May 14, 1940. F. T. HICKS 2,200,604

TIMEPIECE REGULATING SYSTEM AND METHOD

Original Filed Oct. 31, 1935

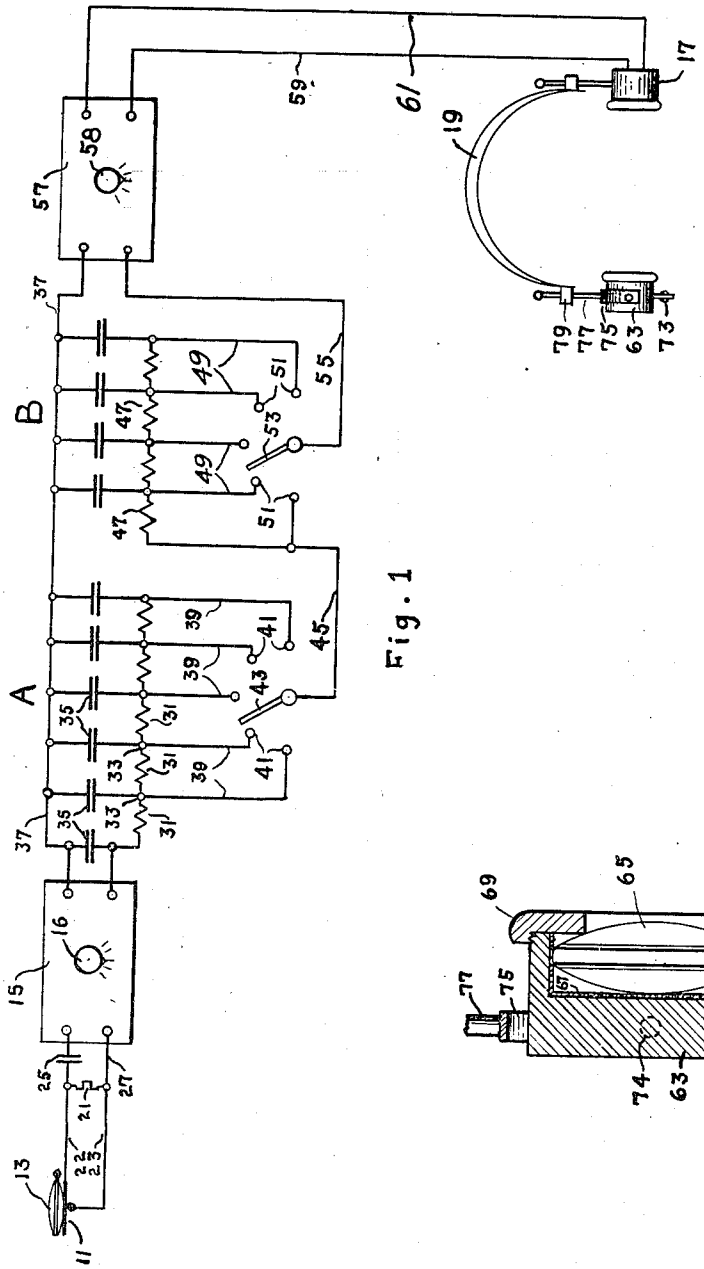


Fig. 1

Fig. 2

INVENTOR

Frederick T. Hicks

Patented May 14, 1940 2,200,604

UNITED STATES PATENT OFFICE

2,200,604

TIMEPIECE REGULATING SYSTEM AND METHOD

Frederick T. Hicks, Detroit, Mich., assignor to The Indemse Corporation, a corporation of Michigan

Application October 31, 1935, Serial No. 47,640
Renewed September 15, 1939

4 Claims. (Cl. 73—51)

My invention pertains to regulating timepieces and more particularly to a simple method of and apparatus for quickly regulating watches and other chronometers.

It is an object of my invention to provide a simplified watch regulating system utilizing an adjustable time retarding device for audibly comparing the operation of a watch to be regulated with a standard watch whereby complicated visual indicators and rotating elements are eliminated.

It is also an object of my invention to provide a simple watch regulating system for comparing the operation of a timepiece which is to be regulated with the operation of a standard timepiece which comprises means for impressing impulses from one watch, arranged for conveniently regulating, upon one ear of an operator through adjustable time retarding means, from an amplifier having an adjustable volume control, and means for holding the other watch directly upon the other ear of the operator.

It is a further object of my invention to provide a simplified method of regulating timepieces by comparing the operation of a timepiece which is to be regulated with a standard timepiece by applying the sound of the ticks of one timepiece directly to the ear and applying the ticks of the other timepiece through an adjustable time retarding device to the other ear whereby a binaural balance may be obtained, observing the relative operation of the timepiece after the binaural balance has been obtained and thereafter adjusting one of the timepieces to maintain the binaural balance.

The invention itself, however, both as to its construction and method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments, when read in conjunction with the accompanying drawing, in which

Figure 1 is a diagrammatic view representing a watch regulating system arranged in accordance with my invention; and

Figure 2 is a detail view illustrating a watch holding device for supporting a standard watch on the ear of the operator.

Referring more particularly to Figure 1 of the drawing, it will be seen that a watch regulating system arranged in accordance with my invention comprises generally a sound pick-up microphone 11 upon which a watch 13 to be regulated is conveniently placed, an interconnected electronic amplifying device 15 and associated adjustable time retarding units A and B from which the amplified impulses are transmitted to a sound reproducing device 17 such as a telephone receiver on a suitable headband 19.

The microphone 11 is preferably a piezo-electric type and the sound reproducing telephone receiver 17, which is supported upon the ear of the operator, is likewise preferably a piezo-electric type having accurate response to the higher frequencies. The interconnecting electronic amplifier 15 is likewise selected to have similar high fidelity characteristics for the higher frequencies in order that the accurate obtaining of a binaural balance may be facilitated and it comprises a volume controller 16 for varying the amplification thereof, as by varying a resistor connected into any suitable part of the amplifier circuit, in a well known manner. Amplifiers are obtainable on the market which are provided with volume controllers and such amplifiers, per se, form no part of my invention. In assembling the units of my system the piezo-electric sound pick-up device 11 is coupled to the input circuit of the amplifier by any suitable coupling means, which may comprise a resistor 21 which is connected in circuit 22, 23 with the pick-up device 11, and a coupling condenser 25 which is connected between one end of the resistor and an input terminal of the amplifier. The other end of the resistor 21 is connected to the other input terminal of the amplifier through a suitable conductor 27.

The time retarding devices, A and B, comprise time delay networks including inductances 31 connected in series relation through interconnecting conductors 33 and associated with bypassing condensers 35 which are connected across between the interconnecting inductance conductors 33 to a conductor 37 which extends directly to the retarding devices A and B from the amplifier 15. From the junction conductors 33 between the series connected inductances 31 of the first retarding device A, conductors 39 are connected to the contacts 41 of a multiple position switch comprising a brush 43 movable to selectively engage the contacts 41 whereby various sections of the retarding network may be switched in or out of the circuit. From the movable brush 43 of the switching means associated with device A a conductor 45 extends to the input end of the network of the second time delay device B which may be of similar construction. From the junction point of series connected inductances 47 of the second retarding device B, conductors 49 are extended to the stationary contacts 51 of a

second multiple position switch comprising a movable brush 53 from which the output conductor 55 extends. By suitably selecting the inductances and condensers of the time retarding device A, large units of retardation may be thereby provided. In the device B the inductances and condensers are preferably so selected that very small units of time-delay are introduced thereby. Thus it will be readily understood that by properly adjusting the two switches and selecting suitable combinations of coarse units and fine units connected in series relation a very fine adjustment of time retardation may be conveniently obtained by the operator.

For convenience the adjustable switches 43 and 53 are preferably mounted adjacent whereby the operator may conveniently adjust the movable brushes of one and then the other to obtain a precise balance. It will be understood that various other forms of time-delay network may be utilized in the time-delay devices, if desired, and also additional banks of time units may be provided in series connected relation. The time-delaying sections A and B are well-known in the electrical arts, and the applicant does not claim to have provided any improvement therein. From the last time-delay device of the series, the delayed impulses are impressed through conductors 37 and 55 upon the input of a second amplifier unit 57, having a volume controller 58, by means of which they are amplified to a desired level. From the output of the second amplifier unit 57 the impulses are transmitted by suitable conductors 59 and 61 to the sound reproducing headphone 17.

The other member of the headset comprises a holder for supporting a watch correctly upon the other ear of the operator. This watch is preferably the standard watch with which the operator wishes to compare the operation of the watch which is to be regulated.

As shown in Figure 2, the watch-supporting holder comprises a circular disc shaped casing 63 having a cavity in one side thereof for receiving the standard watch 65. The watch-receiving cavity is preferably lined with felt or other fibrous material 67, and it is partially closed around its open side by a cap 69 which fits over the open edge, the adjacent engaging surfaces being cooperatively threaded. The lower rim of the casing 63 is provided with a cut-out portion or slot 71 into which the stem 73 of the standard watch 65 is inserted when it is placed within the casing. The cover 69 is then screwed upon the casing 63 to hold the watch firmly in position. The casing is pivotally supported between the ends 74 of a U-shaped bracket 75 on a shaft 77 which pivotally slides through bearings 79 on the headband 19 in the manner usual with headphones.

In operation the operator places the watch 13 which is to be regulated upon the piezo-electric sound pick-up device 11. He then puts on the headset and listens simultaneously to the ticks of the two watches. By properly adjusting the volume control on either amplifier, the volume or intensity of the sounds applied to the ears is adjusted to be substantially equal from both watches. The operator then adjusts the time-delay devices A and B until the ticks of the two timepieces are accurately synchronized when the sound will seem to be centered directly in front of him. The sounds are then binaurally balanced. By thus utilizing the operator's binaural sense it is possible to very accurately determine when the sounds are precisely synchronized because the operator will be conscious of a time variation of a very short interval of the order of one ten-thousandth of a second or less.

After having obtained a binaural balance the operator continues to listen, and as one watch runs slightly faster than the other its ticks will soon become relatively advanced and the effect will be as though the source of sound was moving from in front of the operator toward the side corresponding to the ear associated with the faster timepiece. If, for example, the test watch 13 is running ten seconds fast per day it will gain one one-thousandth of a second in less than nine seconds, and one one-thousandth of a second variation is sufficient to create a very noticeable unbalancing effect. The operator is thus enabled to very quickly ascertain the accuracy of the tested watch with reference to the standard watch.

After making this determination the operator now makes the proper adjustments on the tested watch 13, which is lying conveniently on the sound pick-up device, and then again repeats the test to determine the results. In accordance with my invention a number of adjustments and tests may be conveniently completed in a few minutes, and the watch is regulated to the desired degree of accuray while the customer waits, thereby avoiding the inconvenience of depriving the customer of his watch or the necessity of providing a second watch for the use of the customer for several weeks.

The piezo-electric sound pick-up device and the piezo-electric headphone have very good high frequency response characteristics, thereby making it possible to obtain accurate binaural balancing in my system. Furthermore, these devices are not magnetic and may be used without danger of magnetizing the timepiece. Suitable devices of this type are available on the market and form no part of my invention.

It will be seen that I have provided a simple system whereby the binaural sense may be utilized for facilitating the quick adjustment of watches or other timepieces whereby the tested watch is conveniently disposed, the operator's hands and visual attention are free for conveniently adjusting the timepiece, and visual indicators and rotating members are eliminated.

Aside from the specific embodiments of the invention herein shown and described, it will be understood that numerous details may be altered or omitted without departing from the spirit and scope of the invention as disclosed and claimed, and that I do not desire to limit the invention to the exact arrangements as herein set forth.

I claim as my invention:

1. A testing device having in combination, a head-band, a watch holder mounted on said head-band for holding a watch adjacent one ear of a wearer, a telephone receiver secured on said head-band for disposal adjacent the other ear of the wearer, means coupled with said telephone receiver for energizing it in accordance with the operations of a mechanism to be tested comprising, a sound pick-up device arranged for convenient disposal adjacent said mechanism for translating sound impulses into electrical impulses, and adjustable time delaying means interconnected between said pick-up device and said telephone receiver.

2. In watch testing apparatus the combination of, means for holding a watch to one ear of an operator for listening directly thereto, means for

adjustably retarding the generated impulses from another watch, and means for separately applying the retarded impulses to the other ear of the operator whereby a binaural balance may be obtained between the sound impulses created by the operation of two watches irrespective of the relative phase relations of the watches.

3. In watch testing apparatus the combination of, sound pick-up means on which a watch may be placed in a position convenient for regulation, means for adjustably retarding the ticks received by said sound pick-up means, means for applying the retarded ticks to one ear of an operator, and means for supporting a standard watch directly upon the other ear of the operator whereby the frequency of operation of the first mentioned watch may be conveniently compared with said standard watch.

4. The method of comparing the operation of a timepiece to be tested with the operation of a standard timepiece which consists in, operating said timepieces simultaneously to produce impulses in accordance with the respective operations thereof, retarding the impulses from one of said timepieces into synchronous relation with the impulses from the other timepiece irrespective of the relative phase relation of the timepieces, and ascertaining the operating condition of the tested timepiece by synchronously comparing the impulses from said timepieces irrespective of the operating phase relations thereof whereby an ordinary accurate timepiece may be utilized as a standard timepiece if desired.

FREDERICK T. HICKS.