May 15, 1962 M. A. HALL 3,034,370

INCREMENT WHEEL

Filed May 27, 1960

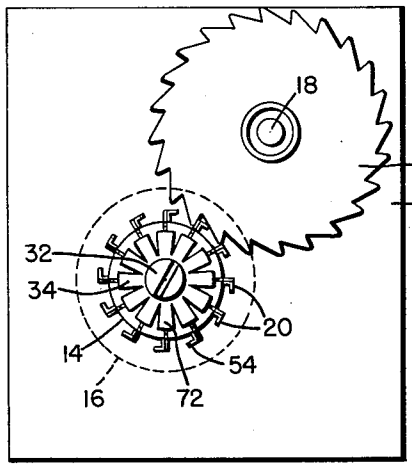


Fig. 1

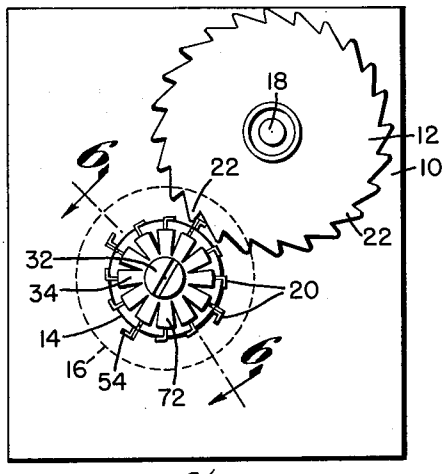


Fig. 2

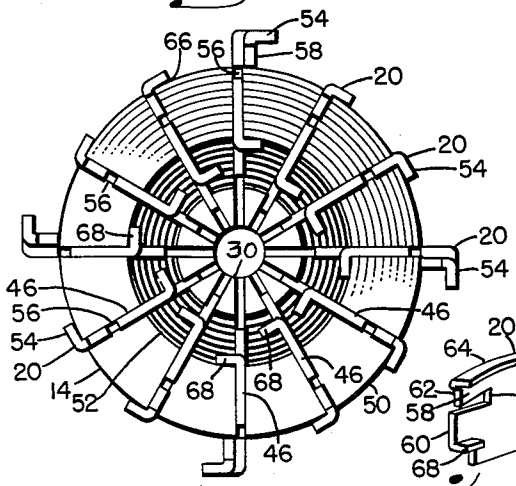


Fig. 3

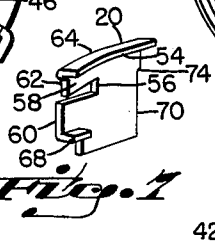


Fig. 7

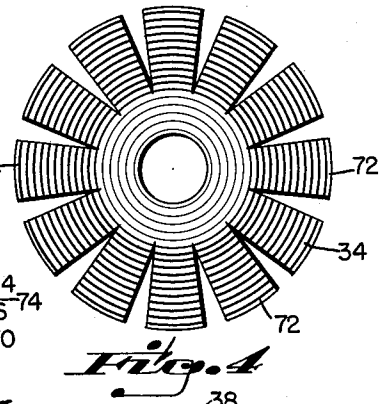


Fig. 4

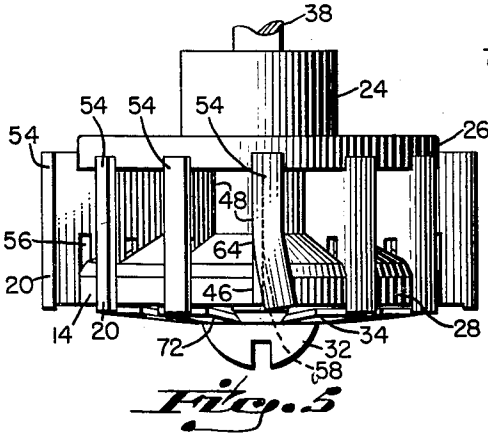


Fig. 5

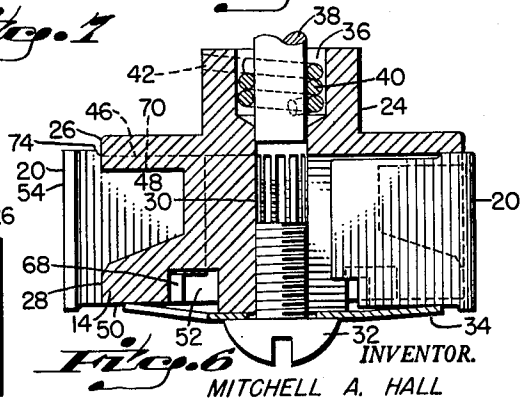


Fig. 6

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INCREMENT WHEEL

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14 Claims. (Cl. 74—415)

The present invention relates to an increment wheel, and is concerned particularly with means to activate automatically a subject device such as a valve, an electrical switch, a mechanical linkage or other apparatus to be controlled, at preselected time intervals and/or for predetermined periods of time, as may be determined from time to time according to the will of an operator. In other words, the increment wheel can be set or adjusted whenever necessary, to perform functions or services at regular or irregular time intervals, or throughout periods of predetermined duration, as may be required.

An object of the invention is to provide an improved control device of the character stated, which is highly dependable and accurate in its operation.

Another object is to incorporate in a device of the character stated, improved easily manipulated means for changing or resetting the operating characteristics of the device instantly and without the use of tools.

A further object is to provide simple and inexpensive means for locking certain operating elements of the control device in adjusted positions, to avoid the possibility of erratic or undependable performance due to possible loss or change of adjustments in the course of operation of the device.

The foregoing and other objects are attained by the means described herein and illustrated upon the accompanying drawings, in which:

FIG. 1 is a front elevational view of the improved control device of the invention, shown adjusted or set to perform a maximum number of successive actuations at regular time intervals.

FIG. 2 is a view similar to FIG. 1, showing the device set to perform a lesser number of successive actuations in a given period of time.

FIG. 3 is an enlarged front elevation of a driving apparatus constituting an element of the control device, parts thereof being removed to disclose interior construction.

FIG. 4 is a plan view of a spring plate constituting part of the driving apparatus.

FIG. 5 is a top plan view looking downwardly upon FIG. 3.

FIG. 6 is a cross-sectional view taken on line 6—6 of FIG. 2.

FIG. 7 is a detail perspective view of an adjustable stop or abutment forming part of the driving apparatus.

The present invention constitutes an improvement over the device disclosed in my copending application Serial No. 819,355, filed June 10, 1959.

In the drawing, 10 indicates a support upon which are rotatably mounted a ratchet wheel 12 and a driving element drum or increment wheel 14, the latter being preferably kept in continuous slow rotation by means of a synchronous electric motor 16 or equivalent prime mover. It may be assumed, for the purpose of the instant explanation, that the motor rotates element 14 at a constant speed of one revolution per hour; however, the particular rate of rotation is a matter of immateriality to the present invention, and should be so considered.

The driven member 12, which may be a ratchet wheel or equivalent element, may have a central shaft 18 adapted to activate any form of subject apparatus, such as a valve, an electrical switch, or a mechanical linkage or the like to be controlled, such subject apparatus being omitted from the disclosure as unnecessary to a full and complete understanding of the present invention.

As indicated upon FIGS. 1, 2 and 3, the slowly rotating driving element or increment wheel 14 carries a multiplicity of selectively extensible blades or abutment elements 20, which when extended radially outwardly from the periphery of the driving element may engage a tooth such as 22 of the ratchet wheel, for partially rotating the latter. Referring to FIG. 2, for example, one of the blades or abutment elements 20 is shown in driving contact with one of the ratchet wheel teeth 22, for rotating the ratchet wheel in clockwise direction a distance determined by the time that the blade or abutment element remains in driving contact with the tooth 22. It is assumed, of course, that the driving element 14 is slowly rotating continuously in counter-clockwise direction.

Those blades or abutment elements 20 which are shown retracted with relation to the driving element periphery will not reach a ratchet wheel tooth, and will not therefore drive the ratchet wheel as the increment wheel or driving element rotates. But as a blade 20 fully extended is brought into position to contact any tooth 22 of the ratchet wheel, the extended blade will engage the tooth to transmit to the ratchet wheel the motion of the driving element so long as the engagement persists, or until the blade passes over the peak of the tooth.

From the foregoing, it will be understood that with four blade or abutment elements extended, as in FIGS. 2 and 3, one full rotation of the increment wheel, drum or driving element 14 will result in imparting four impulses to the ratchet wheel, causing it to rotate a total distance traversed by four ratchet wheel teeth.

In the example of FIG. 1, there are twelve blade or abutment elements extended from the increment wheel or driving element 14, so that upon one full rotation of the driving element, twelve impulses will be delivered to the ratchet wheel. If but one blade or abutment element were extended, only one actuation of the ratchet wheel would occur during a complete rotation of the driving element.

Thus it will be understood that if the increment wheel or driving element of FIG. 2 rotates at the rate of one revolution per hour, the ratchet wheel will be actuated at fifteen-minute intervals so long as the driving element rate of rotation is maintained. If there are twelve blade or abutment elements extended, as in FIG. 1, the ratchet wheel will be actuated at five-minute intervals, under the same rate of rotation of the driving element. The number and the sequence of abutment elements to be extended is by choice of the operator, as will be understood.

The body of the increment wheel, drum or driving element 14 may consist of a turned wheel having a centrally bored hub 24 and a pair of spaced annular flanges 26 and 28 integral therewith. The bore 30 of the hub may be interiorly screw-threaded to receive a screw 32, the purpose of which is to secure in position against the outer face of flange 28 a spring plate 34, to be referred to in greater detail hereinafter. Bore 30 may be counterbored as at 36 to accommodate the drive shaft 38 of a synchronous electric motor for slowly rotating the element 14 as previously explained.

Shaft 38, if desired, may be keyed or otherwise fixedly secured within bore 30, or, as shown in FIG. 6, the shaft may drive the element 14 through the intermediary of a one-way clutch, herein disclosed by way of example as a coiled spring 40 embracing the shaft and having one of its ends 42 anchored to the hub 24. This form of clutch depends for its operation upon the ability of the spring coils to contract upon the shaft when the shaft is rotated in one direction, to effect the driving connection. Relative rotation between the shaft and the body of element 14 in the opposite direction causes the coils to release their hold upon the shaft, thereby per-

mitting manual rotation of element 14 independently of the shaft.

The provision of a clutch as above described facilitates assembly and servicing of the device in the event that it may become desirable or necessary to manually rotate the driving element 14 relative to the drive shaft 38. Such manipulation of the driving element may be resorted to in timing the operation of the device, or in making other adjustments. The arrangement provides also for quick and easy bodily displacement of the element 14 from its drive shaft 38, for purposes of repair, replacement, or adjustment. As will readily be understood, the clutch remains in engagement so long as shaft 38 rotates in the proper direction for causing the element 14 to drive the ratchet wheel 12 as previously explained. Shaft connections other than the clutch disclosed may be employed, if desired.

The blades, stops or abutment elements 20 are slidable individually and selectively from a retracted or inoperative position, to an extended operative position, radially from the periphery of the body or element 14. For this purpose, a series of equally spaced radial slots 46 is formed in the part 14, such slots traversing the flange 28 and terminating in the material of flange 26. The bottom 48 of each slot may terminate in the hub portion of element 14 between the flanges. All of the slots are individually planar, and are open at the periphery and at the front wall 50 of element 14. The front wall 50 is provided with a concentric annular groove 52, which is intersected by each of the slots 46, for a purpose to be explained.

The stops or abutment elements 20 are all identical in form, and each comprises a generally flat, thin, resilient plate or sheet substantially rectangular of shape, and having a head 54 formed along its outer edge, preferably by turning at right angles a marginal portion of said edge, as shown. A limited portion 58 of the plate adjacent to the head 54, as defined by a short slot or slit 56 extending inwardly from the forward edge 60, constitutes a tongue integral with the head, and has a free end 62 coextensive with the forward edge 60.

As the drawing indicates, FIGS. 5 and 7, the tongue 58 and that portion of the head which overlies it, are biased to one side of the plane of the plate or sheet, so that edge 62 is offset laterally from the forward edge 60, thereby producing a bend at 64. This may be done by means of a portion of a forming die striking and bending the material of the plate at the approximate location of the base of slot or slit 56.

In its normal state, the blade or abutment element is deformed with the tongue and edge 62 offset as stated; but due to the resiliency of the metal constituting the element, it is possible, by means of the human fingers, to press the tongue and head temporarily to a condition of alignment with the edge 60 and the remainder of head 54. That is, tongue 58 and its edge 62 may be yieldingly displaced into the plane of the plate or sheet constituting element 20, so that the edges 60 and 62 may enter one of the slots 46 of the body 14, thereby to dispose the head 54 in substantial flatwise contact upon the periphery of body 14, as indicated at 66 of FIG. 3. This constitutes the inoperative or retracted condition of the blade, stop or abutment element 20.

In the retracted or inoperative position of the blade or abutment element, the tongue 58 is, of course, under stress, it having been forced to align with the edge 60 in order to enter slot 46. Accordingly, if the head 54 be grasped and pulled radially outwardly to extend the abutment element to operative position, the tongue will leave slot 46, as indicated at the top of FIG. 3, and will immediately spring to and resume the normal biased position of FIG. 7. In the biased position of the tongue, shown in dotted lines at 58 of FIG. 5, the lower edge of tongue 58 will rest upon the periphery of flange 28, where it will remain until, by a deliberate manual straightening of the head 58, it may be re-aligned with slot 48 for reentry thereinto.

In the absence of a deliberate manual straightening or twisting of head 58, as above explained, displacement of the stop or abutment element 20 to the inoperative position is impossible. It is therefore a certainty that the blade, stop or abutment element 20, when deliberately withdrawn to extended position, cannot by accident or inadvertence become displaced to the retracted or inoperative position.

In order to limit the outward or extended position of the blades or abutment elements 20, each of them may be provided with a laterally extended lug 68 struck from the material of the sheet or plate constituting the abutment element, near the forward edge 60 thereof. The lugs 68 are adapted to stop against the peripheral wall of groove 52, when the elements 20 are extended, to establish the outward limit of projection beyond the periphery of drum 14. Inward projection of blades or elements 20 is established by the heads 54.

Assembly of the abutment elements upon the drum or body 14 is very simply accomplished by inserting the rear edge 70 of each element 20 into a drum slot 46, and bodily advancing the element in the direction of the drum axis until said edge 70 rests within the radial slot of flange 26. The several abutment elements so applied to the drum will have their forward edges 60 exposed at the planar outside face 50 of flange 28. To maintain the abutment elements in position within the slots, the circular disc-like spring plate 34 may be centered upon the face of flange 28, as in FIGS. 2 and 6, and secured thereon by means of screw 32, with the segments 72 of the spring plate each overlying and preferably contacting the edge 60 of an abutment element.

Along the rear edge 70 of each blade or abutment element, near the head 54, may be provided a slight incline or cam 74, which in the extended position of the abutment element, rests at the entrance of a slot 46 to yieldingly oppose shifting of the abutment element radially inwardly toward the hub of the drum. Whenever by deliberate action the blade or abutment element is shifted to the inoperative or retracted position, the incline enters slot 46 in the side of flange 26, causing the abutment element to shift slightly in the direction of spring plate 34, thereby to impose spring pressure against the edge 60 of the abutment element, to frictionally hold the abutment element in retracted or inoperative position. This obviates the possibility of accidental or inadvertent outward extension of the abutment elements during operation of the control device.

In the operation of the device, an attendant upon being informed of the timing and the sequence of ratchet wheel actuations required, selects the blades, stops or abutment elements 20 to be rendered active, and by grasping the heads 54, pulls them radially outwardly to the fully extended or operative position, limited by the lugs 68. The blades, stops or abutment elements so extended are operative to reach and advance the teeth of the ratchet wheel 12, as the increment wheel or driving element 14 is slowly and continuously rotated by means of a synchronous electric motor, or otherwise.

Upon being fully extended, the blades, stops or abutment elements 20 are positively latched in the operative position by the tongues 58, as previously explained. To return any element 20 to the retracted or inoperative position, it is necessary to twist the offset portion of its head 54 for aligning the tongue 58 with edge 60, whereupon the tongue will be acceptable by slot 46 to permit inward radial shifting of the abutment element. Due to the deliberate manipulation required, the stops or abutment elements cannot by accident retire to the retracted or inoperative position, and thereby alter the timing and operating sequence of ratchet wheel 12.

The control device as herein disclosed is completely reliable and accurate in its operation, but may be ad-

justed with ease and dispatch to incorporate any desired sequence or timing of controlled operations. Replacements, substitutions, or servicing of parts is accomplished quickly and with a minimum of effort, due to the simplicity of construction and assembly of the device. The number of blades, stops or abutment elements incorporated in the device, as well as the spacing thereof relatively, may be modified in accordance with the service to be performed, and as is obvious, the rate of rotation of the increment wheel, drum or driving element may be a matter of choice or judgment.

It is to be understood that various other modifications and changes in structural details of the device may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is:

1. A control device comprising a body having an outer periphery, an adjustable blade shiftable toward and from the body periphery between a fully retracted position and a fully extended position, and means releasably securing said blade in the positions stated, said means including a self-engaging manually releasable latch for locking the blade in one of said positions, said latch engaging the periphery of the body, to normally preclude displacement of the blade from extended position.

2. A control device comprising in combination, a drum-like body having an outer periphery transversely slotted, an abutment element slidable in the slot and including a head movable toward and from said periphery, and latch means on the head slidable within the slot, said latch means being resiliently biased crosswise of the slot, to leave the slot and overlie the drum periphery upon predetermined extension of the head outwardly beyond the periphery of the drum body.

3. A control device comprising in combination, a drum-like body having an outer periphery transversely slotted, a substantially flat abutment element slidable in the slot and including an elongate head movable toward and from said periphery, the abutment element being slitted lengthwise of the head at a distance therefrom to provide a tongue integral with the head, said tongue and a portion of said head being resilient, and biased normally toward one side of the plane of the substantially flat abutment element, the biased tongue and head being subject to manipulation for disposing the tongue yieldingly into the plane of the flat abutment element, for reception of the tongue by the transverse slot of the drum-like body, and means for limiting extension of the head and the tongue outwardly beyond the periphery of said body.

4. The device as set forth in claim 3, wherein the abutment element includes a cam portion acting upon the body to shift the abutment element in the direction of extension of the tongue when the head is moved toward the body periphery, and means for yieldingly resisting such shifting of the abutment element.

5. An increment wheel comprising in combination, a drum-like body having an outer periphery transversely slotted, a substantially flat, resilient abutment element slidable in the slot and including a head movable toward and from said periphery, the abutment element being slitted to provide a resilient tongue originally in the plane of the abutment element, but biased toward one side of said plane, so as to be normally disaligned with respect to the slot of the drum-like body, said tongue being subject to manipulation for yieldingly aligning the tongue with said slot for entry into said slot at the periphery of said body, and means for limiting extension of the head and the tongue outwardly beyond the periphery of said body.

6. The device as set forth in claim 5, wherein the abutment element includes a cam portion acting upon the body to shift the abutment element in the direction of extension of the tongue when the head is moved toward the body periphery, and means for frictionally resisting such shifting of the abutment element.

7. An increment wheel comprising in combination, a circular body having an outer peripheral surface and an axial face, said face having an annular recess therein defining an annular hub and a concentric inside wall uniformly spaced from the peripheral surface of the body, the axial face and the peripheral surface being slotted at intervals radially of the body, and transversely to the peripheral surface, each of the slots being planar and intersecting the inside wall of the recess aforesaid, a plurality of substantially flat planar abutment elements of resilient material slidably received one within each of said slots, and slidable radially from an extended operative position to a retracted inoperative position relative to the peripheral surface of the body, a laterally extended lug on each abutment element disposed within the annular recess of the body, to contact the inside wall of the recess for limiting extension of the abutment element to operative position, a head on each abutment element disposed exteriorly of the peripheral surface of the body and movable with the abutment element toward and from said peripheral surface, a resilient tongue on the abutment element adjacent to the head thereof, said tongue being permanently but yieldingly bent laterally out of the plane of the abutment element, to normally escape registry with the slot at the peripheral surface of the body and thereby contact said surface to oppose shifting of the abutment element from the extended operative position to the retracted inoperative position, said tongue being manually subject to flexation into registry with said slot for shiftability of the abutment element to retracted inoperative position, the tongue being adapted to flex out of the plane of the slot and to overlie a solid portion of the body periphery with each movement of the abutment element to operative position, thereby to lock the abutment element in extended operative position.

8. The device as set forth in claim 7, wherein the head of the abutment element is flexible and integral with the tongue, to transmit flexation of the head to the tongue.

9. A control device comprising in combination, a circular body having an outer peripheral surface slotted transversely at intervals substantially radially of the body, each of the slots being planar and open at the body periphery, a plurality of substantially flat planar abutment elements of resilient material slidably received one within each of said slots, and slidable radially from an extended operative position to a retracted inoperative position relative to the peripheral surface of the body, a head on each abutment element disposed exteriorly of the peripheral surface of the body and movable with the abutment element toward and from said peripheral surface, a resilient tongue on the abutment element adjacent to the head thereof, said tongue being permanently but yieldingly bent laterally out of the plane of the abutment element, to normally escape registry with the slot at the peripheral surface of the body and thereby contact said peripheral surface to oppose shifting of the abutment element from the extended operative position to the retracted inoperative position, said tongue being manually subject to flexation into registry with said slot for shiftability of the abutment element to retracted inoperative position, the tongue being adapted to flex out of the plane of the slot and to overlie a solid portion of the body periphery with each movement of the abutment element to extended operative position, thereby to lock the abutment element in the operative position.

10. The device as set forth in claim 9, wherein the head of the abutment element is flexible and integral with the tongue, to impart manual flexation of the head to the tongue.

11. A control device comprising in combination, a circular body having a central axially bored hub and an outer peripheral surface slotted transversely and toward

the hub, each of the slots being planar and open at the body periphery, a plurality of substantially flat planar abutment elements of resilient material slidably received one within each of said slots, and slidable toward and from the hub from an extended operative position to a retracted inoperative position relative to the peripheral surface of the body, a head on each abutment element and movable therewith, the head being exposed exteriorly beyond the peripheral surface of the body, a resilient tongue on the abutment element adjacent to the head thereof, and extending in substantial parallelism with the bore of the body, said tongue being permanently but yieldingly bent laterally out of the plane of the abutment element, to normally escape registry with the slot at the peripheral surface of the body and thereby impinge against said surface marginally of the slot to oppose shifting of the abutment element in one direction, said tongue being manually subject to flexation into registry with said slot to render the tongue coplanar with the abutment element and thereby condition said element for shifting within the slot toward the retracted inoperative position, the tongue by reason of its resiliency being adapted to flex itself out of the plane of the slot whenever the abutment element is shifted to the extended operative position, thereby the resume impingement of the tongue against the peripheral surface of the body marginally of the slot, and means associated with the hub to rotate the circular body axially.

12. The device as set forth in claim 11, wherein the head of the abutment element is manually movable and has connection with the tongue to impart movement thereof to the tongue.

13. An increment wheel comprising in combination, a drum-like body axially rotatable and having an outer periphery transversely slotted, each of the slots being planar and open at said periphery, a plurality of substantially flat planar abutment elements of resilient material slidably mounted one within each slot, said elements each including a head movable toward and from said periphery, a resilient tongue on each abutment element adjacent to the head thereof, said tongue being biased toward one side of the plane of the abutment element in normal disalignment with its associated slot, so that the tongue impinges upon the body periphery marginally of the slot in the extended position of the slidable abutment element, said tongue by reason of its resiliency being subject to manipulation for aligning the tongue with the slot, for selective entry into the slot as the abutment element is moved therein toward the axis of the drum-like body.

14. The device as set forth in claim 13, wherein the head of the abutment element is flexible under manual force and has connection with the tongue to impart movement of the head to said tongue.

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