Nov. 7, 1939. P. F. K. ERBGUTH 2,178,538

INSTRUMENT SPRING LINK MOVEMENT

Filed Nov. 26, 1937

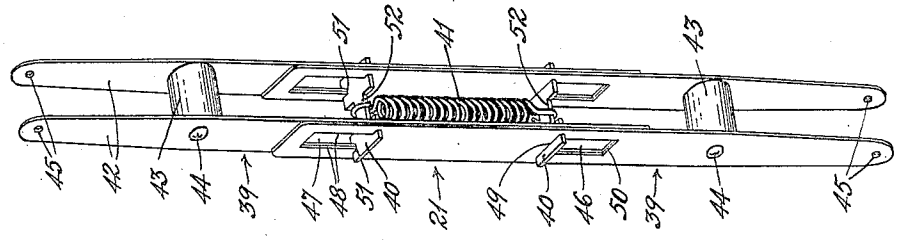


Fig. 3.

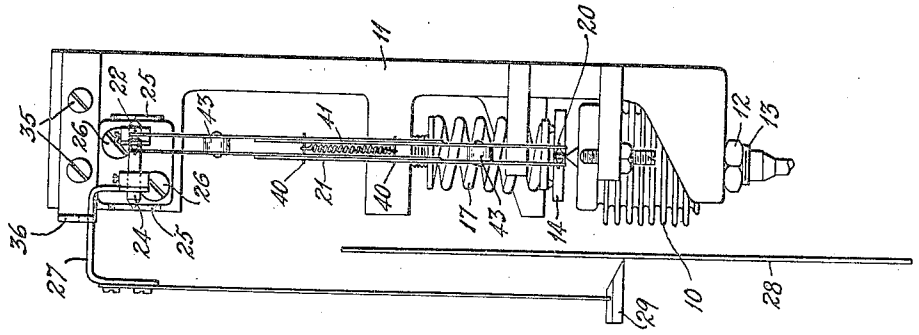


Fig. 2.

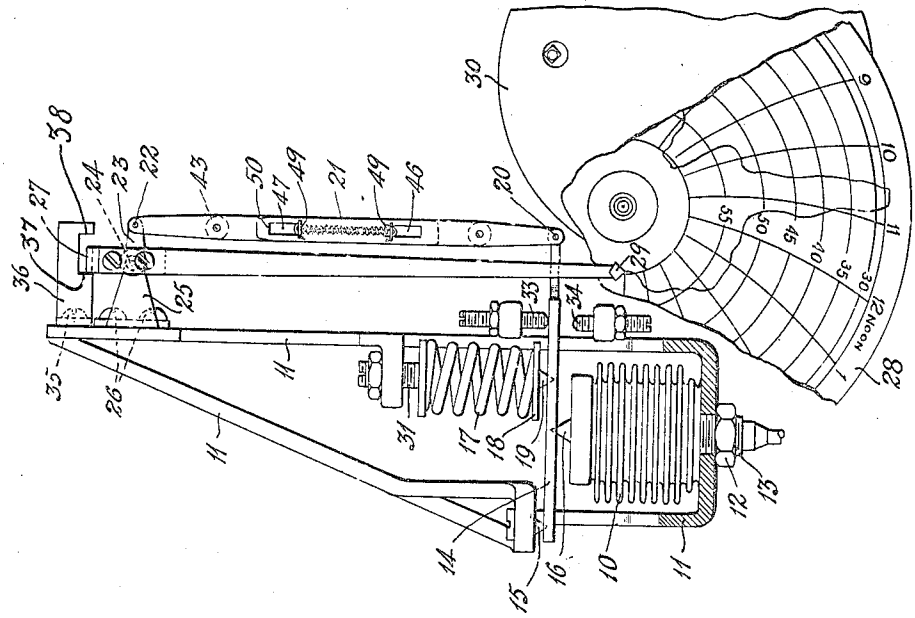


Fig. 1.

WITNESS

Ed S. Smith, Jr.

BY

INVENTOR

Paul F. K. Erbguth

Wilson & Schrenk

ATTORNEY

Patented Nov. 7, 1939 2,178,538

UNITED STATES PATENT OFFICE

2,178,538

INSTRUMENT SPRING LINK MOVEMENT

Paul F. K. Erbguth, Brooklyn, N. Y., assignor to Charles J. Tagliabue Mfg. Co., Brooklyn, N. Y., a corporation of New York

Application November 26, 1937, Serial No. 176,675

7 Claims. (Cl. 74—579)

The present invention relates to a spring linkage mechanism. It particularly relates to such a mechanism in a precision instrument for indicating, recording or controlling the value of a variable wherein a driving member is automatically maintained in correspondence with the variable over a wider range than that of a driven member, which is, e. g., a marking member movable over a range only slightly greater than that of the recording chart.

Precision instruments have a common problem: that of keeping to a minimum the weight and mass of the driven member and its friction while at the same time providing a powerful driving member which exerts large forces per unit departure from correspondence with the variable. The main object of the present invention is the provision of a spring link connecting the driving and driven members which protects the delicate member from injuriously large forces in either direction whether these be due to the driving member, in case of sticking of the driven member for any reason, or from careless manual manipulation of the driven member as, e. g., accidently striking the marking pen while changing charts on a recorder.

A related object is the provision of such a link having a normal fixed length which is maintained with great exactness in the presence of any usual operating forces existing between the driving and driven members and yet which can alter its length within reasonable limits upon the presence of any unusually large force which would otherwise result in damage to the driven member.

Further objects of the invention are the lightening and lowering of the cost of such a spring link by suitable construction which also makes use of inexpensive parts, most of which occur either in duplicate or quadruplicate in a given link with a considerable resultant reduction in the cost of the tools, jigs and fixtures required in their manufacture. The use of parallel thin plates, with suitable guiding floating and spacing elements is both novel and highly advantageous in lightening such a link while still retaining to a surprising extent its desired normal rigidity.

One object of the invention is the provision of resilient means cooperating with the floating elements to bias the several relatively displaceable portions of the link into a normally abutting position, and a particular object is the provision for this purpose of a single tension spring, the lightest possible resilient means.

Still a further object is the provision of such a spring link in which the biasing force increases from an appreciable value for the normal fixed length upon either increasing or decreasing the length therefrom.

Another object is the provision of such a link with two pairs of abutting portions, both pairs of which normally abut, and only one pair of which is effective upon an increase and the other upon a decrease of length from the normal.

A specific object is the provision, in a spring link, of apertures having parallel longitudinal edges cooperating with the floating spring-tensioned elements and abutting end edges which limit the length to the normal fixed length in one direction and to extreme fixed lengths as the minimum and maximum that are required.

These and other objects of my invention will appear to those skilled in the art from the accompanying figures and specification, in which are illustrated and described several embodiments of the invention. It is my intention to claim all that I have disclosed which is new and useful.

In the figures, wherein like characters indicate like parts thereon: Fig. 1 is a broken front elevation of a recorder movement embodying the present invention; Fig. 2 is a broken side elevation thereof; and Fig. 3 shows in perspective the spring link of the present invention.

The recorder movement, shown by way of illustration rather as in any way defining the scope of the invention, is in general that disclosed in U. S. Patent 2,096,179 for an Instrument link movement granted to Lawrence C. Irwin and assigned to Charles J. Tagliabue Mfg. Co., the owner of the present invention. The portion of the following description which applies to the recorder mechanism is liberally copied from the above-mentioned patent.

As shown in Figs. 1 and 2, a metallic bellows 10 is securely fastened to a support or frame 11 by means of a nut 12 mounted upon a threaded hollow stem 13 projecting from the bottom of the bellows and passing through a suitable opening in the frame. A lever 14 is hinged upon a pivot composed of a pair of screws 15 having pointed ends engaged by the lever, the latter being urged upwardly by means of a lug 16 fixed to the upper portion of the bellows. This movement is opposed by a spring 17 which rests upon a plate 18 provided with a pointed projection 19 bearing upon the upper face of the lever. The right-hand end of lever 14, which is the motion-transmitting, or driving, member of the sensitive system and which is positioned in correspondence with the value of the condition to be observed, recorded,

or controlled, is provided with pivots 20 with which is pivotally connected spring link 21 whose upper end is similarly pivotally connected with pivots 22 of a rocker arm 23 mounted for oscillation upon a shaft 24 journalled in the horizontally disposed arms 25 of a U-shaped bracket secured to the main frame 11 in any suitable manner, as by screws 26. The rocker arm 23 is the element of the translating system which is driven by or through the motion of the lever 14 of the sensitive system. The member 23 is of sheet metal. Also attached to the shaft 24 is arm 27 of inverted U-shape (which extends around the edge of the chart 28 when this is of large size) and has attached thereto marking pen or stylus 29 which engages the chart (see Fig. 2). The chart is mounted upon a plate (not shown) which is rotated in known manner by clock mechanism 30.

The pressure of spring 17 may be adjusted by screw 31. By proper rotation of the screw, the spring may be set to a definite point, indicated by pen 29 on chart 28, e. g., corresponding to the temperature of a thermostatic bulb (not shown) which is located at a place whose temperature is being measured or recorded. Two stops in the form of adjustable screws 33 and 34 are mounted upon frame 11 and adjusted to limit the movement of pen 29 to a range considerably in excess of that of the chart.

Affixed by screws 35 to base 11 is arm 36 which is provided with stops 37—38 which are abutted by arm 27 at positions of pen 29 which are slightly outside the limits of the graduations of chart 28. These limits are somewhat smaller than the range of driving member 14 set by its limit stops 33—34. Where the recorder is for a suppressed range, there is generally considerable difference between the ranges permitted by limit stops 33—34 for driving member 14 and limit stops 37—38 for driven member 27. Such a difference may be required, e. g., where the driving member may operate alarm contacts (not shown) which lie considerably outside of the recording range.

Referring to Fig. 3, spring link 21 is composed of two relatively movable means 39, a pair of floating elements 40 adapted to normally abut both of means 39, and a resilient tension spring 41 connecting floating 40, and arranged to bias movable means 39 to abut floating elements 40 as long as only the usual small operating forces act to then provide a fixed normal length. Each relatively movable means 39 comprises two flexible plates 42 held in parallel spaced relation by block 43 having riveting stud ends 44 which secure block 43 and plates 42 in a fixed relation. Each plate has round bearing hole 45, for its pivot 20 or 22, near its outer end, aperture 46 near its inner end and aperture 47 at a definite distance away from both hole 45 and aperture 46. Both apertures form identical rectangles and have edges 48 parallel with each other and with the longitudinal line between the centers of bearing holes 45, and inner transverse edges 49 and outer transverse edges 50. Floating elements 40 have guiding slots 51 which are slightly wider, e. g. 0.003", than twice the thickness of each plate 42, and slightly less, e. g., approximately 0.001", total clearance between the bottom of slots 51 and edges 48 of apertures 46—47. Each floating element 40 is also provided with a pair of slots 52 centrally located between slots 51 for the purpose of centrally locating spring 41 so that it clears plates 42 when link 21 is assembled. Tension spring 41 is provided with conventional hookends which are detachably connectable to floating elements 40 in their slots 52 and has a free length of less than the distance between apertures 46—47, e. g., 60%. This relative free length puts an appreciable tension on spring 41. The length of aperture 46 or 47 is a small fraction, e. g., 40%, of the space between them with the result that spring 41 can be stretched to only slightly more than twice its free length, an amount which is safely less than that which could produce a "set" of spring 41 which is preferably made of steel music wire closely wound in a helix having an outside diameter of approximately seven times its diameter, its hooked ends being substantially parallel. The outside of the helix has, e. g., approximately 0.004" radial clearance from the inner walls of plates 42, an amount found ample in practice.

Spring link 21 is easily assembled as follows after all parts have been finished to remove all burrs: a pair of plates 42 is riveted to its spacing block 43 by rivet ends 44 with bearing holes 45 in accurate alignment. Two of these assemblies, each forming relatively movable means 39, are put in their proper unsymmetrically overlapping position and with the apertures aligned. A floating element 40 is inserted in each pair of apertures and twisted and moved into its normal position abutting inner transverse edges 49 of the apertures. Tension spring 41 is then hooked onto floating elements 40 in their central slots 52. Bearing holes 45 near each end of spring link 21 cooperate with pivots 20 and 22 as in the above-mentioned patent, while spring link 21 at the same time serves to protect driven member 23 from injuriously large forces: a considerable advance in the art.

The terms and expressions which I have employed are used as terms of description and not of limitation, and I have no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described and portions thereof, but recognize that various modificaitons are possible within the scope of the invention claimed. While a tension spring, as described, is preferably used, it would be apparent, to one skilled in this art, that a compression spring, or even a weight, would be an equivalent; however, in precision instruments, the spring is lighter and hence is more suitable than a weight. It would also fall within the broad teachings of the present disclosure to use a plurality of springs instead of a single spring, although the use of the single spring is preferable in the particular construction disclosed herein.

I claim:

1. In an indicating, controlling or recording instrument having a mechanism sensitive to changes in a physical condition and thus generally subjected to almost constant movement, the combination with a driving movable member, arranged to partake of the movement of said sensitive mechanism, and a driven movable indicating, controlling or recording member, a connection between said driving and driven members comprising two relatively displaceable means each having a portion adapted to be pivotally connectable to its respective member, a pair of floating elements each adapted to abut both of the displaceable means, and a tension spring operatively connecting said floating elements for biasing said elements into such abutting relation; all adapted and arranged to maintain a fixed length between said displaceable element connecting portions in

the presence of any smaller force between said driving and driven members than that required to overcome the biasing force of the spring to destroy such abutting relation.

2. A link, for connecting driving and driven members, comprising a pair of relatively displaceable means, a pair of floating elements, and a tension spring operatively connecting said floating elements to normally bias them into abutting relation with said displaceable means; each displaceable means comprising a pair of substantially identical plates and a connecting block affixed to said plates to maintain them substantially parallel at a fixed distance apart, the outer end of each plate being adapted to be pivotally connectable with its respective driving or driven member, and another portion of each plate being provided with two slotted apertures, each aperture having its edges parallel with each other and with the longitudinal axis of the link between the pivotal connections, and the inner and outer ends of each aperture being shaped to abut its respective floating element; said floating elements being substantially identical flat plates and each such element having a plurality of slots on its outside edge which are adapted and arranged to guide each of the plates by the parallel edges of its said apertures, and each floating element also having a central portion; said tension spring having its ends adapted to be detachably securable to the central portion of each of said floating elements, and having a free length of less than the distance between the inner ends of said apertures, whereby the spring is under appreciable tension in the normal position in which said displaceable means abut said floating elements.

3. In a device having a driving member, a driven member, and a link pivotally connecting each of said members, said link comprising, in combination, two pairs of substantially identical thin plates, each plate having two longitudinally spaced apertures each with side edges parallel to a line between the pivoted connections and with an inner end edge and an outer end edge, each pair of plates being spaced parallel and substantially equal distances apart, a pair of floating elements each adapted to abut the end edges of each of the said apertures and to slidingly coact with each of the side edges of said apertures to constrain the plates to move only slidably in the direction of said line, and a spring operatively connecting said floating elements to bias said elements into normally abutting relation with each of the inner end edges of said apertures.

4. A link for pivotally connecting a driving and a driven member and including in combination, two relatively movable pairs of substantially identical members, and means for continuously biasing said pairs to provide a fixed normal length of said link, each member having two portions both of which portions are adapted and arranged relative to said means to be normally abutted by said means, said members and said means being so constructed and arranged that one of said portions of each member is abutted by said means upon a lengthening and the other of said portions of each member upon a shortening of the length of said link from its normal length.

5. The link set forth in claim 2, in which the central portion of each floating element is centrally notched for detachably engaging its spring-end.

6. In combination, a pair of substantially identical displaceable means which are relatively movable within limits, a pair of substantially identical floating elements, and a spring operatively connecting said floating elements to continuously bias the latter toward abutting relation with said displaceable means; each displaceable means comprising a pair of substantially identical plates secured together to be similarly disposed and substantially parallel at a fixed distance apart, each plate being provided with an aperture for each of said elements elongated in the direction of relative motion of said means and each aperture having inner and outer ends for abutting its element; said elements and said means being adapted and arranged to cause said elements to abut like ends of all apertures with said means in their normal relationship, to abut only the said end of one aperture in each plate when the relationship is changed in one direction and to abut only the said end of the other aperture in each plate when the relationship is changed in the other direction within said limits, and to also abut the other end of the opposite aperture at said limit.

7. In combination, a pair of substantially identical means which are relatively slidably movable from a normal relation within limits, a pair of floating elements, and a means for operatively connecting said elements to continuously bias the latter toward abutting relation with said displaceable means; each displaceable means comprising a pair of similarly disposed and substantially identical plates, each plate being provided with an aperture for each of said elements having clearance in the direction of relative motion of the first named means and each aperture having an inner end for abutting its element, and said elements and first named means being adapted and arranged to cause said elements to normally substantially abut all eight of such aperture ends when the relation of said first named means is normal and to substantially abut only four of said ends when such relation departs from normal.

PAUL F. K. ERBGUTH.