Nov. 13, 1934. H. R. COOL 1,980,786

RECORDER

Filed Nov. 4, 1931 2 Sheets-Sheet 1

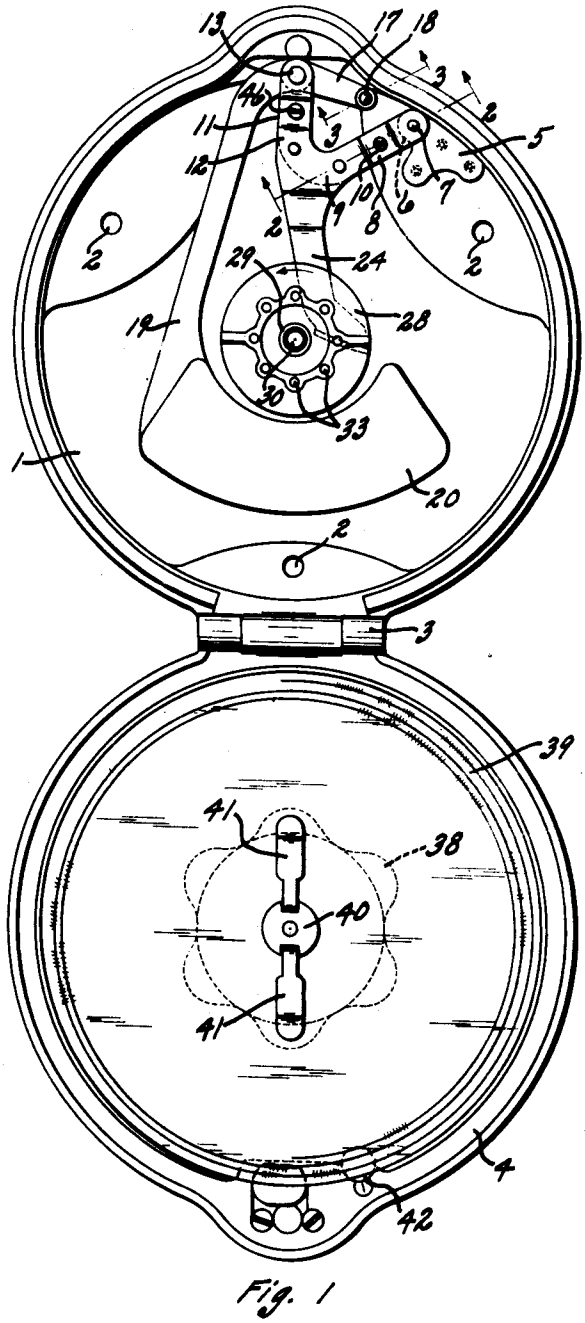


Fig. 1

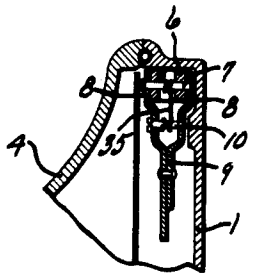


Fig. 2

Fig. 3

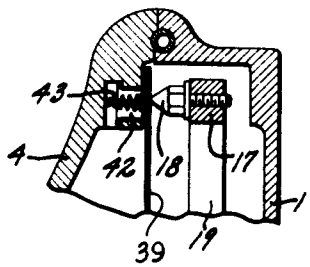
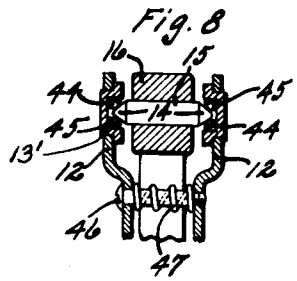


Fig. 8



INVENTOR

Henry R. Cool

BY

Brockett, Hyde, Higley & Meyer

ATTORNEYS

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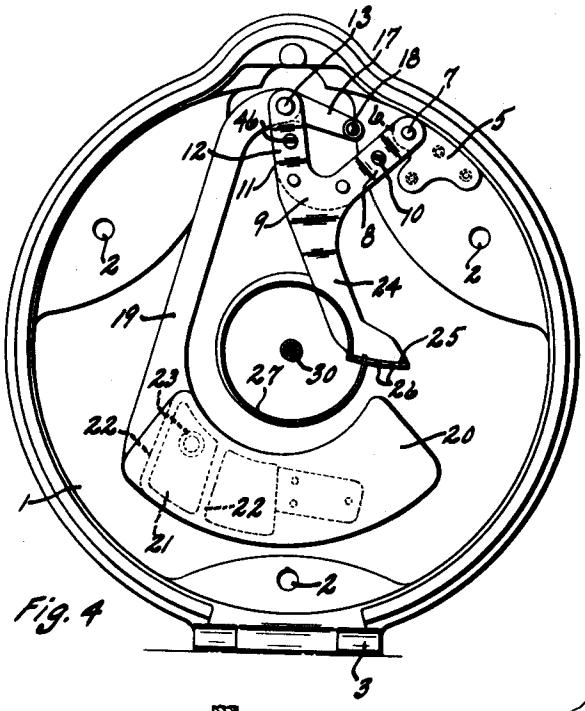


Fig. 4

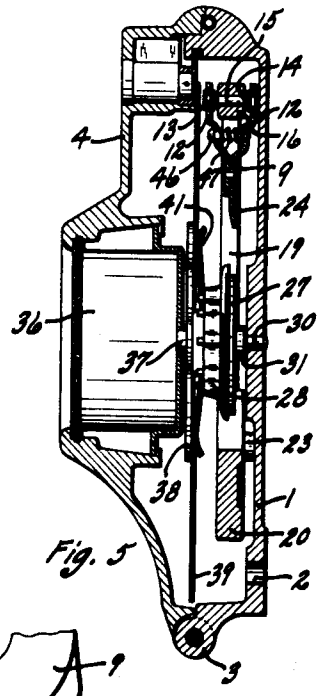


Fig. 5

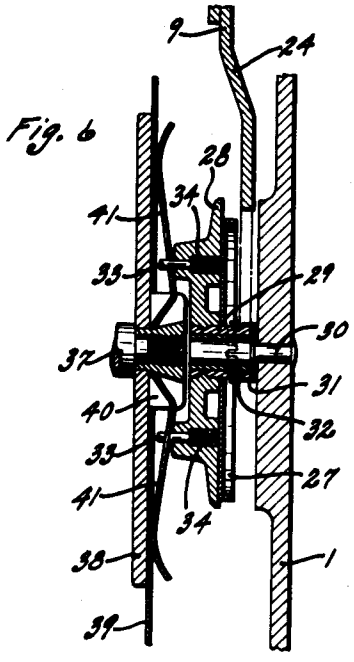


Fig. 6

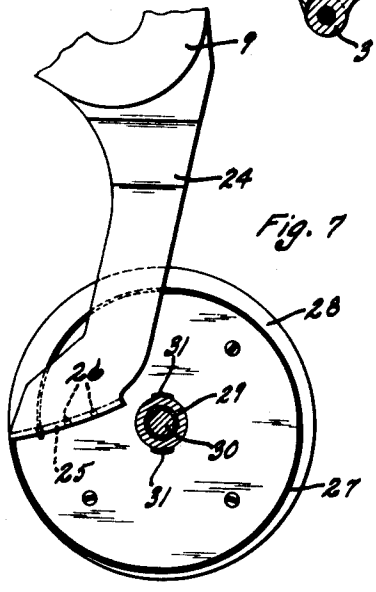


Fig. 7

INVENTOR

Henry R. Cool

BY

Brockett, Hyde Higley & Meyer

ATTORNEYS

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UNITED STATES PATENT OFFICE

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RECORDER

Henry R. Cool, Cleveland, Ohio, assignor to The Service Recorder Company, Cleveland, Ohio, a corporation of Ohio

Application November 4, 1931, Serial No. 572,999

20 Claims. (Cl. 234—5.6)

The invention disclosed in this application relates to motion recorders used to record motions, such as the vibrations of machines and devices of various types, including trucks and the like.

The object of the invention is to lengthen the period covered by the record, that is to say, to increase it in length from twenty-four hours, for example, to a multiple of such period, without alteration in the record sheet or chart, which, in this instance, is a circular disc of treated paper which will produce an indication by an abrasion.

The invention is shown applied to the hinged two-piece type of recorder, the clock and record motor means being in the lower half when opened, and the stylus and its operating device or pendulum being in the other half. In such an arrangement, one phase of the invention provides mechanism for moving the pendulum and its stylus bodily, with the latter travelling in a substantially radial path. This mechanism is operated by a yielding pawl or pin connection with the clock train or motor means in the other half, when the instrument is closed, to cause bodily movement of the pendulum and stylus to be in time with the operation of the clock train or motor means. The important feature of this arrangement is that when the two halves of the instrument are in closed operating position there is no jamming of the teeth of gears or other coupling means, and the clock train may freely pick up the stylus and pendulum moving means as the parts move around into proper engaging position.

Invention also resides in the ball bearing pivot arrangement for the pendulum and stylus unit; the specific penduludm and stylus moving means or carrier; the pendulum carrier actuator and cam hoop for actuating the pendulum and stylus moving carrier; the arrangement of a tension device effective upon the pendulum and stylus moving means for taking up any back lash between the parts to avoid irregularities in the record; and to a specific form of bumper or shock absorber for the pendulum, whereby any tendency for it to move unduly is arrested with as little shock as possible upon the mounting of the pendulum and upon the clock movement itself.

Other features of the invention will be brought out in the following description, drawings and claims.

Referring to the drawings, Fig. 1 is a front elevation showing the casing open; Fig. 2 is a detail sectional view on the line 2—2 of Fig. 1, showing the support for the pendulum carrier; Fig. 3 is a detail sectional view through the stylus record and anvil on the line 3—3, Fig. 1; Fig. 4 is a view partly in section and partly in elevation showing the pendulum casing part with the pendulum and carrier properly mounted and with the hoop cam in section; Fig. 5 is a vertical sectional view with parts shown in elevation taken through the instrument when closed; Fig. 6 is a vertical sectional enlarged fragmental sectional view showing the driving and coupling means between the motor means and the stylus and pendulum mechanism; Fig. 7 is an enlarged detail view showing the cam hoop and carrier operating arm; and Fig. 8 is an enlarged detailed sectional view of the pendulum pivot.

In the embodiment shown, the main casing is made up of the pendulum part 1, provided with suitable openings 2 by which it may be secured to a relatively stationary part, such as the dash of a truck or the like. Of course, it may be secured to any part of any machine which is relatively stationary but which receives vibrations or sway from the operation of the machine. To this pendulum part is hinged, as at 3, the motor means and casing part 4. These parts are adapted to fit snugly together, as shown in Fig. 5.

Mounted in the pendulum part near its periphery and to the right of the top center, as shown in Fig. 1, is a pendulum carrier support 5 having a bifurcated bearing boss portion 6. This boss receives a pivot pin 7 extending through the side portions 8 of the carrier supporting arm 9. The side portions 8 may be drawn together to snugly fit the bearing boss by a suitable screw 10 extending through one side member 8 and threaded into the other. This supporting arm 9 forms a part of the carrier or lever which includes, in addition to the arm 9, a pendulum carrying arm 11 bifurcated into two side arms 12, each carrying a bearing portion 13 (Fig. 5) engaging conical ends 14 provided upon a pendulum pin 15 arranged in a pendulum boss 16. This pendulum boss carries a stylus arm 17 extending laterally toward the carrier support 5 and provided with a stylus 18 at its end projecting outwardly or toward the record in the other casing part. The same boss 16 carries a pendulum arm 19 extending diagonally downward and provided at its lower end with an arc-shaped pendulum weight 20 provided in its back and near the arm 19 with an opening 21 shown in dotted lines in Fig. 4. This opening provides lateral shoulders 22 adapted to engage a suitable rubber bumper, indicated at 23. This bumper arrangement is located at such a point with respect to the pendulum arm and weight that it arrests the movement with as little jar as possible to the other parts of the mechanism,

The carrier or lever is also provided with an operating arm 24 extending downward toward the center of the pendulum casing part and provided with a forwardly extending flange 25 provided with cam notches, indicated at 26. This notched flange forms a rack adapted to be engaged by a spiral hoop cam 27 mounted upon the back of an actuator 28, which is provided with a central bearing portion 29 engaging a pin

30 at substantially the center of the pendulum casing part. The axis of this actuator is also in axial alignment with the driving element in the other casing part, as will appear.

The actuator bearing is preferably provided with an annular recess 32 adapted to be engaged by a spring device, indicated at 31, for removably holding the actuator in place in the pendulum casing part.

The actuator is also provided with a plurality of spring pressed plungers 33 arranged symmetrically in a group about the center and spring pressed outwardly by suitable springs 34. There are eight of these pins and since they are symmetrically disposed in a group, the spaces between them are alike. These pins constitute the actuator coupling means and when they are engaged by the driving element of the motor means in the other casing part, they will cause the actuator and its hoop cam to be rotated, which will cause the carrier arm 24 to be moved and the pendulum pivot likewise shifted. The path of the stylus is in a radial line with respect to the axis of the motor means carrying the record so that the stylus, when moved by the vibrations of the pendulum, will produce a multiplicity of contacting radial lines and produce a substantially continuous wide line on the record. Owing to the action of the cam 27 in moving the fulcrum of the pendulum, the record line also will be spiral so that successive 360° periods will overlap, as shown in Fig. 1, and the capacity of the recorder will be thereby increased.

In order to take up any back lash between the rack and the hoop cam, a spring 35, Fig. 2, engages around the pin 7 and has one end engaging the case and the other end engaging the screw 10. This places a tension upon the carrier arm and tends to move it in a contra-clockwise direction, in Fig. 4. The tension of the spring is sufficient to prevent any chattering of the rack against the cam.

Arranged in the other casing part 4 is a motor means 36 which may be in the form of a clock train. It is held in this casing part in any suitable manner and has a driving shaft 37 projecting outward when the case is open and toward the actuator in the pendulum casing part when the casing is closed. The axis of this shaft coincides with the axis of the pendulum actuator, as above indicated. This shaft has a suitable record supporting plate 38 for receiving the paper record 39. This record has an opening at its center receiving a pilot boss 40, in which is mounted, preferably, a pair of opposite extending spring clamping fingers 41 adapted to clamp the record in place. They also serve to engage between the pins 33 in driving the actuator for the pendulum carrier. When the two casing parts are in assembly, as shown in Figs. 5 and 6, the opposite pairs of pins 33 engage opposite edges of the fingers 41, and the record sheet is driven and the pendulum and stylus carrier is also driven so that the spiral record on the record sheet is produced.

Back of the record sheet 39, Fig. 3, and in alignment with the stylus is an anvil button 42 forced outward by a spring 43.

As shown in Fig. 5, the pendulum pin 15 is provided with conical ends which engage plain bearings 13. These plain bearings may be replaced by ball bearing structures 13' Fig. 8, each such structure consisting of a group of balls 44 engaging a flanged race 45 pressed into a side arm 12. The use of ball bearings in this particular arrangement is unique when coupled with a tension device such as is shown in Figs. 5 and 8, wherein the two side arms 12 are drawn together by a suitable bolt or screw 46 with the spring 47 between the two arms, in that great tension may be exerted upon the bearings to prevent any lost motion and yet the pendulum is free to swing without any great resistance. It is obvious that the best record is produced by a stylus and pendulum unit where all possible lost motion is done away with and yet the pendulum is free to swing without any considerable resistance. By the use of ball bearings and the tension device such a result may be attained.

In operation, assuming that the clock train or other motor means is in operation, a record sheet is in place and the casing is closed, the vibrations or sway of the vehicle or other device to which the device is applied are transmitted to the pendulum with the result that it oscillates back and forth and produces a record on the sheet. At the same time that this record is being made, the stylus carrier is gradually moving the stylus inward, producing an overlapping spiral record. In order to reset the apparatus, the operator turns the actuator in the pendulum casing part back to initial position, which is one with the stylus in the outer position.

What I claim is:

1. In a motion recorder, a casing comprising two cooperating parts, a carrier movably mounted in one casing part, a stylus movably supported thereby, a rotatable actuator for said carrier, motor means in the other casing part and having a driving element, and means for yieldingly coupling said driving element and said actuator for continuously rotating said actuator.

2. A motion recorder as in claim 1, wherein the yielding coupling means is carried by the actuator.

3. In a motion recorder, a casing comprising two cooperating parts, motor means in one part, a chart driver and coupling device carried by the motor means, a carrier and shifter movably mounted in the other casing part, a stylus mounted thereon, a carrier actuator rotatably mounted in the carrier casing part in such position as to be concentric with the axis of said coupling device when the casing is closed, operating connections between the carrier actuator and the carrier, and yielding coupling means between the actuator and said coupling device.

4. A motion recorder as in claim 3, wherein the yielding coupling means is concentric with the axis of rotation of the actuator.

5. A motion recorder as in claim 3, wherein the yielding coupling means is concentric with the axis of rotation of the actuator and comprises a plurality of yielding pins.

6. A motion recorder as in claim 3, wherein the yielding coupling means is concentric with the axis of rotation of the actuator and comprises a plurality of yielding pins, and the coupling device carried by the motor means comprises a pair of diametrically opposed coupling members adapted to engage between opposite pairs of said yielding pins.

7. In a vibration recorder, a casing comprising two cooperating parts, a support mounted within and near the periphery and to one side of the top center of one part, a carrier having a lever arm pivoted to said support, an upwardly extending pendulum arm, and a depending actuating arm, a pendulum and stylus unit mounted in the pendulum arm, an actuator rotatably mounted in

the pendulum casing part, actuating connections between said actuator and the depending carrier arm, motor means mounted in the other casing part, and coupling means between said motor means and said actuator.

8. A vibration recorder as in claim 7, wherein the actuating connections comprise a rack carried by the depending carrier, and a hoop cam carried by the actuator.

9. A vibration recorder as in claim 7, wherein the pendulum and stylus unit comprises a pivot portion, a stylus arm extending therefrom toward the carrier support, a stylus carried by said arm, a pendulum arm extending down outside of the actuator, and an arc-shaped pendulum weight extending laterally from said arm under the actuator.

10. A vibration recorder as in claim 7, wherein the pendulum and stylus unit comprises a pivot portion, a stylus arm extending therefrom toward the carrier support, a stylus carried by said arm, a pendulum arm extending down outside of the actuator, an arc-shaped pendulum weight extending laterally from said arm under the actuator and having an opening in its back providing bumper engaging shoulders, and a bumper carried by the pendulum part of the casing and engaging in said opening.

11. A motion recorder, comprising a casing including two cooperating parts, a carrier movably mounted in one casing part, a stylus movably supported thereby, a rotatable actuator for said carrier, motor means in the other casing part, and a rotatable holder driven by said motor means for supporting and rotating a chart, said holder and actuator being so mounted in their respective casing parts as to be coaxial and with a direct driving connection between them when the casing is closed.

12. A motion recorder as in claim 11, wherein the chart holder includes a chart clamp which directly engages and drives the actuator.

13. A vibration recorder, comprising a support, a pendulum mounted thereon, a stylus arranged to be vibrated by said pendulum, a movable carrier for the stylus, a rotatable actuator for moving said carrier, a clock train having a rotatable arbor, chart carrying means carried by and rotating in unison with said arbor, and a separable connection between said arbor and said rotatable actuator, whereby the motion of the arbor is transmitted to the actuator to cause the latter to be continuously rotated at the same angular speed as the arbor.

14. A motion recorder, comprising a casing including two separable parts adapted to be closed in registering relation, a clock train and rotatable arbor in one part, a rotatable actuator mounted in the other part in such position as to be concentric with the arbor axis when the casing parts are registered, a movable carrier mounted in the same casing part as the actuator and operatively connected thereto, and a pendulum and stylus supported by said carrier.

15. A motion recorder, comprising a casing including two cooperating parts, a clock train and arbor rotatably mounted in one part, an actuator rotatable in the other part and so mounted as to be co-axial with said arbor when the casing is closed, said actuator being provided with a spiral hoop cam, a carrier movably mounted in the same casing part containing the actuator and provided with a rack engaging the hoop cam, and a recording stylus movably mounted on said carrier.

16. A motion recorder, comprising a casing including two cooperating parts, a clock train and arbor rotatably mounted in one part, an actuator rotatable in the other part and so mounted as to be co-axial with said arbor when the casing is closed, said actuator on that face presented to the clock train being provided with a yieldable connection to said arbor and upon its opposite face with a hoop cam, a carrier movably mounted in the same casing part containing the actuator and provided with a rack engaging the hoop cam, and a recording stylus movably mounted on said carrier.

17. A vibration recorder, comprising a two part casing, and two parts of the casing being adapted to be opened and closed by relative movement out of and into registering relation, a clock train provided with a record carrying arbor mounted in one part, a pendulum pivoted in the other casing part, a stylus operated thereby, a movable carrier mounted in the same casing part which contains the pendulum and supporting the movable stylus, and a rotatable actuator provided with operating connections to said carrier, and with coupling connections to said arbor, the actuator and arbor being so mounted in their respective casing parts as to be co-axial when said casing parts are in closing registering relation.

18. A vibration recorder, comprising two cooperating casing parts adapted to be opened and closed by movement out of and into registering relation with each other, a clock train and arbor mounted in one casing part, a pendulum pivoted in the other casing part, a stylus actuated thereby, a movable carrier mounted in the same casing part which contains the pendulum and supporting the movable stylus, an actuator rotatable in the same casing part as the pendulum, a spiral hoop cam driven by said actuator and operatively connected to said carrier, releasable driving connections between said arbor and actuator adapted to be coupled and uncoupled by closing and opening relative movements of the casing parts, said hoop cam actuator and arbor being coaxial when the casing parts are in closing registering relation.

19. In a motion recorder, a casing comprising two cooperating parts, a carrier movably mounted in one casing part, a stylus movably supported thereby, an actuator for said carrier, motor means in the other casing part and having a driving element, and yielding coupling means between said driving element and said actuator for continuously driving the latter, said yielding coupling means comprising a plurality of spring pressed plungers mounted in the actuator and adapted to engage the driving element of the motor means.

20. In a motion recorder, a casing comprising two cooperating parts, a carrier movably mounted in one casing part, a stylus movably supported thereby, an actuator for said carrier, motor means in the other casing part and having a driving element, said actuator being rotatable and being concentric with said driving element when the casing is closed, and yielding coupling means between said driving element and said actuator for continuously rotating said actuator, said coupling means comprising a plurality of spring pressed plungers carried by said actuator and grouped concentrically about the axis of rotation thereof and adapted to engage the driving element of the motor means.

HENRY R. COOL.