United States Patent [19]

Ward

[11] **3,855,560**

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[54] **MULTI POSITION ROTARY DETENT DEVICE**

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[52] **U.S. Cl.** **335/302,** 310/156, 335/253

[51] **Int. Cl.** **H01f 7/02**

[58] **Field of Search** 335/229, 230, 272, 279, 335/302, 253; 310/49, 103, 156

[56] **References Cited**

UNITED STATES PATENTS

2,212,192	8/1940	Howell	310/156
3,344,378	9/1967	Wilhelmson	335/272
3,473,061	10/1969	Soehner	310/156

FOREIGN PATENTS OR APPLICATIONS

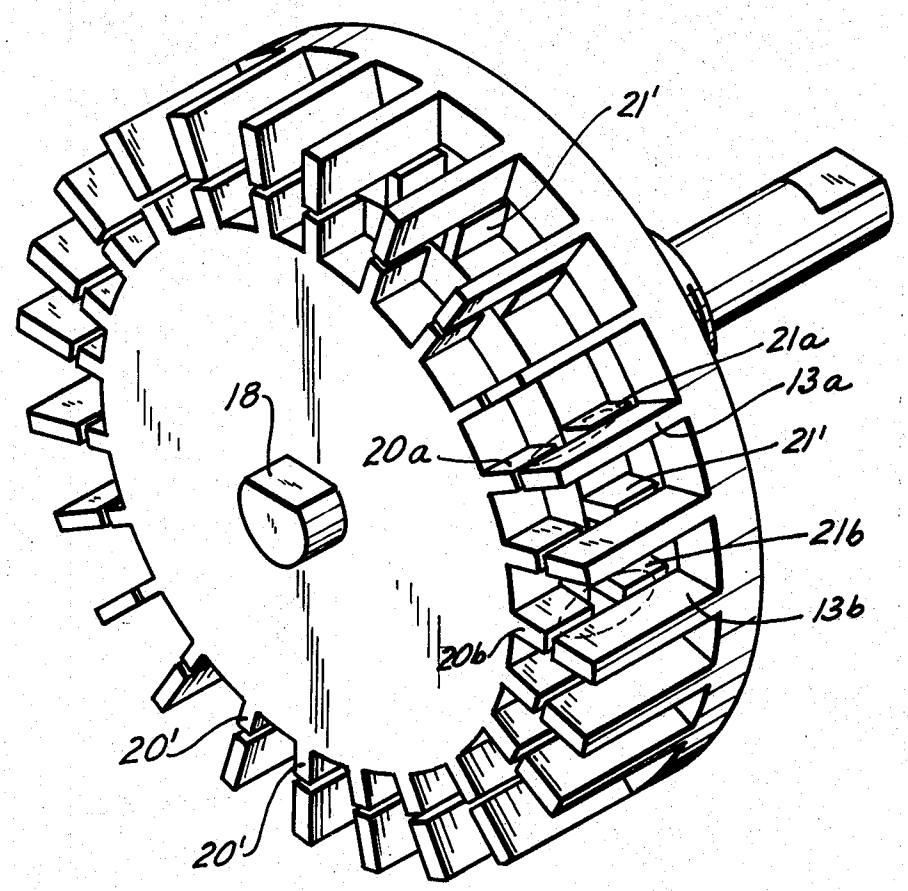
884,471	12/1961	Great Britain	310/156

Primary Examiner—G. Harris

[57] **ABSTRACT**

A multi position rotary detent device in which a plurality of detent positions are available with each position determined by discrete magnetic fields established between rotor pole pieces and stator pole pieces and in which selected detent positions can be achieved by rotation of the rotor to establish magnetic fields between selected rotor pole pieces and selected stator pole pieces.

8 Claims, 4 Drawing Figures



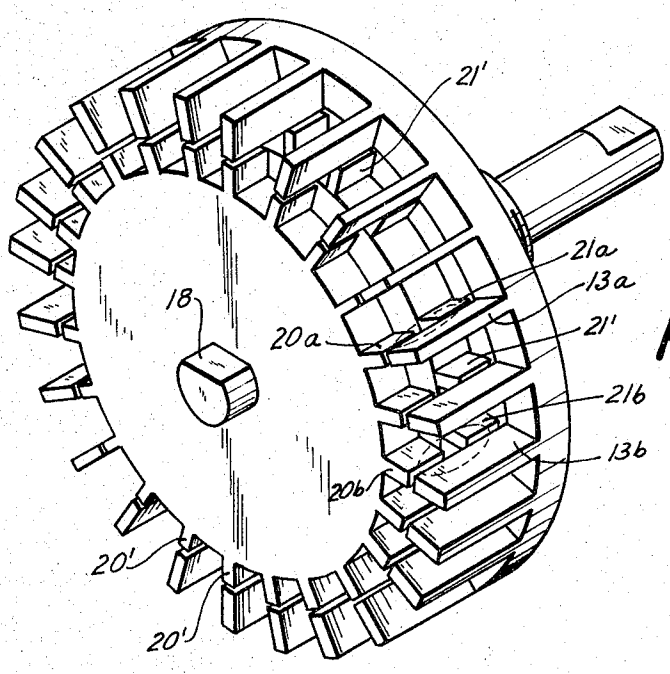

21'
21a
13a
18
20a
21'
21b
13b
20b
20'
20'

FIG. 1

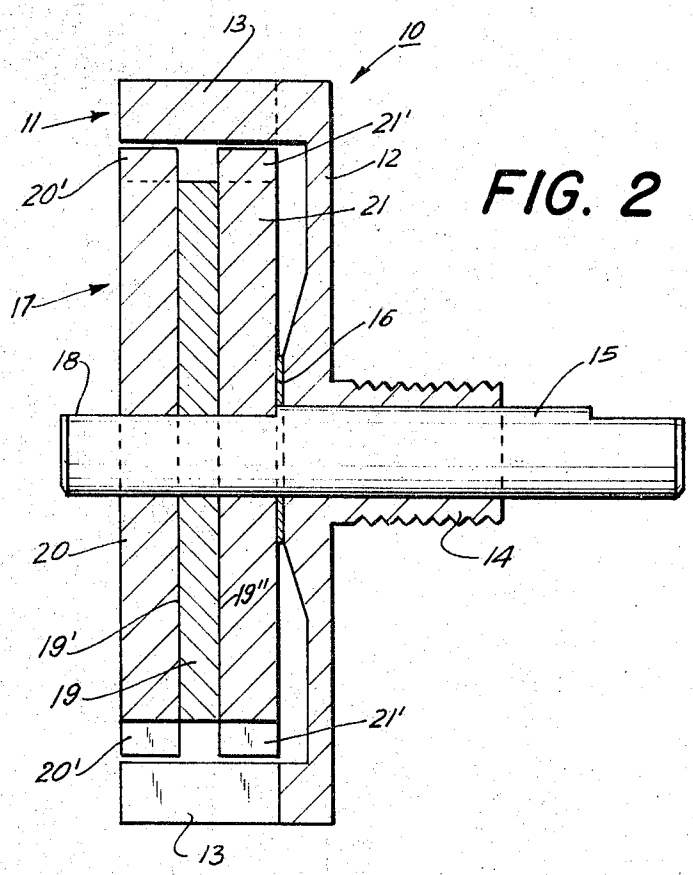

13
10
11
21'
12
20'
21
17
16
18
15
20
14
19''
19'
19
21'
20'
13

FIG. 2

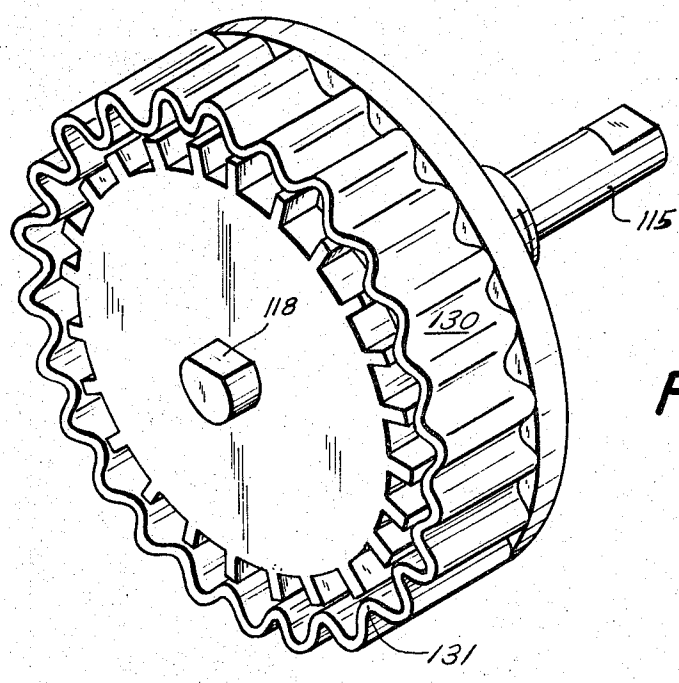

115
118
130
131

FIG. 3

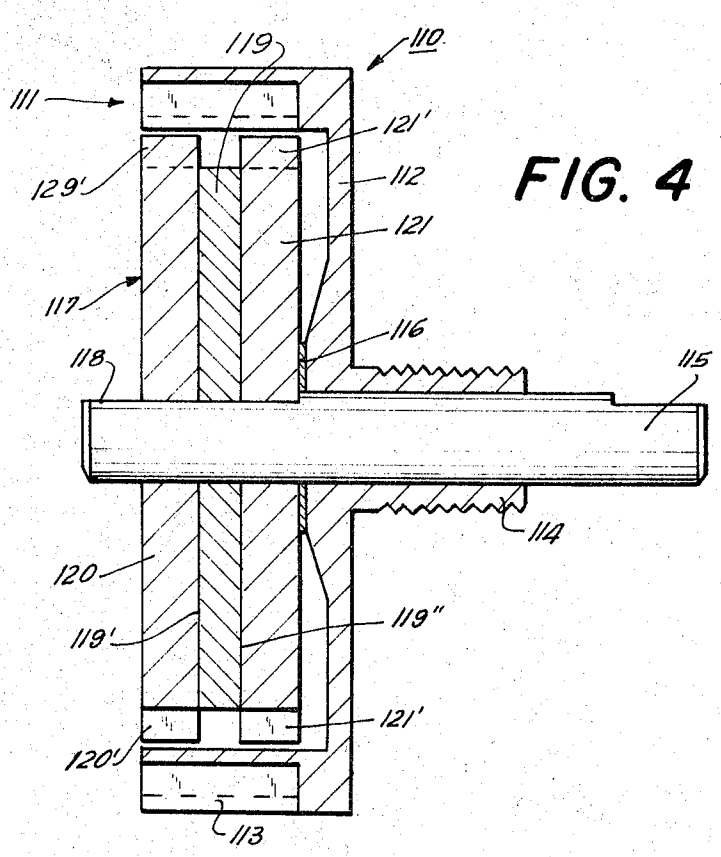

119
110
111
121'
129'
112
121
117
116
118
115
114
120
119'
119"
121'
120'
113

FIG. 4

MULTI POSITION ROTARY DETENT DEVICE

BACKGROUND OF THE INVENTION

A detent device is one in which a moving part thereof is stopped due to the action of the device in a predetermined position. A multi position rotary detent device is one in which a part which is capable of rotary movement is provided with a number of stopping points - each being a detent position. The stopping point in a detent device is not a positive stop but one in which an additional amount of energy or force must be utilized in order to move out of that position.

Detent devices in various configurations are well known in the art. A detent device which is stopped or which has its detent positions determined by mechanical action has a relatively short life due to the frictional engagement of parts. It is important in many applications to have a relatively simple detent device which is capable of long life and one which is not subject to severe wear due to frictional engagement of parts.

SUMMARY OF THE INVENTION

A multi position rotary detent device in which spaced stator and rotor members are provided with means for developing discrete zones of magnetic flux establishing detent positions and the angular position of a shaft projecting from the rotor determines the magnetic flux paths between selected zones.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front perspective view of a multi position rotary detent device constructed in accordance with the teachings of this invention;

FIG. **2** is a longitudinal sectional view of the device shown in FIG. **1**;

FIG. **3** is a perspective view similar to that of FIG. **1** of an alternate embodiment of the invention in which the rotor configuration is identical to that of the embodiment of FIGS. **1** and **2** and the static configuration is modified; and

FIG. **4** is a longitudinal sectional view of the device shown in FIG. **3.**

DESCRIPTION OF THE INVENTION

A multi position detent device constructed in accordance with the invention is shown in FIGS. **1** and **2** and indicated by the numeral **10.** Stator **11** of the device includes a circular disk base **12** having a plurality of circularly arranged teeth **13** formed integrally therewith projecting axially and radially inwardly. In the embodiment shown in FIGS. **1** and **2** there are 24 such teeth or pole pieces. The stator is formed of a magnetic material, such as low carbon content, iron or steel. If the teeth are not formed integral with the base a non-magnetic material is preferred for the base **12.**

In the embodiment of FIGS. **1** and **2** a bushing **14** is formed integral with the base and rotatably supports non-magnetic shaft **15.** Flat washer **16** is also used in this embodiment spacing the rotor **17** from the stator **11.**

The shaft **15** is provided with a flattened surface portion or keyway **18** upon which the rotor is mounted so that the rotor cannot rotate relative to shaft **15.** Cylindrical disk magnet **19** is provided in the rotor with the surface **19'** oriented magnetic north and the surface **19''** oriented magnetic south. A first rotor pole member **20** is provided adjacent surface **19'** and a like rotor pole member **21** is provided adjacent magnet surface **19''.** Each of the pole members has a disk body similar to that of magnet **19** but with pole pieces projecting radially outwardly therefrom, hence, as seen in the FIGS. pole member **20** is provided with pole pieces **20'** projecting radially outwardly therefrom while pole member **21** is provided with pole pieces **21'** projecting outwardly therefrom.

Since pole member **20** is adjacent surface **19'** of the magnet which is oriented magnetic north the pole member and hence the pole pieces **20'** are oriented magnetic north, and likewise pole member **21** is oriented magnetic south as are pole pieces **21'** oriented magnetic south. The pole members as are the pole pieces **13** of the stator are formed of a magnetic material.

It is noted that the diameter of the magnet is less than the diameter of either of the pole members and that each stator pole piece is a discrete rectangular member having an inwardly facing edge which in the detent position extends from one of the rotor pole pieces of the first pole member to one of the pole pieces of the second pole member while spanning the magnet.

In the position of the rotor with respect to the stator that is shown in the FIGS. **1** and **2** the device is considered to be in the detent position and there are magnetic flux paths established between selected rotor pole pieces or pairs of selected rotor pole pieces and a stator pole piece. Hence as seen in FIG. **1** in this particular detent position the flux path X is established by the pole pieces **20***a*, **21***a* and **13***a*. Also a flux path by way of example, is established by pole pieces **20***b*, **21***b* and **13***b*. The selected path is determined by the angular position of shaft **15.** Rotation of shaft **15** if desired, could establish new flux paths so that by way of example, a flux path would be determined by pole pieces **20***a*, **21***a* and **13***b*. Upon the establishment of a flux path a detent position is determined.

In FIGS. **3** and **4** an alternate embodiment of the invention is shown in which the rotor is identical to the rotor of the embodiment of FIGS. **1** and **2** but the stator is of different configuration.

Hence in FIGS. **3** and **4** rotor **117** consisting of magnet **119** and rotor members **120** and **121** is identical to rotor **17** consisting of magnet **19** and pole members **20** and **21** and mounted upon shaft **115** which is rotatably supported in bushing **114** of base **112** of stator **111.** The rotor is mounted on the flat **118** of the shaft **115** and washer **116** is provided for spacing.

The stator in this embodiment differs from the stator of the first embodiment in the structure of the pole pieces. In this embodiment the stator has a generally circular wall **130** of magnetic material and serpentine configuration surrounding the rotor with the inwardly directed crests **131** thereof respectively providing stator pole pieces. As in the first embodiment, each of the stator pole pieces can extend from one of the pole pieces of the rotor to another while spanning the magnet. The serpentine wall **130** can also be formed integral with base **112** and in the embodiment shown in FIGS. **3** and **4** there are 24 inwardly directed crests **131** providing 24 stator pole pieces to cooperate with 24 pairs of rotor pole pieces in the manner in which the pole pieces cooperate in the first embodiment as described above.

I claim:

1. A multi position rotary detent device including in combination a first rotary member, a plurality of circularly arranged first pole pieces of said first rotary member, said first pole pieces being formed of a magnetic material, a second rotary member rotatably supported with respect to said first rotary member, a magnet of said second rotary member having first and second surfaces respectively oriented magnetic north and magnetic south, a first pole member of said second rotary member adjacent said first surface and having second pole pieces, a second pole member of said second rotary member adjacent said second surface and having third pole pieces, said pole members being in fixed relation with said magnet and formed of a magnetic material, said second and third pole pieces and said first pole pieces projecting toward each other, and means for relatively rotating said first and second rotary members whereby the relative angular position of said first rotary member with respect to said second rotary member determines the magnetic flux paths between selected second and third pole pieces and selected said first pole pieces.

2. A multi position rotary detent device including in combination a stator, a stator base of said stator formed with a plurality of circularly arranged stator pole pieces, said stator pole pieces being formed of a magnetic material, and a bushing formed on said stator base; a shaft rotatably supported in said bushing on the axis of said stator, said shaft being formed of a non-magnetic material; a rotor supported by said shaft in fixed relation with respect thereto, a magnet of said rotor having first and second surfaces respectively oriented magnetic north and magnetic south, a first rotor pole member adjacent said first surface and having first rotor pole pieces projecting radially outwardly therefrom, a second rotor pole member adjacent said second surface and having second rotor pole pieces projecting radially outwardly therefrom, said pole members being formed of a magnetic material and whereby the angular position of said shaft determines a plurality of magnetic flux paths, each of said flux paths being between selected first and second pole pieces and selected stator pole pieces which provides the magnetic circuit of said flux path.

3. A multi position rotary detent device in accordance with claim 2 in which said stator pole pieces are formed integral with said stator base.

4. A multi position rotary detent device in accordance with claim 2 in which said magnet is a circular disk and said pole members are disks with said rotor pole pieces projecting outwardly respectively in the planes thereof and the diameter of said magnet is less than the diameter of either of said pole members.

5. A multi position rotary detent device in accordance with claim 2 in which each of said stator pole pieces projects axially of said stator.

6. A multi position rotary detent device in accordance with claim 5 in which each of said stator pole pieces is a discrete rectangular member having an inwardly facing edge which in the detent position extends from one of said first rotor pole pieces to one of said second rotor pole pieces while spanning said magnet.

7. A multi position rotary detent device in accordance with claim 5 in which said stator has a generally circular wall of serpentine configuration surrounding said rotor with the inwardly directed crests thereof respectively providing the stator pole pieces and wherein each stator pole piece in the detent position extends from one of said first rotor pole pieces to one of said second rotor pole pieces while spanning said magnet.

8. A multi position rotary detent device in accordance with claim 2 in which each of said first rotor pole pieces forms a pair with one of said second rotor pole pieces and there are the same number of pairs so provided as are stator pole pieces.

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