

April 10, 1945.

S. G. ISSERSTEDT

2,373,186

STOKER CONTROL

Filed March 26, 1943

2 Sheets-Sheet 1

Fig. 1.

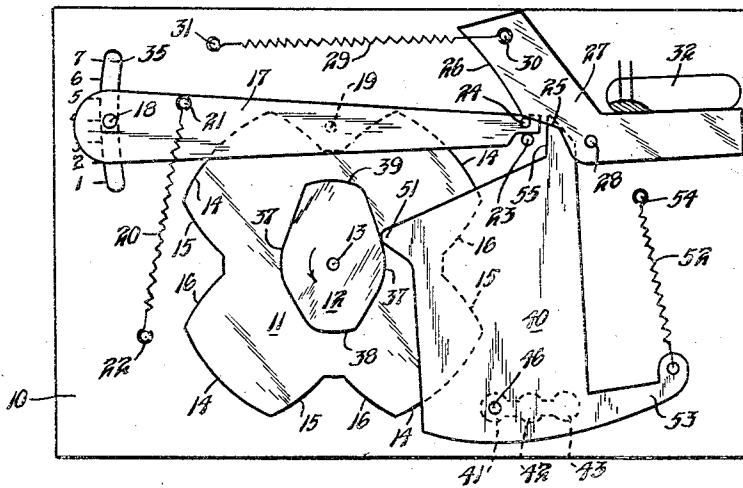


Fig. 4.

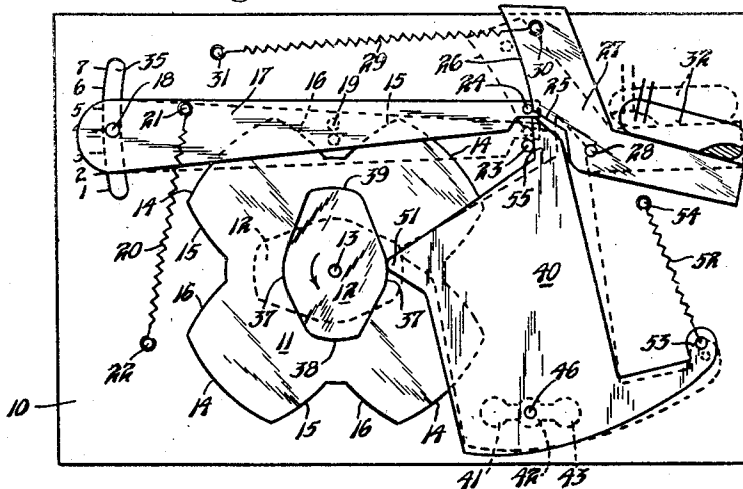


Fig. 3.

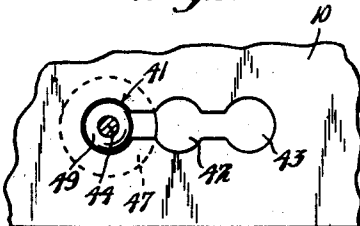
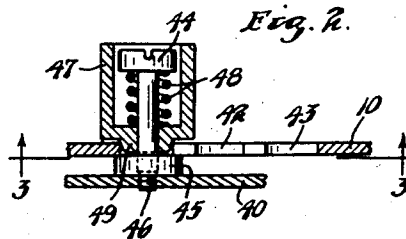


Fig. 2.



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Fig. 5.

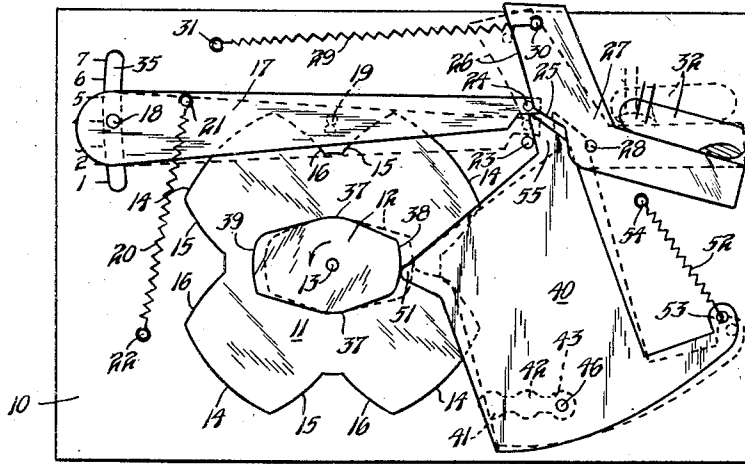
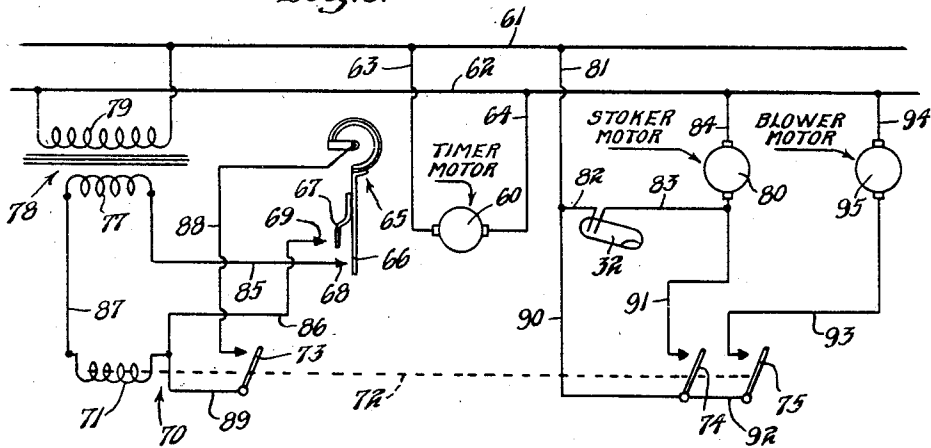


Fig. 6.



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STOKER CONTROL

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16 Claims. (Cl. 161—1)

The present invention relates to timing devices and particularly of the type employed in controlling stokers for operating the same sufficiently often to prevent extinguishment of the fire under low heat requirement conditions.

In order to provide a timer for universal application to different makes of stokers, different grades of fuel, and other variable factors, it has been found desirable to provide adjustments by which the periodicity of the timed operations and their length of duration can be simply and readily adjusted.

One of the objects of the present invention is to provide a simple and durable timer, for use for example in controlling a stoker, having simplified adjusting means so arranged that many of the parts can be made of simple stampings.

Another object of the invention is the provision of a simplified arrangement by which the periodicity of the timing or firing period can be readily changed.

A further object of the invention is the provision of a simple and easily operated means by which the length of the timing or firing periods can be adjusted.

A further object of the invention is the provision of durable and simple adjusting means for adjusting both the length and the periodicity of the timing or firing periods by merely shifting the pivotal points of a pair of cam followers. As a result, such expedients as providing cover up sectors, moving cam surfaces relatively to each other, providing in effect a plurality of different cams which are selectively used to operate the cam follower, providing separate interruption switches, or other complicated, delicate or cumbersome arrangements are all eliminated.

Other objects and advantages of the present invention will become apparent as the detailed description thereof proceeds and upon reference to the accompanying drawings, in which:

Fig. 1 is a showing of the essential elements of my improved mechanism with the parts adjusted to operate the switch once every fifteen minutes;

Fig. 2 is a detailed showing of one of the adjusting mechanisms;

Fig. 3 is a section taken on the line 3—3 of Fig. 2;

Fig. 4 is a view similar to Fig. 1 but with the parts adjusted to operate the switch every half hour.

Fig. 5 is a view similar to Fig. 1 but with the parts adjusted to operate the switch once every hour, and

Fig. 6 is a diagrammatic showing of one manner in which my invention may be utilized.

Turning now to the drawings, it might be stated that the drawings have been prepared with the view of showing, as clearly as possible, the particular configuration and shape of the fundamental parts of my invention and the manner in which they cooperate with each other as distinguished from detailed mechanical drawings of an actual device constructed in accordance with my invention, since it is believed that such a mechanical drawing would confuse rather than clarify the basic principles involved.

Turning now to Figure 1, a single base plate or supporting plate is shown at 10. In actual practice there would of course be at least two of these supporting plates so as to provide support at each end of the various shafts, journals and the like. Rotatably mounted upon the base plate 10 is a pair of cams 11 and 12 driven in a counter-clockwise direction by a shaft 13 suitably journaled in the base plate 10 and driven in such a counter-clockwise direction by any suitable timing means, such as is well known in the art. The cams 11 and 12 are preferably formed by stampings and are caused to rotate together as a single unit, either by being secured to each other or by being individually secured to the common shaft 13. The cam 11 is provided with four lobes which are exactly alike. Each lobe comprises a dwell portion 14, a lifting or off portion 15, and a retracting or on portion 16.

Cooperating with the cam 11 is a cam follower 17 pivoted upon a pivot pin 18. The cam follower 17 is shown lying in front of cam 11 and it supports a backwardly extending pin 19 that is adapted to ride upon the various surfaces of the cam 11. The cam follower 17 is biased to rotate about a pivot 18 in a clockwise direction by any suitable means such as the spring 20 which has one of its ends secured to the cam follower 17 at 21 and its other end secured to a suitable pin or other support 22 mounted upon the base plate 10. Clockwise rotation of cam follower 17 about its pivot 18 is limited by a stop pin 23 with which the extreme right-hand end of cam follower 17 cooperates. The stop pin 23 may be suitably mounted upon the base plate 10.

With the parts thus far described, upon counter-clockwise rotation of cam 11, the dotted surface just to the right of follower pin 19 will engage such pin and upon continued counter-clockwise rotation of cam 11 the pin 19 will be raised, thus rotating cam follower 17 in a counter-clockwise direction. This movement of cam follower

17 will continue until the follower pin 19 rides up on one of the dwell surfaces 14 of the cam 11. The cam follower 17 will then be maintained in its raised position until the follower pin 19 rides off of the dwell surface 14 and begins riding down the on portion of the cam. Such downward movement of the cam follower 17 will continue until the extreme right-hand end thereof engages the stop pin 23. As a result, it will be seen that the cam follower 17 is oscillated up and down four times for each revolution of cam 11. Assuming that the shaft 13 is driven at the rate of one revolution per hour (by the timing means not shown), it will be evident that the cam follower 17 makes four complete up and down movements or reciprocations each hour. In other words, the cam follower 17 is moved upwardly to its extreme position and then moved downwardly until its right-hand end engages stop 23 once each fifteen minutes.

These up and down or reciprocating movements of the cam follower 17 may be used to operate any desired type of device. Also, such operation may be direct or indirect through suitable connecting means. In the present instance, I have shown the cam follower 17 as operating a switch of the mercury switch type through suitable connecting linkage. For this purpose, the right-hand end of cam follower 17 is provided with an operating pin 24. The pin 24 cooperates with cam surfaces 25 and 26 formed on two edges of one arm of a bell-crank 27 which is in turn pivoted to the base plate 10 at 28. Suitable biasing means such as the coil spring 29 having one end secured to one of the arms of the bell crank 27, as at 30, and its other end secured to a pin 31 carried by the base plate 10, serves to maintain the cam surfaces 25 and 26 in engagement with the actuating pin 24. A mercury switch 32 having the usual electrodes in its left-hand end is mounted upon the other arm of the bell-crank 27. The relation of the parts is such, as shown in Fig. 1, that when the right-hand end of cam follower 17 is engaging stop pin 23, the bell-crank 27 is in such position that the mercury switch 32 is tilted to the left so that the mercury therein bridges the electrodes carried in the left-hand end of the mercury switch thereby completing an electrical circuit therethrough.

Upon movement of cam 11 in a counter-clockwise direction, as one of the "off" surfaces 15 thereof raises the follower pin 19, the actuating pin 24 carried at the right-hand end of cam follower 17 will rotate bell-crank 27 in a clockwise direction about its pivot 28 and tilt mercury switch 32 towards the right. As a result, the mercury therein will flow to the right-hand end of the mercury switch 32, thereby interrupting the circuit therethrough. In this manner, upon continued and constant rotation of the cam 11 at the rate of one revolution per hour, the mercury switch 32 will be opened and closed four times an hour, or once each fifteen minutes.

In order to adjust the length of time which the mercury switch will be closed, the pivot 18 for the left-hand end of cam follower 17 may be adjusted in the base plate 10 by sliding it up or down in a slot 35 provided therein. With the parts in the positions shown, the pivot 18 is placed at an intermediate point in slot 35 with the result that the switch 32 will remain on or closed for substantially three and a half minutes out of every fifteen minutes. Now if the pivot 18 is moved to the upper end of the slot 35, the result will be to maintain the mercury switch 32 in

closed position substantially seven minutes out of each fifteen minutes. It will be seen that upon such upward movement of pivot 18, the follower pin 19 will likewise move upwardly. As a result, the cam 11 will have to turn further before one of the off portions 15 thereof engages the follower pin 19 and lifts the cam follower 17 so as to move the mercury switch 32 to its off position. Similarly, upon continued rotation of the cam 11, as the pin 19 starts riding down one of the on portions 16 of the cam, the mercury switch 32 will be moved to its on position more quickly since the follower pin 19 need only ride down such on portion 16 a relatively short amount before the right-hand end of cam follower 17 will have moved down to the switch closing position. On the other hand, if the pivot 18 be moved down to the lower end of slot 35, the mercury switch 32 will remain on for only approximately one minute out of every fifteen minutes. Such downward movement of the pivot 18 moves the cam follower 19 downwardly to a position in which adjacent on and off surfaces 15 and 16 of the cam are very close together so that there will only be a relatively short period of time during which the right-hand end of cam follower 17 is sufficiently low to permit a switch closing movement of the mercury switch 32.

With the parts thus far described, the mercury switch 32 is closed every fifteen minutes and the length of time which it is closed may be adjusted from one minute to seven minutes simply by shifting the pivotal member 18 for the left-hand end of cam follower 17 upwardly and downwardly within the slot 35 provided in base plate 10. It will thus be seen that I have provided a simple adjusting mechanism for varying the duration of switch closure, which mechanism eliminates the necessity of using relatively movable cam surfaces or similar complicated expedients.

The cam 12 is provided with four operating surfaces. Two of these, numbered 37, are exactly alike and have relatively small radii. A third of these cam surfaces indicated at 38 has a somewhat larger radius and the fourth surface 39 has a still larger radius. Cooperating with the surfaces of cam 12, which cam might well be termed the interrupter cam, is an interrupter plate or member 40. The interrupter member 40 is pivoted upon the base plate 10 by a shiftable pivot, the details of which are shown in Figs. 2 and 3. Turning to these figures, it will be seen that the base plate 10 is provided with a slot comprising three holes 41, 42 and 43 which are spaced from each other and are joined together by slotted portions having a width less than the diameter of the holes 41, 42 and 43. A screw 44 is provided with a shank having a diameter substantially equal to the width of the slots which interconnect the holes 41, 42 and 43. As shown in Fig. 2, the screw 44 is extending through the hole 41 and likewise extends through a spacing washer 45. The end of the shank is provided with a reduced screw-threaded portion 46 which is threaded into the interrupter plate 40. A cup shaped member 47 is mounted on the shank between the head of the screw 44 and the base plate 10 and a coil spring has one end engaging the head of the screw and its other end engaging the bottom of the cup shaped member 47 in a manner to press the cup shaped member 47 against the base plate 10. The bottom of the cup shaped member 47 is provided with a shoulder portion 49 which snugly engages the hole 41. If it is desired to shift the pivotal point of the interrupter plate 40, it is only neces-

sary to pull outwardly on the cup shaped member 47 against the pressure of spring 48. This removes the extension 49 from the hole 41, whereupon the complete assembly may be slid in the slots joining holes 41, 42 and 43. When the desired position is reached, releasing of the cup shaped member 47 permits the spring 48 to press the extension 49 into the proper hole 42 or 43 as selected by the person adjusting the apparatus. As a result, the pivotal point for the interrupter plate 40 may be shifted from hole 41 to hole 42, or to hole 43 at the option of the operator. With the parts as shown in Fig. 1, the pivotal point of the interrupter plate 40 is located in the hole 41.

Turning back to Fig. 1, it will be seen that the interrupter 40 is provided with a follower portion 51 which cooperates with the surfaces of cam 12.

A spring 52 has one end connected to an extension 53 of the interrupter plate 40 and its other end secured to a pin 54 mounted on base plate 10. This spring 52 biases the interrupter plate 40 in a counter-clockwise direction about its pivot so as to maintain cam follower portion 51 in engagement with the various cam surfaces of cam 12. Interrupter plate 40 is further provided with an upward extension or interrupting finger 55 which extends above stop pin 23 and which, under certain conditions, is adapted to be moved into engagement with the right-hand side of stop pin 23. With the interrupter plate 40 pivoted in hole 41 of base plate 10 as shown in Fig. 1, it will be noted that the cam surfaces 37, even though of small radius, have sufficient throw to maintain the interrupter finger 55 at a point spaced to the right from stop pin 23. Now as the cams 11 and 12 rotate in counter-clockwise direction, the interrupter finger 55 will never move any closer to stop pin 23, but, to the contrary, will move even further away from this stop pin since the cam surfaces 38 and 39 are each provided with a radius larger than those of the cam surfaces 37. Therefore, under these conditions of adjustment of the interrupter plate 40, no interruptions of the operation of switch 32 will take place and this switch will be operated once each fifteen minutes as heretofore explained.

Turning now to Fig. 4, the parts are shown in the same general position as in Fig. 1 except that the interrupter plate 40 has had its pivot shifted from the hole 41 in the base plate 10 to the hole 42 thereof. As a result of this shifting, as the cams 11 and 12 moved to the position shown and while the cam follower 17 was still in a somewhat raised position due to the cooperation of follower pin 19 with one of the "on" surfaces 16, the surfaces of cam 12 in cooperation with the new pivotal point of interrupter plate 40 permitted the same to move to such a position that the interrupter finger 55 is now engaging the stop pin 23 and extending thereabove. As a result, the extreme right-hand end of cam follower 17 has had its downward movement stopped by engaging the tip of the interrupter finger 55. As a result, the cam follower 17 has not been permitted to move to its extreme downward position. Such engagement of the right-hand end of cam follower 17 with the upper tip of interrupter finger 55 has prevented the right-hand end of cam follower 17 from moving into engagement with stop pin 23. As a result, the actuating pin 24 is engaging the cam surface 26 of the bell-crank 27 whereby the bell-crank 27 is held in such position that the mercury switch 32 is tilted to the right and the circuit therethrough is open. In other words, the interrupter plate 40 has prevented the switch 32

from moving to its closed position as such switch would have done had the pivotal point 46 of the interrupter plate 40 remained in the hole 41 instead of being shifted to the hole 42. Now as the cams 11 and 12 continue to rotate in counter-clockwise direction, the surface 38 of cam 12 which has a larger radius than the surface 37 will approach the cam follower portion 51 of the interrupter plate 40. As a result, the interrupter plate 40 will move toward the dotted line position, which is the position it assumes when the cam 12 has moved to the dotted line position. With the interrupter plate 40 in the dotted line position, the interrupter finger 55 has again been moved away from the stop pin 23 and is no longer positioned under the extreme right-hand end of cam follower 17. The cam follower 17 will therefore be permitted to move downwardly to its usual full extent with the result that switch 32 will move to closed position in the same manner as it did in Fig. 1. Upon further counter-clockwise rotation of cam 11 to an extent determined upon the setting of pivotal member 18 within slot 35, the cam follower 17 will again be raised sufficiently to move mercury switch 32 to its off position. Further continued counter-clockwise movement of cams 11 and 12 will again present the other cam surface 37 to the cam follower portion 51 of interrupter plate 40. Therefore, as the cam follower 17 again starts its succeeding downward movement, the interrupter finger 55 will again move into engagement with stop pin 23 to a position in which it is underneath the extreme right-hand end of cam follower 17. As a result, once more cam follower 17 will not be permitted to complete its full downward movement and switch 32 will again be held in its off position. Upon further rotation of the cams 11 and 12, cam surface 39 having the largest radius will present itself to cam follower portion 51 of interrupter plate 40 and the interrupter plate 40 will then move to a position in which interrupter finger 55 is even further to the right than shown in the dotted line position. Under these conditions, cam follower 17 will of course be permitted to complete its full downward movement so that mercury switch 32 will again move to closed position.

It therefore follows, with the interrupter plate 40 pivoted in the hole 42 of base plate 10, the cam follower 17 is permitted to move downwardly to its fullest extent twice for each complete revolution of the cam 11. Mercury switch 32 will therefore move to closed position only twice per revolution of cam 11 or twice an hour—that is only once each half hour instead of once each fifteen minutes as was the case in connection with Fig. 1.

Turning to Fig. 5, the pivotal point of interrupter plate 40 has now been moved to hole 43 in base 10. As shown in full lines, when the cam surface 38 of intermediate radius of cam 12 is presented to cam follower portion 51 of interrupter plate 40, due to the new position of the pivotal point of interrupter plate 40, interrupter finger 55 is nevertheless positioned against stop pin 23 and underneath the extreme right-hand end of cam follower 17. It follows, that upon rotation of cams 11 and 12 in a counter-clockwise direction, the next succeeding surface 37 of still smaller radius of cam 12 will likewise permit the interrupter finger 55 to move into engagement with stop pin 23 and underneath the extreme right-hand end of cam follower 17. However, upon continued rotation and presentation of cam surface 39 of cam 12, which cam surface has the largest radius, the interrupter plate 40 will be

moved to the dotted position wherein the interrupter finger 55 has been moved away from stop pin 23 and out from underneath the extreme right-hand end of cam follower 17. Therefore, during this one part of the complete revolution of cams 11 and 12, the cam follower 17 is permitted to move to its lowermost position in which the right-hand end engages stop pin 23 and the mercury switch 32 closes. During each of the other three reciprocations of cam follower 17, its downward movement is quickly stopped by the interrupted finger 55 so that the mercury switch 32 is unable to close during these three partial downward movements of the cam follower 17. In other words, the mercury switch 32 moves to closed position but once during an hour's time which is required for a complete revolution of the cam 11 when the interrupter 40 is pivoted in the hole 43 of base plate 10.

It will thus be seen that I have provided a very simple means of adjusting the number of times the mercury switch 32 will be actuated to its closed position simply by changing the pivotal point of the interrupter plate 40. With the interrupter plate 40 pivoted in hole 41 as shown in Fig. 1, the mercury switch 32 is moved to closed position four times each hour or once every fifteen minutes. With the interrupter plate 40 pivoted in the hole 42 as shown in Fig. 4, the mercury switch 32 closes only twice each hour or once every thirty minutes. With the interrupter plate 40 pivoted in the hole 43 as shown in Fig. 5, the mercury switch 32 is permitted to move to closed position only once every hour. Regardless of the pivotal point of interrupter plate 40, the shape of the parts as shown in the drawings is so arranged that the duration of whatever number of switch closures is allowed mercury switch 32 may be changed from 1 minute to seven minutes by simply sliding the pivot 18 up and down in the slot 35 of plate 10.

From the foregoing description it will be obvious that I have provided a very simple timing mechanism in which most of the parts may be made from simple ordinary stampings. This mechanism, in spite of its simplicity, nevertheless provides for adjustment of the periodicity or frequency at which the mercury switch 32 is closed and likewise provides for changing or adjusting the duration of each switch closure period. Each of these adjustments may readily be made while the parts are moving and the apparatus is in normal operation. Furthermore, such devices as changing the relative positions of cam surfaces, moving a cam follower bodily or sidewise so that it in effect engages a different cam than before and similar cumbersome and expensive modes of construction have been entirely eliminated in my apparatus.

Turning now to Fig. 6, I have shown one of the manners in which my simplified timing apparatus may be utilized. I have shown a constantly energized timer motor 60 connected to line wires 61 and 62 by means of wires 63 and 64. The timer motor 60 would of course be connected to the shaft 13 of my timing mechanism through any suitable gear reduction so as to drive the shaft 13 at a speed of one revolution per hour.

The system of Fig. 6 includes a room thermostat 65 of usual construction having contact arms 66 and 67 which sequentially engage stationary contacts 68 and 69 in the order named upon temperature fall. The room thermostat 65 controls energization of a relay 70 having an oper-

ating coil 71 and an armature 72. Armature 72 operates a maintaining switch 73 as well as load switches 74 and 75. Power for the room thermostat and relay is provided by the low voltage secondary 77 of a transformer 78 having a primary 79 connected to the line wires 61 and 62.

With the parts in the position shown, the room thermostat is in its open position since the room temperature is sufficiently high. Even though the room thermostat is satisfied, however, the stoker motor 80 will be operated periodically by the mercury switch 32 at a frequency and for a duration of time determined by the settings of my novel timing mechanism as heretofore explained. This circuit for stoker motor 80 goes from line wire 61 through wires 81 and 82 to the mercury switch 32, then by a wire 83 to the stoker motor, and then back to the other line 62 by wire 84.

When the room temperature falls sufficiently to close both sets of room thermostat contacts, relay coil 71 is energized as follows: secondary 77, wire 85, contact 68, contact blade 66, contact blade 67, contact 69, wire 86, relay coil 71, and wire 87 to the other side of secondary 77. Such energization of relay coil 71 closes the switches 73, 74 and 75. Closure of switch 73 establishes a holding circuit for relay coil 71 which is independent of contact blade 67 and contact 69 so that the relay coil 71 will remain energized upon a first rise in temperature as is well known in the art. This holding circuit is as follows: secondary 77, wire 85, contact 68, contact blade 66, wire 88, switch 73, wire 89, relay coil 71, and wire 87 to the other side of secondary 77. Closure of switch 74 energizes stoker motor 80 as follows: line 61, wire 81, wire 90, switch 74, wire 91, stoker motor 80, and wire 84 to the other line wire 62. Closure of switch 75 energizes blower motor 95 as follows: line wire 61, wire 81, wire 90, wire 92, switch 75, wire 93, blower motor 95 and wire 84 to the other line wire 62.

When the room thermostat becomes entirely satisfied and separates contact blade 66 from contact 68 as well as contact blade 67 from contact 69, relay coil 71 will be deenergized and all of the switches 73, 74 and 75 will open. As a result, stoker motor 80 and blower motor 95 will be deenergized.

While I have shown the use of separate stoker and blower motors wherein the blower motor is only energized upon a demand for heat by the room thermostat whereas the stoker motor is energized either upon a demand for heat by the room thermostat or upon closure of the fire maintaining switch 32, it is to be understood that a single motor could be used as is well known in the art. Likewise, while I have shown my novel timing mechanism arranged with adjustments of the type particularly adapted for stoker operation, it is to be understood that other ranges of adjustment could easily be incorporated therein where it is desired to use my novel timer in connection with apparatus other than stokers. Furthermore, the reciprocatory movements of cam follower 17 and the interruptions thereof by the interrupter plate 40 may be utilized to control any desired type of apparatus, other than a switch, either directly or through various mechanical connections, depending entirely upon the use to which it is desired to put my novel timing mechanism.

While I have shown and described a preferred embodiment of my invention and its applica-

tion to a preferred use, as in the controlling of stokers, it is to be understood that many changes can readily be made by those skilled in the art and I therefore intend to be limited only by the scope of the appended claims.

I claim as my invention:

1. A timing mechanism, comprising, in combination, a device to be actuated periodically and repeatedly from a first position to a second position, actuating means which periodically and repeatedly moves said device from said first position to said second position upon substantially constant movement of said actuating means, movable means movable to a position to prevent actuation of said device by the actuating means, and means to control said movable means to automatically and repeatedly move it to its position in which it permits actuation of said device at a periodicity selectively less than that at which the actuating means moves to its actuating position.

2. A timing mechanism, comprising, in combination, a device to be actuated periodically and repeatedly from a first position to a second position, actuating means which periodically and repeatedly moves said device from said first position to said second position upon substantially constant movement of said actuating means, movable means movable to a position to prevent actuation of said device by the actuating means, means to control said movable means to automatically and repeatedly move it to its position in which it permits actuation of said device, and means for selectively controlling the periodicity at which said movable means is moved to its last-named position by the substantially constant movement of said actuating means.

3. The combination with a device to be actuated and means for periodically and repeatedly actuating said device to a predetermined position, of means operable to prevent such actuation of said device and movable to an operative position permitting actuation of said device, abutment means for maintaining said last named means in position to prevent actuation of said device, and means to selectively place said preventing means in said operative position during a predetermined number of times said actuating means moves to its device actuating position.

4. The combination with a device to be actuated and means for periodically and repeatedly actuating said device to a predetermined position, of means operable to prevent such actuation of said device and movable to an operative position permitting actuation of said device, means to place said preventing means in said operative position during a predetermined number of times said actuating means moves to its device actuating position, and adjustable means to determine the number of times said actuating means will be prevented from moving said device to its predetermined position in respect to the number of times it will be permitted to move the device to said predetermined position.

5. The combination with a device to be actuated and means for periodically and repeatedly actuating said device to a predetermined position, of means operable to prevent actuation of said device to said predetermined position, cam means operable to move said preventing means to permit actuation of said device, and adjustable means to determine the ratio of operation of said device to non-operation of said device by said actuating means and to selectively vary the time said

device is maintained in said predetermined position.

6. The combination with a device to be actuated and means for periodically and repeatedly actuating said device to a predetermined position, of movable means movable selectively to positions preventing or permitting operation of said device by the actuating means, cam means including portions having different throws for operating said movable means, and adjusting means associated with one of said two last-named means to determine which portions of said cam means shall be effective to position said movable member in each of its two positions.

7. The combination with a device to be actuated and means for periodically and repeatedly actuating said device to a predetermined position, of movable means movable selectively to positions preventing or permitting operation of said device by the actuating means, cam means for operating said movable means to each of its positions, adjustable means associated with one of said two last-mentioned means to vary the ratio between device actuation and prevention by said movable means, and independent means associated with the other of said two mentioned means to selectively vary the period of time said device is maintained in said predetermined position.

8. The combination with a device to be actuated and means for periodically and repeatedly actuating said device to a predetermined position, a movable member movable selectively to positions permitting or preventing actuation of said device by the actuating means, cam means for actuating said movable member, and means for bodily adjusting said movable member in respect to said cam means to vary the ratio between device actuation and prevention by said movable member.

9. The combination with a device to be actuated and means for periodically and repeatedly actuating said device to a predetermined position, a pivoted member movable selectively to positions permitting or preventing actuation of said device by the actuating means, a cam having a variable contour for moving said movable member whereby said movable member is moved back and forth variable amounts about its pivot during a single revolution of said cam, and means for shifting the pivot of said movable member to determine which portions of the variable contour of said cam shall be effective to move said pivoted member to one of its two aforementioned positions.

10. In a timing device, in combination, a device to be repeatedly actuated from a first position to a second position, cam means associated with said device normally effective to repeatedly and periodically actuate said device to its two positions, means physically independent of said cam means to selectively vary the time said device is maintained in either of its two positions, means physically independent of said cam means but synchronized therewith to prevent actuation of said device to one of its positions at least part of the time, and adjustable means to render said last-named means effective or ineffective.

11. In combination, a device to be actuated, cam means having a plurality of high dwells associated with said device for repeatedly actuating said device, a member physically independent of said cam means movable to positions to permit or prevent actuation of said device by certain high dwells of said cam means, and means

for simultaneously driving said cam means and for positioning said member.

12. In combination, a device to be actuated, cam means associated with said device for repeatedly actuating said device, a member physically independent of said cam means movable to positions to permit or prevent actuation of said device by said cam means, means for simultaneously driving said cam means and for positioning said member, and adjustable means to determine the number of device actuations permitted by said movable member in respect to the total number of actuations which would take place if said movable member were maintained continuously in its device actuation permitting position.

13. In a timing mechanism, a device to be actuated, a first cam for actuating said device, a second cam for preventing actuation of said device by said first cam, a single driving means for both of said cams, an adjustable means to determine the ratio of device actuation to device non-actuation permitted by said second cam.

14. In a timing mechanism, in combination, a cam, a pivoted cam follower which is oscillated by said cam upon rotation of said cam, a device actuated by said cam follower, means for shifting the pivot point of said cam follower to vary

the amount of movement imparted to said cam follower by said cam, and means preventing movement of said cam follower from actuating said device.

15. In a timing mechanism, in combination, a cam, a pivoted cam follower which is oscillated by said cam upon rotation of said cam, a device actuated by said cam follower, a member movable to a position to prevent movement of said cam follower from actuating said device, and means to move said member to said position at predetermined intervals correlated with the rotation of said cam to thereby prevent actuation of said device at predetermined times.

16. In a timing mechanism, in combination, a cam, a pivoted cam follower which is oscillated by said cam upon rotation of said cam, a device actuated by said cam follower, a member movable to a position to prevent said cam follower from following said cam, means to move said member to said position at predetermined intervals correlated with the rotation of said cam to thereby prevent actuation of said device at predetermined times, and means to adjust the effect of said last-named means on said movable member to cause said movable member to move to said position at varying intervals of time.

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