June 28, 1938. W. B. EDDISON 2,121,773

MOTION CHECKING APPARATUS

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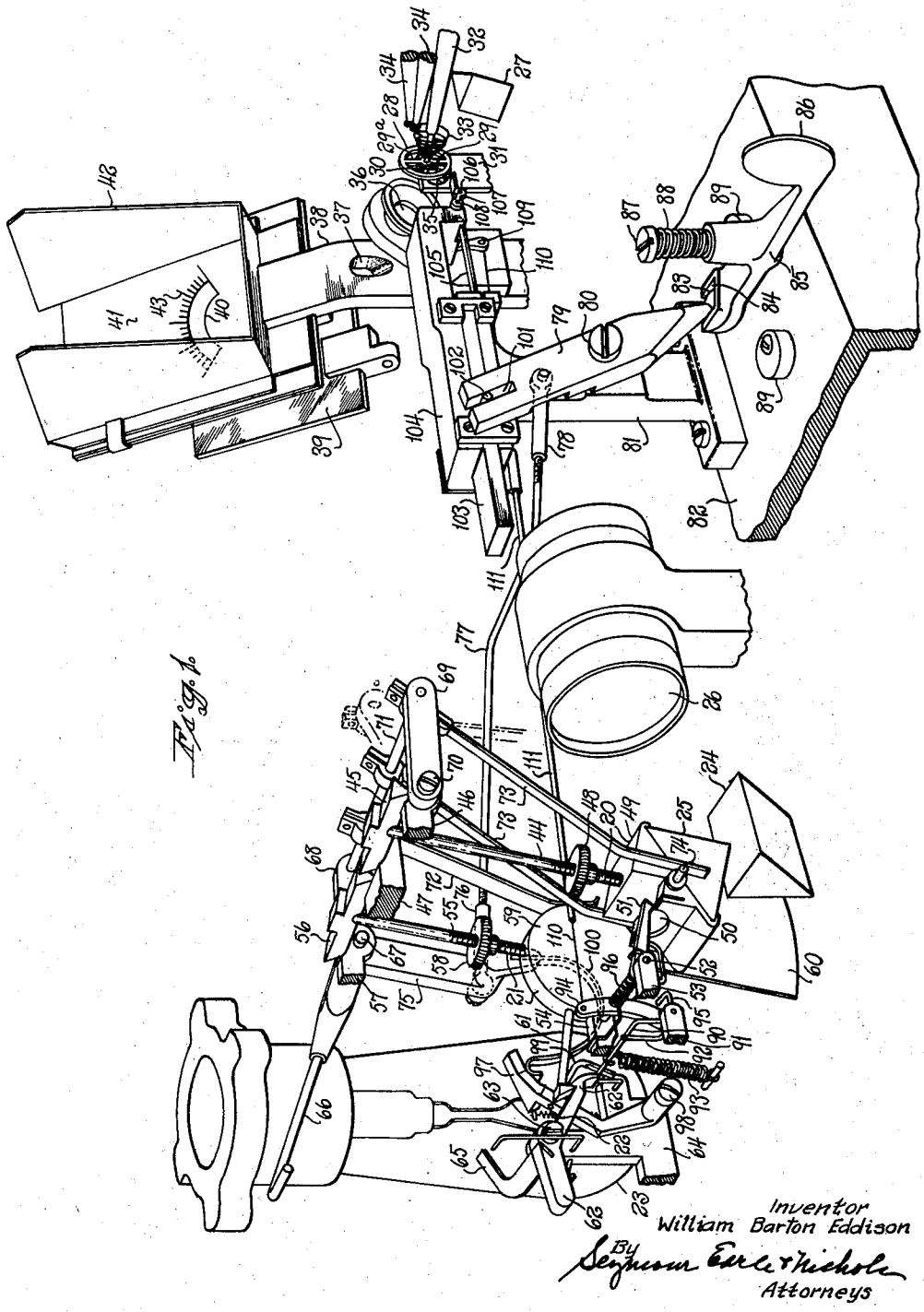


Fig. 1.

Inventor
William Barton Eddison
By Seymour Earle & Nichols
Attorneys

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Fig. 2.

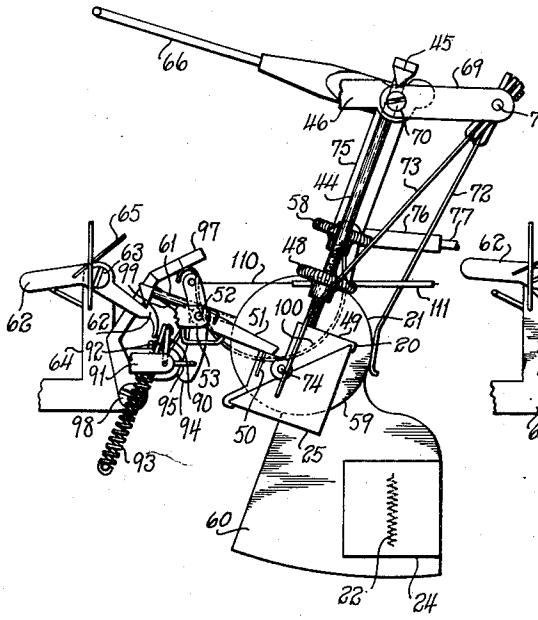


Fig. 3.

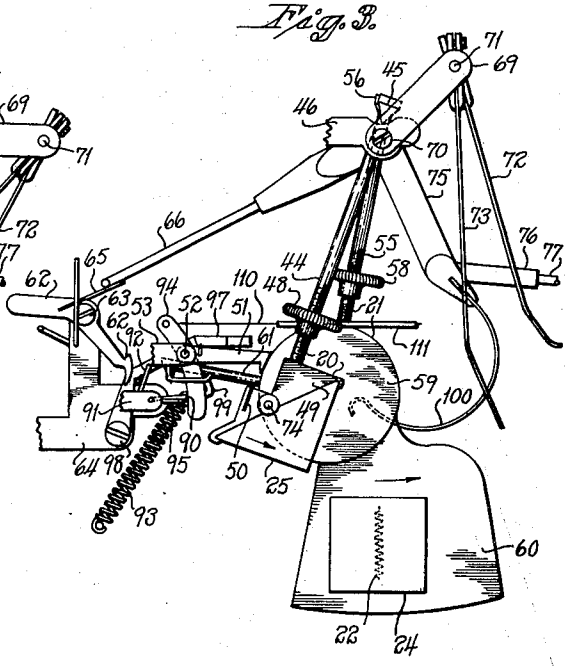


Fig. 4.

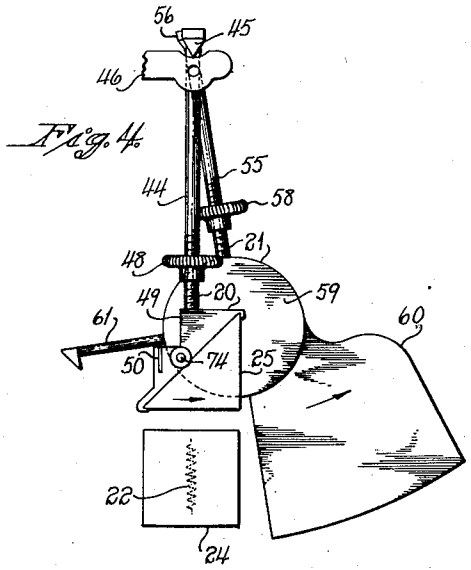
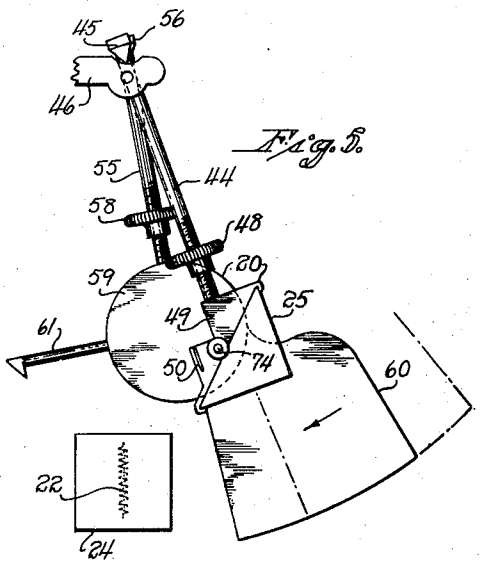


Fig. 5.



Inventor
William Barton Eddison
By Seymour Earle & Nichols
Attorneys

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Fig. 6.

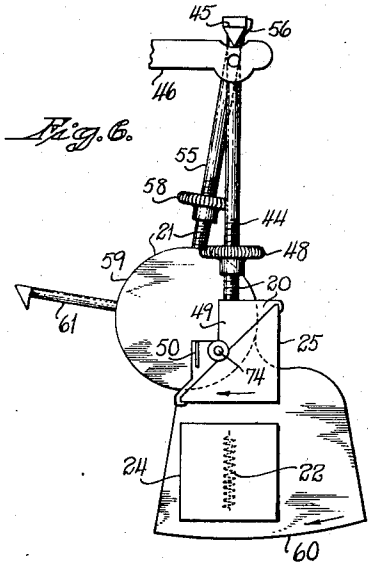


Fig. 7.

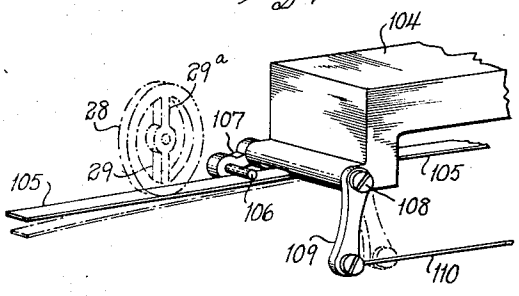
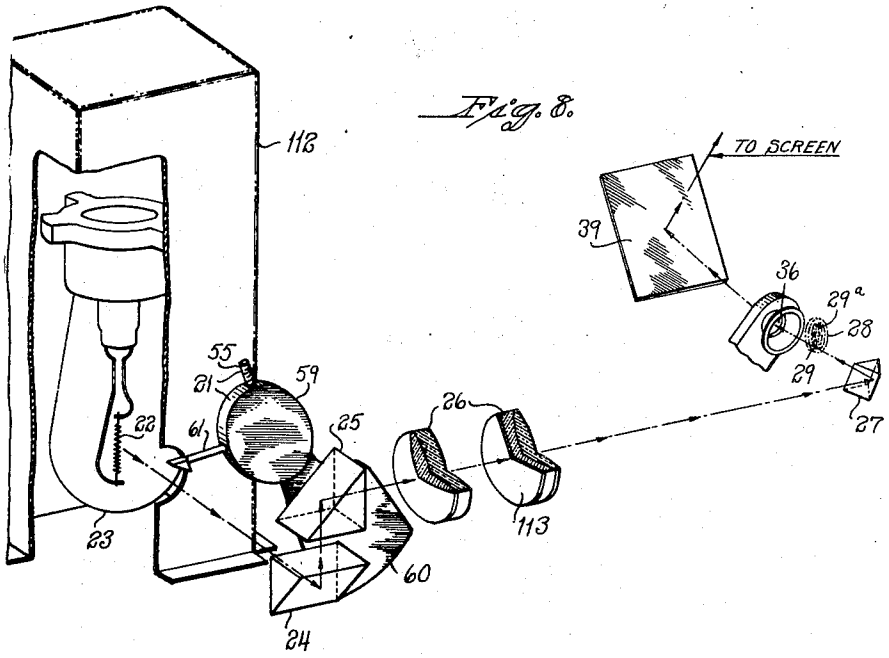


Fig. 8.



Inventor
William Barton Eddison
By Seymour Earle Nichols
Attorneys

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UNITED STATES PATENT OFFICE

2,121,773

MOTION CHECKING APPARATUS

William Barton Eddison, Ardsley on Hudson, N. Y.

Application January 30, 1936, Serial No. 61,550

29 Claims. (Cl. 73—51)

This invention relates to an improvement in motion-checking apparatus and is particularly suitable for checking the oscillatory movement of time-instrument balance-wheels, though available for other uses.

One of the objects of the present invention is to provide a superior motion-checking apparatus characterized by convenience and simplicity of use.

A further object is to provide a superior apparatus of the class referred to which is characterized by accuracy of performance.

Another object of the present invention is to provide an apparatus of the class referred to by means of which eye-strain is minimized.

A still further object is to provide a superior motion-checking apparatus which will clearly and accurately indicate whether the motion being checked is either slow or fast with respect to a predetermined standard rate.

With the above and other objects in view, as will appear to those skilled in the art from the following, considered in conjunction with the accompanying drawings and appended claims, the present invention includes all features disclosed therein which are novel over the prior art.

In the accompanying drawings:

Fig. 1 is a schematic perspective view illustrating one form which an apparatus embodying the present invention may assume, the parts being shown in position preparatory to the start of a cycle of operation;

Fig. 2 is a broken view in elevation of the two pendulums, the latching mechanism and associated parts, the pendulums being shown in their retired and latched positions;

Fig. 3 is a corresponding view but showing the shutter-pendulum as released and traveling on its advance swing and the beam-control pendulum at the instant of its release for advance swinging movement;

Fig. 4 is a view showing the beam-control pendulum in position to project a beam of light through the balance-wheel being checked and the shutter-pendulum advanced in its forward swinging movement to a point sufficient to permit the projection of the beam;

Fig. 5 is a view corresponding to Fig. 4 but showing the beam-control pendulum at the limit of its outward swinging movement and the shutter-pendulum in motion on its back swing;

Fig. 6 is a view corresponding to Figs. 4 and 5 but showing the beam-control pendulum midway of its return stroke and in position to project a beam through the balance-wheel being tested, which beam-projection is prevented by the shutter-pendulum, which is also swinging on its return stroke;

Fig. 7 is a broken detail perspective view showing the tensioning-finger engaged with the balance-wheel; and

Fig. 8 is a diagrammatic view showing the path followed by the light beam when the beam-control pendulum and the shutter-pendulum are in proper relationship with respect to each other and with respect to the other related features of the apparatus.

The embodiment of the invention herein chosen for illustration includes a beam-control pendulum generally designated by the numeral **20** and a shutter-pendulum generally designated by the numeral **21**, both of which are adapted to swing in such manner as to have effect upon light emanating from a suitable light-source such, for instance, as the filament **22** of an incandescent electric lamp **23**. When the pendulums **20** and **21** are in a proper position and relationship as will hereinafter appear, the image of the said filament **22** is received horizontally by a fixed prism **24** and deflected upwardly thereby to a beam-control prism **25** carried by the beam-control pendulum **20**. The beam received by the prism **25** just referred to, is deflected by the said prism **25** through a lens system generally designated by the numeral **26** which is interposed between the prism **25** and a fixed prism **27** which is tilted as shown in Figs. 1 and 8 to deflect the beam laterally and slightly upwardly for passage through the lower portion of a balance-wheel **28** having, as shown, two diametrically-opposite spokes **29** and **29a**.

Light deflectors in the form of prisms are preferred where shown, but it is obvious that other forms of light deflectors such, for instance, as mirrors, may be substituted therefor.

The balance-wheel **28** is rigidly mounted in the usual manner upon a balance-staff **30** which is supported at one end with capacity for free oscillation in a bracket **31** and at its opposite end in a tapered supporting-rod **32** extending substantially-axially with respect to the balance-staff **30**. Secured to the balance-shaft **30** in any approved manner is one end of a spiral so-called "hairspring" **33** which has its opposite end gripped between two coacting adjusting rollers **34—34**, as shown in Fig. 1 of the drawings.

After passing through the lower portion of the balance-wheel **28**, the beam of light deflected by the prism **27** passes through an aperture **35** in the bracket **31** and thence to a lens **36** by means of which it is focused through an aperture **37** in a screen-supporting bracket **38** upon an inclined mirror **39**. The mirror **39** or other suitable light deflector serves to deflect the beam of light received from the lens **36** forwardly and upwardly through a translucent observation segment **40** provided in an upwardly-extending rearwardly-inclined screen **41**. The said screen **41** is preferably provided with a suitable shield

such as 42 to guard against undesirable extraneous light rays, and is preferably formed of a plate of ground glass having all save its segment 40 rendered substantially opaque by suitable backing material. Arranged along the upper edge of the segment 40 of the screen 41 are a series of graduations 43 serving to assist an observer in determining whether the rate of oscillation of the balance-wheel 28 is correct or slower or faster than that desired.

Returning now to the pendulums 20 and 21, it may be stated that the same may be mounted in any approved manner to permit accurately-timed swinging movement. The beam-control pendulum 20 previously referred to includes a rod 44 secured at its upper end to a transversely-extending wedge-shaped "knife-edge" pivot-bar 45 having its respective opposite ends supported for oscillation in supporting-members 46 and 47. The lower portion of the rod 44 is externally-threaded to receive an internally-threaded weight 48 by means of which the rate of oscillation of the pendulum 20 considered as a whole may be regulated. The lower end of the rod 44 mounts a holder 49 which carries the beam-control prism 25 before referred to and which is provided in its outer face with a hardened steel insert 50 constituting a latching-abutment for engagement by the hooked outer end of a latch 51. The said latch 51 is rigidly mounted upon a rock-shaft 52 supported at its respective opposite ends in brackets 53 and 54.

The shutter-pendulum 21, while intended to operate out of phase with the beam-control pendulum 20, is designed to have the same period of oscillation as the said pendulum 20. The said shutter-pendulum 21 includes a rod 55 secured at its upper end to a knife-edge pivot-bar 56 rocking at one end on the supporting-member 47 before referred to and at its opposite end on a supporting-member 57. Like the rod 44, the rod 55 has its lower portion externally-threaded to receive an internally-threaded adjusting-weight 58.

The lower end of the rod 55 of the pendulum 21 carries a disc-shaped weight 59 from which offsets a shutter-plate 60 which is adapted on occasion to be interposed in the light path between the filament 22 of the lamp 23 and the fixed prism 24. The weight 59 of the pendulum 21 is also provided with an offsetting latch-arm 61 which is engaged by the hooked end of a latch 62 pivotally mounted upon a stud 63 carried by a bracket 64.

The latch 62, which serves to hold the shutter-pendulum 21 in its retired position, is provided with a laterally-offsetting L-shaped tripping-finger 65 which is adapted on occasion to be engaged by a tripping arm 66 secured to a stud 67 which in turn rigidly offsets from an L-shaped side-bar 68 and which is rotatably mounted in the supporting-member 57 upon which the pivot-bar 56 of the shutter-pendulum 21 bears, as before described. Arranged in spaced relationship with respect to the side-bar 68 is a companion side-bar 69 which carries a stud 70 bearing in the supporting-member 46 in axial alignment with the stud 67 before referred to.

Rigidly mounted in the ends of the side-bars 68 and 69 remote from the studs 67 and 70 is a cross-bar 71 to which is rigidly clamped a resilient resetting-arm 72 which is adapted to engage with the weight 59 of the shutter-pendulum 21 to swing the latter into its retired position. Also rigidly clamped to and offsetting from the cross-bar 71 are a pair of corresponding resetting-arms 73—73 respectively adapted to engage with projections such as 74 offsetting in opposite directions from the sides of the prism-holder 49 of the beam-control pendulum 20, and serving to swing the latter into its retired position.

The side-bar 68 before referred to which together with the complementary side-bar 69 and cross-bar 71 forms a yoke-shaped unit, is provided with a depending operating-arm 75 to the lower end of which is pivoted the head 76 of an operating-link 77, the opposite end of which latter is provided with a threaded-on head 78 which is pivotally attached to a connecting-lever 79 adjacent the upper end thereof. Intermediate its respective opposite ends, the connecting-lever 79 is mounted for rocking movement upon a stud 80 which in turn is mounted in a bracket 81 upstanding from a bed-plate 82, as clearly shown in Fig. 1 of the drawings.

The lower end of the connecting-lever 79 is provided with a ball-like terminal 83 fitting within a slot 84 in the inner end of a manual operating-lever 85 having a broad terminal finger-piece 86 and pivotally mounted intermediate its ends upon a stud 87 vertically mounted in the bed-plate 82 before referred to. The said manual operating-lever 85 is restrained against too free swinging movement by a helical tensioning-spring 88 mounted upon the stud 87 which is adjustably threaded in the bed-plate 82. The horizontal swinging movement of the operating-lever 85 is limited by means of a pair of spaced-apart and adjustable stops 89—89 mounted upon the upper surface of the bed-plate 82.

As will appear more fully hereinafter, the shutter-pendulum 21 is first released and when it reaches a predetermined position in its advance swing relative to the beam-control pendulum 20 it serves to effect the release of the latter pendulum.

For the purpose just above referred to, the latch-arm 61 of the shutter-pendulum 21 is adapted when released to engage a tripping-loop 90 which is pivoted at one of its ends in the bracket 64 before referred to and at its opposite end coaxially pivoted in a bracket 91. The said loop when the pendulums are in their latched positions as shown in Fig. 1 rests against a stop 92 carried by the bracket 91 and is held in such position, which is just slightly past dead-center, by a helical actuating-spring 93.

The tripping-loop 90 above referred to is adapted to be rapidly snapped to the right and downwardly (as viewed in the drawings) for cam-like engagement with the rear edge of the lower arm of a double-ended tripping-lever 94 which latter is rigidly mounted upon the rock-shaft 52 to which the latch 51 before referred to is also secured. The forward and downward swinging movement referred to of the tripping-loop 90 is checked by a stop-finger 95 mounted in the bracket 91. The said shaft 52 is encircled by a helical spring 96 which exerts a constant effort to turn the said shaft in a direction required to swing its latch 51 downwardly for engagement with the latch-abutment 50 of the pendulum 20.

For the purpose of resetting the tripping-loop 90 by moving the same from the position in which it is indicated in Fig. 3 back to the position in which it is indicated in Figs. 1 and 2, a resetting-lever 97 is provided which is pivotally mounted upon a stud 98 carried by the bracket 64 before

referred to. The said resetting-lever 97 carries a resetting-arm 99 which is engageable with the tripping-loop 90 for resetting the same as described.

The resetting-lever 97 is swung upwardly and rearwardly for the purpose of resetting the tripping-loop 90 by means of a resilient-arm 100 secured to the depending operating-arm 75 to which the operating-link 77 is pivotally connected.

The upper end of the connecting-lever 79 is bifurcated to form a coupling-notch 101 receiving a coupling-pin 102 laterally offsetting from a tensioning-slide 103 which is mounted for reciprocating movement toward and away from the balance-wheel 28 in a guide-head 104 carried at the upper end of the bracket 81 before referred to. At its forward end the tensioning-slide 103 carries a resilient tensioning-finger 105 which may be made of spring steel and which is preferably adapted to engage the periphery of the balance-wheel 28 to rotate the same for the purpose of tensioning the hairspring 33 preparatory to the release of the said balance-wheel for oscillation by the said hairspring during the testing or checking period. The said tensioning-finger in its engagement with the balance-wheel 28 will move from the position in which it is indicated by full lines in Fig. 1 to the position in which it is indicated in broken lines in the same figure.

For the purpose of rapidly disengaging the tensioning-finger 105 from the balance-wheel 28 to release the balance-unit of which the same forms a part, for free oscillation after the hairspring 33 has been tensioned as above described, a releasing-finger 106 is provided. The said releasing-finger is mounted in the outer end of an arm 107 rigidly secured to one end of a rock-shaft 108 which bears in the guide-head 104 at a point above the resilient tensioning-finger 105. The opposite end of the rock-shaft 108 has rigidly secured to it a downwardly-extending arm 109 to the lower end of which is connected the forward end of a releasing-link 110 which preferably is in the form of a relatively-light though sufficiently-rigid strand of piano wire or other suitable material. The said releasing-link is guided in its reciprocating movement in a guide-tube 111 suitably supported in the framework of the apparatus. The end of the releasing-link 110 opposite to the end which is pivotally connected to the arm 109 is connected to the upper end of the tripping-lever 94 before referred to so as to move concurrently therewith when the same is struck by the tripping-loop 90 in a manner as will be hereinafter described.

For the purpose of a better understanding of the mode of operation of the particular motion-checking apparatus herein chosen for the illustration of the present invention, let it be assumed that the parts are in the positions in which they are shown in Figs. 1 and 2, in which it will be noted that both the beam-control pendulum 20 and the shutter-pendulum 21 are in their latched positions and the balance-wheel is oriented so that one of its spokes extends vertically downward. Let it be presumed further that the filament 22 of the incandescent electric lamp 23 is energized so as to supply the necessary light-beam. Let it also be assumed that the said incandescent lamp 23 is provided with a suitable shield such as 112 (Fig. 8) which will permit the light-beam to pass freely toward the fixed prism 24, but guard against the impingement of stray light rays upon the various other light deflectors and lenses.

If, now, the finger-piece 86 of the manual operating-lever 85 is moved from left to right, this movement will correspondingly move the upper end of the connecting-lever 79 and will simultaneously move the tensioning-slide 103 and the operating-link 77 from left to right.

The movement of the tensioning-slide, just referred to, will serve to move the resilient tensioning-finger 105 carried thereby into engagement with the forward portion of the periphery of the balance-wheel 28, and will rotate the same to thus tension the hairspring 33. The said tensioning-finger 105, at the limit of its advance movement, will assume the position in which it is indicated by full lines in Fig. 7.

Simultaneously with the movement of the tensioning-slide 103 and its associated parts, the operating-link 77 will be moved with the effect of rocking in a counterclockwise direction, the yoke-shaped unit formed by the side-bars 68 and 69 and cross-bar 71 about the studs 67 and 70. This movement will similarly effect a corresponding swinging movement of the parts carried by or connected to the said yoke-shaped unit.

As the movement just above referred to takes place, the resilient-arm 100 carried by the operating-arm 75 will be moved out of engagement with the resetting-lever 97 and thus permit the same to swing forwardly and downwardly by gravity so as to clear its resetting-arm 99 from the path of the tripping-loop 90.

The swinging movement of the yoke-shaped unit will serve also to retire the resetting-arms 72 and 73—73 out of the path of movement of the respective pendulums 21 and 20.

The counterclockwise rocking movement of the yoke-shaped unit, above referred to, will further cause the descent of the tripping-arm 66 and its ultimate engagement with the tripping-finger 65 carried by the latch 62, with the ultimate effect of disengaging the latch 62 from the latch-arm 61 of the shutter-pendulum 21 at a time that the resetting-arms 72 and 73—73, above referred to, have been sufficiently retired. Thus, the shutter-pendulum will be released for swinging movement from left to right.

When in its swinging movement from left to right, as described, the shutter-pendulum 21 reaches substantially the position in which it is shown in Fig. 3, its latch-arm 61 will have engaged with and have swung the tripping-loop 90 to the other side of its dead-center from that indicated in Figs. 1 and 2. As soon as the tripping-loop has been swung in advance of dead-center, as just described, the spring 93 will act to snap said loop in a clockwise direction, thus causing the same to engage the adjacent edge of the tripping-lever 94, with the effect of turning the same in a counterclockwise direction. Inasmuch as the said tripping-lever 94 is rigidly attached to the rock-shaft 52 carrying the latch 51 which serves the beam-control pendulum 20, the said shaft 52 will be similarly rocked in its bearings, with the effect of disengaging the nose of the latch 51 from the latch-abutment 50 of the beam-control pendulum 20. The parts will now have assumed substantially the positions in which they are shown in Fig. 3.

Simultaneously with the rocking of the tripping-lever in a counterclockwise direction, the wire-like releasing-link 110, owing to its connection with the tripping-lever 94, will be moved from

right to left with the effect of swinging the releasing-finger 106 downwardly so as to flex the tensioning-finger 105 out of engagement with the periphery of the balance-wheel 28, as indicated in Fig. 7. The said balance-wheel and the balance-unit of which it forms a part will commence its oscillatory movement under the urge of its hairspring 33 simultaneously with the release of the beam-control pendulum 20.

From the foregoing, it will be seen that after the shutter-pendulum 21 has been manually released and has moved to a predetermined point in its advanced swing, the said shutter-pendulum will automatically effect the release of the beam-control pendulum 20 and the balance-unit.

When the beam-control pendulum reaches substantially the position in which it is shown in Fig. 4, the beam-control prism 25 carried thereby will pick up the image of the filament 22 from the fixed prism 24 or other suitable light deflector. The said beam-control prism 25 will now deflect the image of the filament 22 through the lens system 26, thence to the inclined prism 27 and through the space within the lower portion of the rim of the now oscillating balance-wheel 28. The image of the filament will pass on through the lens 36, etc., for impingement upon the rear surface of the screen 41 and through the translucent observation segment 40 in the latter. The shadow of the spoke 29 of the balance-wheel 28 may now be seen through the said observation segment 40 each time the pendulum 20 advances but not when the same retires. The pendulums 20 and 21 will now have assumed substantially the positions in which they are shown in Fig. 4, in which it will be noted that the shutter-plate 60 of the shutter-pendulum 21 has passed the fixed prism 24, so as not to interfere with the reception by the latter of the image of the filament 22 when the beam-control prism 25 is swinging from left to right.

In Fig. 5, the beam-control pendulum 20 is shown substantially at the limit of its advance movement, and it will be noted that the shutter-pendulum has at this time moved part way back on its return swing.

Owing to the out-of-phase relationship between the beam-control pendulum 20 and the shutter-pendulum 21, by the time that the beam-control prism 25 of the pendulum 20 has swung back over the fixed prism 24, as indicated in Fig. 6, the shutter-pendulum 21 will have moved even further on its return swing so as to interpose its shutter-plate 60 between the filament 22 and the fixed prism 24, thus precluding the image of the said filament from reaching the observation segment 40 during the return swing of the beam-control pendulum 20. Both of the pendulums 20 and 21 will continue to swing back and forth in substantially the same out-of-phase relationship above described, with the effect of impinging the image of the filament 22 upon the rear face of the screen 41 for observation through the segment 40 thereof once during each swing of the beam-control pendulum from left to right, but not during the swing of the said pendulum from right to left.

The purpose of precluding the deflection of the image of the filament 22 to the screen 41 during one of the phases of each cycle of the beam-control pendulum 20 is to avoid confusion between the shadow of a given one of the spokes 29 and 29a of the balance-wheel 28, when such spoke is moving in opposite directions. The arrangement just referred to insures that the shadow of the lower spoke of the balance-wheel 28 will show through the observation segment 40 only when the said spoke is swinging in a clockwise direction and not when it is swinging back in a counterclockwise direction.

If the shadow of the selected spoke of the balance-wheel 28 remains substantially stationary in the center of the observation segment 40 for a plurality of movements of the pendulum 20, assurance is had that the said balance-wheel is in time with the said pendulum 20, which latter, together with the shutter-pendulum 21, is carefully timed to a predetermined rate. If the shadow of the selected spoke of the balance-wheel 28 appears to the left of the center of the observation segment 40, this will indicate that the rate of oscillation of the said balance-wheel is slow as compared to the predetermined standard. The speed of oscillation of the balance-wheel may now be increased by suitably adjusting the hairspring 33, which may be effected conveniently by turning the adjusting-rollers 34—34 to in effect shorten the said hairspring 33 in such manner as not to disturb the previously-determined position of the selected spoke of the said balance-wheel when midway of its swing. If, now, the swinging movement of the pendulums 20 and 21 has not so far died down as to be ineffective, the shadow of the selected spoke may be again observed in the segment 40 or, if desired, the apparatus may be restarted.

If the shadow of the spoke should appear to the right of the center of the observation segment 40, this will be an indication of the fact that the balance-wheel is oscillating at a too-rapid rate as compared to the predetermined standard and may be compensated for by turning the adjusting-rollers 34—34 to lengthen the effective portion of the hairspring 33.

It is to be here noted that in referring as above to the fact that the appearance of the shadow of the selected spoke in the left side of the observation segment 40 indicates that the balance-wheel is oscillating at a rate below standard, this condition would be reversed with a hairspring which is wound in the opposite direction. Thus, it might be that with some types of balance-wheel units, the appearance of the shadow of the selected spoke in the left portion of the observation segment 40 would indicate a too-rapid rate of oscillation rather than a two-slow rate, as before described.

The pendulums 20 and 21 may be restored to their latched positions in which they are indicated in Figs. 1 and 2, preparatory to another testing operation either upon the same or a different balance-wheel, by swinging the finger-piece 86 of the manual operating-lever 85 from right to left, which will cause the various resetting-arms to restore the parts to the positions in which they are indicated in Figs. 1 and 2.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are therefore to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. A motion-checking apparatus including in combination: a source of light; a movable beam-control member acting to flash a beam of light from the said source at predetermined intervals

upon the object whose motion is to be checked; and a shutter-member movable into the path of the beam emanating from the said source and acting to periodically nullify the stated action of the said beam-control member.

2. A motion-checking apparatus including in combination: a source of light; a movable beam-control member acting to flash a beam of light from the said source at predetermined intervals upon the object whose motion is to be checked; and means for nullifying every alternate one of the stated actions of the said beam-control member.

3. A motion-checking apparatus including in combination: a source of light; a movable beam-control member acting to flash a beam of light from the said source at predetermined intervals upon the object whose motion is to be checked; and a shutter-member movable into the light path between the said source and the said beam-control member to periodically nullify the stated action of the latter.

4. A motion-checking apparatus including in combination: an observation-screen; a source of light; a movable beam-control member acting to flash a beam of light from the said source at predetermined intervals upon the observation-screen and upon the object whose motion is to be checked; and a shutter-member movable into the path of the beam emanating from the said source and acting to periodically nullify the stated action of the said beam-control member in flashing a beam of light upon the said observation-screen.

5. A motion-checking apparatus including in combination: an observation-screen; a source of light; a movable beam-control member acting to flash a beam of light from the said source at predetermined intervals upon the said observation-screen and upon the object whose motion is to be checked; and means for nullifying every alternate one of the stated actions of the said beam-control member in flashing a beam of light upon the said observation-screen.

6. A motion-checking apparatus including in combination: an observation-screen; a source of light; a movable beam-control member acting to flash a beam of light from the said source at predetermined intervals upon the said observation-screen and upon the object whose motion is to be checked; and a shutter-member movable into the light-path between the said source and the said beam-control member to periodically nullify the stated action of the latter.

7. A motion-checking apparatus including in combination: a source of light; a beam-control pendulum serving to periodically flash a beam of light from the said source upon the object whose motion is to be checked; and a shutter-member movable into the path of the beam of light emanating from the said source and acting to periodically nullify the stated action of the said beam-control pendulum.

8. A motion-checking apparatus including in combination: a source of light; a beam-control pendulum serving to periodically flash a beam of light from the said source upon the object whose motion is to be checked; and means for nullifying every alternate one of the stated actions of the said beam-control pendulum.

9. A motion-checking apparatus including in combination: a source of light; a beam-control pendulum having a light-deflector serving to periodically flash a beam of light from the said source upon the object whose motion is to be checked; and a shutter-member movable into the light-path between the said source and the light-deflector of the said beam-control pendulum to periodically nullify the stated action of the said beam-control pendulum.

10. A motion-checking apparatus including in combination: a source of light; a beam-control pendulum having a light-deflector serving to periodically flash a beam of light from the said source upon the object whose motion is to be checked; and means for nullifying every alternate one of the stated actions of the said beam-control pendulum.

11. A motion-checking apparatus including in combination: an observation-screen; a source of light; a beam-control pendulum acting to flash a beam of light from the said source at predetermined intervals upon the observation-screen and upon the object whose motion is to be checked; and a shutter-member movable into the path of the beam emanating from the said source and acting to periodically nullify the stated action of the said beam-control pendulum in flashing a beam of light upon the said observation-screen.

12. A motion-checking apparatus including in combination: an observation-screen; a source of light; a beam-control pendulum acting to flash a beam of light from the said source at predetermined intervals upon the said observation-screen and upon the object whose motion is to be checked; and means for nullifying every alternate one of the stated actions of the said beam-control pendulum in flashing a beam of light upon the said observation-screen.

13. A motion-checking apparatus including in combination: an observation-screen; a source of light; a beam-control pendulum acting to flash a beam of light from the said source at predetermined intervals upon the said observation-screen and upon the object whose motion is to be checked; and a shutter-member movable into the light-path between the said source and the said beam-control pendulum to periodically nullify the stated action of the latter.

14. A motion-checking apparatus including in combination: an observation-screen; a source of light; a beam-control pendulum acting to flash a beam of light from the said source at predetermined intervals upon the said observation-screen and upon the object whose motion is to be checked; and means for nullifying every alternate one of the stated actions of the said beam-control pendulum.

15. A motion-checking apparatus including in combination: a source of light; a beam-control pendulum serving to periodically flash a beam of light from the said source upon the object whose motion is to be checked; and a shutter-pendulum movable into the path of the beam of light emanating from the said source and acting to periodically nullify the stated action of the said beam-control pendulum.

16. A motion-checking apparatus including in combination: a source of light; a beam-control pendulum serving to periodically flash a beam of light from the said source upon the object whose motion is to be checked; and pendulum-means for nullifying every alternate one of the stated actions of the said beam-control pendulum.

17. A motion-checking apparatus including in combination: a source of light; a beam-control pendulum carrying a light-deflector serving to periodically flash a beam of light from the said source upon the object whose motion is to be checked; and a shutter-pendulum movable into the path of the beam of light emanating from the

said source and acting to periodically nullify the stated action of the light-deflector carried by the said beam-control pendulum.

18. A motion-checking apparatus including in combination: a source of light; a beam-control pendulum carrying a light-deflector serving to periodically flash a beam of light from the said source upon the object whose motion is to be checked; and pendulum-means for nullifying every alternate one of the stated actions of the said beam-control pendulum.

19. A motion-checking apparatus including in combination: a source of light; an observation-screen; a beam-control pendulum acting to flash a beam of light from the said source at predetermined intervals upon the object whose motion is to be checked and upon the said observation-screen; latching-means releasably holding the said beam-control pendulum in a retired position; a shutter-pendulum movable into the path of the beam emanating from the said source and acting to periodically nullify the stated action of the said beam-control pendulum in flashing a beam of light upon the said observation-screen; latching means for releasably holding the said shutter-pendulum in a retired position; and releasing-means brought into action by the movement of one of the said pendulums to release the other thereof.

20. A motion-checking apparatus including in combination: a source of light; an observation-screen; a beam-control pendulum acting to flash a beam of light from the said source at predetermined intervals upon the object whose motion is to be checked and upon the said observation-screen; latching-means releasably holding the said beam-control pendulum in a retired position; a shutter-pendulum movable into the path of the beam emanating from the said source and acting to periodically nullify the stated action of the said beam-control pendulum in flashing a beam of light upon the said observation-screen; and releasing-means brought into action by the movement of the said shutter-pendulum to release the said beam-control pendulum.

21. A motion-checking apparatus including in combination: means for mounting a balance-wheel unit whose motion is to be checked; a source of light; movable light-flashing means acting to periodically flash a beam of light from the said source upon said balance-wheel unit; and mechanical means serving to start the said balance-wheel unit substantially simultaneously with the starting of the said light-flashing means.

22. A motion-checking apparatus including in combination: means for mounting a balance-wheel unit whose motion is to be checked; a source of light; a light-flashing pendulum acting to periodically flash a beam of light from the said source upon said balance-wheel unit; and means serving to start the said balance-wheel unit substantially simultaneously with the starting of the said light-flashing pendulum.

23. A motion-checking apparatus including in combination: means for mounting an oscillatable balance-wheel unit having a hairspring; a source of light; movable light-flashing means acting to periodically flash a beam of light from the said source upon the said balance-wheel unit; tensioning-means engageable with the balance-wheel unit and serving to tension the hairspring thereof; and means serving to disengage the said tensioning-means from the said balance-wheel unit substantially simultaneously with the starting of the said light-flashing means.

24. A motion-checking apparatus including in combination: means for mounting an oscillatable balance-wheel unit having a hairspring; a source of light; a light-flashing pendulum acting to periodically flash a beam of light from the said source upon the said balance-wheel unit; tensioning-means engageable with the balance-wheel unit and serving to tension the hairspring thereof; and means serving to disengage the said tensioning-means from the said balance-wheel unit substantially simultaneously with the starting of the said light-flashing pendulum.

25. A motion-checking apparatus including in combination: means for mounting an object whose motion is to be checked; a source of light; movable light-flashing means acting to periodically flash a beam of light from the said source upon the object whose motion is to be checked; a movable shutter acting to periodically nullify the stated action of the said light-flashing means; and means serving to start the said object substantially simultaneously with the starting of the said light-flashing means.

26. A motion-checking apparatus including in combination: means for mounting an object whose motion is to be checked; a source of light; a light-flashing pendulum acting to periodically flash a beam of light from the said source upon the object whose motion is to be checked; a shutter-pendulum acting to periodically nullify the stated action of the said light-flashing pendulum; and means serving to start the said object substantially simultaneously with the starting of the said light-flashing pendulum.

27. A motion-checking apparatus including in combination: means for mounting an oscillatable balance-wheel unit having a hairspring; a source of light; movable light-flashing means acting to periodically flash a beam of light from the said source upon the said balance-wheel unit; a movable shutter acting to periodically nullify the stated action of the said light-flashing means; tensioning-means engageable with the balance-wheel unit and serving to tension the hairspring thereof; and means serving to disengage the said tensioning-means from the said balance-wheel unit substantially simultaneously with the starting of the said light-flashing means.

28. A motion-checking apparatus including in combination: means for mounting an oscillatable balance-wheel unit having a hairspring; a source of light; a light-flashing pendulum acting to periodically flash a beam of light from the said source upon the said balance-wheel unit; a shutter-pendulum acting to periodically nullify the stated action of the said light-flashing pendulum; tensioning-means engageable with the balance-wheel unit and serving to tension the hairspring thereof; and means serving to disengage the said tensioning-means from the said balance-wheel unit substantially simultaneously with the starting of the said light-flashing pendulum.

29. A motion-checking apparatus including in combination: means for mounting an object whose motion is to be checked; a source of light; movable light-flashing means acting to periodically flash a beam of light from the said source upon the object whose motion is to be checked; and means serving to start the said object in definite phase relationship with respect to the said light-flashing means.

WILLIAM BARTON EDDISON.