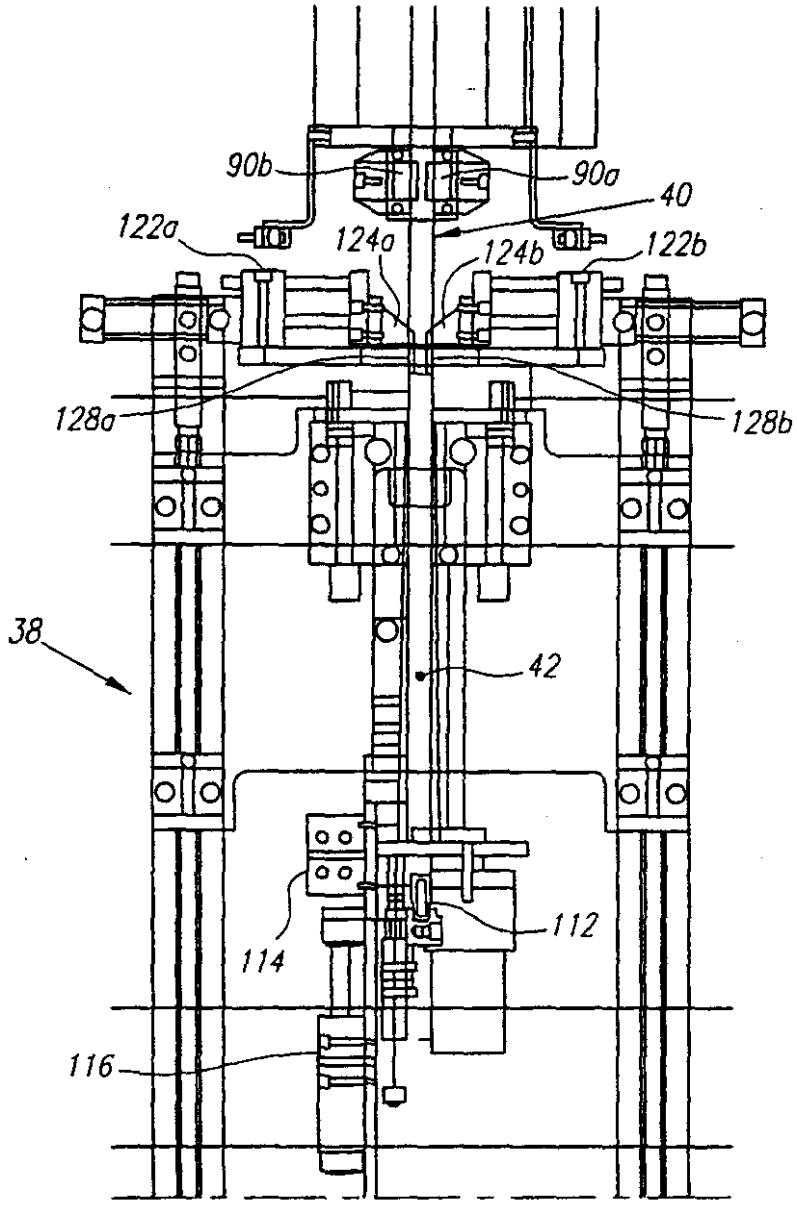


FIG. 18

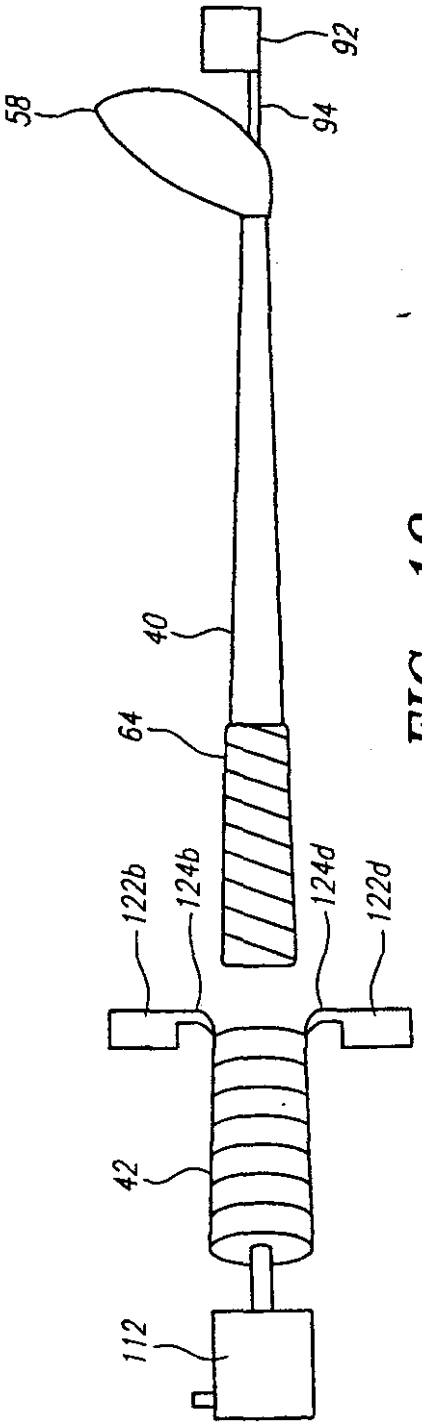

58
92
94
40
64
122b
124b
124d
122d
42
112

FIG. 19

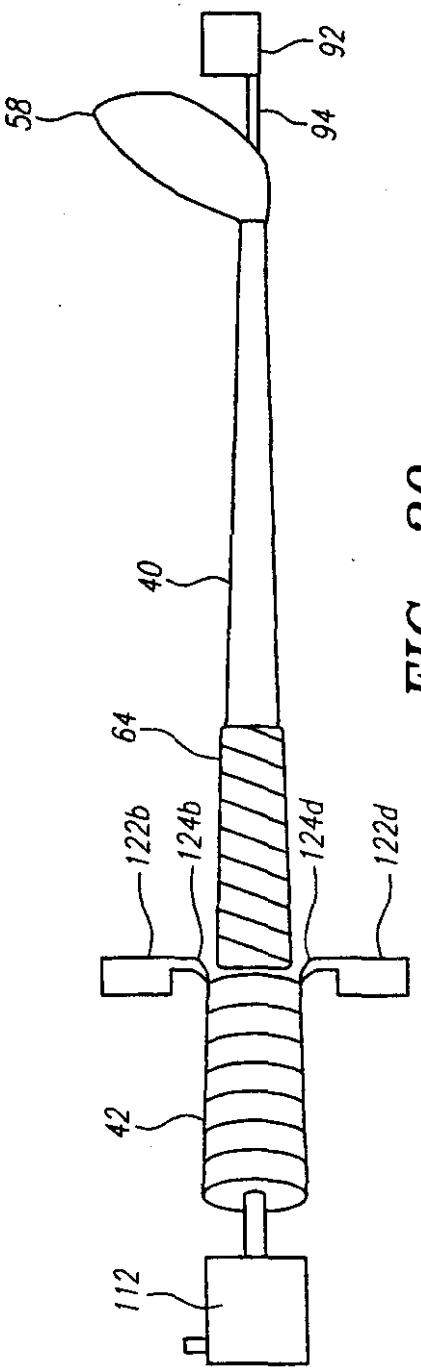

58
92
94
40
64
122b
124b
124d
122d
42
112

FIG. 20

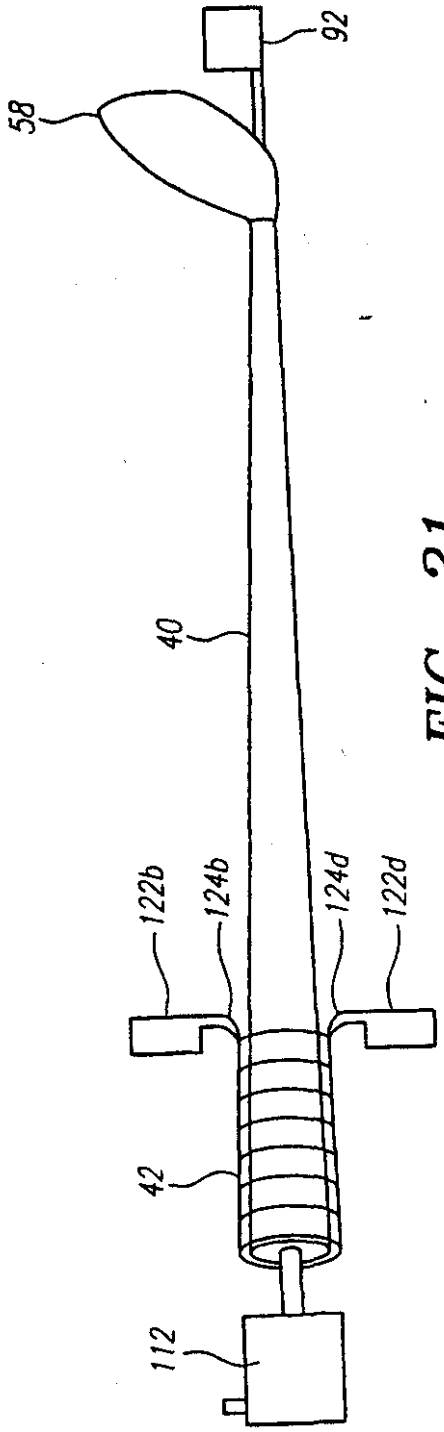

92
58
40
122b
124b
124d
122d
42
112

FIG. 21

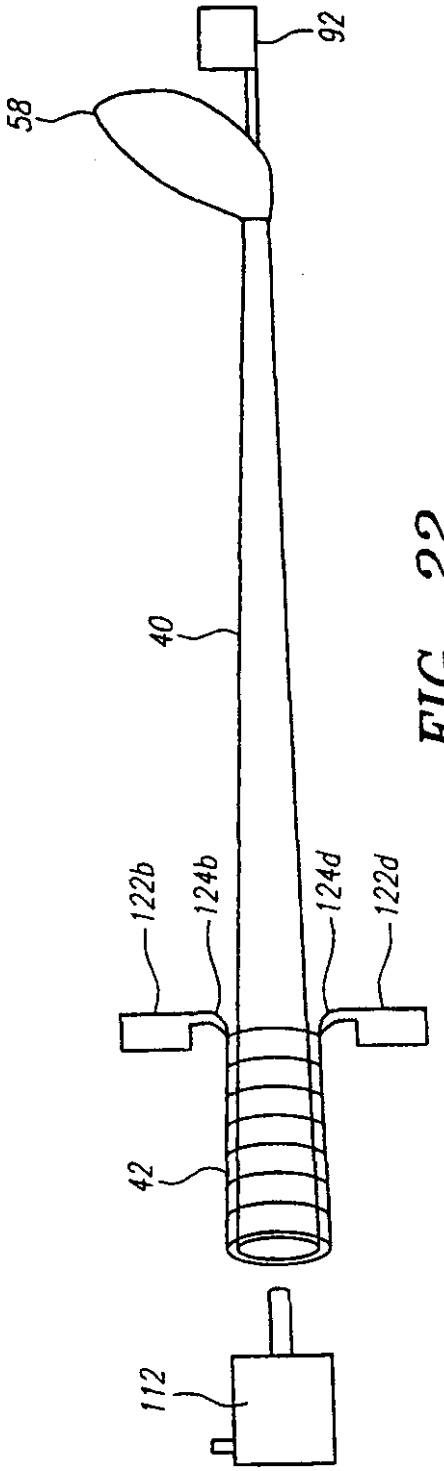

92
58
40
122b
124b
124d
122d
42
112

FIG. 22

[19]中华人民共和国国家知识产权局

[51]Int. Cl[7]
A63B 53/14

[12]发明专利申请公开说明书

[21]申请号 00801442.6

[43]公开日 2001年10月17日

[11]公开号 CN 1317981A

[22]申请日 2000.7.14 [21]申请号 00801442.6
[30]优先权
[32]1999.7.20 [33]US [31]09/357694
[86]国际申请 PCT/US00/19262 2000.7.14
[87]国际公布 WO01/05470 英 2001.1.25
[85]进入国家阶段日期 2001.3.19
[71]申请人 卡拉韦高尔夫公司
地址 美国特拉华州
[72]发明人 K·伦霍夫 J·V·布兰克
[74]专利代理机构 中国专利代理(香港)有限公司
代理人 蔡民军 章社杲

权利要求书2页 说明书8页 附图页数15页

[54]发明名称 在高尔夫球杆轴上自动装配抓手的方法和装置

[57]摘要

一种在一高尔夫球杆轴(40)上自动装配一抓手(42)的方法和 装置(30)。该抓手(42)在干燥状态下装配到该高尔夫球杆轴(40) 上。本发明在把抓手(42)装配到高尔夫球杆轴(40)上时不使用溶 剂、润滑剂之类。该装置(30)有一个把一双面胶带(70)自动包到 高尔夫球杆轴(40)的粗端(64)上的贴胶带机构(36)。该装置(30) 还有一在干燥状态下在一轴(40)上自动装配一抓手(42)的抓手装 配机构(38)。该装置(30)还有一把高尔夫球杆轴(40)从该贴胶 带机构(36)传送到该抓手装配机构(38)的轴移动机构(34)。该 抓手装配机构(38)有在把抓手装配到高尔夫球杆轴(40)的粗端(64) 上前扩张该抓手(42)的装置。

ISSN1008-4274

知识产权出版社出版

权　利　要　求　书

1. 一种在一高尔夫球杆轴（40）上自动装配一抓手（42）的方法，该抓手（42）有一具有第一直径的空心内部，该方法包括：

在该整个装配过程中使一高尔夫球杆（40）的粗端（64）和该抓手（42）的空心内部（48）保持干燥；

把一气体介质注入该抓手（42）中，使该抓手（42）的空心内部（48）从第一直径扩张成第二直径；

使该高尔夫球杆轴（40）的粗端（64）与该抓手（42）的该扩张的空心内部（48）配合。

2. 按权利要求 1 所述的方法，其特征在于还包括：在使该高尔夫球杆轴（40）的粗端（64）与该抓手（42）的该扩张的空心内部（48）配合前用多个爪（124）撑开该抓手（42）的开口端（46）。

3. 按权利要求 1 所述的方法，其特征在于还包括：用一双面胶带（70）包住该高尔夫球杆轴（40）的粗端（64），为此，把该胶带（70）的中部（70a）粘到该粗端（64）上，然后把该胶带（70）的第一侧部（70b）粘到该粗端（64）上，然后把该胶带（70）的第二侧部（70c）粘到该粗端（64）上，该胶带（70）的第二侧部（70c）的端部与第一侧部（70b）搭接。

4. 按权利要求 2 所述的方法，其特征在于还包括：在使该高尔夫球杆轴（40）的粗端（64）与该抓手（42）的空心内部（48）配合后，向前移动该多个爪（124），使其与抓手（42）的开口端（46）脱离。

5. 按权利要求 3 所述的方法，其特征在于还包括：把其粗端（64）包有胶带的高尔夫球杆轴（40）从一胶带自动粘贴工段（36）传送到一抓手自动装配工段（38），以使该高尔夫球杆轴（40）的包有胶带的粗端（64）与该抓手（42）的空心内部（48）配合。

6. 一种在一高尔夫球杆轴（40）的粗端（64）上自动装配一抓手（42）的装置（30），该装置（30）包括：

一机架（32）；

一安装在该机架（32）上的贴胶带机构（36）；

一安装在该机架上的抓手装配组件（38），该抓手装配组件（38）包括一抓手接收套筒（100）上的一空气注入器（92）、多个可从一

合上位置移动到一张开位置的爪（124）和一驱动机构（116）；

一轴移动机构（34），该轴移动机构可从机架（32）上一与该贴胶带机构（36）对齐的位置移动到机架上（32）一与该抓手装配组件（38）对齐的位置。

7. 按权利要求 12 所述的装置（30），其特征在于还包括：一位于该抓手装配组件（38）上的抓手定向装置（104），该抓手定向装置（104）可把一抓手（42）定向在一预定位置上。

8. 按权利要求 12 所述的装置（30），其特征在于该贴胶带机构（36）进一步包括一胶带分配器（74）、一位于该胶带分配器（74）旁的胶带切割器（80）、一可围绕一固定轴线转动的胶带压辊（86）和一与该胶带压辊（86）相对的轴滚轮（88）。

9. 按权利要求 12 所述的装置（30），其特征在于该轴移动机构（34）进一步包括多个在把一抓手（42）装到该轴（40）的过程中使该轴（40）定位的引导件（90）。

10. 按权利要求 12 所述的装置（30），其特征在于还包括一装在该机架（32）上、与该抓手装配组件（38）对齐的轴定向装置（44），该轴定向装置（44）包括一轴对准件（96）和一第二注气器（92）。

说　明　书

在高尔夫球杆轴上自动装配抓手的方法和装置

本发明涉及在一高尔夫球杆轴上装配一抓手，特别涉及不使用溶剂把一抓手自动装到一高尔夫球杆轴上的方法和装置。

高尔夫上的抓手供球手挥杆时紧紧抓住球杆．早在1700s就已使用抓手，当时使用的是羊皮抓手。在1800s，皮革抓手开始出现在高尔夫球杆上，不久便流行起来。在1900s，主要由橡胶制造商开发出各种橡胶抓手。现在，抓手用合成橡胶、塑料等制成。

抓手一般在球杆制造场所装配在高尔夫球杆轴的粗端上。该装配过程大部分是手工操作，自动化程度极低。用手工把双面胶带包住高尔夫球杆轴的粗端。然后，在把抓手套到该包住的粗端上时为了不被双面胶带上的胶粘住，从抓手的开口端把溶剂或润滑剂喷入抓手的空心内部。抓手拉套到该轴上，直到抓手的封闭端与该轴的粗端齐平。最后溶剂蒸发，从而胶带粘住在抓手空心内部的表面上。因此，显然，如制造商不采取预防措施，这一重复程度很高的过程会危及工人健康。此外，某些溶剂和润滑剂的使用会污染环境。而且，喷射溶剂或润滑剂的步骤提高了生产成本。

高尔夫制造业及其相关产业致力于某些过程的自动化，以提高产量，减轻对工人的伤害。一个例子是Hsu的美国专利No.4,899,428（'428专利）“一种高尔夫球杆手柄套装配机构”．该'428专利所公开的装配机构包括滑动台、其上有用来张开抓手前端的爪的三致动器、一把空气鼓入抓手后部中的鼓风机和一把溶剂或润滑剂喷入抓手以便把该轴插入抓手中的皮管。另一个例子是Vald'via的美国专利No.5,407,026（'026专利）“一种高尔夫球杆抓手装配装置”．'026专利使用一抓手润滑装置和一高尔夫球杆轴润滑装置．在'026专利中，润滑剂的数量可控，便于把该轴插入抓手中。另一个例子是Cresse等人的美国专利No.5,429,706（'706专利）“把空心抓手装配到细长轴端上的装置和方法”．'706专利所公开的装置和方法用抓手内表面上的液态粘胶代替胶带把轴与抓手粘在一起．'706专利在轴插入抓手前对抓手充气。另一个例子是美国专利No.5,870,815（'815专利）“用于手柄装配的高尔夫球杆对准装置和方法”．'815

专利公开了一种对准组件，在抓手装配到轴的粗端上前对装在轴上的球杆头进行定位。

上述各专利无法实现抓手在高尔夫球杆轴上的全自动装配，并且仍需要使用溶剂或润滑剂。此外，上述各专利要求把一球杆头装到该轴上或堵住轴。需要有一种更自动的方法，它能抓住一开口轴、不使用溶剂或润滑剂。

为满足高尔夫制造业的这些需要，本发明提供一种自动化程度更高的在高尔夫球杆轴上装配抓手的方法和装置。本发明能在保持抓手和高尔夫球杆轴干燥的情况下做到这一点。即，本发明在把抓手装配到高尔夫球杆轴上时不使用溶剂、润滑剂等。

本发明的一个方面是一种在高尔夫球杆轴上自动装配抓手的方法。该抓手有一具有第一直径的空心内部。该方法一般在整个装配过程中使高尔夫球杆粗端和抓手空心内部保持干燥。该方法的下一步是把一气体介质注入抓手中，使抓手的空心内部从第一直径扩张成第二直径。下一步是使高尔夫球杆轴的粗端与抓手的扩张的空心内部配合。

本发明的另一个方面是一种在高尔夫球杆轴的粗端上自动装配抓手的装置。该装置包括一机架、一贴胶带机构、一抓手装配组件和一轴移动机构。该贴胶带机构装在该机架上。该抓手装配组件也装在该机架上。该抓手装配组件包括一抓手接收套筒上的空气注入器、多个可从一合上位置移动到一张开位置的爪和一驱动机构。轴移动机构可从机架上一与该贴胶带机构对齐的位置移动到机架上一与该抓手装配组件对齐的位置。

本发明的主要目的是提供一种在保持抓手和轴干燥的同时把抓手装配到高尔夫球杆轴上的方法和装置。

本发明的另一个目的是提供一种把抓手自动装配到高尔夫球杆轴上的方法和装置。

图 1 为本发明抓手自动装配装置的俯视图。

图 2 为与本发明相关的一高尔夫球杆抓手的视图。

图 3 为与本发明相关的一未装抓手的高尔夫球杆轴的视图，其上有一头部。

图 4 为一未装抓手的高尔夫球杆轴的侧视图，示出其在本发明装

置的贴胶带机构中的第一时刻.

图 5 为一未装抓手的高尔夫球杆轴的侧视图，示出其在本发明装置的贴胶带机构中的第二时刻.

图 6 为一未装抓手的高尔夫球杆轴位于本发明装置的贴胶带机构中的俯视图，胶带初步粘到该轴上.

图 6A 为图 6 的横截面图.

图 7 为一未装抓手的高尔夫球杆轴位于本发明装置的贴胶带机构中的俯视图，胶带进一步粘到该轴上.

图 7A 为图 7 的横截面图.

图 8 为一未装抓手的高尔夫球杆轴位于本发明装置的贴胶带机构中的俯视图，胶带在该轴上完成粘贴.

图 8A 为图 8 的横截面图.

图 9 为本发明装置的轴定向机构的俯视图.

图 10 为本发明装置的抓手装配机构的后视图.

图 11 为本发明装置的抓手装配机构的俯视图.

图 12 为本发明装置的抓手装配机构的爪组件的正视图.

图 13 为本发明装置的爪组件与一抓手啮合的另一实施例的正视图.

图 14 为本发明装置的一爪的正视图.

图 15 为本发明装置的一爪的俯视图.

图 16 为本发明装置的一爪的侧视图.

图 17 为抓手装配机构的俯视图，在一高尔夫球杆轴上装配一抓手.

图 18 为抓手装配机构在一高尔夫球杆轴上完成装配一抓手后的俯视图.

图 19 为在一高尔夫球杆轴上装配一抓手的第一时刻的侧视示意图.

图 20 为在一高尔夫球杆轴上装配一抓手的第二时刻的侧视示意图.

图 21 为在一高尔夫球杆轴上装配一抓手的第三时刻的侧视示意图.

图 22 为一抓手在一高尔夫球杆轴上完成装配时的侧视示意图.

本发明装置和方法用来在保持抓手和高尔夫球杆轴的粗端干燥的同时把一抓手装配到一高尔夫球杆轴上。如图 1 所示，本发明抓手自动装配装置用标号 30 表示。装置 30 包括一机架 32、一轴来回移动机构 34、一贴胶带机构 36 和一抓手装配机构 38。轴来回移动机构 34、贴胶带机构 36 和抓手装配机构 38 以一定位置关系装在机架 32 上。贴胶带机构 36 和抓手装配机构 38 平排在机架 32 的一端，而轴来回移动机构 34 装在机架 32 的另一端上。轴来回移动机构 34 把一轴从与贴胶带机构 36 对齐的一位置传送到与抓手装配机构对齐的另一位置。

轴用传送带之类公知装置从一轴供源传送给装置 30。轴 40 放置在轴来回移动机构 34 上后传送到贴胶带机构 36，以把胶带贴到轴 40 上。然后用轴来回移动机构把贴有胶带的轴 40 传送到与抓手装配机构对齐的位置，以在其上装配抓手 42（无需溶剂）后用轴定向装置 44 对轴 40 进行定向。

如图 2 所示，抓手 42 一般有一可通向一空心内部 48 的开口端 46。与开口端 46 相反的封闭端 50 有一也可通向抓手 42 空心内部 48 的孔 52。抓手 42 的主体 54 上可有一个把抓手 42 对准在轴 40 上的对准切口 56。尽管以上示出、说明了一种抓手 42，但本领域普通技术人员不难看出，本发明也可用于如果说不是所有类型、但也是大部分类型的抓手。

如图 3 所示，轴 40 在其顶端 60 上装有一高尔夫球杆头部 58。顶端 60 插入高尔夫球杆头部 58 的一孔 62 中。抓手 42 套在轴 40 的粗端 64 上。粗端 64 上有一通向轴 40 空心内部 68 的开口 66。粗端 64 的圆周一般比顶端 60 大。轴 40 可用石墨材料、钢材等制成。轴的长度视高尔夫球杆长度的不同而不同。尽管以上示出、说明了一种轴 40，但本领域普通技术人员不难看出，本发明也可用于如果说不是所有类型、但也是大部分类型的轴。

图 4－8（包括 6A、7A 和 8A）示出在贴胶带机构 36 把双面胶带（两面上都有粘胶）贴到一轴 40 的粗端 64 上。用轴来回移动机构 34 把一轴 40 放置在贴胶带机构 36 上。轴 40 的粗端 64 与从一胶带分配机 74 上一卷胶带 72 退绕的一定长度的胶带 70 相对。一胶带移动板 76 把胶带 70 放置到轴 40 粗端 64 上方。胶带移动板 76 还用来

除去双面胶带 70 的衬纸 78。胶带移动板 76 从图 4 所示前伸位置移动到图 5 所示后退位置。

胶带 70 在一胶带切割机构 80 处被切断。该胶带切割机构 80 一般包括一刀刃 82 和一驱动机构 84。该驱动机构 84 可为任何现有装置，例如一汽缸或一伺服电动机。刀刃 82 把胶带 70 切割成预定长度，其一部分伸出轴 40 粗端 64 之外。但是，一胶带压辊 86 先使胶带 70 压靠轴 40 的粗端 64，把胶带 70 的一面粘在该粗端上。然后刀刃 82 把该胶带 70 切割成预定长度。胶带压辊 86 上有与胶带 70 不粘的硅酮橡胶，因此可把胶带 70 的一个表面粘到轴 40 的粗端 64 上，同时又保持胶带 70 另一面的粘性。该胶带压辊 86 的表面也可用其他不粘材料构成。在把胶带 70 粘到轴 40 的粗端 64 上的过程中，轴 40 用多个轴引导件 90a-d 定位，然后用多个轴滚轮 88a-b 转动该轴。

一般以下述步骤进行施加过程。首先，如图 6 和 6A 所示，把胶带 70 长度中部 70a 粘到轴 40 的粗端 64 上。接着，刀刃 82 把胶带切割成预定长度。接着，如图 7 和 7A 所示，用轴滚轮 88a-b 转动轴 40，把胶带 70 长度的第一侧部 70b 粘到该粗端上。在一优选实施例中，轴 40 转动约 180°。然后反向转动该轴 40，把胶带 70 的第二侧部 70c 粘到轴 40 的粗端 64 上，使得第二侧部 70c 的端部与第一侧部 70b 的端部搭接。一比胶带压辊 86 大、位于胶带压辊 86 粗端旁的轮子（未示出）把胶带 70 的该端压靠到轴 40 的粗端 64 上，形成一前边缘，便于把抓手 42 套到轴 40 上。该胶带压辊 86 以均匀压力粘贴胶带 70，使得胶带 70 平整地粘到轴 40 的可能不平的表面上。

用胶带 70 包住轴 40 的粗端 64 后，把该轴传送到一与抓手装配机构 38 对齐的位置上。在一优选实施例中，在一水平面上传送该轴 40。但也可不在水平方向上传送该轴。除了与该抓手装配机构 38 对齐外，轴 40 还与在与抓手装配机构 38 相反一边上的轴定向装置 44 对齐。

如图 9 所示，轴定向装置 44 一般包括一有一顶端 94 的轴注气器 92，轴对准件 96 上可有一球杆头。可把轴定向装置 44 移向轴 40，也可把轴 40 移向轴定向装置 44。在一实施例中，在把抓手 42 装到轴 40 上后把球杆头 58 装到轴 40 上。在另一实施例中，在轴 40 传给装置 30 前把球杆头 58 装到轴 40 上。在又一个实施例中，球杆头 58

在该轴定向装置 44 上装到轴 40 上。如前所述，轴 40 插入球杆头 58 的一孔 62 中。

在有或无球杆头 58 的情况下，轴定向装置 44 对轴 40 进行定向，以把抓手 42 安装其上。轴注气器 92 的顶端 94 插入轴 40 顶端 60 的开口中。顶端 94 与对准件 96 一起使得轴 40 定位。如不从轴 40 的顶端 60 注入空气，则可堵塞顶端 60，保持抓手 42 内部压力，这在下文详述。

下面说明抓手装配机构 38，用传送带之类公知装置把抓手 42 从一抓手源供应给装置 30。如图 10 所示，把每一抓手 42 放置到抓手装配机构 38 的一接收套筒 100 上。该抓手 42 实际上放置在该接收套筒 100 的一槽道 101 中。抓手 42 的封闭端 52 面朝外，而开口端 46 面向一抓手装配机构壳体 102。一旦在该接收套筒 100 中，抓手 42 用一抓手定向装置 104 定向。抓手 42 的定向可与胶带 70 包住轴 40 的粗端 64 同时进行。抓手定向装置 104 一般包括一抓手转轮 106 和一有一啮合端 110 的杆 108。抓手转轮 106 转动槽道 101 中的抓手 42，直到啮合端 110 啮合抓手 42 的切口 56。尽管上述抓手定向装置 104 可应用于许多抓手，但本领域普通技术人员不难看出，对于其上没有切口 56 的其他抓手，也可使用激光对准装置之类其他定向装置。

抓手 42 一旦正确定向，一抓手注气器 112 的顶端 114 插入抓手 42 封闭端 50 的孔 52 中而抵住该抓手 42。用一驱动机构 116 把该抓手注气器 112 移向抓手 42。该驱动机构 116 可为汽缸、伺服电动机等。其顶端 114 插入孔 52 中的该抓手注气器 112 把抓手 42 推入抓手装配机构壳体 102 中，以进行扩张过程。一旦位于抓手装配机构壳体 102 中，抓手 42 即可扩张。抓手装配机构壳体 102 有一体积一定的室 103，以限制抓手 42 的扩张量。室 103 确保抓手不因过度扩张而破裂。

如图 12 所示，抓手装配机构壳体 102 的另一边上有一爪组件 120。该爪组件 120 一般包括分别受驱动机构 122a-f 驱动的多个爪 124a-f。这些爪驱动机构 122a-f 可为汽缸、伺服电动机等。在图 12 中，该爪组件 120 有 6 个爪 124a-f，而在图 13 中，另一种爪组件 120' 有 3 个爪 124a'-c'。如图 13 所示，爪 124a'-c' 啮合抓手 42 开口端 46，扩张该开口端 46，以把轴 40 插入其中。

如图 14－16 所示，每一爪包括一细长主体 126 和一啮合件 128。该啮合件 128 从开口端 46 插入抓手 42 空心内部 48，在抓手 42 内表面上施加向外力扩张该开口端 46。

如图 17 和 18 所示，用一未示出的驱动机构 130 把其中有一抓手 42 的抓手装配机构 38 移向原先已用轴定向装置 44 对准的轴 40。该驱动机构 130 可为汽缸、伺服电动机等。或者，也可用轴移动机构 34 把轴 40 移向抓手装配机构 38。一旦轴 40 包有胶带的粗端 64 顶住抓手 42 的开口端 46，抓手注气器 112 把一气体介质、最好为空气注入抓手 42 的空心内部 48，把该空心内部从第一直径扩张到第二直径。在抓手 42 套在轴 40 上的同时，各爪 124a-f 把抓手 42 的开口端 46 撑开。由于开口端 46 和空心内部被撑开，因此可在干燥、无溶剂状态下把抓手套在轴 40 的粗端 64 上。确切说，为了把抓手 42 套到轴 40 的粗端上无需使用溶剂、水成介质或润滑剂。因此，整个操作过程在安全、不污染环境的干燥状态下进行，而且成本大大下降。

抓手 42 一旦套在轴 40 上，这多个爪 124a-f 从抓手 42 的开口端 46 向前移动，从而使得开口端 46 紧紧套在轴 40 上。

图 19－22 简示出该装配过程。如图 19 所示，用胶带 70 包住的轴 40 的粗端 64 移向抓手 42 开口端。多个爪 124a-f 撑开抓手 42 的开口端 46。如图 20 所示，轴 40 的粗端 64 抵住抓手 42 的开口端，防止空心内部 48 中的气体介质向外流出。气体介质从插入抓手 42 封闭端 50 的孔 52 中的抓手注气器 112 的顶端 114 注入空心内部 48 中。气体介质还可从插入轴 40 的顶端 60 的轴注气器 92 的顶端 94 注入轴 40 的空心内部 68 中。轴注气器 92 的该反向气流也用来档住抓手注气器 112 的气流。由于气流受阻，因此抓手 42 的空心内部 48 从第一直径扩张成第二直径。例如，第一直径可为 1.3cm，而第二直径为 3.0cm。第二直径必须大到足以容纳轴 40 的包有胶带的粗端 64，使抓手 42 内表面与胶带 70 之间不发生接触。该装配过程正是由于这一扩张才得以在干燥状态下进行。或者，也可不使用反向气流，而是堵塞轴 40 的顶端 60，防止抓手注气器 112 的气流向外流出。该气体介质最好为空气，但也可使用其他气体介质，例如氮气、氩气等。也可通过对抓手装配机构壳体 102 进行抽真空来扩张抓手 42 的空心内部 48。

如图 21 所示，该轴的包有胶带的粗端 64 抵靠抓手 42 封闭端 50 的内表面，从而气流停止注入空心内部 48 中，从而空心内部 48 的扩张停止。因此，抓手 42 空心内部 48 的内表面接触包在轴 40 粗端 64 上的胶带 70. 如图 22 所示，爪 124a-f 从抓手 42 开口端 46 向前移动，注气器 112 和 92 与其上有抓手的高尔夫球杆轴 40 脱离。然后把其上有抓手的轴 40 送出该装置，以作进一步处理。

说 明 书 附 图

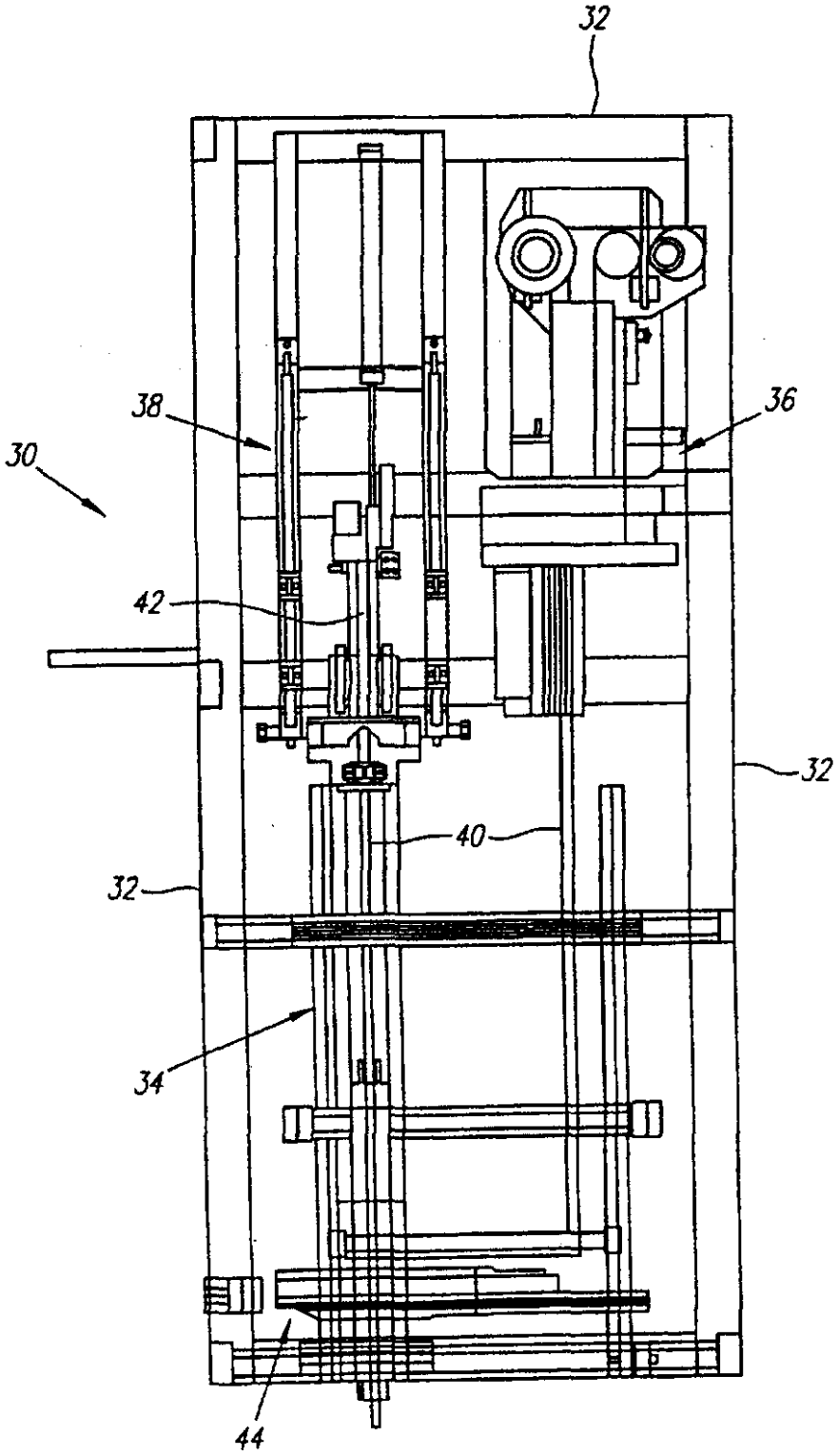


图 1

01.03.18

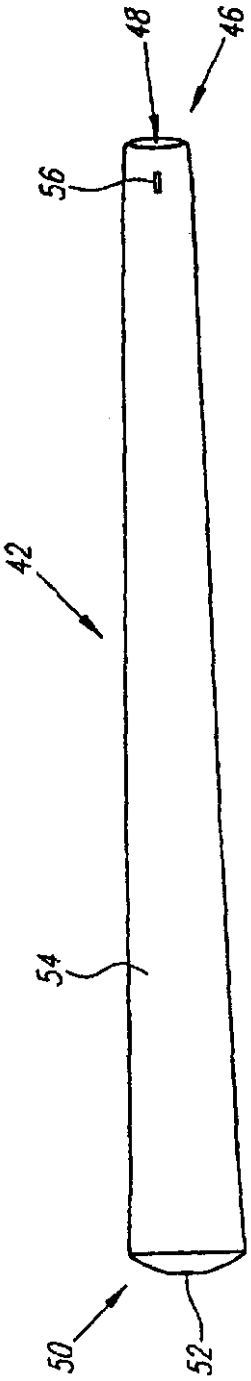


图 2

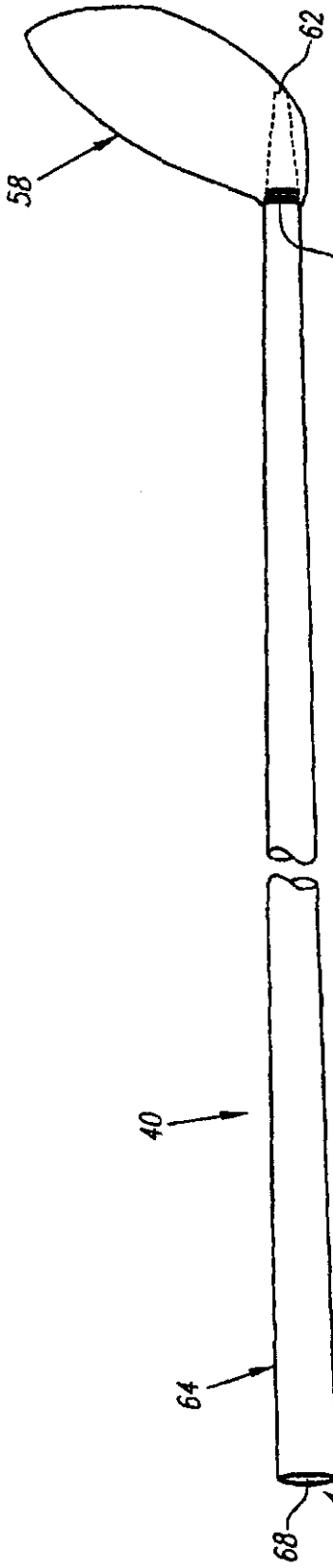


图 3

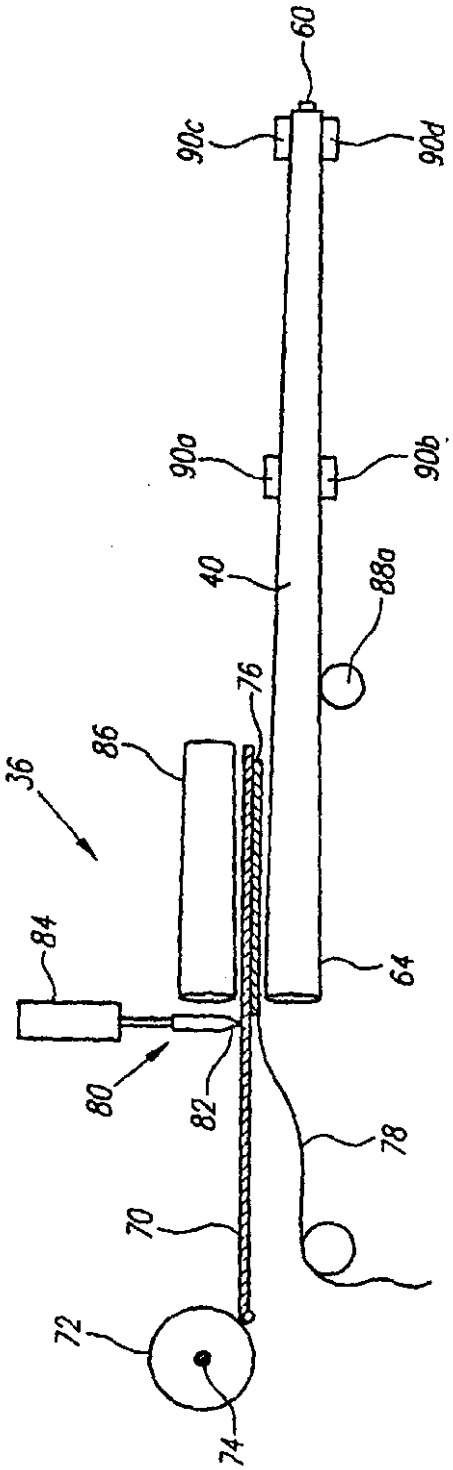

60
90c
90d
90a
90b
40
88a
76
86
36
84
64
80
82
78
70
72
74

图 4

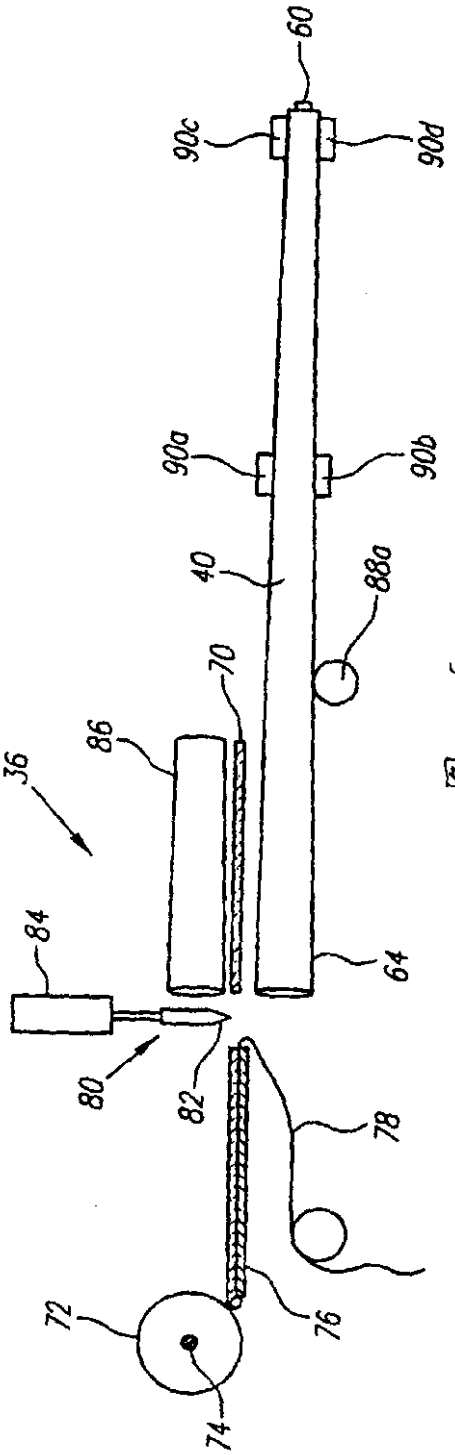

60
90c
90d
90a
90b
40
88a
70
86
36
84
64
80
82
78
76
72
74

图 5

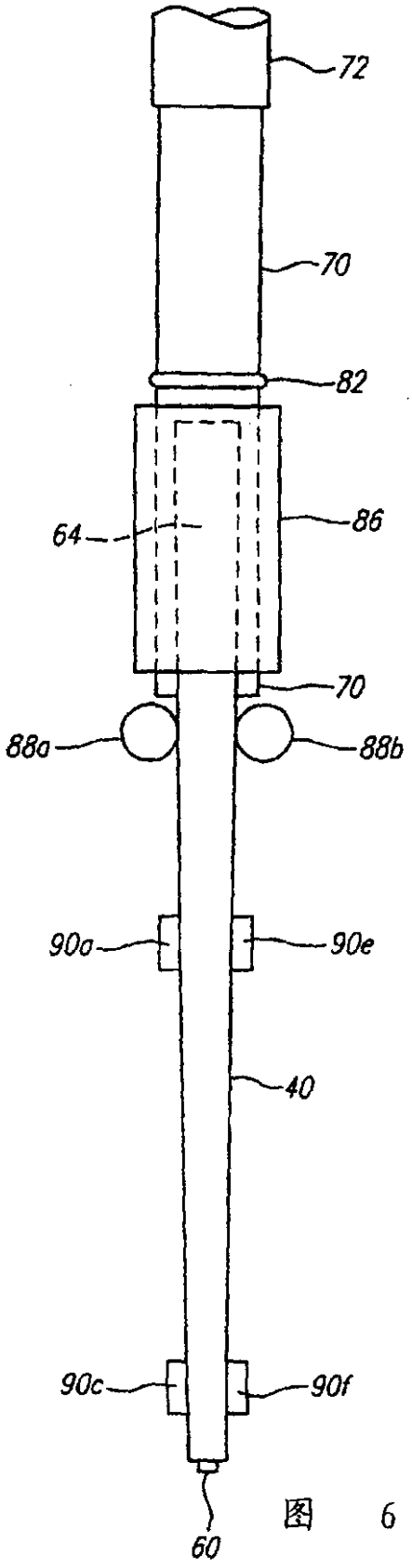

72
70
82
64
86
70
88a
88b
90a
90e
40
90c
90f
60

图 6

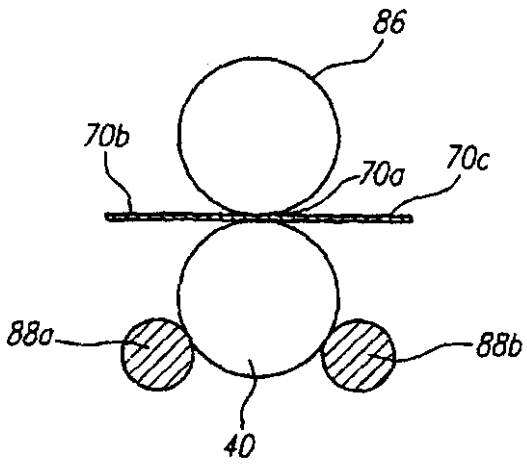

86
70b
70a
70c
88a
88b
40

图 6A

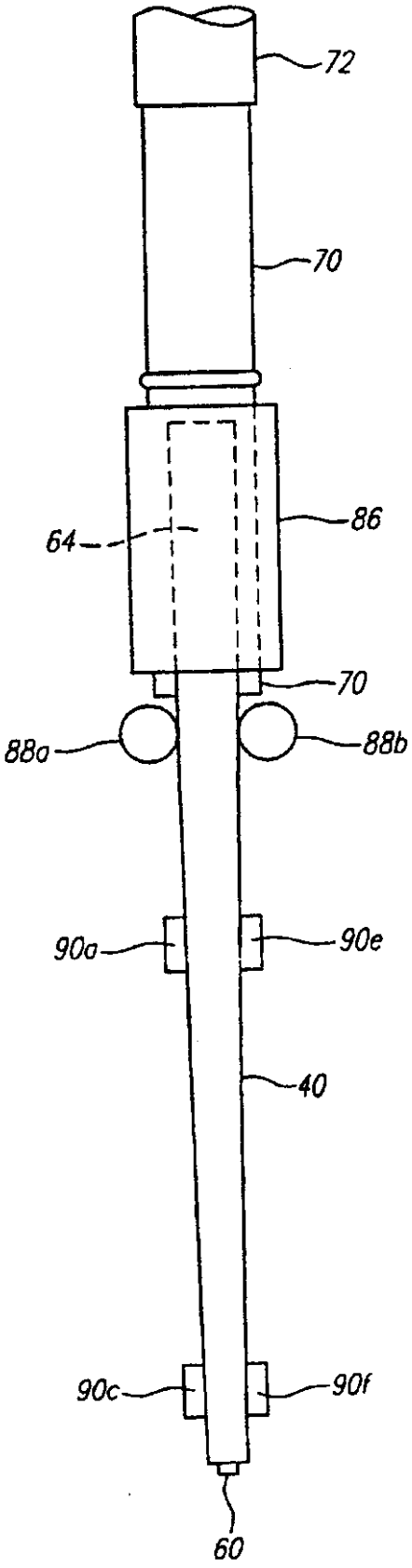

72
70
64
86
70
88a
88b
90a
90e
40
90c
90f
60

图 7

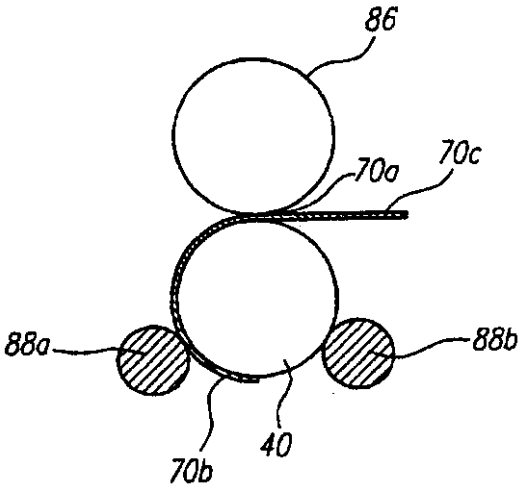

86
70a
70c
88a
88b
70b
40

图 7A

01-03-19

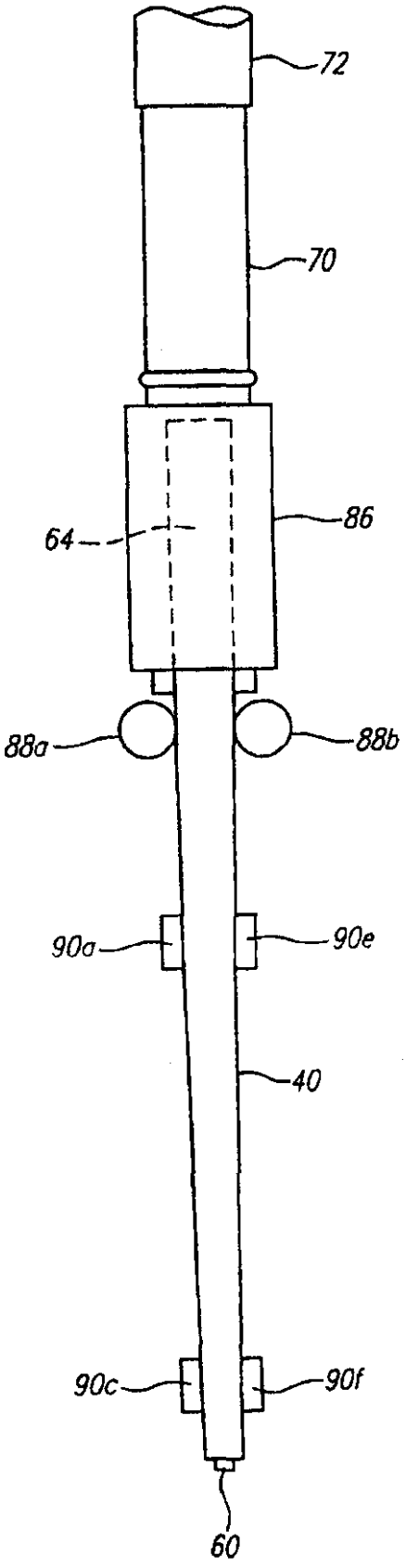


图 8

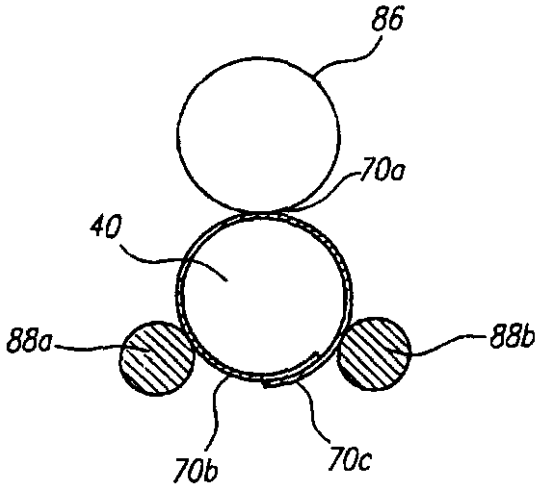


图 8A

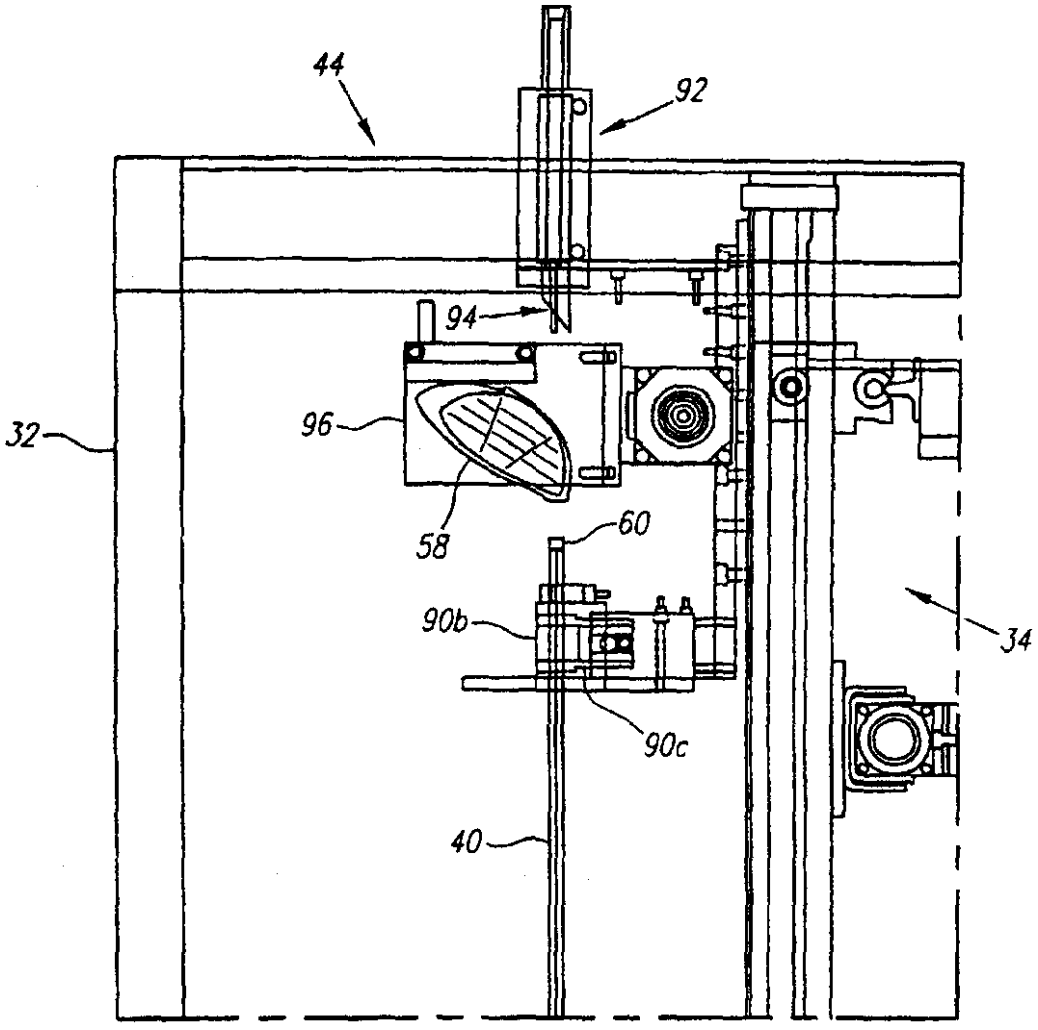


图 9

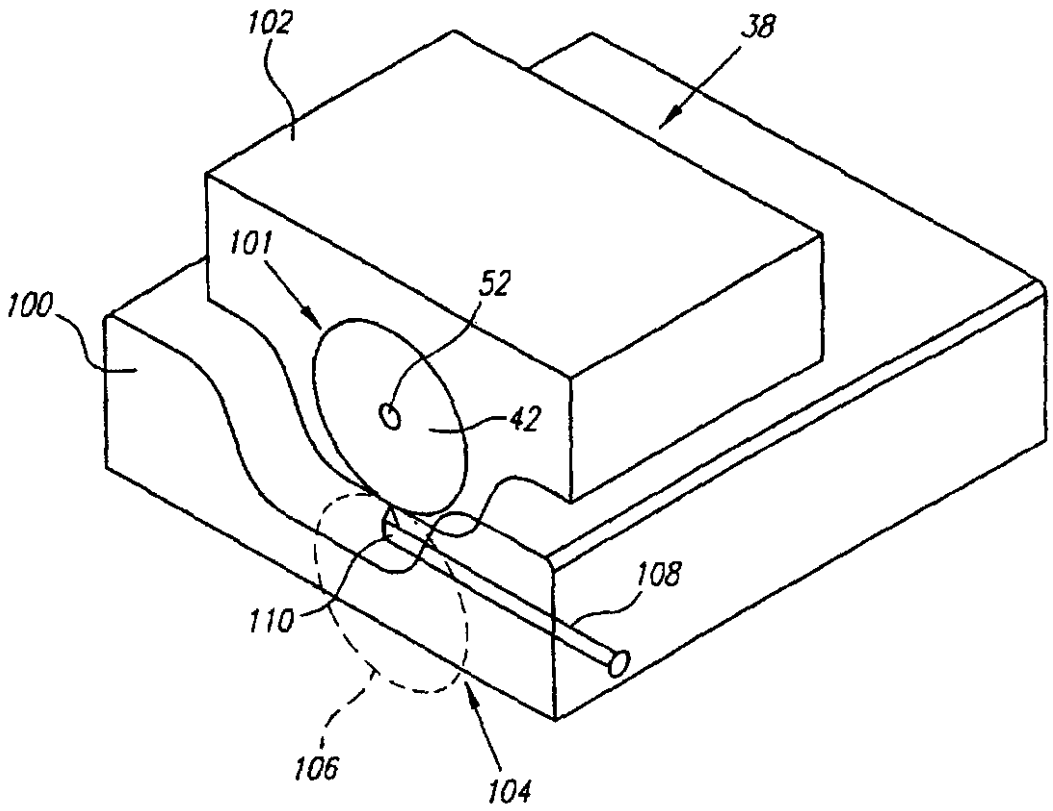


图 10

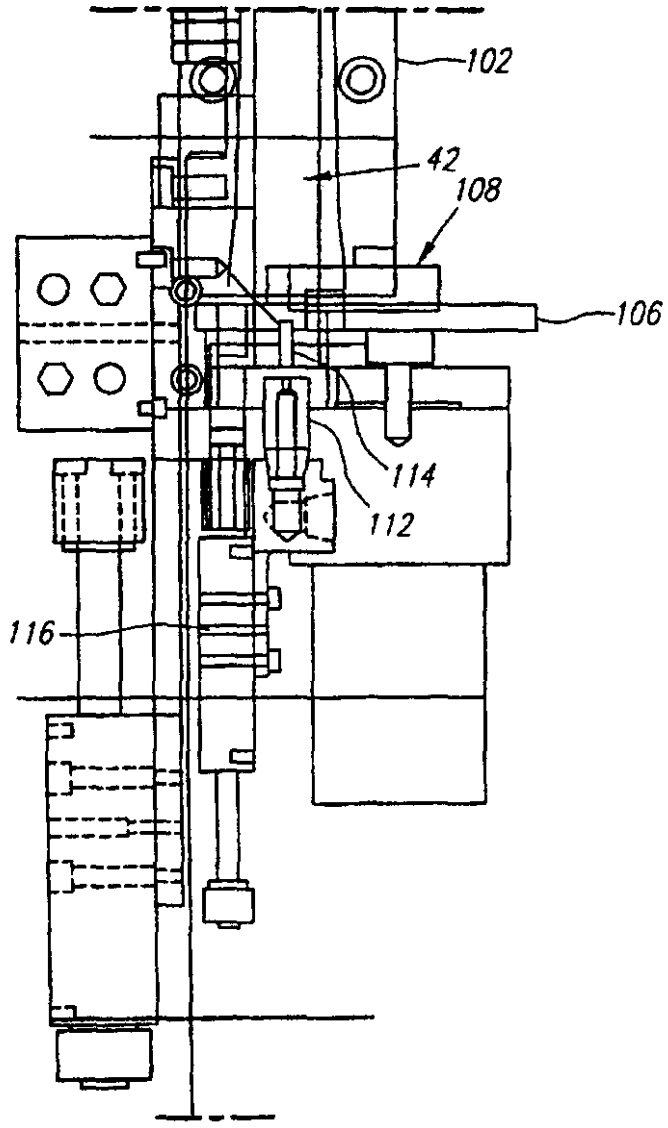


图 11

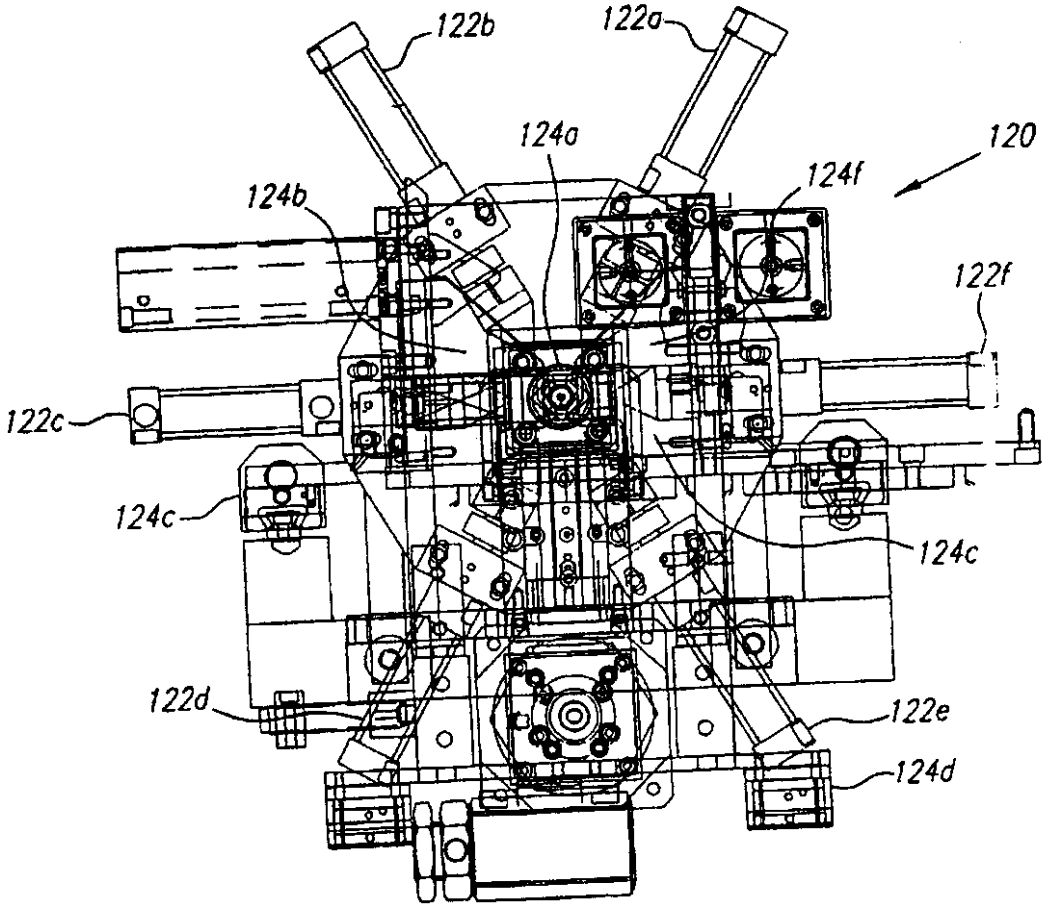

122b
122a
124a
120
124f
124b
122f
122c
124c
124c
122d
122e
124d

图 12

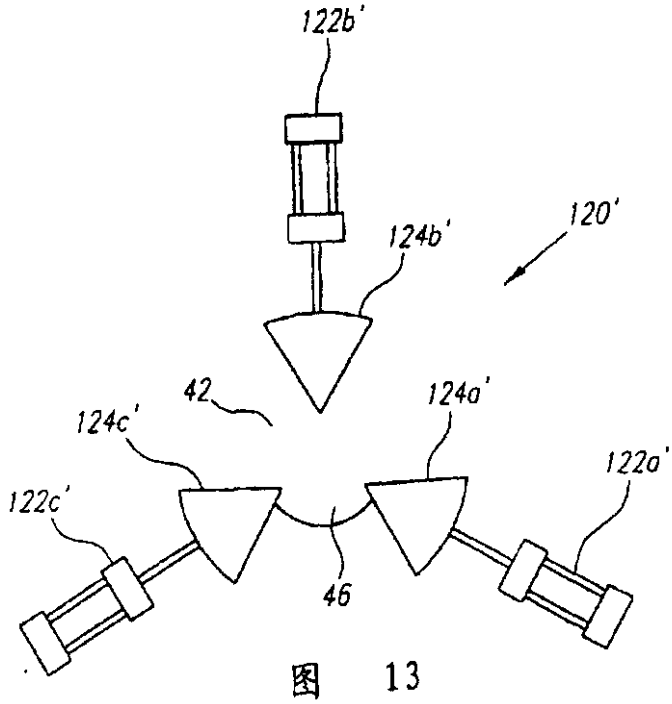


图 13

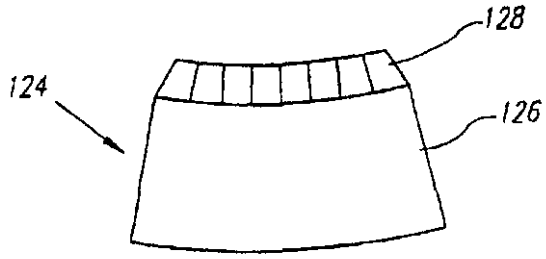


图 15

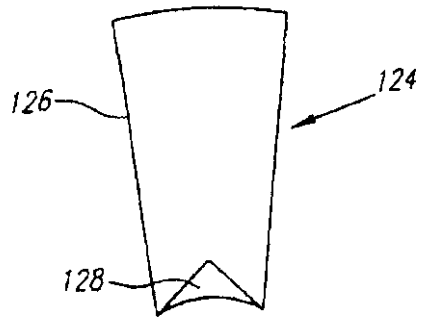


图 14

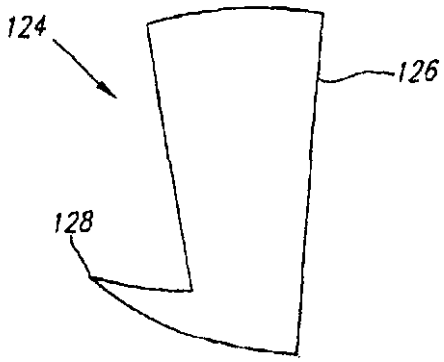


图 16

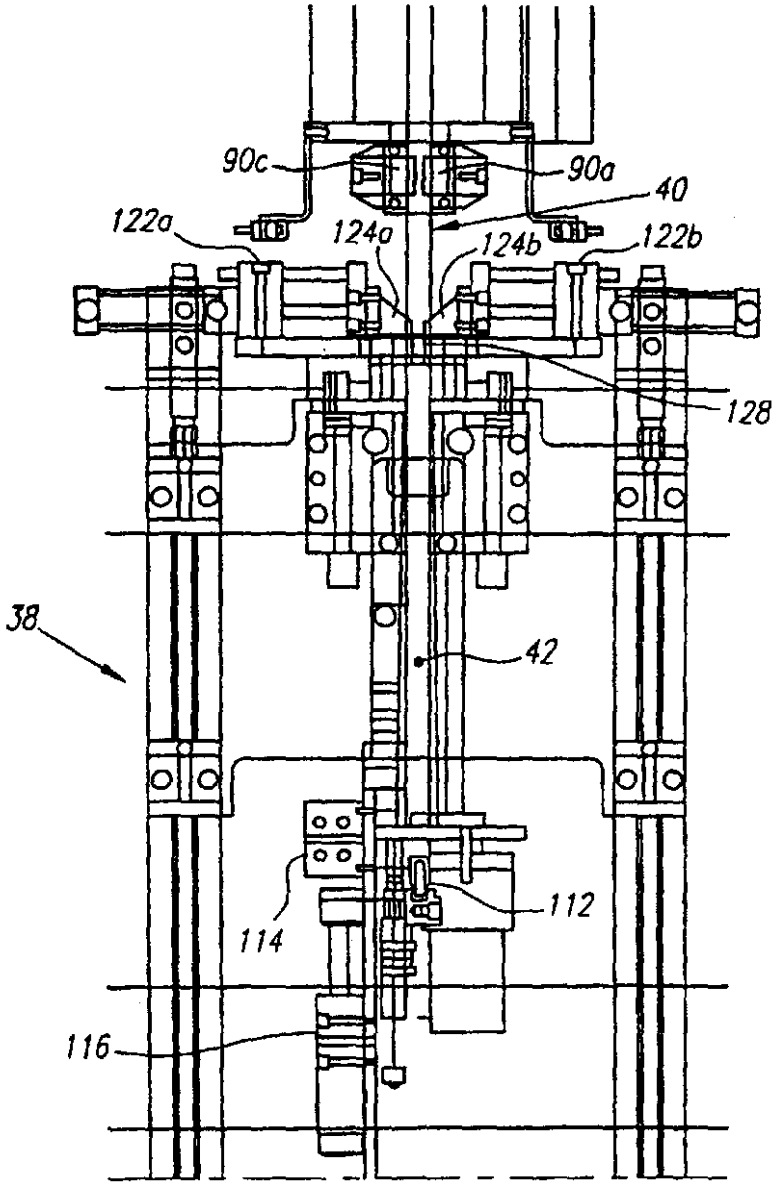


图 17

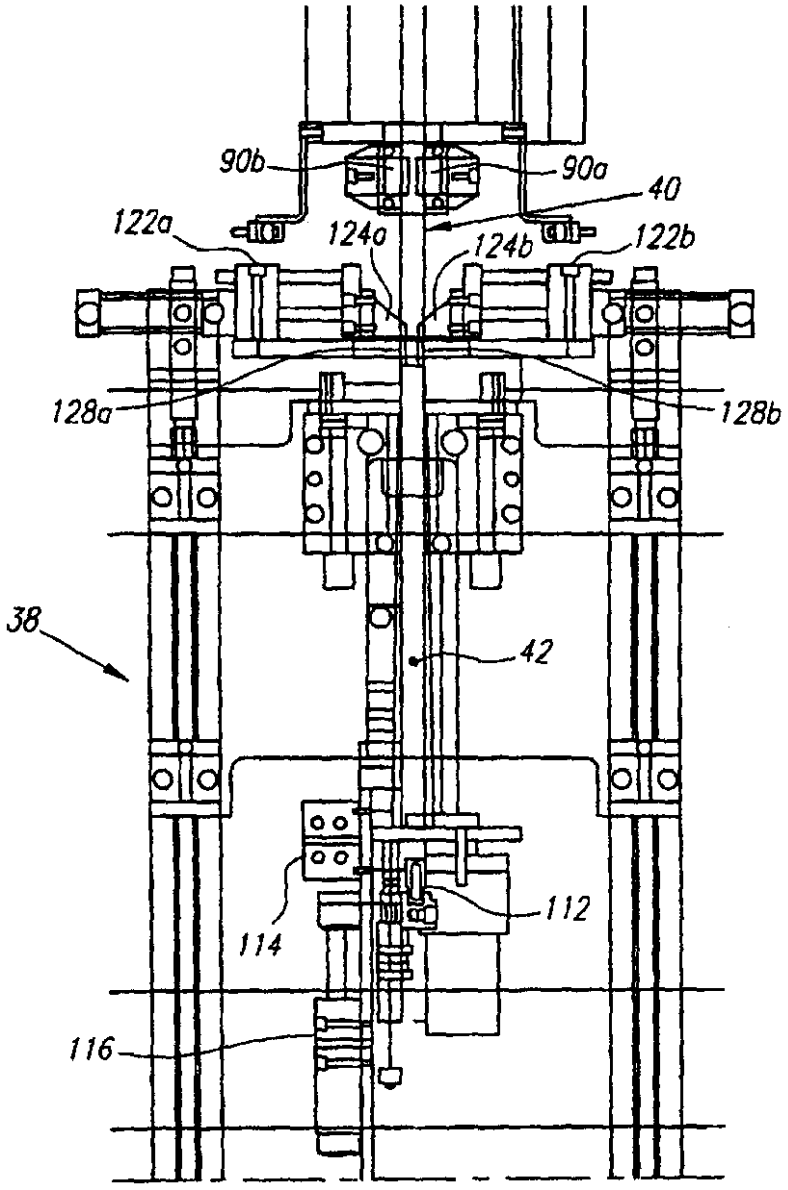


图 18

01-03-19

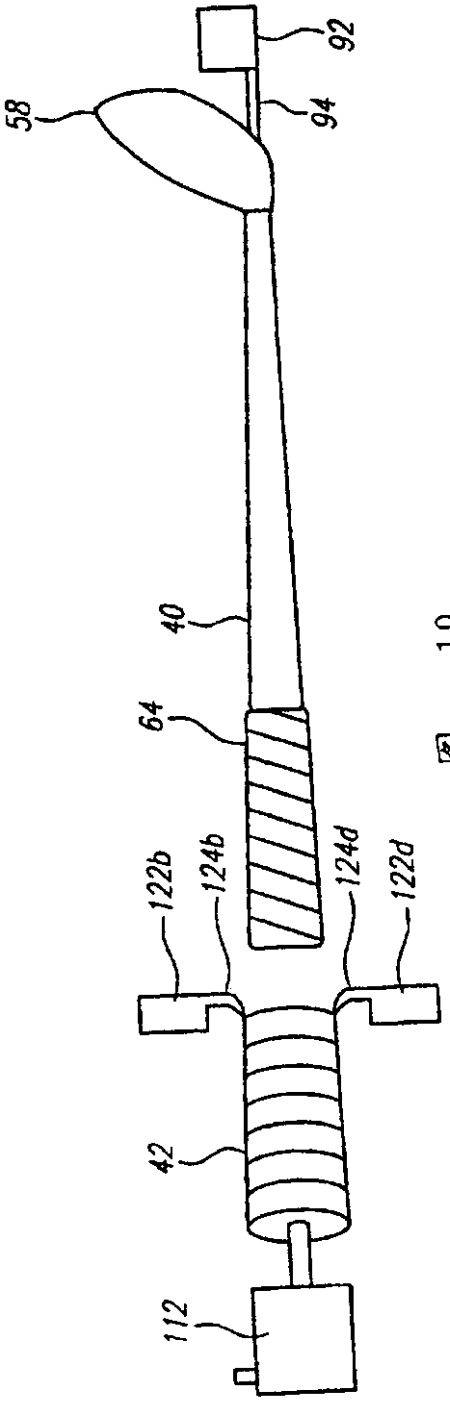


图 19

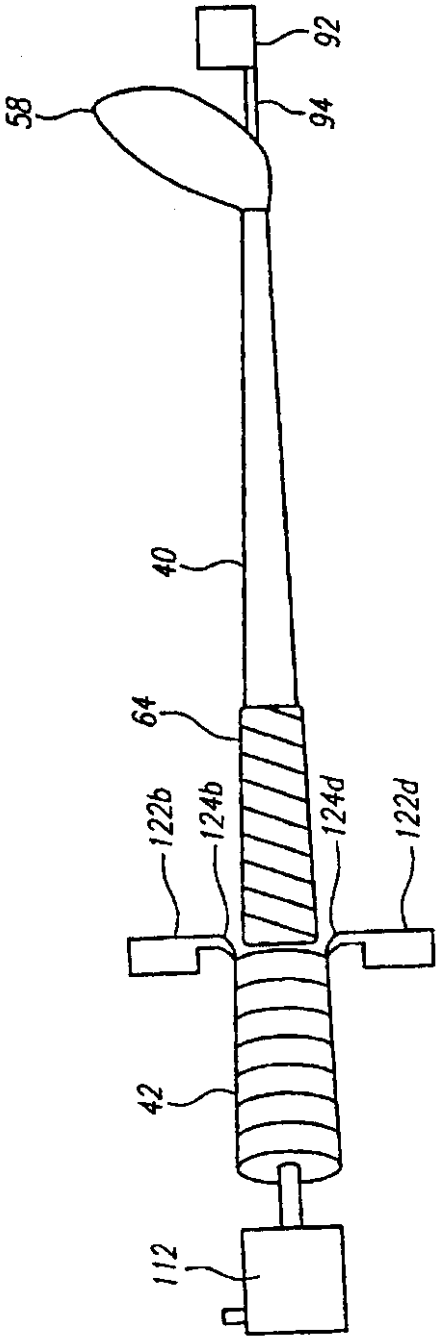


图 20

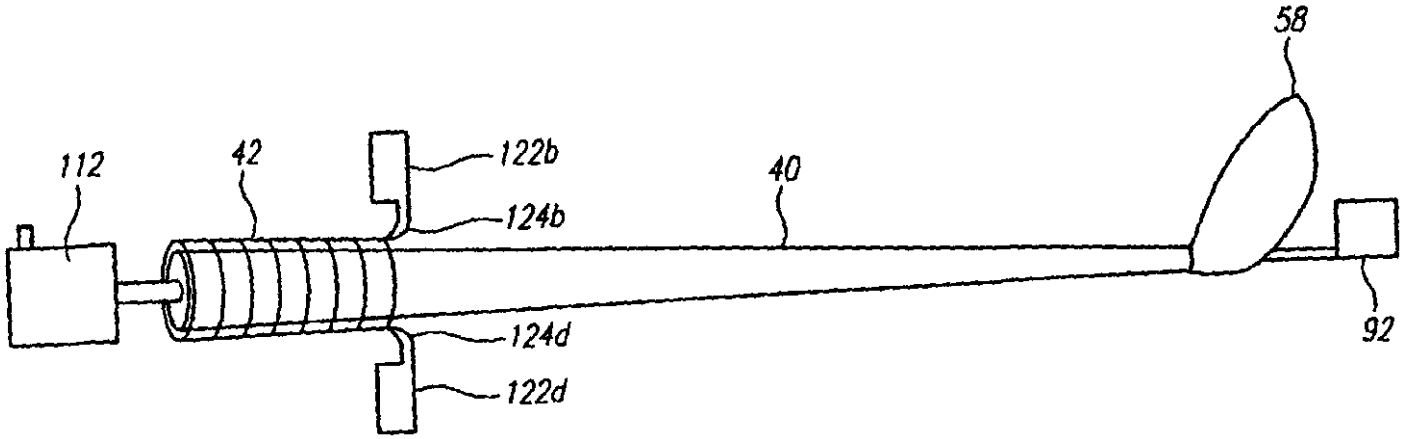

58
112
42
122b
124b
40
124d
122d
92

图 21

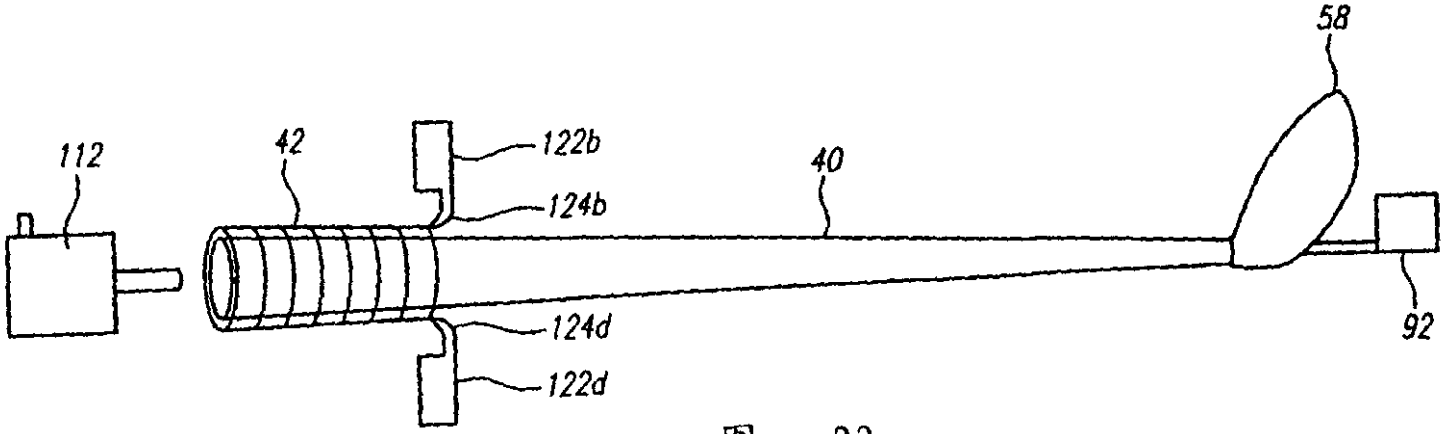

58
112
42
122b
124b
40
124d
122d
92

图 22