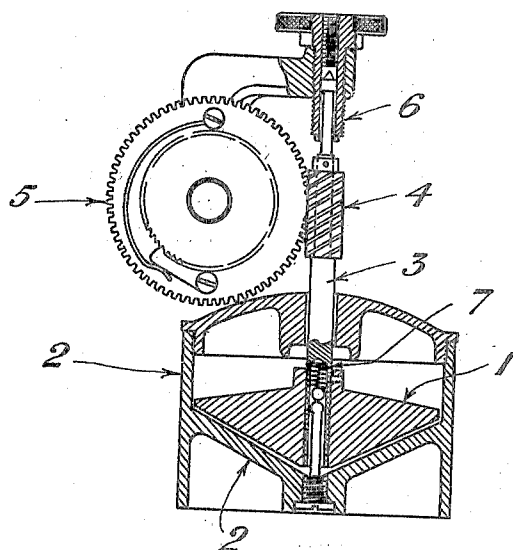


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A. BARR ET AL
SPEED CONTROLLING DEVICE
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SPEED-CONTROLLING DEVICE.

Application filed February 10, 1921. Serial No. 443,977.

To all whom it may concern:

Be it known that we, ARCHIBALD BARR and WILLIAM STROUD, subjects of the King of Great Britain and Ireland, and both of
5 Caxton Street, Anniesland, Glasgow, Scotland, have invented new and useful Improvements in a Speed-Controlling Device, of which the following is a specification.

The object of our invention is to provide
10 a ready means for controlling the speed of mechanisms and varying the speed at will through a wide range of speeds. It is applicable for example to the control of recording drums used in physiological and other ex-
15 periments, to the control of the reading motion in optophones, and for many other purposes.

We accomplish this by causing the mechanism to be controlled to drive a new or improved type of governor consisting essentially of a rotating part and a stationary
20 part between which there is a more or less viscous fluid constrained into the form of a thin lamina, and providing means for varying the moment of resistance of the fluid
25 friction by varying the area of the lamina that is distorted during the motion of the rotating part, varying the thickness of the lamina, and varying the mean radius at
30 which the rotating part acts on the fluid.

The stationary part consists of a casing with a conical hemispherical or otherwise recessed bottom placed with its axis vertical and provided with bearings for a vertical
35 rotating spindle, and mounting on the rotating spindle a rotor the base of which conforms or approximately conforms to the form of the bottom of the casing. In the bottom of the casing a suitable amount of
40 liquid is placed, so that the rotor experiences fluid friction in revolving. Provision is made for raising or lowering the rotor in the box. When the rotor is raised the area
45 of rotor surface acting on the liquid is reduced, the thickness of the liquid lamina is increased and the mean radius of the liquid lamina is reduced. All of these variations
50 tend towards the reduction of the resistance at any given speed of rotation; or otherwise, the speed for a certain driving torque is increased. In this manner a wide range of speed is obtained for a constant torque applied to the rotor.

The effectiveness of the device can be in-
55 creased by providing a driving gear to the

rotor of a mechanically inefficient type. Thus the rotor of the control device may be driven by a wheel acting on a quick pitched worm such as is often used for driving control mechanisms of other types, in gramophones, etc.

It will be evident that by the intervention of suitable connecting means the apparatus may be used to control the speed of parts
60 having rotating, straight line, or other motions.

An example of a device constructed according to this invention will now be described with reference to the accompanying drawing, in which the figure is a vertical
70 section.

In the drawing 1 designates the rotor, 2 the casing in which it revolves, 3 the spindle, and 4 one element of the driving gear.

The under side of the rotor 1 and the bottom of the case 2 are conical in form. The driving gear provided comprises a helical
75 toothed driving wheel 5 and worm 4 so arranged that when the drive is applied the driving wheel 5 tends to lift the rotor spindle up against a bearing in an adjusting screw 6. The lifting of the rotor may
80 be assisted by a spring 7 supported within the lower end of the spindle. Thus, when the drive is applied if the screw 6 is raised the rotor rises, increasing the clearance between its under surface and the bottom of the case. The spring 7 may be
85 made strong enough to bear the whole weight of the rotor and even to support the rotor against the driving force of the wheel when the latter is driven in the direction that tends to force the rotor spindle down.

If now, when the rotor is in a low position, the space between the case and the rotor is filled with liquid up to the level of the rim of the rotor, there is a certain resistance
95 to the rotation of the rotor, and consequently to the rotation of the wheel 5, which resistance will vary proportionally, or nearly so, to the velocity of rotation of the rotor, and
100 therefore there is an effective control of the speed of rotation of the wheel 5 if a given torque is applied to it. Now if the screw 6 is raised the rotor will rise and the liquid
105 will no longer occupy the whole space between the under side of the rotor and the bottom of the case, and moreover the thickness of the lamina of liquid between the rotor and the case will be increased. It will
110

be evident that the torque required for a given speed of rotation of the rotor will thus be reduced (a) in virtue of the increase in the thickness of the liquid lamina (b) on account of the reduction of the area of the lamina in contact with the rotor; and (c) on account of the effective radius at which the resistance acts on the rotor being reduced. It follows then that, for a given torque applied to the spindle of the rotor, the velocity of rotation will increase as the screw 6 is raised. The result is that we have a control that can be very readily and rapidly adjusted to allow the driving mechanism to revolve at any desired speed, within wide limits, for a given driving torque applied to the rotor spindle.

We do not limit ourselves to the use of the type of drive shown, viz, a toothed wheel driving a quick worm on the rotor spindle, but this type, for many applications of the invention, has the advantage that a given change in the resistance to revolution of the rotor produces a greater change in the driving torque required at the driving wheel than would be the case if a more efficient driving gear—such, for example, as a wheel and pinion—were used to communicate motion to the rotor spindle.

The drawing shows the case constructed so that no stuffing box is required to prevent egress of the liquid, the construction of the cover being such that if the apparatus be turned upon its side or inverted the liquid is caught and does not leak past the shaft.

It will be evident that the principle of the apparatus is in no way altered if the interior part that has been called the rotor is held stationary and the part that has been called the case is rotated by the mechanism to be controlled, the essential feature being relative rotation of the inner and outer components.

We claim:—

1. A speed controlling device comprising a rotatable member rotatable about a vertical axis and a stationary member having complementary surface portions the lower of which is recessed in close proximity forming a receptacle such that liquid within the receptacle is constrained by the surface portions into the form of a thin lamina and means for effecting relative axial adjustment of the members for varying the moment of the liquid friction involving variation of the thickness of the lamina, variation of the

area of contact of the lamina with one of the members and variation of the effective radius at which the liquid acts upon the rotating member.

2. A speed controlling device comprising a stationary casing, a rotatable member contained within the stationary casing mounted to rotate about a vertical axis the casing and rotatable member being mounted capable of relative axial adjustment and having surface portions in close proximity forming a receptacle, liquid within the receptacle constrained by the surface portions into the form of a thin lamina and means for effecting relative axial adjustment, for the purpose set forth.

3. A speed controlling device comprising a rotatable member rotatable about a vertical axis and a stationary member having complementary surface portions the lower of which is recessed in close proximity forming a receptacle, gearing of a mechanically inefficient type for driving the rotatable member, liquid within the receptacle constrained by the surface portions into the form of a thin lamina and means whereby provision is made for varying the moment of the liquid friction in the process of operation.

4. A speed controlling device comprising a rotatable member rotatable about a vertical axis and a stationary member having complementary surface portions the lower of which is recessed in close proximity forming a receptacle, gearing comprising a helical toothed driving wheel and worm, liquid within the receptacle constrained by the surface portions into the form of a thin lamina and means whereby provision is made for varying the moment of the liquid friction in the process of operation.

5. A speed controlling device comprising a stationary casing, a rotatable member contained within the stationary casing mounted to rotate about a vertical axis the casing and rotatable member being mounted capable of relative axial adjustment and having surface portions in close proximity forming a receptacle, liquid within the receptacle constrained by the surface portions into the form of a thin lamina, a spring support for the rotatable member and means for effecting relative axial adjustment, for the purposes set forth.

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