United States Patent [19]

Clark

[11] **3,828,893**

[45] **Aug. 13, 1974**

[54] **SERVO-DRIVE POSITIONING DEVICE**

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[73] Assignee: **The National Cash Register Company,** Dayton, Ohio

[22] Filed: **Nov. 22, 1972**

[21] Appl. No.: **308,652**

[52] **U.S. Cl.** **188/67,** 74/531, 248/355

[51] **Int. Cl.** **B65h 59/10**

[58] **Field of Search** 188/67; 248/355; 74/531; 254/105, 106; 403/104

[56] **References Cited**

UNITED STATES PATENTS

2,363,229	11/1944	Cade	403/104 X
2,579,305	12/1951	Cushman	188/67 X
2,629,267	2/1953	Hart	254/106 X
3,156,963	11/1964	Owen	254/106 X
3,277,980	10/1966	Haaker	188/67

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Attorney, Agent, or Firm—J. T. Cavender; Wilbert Hawk, Jr.; George J. Muckenthaler

[57] **ABSTRACT**

A linkage connects an off-center point of a motor-driven assembly to a pivot point on a reference or frame member and is used for holding a movable member in a fixed position relative to the reference member. The linkage includes a double-locking clutch with two sets of springloaded washers carried on a shaft in canted manner, and a pair of opposed plungers positioned between the sets of washers to maintain position of the washers on the shaft. A small force applied to a trigger sleeve, which encloses the clutch, unlocks one set of the washers to release a locking sleeve to move in the direction of the applied force and thereby adjust the position of the locking sleeve in relation to the reference member, and when the force is removed, the locking sleeve is locked on the shaft in a self-centering position.

6 Claims, 9 Drawing Figures

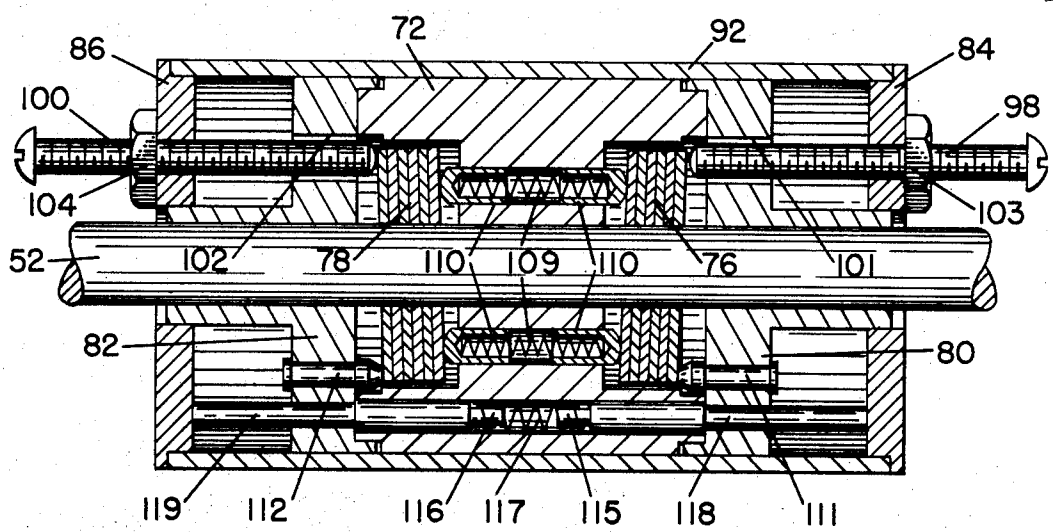


FIG. 1

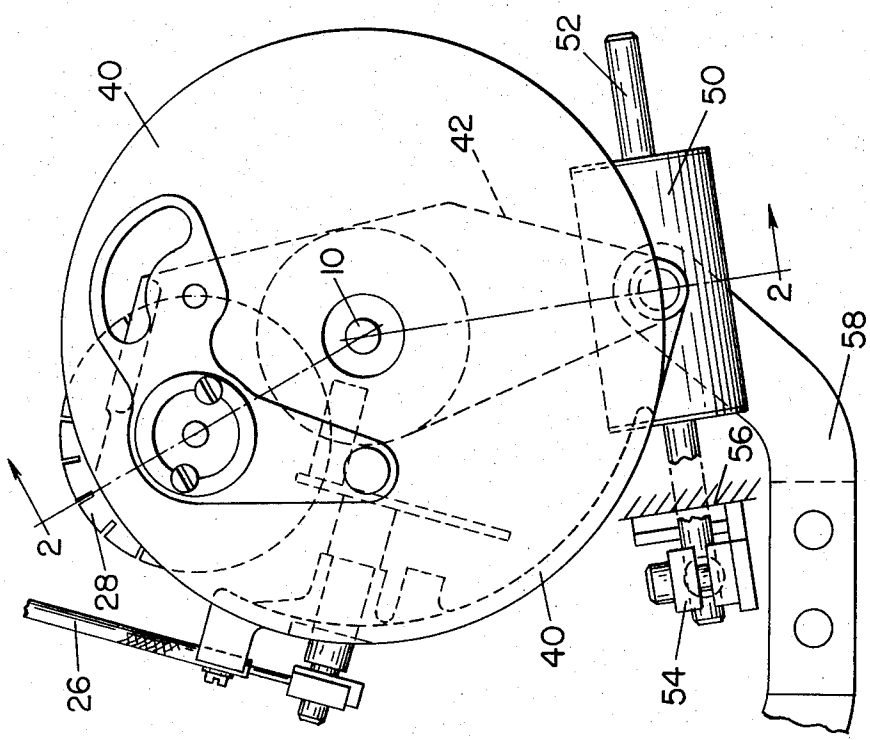

40
42
52
50
10
2
58
56
2
28
26
40
54

FIG. 2

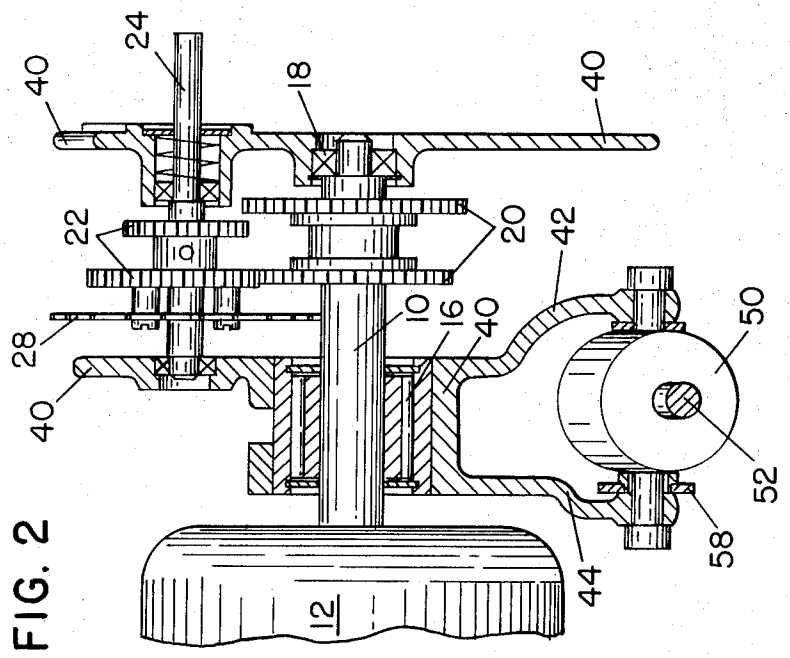

24
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40
50
52
58
44
12

FIG. 3

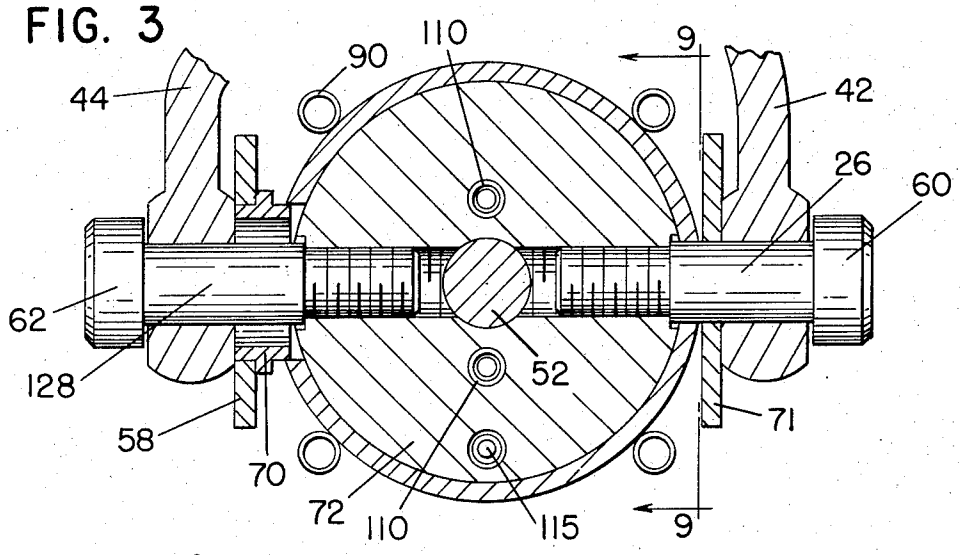


FIG. 4

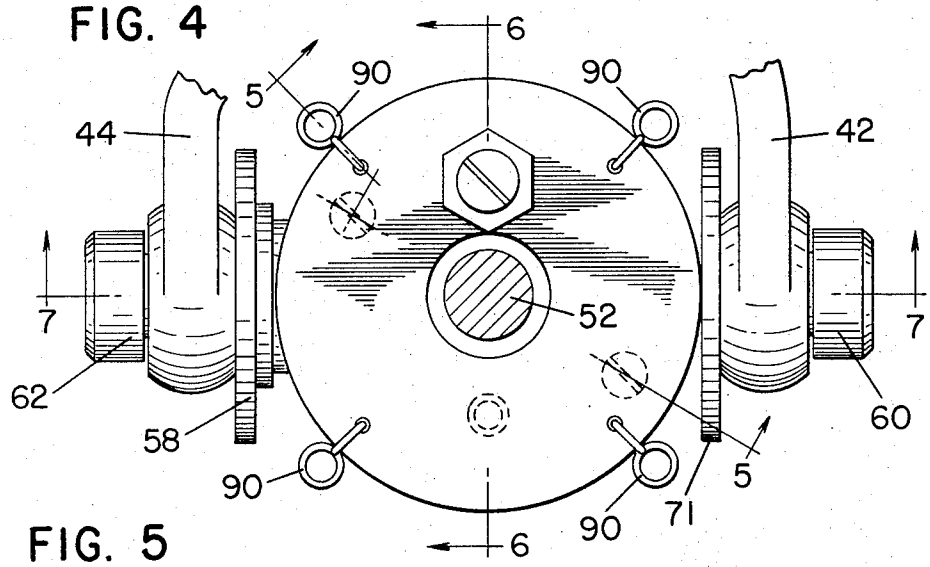


FIG. 5

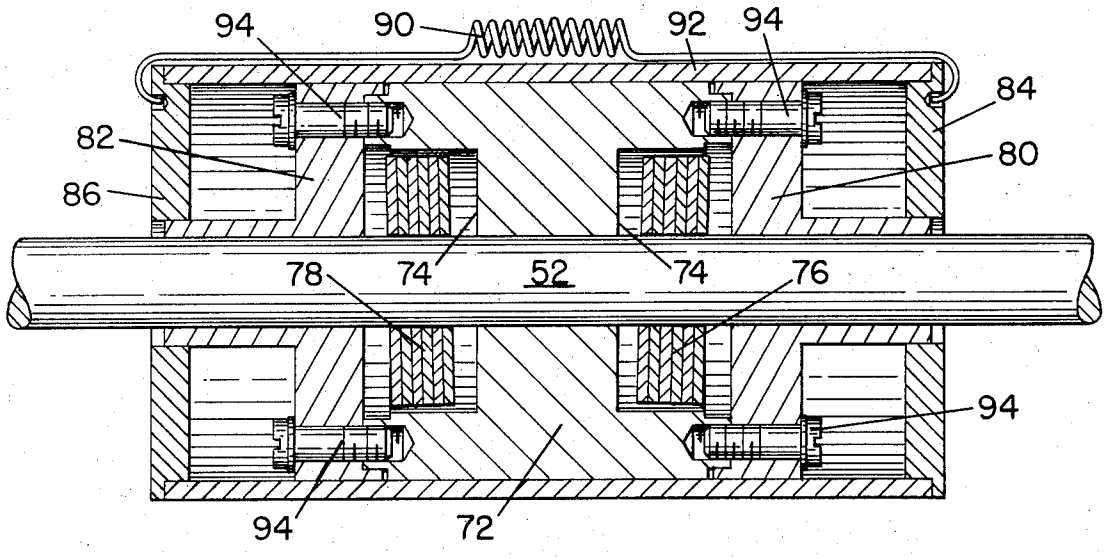


FIG. 7

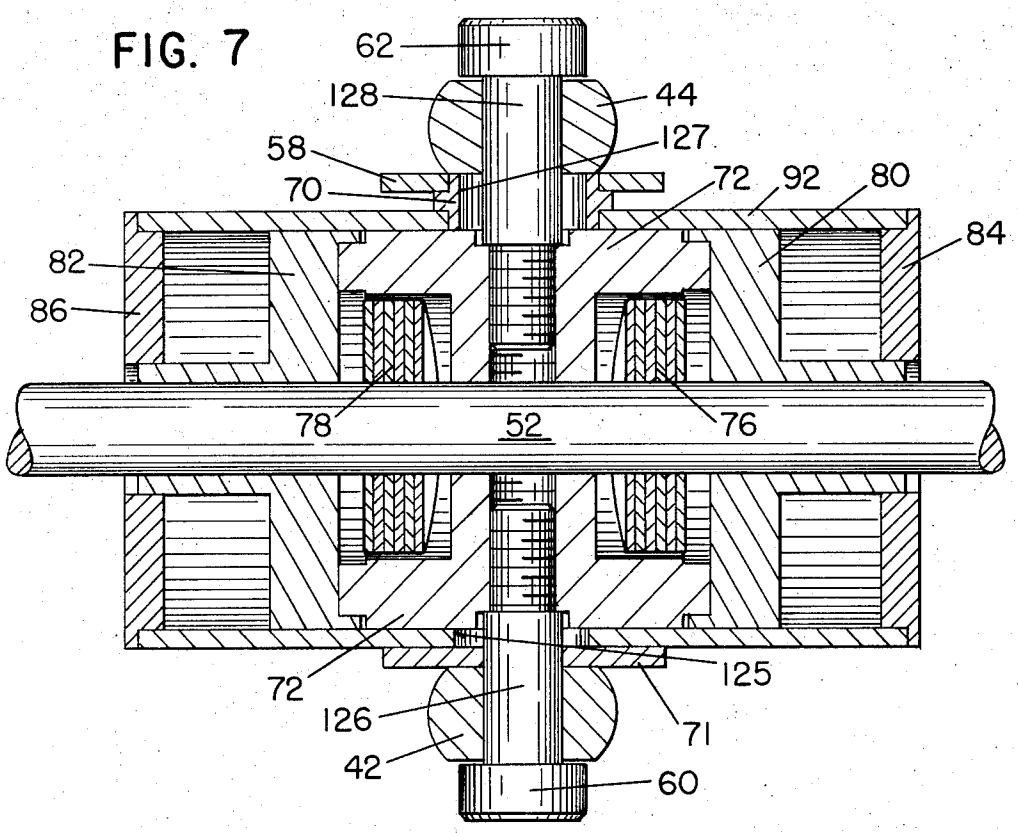

62
128
44
127
58
70
72
92
80
84
82
86
78
52
76
72
125
126
71
42
60

FIG. 6

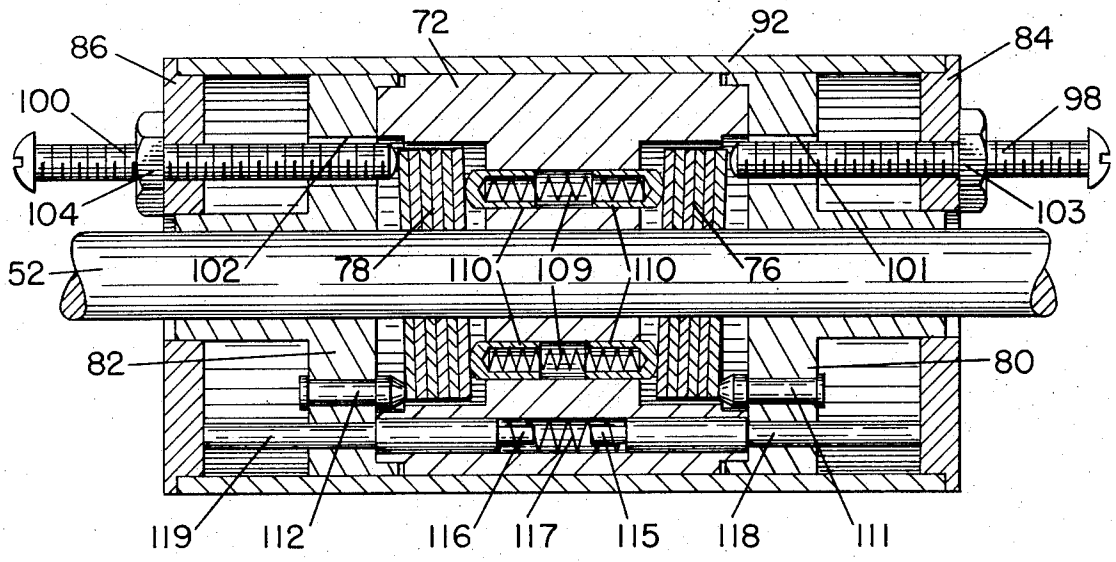

72
92
86
84
100
98
104
103
52
102
78
110
109
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76
101
82
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119
112
116
117
115
118
111

FIG. 8

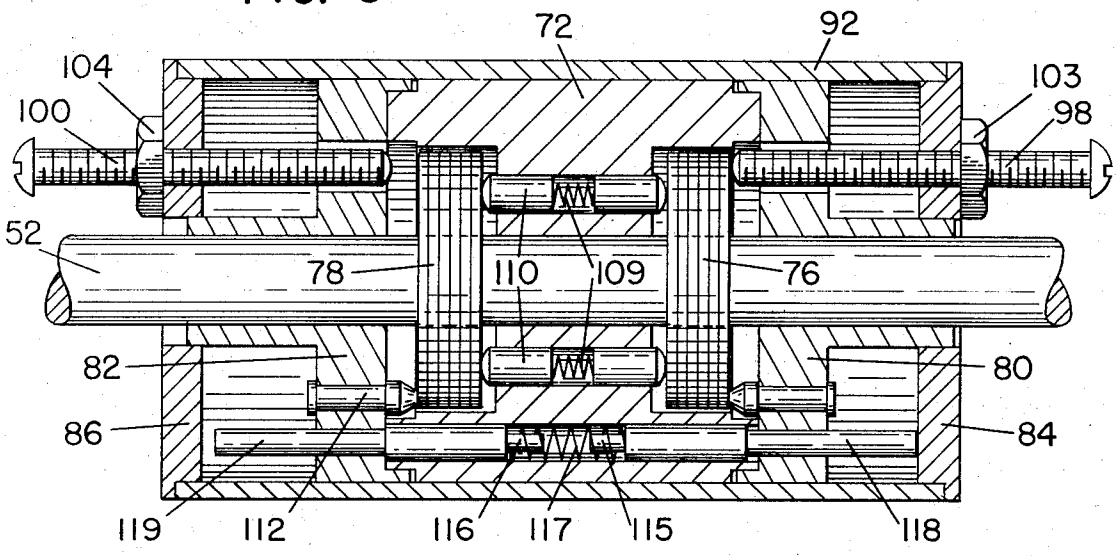
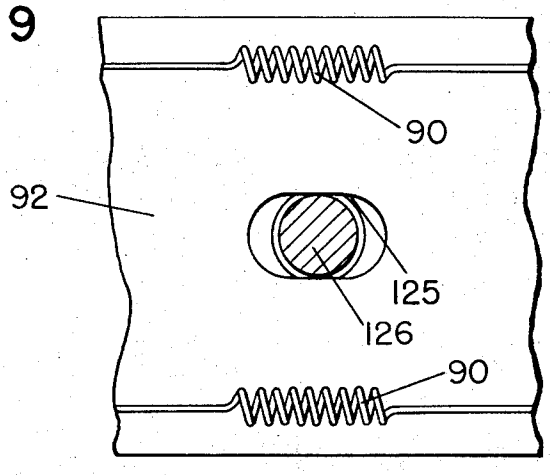

72
92
104
103
100
98
52
78
110
109
76
82
80
86
84
119
112
116
117
115
118

FIG. 9


90
92
125
126
90

SERVO-DRIVE POSITIONING DEVICE

BACKGROUND OF THE INVENTION

In the matter of positioning and retaining the position of mechanical devices, which are subject to forces not contemplated within a system, there have been ways and means for controlling the position of one member relative to another member. In this respect, the use of springs, plungers, and like devices have been used for maintaining various elements in adjustment where such devices can be used in an assembly. The spring loading feature and associated structure, as well as hydraulic or dash-pot devices, may also be utilized in similar circumstances to control or to adjust one element in relation to another. Normally, such structure takes on the concept of providing means for maintaining position of a movable member relative to a fixed member, while permitting adjustment of the movable member under certain conditions.

Closer to the present invention is the concept of a rod carrying a slidable member abutting a cylinder wherein the slidable member assumes a canted position to retain the cylinder along the rod, such as is commonly used in door closers.

SUMMARY OF THE INVENTION

The present invention relates to positioning devices and more particularly to a linkage mechanism connected to a reference member and to an assembly for adjusting certain parts of the assembly in relation to the reference member. The linkage mechanism incorporates a double-locking clutch with two sets of spring-loaded washers carried on a shaft in canted manner and a pair of opposed plungers positioned between the sets of washers to maintain position thereof. A slidable locking sleeve encircles the washers and a portion of the shaft, and the washers, when in the canted position, prevent relative motion between the locking sleeve and the shaft, except when it is desired to make an adjustment.

A small force is applied in one direction to a trigger or actuating sleeve and thereby releases one set of the locking washers from the shaft to permit movement of the locking sleeve along the shaft to a new position. The locking sleeve follows the motion of the trigger sleeve in the direction of the applied force and when once the force is stopped, the locking sleeve will be locked on the shaft with the trigger sleeve recentering itself in relation to the locking sleeve. The construction of the present invention and the action obtained therefrom permit a self-centering of the trigger sleeve when the new adjustment position is reached.

In line with the above discussion, the principal object of the present invention is to provide a positioning device which performs fine-tuning adjustment.

Another object of the present invention is to provide a linkage mechanism for connecting a servo assembly to a reference member for remote control of adjustment.

An additional object of the present invention is to provide a positioning device for adjusting printing mechanism along a print line.

A further object of the present invention is to provide spring loaded plungers and sets of washers for locking of a cylinder along a shaft.

Another object of the present invention is to provide resilient means between the several members for recentering of the actuating member after adjustment of the positioning device.

Additional features and advantages will become apparent from a reading of the following specification taken together with the annexed drawings, in which:

FIG. **1** is a side elevational view of a portion of servo mechanism incorporating the subject matter of the present invention;

FIG. **2** is a sectional view taken on the line **2—2** of FIG. **1**;

FIG. **3** is an enlarged sectional view of a portion of FIG. **2**;

FIG. **4** is an end view of the positioning device;

FIG. **5** is a sectional view taken on the line **5—5** of FIG. **4**;

FIG. **6** is a sectional view taken on the line **6—6** of FIG. **4**;

FIG. **7** is a sectional view taken on the line **7—7** of FIG. **4**;

FIG. **8** is a sectional view similar to FIG. **6** and showing a slightly different position of the parts thereof; and

FIG. **9** is an enlarged view taken on the line **9—9** of FIG. **3**.

Referring now to FIGS. **1** and **2** of the drawings, there is shown certain structure including a motor shaft for a servo assembly which assembly has one application for positioning and controlling the position of printing mechanism when printing on form paper or the like. As is well known, continuous form paper is used in high speed printing apparatus, the form paper being driven by tractor mechanism past a print station wherein character or other indicia printing may be accomplished in line manner. As is also well know, it is extremely important that the printing position on the paper be controlled to the extent that, because of pre-printed lines on the paper, the printed characters or other indicia are maintained evenly spaced and in a straight format across the paper. Additionally, after certain periods of operation, there may be a tendency for the paper to inch ahead or fall behind during the travel thereof in relation to the printing mechanism. This becomes even more important when the paper includes such pre-printed lines thereon and it is desired to print in precise manner between the lines. Of course, should the paper have the tendency to become slightly displaced in relation to the printing mechanism, there must be provided means for adjusting the line of print so as to maintain an exact format of line printing.

The present invention is considered important as a part of a drive assembly which performs a stepping operation by driving the paper a line at a time. In this respect a servo mechanism drives the paper forward in stepping manner so that the paper is successively positioned for printing on each succeeding line.

The present invention is directed to means for repositioning or adjusting the drive mechanism in those instances when the drive line veers from a correct position and such drive mechanism includes a motor shaft **10** driven by a servo motor **12** supported from machine framework in the nature of a flange, the major portion of surrounding framework being omitted from the drawing for reason of clarity. Shaft **10** is carried in bearings located inside the motor in conventional manner, and the shaft carries a pivotable casting **40** upon

bearings **16** and **18**, and within such casting carries a gear cluster **20** for meshing with a second gear cluster **22** on a shaft **24** parallel to shaft **10**, the shaft **24** being supported in suitable bearings in the casting **40**. In other words, the casting **40** is solely supported from the shaft **10**, which extends from and is supported from the motor **12**, which, in turn, is flange mounted to the machine frame. The purpose of the gear clusters **20** and **22** is to provide for the printing of either **6** lines or **8** lines per inch, with the gears shown in the **6** lines per inch position. One end of a bowden wire **26** is for the purpose of changing the line spacing from **6** to **8** lines. Gear cluster **22** has connected thereto an optical disk **28** used in the control system, which is not a part of the present invention.

The shaft-supported casting **40** furthermore has legs **42** and **44** (FIG. **2**) extending downwardly and connected to a positioning device **50** carried on a rod or shaft **52** pivotally supported at one end thereof to a clutch anchor pivot **54** connected to a framework **56** so as to provide a reference member for the device **50**. The device **50** is constructed to be slidable along the rod **52** in relation to the reference member **56** in operation of which will be further described. Sliding movement of the device **50** along the rod **52** is accomplished by means of a link or arm **58** connected to the device **50** and extending to a control lever (not shown).

In FIG. **3** is shown an enlarged sectional view of the positioning device **50** with the rod or shaft **52** in the center thereof, and the legs **42** and **44** connected to the device by means of studs or shoulder screws **60** and **62** threaded into the body of the device midway between the ends thereof. It is thus seen that the location of device **50** on shaft **52** determines the angular position of casting **40** about its support shaft **10**, within desired adjustment limits. FIG. **4** shows an end view of the positioning device with certain parts similar as FIG. **3**. The link **58** connects to a shoulder **70** on the device **50** and the other end connects to the manually positionable control lever, not shown. A washer **71** is disposed between the leg **42** and the exterior surface of the device **50**.

Referring now to FIG. **5**, the positioning device **50** is carried by the shaft **52** and includes a locking sleeve **72** adjacent the shaft, the sleeve assuming the shape of a "T" in cross-section thereof and providing a recess **74** in the vicinity of each end for reception of a set of washers **76** and a set **78**. The two sets of washers are positioned on the rod **52** in such manner as to be capable of being slightly canted thereon for purposes to be described. The support for the shaft **52** in the device **50** is derived from a pair of hubs **80** and **82** over the ends of which are cover plates **84** and **86**, respectively, the plates being retained in position by means of coil springs **90** attached to the cover plate at each end of a cylinder **92** and stretched along the periphery thereof. The cylinder **92**, which generally comprises a sleeve, encloses the parts in compact manner with screws **94** securing the shaft support hubs **80** and **82** with the locking sleeve **72**. Additionally, a pair of adjusting screws **98** and **100** (FIG. **6**) are threaded into the respective cover plates **84** and **86** and through respective openings **101** and **102** in the hubs **80** and **82** to position the ends of the screws adjacent the sets of washers **76** and **78**. A nut **103** is carried by the screw **98** to be disposed against the cover plate **84** and a similar nut **104** is on screw **100** and against plate **86** to provide for the adjusting action of the ends of the screws in relation to the sets of washers.

The two sets of washers **76** and **78** are position controlled along the shaft **52** by means of four spring-loaded locking plungers **110**, (FIGS. **6** and **8**) a pair of which are axially aligned and diametrically opposite from a second pair, also axially aligned, and engaging the sets of washers on one side thereof in opposing manner by a pair of springs **109**. A pair of stop pins **111** and **112** are secured in the support hubs **80** and **82** in position directly opposite the adjusting screws **98** and **100**.

An additional feature of the present invention provides for self-centering of the trigger sleeve **92** in relation to the locking sleeve **72** after the adjusting action is completed. This is accomplished by means of a pair of centering plungers **115** and **116** loaded by a spring **117** and having stems **118** and **119** engageable with the cover plates **84** and **86**, respectively (see FIGS. **6** and **8**). This structure, in effect, provides a self-centering concept in the design to bring the trigger sleeve **92** to a new home position in relation to the locking sleeve **72**. This is an important feature in that it maintains, while the device is in a holding condition, a finite gap between screw **100** and washers **78** and between screw **98** and washers **76** so that minute machine vibrations will not cause gradual loss of position due to "creep" (see FIG. **6**). As seen in FIG. **9**, the trigger sleeve **92** includes an elongated slot **125** through which extends the shank **126** of stud or screw **60**. A similar slot **127** on the opposite side of the sleeve **92** from the slot **125** accommodates the shank **128** of stud **62** (FIG. **7**) so as to permit clearance for the self-centering featured parts. The screws **126** and **128** fit tightly in the locking sleeve **72** but freely pivot in the casting bosses **42, 44**, as shown.

In the operation of the device, wherein a typical application is in a line printer wherein it is desired to maintain registration of the line of print hammers with the pre-printed lines on continuous form paper or the like, the normal stepping action of the paper advancing mechanism can be position adjusted at any point in time. Once the paper has started through the printer, it is extremely difficult to advance or retard the continuous form, so it is necessary to pivot the movable assembly in relation to the machine frame. Since, as mentioned above, the servo-drive assembly is supported by bearings **16** and **18** on the motor shaft **10** or an extension thereof, te assembly must be restrained against rotation during advancement of and stopping of the motor because of the torque and counter torque action. Additionally, the motor is prevented from a reversing or backing action against a one-way clutch (not shown) to maintain position of the drive mechanism. In the present instance, it may be necessary to pivot the servo-drive assembly up to 22° in either direction by means of the remote control handle, in order to adjust the line of character or other indicia printing to register with the pre-printed lines on the paper. The positioning device **50** is intended to hold the movable servo-assembly at a fixed position in relation to the machine frame, and therefore the relative paper stopping point, and to resist any forces tending toward relative motion of the movable assembly; however, when so desired, the assembly may be moved to a new "fixed" position and thereheld in the new position against all forces tending to act thereon.

The device acts as a link connecting the off-center point on the movable assembly to the pivot point on the machine frame, and therefore the locking sleeve **72** must not slide on the shaft **52.** It must resist forces tending to make the link longer or shorter, except when an adjustment is required. When a small force is applied to the trigger sleeve **92,** a slight relative lost motion occurs between the trigger sleeve **92** and the locking sleeve **72,** by reason of the elongated slots **125** and **127** in the trigger sleeve, which motion permits the locking sleeve **72** to be unlocked and to move freely along the shaft **52.** This establishes a new length for the link and a new annular position for the movable assembly. When the small force is removed from the link by stopping movement of the control handle, the locking sleeve is bi-directionally locked in the new position.

The principle is based upon the sets of wasers being canted on the shaft and retained in position by the spring loaded plungers, the stop pins and the adjusting screws. In FIG. **6** is shown the locked position of the device with the sets of washers **76** and **78** being held in the canted position on the shaft **52.** A small force on the arm or link **58,** say to the right in FIG. **6,** acts on the hub **70** to move the locking sleeve **72** to the right. This movement straightens the washers **78** on the shaft and permits such washers to be moved therealong, while at the same time the movement of the locking sleeve **72,** along with the action of the plungers **110,** straightens the washers **76** by reason of the frictional effect of the washers **76** against the shaft **52.** When the new position is reached, the control handle is released and the locking sleeve **72** is again locked on the shaft **52** and the washers **76, 78** are urged to the canted position. The self-centering plungers **115, 116** then return the trigger sleeve **92** to the new home position so that no forces can prevail against the locking sleeve **72** until the next adjustment is made.

It is therefore seen that herein shown and described is a positioning device which utilizes canted washers on a shaft, and is controlled by spring-loaded plungers to effect adjustment of position of the locking sleeve along the shaft. The trigger sleeve centers itself in the new position so that the locking sleeve is not affected by forces derived from operation of the drive means for the stepping action, and so that vibrations of the trigger sleeve related linkage are not communicated to the locking washers. The apparatus enables the accomplishment of the objects and advantages mentioned above, and while only one embodiment of the invention has been disclosed herein, certain variations may occur to those skilled in the art. It is contemplated that all such variations, not departing from the spirit and scope of the invention, are to be construed in accordance with the following claims.

What is claimed is:

1. A positioning device comprising a shaft and journal means therefor, said shaft being connected to a reference member, locking means including a sleeve slidable on the shaft and a

plurality of elements spaced along and cantably carried on said shaft for gripping thereof and securing said sleeve thereon,

resilient means diametrically positioned for urging said plurality of elements into a locked position on said shaft,

means for releasing said plurality of elements from their locked position and permitting movement of said locking sleeve and said elements along said shaft, said releasing means including an actuating sleeve operably associated with said locking sleeve for moving thereof along said shaft to a new position in relation to said reference member, and

means for centering said releasing means in relation to said locking means upon movement of said locking sleeve to said new position, said means for centering including a lost-motion connection between said locking sleeve and said actuating sleeve and opposing resilient means for urging said actuating sleeve to a centered position in relation to said locking sleeve.

2. The device of claim **1** wherein said lost-motion connection includes elongated apertures in said actuating sleeve for permitting said opposing resilient means to move said actuating sleeve to its centered position.

3. A positioning device for a servo-assembly, said device comprising a

shaft and journal means therefor, said shaft being connected to a reference member,

locking means slidably carried on the shaft and including a sleeve and a plurality of washer elements,

resilient means including a plurality of springs on opposite sides of the shaft and positioned to urge said washer elements into a canted position to lock said sleeve and said elements on said shaft,

means for releasing said locking means from said shaft, said releasing means including an actuating sleeve encircling said locking means, and yoke means connected with said locking sleeve and engageable with said actuating sleeve for movement thereof, and

means for centering said actuating sleeve in relation to said locking sleeve, said centering means including a lost-motion connection operably associating said actuating sleeve and said locking sleeve and spring urged plungers positioned to center said actuating sleeve in relation to said locking sleeve after movement of said locking sleeve to a new position.

4. The device of claim **3** wherein said lost-motion connection includes elongated apertures in said actuating sleeve for permitting said plungers to move said actuating sleeve to its centered position.

5. Means for adjusting and retaining position of a servo-assembly in relation to a reference member on a business machine, said means comprising a shaft pivotally connected to said reference member,

clutch means including a locking sleeve having opposed sets of washer elements spaced along the shaft and lockable thereon,

means for resiliently urging the opposed sets of washer elements into locking engagement on said shaft, said resilient urging means including a plurality of springs diametrically positioned adjacent said shaft,

means for releasing the opposed sets of washer elements from locking engagement with the shaft to thereby permit pivoting of said servo-assembly and movement of said locking sleeve to a new position on said shaft, said releasing means including a trigger sleeve with end mounted elements and yoke means connected with said locking sleeve and en-

gageable with said trigger sleeve for movement thereof, and

means for centering of said trigger sleeve in relation to said locking sleeve, said centering means including a lost-motion connection between said locking sleeve and said trigger sleeve and a pair of opposed spring loaded plungers connected between the end mounted elements for centering of said trigger sleeve in relation to said locking sleeve after adjustment of the locking sleeve to a new position.

6. The subject matter of claim **5** wherein said lost-motion connection includes elongated apertures in said actuating sleeve permitting said pair of spring loaded plungers to move said trigger sleeve to its centered position.

* * * * *