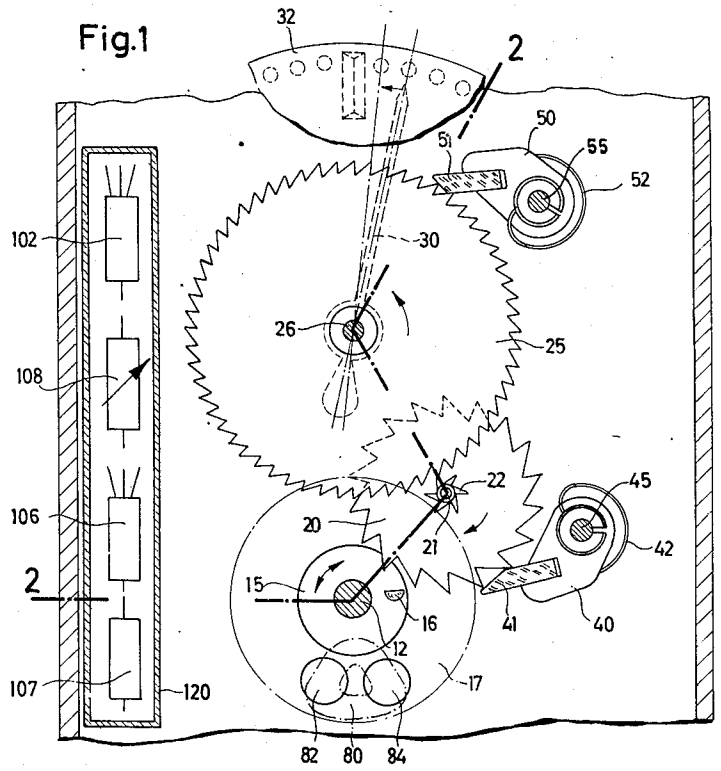
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SECOND HAND DRIVE FOR TIMEPIECES

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Fig.1



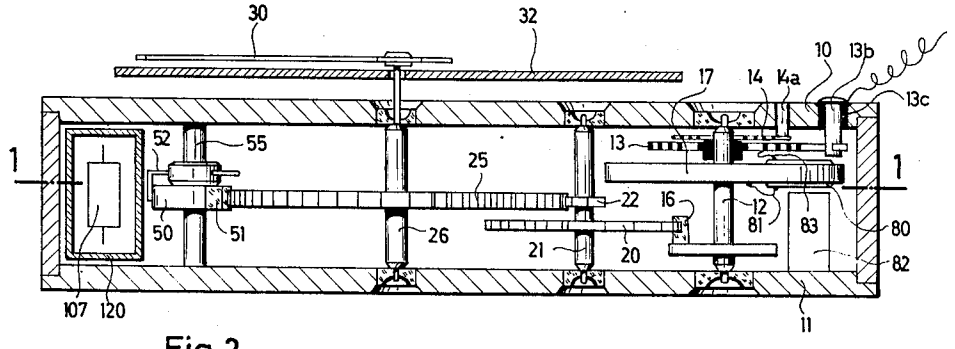


Fig.2

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Fig. 3

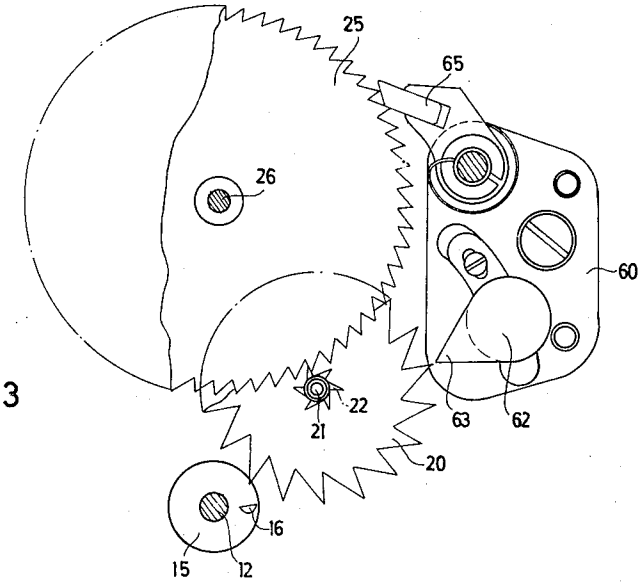
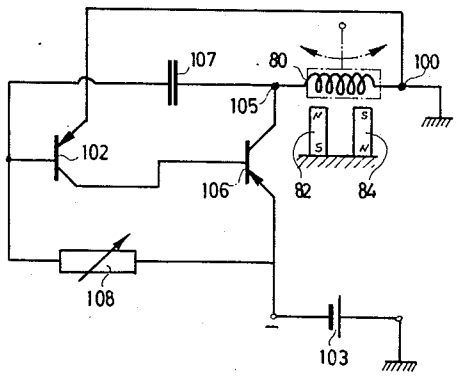


Fig. 4



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SECOND HAND DRIVE FOR TIMEPIECES

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5 Claims. (Cl. 58—28)

The present invention relates to timepieces such as wrist watches, for example.

More particularly, the present invention relates to the drive of the second hand of such timepieces.

Timepieces of this type have a second hand which sweeps around the dial once every minute. It is highly desirable to provide a second hand which instead of continuously turning, turns in a stepwise manner through increments of 6° at intervals of one second.

Particular difficulties are involved in providing a timepiece such as a watch with a drive for the second hand which will turn the second hand in this stepwise manner. The conventional structure used for this purpose includes elements which oscillate back and forth and snap into and out of starting and end positions, and as a result the drive for the stepwise turning second hand is undesirably complex, easily leads to faults, and has parts which become rapidly worn away.

One of the objects of the present invention is to overcome the above drawbacks by providing a timepiece of the above type with a second hand drive which is far simpler than a conventional second hand drive while at the same time turning the second hand in a stepwise fashion as discussed above.

Another object of the present invention is to provide a second hand drive of the above type in which the transmission from the oscillatory drive of the timepiece to the second hand consists entirely of a gear train each of whose gears turn at all times in only one direction.

It is also an object of the present invention to provide a second hand drive which operates with a high degree of accuracy without any appreciable friction.

With the above objects is view the present invention includes in a timepiece, a second hand and an oscillatory drive means. In accordance with the invention a transmission means transmits the drive from the oscillatory drive means to the second hand to turn the latter in stepwise fashion through increments of 6° at intervals of one second, and this transmission means includes a sliding gear wheel and a pillar wheel fixed coaxially to the sliding gear wheel to turn the latter, this pillar wheel having a number of teeth which is a complete multiple of the number of teeth of the sliding gear wheel.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a sectional plan view of the second hand driving structure illustrated in FIG. 2 taken along line 1—1 of FIG. 2;

FIG. 2 is a sectional view of the structure of FIG. 1 taken along line 2—2 of FIG. 1;

FIG. 3 fragmentarily illustrates part of the structure shown in FIG. 1 with a different embodiment of a device for holding a wheel in predetermined angular positions; and

FIG. 4 is a wiring diagram of the electrical driving structure.

Referring now to FIGS. 1 and 2 there is shown therein the plate 11 and bridge 10 which serve to carry all of

the parts of the movement. The plate 11 and bridge 10 turnably support, in a known way, the balance staff 12 to which the hair spring 13 is fixed, whose inner end is secured on an insulating bushing of the balance staff and whose outer end is attached to a pin 13*b* mounted in an insulating busing 13*c* secured in a hole of plate 10. A second hair spring 14 is in an electrically conductive manner attached with its inner end to the balance staff and with its outer end to a pin 14*a* mounted in plate 10. The hair spring 14 forms an electrical contact engaging the balance staff 12, this contact being carried by and insulated from the bridge 10.

The balance staff 12 fixedly carries the roller 15 provided with the impulse pin 16 which is in the form of a jewel.

The impulse pin 16 cooperates with a pillar wheel 20 which is carried by the pillar shaft 21 on which is fixed, coaxially with the stepping pillar wheel 20, the sliding gear wheel 22 which cooperates directly with the fourth wheel 25 carried by the shaft 26 which directly carries the second hand 30 which sweeps over the dial 32.

The balance staff 12 carries the balance 17, and the parts 12, 13, 15–17 form an oscillatory drive while the parts 20–22, 25, 26 form a transmission means which transmits the drive from the oscillatory drive means to the second hand 30.

In order to control the second hand 30 to move in a stepwise fashion the structure includes a means for holding the pillar wheel 20 accurately in predetermined angular positions spaced from each other by a distance equal to the size of each tooth of the pillar wheel 20 after each movement of the latter by the impulse pin 16, so that in this way the pillar wheel 20 will turn in stepwise fashion and will be accurately held in predetermined angular positions. This means which holds the pillar wheel 20 in this way is in the embodiment of FIG. 1 a pawl means which includes the pawl member 40 which carries the pawl tooth 41 in the form of a jewel and which is acted upon by a spring 42 so as to cooperate with the teeth of the pillar wheel 20 so as to compel the latter to turn only in a clockwise direction, as viewed in FIG. 1, to stop in predetermined angular positions, and so as to guarantee that each increment of angular movement is equal to the angle through which each tooth extends. The pawl 40 is carried by a shaft 45.

A similar pawl construction which includes the pawl 50 and its tooth 51 in the form of a jewel is acted upon by a spring 52 so as to be pressed toward the teeth of the fourth wheel 25 to constrain the latter to turn only stepwise in a counterclockwise direction, as indicated by the arrow in FIG. 1, the pawl 50 being carried by the shaft 55.

Instead of the pawl construction of FIG. 1 which cooperates with the pillar wheel 20, the embodiment shown in FIG. 3 may be used. This structure of FIG. 3 includes a support plate or bridge 60 which carries a permanent magnet 62 whose position may be adjusted along an arcuate slot in the manner indicated in FIG. 3. The permanent magnet 62 has a pointed pole end 63 which is directed toward the tip of each tooth of the pillar wheel 20 as the latter turns from one angular position to the next angular position under the action of the impulse pin 16. The carrier bridge 60 additionally carries a pawl 65 which corresponds to and replaces the pawl 50 of FIGS. 1 and 2.

The embodiment of FIG. 3 is used for timepieces where a particularly high accuracy without any significant friction is required. With this embodiment the teeth of the pillar wheel 20 can be provided at least at their outer tips with a coating of soft iron or they can be rendered magnetic in any other desired manner so that the teeth will individually be radially attracted toward the tip 63 of the permanent magnet 62 so as to be successively held in the position indicated in FIG. 3 after each actuation of the pillar wheel 20 by the impulse pin 16.

As is apparent from the above description, at each cycle of movement of the balance staff and the roller **15** and impulse pin **16** therewith, the pillar wheel **20** is angularly advanced by a distance of one tooth and the pawl **40** or the permanent magnet **62** serve to reliably hold the pillar wheel **20** accurately in its next angular position. In the illustrated example the pillar wheel **20** has eighteen teeth while the sliding gear wheel **22**, which is fixed coaxially to the pillar wheel **20** to turn therewith, is provided with six teeth, so that the pillar wheel **20** must be turned through an angular distance occupied by three successive teeth thereof in order to turn the sliding gear wheel **22** through an angular distance occupied by one tooth thereof. At each turning movement of the sliding gear wheel **22** through an angular distance equal to one of the teeth thereof, this distance being 60° in the example illustrated, the fourth wheel **25** turns through an angular distance occupied by one of its teeth. In order to guarantee that the fourth wheel **25** turns exactly through an angular distance occupied by one of its teeth at each actuation by the sliding gear wheel **22**, the pawl **50** is provided. The fourth wheel **25** has sixty teeth and the oscillations of the balance staff are such that the fourth wheel is turned through an angular distance equal to one of its teeth each second.

The drive for the balance **17** is provided in an electromagnetic manner. The balance **17** carries a driving coil **80** which oscillates over a pair of permanent magnets **82** and **84**.

As may be seen from FIG. 4, the coil **80** is connected at **100** to the emitter of the transistor **102** and also to the positive pole of the battery **103**, while the junction **105** serves to interconnect the coil **80** with the collector of the transistor **106** and through the condenser **107** with the base of the transistor **102**. The base of the transistor **106** is connected to the collector of the transistor **102**.

The base of the transistor **102** is moreover connected by a variable resistor **108** to the emitter of the transistor **106** as well as to the negative pole of the current source **103**.

In the following it will be explained how the connections to coil **80** are arranged in the construction as shown in FIG. 2.

One end of coil **80** is connected through a wire **81** to the balance **17** and from that to balance staff **12** to which the hair spring **14** is connected, the hair spring being connected to plate **10** by pin **14***a*. Thus the aforementioned end of coil **80** is grounded and this ground corresponds to the junction **100** in FIG. 4.

The other end of coil **80** is attached through wire **83** to the insulated hair spring **13** and the insulated pin **13***b* corresponds to junction **105** of FIG. 4. From there a wire leads to the collector of transistor **106**.

The battery **103** is not shown in FIGS. 1 and 2 and may be arranged in any suitable manner inside or outside the timepiece.

As may be seen in FIGS. 1 and 2, the transistors **102** and **106**, the condenser **107** and the resistor **108** are located in a separate container within the housing of the timepiece. In this container also the battery may be arranged.

In connection with the electric drive it is emphasized that this drive taken by itself is no part of the invention and thus this drive may take any from suited to operate the timepiece. Further modes of such electric drives are described in the U.S. Patients 2,789,411 and 2,800,763, and the British Patent 764,450.

As will be apparent from the above description, inasmuch as the second hand **30** is connected directly to the fourth wheel **25** to turn therewith and inasmuch as the latter is driven from the impulse pin **16** only through the pillar wheel **20** and sliding gear wheel **22**, the structure of the invention is exceedingly simple while at the same time providing the desired stepwise turning of the second hand **30** through increments of 6° at intervals of one second, and at the same time the entire transmission from the oscillatory drive means to the second hand **30** consists of the gear train **20**, **22**, **25** each of the gears of which turns at all times in only one direction so that the parts operate very efficiently with a minimum possibility of failure.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of timepieces differing from the types described above.

While the invention has been illustrated and decribed as embodied in second hand drives, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In a timepiece, in combination, a second hand; an oscillatory drive including a rigid oscillating impulse pin; a gear train positively connecting said drive with said second hand, and having a plurality of elements turnable about different axes and including a gear having sixty teeth and being connected to said second hand for turning movement therewith, and a stepping wheel having teeth positioned to be engaged by said impulse pin during movement of the same in one direction so that said impulse pin drives said stepping wheel in angular steps; and a plurality of positioning means individually cooperating with every turnable element of said gear train for locating each turnable element in uniformly spaced positions and including first means cooperating with said teeth of said stepping wheel for accurately locating said stepping wheel in uniformly spaced angular positions, and second means cooperating with said teeth of said gear for accurately locating said gear and thereby said second hand in sixty uniformly spaced angular positions whereby all elements of said gear trains are accurately located in all said sixty positions of said second hand.

2. An arrangement as set forth in claim 1 wherein said first means include a spring-loaded pawl cooperating with said teeth of said stepping wheel.

3. In a timepiece, in combination, a second hand; an oscillatory drive including a rigid oscillating impulse pin; a gear train positively connecting said drive with said second hand, and having a plurality of elements turnable about different axes and including a gear having sixty teeth and being connected to said second hand for turning movement therewith, and a stepping wheel having teeth positioned to be engaged by said impulse pin during movement of the same in one direction so that said impulse pin drives said stepping wheel in angular steps, at least the outer tips of said teeth of said stepping wheel being magnetizable; and a plurality of positioning means individually cooperating with every turnable element of said gear train for locating each turnable element in uniformly spaced positions and including first means cooperating with said teeth of said stepping wheel and including a permanent magnet located to successively cooperate with said outer magnetized tip of each tooth of said stepping wheel for accurately locating said stepping wheel in uniformly spaced angular positions, and second means cooperating with said teeth of said gear for accurately locating said gear and thereby said second hand in sixty uniformly spaced angular positions whereby all elements of said gear trains are accurately located in all said sixty positions of said second hand.

4. In a timepiece, in combination, a second hand; an oscillatory drive including a rigid oscillating impulse pin;

a gear train positively connecting said drive with said second hand, and including a gear having sixty teeth and being rigidly secured to said second hand for turning movement therewith, a stepping wheel having teeth positioned to be engaged by said impulse pin during movement of the same in one direction so that said impulse pin drives said stepping wheel in angular steps, and a gear wheel having a number of teeth which is a simple fraction of the number of said teeth of said stepping wheel, said gear wheel being rigidly secured to said stepping wheel for turning movement therewith and driving with the teeth thereof said sixty teeth of said gear; first means cooperating with said teeth of said stepping wheel for accurately locating and positioning said stepping wheel in uniformly spaced angular positions; and second means cooperating with said teeth of said gear for accurately locating and positioning said gear and thereby said second hand in sixty uniformly spaced angular positions whereby all elements of said gear trains are accurately located in all said sixty positions of said second hand.

5. In a timepiece, in combination, a second hand; an oscillatory drive including a rigid oscillating impuse pin; a gear train positively connecting said drive with said second hand, and including a gear having sixty teeth and being rigidly secured to said second hand for turning movement therewith, a stepping wheel having teeth positioned to be engaged by said impulse pin during movement of the same in one direction so that said impulse pin drives said stepping wheel in angular steps, at least the outer tips of said teeth of said stepping wheel being magnetizable, and a gear wheel having a number of teeth which is a simple fraction of the number of said teeth of said stepping wheel, said gear wheel being rigidly secured to said stepping wheel for turning movement therewith and driving with the teeth thereof said sixty teeth of said gear; first means cooperating with said teeth of said stepping wheel and including a permanent magnet having an adjustable projecting pole shoe located to successively cooperate with said outer magnetizable tip of each tooth of said stepping wheel for accurately locating and positioning said stepping wheel in uniformly spaced angular positions; and second means cooperating with said teeth of said gear for accurately locating and positioning said gear and thereby said second hand in sixty uniformly spaced angular positions whereby all elements of said gear trains are accurately located in all said sixty positions of said second hand.

References Cited in the file of this patent

UNITED STATES PATENTS

2,195,311	Hurst	Mar. 26, 1940
2,353,280	Swisher	July 11, 1944
2,662,366	Koehler	Dec. 15, 1953
2,766,578	Robert-Charrue	Oct. 16, 1956
2,845,772	Beyner	Aug. 5, 1958
2,865,163	Ensign et al.	Dec. 23, 1958