Serial Number 09/426,367

Filing Date 25 October 1999

Inventor Fred W. Watson, Jr.

NOTICE

The above identified patent application is available for licensing. Requests for information should be addressed to:

OFFICE OF NAVAL RESEARCH
DEPARTMENT OF THE NAVY
CODE 00CC
ARLINGTON VA 22217-5660

SPOTTING RIFLE BARREL ALIGNING AND RETAINING SYSTEM

Origin of the Invention

Field of the Invention

The invention relates generally to gun aiming devices, and more particularly to a system for aligning and retaining a spotting rifle barrel.

Background of the Invention

Spotting rifles are used to determine range to a target. In general, the spotting rifle is set for a specific range and a tracer or burning round is fired to see if the selected range was accurate. If not, corrections are made until the correct range is achieved. Frequently, a spotting rifle is coupled to another launching device. That is, the spotting rifle is used to select the range for the launching device. Accordingly, it is desirable to align the boresight of the spotting rifle with that of the launching device. The advent of the ballistically matched spotting round has greatly reduced the difficulty and time required to align the spotting round impact with the launching device's round. However, it is still necessary to accurately align the spotting rifle barrel with the launching device.

A preferred solution to this problem is to adjust the barrel of the spotting rifle without having to relocate the entire spotting rifle in relation to the main launch tube or

rifle. One such spotting rifle barrel alignment mechanism is disclosed in U.S. Patent No. 5,657,546 in which the breech end of the spotting rifle barrel floats in a seat where it engages the spotting rifle's receiver housing. The spotting rifle barrel is clamped at its muzzle end to a bracket depending from the muzzle of the launch tube. When a spotting round is fired, inertia of the round moving towards the muzzle end of the spotting rifle barrel tends to drive the spotting rifle barrel out of its floating breech end seat in the receiver housing. Once out of its breech end seat, the spotting rifle barrel tends to lose its boresight. Further, because the muzzle end of the spotting rifle barrel is clamped to the muzzle of the launch tube, the inertia of the round causes the launch tube to bow slightly as forces generated by the movement of the spotting rifle barrel are transferred to the muzzle of the launch tube. This is especially true when the launch tube is made from a material such as fiberglass.

Summary of the Invention

Accordingly, it is an object of the present invention to provide a system that can align and retain a spotting rifle barrel.

Another object of the present invention is to provide a spotting rifle barrel alignment system that retains its boresight upon the firing of a spotting round.

Still another object of the present invention is to provide a spotting rifle barrel alignment and retaining system that prevents bowing of a launch tube to which the spotting rifle barrel is coupled.

Other objects and advantages of the present invention will become more obvious hereinafter in the specification and drawings.

In accordance with the present invention, a system aligns and retains a spotting rifle barrel relative to a launch tube and a spotting rifle receiver housing. A first annular lug is coupled to an outer portion of a breech end of the spotting rifle barrel. A second annular lug is coupled to an inner portion of the spotting rifle receiver housing. The spotting rifle barrel extends through the second annular lug so that a forward end of the first annular lug abuts an aft end of the second annular lug. The forward end of the first annular lug and the aft end of the second annular lug meet at a complementary radius of curvature. Further, means are provided to retain the forward end of the first annular lug in an abutting relationship with the aft end of the second annular lug. A boresight adjustment assembly depends from a muzzle of the launch tube and contacts a muzzle end of the spotting rifle barrel. The boresight adjustment assembly adjusts the boresight of the spotting rifle barrel while allowing for axial movement relative thereto.

Brief Description of the Drawings

FIG. 1 is a side view of a launching device with a spotting rifle coupled thereto in accordance with the present invention;

FIG. 2 is a side cross-sectional view of a spotting rifle barrel and the aligning and retaining system of the present invention used to couple the spotting rifle barrel between the launching device's launch tube and receiver; and

FIG. 3 is a cross-section taken along line 3-3 in FIG. 1 illustrating the boresight adjustment assembly of the present invention.

Detailed Description of the Invention

Referring now to the drawings, and more particularly to FIG. 1, a launching device is illustrated and referenced generally by numeral 100. Launching device 100 includes a launch tube 102 from which a main round (not shown) is fired. Launch tube 102 serves as a mount for a spotting rifle 104 and a sight unit 106. Spotting rifle 104 includes a spotting rifle barrel 104A from which a spotting or tracer round (not shown) is fired, a receiver housing 104B, and a boresight adjustment assembly 104C. Spotting rifle barrel 104A has its breech end supported in receiver housing 104B. The muzzle end of spotting rifle barrel 104A is supported by boresight adjustment assembly 104C.

Referring now additionally to FIG. 2, the details of a system for aligning and retaining spotting rifle barrel 104A relative to a (rocket) launch tube 102 and receiver housing 104B are illustrated. For simplicity of illustration, launch tube 102 and receiver housing 104B are shown only in their relevant portions. Specifically, the muzzle end of launch tube 102 and the forward end of receiver housing 104B are illustrated.

Coupled to the breech end of spotting rifle barrel 104A is an annular lug 10. Annular lug 10 can be integral with spotting rifle barrel 104A or could be threaded onto the breech end of spotting rifle barrel 104A. If a threaded coupling is used, annular lug 10 can incorporate an annular seating flange 12 that will abut the breech end of spotting rifle barrel 104A to assure proper positioning of annular lug 10 thereon. The forward end 14 of annular lug 10 is formed with a convex radius of curvature defined by a radius R_1 that originates from a point 16 located on the central longitudinal or boresight axis of spotting rifle barrel 104A in proximity to the breech end of spotting rifle barrel 104A. The exact

location of point 16 is based on the position of boresight adjustment assembly 104C as will be explained further below. To prevent rotation of spotting rifle barrel 104A, a slot or notch 18 provided in annular lug 10 is engaged by a barrel position set screw 19 passing through receiver housing 104B.

Coupled to an inner diameter of receiver housing 104B is an annular lug 20. Annular lug 20 can be integral with or threaded into receiver housing 104B. If threaded into receiver housing 104B, a set screw 22 passing through receiver housing 104B can be used to engage annular lug 20 to hold it in position. Whether threaded into receiver housing 104B or integrated therewith, the aft end 24 of annular lug 20 is formed with a concave radius of curvature complementary to the radius of curvature of forward end 14 of annular lug 10. That is, radius R_1 also defines a concave radius of curvature of aft end 24. Further, the inside diameter of annular lug 20 is less than the outside diameter of annular lug 10. During assembly, spotting rifle barrel 104A with annular lug 10 coupled thereto is inserted through receiver housing 104B until forward end 14 of annular lug 10 abuts aft end 24 of annular lug 20. Note that the complementary radius of curvature fit between forward end 14 and aft end 24 allows spotting rifle barrel 104A to be pivoted smoothly about point 16 during boresight adjustment of spotting rifle barrel 104A as will be explained further below.

To retain annular lug 10 and annular lug 20 in their abutting relationship, a variety of mechanisms can be used. In general, it is preferred that the retaining mechanism apply an axial force to spotting rifle barrel 104 so that annular lug 10 is pulled forward towards annular lug 20. In this way, the force of retention is aligned with the inertia of the fired spotting or tracer round.

One such mechanism for applying and maintaining the necessary axial force will be described by way of example. The mechanism includes an annular extension 30, a threaded ring 40 and, if needed, a lock nut 50. Annular extension 30 is coupled (e.g., integrated with or attached to) receiver housing 104B. Annular extension 30 is disposed about spotting rifle barrel 104A with sufficient clearance to allow barrel 104A to be pivoted about point 16. The forward end 32 of annular extension 30 is formed with a convex radius of curvature defined by a radius R_2 that originates from point 16. Threaded ring 40 is threaded onto spotting rifle barrel 104A. The aft end 42 of threaded ring 40 has a concave radius of curvature complementary to that of forward end 32. That is, radius R_2 also defines a concave radius of curvature of aft end 42. Lock nut 50 is threaded onto spotting rifle barrel 104A and is used to fix the position of threaded ring 40.

Located at the muzzle end of spotting rifle barrel 104A is boresight adjustment assembly 104C which will be explained using FIGs. 2 and 3. Assembly 104C includes a bracket 60 depending from the muzzle of launch tube 102 and a plurality of adjustment screw assemblies 62, 64 and 66. Bracket 60 serves as a housing through which the muzzle end of spotting rifle barrel 104A passes. Adjustment screw assemblies 62, 64 and 66 (e.g., each of which can include a corresponding locking helicoil 62A, 64A and 66A set in bracket 60 with a corresponding set screw 62B, 64B and 66B passing therethrough) are distributed about bracket 60 to align the boresight of spotting rifle barrel 104A. Each set screw is positioned such that respective tips 62C, 64C and 66C contact the outer portion of spotting rifle barrel 104A as best seen in FIG. 3. That is, the muzzle end of spotting rifle barrel 104A is restrained from radial movement by assembly 104C but is not

restrained axially. In this way, spotting rifle barrel 104A is free to expand or stretch axially without affecting the boresight of barrel 104A and without transferring any axial forces to launch tube 102 which could cause bowing thereof. The use of locking helicoils 62A, 64A and 66A prevents any movement of the corresponding set screw when the spotting rifle is fired.

In use, spotting rifle barrel 104A is inserted through annular lug 20 and boresight adjustment assembly 104C until annular lug 10 abuts annular lug 20. Annular extension 30, threaded ring 40 and lock nut 50 cooperate to apply and maintain an axial force that maintains the abutting relationship between annular lugs 10 and 20. Set screw assemblies 62, 64 and 66 are then adjusted as needed to change the boresight of spotting rifle barrel 104A. The radius of curvature fit between annular lugs 10 and 20, and annular extension 30 and threaded ring 40, allow spotting rifle barrel 104A to pivot about point 16 during the boresight adjustment thereof using adjustment screw assemblies 62, 64 and 66.

The location of pivot point 16 is determined by the plane at which adjustment screw assemblies 62, 64 and 66 contact spotting rifle barrel 104A. For example, in the illustrated embodiment, the plane of contact defined by the adjustment screw assemblies (i.e., line 3-3 in FIG. 2) is aft of the muzzle opening of spotting rifle 104A. Accordingly, point 16 will be aft of the breech opening of spotting rifle barrel 104A.

The advantages of the present invention are numerous. A spotting rifle barrel is aligned and retained in alignment during the firing of a spotting round. Launch tube integrity is maintained as the inertia of the spotting round is not transferred to the launch tube since the spotting rifle barrel is only restrained axially at its breech end.

Although the invention has been described relative to a specific embodiment thereof, there are numerous variations and modifications that will be readily apparent to those skilled in the art in light of the above teachings. For example, annular extension 30 could be integral with receiver housing 104B or incorporated as part of annular lug 20. Further, as mentioned above, annular lug 10 could be integral with spotting rifle barrel 104A and annular lug 20 could be integral with receiver housing 104B. Note that if annular lug 20 is integral with receiver housing 104B, set screw 22 is not needed. It is therefore to be understood that the invention may be practiced other than as specifically described.

Abstract

A spotting rifle barrel is aligned and retained relative to a launch tube and a spotting rifle receiver housing. A first annular lug is coupled to an outer portion of a breech end of the spotting rifle barrel. A second annular lug is coupled to an inner portion of the spotting rifle receiver housing. The spotting rifle barrel extends through the second annular lug so that a forward end of the first annular lug abuts an aft end of the second annular lug. The forward end of the first annular lug and the aft end of the second annular lug meet at a complementary radius of curvature. The first annular lug is retained in an abutting relationship with the second annular lug. A boresight adjustment assembly cooperates with a muzzle end of the spotting rifle barrel to adjust the boresight of the spotting rifle barrel while allowing for axial movement of the barrel.

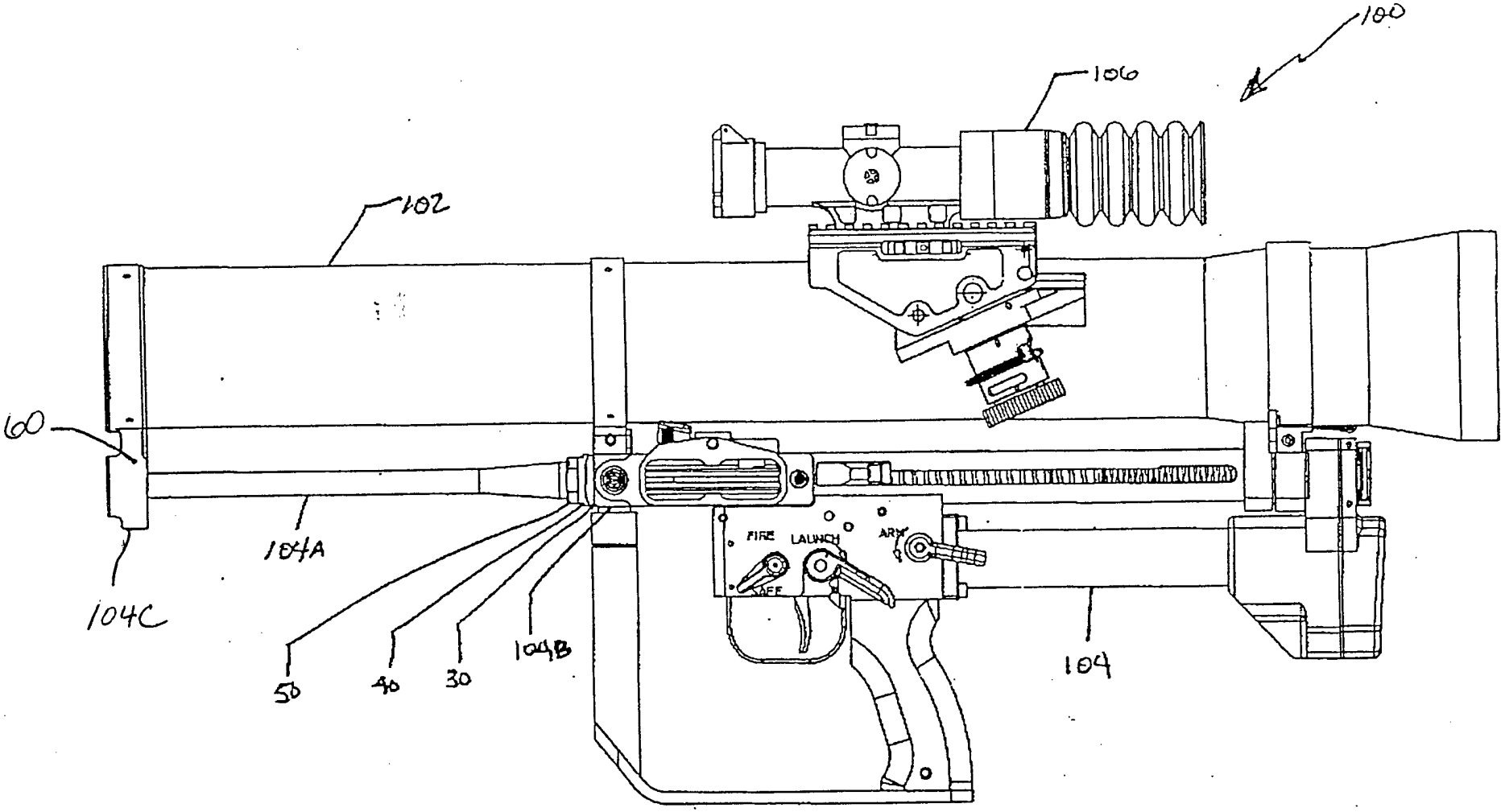

FIG. 1

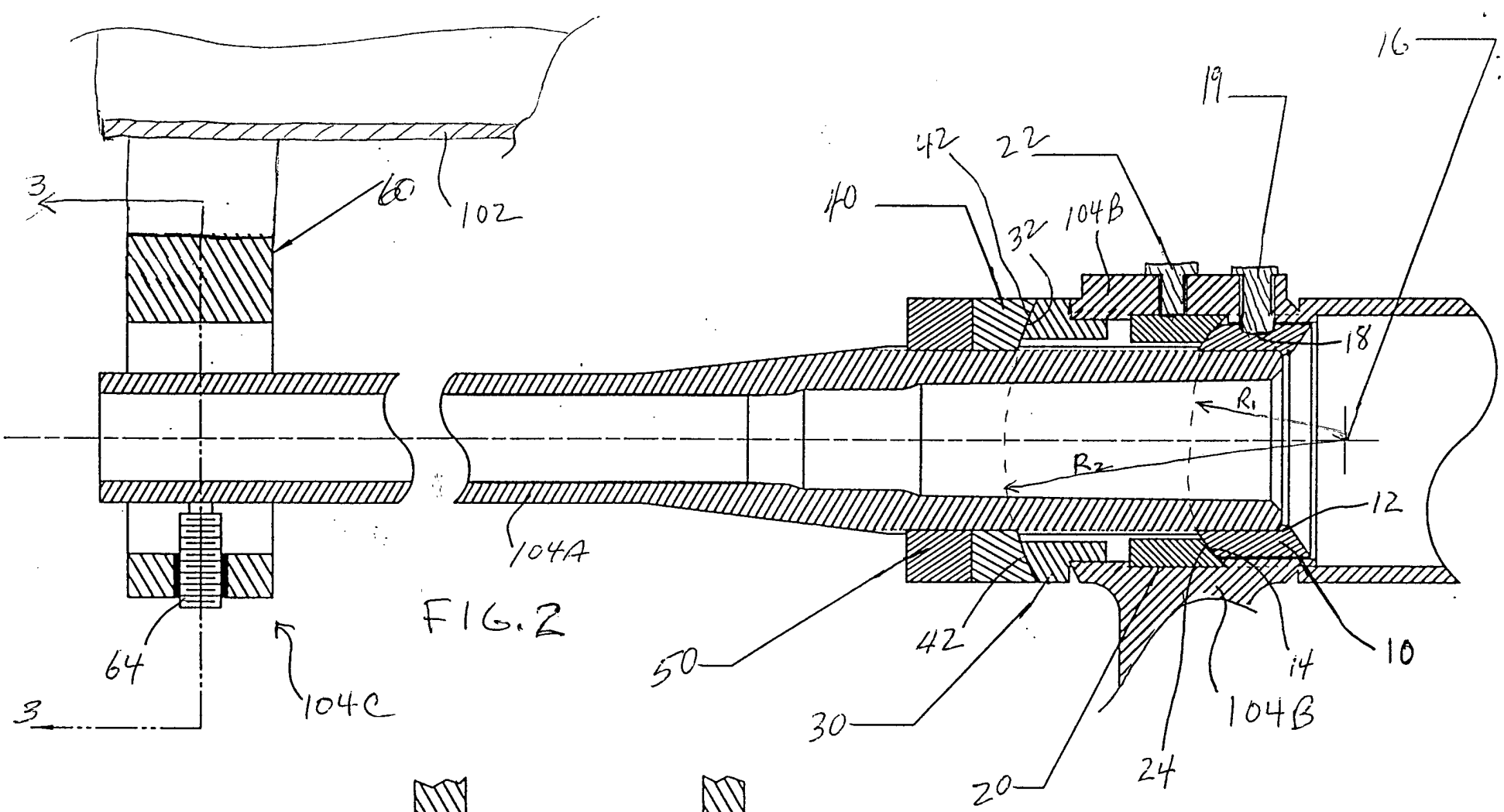
3
60
102
16
19
42
22
40
32
104B
18
R_1
R_2
12
104A
64
104C
3
50
42
14
10
30
104B
20
24

FIG. 2

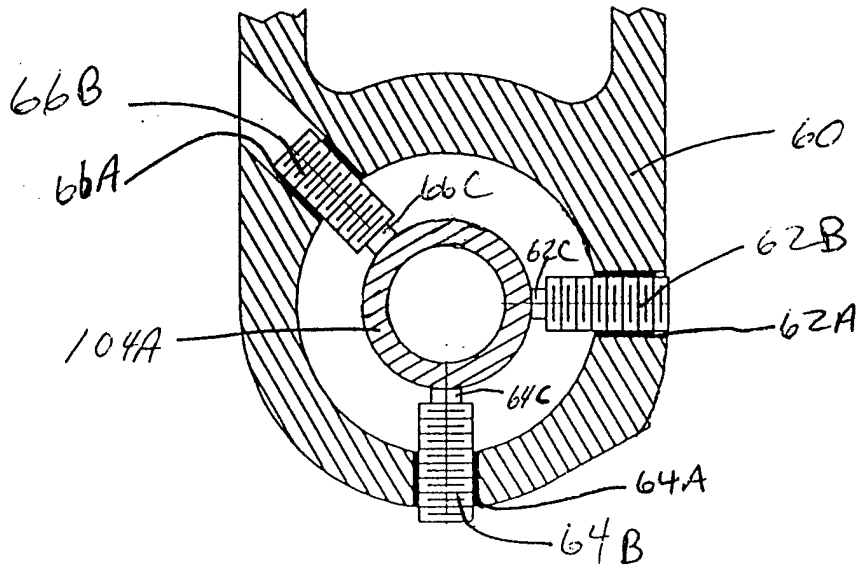
66B
66A
66C
60
62C
62B
62A
104A
64C
64A
64B

FIG. 3