

Aug. 22, 1944.

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2,356,167

MOVEMENT DETERMINING MECHANISM

Filed Feb. 26, 1942

FIG. 1

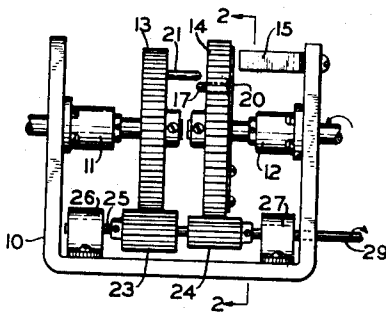


FIG. 3

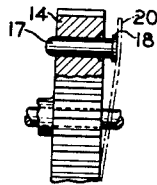


FIG. 2

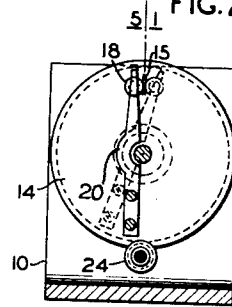


FIG. 4

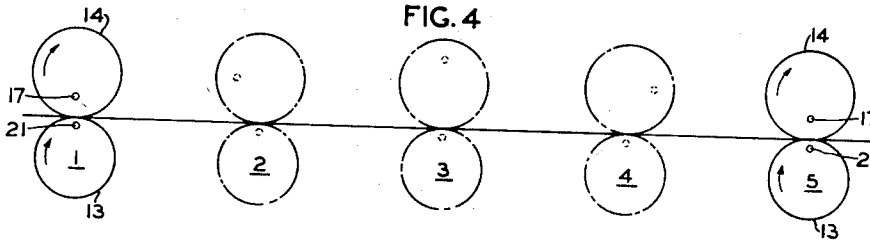


FIG. 5

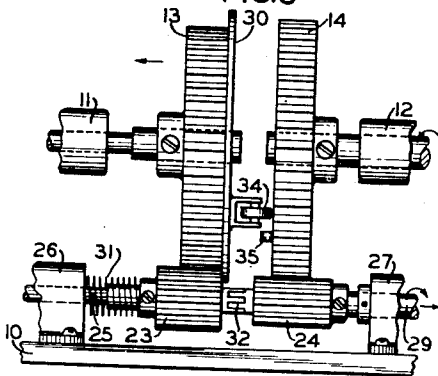


FIG. 6

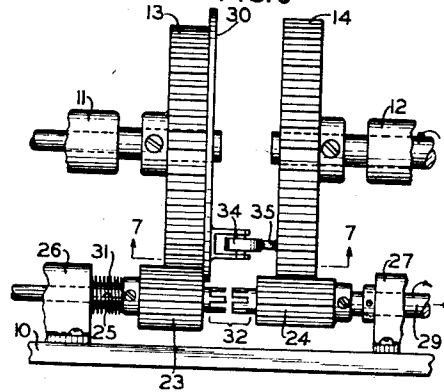
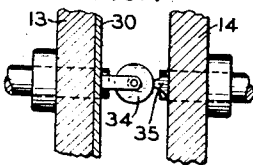


FIG. 7



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2,356,167

MOVEMENT DETERMINING MECHANISM

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Application February 26, 1942, Serial No. 432,409

11 Claims. (Cl. 74—189)

This invention relates to movement determining mechanisms. More particularly, the invention concerns a mechanism by which the extent or degree of mechanical motion in the parts of a given apparatus or device may be confined within predetermined limits or measured at desired constant intervals.

An object of the invention is to provide a self-contained small mechanical unit of this character which is readily adapted to any desired apparatus with which it may be advantageously employed.

One of the features of the invention resides in the use of two rotatably mounted controlling members for the mechanism which are driven in the same direction at different rates of speed, the respective members having cooperating elements thereon which engage and, when engaged, coact with a piece in the mechanism which determines the extent of movement of the members.

A further feature of the invention consists in the provision of spaced gears to form the controlling members of the mechanism, the gears being coaxially arranged with respect to one another and being of different pitch diameters.

Other objects, features and structural details of the invention will be apparent from the following description when read in connection with the accompanying drawing, wherein

Fig. 1 is a side elevation of a preferred embodiment of the improved mechanism in which the same serves to limit the extent of motion of a desired part of the apparatus with which it is employed.

Fig. 2 is a cross-section taken on line 2—2 in Fig. 1.

Fig. 3 is an enlarged detail view showing the movably mounted stop engaging element employed in this form of the invention.

Fig. 4 is a schematic view showing different relative positions of the engaging elements on the rotating members or pinions which cooperate with the limit stop to determine the extent of movement of the members.

Fig. 5 is a side elevation view of a modified form of the invention in which the same is employed in measuring constantly spaced intervals in the operation or extent of movement of a desired part of the apparatus with which it is associated.

Fig. 6 is a view similar to Fig. 5 showing the cooperating elements of the rotatable member in an engaged position, and

Fig. 7 is a cross-section taken on line 7—7 in Fig. 6.

With reference to Figs. 1 to 3, inclusive, the improved movement determining mechanism is illustrated as contained on a U-shaped bracket mounting 10. Secured to the sides of the mounting 10 are oppositely disposed bearings 11 and 12 by which two separate rotatable members in the form of gears or pinions 13 and 14 are arranged with their respective shafts in coaxial relation. In the construction shown, the pinion or rotatable member designated at 14 has a larger pitch diameter than the gear or member 13 with which it is associated. In order to clarify the description with reference to the claims, member 14 is hereinafter termed the first rotatable gear or pinion while member 13 is termed the second rotatable gear or pinion. The movement determining piece for the mechanism is indicated at 15 in this form of the invention, the same being a fixed bracket element mounted directly on the U-shaped frame mounting 10.

The first rotatable member includes a normally ineffective movable element therein which engages the stop or limit piece 15, in this instance, at either side of the same as shown in Fig. 2. Gear 14 is consequently confined within predetermined limits of operation in this embodiment of the invention and the mechanism thereby limits the extent of motion of a desired part of the apparatus with which it may be employed. The movable element on member 14 is designated at 17, the same being situated in an eccentric position in the member 14 in an opening provided therein for this purpose. One end of the element 17, which is pin-shaped, includes a positioning flange portion 18 that, in connection with a spring 20, locates the element in a normally ineffective position with respect to the movement determining piece 15. The pin element 17 is shown in an operative or effective position in Fig. 3. The opposite end of the element 17 is rounded at its tip in this instance, and extends in a longitudinal direction along the axis of the pinion towards the associated gear or rotatable member 13.

Means in the form of a further pin 21 situated on the second member 13 is provided for moving the movable element 17 to an effective stop engaging position. Pins 17 and 21 provide relatively movable parts of a two-part cooperating element for the limit piece 15, the end of pin 21 engaging the rounded tip of the movable pin 17 and urging the same in a longitudinal direction against the action of spring 20 to obtain this re-

sult. Spring 20 is suitably secured to the side of pinion or rotatable member 14.

The respective members 13 and 14 are connected by means which rotates the same in like directions within the limits permitted the members by the piece 15. This is accomplished in the present instance by pinions 23 and 24 mounted on a common shaft 25 located in bearings 26 and 27 situated in the base of the bracket mounting piece 10. Pinion 23 meshes with pinion 13 and pinion 24 meshes with pinion 14. The axis of shaft 25 for the gearing connection illustrated is situated in parallel relation to the axis of the coaxially arranged first and second pinions or rotating members. The motion whose extent is to be determined or limited may be introduced by way of the common shaft 25. Because of this fact, these respective shafts are shown in Fig. 1 as extending exteriorly of the bracket mounting 10. For purposes of description it will be assumed that the motion of the part of the apparatus which is to be limited is introduced into the mechanism by way of the extending portion of the shaft 25, as designated in the drawing at 29.

In considering the operation of the mechanism, it will be further assumed that the mechanism starts from one of its limiting positions, such as provided by the parts in their dotted line position in Fig. 2. As shown in this figure, the extended end of pin 17 engages the right-hand side of the stop piece 15 and prevents further counter-clockwise movement of gear or rotating member 14 in this direction. Shaft 29, however, is permitted to move under the control of the part of the apparatus with which it is employed so that gear or rotating member 14 is free to rotate in a clockwise direction. Movement of gear 14 in this direction is permitted by the mechanism until the other limiting position is reached, in which the pin 17 engages the limit piece 15 to the left side of the same as indicated in the full line position of the parts in Fig. 2 of the drawing.

Fig. 4 shows diagrammatically different positions of the parts of the mechanism between its respective limit defining positions. The positions 1 and 5 at the extreme left and right of this figure and in Fig. 2 designate such limit defining positions. For purposes of description in the instant case, gear 14 has a larger pitch diameter than gear 13 and a proportional relation such as 4 to 3 is selected between the respective pitch circumferences of the associated gears. The cooperating elements for the stop, consisting of pins 17 and 21 in the respective rotating members, are each spaced an equal distance from the axis of rotation of the members, as clearly shown in Fig. 2, so that the pins engage when positioned in longitudinal relation by the gears. From one limiting position of the mechanism, such as indicated in the dotted line position of the parts in Fig. 2, motion may be introduced into the mechanism by way of shaft 29 so that the rotatable members 14 and 13 move clockwise until the other limiting position is reached. Fig. 4 shows the relative positions of the cooperating pins of the mechanism as this other stop position is approached. In position 2, gear or rotatable member 13 has passed through one complete revolution of travel. When leaving the stop position 1, the pin or actuator 21 immediately moves out of engagement with pin 17, which is then ineffectively positioned by spring 20. The gears are urged in the same direction at different rates of speed of pinions 24 and 23, the pin 17 lagging

behind pin 21 so that when position 2 is reached, pin 17 is 90° removed from pin 21. As the motion continues and position 3 is reached, in which two revolutions of gear 13 have occurred, the respective pins are then 180° removed from each other. In position 4, which represents the parts when a further full revolution of gear 13 has taken place, pin 21 is shown as overtaking the lagging pin 17 and is then only 90° removed therefrom. On the fourth complete revolution of rotatable member 13, the pins again come into cooperative engagement and pin 17 is rendered effective to limit against the piece 15. This position of the parts is clearly shown by the full line positions thereof shown in Fig. 2.

By changing the gear ratios, the radial positions of the pins, or by obtaining the controlled motion through the shaft of either rotatable member 13 or 14, considerable latitude in the extent of movement determined by the mechanism can be obtained. It is further obvious that more than two rotatable members could be used in accordance with the teaching of the present invention, as intermediately located gears could be employed between gears 14 and 13, each having its own slidable pin element therein. This would considerably extend the limits of movement permitted by the mechanism.

With reference to Figs. 5 to 7, inclusive, a modification of the mechanism is shown which permits continuous motion of the rotating members in one direction and measures the extent of such motion at predetermined constant intervals. In this form of the invention a plate 30 is fixed to one side of gear or rotatable member 13. The plate cooperates with pinion 23 and this assembly of parts is permitted a limited axial movement to the left as viewed in Fig. 5. Spring 31 normally retains the parts in the position illustrated in Fig. 5, in which a clutch means 32 is engaged. The clutch 32 provides a means for disengaging the respective parts of the shaft 25, which is divided in two parts in this instance. The measuring piece for the mechanism may be considered to be the plate or disc 30 in connection with the axially movable shaft of either gear 13 or pinion 23, on which a suitable counting or measuring device can be located and actuated during and by the axial movement of either of these parts. The cooperating elements to effect this result in the instant case are a roller element 34 situated on the plate 30 and a cam piece actuator 35 located on the second rotatable member 14. The motion is preferably introduced to the mechanism in this form of the invention by way of the shaft for gear 14 or the extending shaft of the pinion 24. The mechanism operates in the manner previously described except for the fact that the cam 35 does not limit against the roller 34 but rides over the same to axially displace the gear 13, pinion 23 and the shafts therefor against the action of spring 31 and simultaneously opens the clutch means 32 during this operation. This instantaneous position of the parts of the mechanism is clearly shown in Figs. 6 and 7, the gear thereafter continuing in the same direction of travel and the other parts immediately reassuming their normal positions, which are retained until the following cooperative action of the roller and cam.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above

description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What I claim is:

1. The combination in a movement determining mechanism of, a first rotatable member, a movement determining piece for the mechanism, an element on said member adapted to cooperate with said piece and mounted for movement in a direction parallel to the axis of rotation of the member, a second rotatable member arranged in spaced coaxial relation to the first member, said first and second members being of different diameters, means for connecting said members for rotation in the same direction, and an actuator on said second rotatable member that engages and axially moves said element into cooperable relation with said piece.

2. The combination in a movement determining mechanism of, a first gear, a movement determining piece for the mechanism, an element on said first gear adapted to cooperate with said piece and mounted for movement in a direction parallel to the axis of rotation of the gear, a second gear arranged in spaced coaxial relation to the first gear and being of a different diameter than the same, a gearing connection between said respective gears linking the same for rotation in like directions, and an actuator on said second gear that engages and axially moves said element into cooperable relation with said piece.

3. A motion limiting mechanism comprising a first gear, a second gear coaxially arranged with respect to the first gear and being of a different diameter than the same, a fixed stop piece, a normally ineffective element slidably mounted in the first gear, a second element for rendering said normally ineffective element effective to contact said stop piece, said second element being mounted on the second gear, and a gearing connection for said respective gears facilitating movement of the same in like directions between the limits of travel permitted the mechanism by the stop piece.

4. In a motion limiting mechanism, a limit piece, a first rotatable member having a normally ineffective movable element therein for engaging said limit piece, a second rotatable member coaxially arranged with respect to the first rotatable member and being of a different diameter than the same, connecting means for moving said rotatable members in like directions, and means situated on said second rotatable member for moving said element to an effective,

limit piece engaging position to define the limit of travel of the mechanism.

5. In a motion-limiting mechanism, a first gear, a limit piece for the mechanism, a second gear coaxially arranged with respect to said first gear, said gears being of different diameters, a pair of cooperable elements, a first thereof being movably mounted in said first gear and movable into engageable relation to said limit piece, and the second of said pair being fixed on said second gear in a position to engage the first thereof and move the same to a limit piece-cooperating position, and means for connecting said gears to provide movement of the same in like directions within the limits of travel provided the mechanism by the limit piece.

6. A motion limiting mechanism of the character recited in claim 5 in which the connecting means for said gears are gears of different pitch diameters mounted on a common shaft, the axis of which parallels the axes of the coaxial first and second gears, and in which the first of said cooperable elements is normally ineffectively positioned by means of a spring.

7. A motion limiting mechanism as claimed in claim 4, in which the respective rotatable members are gears and the first has a larger pitch diameter than the second.

8. A motion limiting mechanism as claimed in claim 4, in which the permitted motion is introduced therein by way of the first rotatable member.

9. A motion limiting mechanism as claimed in claim 4, in which the permitted motion is introduced therein by way of one of said rotatable members.

10. A motion limiting mechanism as claimed in claim 4, in which the permitted motion is introduced therein by way of the connecting means for moving the rotatable members.

11. In motion-limiting mechanism of the character described, a plurality of rotatably mounted members, motion-limiting means, a pair of cooperable means, a first means thereof being movably supported on a first of said members and movable into engageable relation to said limiting means, and the second means of said pair being mounted to rotate with a second of said members in cooperable relation to said first means and being adapted to move said first means into engageable relation to said limiting means, and means for rotating said first and second members in the same direction but at different speeds.

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