Nov. 28, 1967 R. J. CARTIER 3,354,733

PROCESS TIMERS

Filed Sept. 29, 1965 4 Sheets-Sheet 1

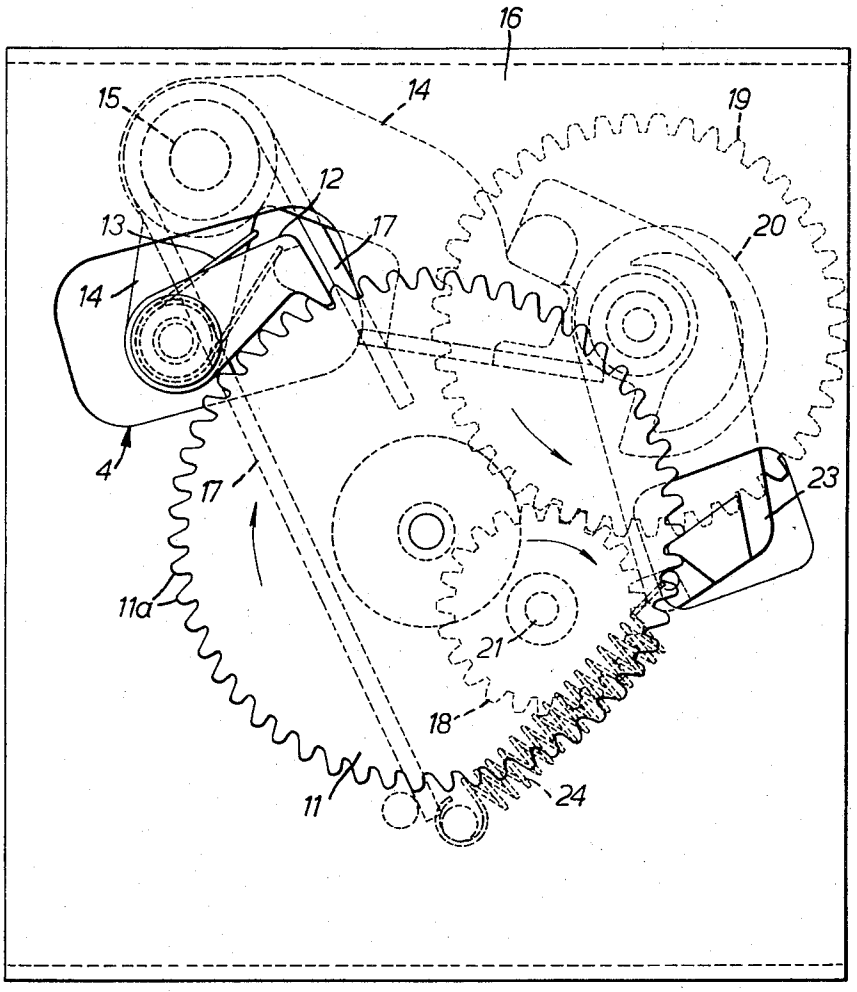


FIG. 1.

INVENTOR
Roger J. Cartier
BY
Bayard H. Michael
ATTORNEY

Nov. 28, 1967 R. J. CARTIER 3,354,733

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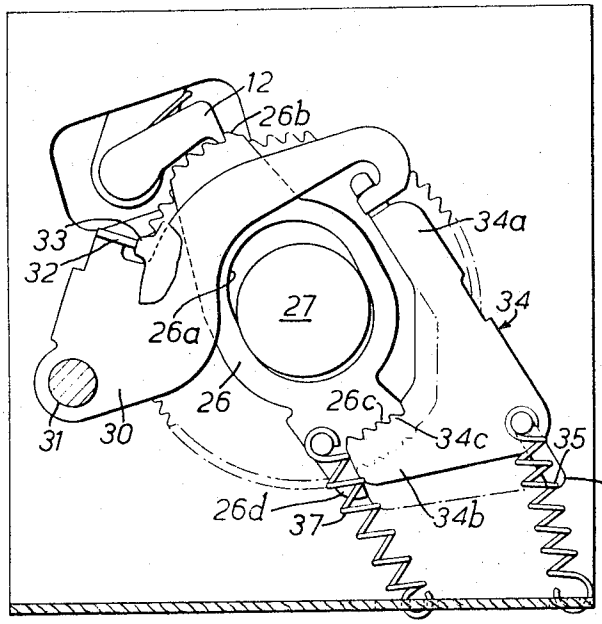


FIG. 2.

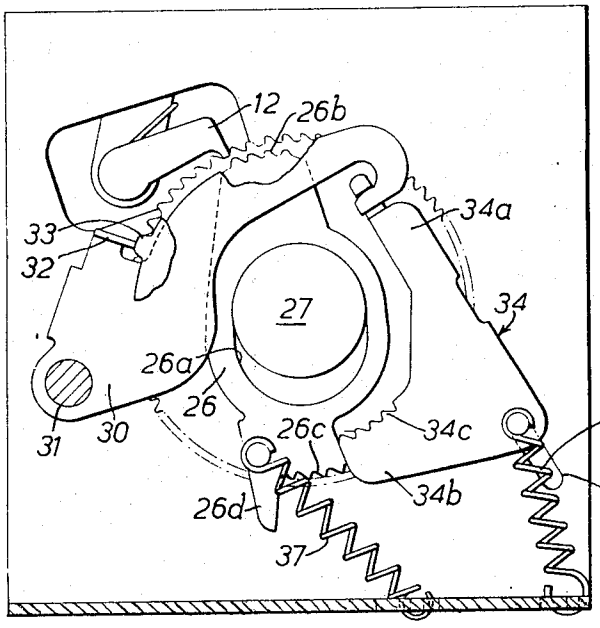


FIG. 3.

INVENTOR
Roger J. Cartier
By
Bayard H. Michael
ATTORNEY

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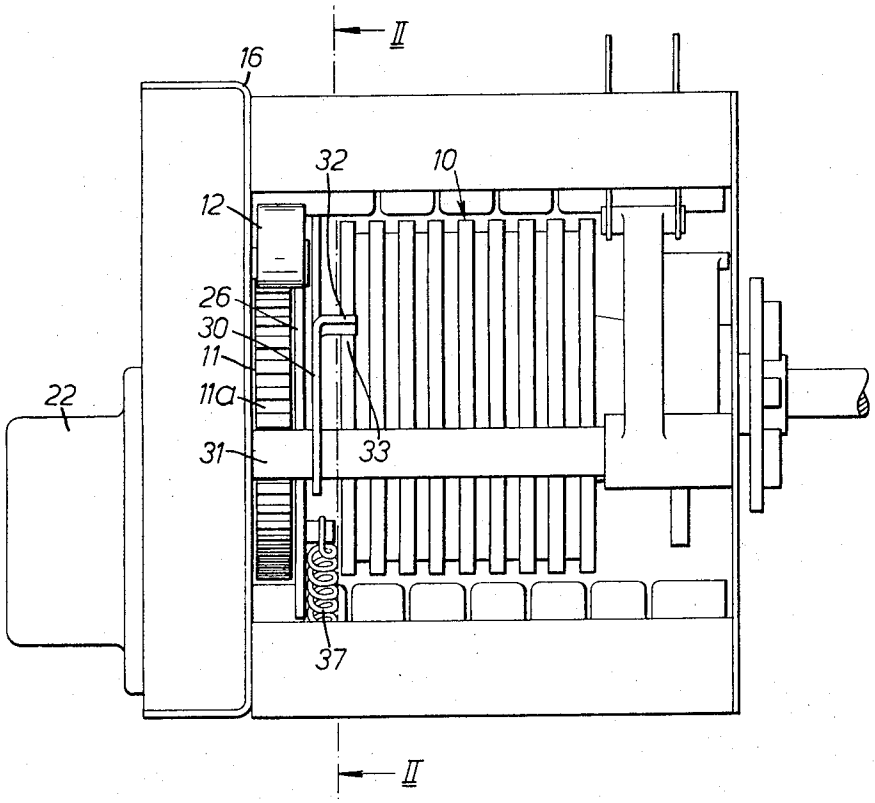


FIG. 4.

INVENTOR
Roger J. Cartier
BY
Bayard H. Michael
ATTORNEY

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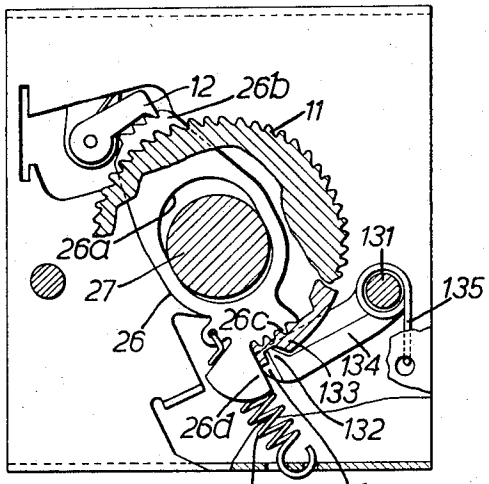


FIG. 5.

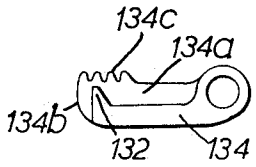


FIG. 5a.

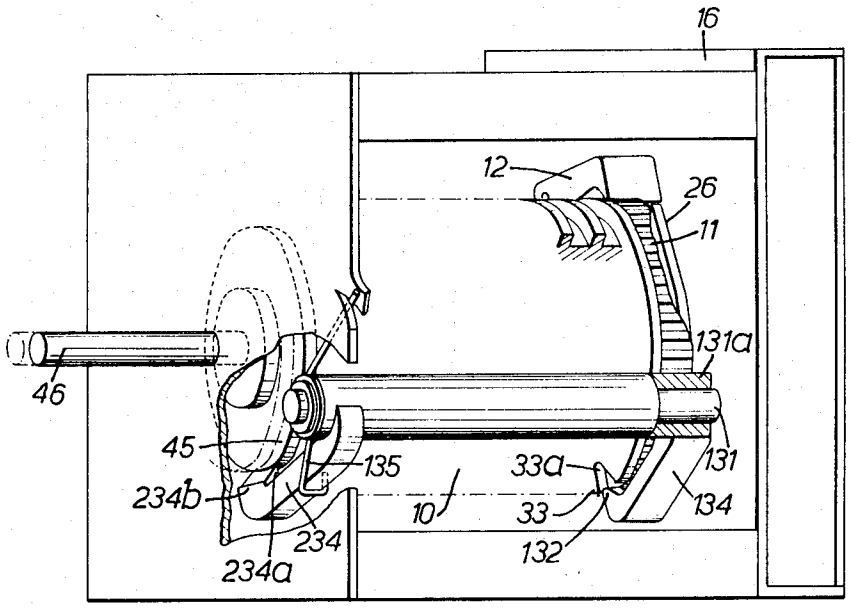


FIG. 6.

INVENTOR
Roger J. Cartier
BY
Bayard H. Michael
ATTORNEY

United States Patent Office 3,354,733 Patented Nov. 28, 1967

3,354,733

PROCESS TIMERS

Roger J. Cartier, Vimercate, Milan, Italy, assignor to Controls Company of America, Melrose Park, Ill., a corporation of Delaware

Filed Sept. 29, 1965, Ser. No. 491,362
Claims priority, application Great Britain, Oct. 24, 1964, 43,452/64
2 Claims. (Cl. 74—125)

ABSTRACT OF THE DISCLOSURE

The periodically actuated pawl advances the ratchet wheel on the end of the timer cam drum. A masking device controlled by a cam on the drum can be moved into position to be engaged by the pawl and prevent pawl engagement with the ratchet. The mask carries teeth engaged by the pawl to move the mask out of masking position in a given number of impulses, thus allowing a given interval on the timer to be prolonged. A manually operable disc can move the cam controlled mask actuator to an inactive position to override the increased interval.

This invention relates to stepping mechanisms and to process timers incorporating such mechanisms, and is a continuation-in-part of my application Ser. No. 392,196, filed Aug. 26, 1964, now Patent No. 3,306,118. More particularly the invention relates to a timing mechanism of the intermittent or step-by-step type incorporating a stepping mechanism and designed for use in controlling the functions of a washing machine.

According to the present invention there is provided a stepping mechanism comprising a ratchet, a pawl biased for engagement with the teeth of said ratchet, means for reciprocating the pawl and operable in each reciprocation to advance the ratchet through a step of one tooth, and means for preventing engagement of the pawl with the ratchet for a predetermined period of time.

More particularly the present invention provides a stepping mechanism comprising a ratchet wheel, a pawl biased for engagement with the teeth of the ratchet wheel, means for reciprocating the pawl and operable at each reciprocation to advance the ratchet wheel through a step of one tooth, a ratchet-toothed member mounted for translational movement transverse to the axis of the ratchet wheel into and out of an active position in which it engages said pawl and disengages the pawl from the ratchet wheel, said member having a plurality of ratchet teeth disposed along a line substantially parallel to the periphery of the ratchet wheel, the ratchet-toothed member also being mounted for pivotal movement about the axis of the ratchet wheel so that, when said member is in its active position, each reciprocation of the pawl effects a pivotal displacement of said member through a step of one tooth, and including control means for controlling the translational movement of the ratchet-toothed member toward the pawl, and operative in response to a predetermined pivotal displacement of the ratchet-toothed member to release said member from engagement with the pawl.

The manner in which such a stepping mechanism can usefully be supplied to an interval timer will now be explained.

One form of such interval timer, comprises a bank of rotary cams which are rotated in a step-by-step manner at intervals, and at each interval the cams selectively actuate switches for controlling the washing machine functions. The drive of such an interval timer conveniently comprises a single synchronous motor having a fixed speed which acts through a stepping mechanism to rotate the cam bank intermittently. Such a stepping mechanism

conveniently comprises a ratchet mechanism having a spring in which potential energy is stored until the mechanism is tripped by a cam rotated continuously by the motor, and the cam bank is rotated through one step.

If now, for example, the motor output shaft rotates at one r.p.m. and the cam bank steps each time the motor output shaft rotates through one revolution, the interval between steps is of one minute duration. Process functions taking longer than one minute therefore require more than one interval for their completion, for example a four minute function will require four intervals.

The advances in modern textile fibre research have resulted in increasing numbers of new textile materials being made available with varying laundering requirements. These in turn have made it necessary to provide domestic machine timers having ever increasing flexibility of operation to permit the required variety of washing programmes to be performed. Multi-programme washing machine timers require a very large number of intervals to handle these programmes, but production problems limit the numbers of intervals which a conventional timer can handle in 360° of rotation.

Thus by incorporating a stepping mechanism, in accordance with the present invention, in an interval timer of the type described above, a high degree of flexibility can be achieved since if the ratchet-toothed device has, for example, four ratchet teeth, the interval during which the device is active will be extended by four times its normal duration.

The present invention therefore, according to another aspect, comprises a timing mechanism of the type having control cams mounted for step-by-step advancement by means of a recipricating pawl engaging a ratchet wheel rotatable with the cams, a masking device selectively movable into a position in which it holds the pawl from engagement with the wheel, and means on the masking device engageable by the pawl to permit the pawl to move the masking device out of its masking position.

Some embodiments of stepping mechanism in accordance with the present invention will now be particularly described with reference to the accompanying drawings in which:

FIG. 1 is a section through a process timer, taken on the line I—I of FIG. 4 and showing the basic parts of the stepping mechanism;

FIG. 2 is a section on the line II—II of FIG. 4 showing the parts of the mechanism which are operable to extend the time duration of an intervals, the parts being illustrated in their active position;

FIG. 3 is a view corresponding to that of FIG. 2 but showing the parts in their inactive position;

FIG. 4 is a side elevation, part sectioned, of the timer;

FIG. 5 is a section, corresponding to that of FIG. 2, through a second embodiment of process timer in accordance with the invention;

FIG. 5*a* shows in detail the mask-controlling arm of FIG. 5, and

FIG. 6 is a perspective view, part sectioned, of the second embodiment.

As shown in the drawings, the timer comprises a cam bank **10** (FIG. 4) which is mounted for rotation coaxial with a ratchet wheel **11** through which the cam bank is driven. A drive pawl **12**, which is biassed into engagement with the teeth of the ratchet wheel by a spring **13**, is pivoted on one end of a cranked drive lever **14** which is pivotally supported at **15** on the timer frame **16**, the opposite end of the drive lever being urged by a spring **17** into contact with a cam **20** rotatable through gears **18**, **19** from the output shaft **21** of the timer motor **22**. This cam **20** is of the slow-rise fast-drop type so that at each revolution of the cam, the drive lever **14** is pivoted

against the force of its spring to move the drive pawl **12** over one of the teeth **11***a* of the stationary ratchet wheel **11**, and when the cam drop is reached, the quick reverse movement of drive lever under the influence of the spring **17** causes the drive pawl to rotate the ratchet wheel through one step i.e. the pitch of one tooth. To prevent the ratchet wheel from being dragged backwards as the drive pawl is moved slowly back across a tooth, a locating lever **23** is urged by a spring **24** into engagement with the teeth of the ratchet wheel.

In order to increase in effect the length of an interval, a mechanism is provided to permit the drive pawl to operate at least twice and preferably several times without advancing the ratchet wheel through a step, by transferring its action away from the ratchet wheel.

This mechanism, in the illustrated embodiment, consists of an actuator comprising an elongated plate shaped actuator member or masking device **26** mounted in a plane parallel to that of the ratchet wheel and having therein an elongate hole **26***a* through which extends a stub shaft **27** projecting from the centre of the ratchet wheel **11**. Across one end of the actuator plate is a row of ratchet teeth **26***b* for example four such teeth, matching those of the ratchet wheel and disposed along an arc of substantially equal curvature. The drive pawl **12** is made broad enough to engage either the teeth of the actuator plate or the teeth of the ratchet wheel according to whichever are at the greater radial distance from the shaft **27**. The hole **26***a* in the actuator plate is sufficiently long to permit the plate to be moved radially either in a direction towards the pawl into an active or masking position in which its teeth are raised above those of the ratchet wheel and thereby raise the drive pawl out of engagement with the ratchet wheel, or in the opposite direction to disengage the actuator teeth from the drive pawl. The width of the hole is such as to prevent lateral movement of the actuator plate on the shaft **27**.

The means for controlling the position of the actuator plate comprises an actuator lever having an arm **30** which is connected by a pivot **31** at one end to the timer frame and carries a cam follower **32** which rides on the periphery of the first cam **33** of the cam bank, i.e. the cam next adjacent the ratchet wheel. The opposite end of the actuator level is pivoted to the outer end of one arm **34***a* of an L shaped trip member **34** which is biassed by a spring **35** to hold the cam follower **32** against the cam **33**, and is guided in a slot **36** in the frame **16** for movement substantially parallel to the length of the actuator plate.

The other arm **34***b* of the trip member supports a row of positioning teeth **34***c* of undulating shape, corresponding in number to the number of ratchet teeth on the plate, and the positioning teeth of the trip member mesh with a corresponding row of similarly shaped positioning teeth **26***c* which extend across the end of the actuator plate remote from its ratchet teeth. A spring **37** acts on the actuator plate **26** obliquely to its length to bias it in a radial direction away from the pawl and also to rotate it into a position in which a projection **26***d* at one corner of the plate adjacent the end of the row of its positioning teeth abuts against the end of the adjacent arm **34***b* of the trip member. Alternatively two separate springs could be used to effect the translational and rotational movements respectively of the actuator plate. In this position illustrated in FIG. 2, the two rows of positioning teeth are fully in mesh and, at the opposite end of the actuator plate, the drive pawl, having completed a backward movement, lies in the trough between the first two actuator ratchet teeth.

Assume however that the cam **33** controlling the actuator has just caused the actuator plate **26** to be displaced radially from a starting position to raise its ratchet teeth **26***b* until they die above the teeth **11***a* of the ratchet wheel, and the drive pawl **12**, at the beginning of its rearward movement is engaging over the first ratchet tooth of the actuator plate. Then upon the completion of the rearward movement of the drive pawl, it engages as illustrated behind this tooth and, upon advancing, the actuator plate it rotated through a step of one tooth. At the same time the positioning teeth are displaced through one tooth distance relative to each other against the force of the plate-biasing spring **37** to hold the actuator plate in its displaced position. However the ratchet wheel and in consequence the cam bank are unaffected and remain stationary. This is repeated at the next two operations of the drive pawl. At the fourth operation of the drive pawl, the positioning teeth **26***c* of the actuator plate become disengaged from the corresponding teeth **34***c* of the trip member and the spring **37** biasing the actuator plate moves it radially away from the drive pawl into an inactive position in which the actuator teeth lie below those of the ratchet wheel and the drive pawl once again engages the ratchet wheel. The actuator plate is retained in its inactive position by engagement of one side of the plate with the end of the adjacent arm **34***b* of the trip member **34** as shown in FIG. 3, and will remain in this position until it is reset to its starting position prior to acting once again in removing the drive pawl from the ratchet wheel. The resetting of the actuator plate is effected automatically in response to the cam follower **32** of the actuator lever dropping into a recess in the first cam **33** of the cam bank. This allows the trip member **34** to be moved under the force of its biasing spring **35** to pull the end of the trip member arm **34***b* away from the actuator plate allowing the latter to swing back until the projection **26***d* of the plate once again abuts against the end of the trip member arm **34***b*.

It will be evident that the number of ratchet teeth on the actuator (and the equal number of positioning teeth on the actuator and trip member) determine the number of steps in each extended interval. Moreover the shape of the first cam will determine the number of intervals, and the position of the intervals, which will be extended intervals. In the limiting case, each interval could be made an extended interval.

By the provision of a suitable discriminating system, the number of actuator ratchet teeth which are operative can be varied thereby to vary the length of any extended interval.

In the embodiment of the invention described above in detail, it will be evident that numerous variations could be made within the scope of the present invention. For example means equivalent to, but different from, the positioning teeth and trip member could perform the same function of moving the actuator ratch teeth into and out of operation. Moreover the actuator could be put into and out of action by means other than a cam of the cam bank. In this way, resetting of the actuator could be effected after any selected number of operations of the pawl and the length of the extended interval could therefore be selected at will.

The second embodiment of the process timer is shown in FIGS. 5, 5*a* and 6 in which parts corresponding to those of FIGS. 1 to 4 are indicated by the same reference numerals.

In this second embodiment manually-operable control means are provided to determine whether the masking device should remain inoperative or be subject to the control of a cam in the cam bank.

The advantage provided by such additional control means is that the number of available programmes can be increased by up to 100%. Assume for example that in washing programme, 13 minutes are required for washing and 6 minutes are required for spinning and that, by using the masking device, this programme is accommodated in three normal one-minute intervals and two extended intervals each of five-minutes duration for washing, and one normal interval and one extended interval for

spinning. If now the additional control means act to render the masking device inoperative, this programme is immediately converted into one of five normal intervals (five minutes) for washing and two normal intervals (two minutes) for spinning. The "rinse" part of the programme could be modified in a similar manner.

The means for controlling the position of the masking plate comprise a trip member in the form of a radial arm **134** (equivalent to the L shaped trip member **34** of FIG. 2) which is rotatably mounted on a shaft **131** extending parallel to the axis of the cam bank. This arm has a substantially large dimension in the direction of the axis of the cam bank to extend from the masking plate on one side of the ratchet wheel **11** to the first cam **33** on the opposite side of the ratchet wheel. This first cam is provided with one or more recesses **33***a* for engagement by a tooth **132** on the free end of the arm **134**.

The opposite side of the arm **134** is provided with a portion **134***a* on which is formed a plurality of positioning teeth **134***c*, similar in shape and function to the teeth **34***c* of FIG. 2, to co-operate with the similarly shaped teeth **26***c* on the masking plate. The arm **134** also has an end portion **134***b* (equivalent in operation to the portion **34***b* of arm **34** of FIG. 2).

A second arm **234** is supported for rotation on the shaft **131**, at its end remote from the arm **134**, but is rigidly coupled to the arm **134** by an outer shaft **131***a*, the second arm **234** having a wedge-shaped projection **234***a* at its free end, the inclined face of which is indicated at **234***b*. A disc **45** is mounted for rotation on the axis of the cam bank and is splined to the cam bank to rotate therewith, but is movable axially into and out of engagement with the projection **234***a*, by means of a manually movable shaft **46** extending outwardly from the timer casing **16**. The arm **234** is urged towards the axis of the cam bank by a spring **135**.

In the operation of this embodiment, when the disc **45** is removed from engagement with the projection **234***a*, the bar spring **135** biases the tooth **132** of arm **134** against the cam **33** so that the operation of the masking device is under the control of this cam.

Upon moving the disc **45** towards the cam bank, the inclined face **234***b* of projection **234***a* rides on the periphery of the disc and rotates the arms **234** and **134** in a direction away from the axis of the cam bank into a position in which the tooth **132** of arm **134** is held out of engagement with the cam **33**. Thus operation of the masking device is prevented.

I claim:

1. In a timing mechanism having control cams mounted for step-by-step advancement by means of a reciprocating pawl engaging a ratchet wheel rotatable with the cams, the improvement which comprises

a masking device,

means controlled by one of the control cams for moving said masking device into a position in which it holds the pawl from engagement with the wheel,

means on the masking device engaged by the pawl to permit the pawl to move the masking device out of its masking position, and

manually operable means for removing the masking device from the control of said one of the control cams.

2. In a timing mechanism having control cams mounted for step-by-step advancement by means of a reciprocating pawl engaging a ratchet wheel rotatable with the cams the improvement which comprises

a trip member controlled by one of the control cams,

a ratchet toothed masking device actuated by the trip member to a masking position in which it holds the pawl from engagement with the wheel and in which position the pawl engages the ratchet teeth to move them masking device out of its masking position,

biasing means acting on said masking device in a sense to withdraw it from said pawl, the displacement of the masking device under the action of the pawl effecting relative displacement between the masking device and the trip member until a position is reached in which the masking device becomes disengaged from said trip member and the biasing means can withdraw the masking device,

said trip member including,

a first arm fixed on a rotatable shaft and having a tooth thereon engageable with said one of the control cams,

a second arm fixed on said shaft,

a disc coaxial with said control cams and manually movable along the axis of said control cams, and

a projection on said second arm engageable with the periphery of the disc in response to axial movement of the disc to move said second arm in a sense to rotate said shaft and thereby rotate said first arm toward and away from said one of the control cams

References Cited

UNITED STATES PATENTS

3,306,118 2/1967 Cartier ---------- 74—150

FOREIGN PATENTS

571,790 9/1945 Great Britain.

MILTON KAUFMAN, *Primary Examiner.*

FRED C. MATTERN, *Examiner.*

W. S. RATLIFF, *Assistant Examiner.*