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L. B. SMITH
TIMING APPARATUS

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2 Sheets-Sheet 1

Fig. 1.

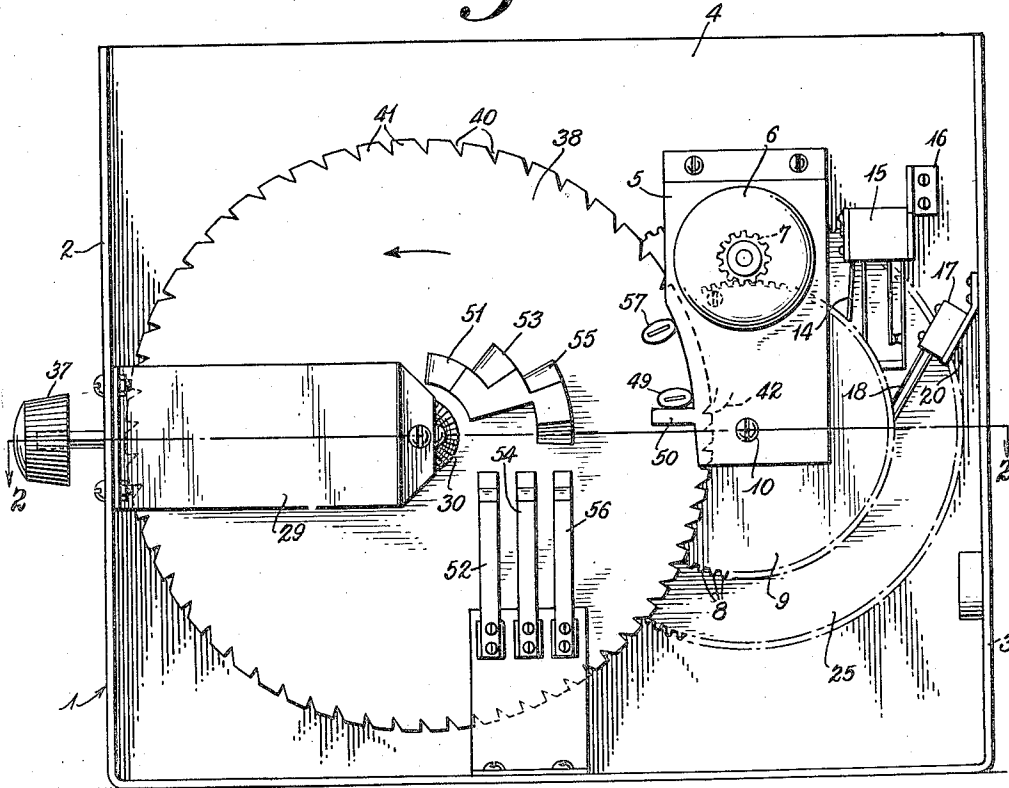
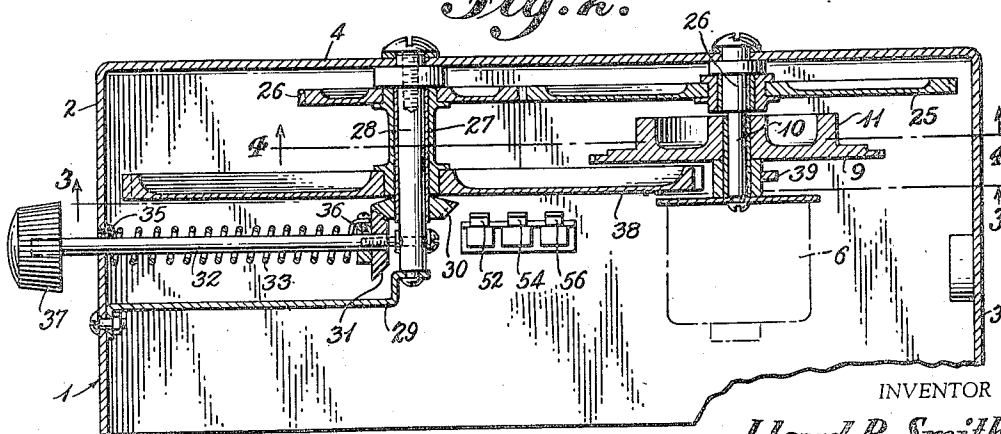


Fig. 2.



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TIMING APPARATUS

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4 Claims. (Cl. 200—38)

This invention relates to a timing apparatus and more particularly to a timing apparatus for starting and then stopping a given operation successively as desired and wherein the interval of time between said starting and stopping is increased progressively in each succeeding cycle of operation.

A timing apparatus constructed in accordance with the teaching of the present invention has particular utility for dispensing individual portions of liquid from a bulk source of liquid wherein the liquid flows by gravity from the bulk source to a receiving receptacle. It is apparent that as the level of liquid in the bulk liquid container becomes lower, the liquid will have to flow from the bulk liquid container to the receiving receptacle for a longer period of time if equal portions of liquid are to be dispensed from the bulk liquid container from the time that the container is full to the time that it is empty. Thus, in each succeeding dispensing operation, the flow time must increase.

It is therefore an object of the present invention to provide a new and improved timing apparatus for starting and then stopping a given operation successively as desired, wherein the time interval between said starting and said stopping is longer in each succeeding cycle of operation.

It is another object of the present invention to provide such a timing apparatus wherein said time interval is increased progressively in each succeeding cycle of operation.

It is a further object of the present invention to provide such a timing apparatus which is rugged, dependable in action, and economical to manufacture.

Briefly described, a preferred embodiment of the present invention comprises a rotary member which is normally at rest but which can be actuated to make a single revolution and then come to rest again. Thus, the rotary member may be actuated a number of times and each time that it is actuated it will complete a single revolution. A first switch is positioned in fixed relation to the rotary member and a second switch is positioned in movable relation to the rotary member. These two switches control the start and stop of a desired operation, such as the dispensing of a predetermined amount of liquid from a bulk source of liquid. Each switch is controlled by a feeler finger which rides on the circumference of the rotary member, said circumference having a notch therein into which the end of a feeler finger moves when the notch comes opposite the feeler finger end, thus controlling each switch. When the first switch feeler finger end moves into said notch the time interval starts and then stops when the second switch feeler finger end moves into the notch.

It is apparent therefore that the length of the time interval is determined by the time that it takes for the notch to travel from the first switch feeler finger end to the second switch feeler finger end. This time interval is increased progressively in each succeeding cycle of operation by causing the second switch feeler finger end to move each time that the rotary member makes a single

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revolution, movement of the second switch feeler finger end being circumferentially away from the first switch feeler finger end to increase the time interval. This movement of the second switch feeler finger end is caused by moving the second switch itself bodily with respect to the rotary member. The second switch is mounted on another rotary member which, in turn, is moved under control of a variable pitch ratchet an amount sufficient to cause the second switch feeler finger end to be positioned with respect to the first switch feeler finger end an angular distance correct to provide the desired progressive increase in the time interval in each succeeding cycle.

Other objects and advantages of the present invention will become more apparent from the following detailed description taken in conjunction with the attached drawings in which:

Fig. 1 is a front elevation view of a preferred embodiment of a timing apparatus constructed in accordance with the teaching of the present invention;

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1; Fig. 3 is a sectional view taken on line 3—3 of Fig. 2; and

Fig. 4 is a sectional view taken on line 4—4 of Fig. 2.

Referring now to Figs. 1 and 2 of the drawings, the reference numeral 1 denotes a casing having side walls 2 and 3 and a connecting rear wall 4. A bracket 5 is attached to and extends from rear wall 4 and supports a motor 6 which drives a pinion 7. Motor 6 is preferably a synchronous motor which, when energized, rotates pinion 7 at a constant slow speed of revolution. Pinion 7 meshes with gear teeth 8 located on the circumference of timing wheel 9 so as to drive the timing wheel at a constant slow speed of revolution when motor 6 is energized. Timing wheel 9 is rotatably supported by a stud 10 which extends between rear wall 4 and bracket 5 as shown in Fig. 2.

Referring more particularly to Figs. 2 and 4, it will be observed that timing wheel 9 has a circular flange 11 extending rearwardly therefrom and that this flange has a depression or notch 12 in the circumference thereof. The end 13 of a feeler finger 14 of switch 15 is shown as being positioned in notch 12. Switch 15 is fixedly positioned with respect to flange 11 by means of a bracket 16 connected to rear wall 4. Therefore, as is described more fully hereinafter, when notch 12 rotates away from contact with feeler finger end 13, the notch and the timing wheel 9 will make a complete single revolution before notch 12 comes back to its initial position. When feeler finger end 13 is in notch 12 as shown in Fig. 4, the timing apparatus is at rest.

Another switch 17 has a feeler finger 18 having a feeler finger end 19 which rides on the circumference of flange 11 thus being capable of dropping into notch 12 when the notch comes opposite the feeler finger end. Switch 17 is also fixedly mounted with respect to flange 11, being supported by a bracket 20 connected to side wall 3 of casing 1. Feeler finger end 19 therefore does not move circumferentially with respect to flange 11.

Still another switch 21 has a feeler finger 22 having a feeler finger end 23 which rides on the circumference of circular flange 11 thus being capable of dropping into notch 12 when notch 12 comes opposite end 23. It is understood, of course, that all of the switch feeler fingers 14, 18, and 22 are made of suitable resilient material so that they bias the respective feeler finger ends 13, 19 and 23 into slidable engagement with the circumference of circular flange 11 and cause the respective feeler finger ends to go into notch 12 when the notch comes opposite any of the feeler finger ends.

In contrast to switches 15 and 17, switch 21 is supported by a bracket 24 attached to gear wheel 25. Gear wheel 25 is also rotatably supported on an enlarged por-

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tion 26 of stud 10 so as to be rotatable or movable about stud portion 26 independently of timing wheel 9. Thus, gear wheel 25 may move at a different rate of movement and in response to a different actuating force as compared to timing wheel 9.

Because gear wheel 25 is movable independently of timing wheel 9, it is apparent that the position of switch 21, and hence the position of feeler finger end 23, can be changed angularly relative to the circumference of circular flange 11 upon which the feeler finger end 23 rests. Thus, assuming that gear wheel 25 is rotated in the direction of the arrow shown in Fig. 4, the circumferential distance or angle between feeler finger ends 19 and 23 will increase thus increasing the length of time for notch 12 to move from feeler finger end 19 to feeler finger end 23.

Movement of gear wheel 25 in the direction of the arrow shown in Fig. 4 is caused by another gear wheel 26 which meshes with gear wheel 25 as shown in Fig. 4. Gear wheel 26 is fixedly connected to a sleeve 27 which is rotatable about a stud 28 which extends between rear wall 4 and a bracket 29 connected to side wall 2. A bevel gear 30 is also fixedly connected to sleeve 27, gear 30 meshing with another bevel gear 31. Gear 31 is attached to a rod 32 adjacent one end of the rod as shown in Fig. 2. A torsion spring 33 surrounds rod 32, one end of the spring being connected with respect to casing side wall 2 at 35 and the other end of the spring being connected to a collar 36 attached to the rod adjacent bevel gear 31. By virtue of this arrangement, it is apparent that when rod 32 is rotated by means such as knob 37, as is done in resetting the timer, the torsion spring 33 will be tightened so as to tend to unwind when the knob is released. In the process of unwinding, the spring will drive bevel gear 31 thus driving gear 30 to rotate gear wheel 26 which turns gear wheel 25 to move switch finger end 23.

Rotation of gear wheel 26 in response to force produced by torsion spring 33 is controlled by an escapement mechanism comprising ratchet wheel 38 and pawl 39. The ratchet wheel has a plurality of ratchet notches 40 extending about the circumference thereof as shown more particularly in Fig. 3. These notches define ratchet teeth 41 adapted to be engaged by a pointed finger 42 on pawl 39 whereby rotation of ratchet wheel 38 in the direction of the arrow shown in Fig. 3 is prevented until pawl finger 42 is withdrawn from within a notch 40 in which it happens to be seated. It will be observed from Fig. 3 that the notches 40 are defined by a steep shoulder and a sloped shoulder, the steep shoulder bearing against the end of finger 42 to prevent movement of the ratchet wheel in the direction of the arrow shown in Fig. 3 when the pawl finger is seated in a notch 40. Pawl finger 42 is biased into seated position in a notch 40 by a tension spring 43 which is connected to pawl 39 at 44 as shown in Fig. 3. The pawl is pivotally mounted on shaft 45 so that the upward force exerted by spring 43 causes pawl finger 42 to be urged against the periphery of ratchet wheel 38.

It is apparent from the foregoing that as long as pawl finger 42 is seated in a notch 40 of ratchet wheel 38, the ratchet wheel is held against movement and, consequently, switch 21 and feeler finger end 23 remain in the same angular relation with respect to circular flange 11 of timing wheel 9. However, ratchet wheel 38 is permitted to escape the distance from one notch to the next adjacent notch counter-clockwise as viewed in Fig. 3 each time that timing wheel 9 makes a single revolution. This escape is permitted by a cam 46 which engages a finger 47 on pawl 39 to move the pawl to the right as viewed in Fig. 3 an amount sufficient to move pawl finger 42 out of the notch 40 in which it was seated, thus permitting the ratchet wheel to turn counter-clockwise under influence of torsion spring 33. Cam 46 has a steep shoulder 48 which clears the end of pawl finger 47 in time to permit

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spring 43 to move pawl finger 42 into the next adjacent notch 40, as the ratchet wheel 38 moves counter-clockwise as viewed in Fig. 3, and thus the ratchet wheel is permitted to escape the distance of a single ratchet tooth 41 each time the timing wheel 9 makes a single revolution. Each time that the ratchet wheel does escape, however, torsion spring 33 turns gear wheel 26, which turns gear wheel 25 to move switch 21 and hence feeler finger end 23 clockwise with respect to circular flange 11 thus increasing the time interval for notch 12 to travel between feeler finger end 19 and feeler finger end 23.

The magnitude of the angular movement of gear wheel 25 which occurs each single revolution of timing wheel 9 is obviously dependent upon the circumferential distance between adjacent notches 40 of ratchet wheel 38 or, to put it another way, on the circumferential side of each ratchet tooth 41. If the ratchet teeth were all of the same size, the angular distance between feeler finger end 19 and feeler finger end 23 would be increased by the same amount each time that the timing wheel 9 makes a single revolution. However, in many operations such as the dispensing of equal individual quantities of liquid from a bulk source of liquid where the liquid flows by gravity and the liquid level in the bulk container drops as the liquid is dispensed, it is necessary to move feeler finger end 23 a progressively larger angular distance in each successive operation of the timing apparatus in order to provide the necessary interval to duplicate the immediately previous operation. In other words, successive operations being timed may not vary in a straight linear relation.

Fig. 3 shows that the ratchet teeth 41 become progressively longer in a direction going clockwise about the circumference of the ratchet wheel. This means that each time that ratchet wheel 38 turns counter-clockwise as viewed in Fig. 3 and pawl finger end 42 moves out of one notch 40 and moves back into the next adjacent notch 40 which comes opposite the pawl finger end, gear wheel 25 and hence feeler finger end 23 will move an angular distance greater than the angular distance through which they moved in the immediately preceding cycle of operation.

The number of successive operations which may be timed by the timing apparatus naturally depends upon the number of ratchet teeth 41 and the allowable extent of travel of feeler finger end 23 of switch 21 along the circumference of circular flange 11 of timing wheel 9 from the time that the first operation is completed to the time that the last operation is completed. It is thus apparent that a predetermined number of operations, say one hundred operations, can be timed by the timing apparatus from the time that the apparatus is initially set until the time that it has to be reset.

The timing apparatus is initially set by turning knob 37 to rotate ratchet wheel 38 until lug 49 on the ratchet wheel comes against stop 50 extending from bracket 5. This is a position shown in Fig. 1. In this position, the smallest ratchet teeth 41 are adjacent pawl finger 42 and the size of the ratchet teeth increases going in a direction circumferentially clockwise of the ratchet wheel.

Toward the end of the counter-clockwise movement of ratchet wheel 38 as viewed in Figs. 1 and 3, cam surface 51 actuates flexible switch arm 52 to provide a first warning that the number of controlled operations is nearing the end of the predetermined total. In the case of liquid dispensing, this could be a warning that the bulk liquid container is almost empty. The first warning could be, for example, the lighting of a warning light. Further counter-clockwise movement of ratchet wheel 38 causes cam surface 53 to actuate a second flexible switch arm 54 to provide a second warning, such as the sounding of a buzzer, that the number of controlled operations is even nearer to the end of the predetermined total permitted by the timing apparatus. Finally, assuming that no action has been taken to disconnect the timing ap-

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paratus and reset it, a third cam surface 55 engages a third flexible switch arm 56 to cut off the timing apparatus and prevent its further energization. A safety stop lug 57 is attached to ratchet wheel 38 and can engage stop 50 mechanically to prevent further counter-clockwise movement of ratchet wheel 38. The timing apparatus is reset by turning ratchet wheel clockwise as viewed in Figs. 1 and 3 until lug 49 comes against stop 50 as heretofore mentioned.

The operation of the timing apparatus is summarized as follows.

When motor 6 is energized by a suitable means, not shown, pinion 7 rotates timing wheel 9 in a clockwise direction as viewed in Figs. 1 and 3. Feeler finger end 13 of switch 15 is in notch 12 in the circumference of circular flange 11 of the timing wheel at the start of revolution of the timing wheel but moves up on the circumference of flange 11 as notch 12 rotates away from feeler finger end 13. Movement of feeler finger end 13 up onto the circumference of flange 11 actuates switch contacts in such a manner that, with associated circuitry not shown, motor 6 is de-energized when feeler finger end 13 again drops into notch 12. It is thus apparent that the timing wheel 9 and consequently circular flange 11 and notch 12 make one complete revolution in each cycle of operation. Since motor 6 is a constant speed synchronous motor, notch 12 travels at a constant angular speed.

Shortly after notch 12 leaves feeler finger end 13, the notch comes opposite feeler finger end 19 of switch 17 and this feeler finger end goes into the notch. When this occurs switch contacts of switch 17 are actuated in such a manner that, through associated circuitry not shown, the operation to be timed is initiated. As notch 12 moves away from feeler finger end 19 and the latter moves up onto the circumference of circular flange 11 again, the operation continues until it is stopped. Notch 12 continues its uniform rate of movement until it comes opposite feeler finger end 23 of switch 21 whereupon end 23 moves into the notch and actuates the contacts of switch 21 to cause, through associated circuitry not shown, the timed operation to stop.

As timing wheel 9, and thus circular flange 11 rotates, cam 46 also rotates and moves pawl finger 42 out of a notch 40 in ratchet wheel 38 to permit the ratchet wheel to advance one step under influence of torsion spring 33. As the ratchet wheel advances it turns gear wheel 26 which, in turn, turns gear wheel 25 clockwise with respect to circular flange 11. This moves feeler finger end 23 circumferentially further away from feeler finger end 19 and increases the interval of time taken for notch 12 to travel from feeler finger end 19 to feeler finger end 23 over the interval of time taken in the preceding cycle of operation. The extent of movement of feeler finger end 23 depends upon the size of ratchet teeth 41 and, in the illustrated embodiment, the angular movement of feeler finger end 23 is progressively greater in each succeeding cycle of operation.

It will be seen from the foregoing description that I provide a timing apparatus capable of timing a plurality of individual operations making up a predetermined total of such operations and capable of progressively increasing the time during which each successive operation is allowed to proceed. As mentioned, such a timing apparatus has particular utility for controlling the dispensing of equal individual quantities of liquid from a bulk source of liquid wherein the liquid flows by gravity and the level decreases as the dispensing operations continue. The timing apparatus thus compensates for the drop in pressure of the liquid flowing from the bulk liquid container. A timing apparatus constructed in accordance with the teaching of my invention is found to be rugged, dependable in operation, and economical to manufacture.

While I have described and illustrated a preferred embodiment of my invention, I wish it to be understood that

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I do not intend to be restricted solely thereto but that I do intend to cover all modifications thereof which would be apparent to one skilled in the art and which come within the spirit and scope of my invention.

What I claim as my invention is:

1. A timing apparatus comprising a timing wheel rotatable about a central axis, means engaging said timing wheel to rotate said timing wheel at a constant rate of speed through a plurality of successive spaced apart single complete revolutions, said timing wheel including a circular flange, a first control switch for initiating a desired operation, said first control switch being mounted in fixed relation to said timing wheel and having a control finger engaging the circumference of said timing wheel circular flange, a second control switch for terminating said operation, a second wheel movable independently of said timing wheel, said second control switch being mounted on said second wheel and having a control finger engaging the circumference of said timing wheel circular flange, means on said timing wheel circular flange operable during each single complete revolution of said timing wheel to first actuate said first control switch to initiate said desired operation and to then actuate said second control switch to terminate said operation, means engaging said second wheel to move said second wheel during each single complete revolution of said timing wheel, an escapement mechanism connected to said second wheel moving means to block movement of said second wheel during each single complete revolution of said timing wheel, and means connected to said timing wheel engageable with said escapement mechanism to actuate said escapement mechanism during each single complete revolution of said timing wheel to unblock said second wheel moving means to permit movement of said second wheel, said movement of said second wheel being in a direction to position the feeler finger of said second control switch further about the circumference of said timing wheel circular flange to increase the time interval between actuation of said first control switch and actuation of said second control switch in each successive single complete revolution of said timing wheel.

2. A timing apparatus according to claim 1 wherein said means on said timing wheel engageable with said escapement mechanism actuates said escapement mechanism to unblock said second wheel moving means a progressively longer time in each succeeding revolution of said timing wheel.

3. A timing apparatus comprising a timing wheel rotatable about a central axis, means engaging said timing wheel to rotate said timing wheel at a constant rate of speed through a plurality of successive spaced apart single complete revolutions, said timing wheel including a circular flange, a first control switch for initiating a desired operation, said first control switch being mounted in fixed relation to said timing wheel and having a control finger engaging the circumference of said timing wheel circular flange, a second control switch for terminating said operation, a second wheel movable independently of said timing wheel, said second control switch being mounted on said second wheel and having a control finger engaging the circumference of said timing wheel circular flange, means on said timing wheel circular flange operable during each single complete revolution of said timing wheel to first actuate said first control switch to initiate said desired operation and to then actuate said second control switch to terminate said operation, means engaging said second wheel to move said second wheel during each single complete revolution of said timing wheel, a ratchet wheel rigidly connected to said second wheel moving means, said ratchet wheel having ratchet teeth about the circumference thereof, a pawl engaging a ratchet tooth to prevent movement of said ratchet wheel and said second wheel moving means during each single complete revolution of said timing wheel, and a

cam connected to and rotatable with said timing wheel during each revolution of said timing wheel, said cam engaging said pawl during each revolution of said timing wheel to move said pawl away from said ratchet wheel and then releasing said pawl to permit said pawl to re-engage said ratchet wheel, said ratchet wheel and second wheel moving means being movable when said pawl is dis-engaged from said ratchet wheel to move said second wheel in a direction to position the feeler finger of said second control switch further about the circumference of said timing wheel circular flange to increase the time interval between actuation of said first control switch and actuation of said second control switch in each successive single complete revolution of said timing wheel.

4. A timing apparatus according to claim 3 wherein

the ratchet teeth located about the circumference of said ratchet wheel vary progressively in size whereby movement of said second wheel is different in extent in each succeeding revolution of said timing wheel.

References Cited in the file of this patent

UNITED STATES PATENTS

1,468,801	Clark	Sept. 25, 1923
1,639,679	Zsoldos	Aug. 23, 1927
2,338,305	Simmon	Jan. 4, 1944
2,439,842	Clark	Apr. 20, 1948
2,454,882	Oakley	Nov. 30, 1948
2,578,824	Morrison	Dec. 18, 1951
2,675,456	Cleminson et al.	Apr. 13, 1954