Oct. 9, 1934. J. STOIBER 1,976,304

CENTRIFUGAL GOVERNOR FOR A MOTION PICTURE CAMERA

Filed June 30, 1932

Fig. 1.

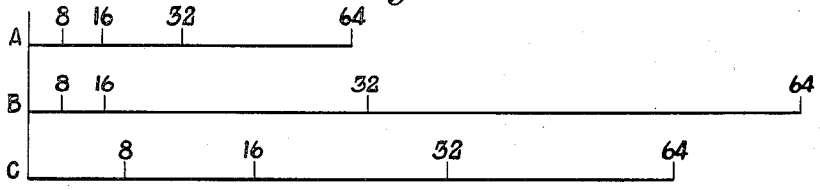



Fig. 2.

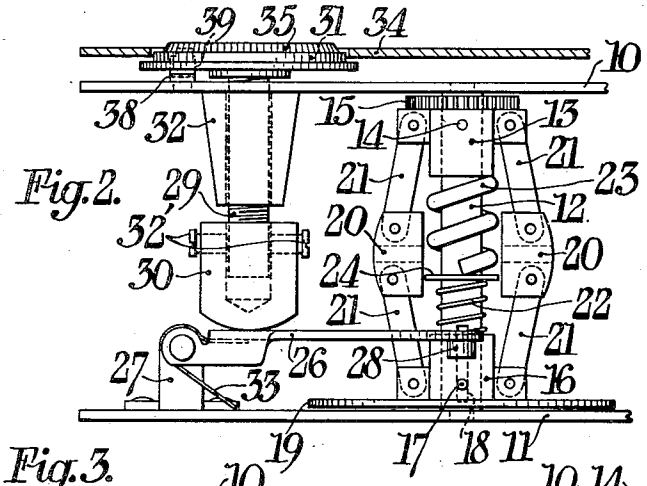



Fig. 3.

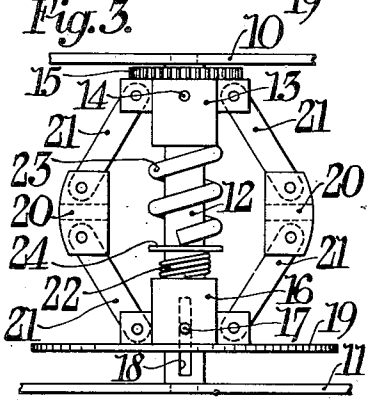



Fig. 5.

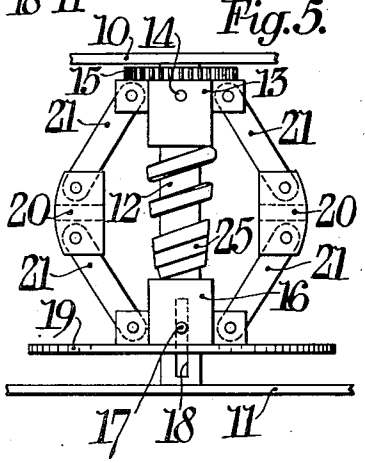
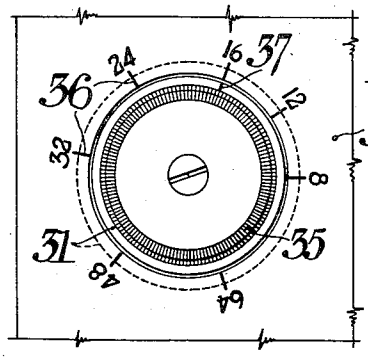



Fig. 4.




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# UNITED STATES PATENT OFFICE

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## CENTRIFUGAL GOVERNOR FOR A MOTION PICTURE CAMERA

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3 Claims. (Cl. 188—187)

The present invention relates to a centrifugal governor and more particularly to a governor for use on high speed motion picture cameras.

The use of multiple speed centrifugal governors on high speed cameras to vary the speed of camera operation is known. However, the weights in the ordinary type of centrifugal governor are only slightly displaced at low speeds so that the graduations for setting the governor are crowded or close together over the range of low speeds.

The primary object of the present invention is the provision of a centrifugal governor in which increasing resilient resistance is offered to displacement of the weights by the centrifugal forces in the governor so that the graduations for the various governor speeds are not crowded together for the low speed settings.

Other objects of the present invention will be suggested to those skilled in the art as the disclosure of my invention is continued hereinafter.

The above and other objects of the invention are attained by the provision in a centrifugal governor of a spring means which presents comparatively little resistance to displacement of the governor weights at low speeds and which presents comparatively high resistance to displacement of the governor weights at high speeds. Such a spring means is preferably composed of two portions of different characteristics, the weaker portion controlling the displacements of the governor weights at low speeds and the stronger portion controlling the displacements of the weights at high speeds. Alternatively, the spring means may have a tapering or increasing cross section so that the spring convolutions of small cross section are weak and result in more even distribution of the governor settings over the low speed range.

Reference is hereby made to the accompanying drawing in the several figures of which similar reference numerals designate similar elements, and in which:

Fig. 1 is a graphical illustration of the operating characteristics of the spring means according to the invention as compared to the characteristics of spring means of known form.

Fig. 2 is a plan view of a centrifugal governor according to the invention and means for setting the governor speed.

Fig. 3 is a plan view of the centrifugal governor shown in Fig. 1 but illustrating that the weaker of the two springs is entirely overcome by axial displacement of the weight members before the stronger spring is appreciably compressed.

Fig. 4 is a side elevation of Fig. 2 illustrating the spacing of the speed settings on the casing.

Fig. 5 is a plan view of a centrifugal governor having a modified form of spring means which in this case has a tapering cross section so that the convolutions of the spring are successively overcome by displacement of the governor weights.

As previously indicated, it has not been possible heretofore to construct a centrifugal governor for motion picture cameras such that the low speed settings of the governor are not crowded together. As a result, the low speed settings of the governor are very apt to be inaccurate and such inaccuracy is quite undesirable, especially at low speeds at which any discrepancy in the speed setting will be more noticeable.

Referring to Fig. 1, the line A graphically illustrates the settings at the various speeds for the ordinary type of centrifugal governor. It will be noted that the lower speeds, namely 8 and 16 frames per second, are close together. The range of governor weight displacements may be increased by using a weaker spring and this is graphically illustrated by the line B in which the entire displacement over the complete speed range is more than twice that of line A. However, the displacements for the low speed settings have not been spread out and are still objectionably close together. The present invention consists in providing a governor spring which offers increased resilient resistance to the displacement of the governor weights as the governor speed increases. Comparatively small resilient resistance is presented to the displacements at low speeds and the seetings for these speeds are spread out as graphically illustrated by the line C of Fig. 1. These graphical illustrations are all based upon the results of actual tests.

Referring now to Figs. 2, 3, and 5 of the drawing, the centrifugal governor is mounted between the camera mechanism plates 10 and 11. A shaft 12 is rotatably mounted at each end in plates 10 and 11. A collar 13 is fixed to shaft 12 by a pin 14 and shaft 12 is rotated by any suitable prime mover through a gear 15, also fastened to shaft 12 adjacent collar 13. A slidable collar 16 is keyed to shaft 12 to turn therewith but adapted to slide axially thereon and has a pin 17 engaging a slot 18 in shaft 12. A governor disk 19 is attached to collar 16 to rotate with shaft 12 but axially slidable with respect thereto. A plurality of weight members 20 are movably mounted between collars 13 and 16 by means of a plurality of links 21. The governor construction thus far described and

the axial displacement of governor disk 19 upon rotation of shaft 12 by virtue of the centrifugal forces created in weight members 20, are well known. However, the present practice recognizes only the use of an ordinary coil spring to oppose the approach of collars 13 and 16 toward each other but, as pointed out, this results in crowding of the low speed settings.

In the preferred form of my invention, the spring means which opposes the displacement of slidable collar 16 and governor disk 19 under the action of weight members 20, is composed of two portions having dissimilar resilient characteristics. One portion of the spring means may be a light coil spring 22 which may encircle shaft 12 adjacent slidable collar 16 while the other portion of the spring means may be a heavy coil spring 23 which encircles shaft 12 adjacent collar 13. A washer 24 encircles shaft 12 and is located between light coil spring 22 and heavy coil spring 23.

The light coil spring 22 is overcome first by axial displacement of collar 16 and has its ultimate resilient resistance under compression proportioned to the ultimate resilient resistance of heavy coil spring 23 so that rotation of the governor shaft 12 at normal speed will result in complete compression of light coil spring 22. The normal speed referred to is the usual speed at which amateur motion picture cameras are operated, that is 16 frames or pictures per second. The relation of the parts at this normal speed, and with the light coil spring 22 completely compressed, is illustrated in Fig. 2. Increase in the rotative speed of shaft 12 beyond the normal speed will result in compression of the heavy coil spring 23.

A modified form of the spring means according to the invention is illustrated in Fig. 5. The spring means in this case is a coil spring 25 having tapering characteristics; that is, the spring is made up in the usual manner and then ground down to a taper while compressed. The coil spring 25 may, of course, be replaced by any other spring of similar characteristics, such as a spring which has been coiled from a gradually tapering wire. The increased resilient resistance of coil spring 25 is attained more gradually than with the pair of springs 22 and 23 because the single convolutions of spring 25 are overcome upon displacement of collar 16 successively and one at a time. The portion of the parts in Fig. 5 illustrates the displacement of collar 16 and governor disk 19 at normal speeds and at which some of the spring convolutions abut each other, leaving only the stronger convolutions of the spring to oppose further increase in the governor speed.

A brake means for limiting the displacement of collar 16 and governor disk 19 by weights 20 under the influence of centrifugal force will next be described. Such a brake means may include a brake arm 26 pivotally mounted upon a bracket 27 which is attached to mechanism plate 11. A brake shoe 28 is mounted upon the free end of brake arm 26 and may be composed of leather, cork, or other suitable material.

An adjustable stop means for controlling the position of the brake arm 26 is composed of a threaded stem 29 having a head piece 30 attached to one end and a dial 31 attached to the other end, the threaded stem 29 engaging a split nut 32 mounted on mechanism plate 10. The head piece 30 is attached to and may be adjustably located on the end of threaded stem 29 by means of a pair of set screws 32'. The head piece 30 abuts brake arm 26 and a spring 33 holds brake arm 26 against head piece 30 in all positions thereof.

The face of dial 31 extends into an opening in the camera casing 34 and a knurled, annular ridge 35 is provided on the face of dial 31 to facilitate manual rotation thereof.

Referring now to Fig. 4, the camera casing 34 is provided with a plurality of graduations 36 adapted to register with an index mark 37 on the face of dial 31 to indicate the various settings of head piece 30 for corresponding governor speeds. Numerals indicating the exposures per second at which the camera is operating are etched upon camera casing 34 adjacent the appropriate graduations 36. A lug 38 on mechanism plate 10 cooperates with a projection 39 on dial 31 to prevent more than a single rotation of dial 31.

The operation of the centrifugal governor according to the invention will now be described. Assuming that dial 31 is set in the position shown in Fig. 4 with index mark 37 opposite the graduation 36 for normal operation of the camera at 16 exposures per second, then brake arm 26 will abut head piece 30 with brake shoe 28 in the position shown in Fig. 2. As the shaft 12 comes up to speed, the centrifugal forces in weight members 20 will cause them to fly away from the shaft and will result in axial movement of slidable collar 16 toward collar 13. The spring means of the governor will be compressed, the resilient resistance of the weaker portion or weaker convolutions of the spring means being first overcome. Since the shaft 12 is preferable driven by a spring motor, the speed of rotation thereof will continue to increase until governor disk 19 rubs against brake shoe 28, which prevents further axial displacement of disk 19 and which prevents further increase in the speed of shaft 12. If the setting of dial 31 is altered, then the position of brake shoe 28 will be correspondingly changed and the displacement of governor disk 19 will be limited to that which corresponds to the speed of rotation desired.

Since many modifications of my invention may be made without exceeding the scope of the invention, the present disclosure is to be construed in an illustrative and not in a limiting sense.

Having now particularly described my invention what I desire to secure by Letters Patent of the United States and what I claim is:

1. A motion picture apparatus for operating over a speed range of which the highest speed is many times the lowest speed, comprising a casing provided with an opening, a centrifugal governor including a plurality of weights mounted for rotation about an axis, including a disk axially movable by the action of said weights, and including a resilient means acting in opposition to axial movement of said disk, a brake member movable to various positions and adapted in each of said positions to limit the axial movement of said disk and to limit the rotational speed of said governor, an adjustable means for controlling the location of said brake member in said various positions, and a plurality of graduations and an index arranged on said casing and said adjustable means for relative movement and adapted to indicate the governor speeds corresponding to said various positions of said brake member, characterized by said resilient means including a plurality of spring convolutions having different resilient resistances and acting at all times simultaneously to present increasing resistance at an

increasing rate to said axial movement of said disk as the governor speeds increase from said lowest to said highest speeds.

2. A motion picture apparatus for operating over a speed range of which the highest speed is many times the lowest speed, comprising a casing provided with an opening, a centrifugal governor including a plurality of weights mounted for rotation about an axis, including a disk axially movable by the action of said weights, and including a resilient means acting in opposition to axial movement of said disk, a brake member movable to various positions and adapted in each of said positions to limit the axial movement of said disk and to limit the rotational speed of said governor, an adjustable means for controlling the location of said brake member in said various positions, and a plurality of graduations and an index arranged on said casing and said adjustable means for relative movement and adapted to indicate the governor speeds corresponding to said various positions of said brake member, characterized by said resilient means including a plurality of springs of different strengths and located in end to end relation to present an increasing resistance at an increasing rate to said axial movement of said disk as the governor speeds increase from said lowest to said highest speeds.

3. A motion picture apparatus for operating over a speed range of which the highest speed is many times the lowest speed, comprising a casing provided with an opening, a centrifugal governor including a plurality of weights mounted for rotation about an axis, including a disk axially movable by the action of said weights, and including a resilient means acting in opposition to axial movement of said disk, a brake member movable to various positions and adapted in each of said positions to limit the axial movement of said disk and to limit the rotational speed of said governor, an adjustable means for controlling the location of said brake member in said various positions, and a plurality of graduations and an index arranged on said casing and said adjustable means for relative movement and adapted to indicate the governor speeds corresponding to said various positions of said brake member, characterized by said resilient means including a conical spring having convolutions of increasing resilient resistances and presenting rapidly increasing resistance at an increasing rate to said axial movement of said disk as the governor speeds increase from said lowest to said highest speeds.

JOSEPH STOIBER.