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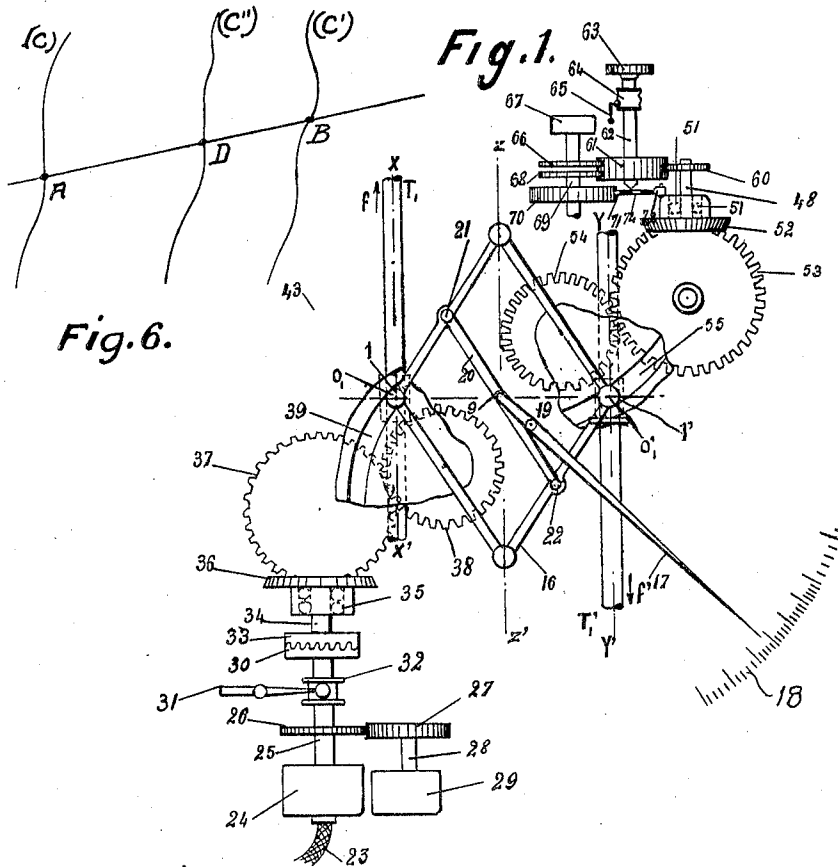
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DEVICE FOR PRODUCING A MOVEMENT FOLLOWING A LOGARITHMIC LAW

Filed Dec. 30, 1927

2 Sheets--Sheet 1



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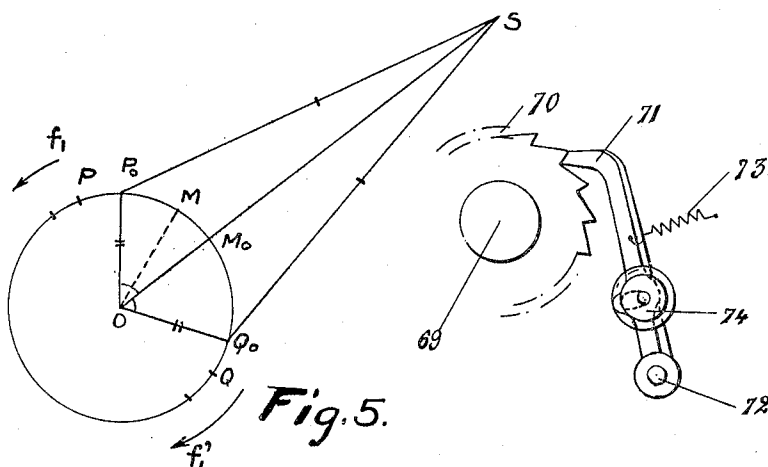


Fig. 2.

Fig. 5.

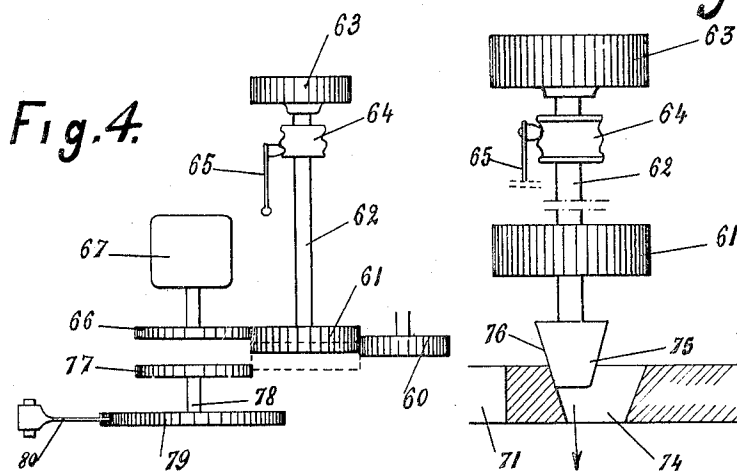


Fig. 4.

Fig. 3.

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DEVICE FOR PRODUCING A MOVEMENT FOLLOWING A LOGARITHMIC LAW

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It is known in the art to build apparatus which give in a continuous manner the quotient of two functions, for instance the mean speed indicator of a vehicle in a manner such that the relative error in the data given out by the apparatus is substantially constant.

Now our invention has for its object an improved apparatus of the above described type of an easy and cheap construction, wherein the play is reduced to a minimum with a view to increase the accuracy of the apparatus, the bulkiness of said apparatus remaining very small.

On appended drawings we have shown by way of example several forms of application of our invention more particularly as adapted to a mean speed indicator.

Fig. 1 gives a general view of a form of execution of an apparatus such as a mean speed indicator according to our invention.

Figs. 2 and 3 show the arrangement for setting the apparatus back to zero.

Fig. 4 is a modified form of the arrangement shown on Figs. 2 and 3.

Figs. 5 and 6 illustrate diagrammatically two more general embodiments of the principle underlying the form of execution shown in Fig. 1.

Fig. 1 is a general diagrammatical view of an apparatus wherein $\log. u$ and $\log. v$ are both given by a cam. If the apparatus is a mean speed indicator, u and v are respectively the distance covered and the time elapsed. The principle of this apparatus is as follows.

A parallel motion 16 moves in such a manner that two opposite apices 1 and 1' move along two parallel lines X'X and Y'Y. It is easy to prove that the center S of the parallel motion moves along a line Z'Z parallel to the former lines and disposed at an equal distance from both. Besides if starting from the position shown on the figures, point 1 moves by x in the direction of the arrow f and point 1' by y in the direction of the arrow f' , the center S moves along Z'Z by a distance from its original position equal to

$$\frac{x-y}{2},$$

which distance may be given out by the

needle 17 moving in front of the dial 18 and secured to a lever 19 one extremity of which is controlled by the center S of the parallel motion. To make this center tangible a bar 20 is pivotally secured to the centers 21 and 22 of two opposite sides of the parallel motion 16. The middle of this bar 20 is the center of the parallelogram. It should be noted moreover that the parallel motion may be reduced to the bar 20 and the half bars 1—21 and 22—1' forming part of the parallel motion 16. It may most generally be replaced by any suitable pivoted link arrangement of the parallelogram or counter parallelogram type.

If in particular the slide 1 is moved along X'X in the direction of the arrow f by amounts proportional to the logarithm of the distances u travelled and if the slide 1' is moved along Y'Y in the direction of the arrow f' by amounts proportional to the logarithm of the time t elapsed, the movements of the center S shown by the amplifying needle 17 are equal to

$$\frac{k \log. u - k \log. t}{2} = \frac{k}{2} \log. \frac{u}{t}$$

and the graduations of the dial 18 may be adapted to give at every moment

$$\frac{u}{t},$$

that is the mean speed.

This being understood, we will now describe the control of the slide 1 giving $\log. u$. A flexible shaft 23 is driven by the vehicle and engages the reducing gear 24 which controls a shaft 25 to which is secured a pinion 26. The latter meshes with a second pinion 27 the axis 28 of which enters the ordinary speedometer 29. The shaft 25 rotates together with the clutch 30 adapted to slide along it under the action of the fork 31 controlling the rings 32 secured to the clutch. This clutch can thereby engage a second clutch 33 secured to the spindle 34 which is urged by a spring 35 to rotate in a certain direction and thus to return to zero as explained hereinafter; to the shaft 34 is secured a pinion 36 meshing with the pinion 37 meshing in its turn with the pinion 38. The

latter is secured to a cam of which the groove 39 alone is shown. This groove is such that it gives the slide 1 a logarithmic displacement from the starting point O_1 onwards.

When the driver wishes to set the space slide back to zero he acts through the fork 31 on the clutch 30 so as to disengage it. The spindle 34 will consequently rotate under the action of the spring 35 and return the whole gearwork controlling the slide 1 to its original position against its normal working direction whereby the slide 1 is returned to zero.

The time slide 1' may be driven in a similar manner by a clockwork.

On the example shown however, we have supposed that instead of taking the driving force from the clockwork itself, the said clockwork is given only a regulating or braking part, the spring 51 corresponding to spring 35 on the space side of the apparatus being adapted to drive the time cams through their shaft 48.

Fig. 5 shows a modified form of the preceding arrangement giving out the difference of two logarithms. The points P and Q corresponding to slides 1 and 1' instead of moving along two parallel lines X'X and Y'Y in the direction of the arrows f and f' by amounts proportional to $\log. u$ and $\log. v$ move along a same circle (or it may be two superposed circles) the center of which is at O, in the direction of the arrows f_1 and f'_1 respectively, starting from the initial positions P_0 and Q_0 . If as in the precedent case, the middle M of PQ (or M_0 of P_0Q_0) is jointed to point O, the angle between OMS and its original position OM_0S_0 will be equal to the half-difference between the arcs P_0P and Q_0Q through which the slides P and Q have moved. This angle will thus be adapted to give out the desired antilogarithm on a suitable scale.

In this case as in the preceding case the geometrical construction disclosed can be materialized for instance as hereinabove by a four-sided link arrangement OP S of which the apex S is formed by a part sliding over a rod figurating O M S. It should be noted that the above disclosed devices are particular forms of execution of monograms in which alined points are used. If a point A (Fig. 6) describes a curve C according to a given function $f(v)$ of a variable v and if the point B describes a curve X' according to a certain function $g(u)$ of another variable u , a point D in alinement with points A and B may describe a curve C'' giving at each moment

$$\frac{u}{v}$$

Our invention comprises all forms of execution based on the principle of monograms giving the desired value through such a method of alined points.

In a modification, instead of the clockwork

acting directly on its cam, said clockwork is given only a regulating or braking part to play, whereas the spring 51 drives the corresponding cam; when working, this spring which has been previously tensioned, slackens and places the slide 1'. When the apparatus is to be set back to zero, the driver bringing the slide back to zero, tensions the spring again. A similar arrangement may be used for the distance slide 1.

To the shaft 48 driving the cam arrangement controlling the time slide 1' is keyed a pinion 60. This pinion 60 serves to transmit the regulating movements of the clockwork when required and to allow the winding up of the spring 51 while the slide 1' is being returned to zero. In view thereof the pinion 60 meshes with the pinion 61 secured to shaft 62 which shaft is provided with the control knob 63 disposed next to the driver's hand. This shaft 62 shows an enlargement 64 against which bears the spring cam 65. The pinion 61 meshes besides on one hand with the pinion 66 controlled by the clockwork or spring motor 67 through the agency of an escapement not shown. It meshes on the other with the pinion 68 secured to the shaft 69 to which is keyed the ratchet wheel 70 (Fig. 2). The ratchet wheel is engaged by a catch 71 pivoting round a spindle 72 and urged by the spring 73. The arm of this catch is provided with a conically shaped aperture 74 (Fig. 3) adapted to be engaged by the conical end 75 of the rod 62. The working is as follows:

The wheel 70 is normally released from the spring urged catch 71 and rotates freely. To bring the slide 1' to O'_1 , the driver pushes down the knob 63 so as to lower the rod 62. One of the sides 76 of the conical end of this rod acts on the aperture 74 of the catch and pushes the latter so as to make it engage the wheel 70. But simultaneously, the pinion 61 disengages the pinion 66 while remaining in gear with the pinions 60 and 68. Through the arrangement of the ratchet wheel 70 and its catch 71, the pinion 60 cannot move any more in the direction corresponding to an advance movement of the slide 1'. On the other hand, the driver acting on the knob 63 makes the spindle 62 rotate in the only possible direction which on one hand causes the slide to return to its original position and on the other winds the spring 51 up. When this double operation has been performed, the driver draws the knob 63 upwards to set the apparatus in its normal working position; the aperture 74 is freed from the conical part 75 and the catch 71 urged by its spring 73 disengages the ratchet wheel 70, the pinion 66 reengaging the pinion 61. The spring 65 bearing on one end of the enlargement 64 keeps the rod 62 in one of its two positions.

The above described arrangement shows among others the advantage that no strain

capable of damaging the clockwork can be given when it is desired to make the teeth of a pinion come into gear.

A modified form is shown on Fig. 4. In its normal position as shown, the pinion 66 drives the pinions 61 and 60; when the rod 62 is lowered as precedently in view of bringing the apparatus back to zero, the pinion 61 meshing with the pinion 60 disengages the pinion 66 and engages the pinion 77 secured to the same spindle 78 as the ratchet wheel 79 engaged by the catch 80. The latter which prevents any rotation allowing the slide to advance allows the setting back to zero. This device is put out of gear by drawing out the rod 62. It should be well understood that the above modification of the device for setting back to zero may be applied as well to the slide relating to the distances as to the slide relating to time without it being necessary for the different slides to be provided with similar devices for their setting back to zero.

What we claim is:

1. A pivoted-link differential for subtracting two logarithms in mean speed indicators comprising four arms each of which is pivotally secured to the next through the adjacent ends of the arms considered, said elements forming a closed four-link figure, means for constraining the pivotal connection between two adjacent arms, on one hand and the two other adjacent arms, on the other, to remain on two parallel lines, a slide adapted to move each of the pivotal connections considered in opposite directions through distances proportional to the corresponding logarithms, a graduated dial, a pointer cooperating with said dial and means whereby the position of the pointer with reference to the dial is controlled by the position of the middle of the straight line connecting the pivotal connections submitted to the action of the slides.
2. A pivoted link differential system for subtracting two logarithms in mean speed indicators comprising two sets of elements of equal length, each element of each set being pivotally secured through its ends to the ends of the elements of the other set so as to form a closed four-link figure, two straight guideways, a slide adapted to move the pivotal connection between two adjacent elements along one guideway through a length proportional to one of the logarithms, a second slide adapted to move the pivotal connection between the two other adjacent elements along the other guideway in a direction opposed to that of the movement of the first mentioned pivotal connection through a length proportional to the other logarithm, a graduated dial, a pointer cooperating with said dial, a bar pivotally secured through its ends to the middle of the

two elements of one set and the middle of which controls the pointer.

3. A pivoted link differential system for subtracting two logarithms in mean speed indicators comprising two sets of adjacent elements of equal length pivoted to one another through their adjacent ends, the free end of each element of each set being pivotally secured to the free end of the corresponding element of the other set so as to form a closed four-link figure, a stationary pivot for the adjacent ends of the elements of one set, slides adapted to move the outer ends of the same elements in opposed directions through lengths proportional to the logarithms respectively, a graduated dial, a pointer, and a bar pivotally secured to the stationary pivot, slidably secured to the pivotal connection between the elements of the other set and adapted to displace the pointer over the dial.

In testimony whereof we have affixed our signatures.

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