March 18, 1947. E. D. MEAD ET AL 2,417,434

MECHANICAL STOP DEVICE

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FIG. 1

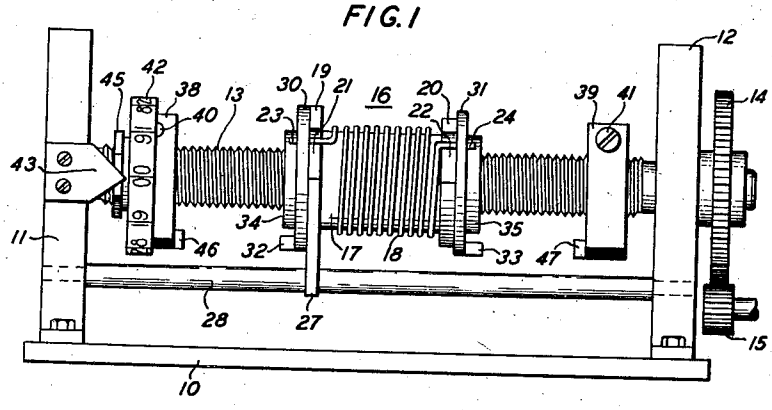

FIG. 2

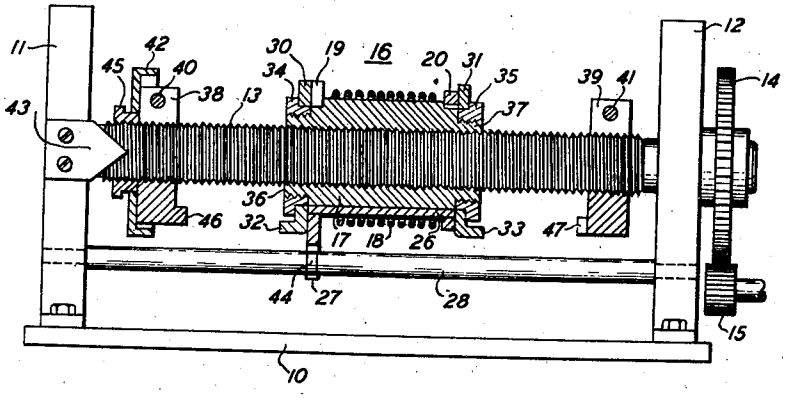

FIG. 3

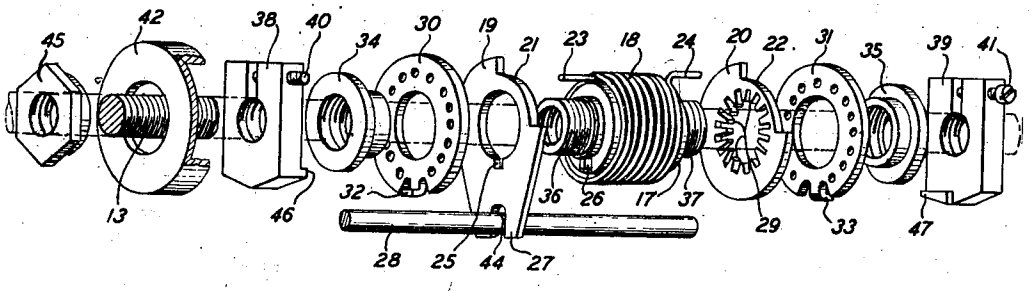

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FIG. 4

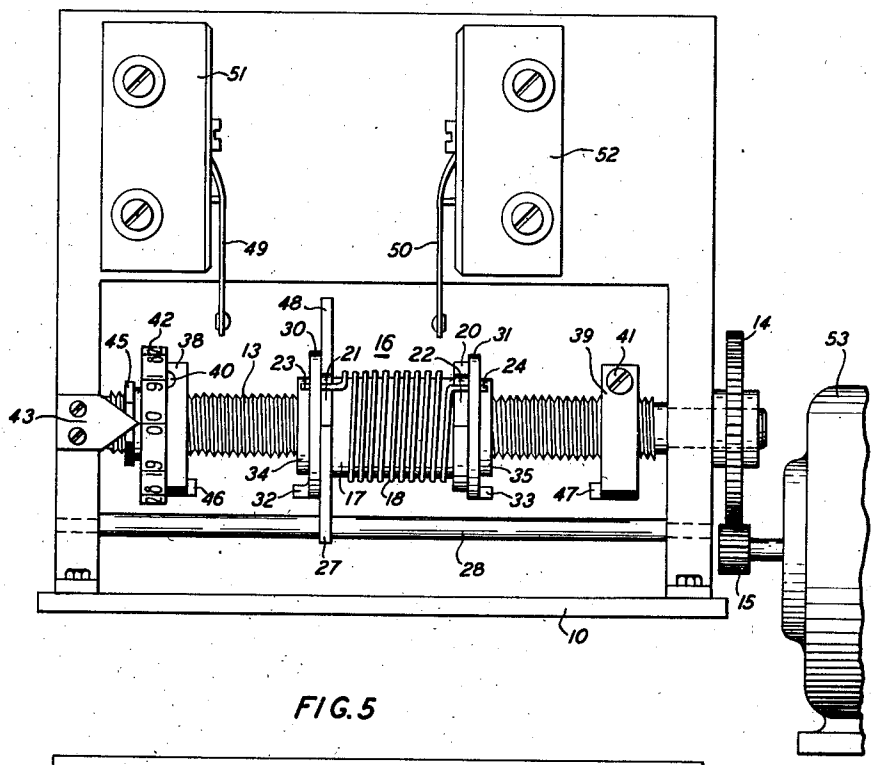

FIG. 5

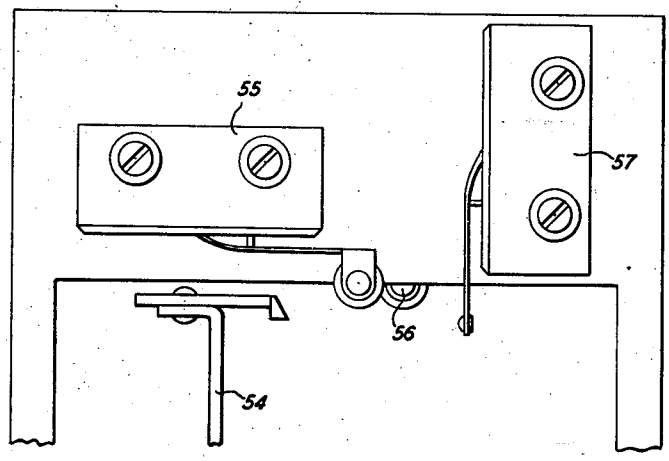

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FIG. 6

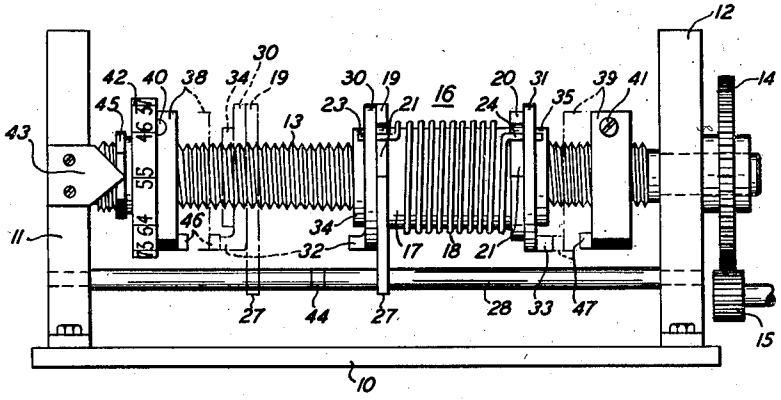
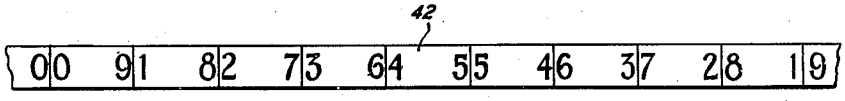


FIG. 7



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UNITED STATES PATENT OFFICE

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MECHANICAL STOP DEVICE

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6 Claims. (Cl. 192—143)

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This invention relates to mechanical stop devices and more particularly to a mechanical device for stopping the rotation of shafts.

The object of the present invention is to provide an improved means for stopping the rotation of a shaft in accordance with a predetermined program or setting.

A feature of the invention resides in the use of a single spring means in the stop device for cushioning the stopping action of a traveler positioned on a rotatable threaded shaft.

Another feature of the invention is the provision of an adjustable means for controlling the operation of the traveler within prescribed limits.

A further object of the invention is the provision of means on the traveler for controlling the operation of electrical switches associated therewith.

The device of this invention provides a means whereby a gradually increasing spring load, provided by a single helical spring, may be applied to a rotatable member in accordance with a predetermined program or setting. For example, the device may be used in gradually stopping the rotatable shaft of a potentiometer or the like to which it is operatively connected, before the wiper contact of the potentiometer operated by the shaft of the potentiometer, nears the end of a resistance winding or approaches a fixed stop thereon.

The invention also contemplates the control of the motor driving the shaft which in turn drives the apparatus connected thereto by not only mechanically stopping the rotation of the shaft and its associated gears, etc., but by also shutting off the electrical current to the motor and in some instances stopping the shaft and reversing the motor to cause the traveler to move in the opposite direction.

Means is also provided for indexing and predetermining the amount of travel on the threaded shaft of the traveler member mounted thereon, said means being provided with numerals thereon which may be calibrated with respect to the pitch of the threaded member and also the diameter thereof, to provide a substantially micrometer adjustment to the stop so as to limit within very close margins the amount of travel of the traveler on the threaded shaft.

The invention will be more clearly understood from the following detailed description when read with reference to the following drawings in which:

Fig. 1 is a side elevational view of the stop device of this invention;

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Fig. 2 is a view similar to Fig. 1 with parts thereof shown in cross-section;

Fig. 3 is an exploded view of the principal portion of the device shown in Figs. 1 and 2;

Fig. 4 is a side elevational view of the device of this invention, employed to control the operation of suitable electrical switches;

Fig. 5 shows a modified type of electrical switching arrangement which may be operated by the device of this invention;

Fig. 6 is a view similar to Fig. 1 except that the traveler of the device has been shifted to the right and alternative positions of the collars or stops on the threaded members are indicated by dot-dash lines; and

Fig. 7 illustrates the numbering arrangement on the dial for the fine adjustment of the collar or stop associated therewith.

Referring now to the drawings, as shown in Figs. 1, 2 and 6, there is provided a base member 10 having mounted thereon in spaced relation, a pair of supporting members 11 and 12, in which there is rotatably mounted, in suitable bearings, a threaded shaft 13. One end of said shaft extends some distance beyond the support 12 and is provided with a gear member 14 which is driven by means of the pinion 15 which may be driven in any suitable manner.

Mounted on the threaded shaft 13 is a traveler member 16 which when the shaft is rotated will traverse either to the right or to the left depending upon the direction of rotation of the shaft 13.

As shown in Fig. 2 and more in detail in Fig. 3, the traveler member 16 comprises an internally threaded sleeve member 17 in engagement with the threaded shaft 13 and is provided at each end with a reduced diameter portion to provide shoulder portions, said reduced diameter portions being provided with external threads. Located on the main body portion of the sleeve 17 is a helical spring 18 each end of which extends outwardly a short distance at right angles with respect to the convolutions of the spring. Positioned on the shoulder portions of the sleeve 17 and located on each end thereof are the washer members 19 and 20 each of which are cut away on their peripheries at 21 and 22 to provide recesses for accommodating the ends 23 and 24 of the spring 18 and to provide stops for definitely limiting the amount of travel of said spring ends, when said spring is tensioned beyond the amount initially set, which will be described more in detail later on in the specification.

The washer 19 is provided with a key-way 25 which is adapted to engage the key 26 located on

the shoulder portion of the sleeve 17 to effect mechanical connection therebetween and due to the extending bifurcated portion 27 of the washer 19, which is in engagement with the longitudinally extending rod 28, the rotation of the sleeve 17 will be prevented when the spring 18 is tensioned by turning it in a clockwise direction either initially or later on within the limits of the recesses 21 and 22 as heretofore described.

The washer 20 is provided with a plurality of key-ways 29, any one of which may be adapted to engage the opposite end of the key 26 which extends the length of the sleeve 17 and projects beyond the surface of the shoulder adjacent said washer. This permits the recess 22 to be positioned with respect to any of the apertures in the washer 31. Thus an initial tension may be applied to the spring 18 by locating the end 24 of the spring 18 in any one of the apertures in the washer 31 while the other end 23 of the spring 18 is located in one of the apertures in the washer 30.

Inasmuch as the end 23 of the spring 18 is in engagement with one of the apertures in the washer 30, the spring may be initially tensioned by rotating the washer 20, locating the end 24 in the proper aperture in the washer 31 and positioning the washer 20 on the shoulder of the sleeve 17 with one of the desired keyways 29 in engagement with the end of the key 26 adjacent said washer 20.

The washers 30 and 31 are each provided with extending ear portions 32 and 33 and are held in intimate contact with the washers 19 and 20 by means of the threaded collars 34 and 35 which pass through the bores of the washers 30, 19 and 20, 31 thereby threadedly engage the reduced diameter portions 36 and 37 of the sleeve 17 and firmly clamp the component parts of the traveler unit 16 together.

Located on the threaded shaft 13 on each side of the traveler member 16 are the internally threaded slotted nuts 38 and 39. These nuts act as stop members for the traveler 16 and may be positioned along the shaft 13 by simply loosening the set screws 40 and 41, which pass through the slotted portion thereof, rotating the nuts with respect to the shaft which will cause them to travel either to the right or the left and then locking them to the shaft by tightening the set screws 40 and 41 which causes the nuts to firmly grip the threaded shaft due to their slotted configuration.

It will be observed that the nut 38 has associated therewith a dial member 42, which has associated with it a pointer 43. This arrangement provides an indexing means for obtaining a predetermined setting of the nuts 38 and 39 with respect to the traveler 16 which has associated therewith an initial setting scribe mark 44 located on the shaft 28 which is intended to register with the end of the bifurcated portion 27 of the traveler 16. Thus when the traveler arm 27 coincides with the scribe mark, the nut 38 may be positioned with respect thereto and the dial 42 firmly clamped thereagainst by means of a nut 45.

Each of the nuts 38 and 39 is provided with lugs or bosses 46 and 47 which are adapted to engage the ears 32 and 33, respectively, on the washers 30 and 31 depending upon the direction of travel, when the traveler 16 has reached the end of its travel, which will cause the traveler to stop with a cushioning effect due to the tensioning of the spring 18, the action of which will be

hereinafter described with respect to the operation of the device.

In Fig. 4 there is shown mounted on the traveler 16 a projecting arm 48 which is adapted to engage arms 49 and 50 of the micro switches 51 and 52. These switches may be utilized to control any desired electrical circuit, for example, they may be used to control the operation and direction of rotation of the driving motor 53.

In Fig. 5 there is shown an arrangement wherein an arm 54 mounted on the traveler will engage in a definite sequence of operation the micro switches 55, 56 and 57. These switches may be connected to any electrical circuit wherein it is desired to control electrical apparatus in a definite sequence of operation.

In the operation of the device as heretofore described, the arm 27 of the traveler 16 is set at the scribe mark 44 on the shaft 28. This indicates that the traveler 16 is substantially centrally located with respect to its travel either to the right or to the left. The next step after it has been determined the distance the traveler is to travel in each direction, to perform the function desired, is to loosen the set screws 40 and 41 of the nuts 38 and 39. The loosening of these set screws will permit the nuts to be moved along the shaft 13 to the desired position where they are secured against movement by tightening the set screws 40 and 41. The dial 42 associated with nut 38 is then moved up into engagement therewith and secured thereagainst by means of the nut 45 with the pointer 43 registering with the 00 mark on the dial.

Thus when the shaft 13 is rotated the traveler 16 will traverse the shaft. For example, when the shaft is rotated clockwise it will cause the traveler 16 to move to the right. When the lug 33 on the traveler 16 engages the lug 46 on the rotating nut 39, it will cause the spring 18 to be wound up or further tensioned inasmuch as the washer 31 which carries the lug 33 will be caused to rotate in a clockwise direction. This will cause the end 24 of the spring 18 which is located in one of the apertures in said washer to travel clockwise and further tension the spring 18. The limit of travel of the end 24 of the spring 18 is controlled by the recess 22 which is approximately one-quarter of the circumference of said washer. This action of the spring end 24 moving approximately 90 degrees gradually increases the torque on the shaft 13 through the sleeve 17 and its associated parts until the rotation of the shaft is stopped.

In a similar manner when the shaft 13 is rotated counterclockwise the lug 46 on the nut 38 will engage the lug 32 on the washer 30 and the sequence of operation described above with respect to the clockwise rotation of the shaft will likewise occur at this time.

The initial tension of the spring 18 may be set as desired by means of the washer 20 and the apertures in the washers 30 and 31. This initial tension is important since the initial tension and the build-up of the spring has to be considered with respect to the kinetic energy of the system which has to be stopped.

While we have shown and described herein the preferred embodiment of our invention it is to be understood that various changes and modifications may be made therein without departing from the spirit of the invention and we only intend to be limited by the scope of the appended claims.

What is claimed is:

1. A device for mechanically stopping the rotation of a shaft which comprises supporting means, a threaded shaft journaled therein, means connected to said shaft for imparting a rotating motion thereto, a traveler member threadedly mounted on said shaft and movable longitudinally therealong by the rotating motion thereof, stops on said shaft for limiting the amount of longitudinal movement of said traveler, and shock-absorbing means on said traveler engageable with said stops for cushioning the stopping action of said traveler.

2. A device for mechanically stopping the rotation of a shaft which comprises supporting means, a threaded shaft journaled therein, means connected to said shaft for imparting a rotating motion thereto, a traveler member threadedly mounted on said shaft and movable longitudinally therealong by the rotating motion thereof, adjustable stops on said shaft for limiting the amount of longitudinal movement of said traveler, and adjustable shock-absorbing means on said traveler engageable with said stops for cushioning the action of said traveler.

3. A device for mechanically stopping the rotation of a shaft which comprises supporting means, a threaded shaft journaled therein, means connected to said shaft for imparting a rotating motion thereto, a traveler member threadedly mounted on said shaft and movable longitudinally therealong by the rotating motion thereof, stops on said shaft for limiting the amount of longitudinal movement of said traveler, and shock-absorbing means on said traveler including a helical spring and engageable with said stops for cushioning the stopping action of said traveler.

4. A device for mechanically stopping the rotation of a shaft which comprises supporting means, a threaded shaft journaled therein, means connected to said shaft for imparting a rotating motion thereto, a traveler member threadedly mounted on said shaft and movable longitudinally therealong by the rotating motion thereof, stops on said shaft for limiting the amount of longitudinal movement of said traveler and shock-absorbing means on each end of said traveler including a single helical spring and engageable with said stops for cushioning the stopping action of said traveler.

5. A device for mechanically stopping the rotation of a shaft which comprises supporting means, a threaded shaft journaled therein, means connected to said shaft for imparting a rotating motion thereto, a traveler member threadedly mounted on said shaft and movable longitudinally therealong by the rotating motion thereof, adjustable stops on said shaft for limiting the amount of longitudinal movement of said traveler, adjustable shock-absorbing means including a helical spring on said traveler engageable with said stops for cushioning the stopping action of said traveler, switches adjacent said traveler, and an arm on said traveler, engageable with said switches for controlling the opening and closing thereof.

6. A device for mechanically stopping the rotation of a shaft which comprises supporting means, a threaded shaft journaled therein, a motor connected to said shaft for imparting a rotating motion thereto, a traveler member threadedly mounted on said shaft and movable longitudinally therealong by the rotating motion thereof, adjustable stops on said threaded shaft for limiting the amount of longitudinal movement of said traveler, adjustable shock-absorbing means including a helical spring on said traveler engageable with said stops for cushioning the stopping action on said traveler, switches adjacent said traveler and an arm on said traveler engageable with said switches for controlling the operation of said motor.

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