Nov. 9, 1943. C. F. ROBBINS ET AL 2,333,888

CONTROL DEVICE

Filed July 24, 1941 3 Sheets-Sheet 1

Fig. 1

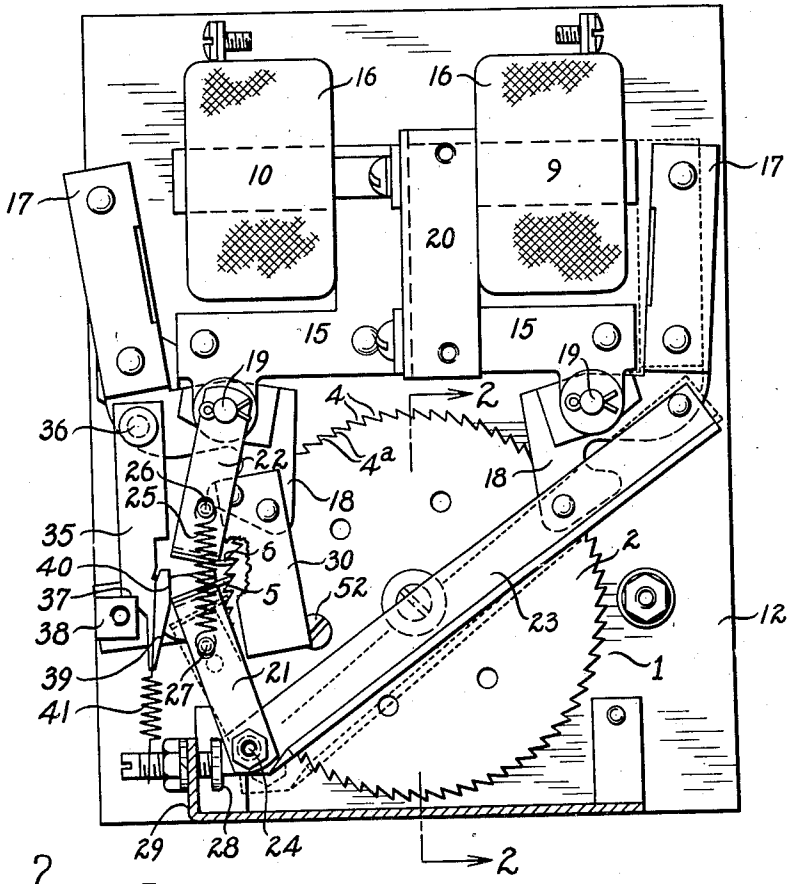
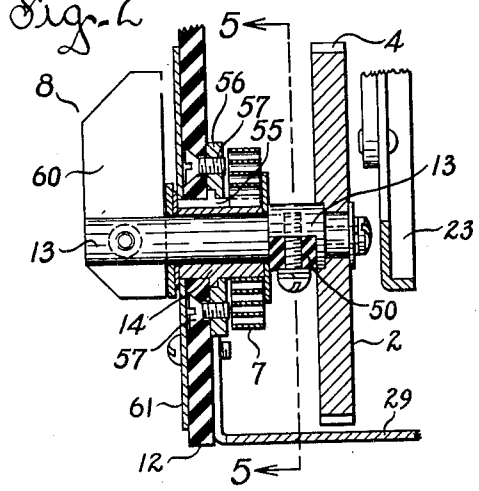


Fig. 2



Inventors
Clyde F. Robbins
Edwin W. Seeger
By Frank H. Hubbard
Attorney

Nov. 9, 1943. C. F. ROBBINS ET AL 2,333,888

CONTROL DEVICE

Filed July 24, 1941 3 Sheets-Sheet 2

Fig. 3

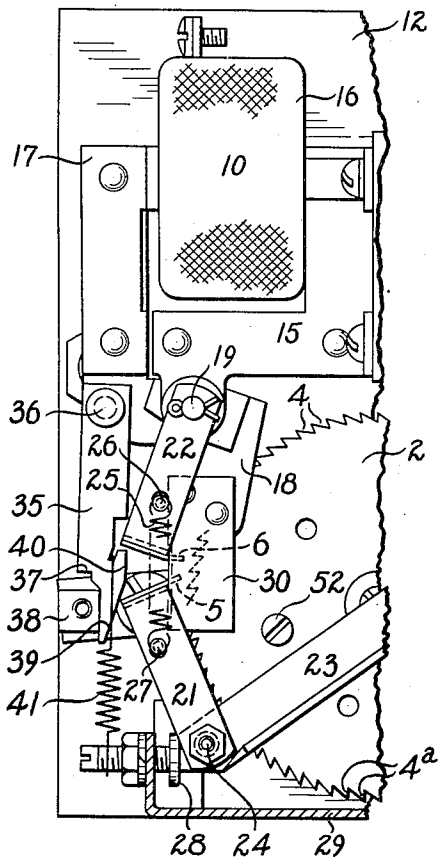
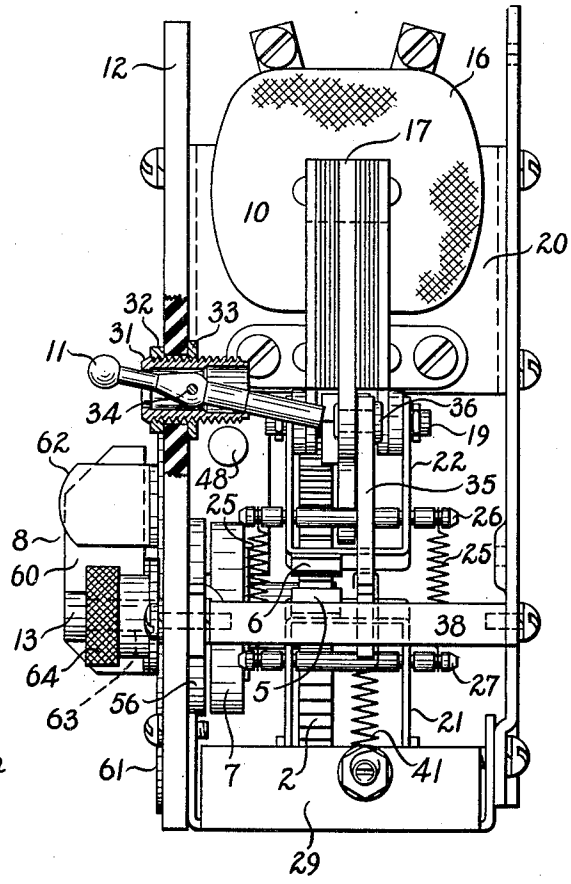


Fig. 4



Inventors
Clyde F. Robbins
Edwin K. Seeger
By Frank H. Hubbard
Attorney

Nov. 9, 1943. C. F. ROBBINS ET AL 2,333,888

CONTROL DEVICE

Filed July 24, 1941 3 Sheets-Sheet 3

Fig. 5

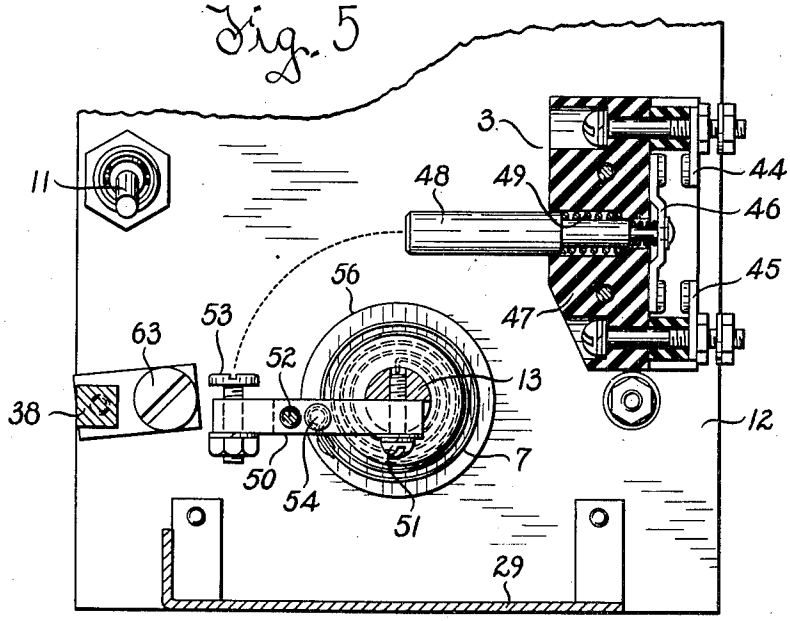
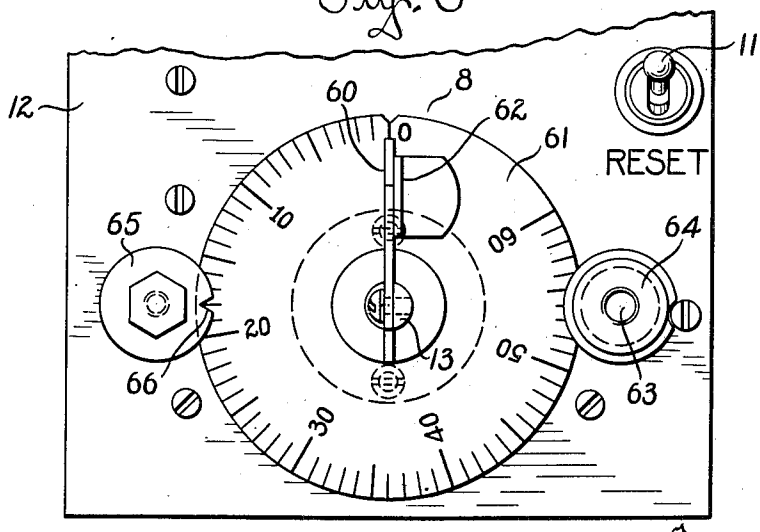


Fig. 6



Inventors
Clyde F. Robbins
Edwin W. Seeger
By Frank H. Hubbard
Attorney

Patented Nov. 9, 1943

2,333,888

UNITED STATES PATENT OFFICE

2,333,888

CONTROL DEVICE

Clyde F. Robbins, Milwaukee, and Edwin W. Seeger, Wauwatosa, Wis., assignors to Cutler-Hammer, Inc., Milwaukee, Wis., a corporation of Delaware

Application July 24, 1941, Serial No. 403,886

3 Claims. (Cl. 74—142)

This invention relates to control devices, and is particularly applicable to electromagnetic control devices for effecting a given control operation in response to a predetermined number of current impulses.

The invention has among its objects to provide an improved electromagnetically operated ratcheting mechanism for use in control devices of the aforesaid character which is compact and rugged in construction and exceedingly positive and reliable in operation.

Another object is to provide a ratcheting mechanism of the aforesaid character having readily adjustable means associated therewith for selecting and indicating the number of current impulses required to effect a given control operation.

Another object is to provide a ratcheting mechanism of the aforesaid character having improved resetting means associated therewith.

Various other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate an embodiment of the invention which will now be described, it being understood that various modifications may be made in the embodiment illustrated without departing from the spirit and scope of the appended claims.

In the drawings,

Figure 1 is a rear elevational view of a control device embodying the invention with portions of the device broken away and shown in section;

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

Fig. 3 is a fragmentary elevational view similar to that shown in Fig. 1 illustrating the resetting mechanism of the device in tripped position;

Fig. 4 is a side elevational view of the device shown in Fig. 1 with portions thereof broken away and shown in section;

Fig. 5 is a fragmentary sectional view taken substantially on line 5—5 of Fig. 2; and

Fig. 6 is a fragmentary front elevational view of the device shown in Fig. 1.

Referring to Fig. 1, the same illustrates an electromagnetically operated ratcheting mechanism 1 including a ratchet wheel 2 which is rotatable in a clockwise direction into a given angular position to operate a switch 3 shown in Fig. 5. Ratchet wheel 2 has a plurality of equally spaced teeth 4 formed on the periphery thereof which are shaped to provide radial faces 4a to be engaged by an operating pawl 5 and a holding pawl 6, and said ratchet wheel is biased to move in a counterclockwise direction by a spring 7 (Figure 2) into a predetermined home position which is determined by the setting of an adjustable stop mechanism 8 shown in Figs. 2, 4 and 6. Pawl 5 is operable by a motor magnet 9 to effect step by step movement of ratchet wheel 2 in a clockwise direction, and upon displacement of said ratchet wheel out of its home position pawl 6 acts to prevent return movement thereof under the action of spring 7. Pawls 5 and 6 are both releasable from ratchet wheel 2 either by trip magnet 10 or by a manual reset lever 11 to permit resetting of said ratchet wheel in its home position under the action of spring 7.

More specifically, the ratcheting mechanism 1 and switch 3 are mounted upon the rear face of a front insulating panel 12. As shown in Fig. 2, ratchet wheel 2 is fixed to a shaft 13 which is rotatably supported within a bearing member 14 mounted within an opening in panel 12. The motor magnet 9 and tripping magnet 10 are arranged above the ratchet wheel 2 and each of said magnets is provided with a horizontally disposed U-shaped core member 15 having an operating winding 16 mounted upon the upper leg thereof. Also each of said magnets is provided with a vertically disposed armature member 17 having a tail piece 18 on the lower end thereof which is pivotally mounted upon a pin 19 carried by the lower leg of its associated core member 15. The core members 15 of magnets 9 and 10 are arranged in opposed relation and are fixed to opposite sides of a bracket 20 which is secured to the rear face of insulating panel 12.

As shown in Fig. 1, the pawls 5 and 6 are arranged to the left of ratchet wheel 2 and as shown in Fig. 4, pawl 5 is fixed to the bight portion of an inverted U-shaped lever 21, while pawl 6 is arranged above pawl 5 and is fixed to the bight portion of a U-shaped lever 22. The tail piece 18 associated with armature 17 of motor magnet 9 has an inclined downwardly extending arm 23 fixed thereto and the open end of lever 21 is pivotally connected to the lower end of said arm by a pin 24. The open end of lever 22 is pivotally mounted upon the pivot pin 19 associated with trip magnet 10. A pair of springs 25—25 are located on opposite sides of levers 21 and 22 and the upper ends of said springs are connected to a pin 26 carried by lever 22, while the lower ends thereof are connected to a pin 27 carried by lever 21. The springs 25 act to bias levers 21 and 22 toward the right to hold their associated pawls 5 and 6 in engagement with the periphery of ratchet wheel 2. Said springs also act to normally hold the lower

end of arm 23 in engagement with a screw stop 28 which is adjustably mounted upon a bracket 29 fixed to the rear face of panel 12.

Upon energization of the motor magnet 9 the armature 17 associated therewith is moved into attracted position and arm 23 and lever 21 are moved from the full line position to the dotted line position illustrated in Fig. 1 against the action of springs 25 to effect downward movement of pawl 5 over the ratchet tooth 4 located immediately below said pawl. During downward movement of pawl 5 into its dotted line position, ratchet wheel 2 is held against counterclockwise rotation by engagement of pawl 6 with the radial face of the ratchet tooth 4 located above said pawl. Upon deenergization of motor magnet 9 its associated armature 17 is released and arm 23 and lever 21 are returned to the full line position illustrated in Fig. 1 under the action of springs 25. During return of lever 21 to its full line position pawl 5 engages the ratchet tooth 4 located thereabove to effect advance of ratchet wheel 2 in a clockwise direction. As is apparent, adjustment of screw stop 28 varies the degree of upward movement of pawl 5 which occurs upon deenergization of motor magnet 9 and said stop is so adjusted that the ratchet wheel 2 is advanced one tooth in a clockwise direction during return of pawl 5 to its full line position. It is thus apparent that energization of motor magnet 9 by successive current impulses effects tooth by tooth advance of ratchet wheel 2 in a clockwise direction against the action of spring 7.

As hereinbefore stated, ratchet wheel 2 is biased by spring 7 to move toward a predetermined home position which is determined by the setting of an adjustable stop mechanism 8 and upon displacement of said ratchet wheel out of home position the same is resettable in such position by the trip magnet 10 or by the manual reset lever 11. As shown in Fig. 1, the tail piece 18 associated with the armature of trip magnet 10 has a downwardly extending plate 30 fixed thereto which is located to the right of the bight portions of levers 21 and 22 and is normally held out of engagement therewith. Upon movement of armature 17 of trip magnet 10 into its attracted position plate 30 engages the bight portions of levers 21 and 22 to move said levers from the position shown in Fig. 1 into the position shown in Fig. 3 to thereby effect disengagement of pawls 5 and 6 from the teeth of ratchet wheel 2. Thus upon energization of trip magnet 10 ratchet wheel 2 is released to permit resetting thereof in home position under the action of spring 7.

As shown in Fig. 4, the manual reset lever 11 is mounted within an externally threaded bushing 31 which is secured within an opening in panel 12 by nuts 32 and 33. Lever 11 is supported intermediate its ends upon a horizontally disposed pivot pin 34 carried by bushing 31 and the inner end of said lever is located immediately below the lower end of armature member 17 of trip magnet 10 while the front end of said lever is accessible for manual operation from the front of insulating panel 12. Lever 11 is normally held by gravity in the position shown in Fig. 4 and the front end thereof is movable downwardly to move armature 17 of trip magnet 10 and its associated plate 30 into the position shown in Fig. 3 to permit resetting of ratchet wheel 2 in home position under the action of spring 7.

Lever 21 has a vertically disposed cam member 35 associated therewith which prevents overtravel of ratchet wheel 2 due to inertia upon upward movement of pawl 5 into the full line position shown in Fig. 1. As shown in Fig. 1 said cam member is located to the left of lever 21 and the upper end thereof is pivotally connected to the tail piece 18 associated with the armature of trip magnet 10 by a pin 36. Also as shown in Fig. 1, cam member 35 has a rectangular recess 37 formed on the left hand side thereof for receiving a square stop member 38 which is adjustably mounted upon the rear face of panel 12 and the right hand side of said cam member is shaped to provide a cam surface having an inclined face 39 and a vertically disposed face 40. A spring 41 acts to bias cam member 35 downwardly and toward the stop member 38.

Cam member 35 is normally held in the position shown in Fig. 1 against the action of spring 41 by engagement of stop member 38 within the recess 37. The inclined face 39 on cam member 35 permits movement of lever 21 toward the left when the same is moved downwardly to move pawl 5 from the full line position to the dotted line position shown in Fig. 1. However, upon return of lever 21 and its associated pawl 5 to full line position shown in Fig. 1 the face 40 on cam member 35 acts to lock said lever and its associated pawl against movement toward the left out of said full line position to thereby prevent overtravel of ratchet wheel 2. As shown in Fig. 3 upon energization of trip magnet 10 cam member 35 is moved upwardly and the surface 40 thereof is then located above lever 21 to permit release of pawl 5 from ratchet wheel 2 by plate 30.

The switch illustrated in Fig. 5 includes a pair of stationary contacts 44 and 45 and a cooperating bridging contact 46. Contacts 44 and 45 are mounted upon an insulating base 47 which is secured to the rear face of panel 12 and bridging contact 46 is yieldingly mounted upon an operating pin 48 which is slidably supported within an opening in said base. Operating pin 48 is normally held in the position shown by a spring 49 and is movable inwardly against the action of said spring to move bridging contact 46 into engagement with its associated stationary contacts 44 and 45. Pin 48 is operable by an insulating arm 50 which is secured to shaft 13 by a screw 51 and is also secured to the rear face of ratchet wheel 2 by a screw 52. Arm 50 has an adjustable screw stop 53 mounted upon the free end thereof and upon step by step advance of ratchet wheel 2 into a given limit against the action of spring 7 said stop engages the operating pin 48 to move bridging contact 46 into engagement with stationary contacts 44 and 45.

As shown in Fig. 2, spring 7 is of spiral form and the outer end thereof is attached to a pin 54 (Fig. 5) mounted upon the switch operating arm 50 while the inner end thereof is held within a slot 55 (Fig. 2) provided on the outer surface of the bearing member 14 associated with shaft 13. Bearing member 14 is capable of rotary adjustment to vary the tension of spring 7 and the same is held in adjusted position upon panel 12 by a collar 56 which is secured to said panel by screws 57.

The adjustable stop mechanism 8 illustrated in Figs. 2 and 6 comprises a lever 60 fixed to the front end of shaft 13 and an adjustable circular dial 61 having a stop 62 mounted upon the front face thereof for engaging lever 60. As shown in Fig. 2, dial 61 is adjustably supported upon the front end of bearing 14 and as shown in Figs. 4 and 6 panel 12 has a screw 63 mounted thereon

which carries a thumb nut **64** for clamping said dial against the front face of said panel to hold the same in adjusted position. Panel **12** also has an indicating member **65** mounted thereon which is located to one side of dial **61** and is provided with a V-shaped notch **66** on the side adjacent said dial.

Ratchet wheel **2** is normally held in a predetermined home position by engagement of lever **60** with the stop **62** associated with dial **61** and as is apparent such home position is determined by the angular setting of said dial. Upon step by step operation of ratchet wheel **2** by the motor magnet **9** lever **60** is moved in a counterclockwise direction (Fig. 6) away from the stop **62** toward the indicating member **65**. Indicating member **65** is so located that when lever **60** is moved into alignment with the V notch **66** the stop **53** on operating lever **50** engages the switch operating pin **48** to move bridging contact **46** into engagement with its cooperating stationary contacts **44** and **45**. It is thus apparent that the angular setting of dial **61** determines the number of successive operations of motor magnet **9** which are required to move the ratchet wheel **2** from home position into the limit wherein switch **3** is operated. Dial **61** is provided with a zero marking corresponding to the position of lever **60** when the same is in engagement with stop **62**. Said dial is also provided with graduations which extend in a counterclockwise direction from said zero position, said graduations being spaced to correspond to the spacing of the teeth **4** on ratchet wheel **2**. Thus the graduation on dial **61** which registers with the V notch **66** indicates the number of successive operations of motor magnet **9** which are required to move ratchet wheel **2** from home position into its switch closing position. Also the position of lever **60** on dial **61** indicates at all times the number of operations which have been counted. By loosening the thumb nut **64** and holding lever **11** in position to disengage the pawls **5** and **6** from ratchet wheel **2** the dial **61** and lever **60** may be readily adjusted to select the number of successive operations which are required to effect operation of switch **3**.

As is apparent, the above described device is capable of being used in connection with machines of various types to count successive operations of the machine and to provide a given control effect upon counting of a selected number of operations. Also the trip magnet **10** may be controlled to effect automatic resetting of the device upon counting of a selected number of operations.

What we claim as new and desire to secure by Letters Patent is:

1. In a mechanism for effecting operation of a control device in response to a selected number of power impulses, in combination, a ratchet member movable in one direction into a given operating limit to effect operation of the control device and biased to move in an opposite direction into a selected home position, means responsive to successive power impulses to effect step by step movement of said ratchet member away from its selected home position toward said given operating limit, said means including an actuating pawl biased toward a given normal position and movable out of and into such position under the action of a power impulse to advance said ratchet member toward said given operating limit, an element for locking said actuating pawl upon return thereof to normal position to prevent overtravel of said ratchet member, a holding pawl engaging said ratchet member to retain the same against return movement upon advance thereof away from home position, and a single trip element for releasing said locking element and for moving said actuating pawl and said holding pawl out of engagement with said ratchet member for resetting of said ratchet member in home position.

2. In a mechanism for effecting operation of a control device in response to a selected number of power impulses, in combination, a ratchet member movable in one direction into a given operating limit to effect operation of the control device and biased to move in an opposite direction into a selected home position, means responsive to successive power impulses to effect step by step advance of said ratchet member away from its selected home position toward said given operating limit, said means including an actuating pawl biased toward a given normal position and movable out of and into such position under the action of a power impulse to advance said ratchet member toward said given operating limit, an element for locking said actuating pawl upon return thereof to normal position to prevent overtravel of said ratchet member, a holding pawl engaging said ratchet member to retain the same against return movement upon advance thereof away from home position, a trip mechanism for releasing said locking element and for moving said actuating pawl and said holding pawl out of engagement with said ratchet member for resetting of said ratchet member in home position, and means associated with said trip mechanism for effecting operation thereof either manually or electromagnetically.

3. In a mechanism for effecting operation of a control device in response to a selected number of power impulses, in combination, a rotatable ratchet wheel movable in one direction into a given operating limit to effect operation of the control device and biased to move in an opposite direction into a selected home position, a motor magnet, an actuating pawl associated with said ratchet wheel and operable by said motor magnet upon energization thereof by successive current impulses to effect step by step advance of said ratchet wheel away from home position toward said operating limit, said actuating pawl being movable out of a given normal position upon energization of said motor magnet and being biased to return to normal position to effect advance of said ratchet wheel upon deenergization of said magnet, an element for locking said actuating pawl upon return thereof to normal position to prevent overtravel of said ratchet wheel, a holding pawl associated with said ratchet wheel to retain the same against return movement upon advance thereof away from home position, and a single trip magnet for releasing said locking element and for also releasing said actuating pawl and said holding pawl from said ratchet wheel for resetting of said ratchet wheel in home position.

CLYDE F. ROBBINS.
EDWIN W. SEEGER.