H. M. BAKER, Jr.

SPEED CONTROL DEVICE.

APPLICATION FILED APR. 6, 1914.

1,239,758.

Patented Sept. 11, 1917.

2 SHEETS—SHEET 1.

Fig. 1

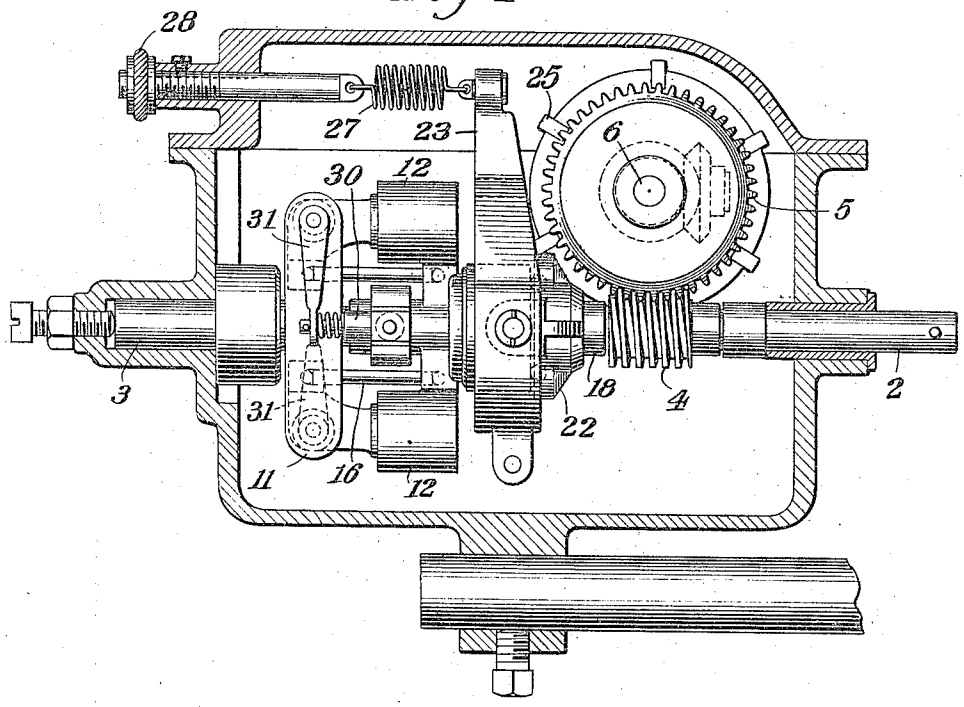
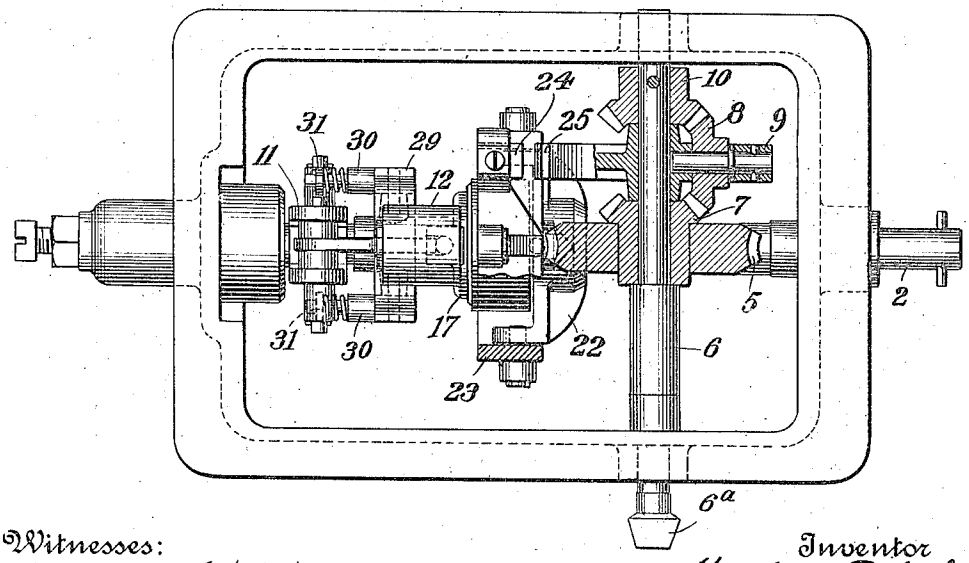


Fig. 2



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2 SHEETS—SHEET 2.

Fig. 3

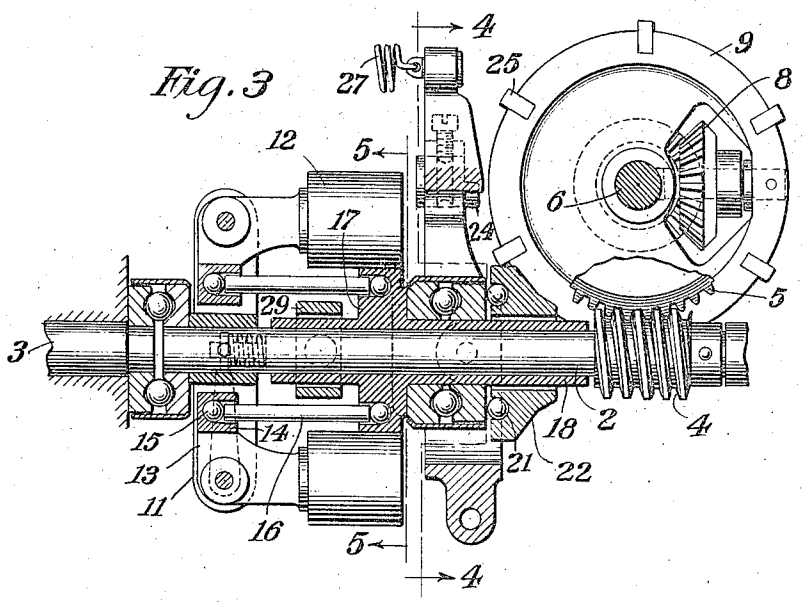


Fig. 4

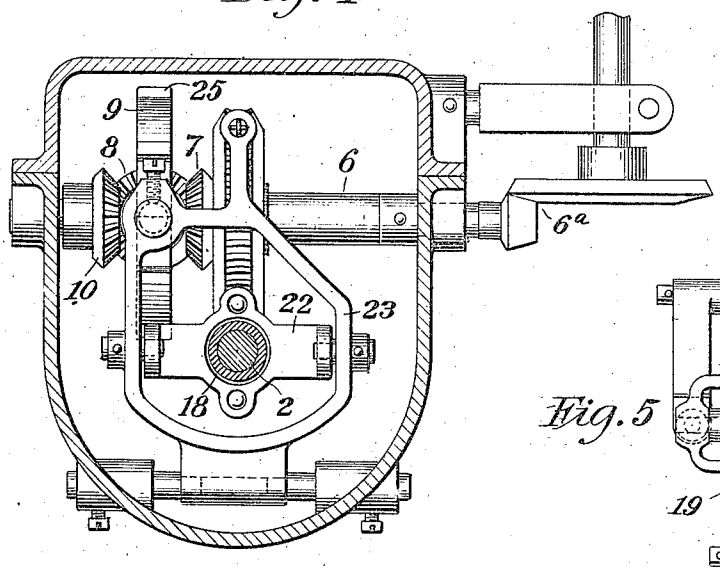
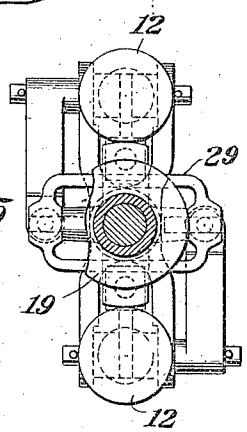


Fig. 5



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UNITED STATES PATENT OFFICE.

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SPEED-CONTROL DEVICE.

1,239,758. Specification of Letters Patent. Patented Sept. 11, 1917.

Application filed April 6, 1914. Serial No. 829,779.

To all whom it may concern:

Be it known that I, HAYDN M. BAKER, Jr., a citizen of the United States, and resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Speed-Control Devices, of which the following is a specification.

This invention relates to gearing for a speed control device and more particularly to an improvement in the mechanism shown and described in a prior Patent No. 942,609, granted to me on December 7, 1909, which mechanism comprises a gearing adapted at a predetermined speed to effect a positive driving connection between a power shaft and a second shaft or other element to be operated thereby.

One object of my present invention is to improve the mechanism therein shown in such manner that the gearing is rendered much more sensitive to small changes in speed. A further object of the invention is to provide a construction in which the accuracy of the instrument is not affected by the continued use thereof.

A further object of the invention is to provide means whereby the instrument may be readily and accurately adjusted to effect the driving connection at different speeds.

With the above and other objects in veiw, which will hereinafter appear, my invention consists of the construction hereinafter described and shown in the accompanying drawings, wherein—

Figures 1 and 2 show the mechanism in longitudinal section each view being at right angles to the other;

Fig. 3 is a longitudinal section similar to Fig. 1 showing the central parts in section;

Fig. 4 is a sectional view on line 4—4 of Fig. 3; and

Fig. 5 is a sectional view on line 5—5 of Fig. 3.

Referring now to the drawings 1 indicates the casing of the device which may be of any suitable configuration and of sufficiently rigid construction to support the coöperating parts. Working in suitable bearings in the end plates of the casing is the driving shaft 2 of the device which for convenience I have shown with a pin on its projecting end for connection with any suitable source of power. The other end of the shaft is supported in a ball thrust bearing whose stationary part 3 is adjustably seated in the end plate of the casing. Attached to the shaft near its projecting end is a worm 4 meshing with a worm wheel 5 mounted for free rotation on a transverse shaft 6 supported above the shaft 2 in the side walls of the casing. The end of the shaft 6 projects through the wall of the casing whereby it may be connected by suitable gearing 6^a or otherwise to a signal or other device which it is desired to operate when the shaft 2 attains the predetermined speed. Attached to the worm wheel 5 is a bevel gear 7 which meshes with a bevel gear 8 supported on an axle set radially between the hub and the rim of a stop wheel 9, the hub of which is also free to rotate on the shaft 6. Meshing with the bevel gear 8 is a third gear 10 fast to the shaft 6.

With the parts assembled as described, and the stop wheel free to rotate, it is obvious that the rotation of the worm wheel will turn the stop wheel around on the shaft 6 in the usual manner of a sun and planet gearing without effecting the rotation of the shaft 6, and when the stop wheel is locked against rotation the gear 8 will act as an idler between the gears 7 and 10 so that the shaft 6 will be operated directly from the shaft 2 through the reducing worm 4.

As in my prior patent I provide a centrifugally controlled device for locking the stop wheel 9 at the desired speed. This centrifugal mechanism has been greatly improved in my present device and comprises a cross-head 11 attached to the shaft 2 immediately beyond its thrust bearing and provided with oppositely extended pairs of arms between which are pivoted the centrifugal governor weights 12. The supporting levers of the weights 12 are each provided with an inward extension or bellcrank arm 13 having in its inner face near its free end a socket 14 for a bearing ball 15. Set loosely in the sockets 14 with their ends resting against the bearing balls are thrust rods 16 whose upper ends project into similar ball sockets in the lower face of a cross-head 17 formed on a sleeve 18 carried by the shaft 2 and free to both slide and rotate thereon. The cross-head 17 is provided with

a flange 19 whose thrust is transmitted through a suitable bearing the stationary part of which engages with its upper face a pair of balls 21 set in sockets on the under face of a third cross-head 22 surrounding the sleeve 18 but clear of the sleeve to permit a limited transverse movement of the yoke as will now be described.

The cross-head 22 is provided with oppositely projecting arms having ears at their extremities which provide bearings for opposite sides of a yoke 23 surrounding the bearing 20 and pivoted at one side on the wall of the casing as shown more particularly in Fig. 4. The opposite end of the yoke 23 projects under the edge of the stop wheel 9 and is provided with a locking projection or pawl 24 adapted to engage when the yoke is raised, with the stop-pins 25 set in the periphery of the stop-wheel. Attached to the free end of the yoke beyond the pawl is a tension spring 27 which yieldingly connects the yoke to an adjusting screw whose end projects through a bore in the wall of the casing, and is provided with an adjusting nut 28 whereby the screw and spring may be adjusted longitudinally.

It is necessary for the bushing or sleeve 18 to revolve in unison with the shaft 2, and yet be perfectly free to slide longitudinally thereon. Any friction arising from the contact of the rotating sleeve with any non-rotating parts of the apparatus, must be overcome in some manner by a connection between the sleeve or bushing 18 and the shaft 2, in order to transmit a rotating motion to the sleeve 18 as stated.

If the ordinary method of using a key, seated in the shaft and fitting a keyway in the bushing, or a pin in the shaft fitting slidably in a slot in the bushing be used, then the effort of the key or pin to transmit rotation from the shaft 2 to the sleeve 18 will produce a pressure between the point of contact of the key or pin with the bushing 18 and also between one side of the bushing 18 and the shaft 2, resulting in a static friction which must be overcome by the centrifugal parts before the endwise motion can take place. It has not been found practicable to eliminate this in part by the use of two oppositely located keys or pins, and even if it were, some sliding friction would remain. I eliminate this static friction by connecting the shaft 2 and sleeve 18 for rotation in the following manner.

The sleeve 18 is fitted with a small yoke 29 which is suspended freely upon two pins located in two oppositely situated hubs, on sleeve 18. This yoke 29 has two pins 30 projecting, one at each end, longitudinally at ninety degrees to its suspension pin supports. It is able to swivel slightly upon its support pins.

In assembling, the sleeve 18 with its yoke 29 is slid upon the shaft 2 and cross-head or weight carrier 11 is pushed onto the shaft to its proper position, adjacent the sleeve 18, and its retaining pin driven through it and the shaft 2.

The bellcrank weight arms are now inserted in the open ends of the carrier 11 and the pivot pins for the weights inserted in such a manner that one end of each pin projects from opposite sides of the carrier 11. Upon each projecting pin is slipped a link 31, the free end of which hooks over a projecting pin 30 of the yoke 29. A small spring is used on each pin or yoke 29 to hold link 31 down to position which is determined by a small cross pin as shown.

It will now be seen that a rotation of the shaft 2 in the direction of dragging both links 31 will tend to swivel the yoke 29 in the direction of rotation at each of its ends, but this cannot be as the yoke 29 is in itself rigid and is suspended from trunnion pins in its plane of rotation with sleeve 18.

It will be seen that a force tending to retard the rotation of the sleeve 18 with its shaft 2 will be transmitted through the trunnion pins of the yoke, to the yoke and through the pins 30 thereof, to links 31, and thence to the weight pivot pins in carrier 11, and so to the shaft. The pressure upon the two pins 30 of the yoke 29, where they enter the holes in the links 31 will be equal, because if there should be imperfect fitting the yoke 29 will rotate upon its pins slightly and cause the pressure to be equalized between its two pins, and the outer ends of the holes in the ends of the links 31.

The effect of this is, therefore, to produce a balanced force of rotation upon the sleeve 18, without side pressure upon the shaft, the sleeve 18 being free to move endwise upon the shaft 2 to the extent desired. In moving forward the sleeve 18 causes the links 31 to raise at their outer ends slightly, and in doing this the sleeve 18 is forced to rotate very slightly upon the shaft 2 in the direction of rotation, which action aids in overcoming the friction of rest between the sleeve 18 and the shaft 2 with relation to its endwise movement.

In centrifugal governors as heretofore constructed, the governor weights were allowed a considerable range of motion, whereby their center of mass are at a greater distance from the center of rotation at the higher speeds than at the lower speeds. This is particularly noticeable in effect with governors which are nearly isochronous, where a slight accession of speed would cause the governor weights to fly out to a relatively great distance, calling for a considerable reduction in speed to bring them to their normal position, and often resulting in "hunting".

In my present construction I guard

against this defect by limiting the movement of the weights to an amount just sufficient to bring the stop pawl into the range of the teeth or pins on the stop wheel. The end of the sleeve 18 is projected through the cross-head of the saddle 22 into close proximity with the adjacent face of the worm 4 whereby when the sleeve has been moved a slight distance on the shaft, it will be stopped by engagement with the worm, and the further pressure of the weights will be taken up between the weight carrying frame 11 and the worm 4.

Owing to this limitation in the movement of the weights they revolve with a nearly uniform radius of rotation, allowing the "critical" speed of the device to be directly and accurately varied by adjusting the tension of the control spring 26.

Further, the instrument is very sensitive as regards the release of the stop pawl with its tooth, as the speed decreases, below the critical point, when the governor weights are free to retire from their actuating position, they not having obtained an extreme position of "throw" even if subject to a great excess of speed, and are consequently ready to retire at the proper reduction of speed. The hard polished surfaces of the teeth in the stop wheel and the pawl in the yoke interpose but little friction in the process of retirement of the pawl, even when under considerable pressure.

It will be noted that the mechanism is constructed throughout to eliminate friction and binding of the engaging parts. The thrust rods between the lever arms of the weights and the cross-head of the sleeve 18 are smaller than their sockets so as to permit free relative angular movement in all directions. Further as the rods are free at each end, each weight is free to produce its full pressure independent of the throw of the opposite ball or weight, its motion not being restricted as it would be by a link such as used in prior constructions.

The ball bearing between the sleeve 18 and the cross head 22 minimizes the friction of rotation between these parts and the balls in the face of the cross-head relieves all friction due to the angular motion of the yoke 23.

I have shown and described a construction using only two weights but it will be understood that the number of weights may be increased as desired by merely adding suitable connections to the frame 11. It will also be understood that the device may be made reversible by providing a second gear device to be locked when the speed of the shaft falls below the desired "critical" speed, and that various other changes may be made in the construction and proportion of the parts without departing from the spirit of my invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. The combination in a speed control device, of a rotatable shaft, centrifugal weights carried thereby, a sleeve surrounding said shaft, connections between said sleeve and said weights for effecting longitudinal movement of said sleeve upon centrifugal movement of said weights, a stop member actuated by longitudinal movement of said sleeve, a secondary shaft extending in an axial line to said main shaft a rotatable member mounted thereon, adapted to be engaged by said stop member, and gearing including a planetary gear for connecting and disconnecting said rotatable member with said main shaft, and a stop attached to said shaft for limiting the movement of said sleeve.

2. The combination in a speed control device, of a rotatable shaft, a cross head attached to said shaft, centrifugal weights pivotally mounted in said cross head, a sleeve to rotate and slide on the shaft connections between said weights and said sleeve for effecting an end-wise movement of said sleeve upon centrifugal movement of said weights, and an equalizing connection between said cross head and said sleeve for transmitting the rotary motion of said cross head to said sleeve.

3. The combination in a speed control device, of a rotatable shaft, a cross head attached to said shaft, centrifugal weights pivotally mounted in said cross head, a sleeve to rotate and slide thereon, connections between said weights and said sleeve for effecting an end-wise movement of said sleeve upon centrifugal movement of said weights, an equalizing connection between said cross head and said sleeve for transmitting the rotary motion of said cross head to said sleeve, comprising a yoke pivoted on said sleeve and having rigid longitudinal pins connected thereto and links connecting said ends with the opposite sides of said cross head.

4. The combination in a speed control device, of a rotatable shaft, a cross head attached thereto, centrifugal weights carried by said cross head, a sleeve mounted on said shaft and free to move end-wise thereon, means for shifting said sleeve comprising bell crank arms carried by said weights, and thrust rods between said arms and a flange of said sleeve, said rods being loosely seated at each end in sockets in said arms and flange respectively.

5. The combination in a speed control device, of a rotatable driving shaft, a driven shaft, a worm gear attached to said driving shaft for driving said driven shaft, a sleeve mounted for longitudinal movement on said driving shaft, centrifugal mechanism for actuating said sleeve, means controlled by said

sleeve, including a secondary shaft extending in an axial line to said main shaft, a rotatable member mounted thereon, and gearing, including a planetary gear, for connecting and disconnecting said rotatable member with said main shaft, said worm gear being positioned on said shaft to prevent movement of said sleeve in excess of its operative movement.

6. The combination in a speed control device, of a rotatable driving shaft, a driven shaft, a worm gear attached to said driving shaft for driving said driven shaft, a sleeve mounted for longitudinal movement on said driving shaft, centrifugal mechanism for actuating said sleeve, means controlled by said sleeve for effecting operative connection between said driving and driven shafts, comprising a yoke pivotally mounted adjacent said sleeve having arms extending on each side thereof, a cross head pivotally connected to the arms of the yoke and having an enlarged bore surrounding said sleeve and flange on said sleeve, and an intermediate member between said cross head and said flange having an anti-friction bearing on each side thereof.

7. In a speed control device, the combination of a rotatable driving member, a revoluble driven member, permanently intermeshing gears connecting the said members with each other, and means for operatively disconnecting the same including a stop member, a governor rotating with the said driving member, a stop mechanism for engagement with the said stop member, and an operative connection between the said governor and the said stop mechanism and independent of the said driving member to eliminate static friction.

8. In a speed control device, the combination of a driving shaft, a driven shaft, permanently intermeshing gears connecting the said shafts with each other and means for operatively disconnecting the same including a stop wheel, a governor rotating with the said driving shaft, a stop device for the said stop wheel, and an operative connection between the said governor and the said stop device and including a sleeve loosely mounted on the said driving shaft to slide and to turn thereon, and to eliminate static friction.

9. In a speed control device, the combination of a driving shaft, a driven shaft, permanently intermeshing gears connecting the said shafts with each other, and means for operatively disconnecting the same including a stop wheel, a governor rotating with the said driving shaft, a stop device for the said stop wheel, an operative connection between the said governor and the said stop device including a sleeve loosely mounted on the said driving shaft to slide and to turn thereon, and means to limit the sliding movement of the said sleeve and thereby the centrifugal action of the said governor.

Signed at New York in the county of New York and State of New York this 28th day of March, 1914.

HAYDN M. BAKER, JR.

Witnesses:
W. B. MORTON,
L. E. JOHNSTON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."