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(54) PROCEDE ET APPAREIL POUR L'INSTALLATION AUTOMATIQUE D'UNE PRISE SUR UN MANCHE D'UNE CANNE DE GOLF

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

(57) 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).

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(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).

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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).

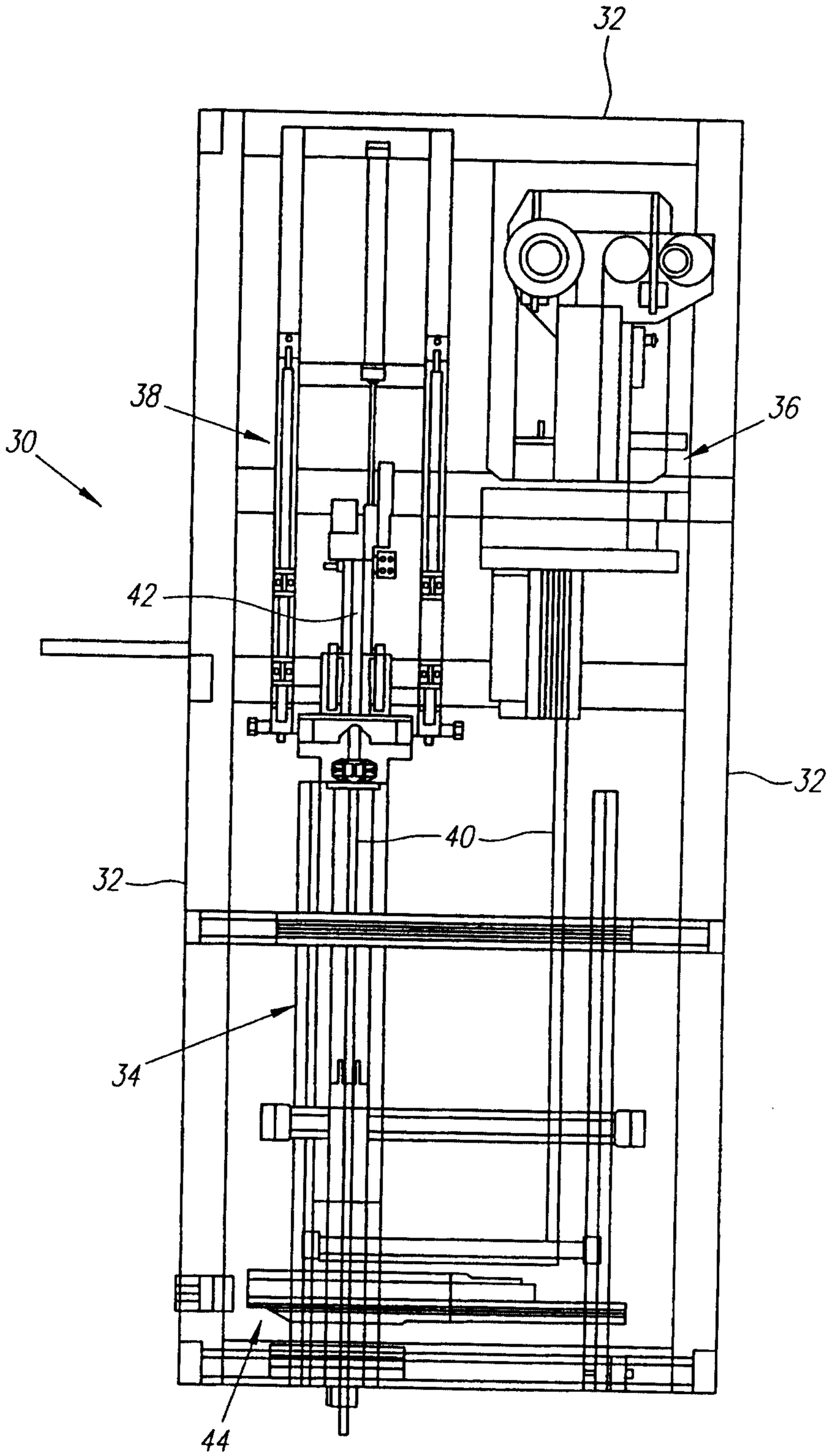


FIG. 1

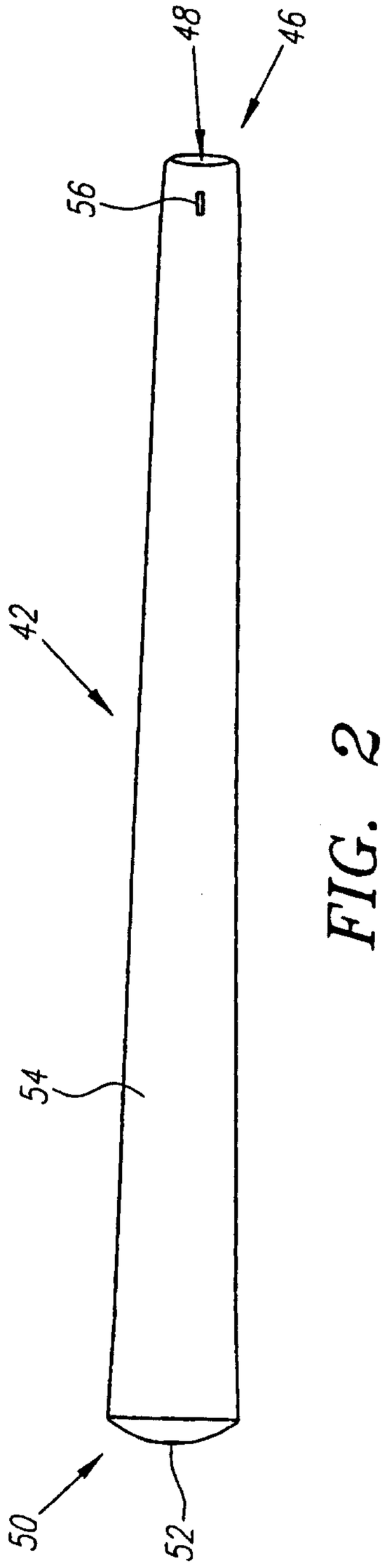


FIG. 2

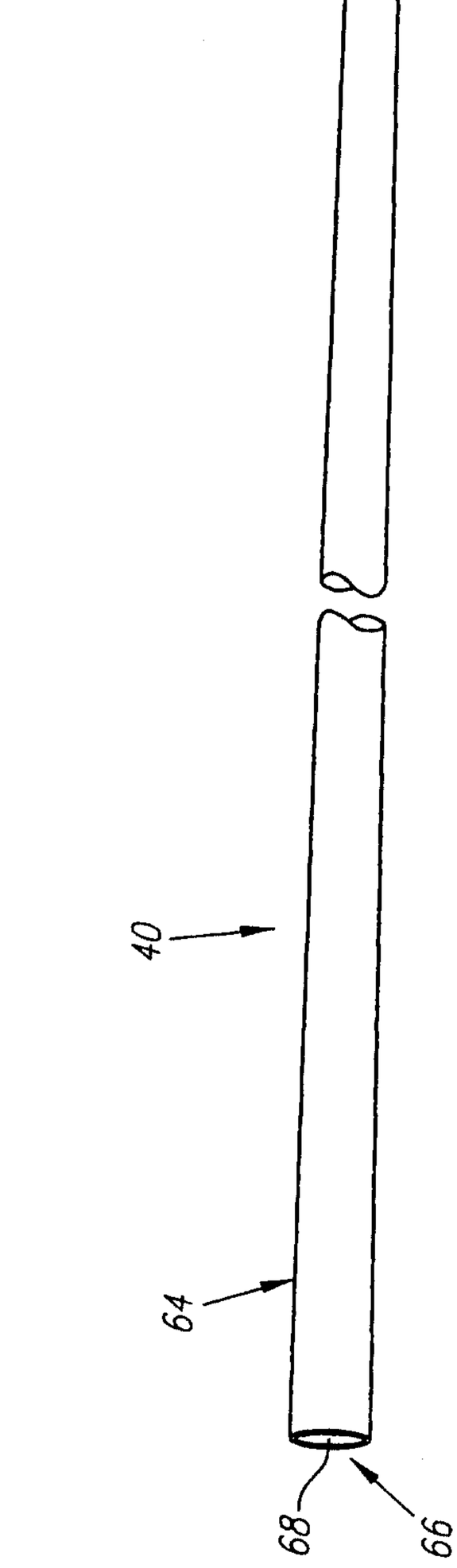


FIG. 3

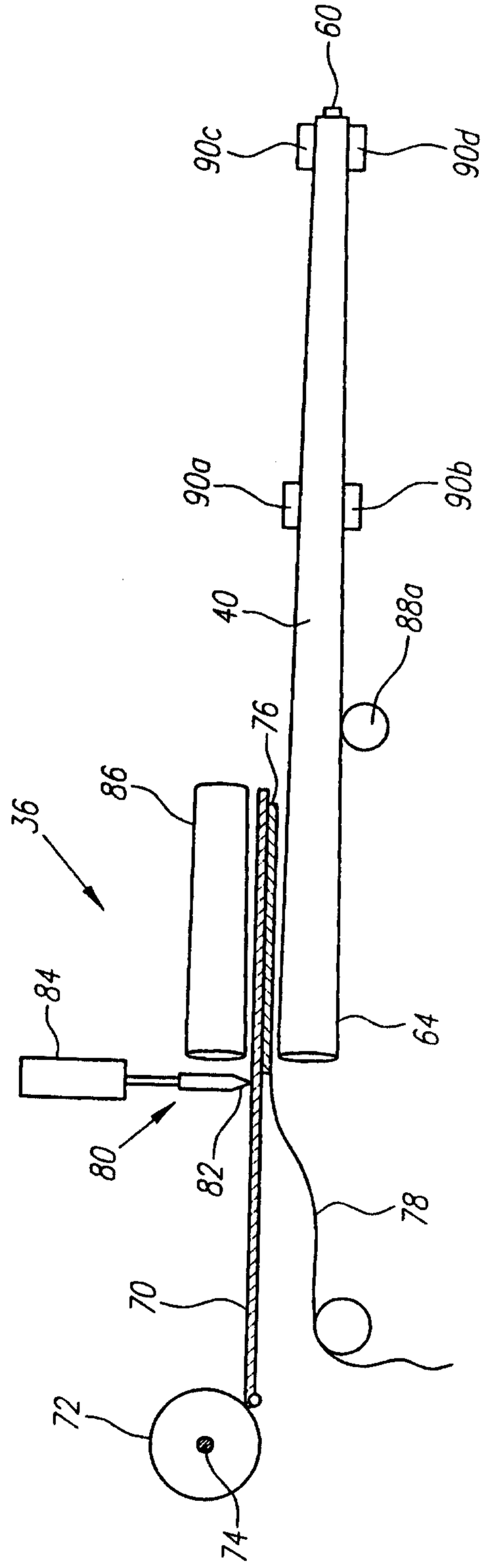

60
90c
90d
90a
90b
40
88a
36
86
76
84
80
82
64
78
70
72
74

FIG. 4

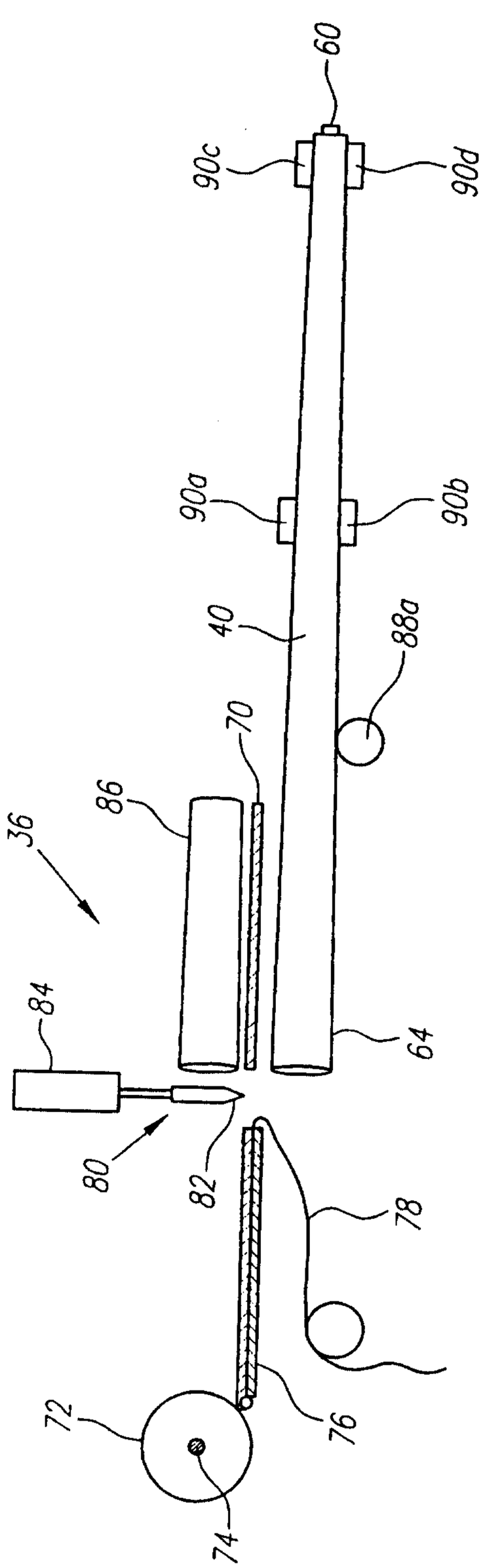

60
90c
90d
90a
90b
40
88a
36
86
70
84
80
82
64
78
72
74
76

FIG. 5

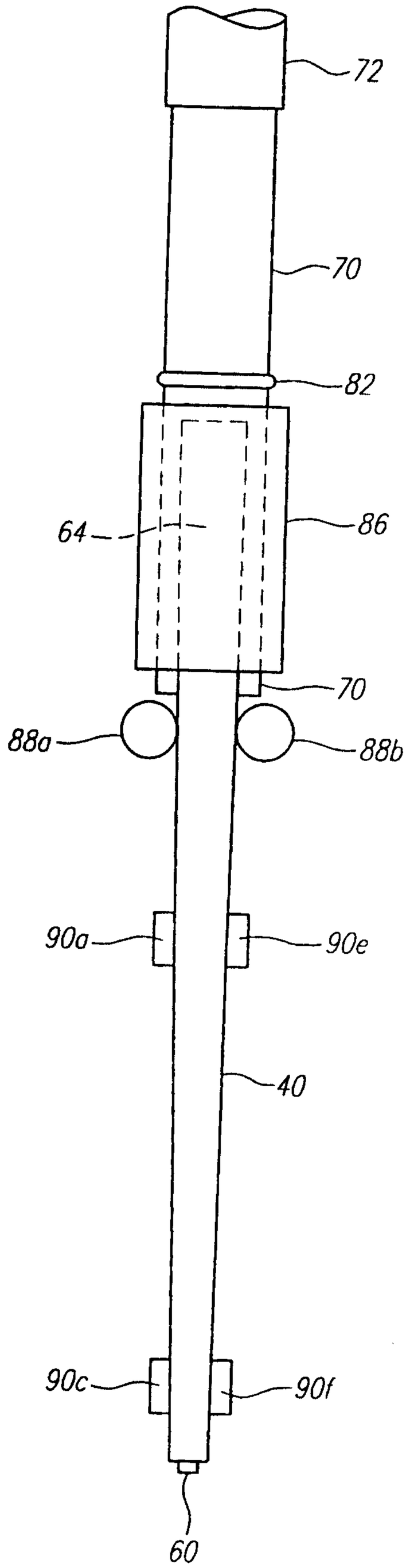

72
70
82
64
86
70
88a
88b
90a
90e
40
90c
90f
60

FIG. 6

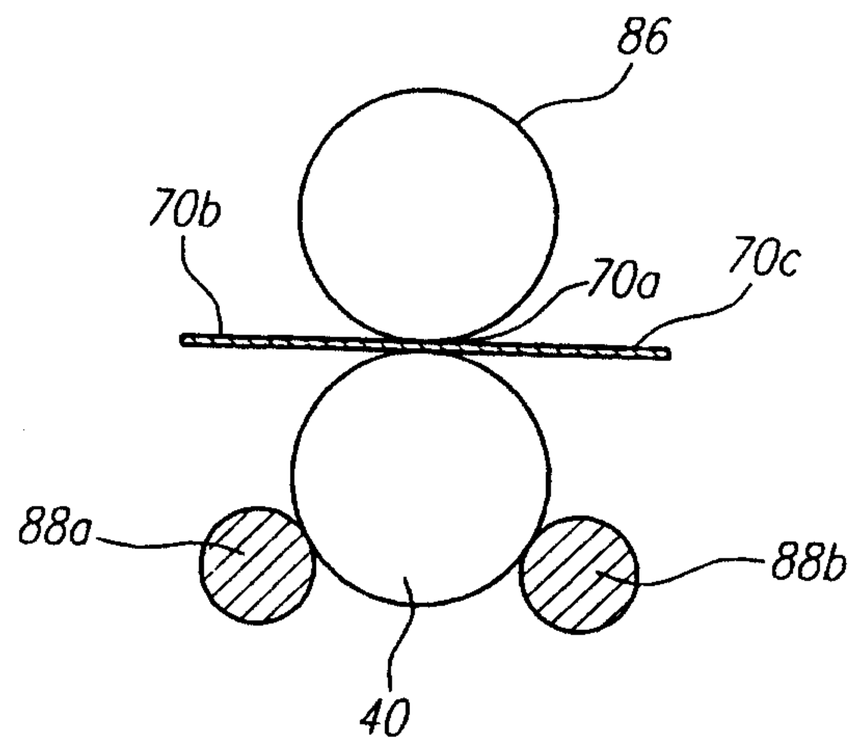

86
70b
70a
70c
88a
88b
40

FIG. 6A

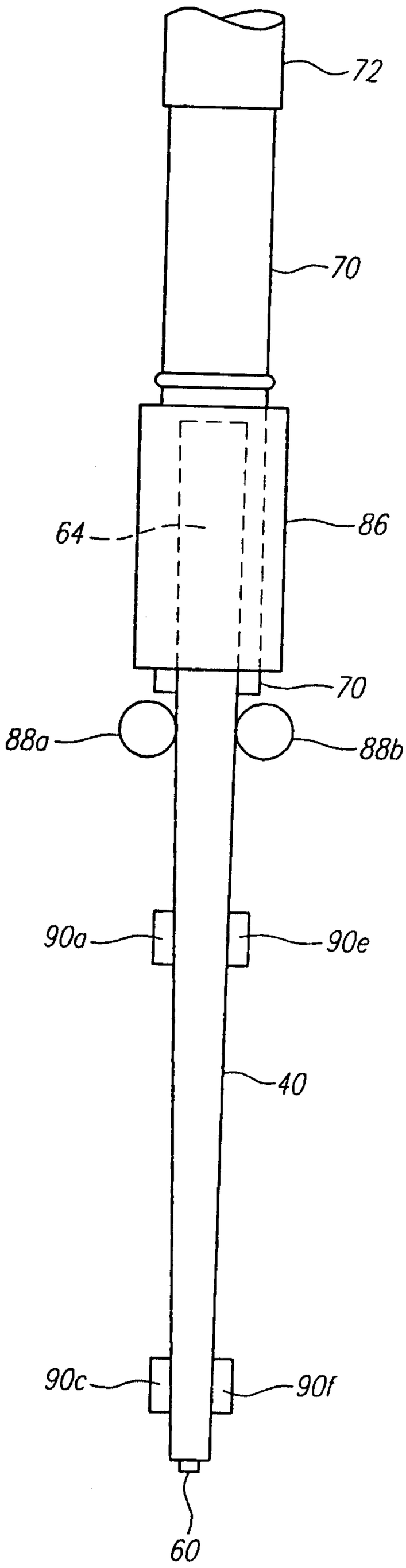

72
70
64
86
70
88a
88b
90a
90e
40
90c
90f
60

FIG. 7

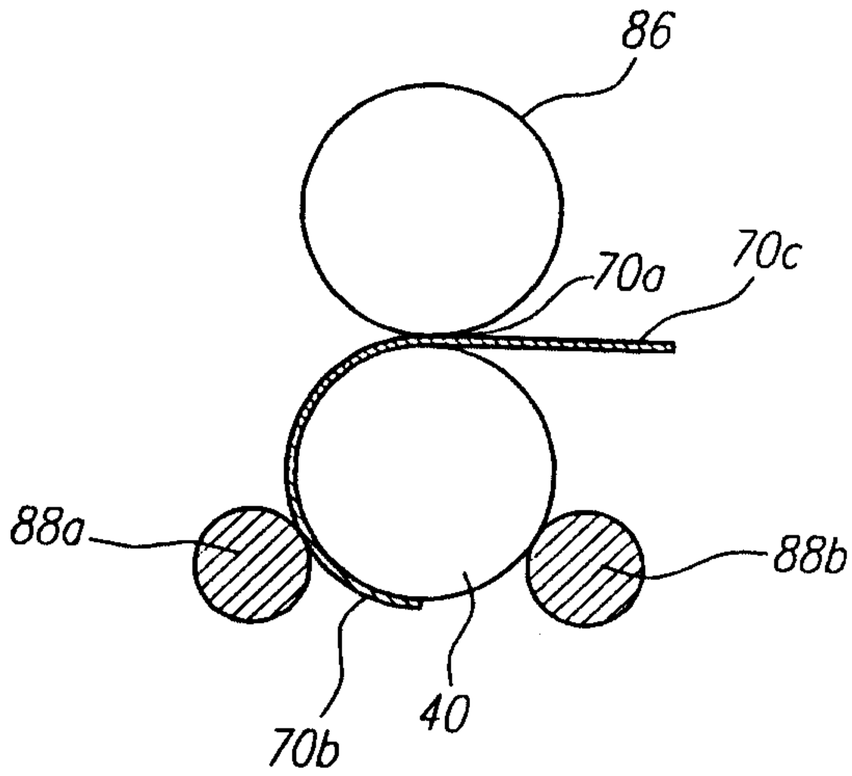

86
70a
70c
88a
88b
70b
40

FIG. 7A

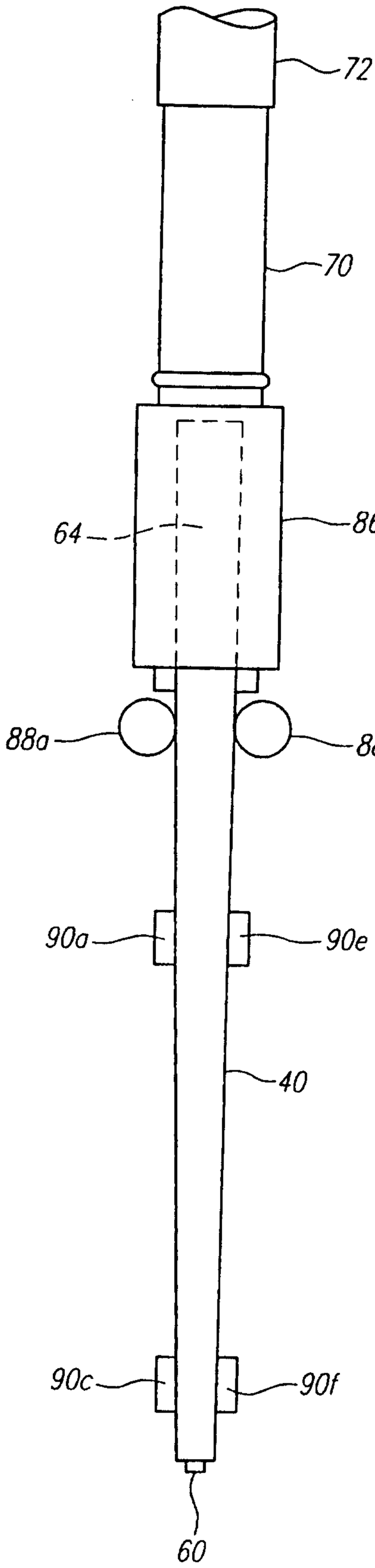


FIG. 8

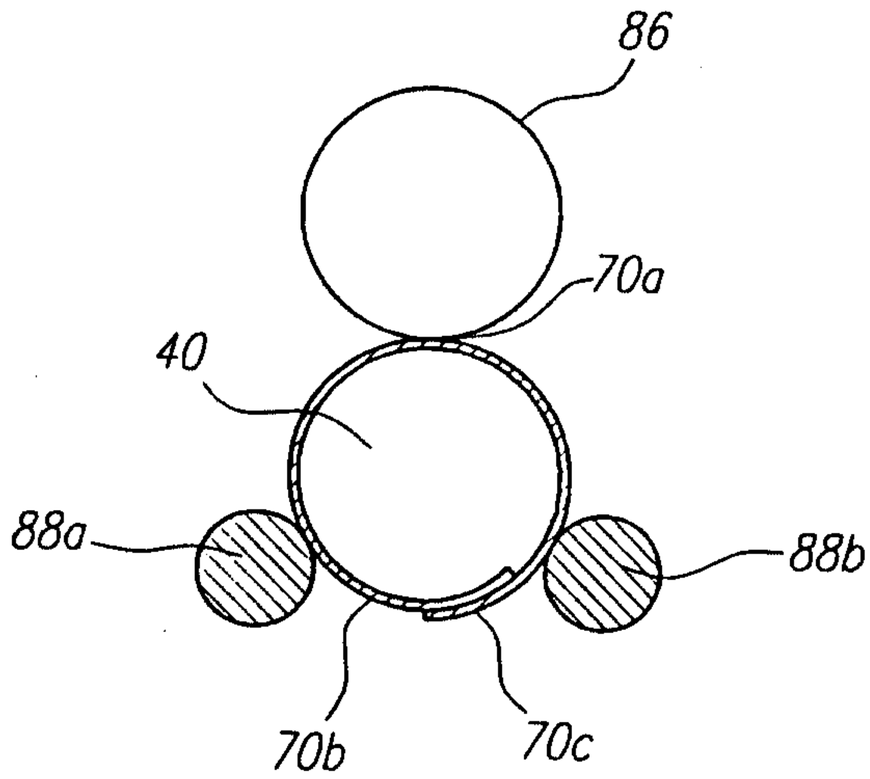


FIG. 8A

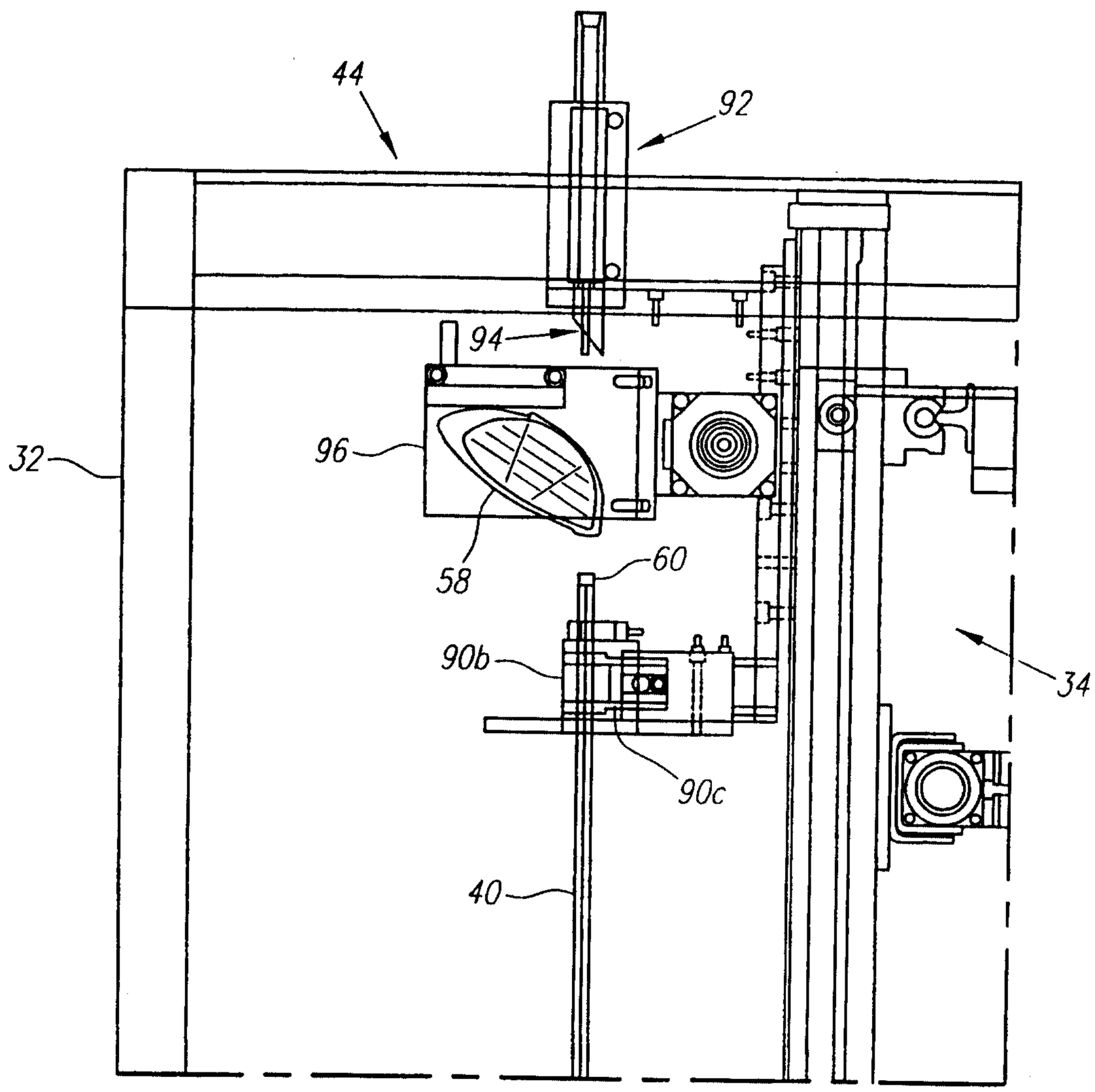


FIG. 9

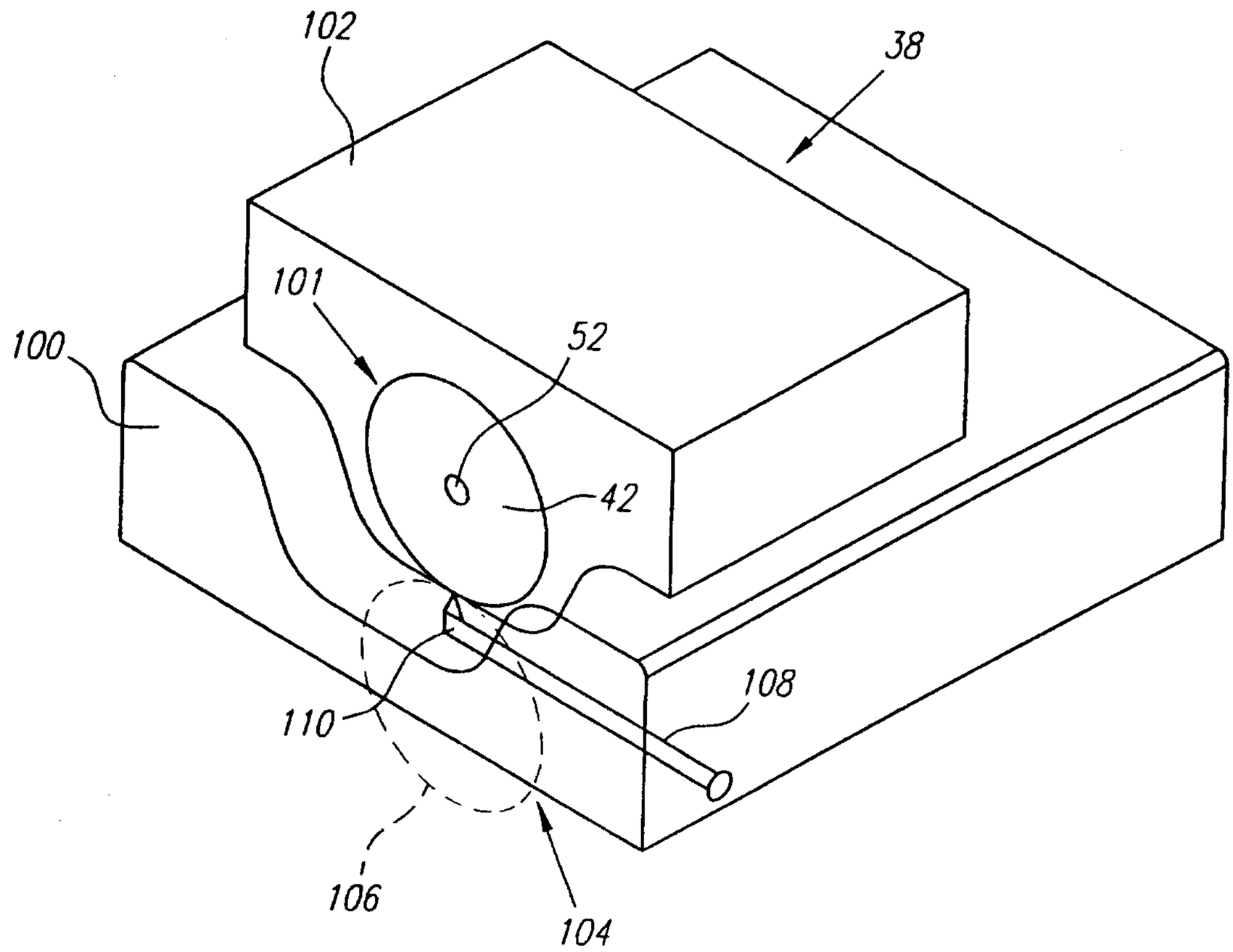


FIG. 10

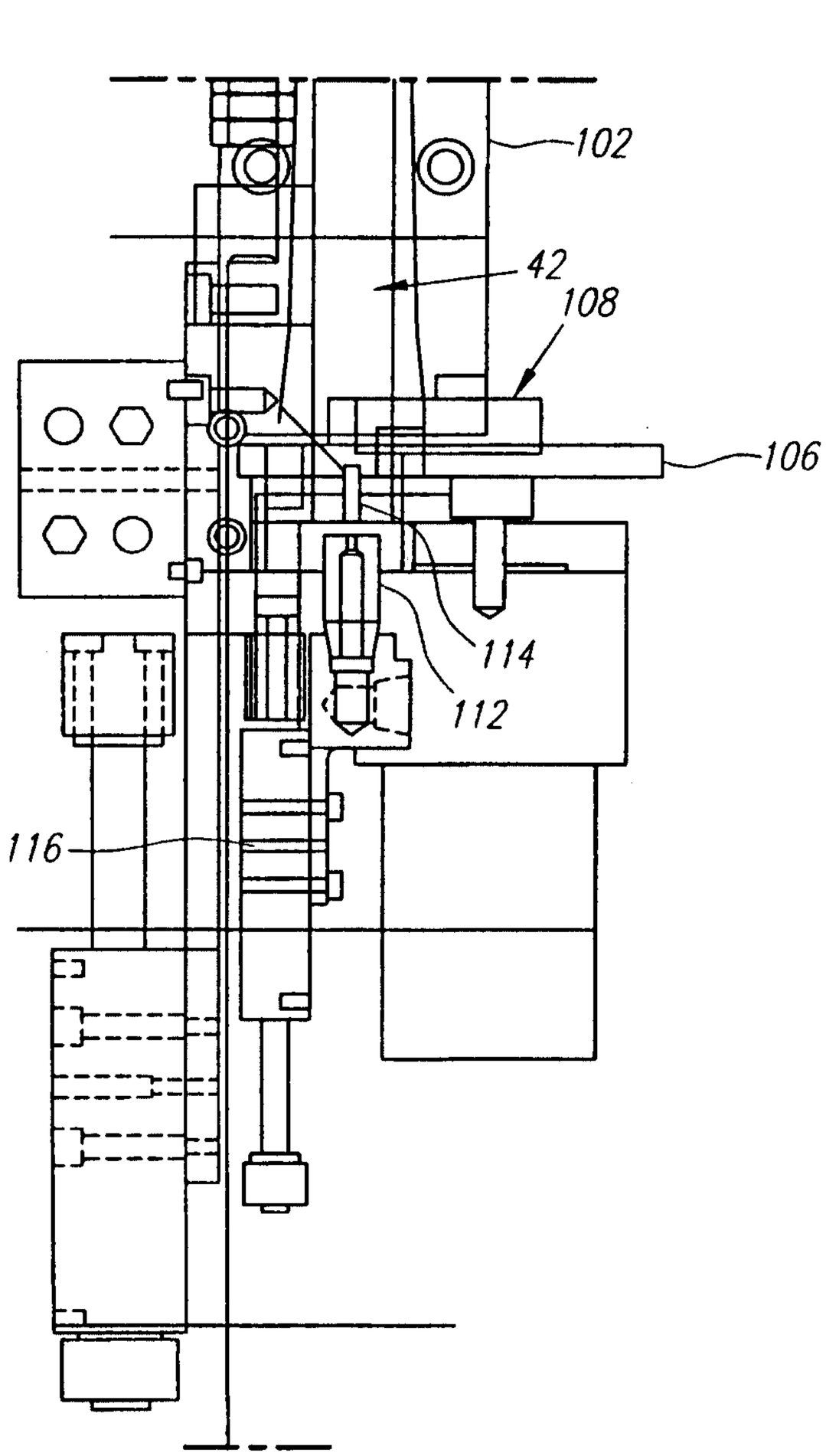


FIG. 11

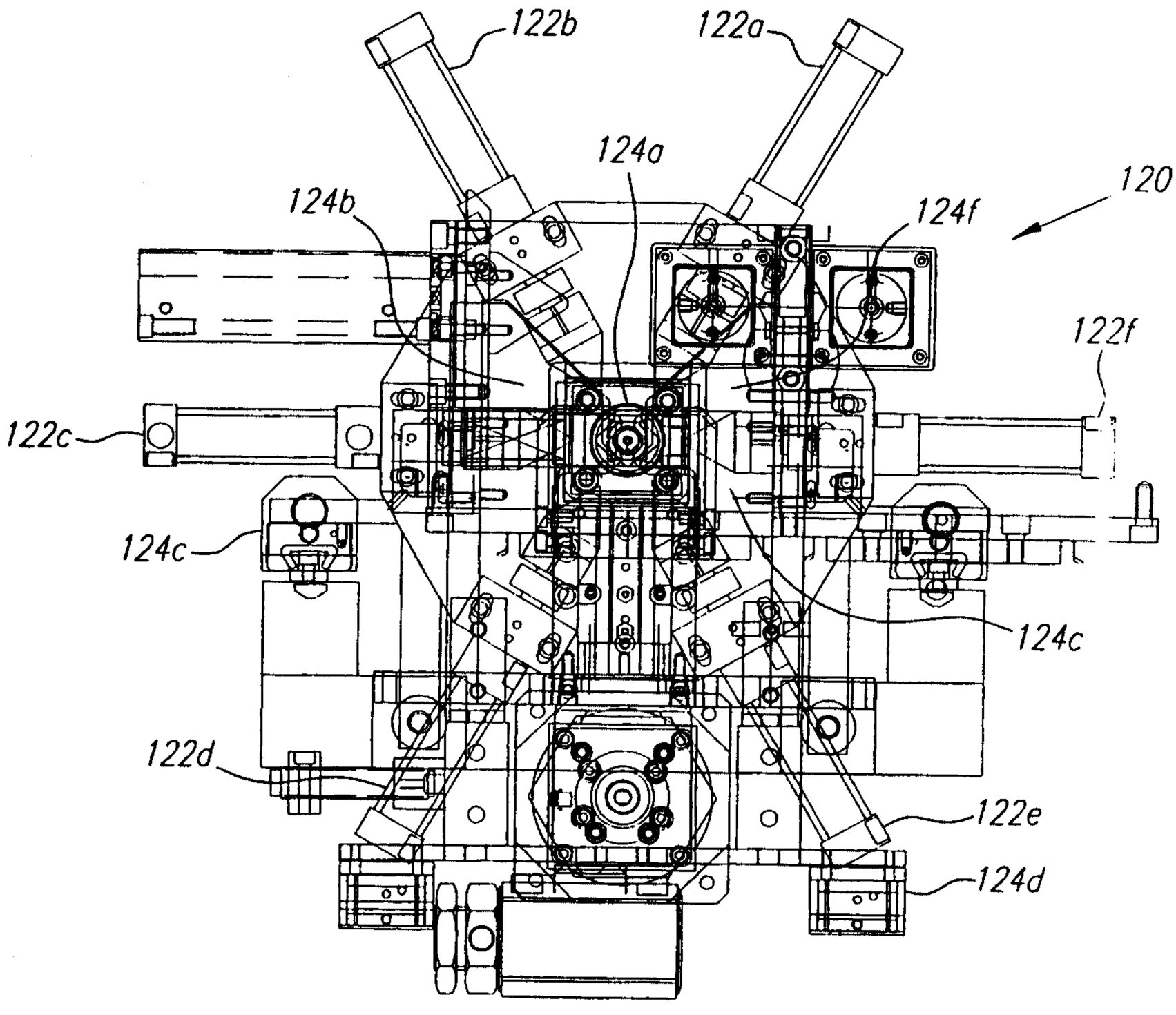

122b
122a
124a
120
124b
124f
122f
122c
124c
124c
122d
122e
124d

FIG. 12

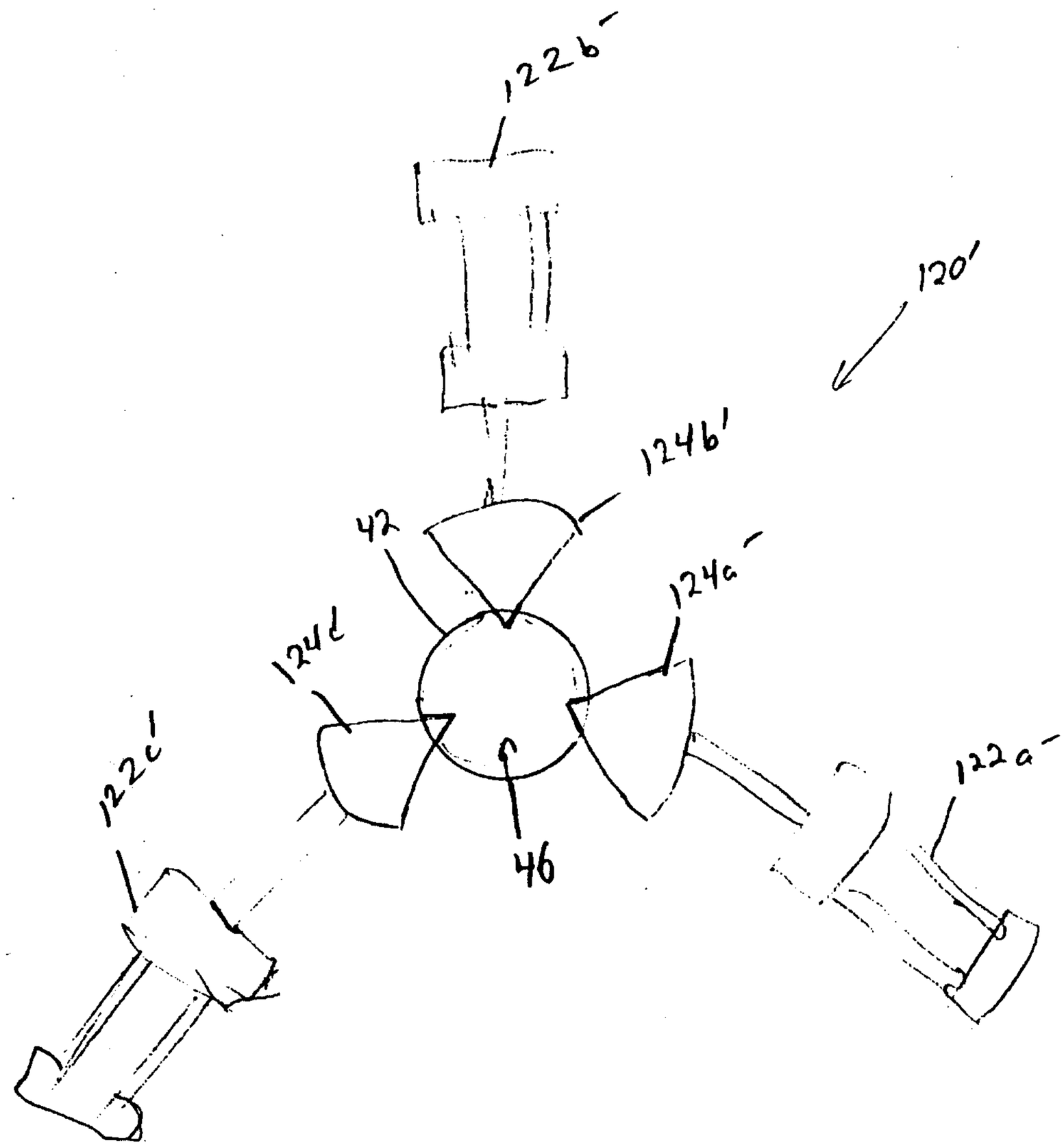


FIG. 13

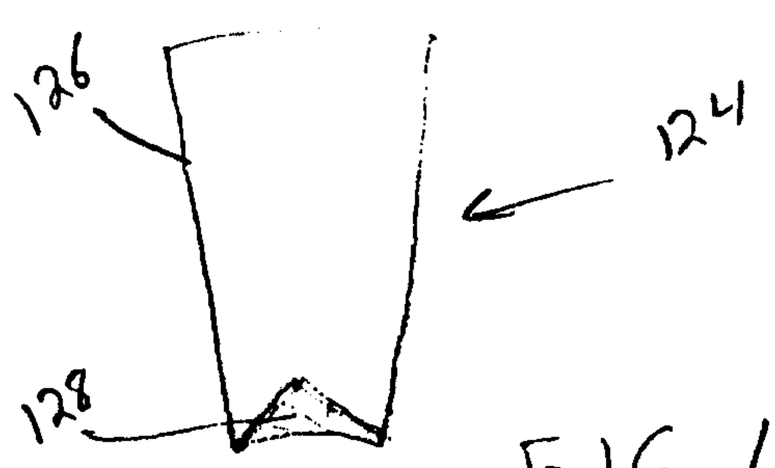


FIG. 14

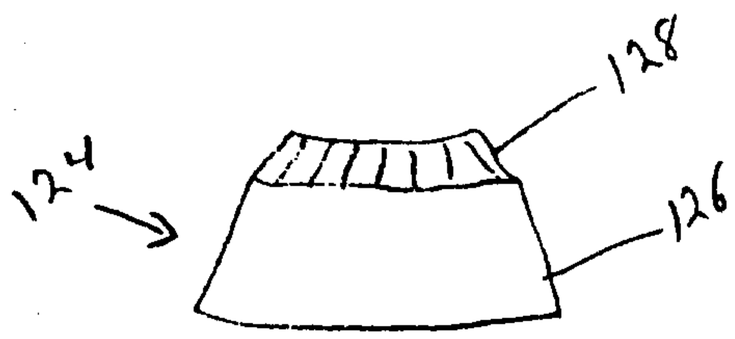


FIG. 15

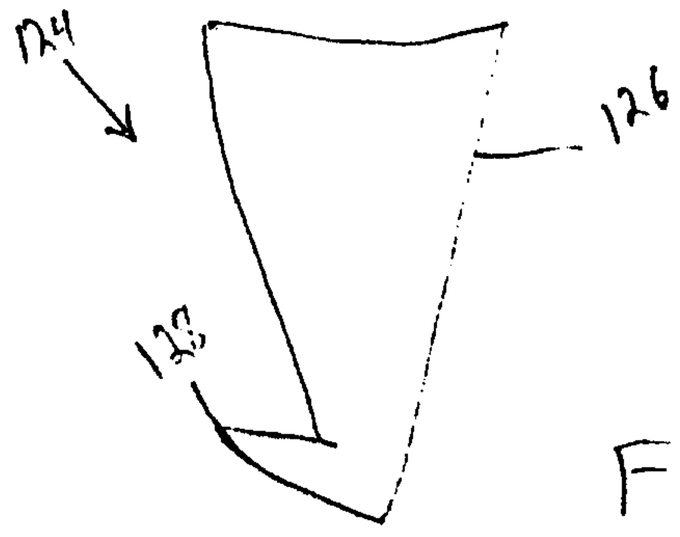


FIG. 16

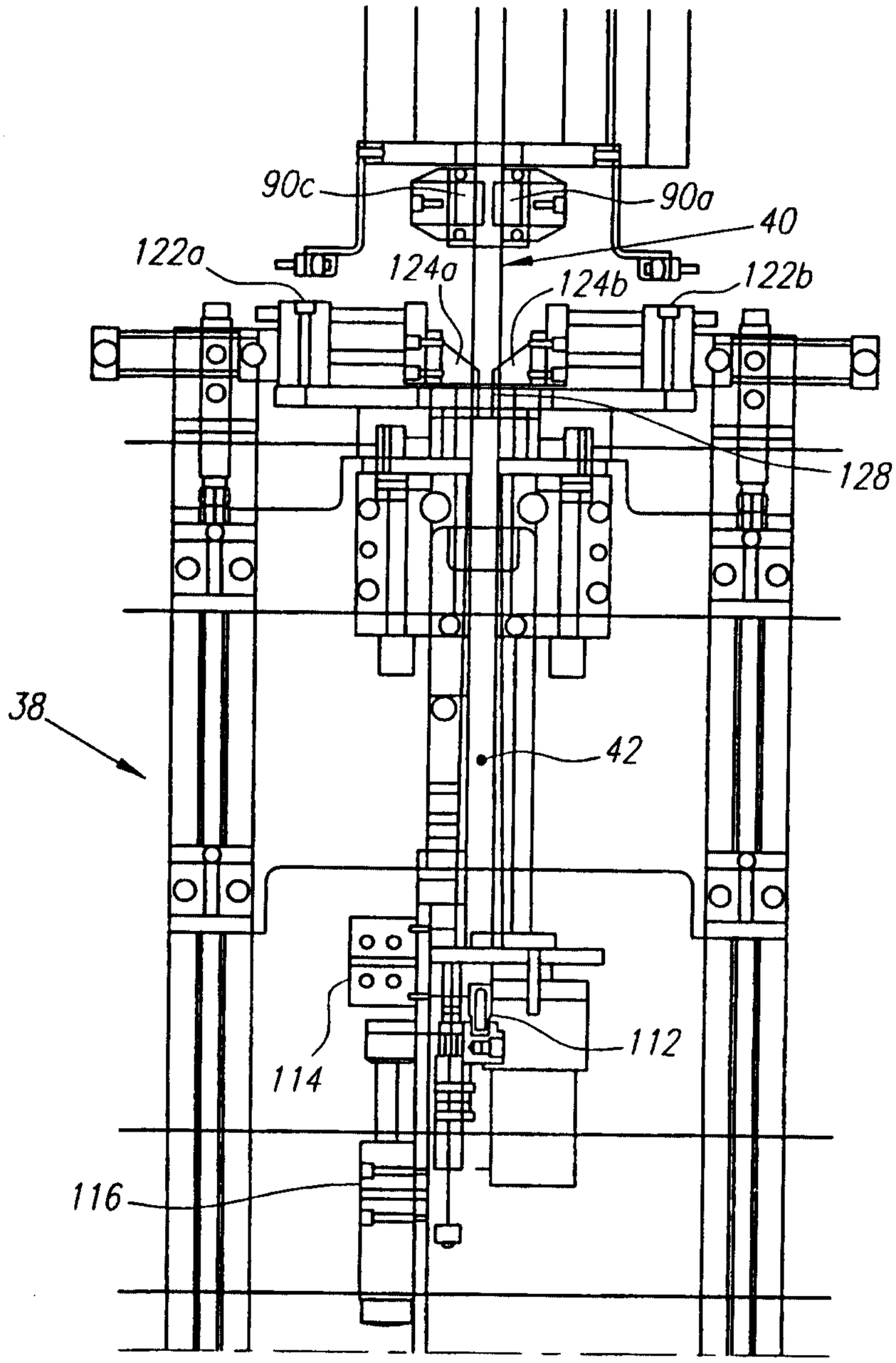


FIG. 17

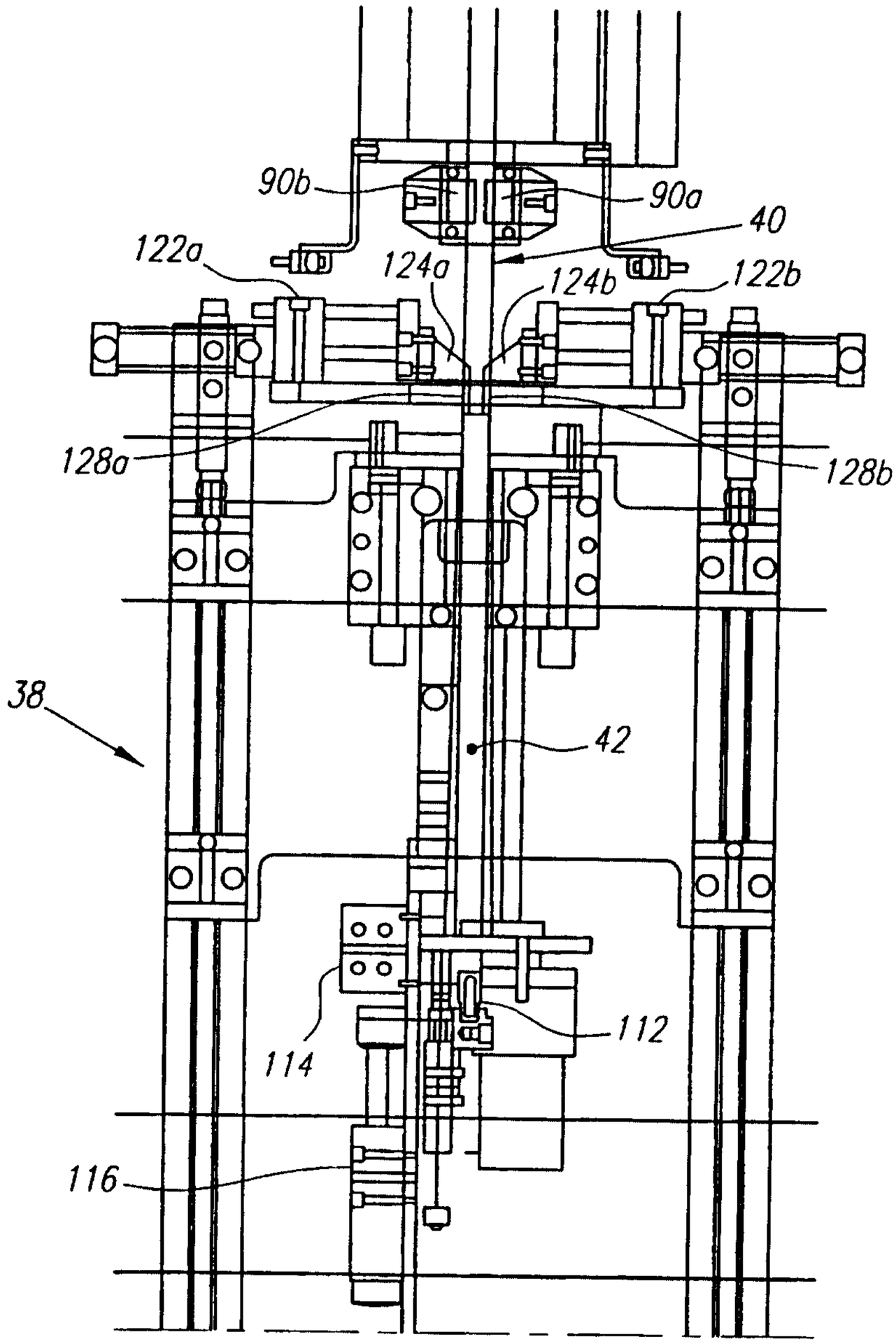


FIG. 18

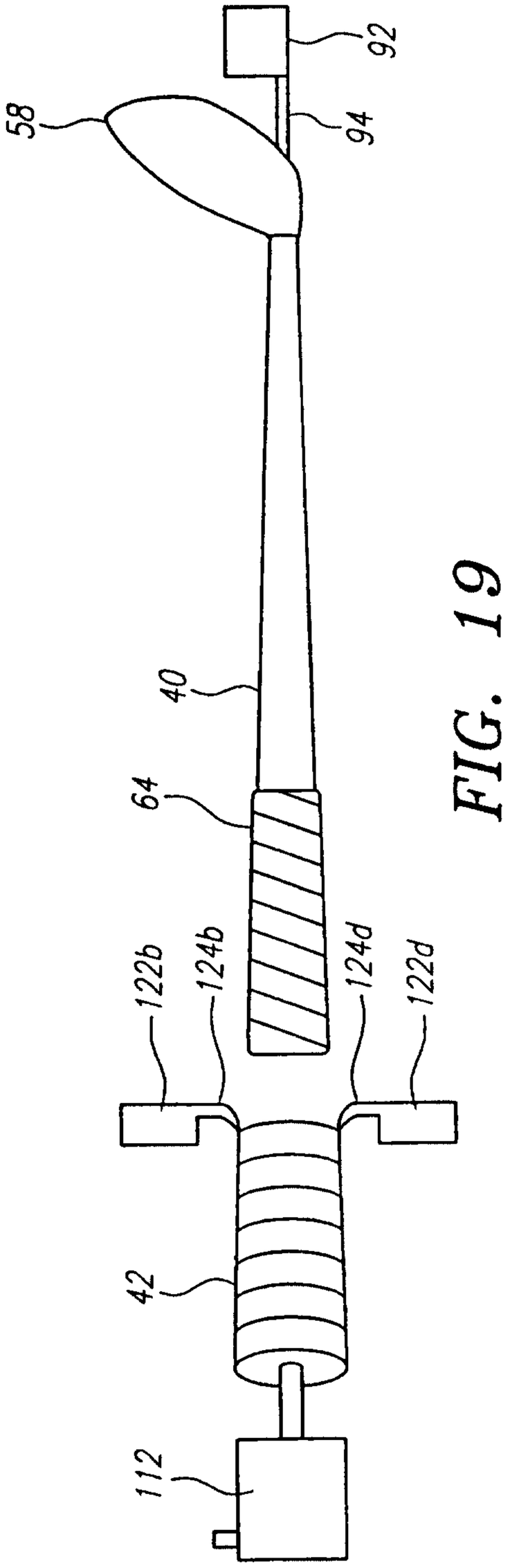

58
92
94
40
64
122b
124b
124d
122d
42
112

FIG. 19

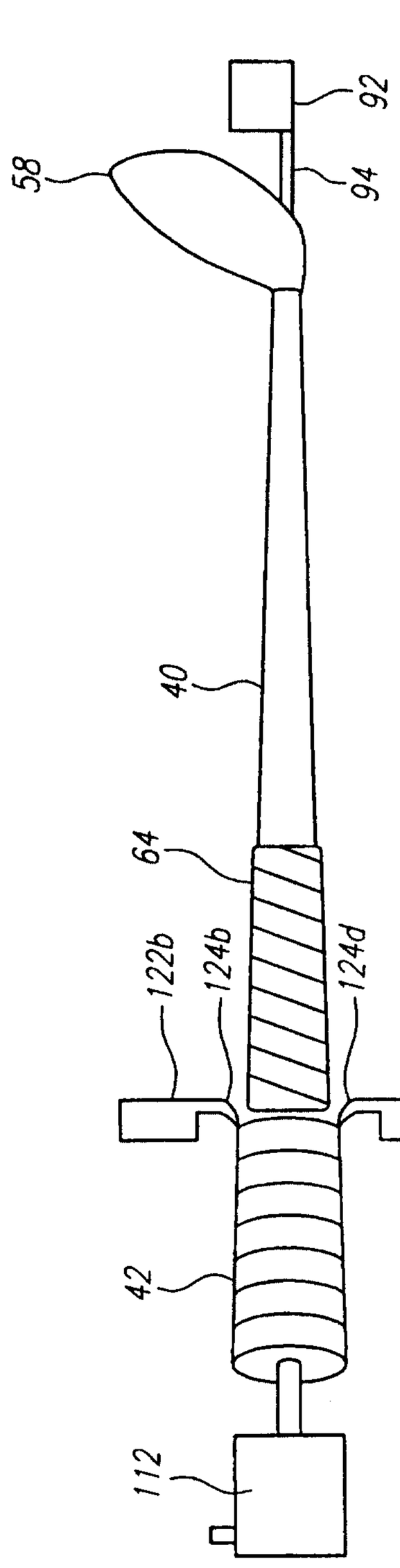

58
92
94
40
64
122b
124b
124d
122d
42
112

FIG. 20

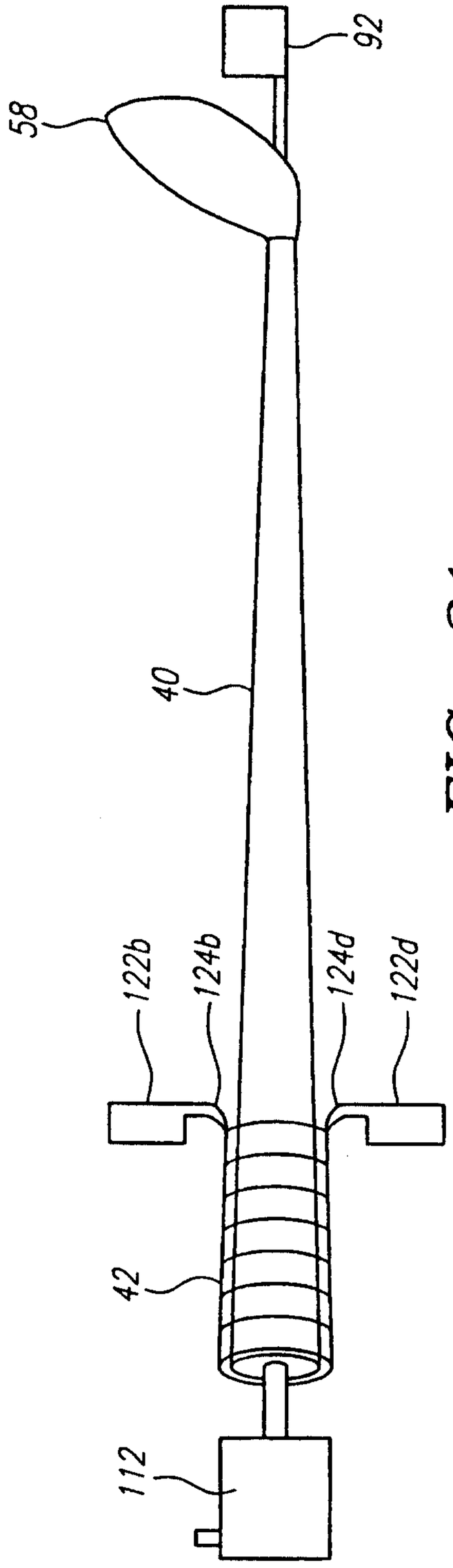

92
58
40
122b
124b
124d
122d
42
112

FIG. 21

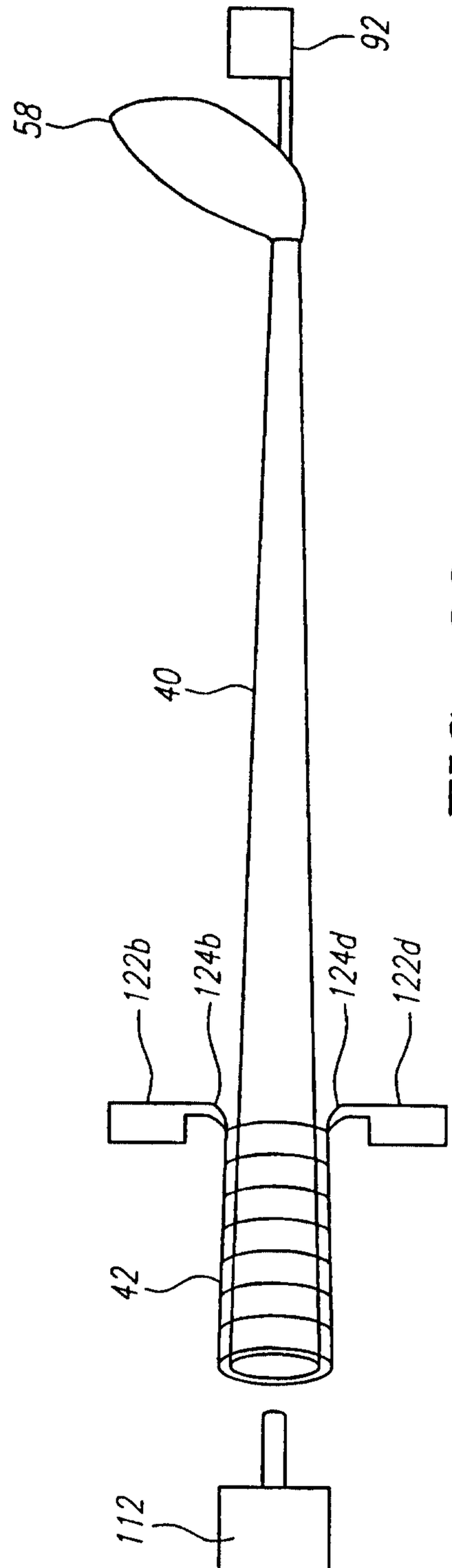

92
58
40
122b
124b
124d
122d
42
112

FIG. 22