

- [54] **SYSTEM FOR REGULATING ROTARY SPEED OF A SHAFT** 3,221,231 11/1965 Reich ..... 58/28 R X  
 3,225,536 12/1965 Reich ..... 58/28 R X  
 3,225,536 12/1965 Reich ..... 58/28 R X  
 [76] Inventor: **Jose Gracia Barba**, 560 E. Lawn 3,293,568 12/1966 Ganter et al. .... 58/23 A  
 Guillermo 39, 40, Barcelona, Spain 3,451,210 6/1969 Helterline, Jr. et al. .... 58/28 R X  
 [22] Filed: **June 15, 1972** 3,512,351 5/1970 Shelley et al. .... 58/23 A  
 [21] Appl. No.: **263,275** 3,568,430 3/1971 Walton ..... 58/23 R  
 3,601,975 8/1971 Wuthrich ..... 58/28 R

[30] **Foreign Application Priority Data**  
 June 15, 1971 Spain ..... 392242

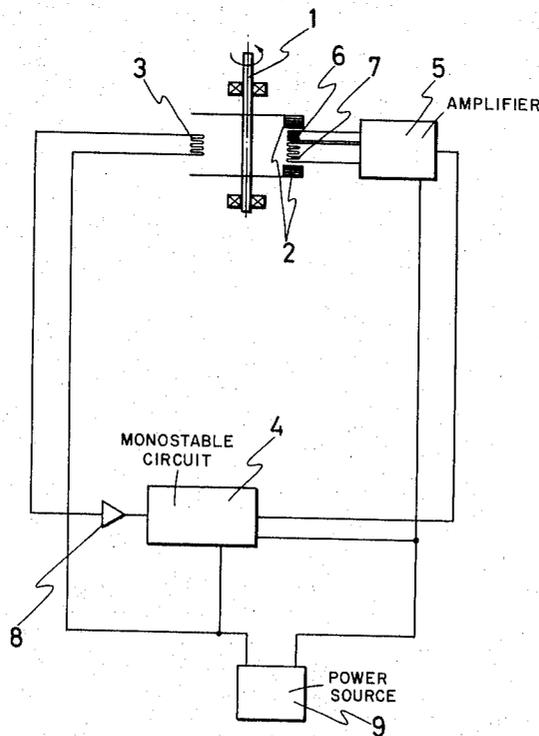
[52] **U.S. Cl.** ..... 58/23 D, 58/28 A  
 [51] **Int. Cl.** ..... G04c 3/04  
 [58] **Field of Search** ..... 73/2.6, 162; 58/23 D, 28 R,  
 58/28 A, 33; 318/131, 461

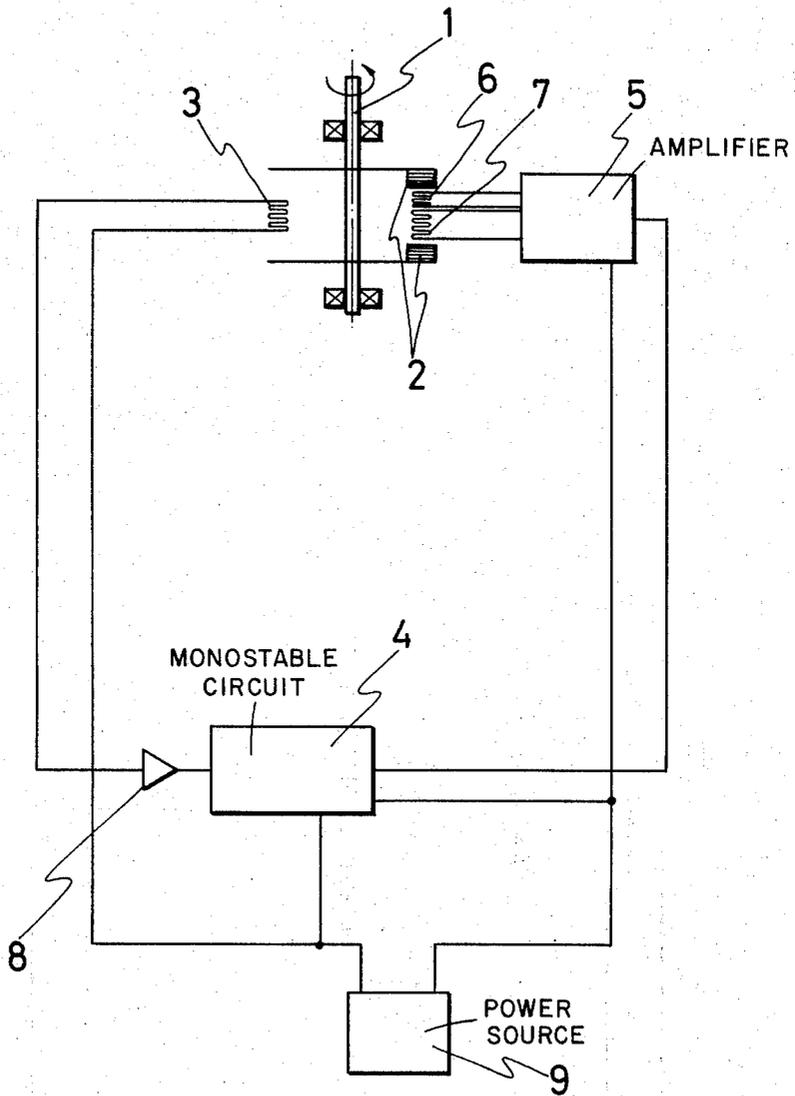
[56] **References Cited**  
**UNITED STATES PATENTS**  
 3,134,220 5/1964 Meisner ..... 58/28 A

*Primary Examiner*—Edith Simmons Jackmon  
*Attorney, Agent, or Firm*—Wenderoth, Lind & Ponack

[57] **ABSTRACT**  
 A pick-up attached to the shaft whose movement is to be regulated picks up a signal periodically produced by the shaft itself during its rotation. The signal triggers an electronic circuit which emits a stable signal of constant duration which acts on the pulsing system of the shaft.

**5 Claims, 1 Drawing Figure**





## SYSTEM FOR REGULATING ROTARY SPEED OF A SHAFT

The following main parts should be distinguished in a clock or watch mechanism: frame, driving member, train of wheels [clockwork], dial plate, escapement, regulating member, winding mechanism and time-setting mechanism. Each of these parts possesses a different and well known function.

The invention relates to a novel regulating member that can be used with a clock or watch mechanism and which possesses considerable advantages of precision, manufacturing cost and stability [strength] in relation to arrangements known until the present time.

The inventor, being an engineer specialized in electronics and after having performed various tests in the field of his specialty, has produced a regulating member based on a novel concept and applicable (among other possibilities) to a clock or watch mechanism which forces the driving member thereof to regulate its speed of rotation in accordance with the response of an electronic circuit.

The regulating member consists basically of peripheral elements and an electronic circuit.

The peripheral elements consist of signal pick-ups [picking up and emitting devices], a pulsing or, driving coil and an amplifier (except in the case where a transistor of the electronic circuit is employed for the purpose of amplification), as well as elements for adapting the electronic circuit to the particular mechanism to be regulated.

The electronic circuit consists of a circuit capable of emitting a response after receiving a signal, which response acts on the shaft pulsing system so as to regulate the speed of the shaft.

The circuit is designed in such a manner that the response consists of a stable signal whose constant duration constitutes the time base of the system.

The electronic circuit receives the signal of a pick-up arranged in the vicinity of the shaft. The signal is produced by the shaft itself periodically during its rotation.

The response of the electronic circuit is employed for blocking an amplifier which controls the driving member in the following manner:

The pick-up connected to the amplifier emits a pulse produced likewise by the shaft itself periodically during its rotation. The pulse is received by the amplifier and, if the amplifier is not blocked by the response signal of the electronic circuit, the pulse is transformed into an amplified pulse in the driving coil which, in turn, transforms it into a thrust exerted on the driving member. In the case where the amplifier is blocked by the electronic circuit owing to the fact that the pulsing coil did not receive the pulse, a thrust is not exerted on the driving member and, consequently, the driving member will reduce its speed.

The driving member should comprise a magnetic circuit subjected to the action of the driving coil and the elements required for producing the signals in the pick-up connected to the electronic circuit and in the pick-up connected to the signal input of the amplifier, that were mentioned above.

These elements could be formed by:

a. the magnetic circuit as such subjected to the action of the pulsing or driving coil, if the pick-up elements consist of coils;

b. any suitable device capable of effecting closing in the case where the pick-up elements consist of mechanical or static switches.

The system is supplied from a source of electrical energy.

The electronic circuit may consist advantageously of a monostable "single-stroke" circuit or another circuit having similar function, that is to say, which, in response to an input pulse, produces another stable pulse whose constant duration constitutes the time base of the system.

In any case, the electronic circuit should meet the requirements of a minimal sensitivity to variations of voltage and temperature. Obviously, this condition is met in the case proposed as an example of the invention.

In order to illustrate the object of the invention in a suitable manner, an exemplified embodiment is explained below in connection with a general diagram.

In the diagram, the electronic circuit is represented (by way of nonrestrictive example) by a monostable "single-stroke" circuit, which among other possibilities could also be replaced by an electronic circuit consisting of a memory unit capable of receiving a pulse from the pick-up and being reset to zero by an oscillator through a Y gate connected (in its turn) to the memory unit; such a replacement does not modify the diagram that we shall examine below.

Other features and advantages of the invention will be better understood from the reading of the following description of an exemplified embodiment made in reference to the attached drawings wherein:

the single FIGURE shows the arrangement of the various elements.

The shaft is equipped with a pair of disks, each disk comprising magnetic elements situated in relatively opposite positions at points near the periphery of the disks.

In regard to the FIGURE, the reference numeral 1 indicates a customary rotary driving shaft of the clock or watch mechanism, the reference numeral 2 indicates magnetic elements, the reference numeral 3 indicates a pick-up coil [receiving-emitting coil] connected to a monostable circuit designated by the reference numeral 4, the reference numeral 5 designates an amplifier, the reference numeral 6 a pick-up coil connected to the amplifier, the reference numeral 7 a pulsing coil likewise connected to the amplifier, the reference numeral 8 designates an optional amplifier and the reference numeral 9 a source of electrical energy.

In accordance with the above exposition and the drawings described, the operation is as follows:

a. An initial pulse produced by any suitable known means is applied to driving shaft 1.

b. When pick-up coil 3 connected to the monostable circuit is encountered by the field of magnetic cores 2 in the course of their trajectory, a voltage pulse is induced by the cores in the pick-up coil, which pulse is transmitted to monostable circuit 4, either directly or through amplifier 8 that is not of essential importance.

c. The response of monostable circuit 4 consists in another pulse, whose duration constitutes the time base of the system, that is picked up by amplifier 5.

d. While all such pulses are produced, the shaft rotates together with the elements 2 integral therewith and when pick-up coil 6 connected to the signal input of the amplifier is encountered by the field of magnetic

3

4

cores 2 in the course of their trajectory, a pulse is induced in the pick-up coil by the cores, which pulse, received by amplifier 5 if the amplifier is not blocked by the signal from the monostable circuit 4, is transformed into an amplified pulse in pulsing or driving coil 7 which, in its turn, transforms it into a thrust exerted on driving shaft 1. If amplifier 5 is blocked by the signal from monostable circuit 4, the passage of magnetic cores 2 brings about a braking effect exerted on driving shaft 1.

In the embodiment described, applied in particular to a clock or watch mechanism, the mechanical means of anchor and hair-spring, escapement and regulation systems (enjoying most wide usage at the present time) are eliminated with the advantage that the mechanism is endowed with a greater precision. Watches which are much more economical (at the present time) than those employing other means, e.g., tuning fork and quartz, can thus be constructed with a sufficient accuracy.

The application of the invention extends to other industrial fields; generally, it can be applied to any case where the rotation of a shaft is to be controlled so that it occurs in a constant time. Consequently, the arrangement is ideal for regulating the operation of the rotary mechanism of a record turn-table, a tape recorder, etc.

Of course, experts may apply certain modifications to the devices or processes just described merely by way of a nonrestrictive example, without thus departing from the scope of the invention. For example, it should be clear that any transducer capable of converting the angular position of the axis to an electrical pulse could be used in place of the coils 3 and 6. These transducers could be mechanical switches or photoelectric means as described in U.S. Pat. Nos. 3,221,231 and 3,225,536, respectively.

I claim:

1. A system for adjusting the rotating speed of a driving shaft comprising first and second transducer means operatively coupled to said shaft for converting specific angular positions of said shaft into electrical signals, each of said transducers having an output where said electrical signals are provided; a monostable circuit having an input and an output for generating a pulse of predetermined constant duration at its output each time a signal is applied to its input, the output of said transducer being connected to the input of said monostable circuit; an amplifier having a signal input, an output and a blocking input; third transducer means operatively coupled to said shaft for converting electrical signals to mechanical pulses for influencing the motion of said shaft, said third transducer having an input for receiving electrical signals; the output of said second transducer being connected to the signal input of said amplifier; the output of said amplifier being connected to the input of said third transducer, and the output of said monostable circuit being connected to said blocking input of said amplifier whereby said amplifier amplifies the signal from said second transducer and applies said amplified signal to said third transducer only when no signal exists at the output of said monostable

circuit and when a signal is produced by said second transducer.

2. The system of claim 1 wherein the specific angular positions of said first and second transducers are determined by the duration of the pulse of the monostable circuit.

3. The system of claim 1 wherein said third transducer means causes the speed of said axis to increase when an input signal is applied thereto from said amplifier output.

4. A system for adjusting the rate of rotation of a drive shaft, comprising:

a first transducer means rigidly coupled to said drive shaft and rotating therewith for generating a signal indicative of the position thereof and for responding to a signal to produce a rotary force for rotation of said rotary drive shaft;

second and third transducer means fixedly positioned at different locations along the path of rotation of said first transducer means for converting specific angular positions of said first transducer means into electrical signals, each of said second and third transducer means having an output where electrical signals are provided;

a monostable circuit means having an input and an output for generating a pulse of predetermined constant duration at its output each time a signal is applied to its input, the output of one of said second and third transducer means being connected to the input of said monostable circuit means;

amplifier means having a signal input, an output and a blocking input, the other of said second and third transducer means being connected to the signal input of said amplifier means, and the output of said monostable circuit means being connected to the blocking input of said amplifier means;

a fourth transducer means coupled to the output of said amplifier means and receiving an output pulse therefrom and positioned along the path of rotation of said first transducer means whereby said first transducer means may be driven by said amplifier means via said fourth transducer means,

whereby said amplifier means only produces an output pulse when no output is produced by said monostable circuit means and when an input signal is received by said amplifier means at said signal input, said predetermined pulse of said monostable circuit means being chosen in accordance with the separation of said second and third transducer means and the desired rate of rotation of said rotary drive shaft, said amplifier means thereby providing an output pulse of longer duration when said rotary drive shaft rotates at a slower than desired rate and providing an output pulse of shorter duration when said rotary drive shaft rotates at a faster than desired rate, thereby maintaining the desired rate of rotation of said rotary drive shaft.

5. The system of claim 4, wherein said first transducer means is comprised of a permanent magnet and said second, third and fourth transducers are comprised of coils.

\* \* \* \* \*