

Dec. 12, 1961

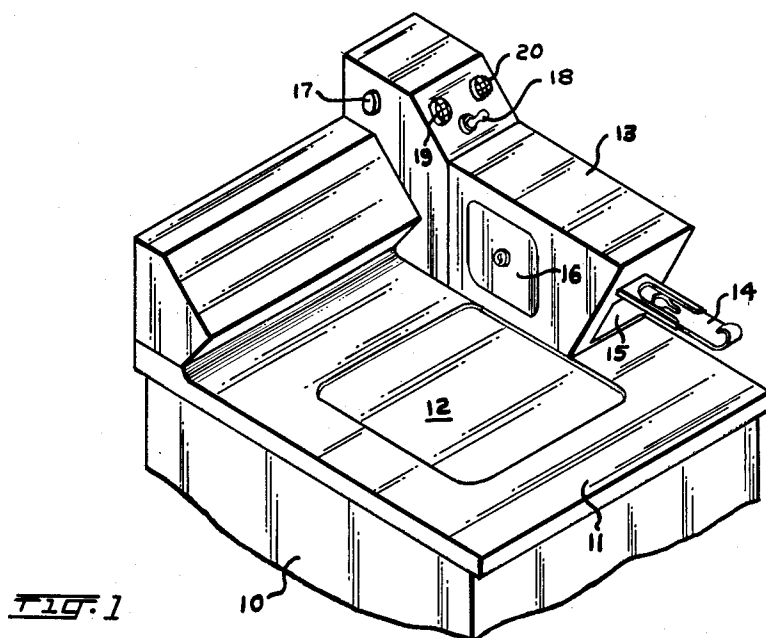
W. M. CISSELL

3,012,428

COIN-CONTROLLED AUTOMATIC CLOTHES WASHING MACHINE

Filed July 9, 1959

5 Sheets-Sheet 1



TIG. 1

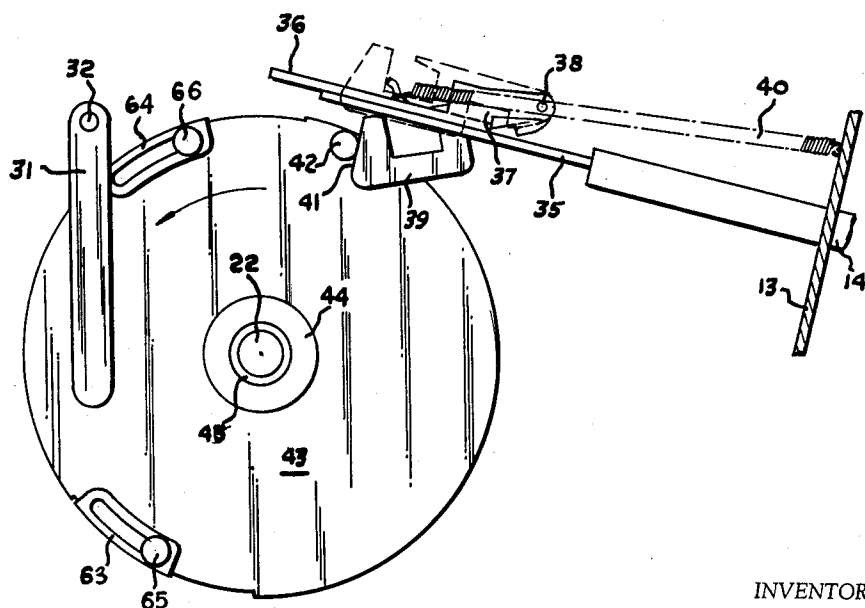


FIG. 2

INVENTOR

WILLIAM M. CISSELL

BY

W. E. Sherwood
ATTORNEY

Dec. 12, 1961

W. M. CISSELL

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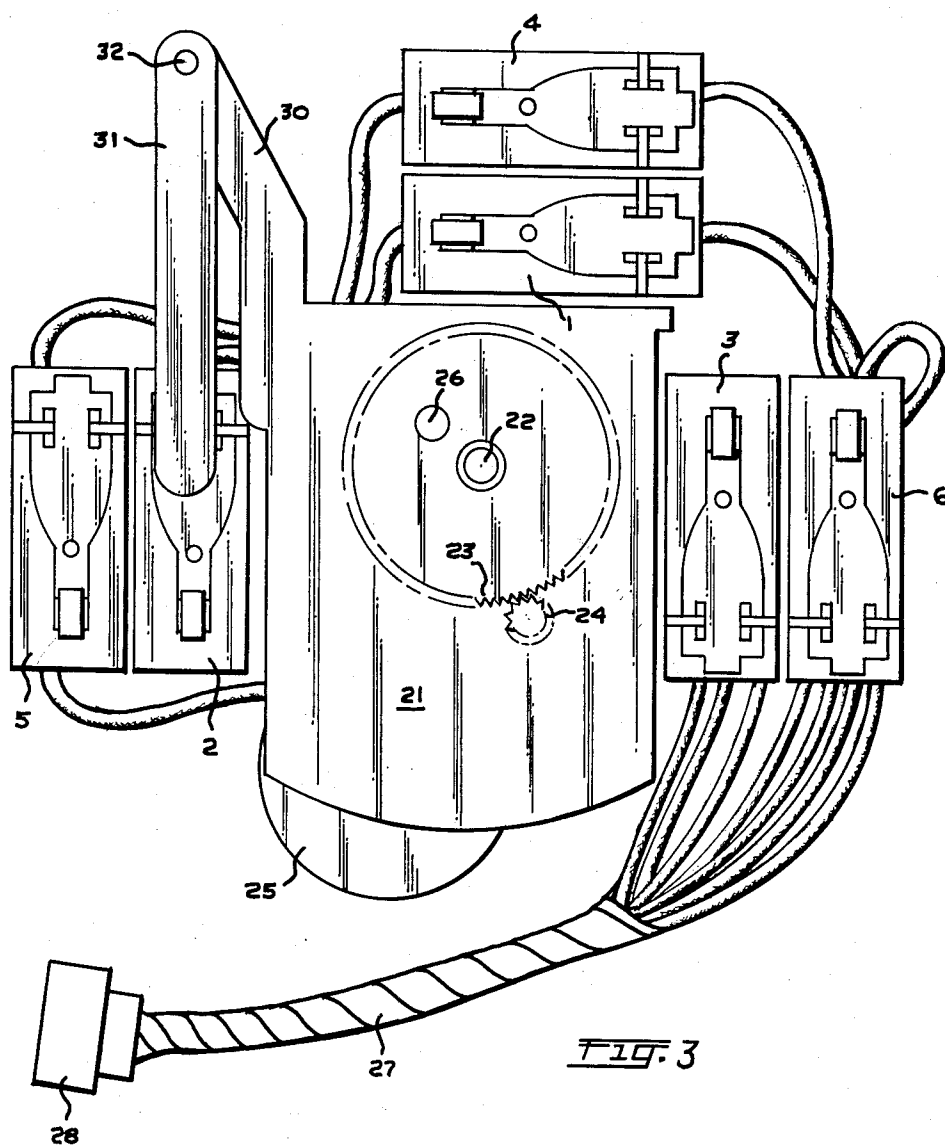


Fig. 3

INVENTOR

WILLIAM M. CISSELL

BY

W. E. Sherwood

ATTORNEY

3,012,428

COIN-CONTROLLED AUTOMATIC CLOTHES WASHING MACHINE

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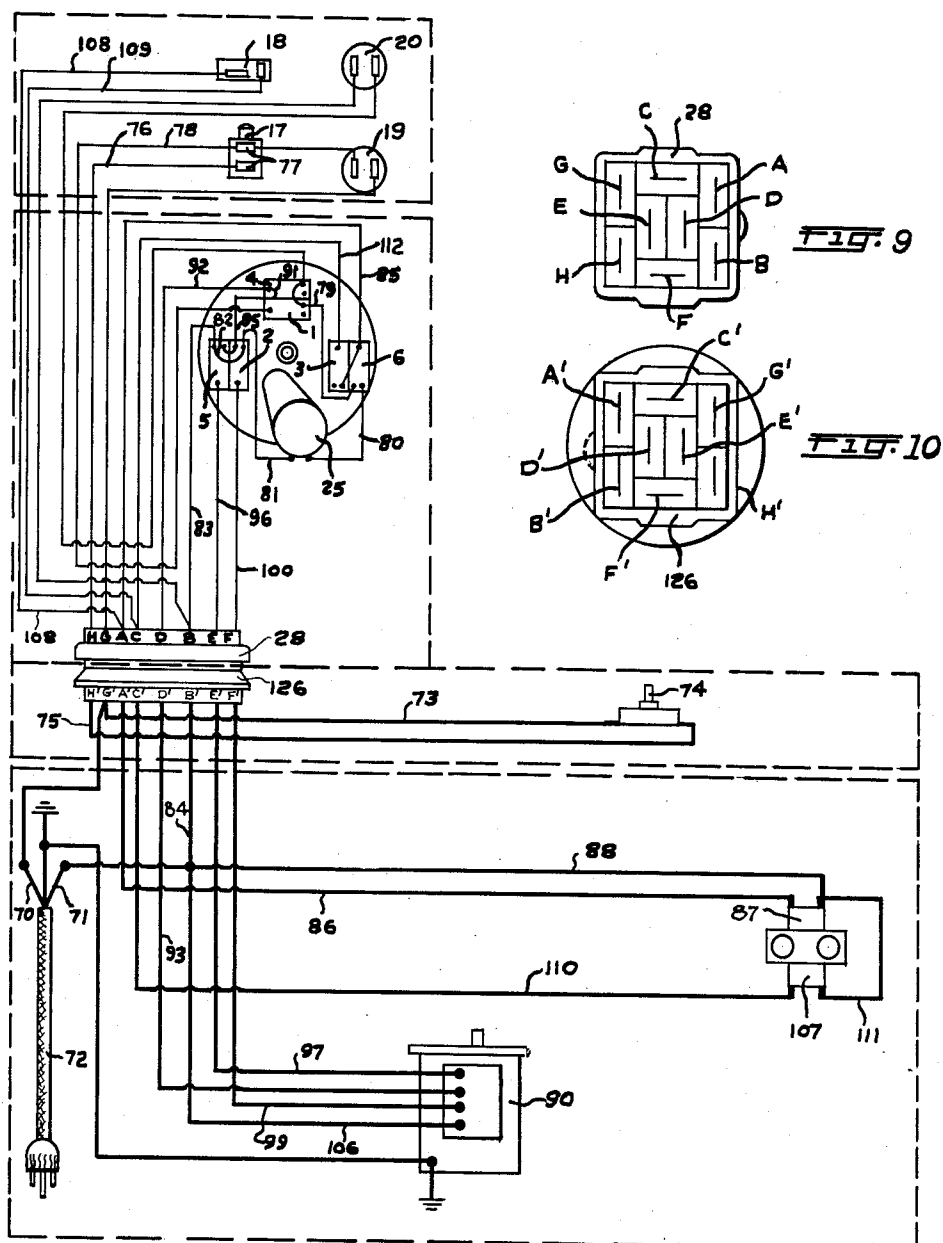


Fig. 6

INVENTOR

WILLIAM M. CISSELL

BY

W. E. Sherwood

ATTORNEY

Dec. 12, 1961

W. M. CISSELL

3,012,428

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5 Sheets-Sheet 5

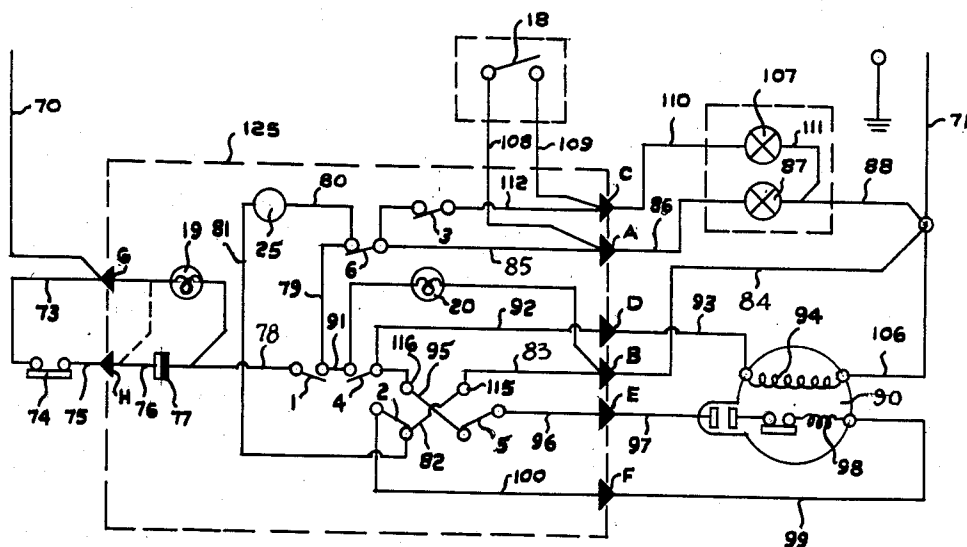


FIG. 7

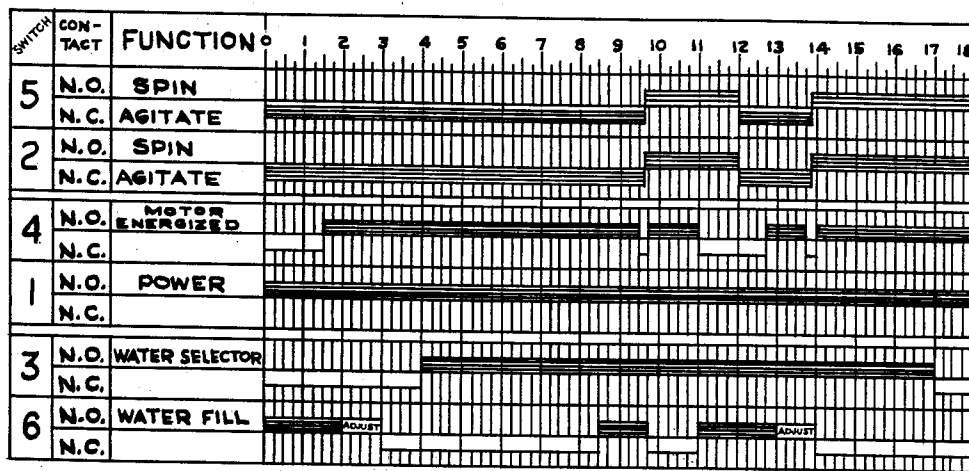


FIG. 8

INVENTOR

WILLIAM M. CISSELL

BY

W. E. Sherwood

ATTORNEY

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3,012,428

COIN-CONTROLLED AUTOMATIC CLOTHES WASHING MACHINE

William M. Cissell, Louisville, Ky.; Eloise C. Lewis and Lillian E. Cissell co-executrices of the estate of said William M. Cissell, deceased, assignors to W. M. Cissell Manufacturing Company, Louisville, Ky., a corporation of Kentucky

Filed July 9, 1959, Ser. No. 826,084
15 Claims. (Cl. 68-12)

This invention relates to an improved automatic clothes washing machine capable of carrying out a complete cycle of operation in a shorter period of time than found in conventional clothes washing machines, while at the same time accomplishing all of the clothes treatment found in such conventional machines. More specifically, it relates to a coin-controlled machine for commercial installations and having an improved coin-meter and timer unit which may be readily attached to such conventional machines without requiring major structural modification of those machines.

In recent years, a large number of small laundry establishments have developed throughout the nation using batteries of conventional small washing machines of the same type as used in homes. When these machines are unattended, the owner provides a suitable coin-operated mechanism on each machine so that the user may employ that machine merely by inserting a coin therein. Largely due to traditional reasons, the capacity of each machine is normally about 9 pounds of clothes and the total time required for conducting the clothes treating cycle was, prior to the adoption of the timing cycle hereinafter described, about 30 minutes. As a result of development work in the laboratories of the assignee of the present invention, it was discovered that by suitable modification of the timing circuit of such conventional washing machines, as will later appear, the elapsed time for conducting the clothes treating cycle could be reduced to about 18 minutes without sacrifice in the treatment of the clothes being processed in the machine. This significant discovery has now been adopted in numerous small laundries of the type above mentioned.

However, it was further discovered that when water pressure conditions vary beyond the expected range for which such modified timing circuits were originally calibrated, or when the user inadvertently slams the coin slide into place, the improved timing circuit would be unable to provide the proper treatment of clothes. Accordingly, the present invention has as an object the provision of an improved coin-operated automatic clothes washing machine of the described type incorporating means for compensating for improper operation of the coin-controlled slide.

Another object is to provide an improved automatic clothes washing machine of the described type incorporating means for compensating for wide fluctuations in pressures of water supplied to the machine.

Another object is to provide an improved coin-meter and timer unit including a wiring harness for incorporation in the electrical circuit of a conventional automatic clothes washing machine in order to convert that machine from a standard operating cycle of about 30 minutes to a cycle of shorter time.

Other objects and advantages of the invention will become more apparent as the description proceeds and when considered in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of the top portion of an automatic clothes washing machine with the coin-meter and timer unit installed thereon.

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FIG. 2 is a side elevation view of outer side of the cam member employed in the timer unit and showing a typical relative positioning of a coin slide, adjustable cam sector means, and momentum absorbing agency with respect thereto.

FIG. 3 is a view to a larger scale showing the timer unit framework with the cam member removed, and including the wiring harness.

FIG. 4 is a view to a somewhat smaller scale than FIG. 3 and showing a side elevation of the inner surface of the cam.

FIG. 5 is a sectional view taken on line 5-5 of FIG. 4.

FIG. 6 is a wiring diagram of the electrical circuit of the automatic clothes washing machine showing the first portion of the circuit arranged on the machine and the complementary second portion of the circuit contained in the wiring harness of the coin-meter and timer unit.

FIG. 7 is a schematic wiring diagram of the complete electrical circuit shown in FIG. 6, but indicating in greater detail certain functional characteristics thereof.

FIG. 8 is a wash cycle chart of the automatic clothes washing machine of the present invention.

FIG. 9 is a face view of the contact portion of the wiring harness of the coin-meter and timer unit, and

FIG. 10 is a face view of the terminals of the first portion of the electrical circuit arranged on the machine.

In accordance with the invention, a conventional automatic clothes washing machine having the customary casing with an aperture for placing clothes in the machine is employed. Within the casing the usual tub, spin basket, agitating means, motor, and electrical and water connections are disposed. However, rather than leading to the usual externally mounted control box which employs a timer designed for an operating cycle of about 30 minutes duration, the electrical connections lead to terminals which are detachably joined to contacts of the improved wiring harness forming a part of the coin-meter and timer unit mounted externally upon that casing at a convenient location for the user of the machine. This unit is designed to provide an operating cycle of about 18 minutes duration for the machine and to incorporate the afore-mentioned safeguards for assuring the complete treatment of clothes deposited in the machine. The arrangements by which these differences in time of the respective cycles are accomplished will be set forth later, as will be the means which provides such safeguards.

Referring first to FIG. 1, the washing machine, which may be any of several conventional types now being used for domestic or commercial purposes (as, for example, the machine disclosed in Clark Patent 2,376,901), may comprise a casing 10 having a cover 11 with an aperture therein for adding or removing clothes from the machine, the aperture being closed by a suitable lid 12 having the usual combination lid and unbalanced basket switch associated therewith. At a suitable position on the cover, a housing 13 for the coin-meter and timer unit is mounted. Projecting from this housing is the coin receiving end 14 of a conventional coin slide which deposits the coin in a box 15 removably locked in the housing. A removable access wall 16 in the housing provides for authorized entry into the housing for maintenance or adjustment of the timer portion of the unit. Also mounted upon the housing is a re-set switch 17, a wash water temperature control switch 18, a light 19 serving to signify an abnormal condition of operation, and a light 20 serving to signify normal operating conditions.

Mounted within the housing 13 is a timer framework and wiring harness, best shown in FIG. 3, and including a supporting plate 21 rigidly mounted upon a stationary axle

or rod 22 which is affixed to the rear wall of the housing and the forward end of which is adapted to support the removable access wall 16 of that housing. Rotatably journaled upon rod 22 is a cam-driving gear 23 having peripheral teeth engaging with the teeth of a pinion gear 24 driven in turn by a small timer motor 25 suitably mounted on the rear side of plate 21. Arranged within gear 23 is a suitable recess 26 into which a small projection from the timing cam, later to be described, fits with a lost motion for a purpose later to become apparent.

Arrayed about and supported upon plate 21 is a series of three pairs of switches 1, 4; 2, 5; and 3, 6; each of which is provided with cam followers and the contacts of which are made and broken in prescribed sequence by the movement of the cam driven by the gear 23. Each of switches 2 and 5 have two closed circuit positions while the remaining switches each have only a single closed circuit position. Wires leading from these switches are collected into a cable 27 terminating in a suitable connector element 28 having eight male contacts indicated at A, B, C, D, E, F, G, and H, respectively, as best seen in FIG. 9. These wires, cable, and contacts collectively form a harness serving as a second portion of an electrical circuit for the washing machine and when supplemented by the first portion of that circuit, as furnished by the manufacturer of the machine, complete the circuit for the machine.

Referring further to FIG. 3, a significant feature of the present invention is shown wherein an upwardly extending bracket 30 is mounted upon plate 21 and forms a mounting for a pivotable arm 31 serving as an inertia pendulum. This arm is freely movable about a pin 32 extending outwardly from the plane of bracket 30 sufficiently far for that arm to move in the plane which includes a cam actuating drive pin 42 on the outer surface of the cam, as later to be described. Since the arm serves to absorb momentum of that cam imparted to the same by the coin slide, the length and mass of the arm is so chosen as to offset the maximum force which can be imparted to that cam by that slide and which in turn is imparted to the swinging arm by the cam. With these qualifications, any type and shape of arm may be employed without departing from the invention. As an illustration of one form of arm which has been found to be satisfactory, an arm comprising a piece of cold rolled steel $\frac{1}{8}$ inch thick, $\frac{1}{2}$ inch wide and $3\frac{1}{4}$ inch long and pivoted closely adjacent one end, serves the intended purpose. Moreover, in the broader aspects, the invention contemplates the use of equivalent means such as springs, dash-pots, or the like, for serving the same function as the inertia pendulum.

Considering now FIG. 2, the coin-slide which is mounted in the wall of housing 13 has a forwardly projecting portion 35 upon which a trigger supporting plate 36 is adjustably mounted. This plate includes an upwardly extending bracket 37 having a pin 38 therethrough and upon which a trigger 39 is pivotally mounted. This trigger is adapted to pivot downwardly by gravity when the slide is moved forwardly a sufficient distance to deposit the coin in the coin box and is cammed upwardly by a suitable stationary plate (not shown) when the slide is retracted. For holding the slide in normally retracted position, a tension spring 40 attached to the housing 13 and to the plate 36 may be used. At its forward end, the trigger includes a pushing surface 41, extending into the trajectory of drive pin 42 which is rigidly affixed to the outer surface of cam 43. This cam includes an apertured outwardly extending hub 44 having a friction reducing bushing 45 therein and is journaled for rotation upon stationary rod 22. As shown in FIG. 5, the bushing also extends through a somewhat shorter hub 46 on the inner surface of the same cam, this shorter hub having a small projection 47 (FIG. 4) thereon which engages within the recess 26 of the cam-driving-gear 23 to form a suitable lost-motion for a purpose later to appear. While the cam may be formed of any suitable material, it is preferred to die-cast the same from a relatively light weight material.

During this casting it will be understood that the cam surfaces shown in FIG. 4 adapted to serve as the cam-follower-actuating means are formed as an integral part of the cam body, with the exception of certain adjustable portions of the water supply cam track, later to be described.

On the inner surface of the cam, six discontinuous cam tracks, each spaced on different length of radii from the center of the cam, are provided. The innermost single track 50 controls the power circuit to the washing machine, as indicated by the chart of FIG. 8, and cooperates with the cam follower of switch 1. It will be understood that the symbol N.O., signifies a normally open circuit condition through the respective switch, while the symbol, N.C., signifies a normally closed circuit condition through the switch. Moreover, the cam is rotated counterclockwise as viewed from its external side in FIG. 2, thus rotating clockwise as viewed in FIG. 4.

Similarly, the cam track which controls the water temperature selector function of the machine, and cooperating with switch 3, has a single track portion 53. The cam track which controls one spin and agitate function of the machine and cooperating with switch 2, has two spaced track portions 51 and 52. The cam track which controls energization of the washing machine motor, and cooperating with switch 4, has four track portions 54, 55, 56 and 57.

The cam track which controls another spin and agitate function of the machine, and cooperating with the switch 5, has two track portions 58 and 59. Finally, the cam track which controls the water fill function of the machine, and cooperating with switch 6, has three track portions 60, 61 and 62. As a significant feature of the invention, each of track portions 61 and 62 may be adjusted as to length by means of sleeve-like cam sectors 63 and 64, respectively, best shown in FIG. 2. These cam sectors are provided with slots through which adjustable screws 65 and 66, respectively extend, the screws being readily accessible to the operator merely by removing access wall 16 of housing 13. It will be understood that the cam sectors, as seen in FIGS. 4 and 5, are on the radius of the water fill cam track and cooperate with the cam follower associated therewith.

With the foregoing structure in mind, reference now is made to FIGS. 6, 7 and 8 diagrammatically showing the manner in which a complete cycle of operation of the machine is carried out. With electrical power supplied to the machine through a conductor 70 together with a return conductor 71 contained in a suitably grounded cable 72, and with the machine containing the clothes to be washed and the necessary soap or detergent, and with water connections established, the operator deposits the coin in coin slide 14 and pushes the slide inwardly. At this time, the trigger 39 engages drive pin 42 on the cam and moves that cam counterclockwise (FIG. 2). Referring to FIGS. 6 and 7, it will be noted that at this time the cam track 50 is in engagement with the cam follower of switch 1 which is thus closed and that a circuit is made through conductor 70, terminal G', conductor 73, combination lid and unbalanced basket switch 74, conductor 75, terminal H¹, contact H, conductor 76, a suitable optional and conventional thermal motor protector 77, conductor 78, closed switch 1, conductor 79, conductor 80, timer motor 25, conductor 81, conductor 82, conductor 83, contact B, terminal B¹, and conductor 84 to return conductor 71. At this start of operation, the combined adjustable cam track portions 64 and 62 are in contact with the cam follower of switch 6 holding that switch closed for immediate water filling operation. A branch circuit through switch 6, conductor 85, contact A, terminal A¹, conductor 86, hot water valve solenoid 87, and conductor 88 to return conductor 71 also is made. Simultaneously, a shunt circuit from contact G through light 19 to conductor 78 is established.

As the timer motor thus starts to operate by turning the cam, water enters the tub of the machine, but rather than being supplied at a flow rate of about 2½ gallons per minute, as in the conventional 30-minute cycle operation, it is supplied at a rate of about 5 gallons per minute in the present invention. Such tubs usually have a capacity of about 12 gallons and since the soap or detergent has been placed in the tub along with the clothes, as soon as about 7½ gallons of water has entered the tub, corresponding to about 1.5 minutes of timer operation, agitation can begin without damage to the clothes. It will be understood that the cam track 58 meanwhile has been holding switch 5 in closed contact awaiting energization of the washing machine motor 90 which occurs as soon as switch 4 is closed. Thus, the present invention provides for beginning agitation when the tub has received a fill of about 62.5% of its water capacity. When agitation first begins in the partially filled tub, a relatively high mechanical wash action with a high soap or detergent concentration is provided. This condition rapidly breaks down the soil in the clothes and as the wash water fill continues with rotation of the cam, the wash water level in the tub is continuously increased until the point of overflow is reached. By this time, the soap or detergent has formed a high suds which then is carried off to drain during the final twenty seconds of the wash fill period and during which approximately 1½ gallons of water overflows from the tub. Since most users of such machines have a normal tendency to "oversoap" the clothes, a normal wash action is secured with the soap remaining in the tub following the described overflow of sudsy, dirty water.

In order to initiate the described agitation, cam track portion 54 engages the cam follower of switch 4 after the timer has been operating 1.5 minutes and closes that switch. As the switch closes, a circuit is made from closed switch 1, conductor 91, closed switch 4, conductor 92, contact D, terminal D¹, conductor 93, run winding 94 of motor 90, conductor 106, and through return conductor 71. Similarly, since switch 5 is normally closed at this time, a circuit is made through closed switch 4, conductor 95, closed switch 5, conductor 96, contact E, terminal E¹, conductor 97, starting winding 98, conductor 99, terminal F¹, contact F, conductor 100, closed switch 2, conductors 82 and 83, contact B, terminal B¹ and conductor 84 to return conductor 71. Thus, at the end of the water fill period, corresponding under normal water line pressures to about 2.0 minutes, after the timing motor has begun to turn the cam, but which by means of the adjustable cam sectors of the present invention may be as much as 3 minutes; the cam track 62 leaves the cam follower of switch 6 opening that switch but in no way interrupting the agitating action then under way.

This agitation continues until the timer has been operating for a total of 8.5 minutes at which time cam track 60 engages the follower of switch 6, again closing that switch and introducing more wash water into the tub. This supplementary or overflow wash water period lasts for 1¼ minutes during the last ¼ minute of which the motor 90 is de-energized in the manner later to be shown. During this 1¼ minutes of supplementary washing, about 6¼ gallons of overflow water is provided, which greatly dilutes the wash water then in the tub, lowers the suds level, and prepares the clothes for the basket spin period which follows.

The temperature of the supplementary wash water is under the control of the operator by means of the water selector switch 18 cooperating with switch 3. As will be seen in FIG. 8, cam track 53, after the lapse of 4 minutes after starting of the timer motor, has engaged the cam follower of switch 3 and closed that switch in readiness for the next closing of the water fill switch 6. The operator, if desiring to use warm water, accordingly can close switch 18 so as to actuate both the hot water valve

solenoid 87 and the cold water valve solenoid 107, but if only hot water is desired, the switch 18 is left open.

When, therefore, at the beginning of the supplementary wash or overflow fill, switch 6 is again closed, this time by cam track portion 60 of a fixed length, water having the selected temperature enters the tub. When selector switch 18 is closed, a supplementary circuit exists from closed switch 6, conductor 85, contact A, conductor 108, closed switch 18, conductor 109, contact C, terminal C¹, conductor 110, cold water valve solenoid 107, conductor 111 and conductor 88 to return conductor 71. Moreover, conductor 112 connects switch 3 to contact C. Then at 9.5 minutes after the timer motor has begun operation, the following sequence occurs with wash water still being supplied to the clothes. Firstly, cam track 54 permits switch 4 to open whereupon the following circuit is employed, it being understood that this action permits the machine motor 90 to come to rest either for the purpose of reversing (if a reversible-type of motor is used), or for shifting to another speed if a transmission using clutches, spin solenoids, or the like, with a non-reversible motor is used. During this pause which may take about 15 seconds, wash water continues to enter the tube of the machine. When this pause is ended at 9¾ minutes of the elapsed cycle, cam track portion 60 permits switch 6 to open and simultaneously cam track portion 53 closes switch 4. Just before this occurs, two other functional operations also occur simultaneously. Firstly, cam track portion 58 permits switch 5 to shift and cam track portion 51 permits switch 2 to shift. As these switches so operate they close upon the respective contacts 115 and 116, thus to reverse the motor 90 when a reversible motor is employed. Cam track portions 50 and 53, meanwhile, are, of course, holding switches 1 and 3 closed.

Upon shifting of switches 2 and 3, and during the concurrent pause or period of rest of motor 90, the conventional mechanism within the washing machine for effecting agitation is inactivated and the conventional mechanism for effecting spin of the basket is placed in readiness for the next phase of the washing cycle. Thus, with switches 1, 2, 3, 5 and 6 in their described operative position, as the timer motor continues to rotate the cam, cam track portion 55 at 9¾ minutes of the elapsed cycle, closes switch 4. As this occurs, a circuit is made from closed switch 1, conductor 91, closed switch 4, contact 116, switch 2, conductor 100, contact F, terminal F¹, conductor 99, start winding 98 of motor 90, conductor 97, terminal E¹, contact E, conductor 96, switch 96, contact 115, conductor 83, contact B, terminal B¹, and conductor 84 to return conductor 71. At the same time, a circuit is made through closed switch 4, conductor 92, contact D, terminal D¹, conductor 93, run winding 94, and conductor 106 to return conductor 71. As motor 90 begins to turn, driving the spin basket at high speed, the wash water from that tub or basket is spilled into the usual drain of the machine. This action takes place for the subsequent 1¼ minutes of the cycle during which time the entire tub capacity of water is removed from the clothes. Moreover, since this water removal takes place in a much shorter time than in conventional cycles for operating the machine, less impactment of clothes occurs in the basket and the subsequent rinsing action is permitted to take place more efficiently.

Following this spin period, cam track portion 55 permits switch 4 to open and motor 90 to come to rest. Simultaneously, cam track portion 62 closes switch 6 and the rinse fill of water begins to enter the tub at the rate of about 5 gallons per minute. This fill continues throughout the 1¼ minute of the pause period of the motor or until about 8¾ gallons of rinse water is in the tub. Meanwhile, during the pause period of the machine motor 90, the timer motor is still turning the cam and before the machine motor again starts to turn, the cam track 58 has permitted switch 5 to reset to its original

position and the cam track 51 has permitted switch 2 to reset to its original position, both as seen in FIG. 7.

Accordingly, after a lapsed cycle time of $12\frac{3}{4}$ minutes, the cam track portion 56 closes switch 4 and the machine motor 90 starts to turn in the same manner as when the initial wash fill was taking place earlier. At this time, the agitate rinse action takes place and continues for 1 minute at the end of which cam portion 56 permits switch 4 to open again. However, during this agitate rinse action the adjustable cam track portion 62, 64 is so set as to provide at least 15 seconds of continued rinse fill supply of water and as much as $1\frac{1}{4}$ minutes of such rinse fill, if so desired, after the motor 90 has begun the rinse agitate operation. That is, if desired, the rinse filling can continue for as long as 15 seconds after the motor 90 has stopped its rinse agitation. Should the rinse water be supplied, then for the entire 3 minute period at its rate of 5 gallons per minute about 4 gallons of the same overflows during the rinse agitate period, thus thoroughly removing soap or detergent which might otherwise cause a discoloring of clothes during a subsequent drying treatment of such clothes.

Referring further to FIG. 8, after a 15 second pause of motor 90, cam track 57 closes switch 4 and motor 90 again is energized and runs until the end of the 18 minute timing cycle is completed. Shortly before switch 4 is so closed, cam track portion 59 permits switch 5 to reset to its connection with contact 115 and cam track portion 52 permits switch 2 to reset to its connection with contact 116. Thus, when restarted, motor 90 is driven through the same circuits as when it operated in the original spin functioning and again water contained in the tub is spilled into the drain of the machine. However, during this final spin, a period of 4 minutes operation is provided in order to spin dry the washed and rinsed clothes.

As will further be noted, at a time, not later than the beginning of this final phase of motor operation, the adjustable cam track 62, 64 permits switch 6 to reopen and at a time not later than the end of this final phase of motor operation, the cam track 53 permits the switch 3 to reopen. Furthermore, at the end of this final phase of motor operation, both cam track 59 and cam track 52 permit their respective switches 5 and 2 to restore to the connections as seen in FIG. 7 in readiness for beginning another cycle of operation.

Referring now to FIGS. 3 and 4, it will be seen that the timer motor pinion gear 24 in driving the gear 23 causes a movement of cam 43 due to engagement of the pin 47 of that cam within the recess 26 of gear 23, which recess provides a small amount of lost motion sufficient to protect the timer motor from shock originating from the coin slide. Thus, when the timer motor completes its prescribed 18 minute cycle, cam track 50 permits switch 1 to open as the terminal cam surface 120 of that track leaves the cam follower for that switch. Power to the timer thus is cut off and the machine motor 90 comes to a stop. At this same time, the cam 43 comes to rest with its driving pin 42 in position to be engaged by trigger 39 when another coin is placed in the coin slide. The stroke of the coin slide is at least long enough to move the cam counterclockwise (FIG. 2) sufficiently far to depress the cam follower of switch 1 by contact with the leading cam surface 121 of cam 50 and to close that switch.

It will be understood that the maximum length of the stroke of the coin slide is sufficient to enable the trigger 39 to travel a short distance with the drive pin 42 on the cam member 43 when the power switch 1 on the machine is thus closed at the start of a cycle. As a result, a careless operator of the machine can, after depositing the coin in slide 14, then slam the slide forward causing trigger 39 to give a sharp impact to drive pin 42. It will be further understood that the cam possesses an appreciable mass and that the frictional load of the rollers of the cam followers for the two normally

closed switches 2 and 5 (seen in FIG 3) is of a relatively small magnitude. Thus, since the cam is free to rotate on axle 22 until its pin 47 passes across the lost-motion space in the recess 26 of gear 23 (here shown as an angular displacement of about 30°) such a movement of the cam occurs almost instantly after trigger 39 contacts drive pin 42. This phase of the movement which is normal and presents no problem, brings the cam follower for power switch 1 into contact with cam track 50 and starts the cycle of operation of the machine.

However, having once been given its momentum, cam 43 does not immediately come to rest and on the contrary now pushes with an excess amount of momentum against the normally trailing edge of recess 26 until its momentum is spent. As it so pushes against the recess edge it serves to drive in their accustomed direction of rotation the gears 23, 24 and the motor of the timing motor which in addition is now receiving power and has acquired its own momentum. The relatively free rotation of the gears, with their own mass now becoming a momentum factor, can easily permit the cam to travel through the additional 30° of angular displacement as seen in FIG. 2 thus making a total angular displacement of about 60° resulting from the slamming of the coin slide by the operator.

As a significant factor, when the cam comes to rest the lost-motion space of recess 26 thereafter becomes immediately effective and depending upon where pin 47 is then resting in that space, the timer motor must turn for a commensurate period of time until the advancing wall of the recess, being driven by gears 24 and 23, can then come into driving contact with that pin. It has been found that if the described momentum of the cam resulting from slamming of the coin slide is only enough to bring the drive pin 42 of the cam into contact with the pendulum arm 31 or to displace that arm only slightly, then no malfunctioning of the machine will occur. However, if the momentum is greater than this amount the contact of drive pin 42 upon arm 31 can cause that arm to swing free, but since the arm itself is given a prescribed mass and leverage it will swing back and strike the drive pin. As it strikes the drive pin in its reverse swing it thereupon brings the cam to rest and then imparts a reverse momentum thereto. Due to the lost-motion space in recess 26, the cam can then rotate backward a short distance and without causing any shock to the driving motor since the pin 47 attached to the cam has not yet been brought into contact with the advancing edge of recess 26. Accordingly, the described arrangement obviates any malfunctioning of the machine regardless of how sharp an impact is given to the coin slide.

As a further feature, the employment of the pendulum arm, or an equivalent device, provides another important safeguard. As seen in the drawings, the several switches are arrayed about the circular cam and its circularly disposed cam tracks in such a manner that angular displacement of the cam affects the operation of those switches.

Referring to FIGS. 4 and 8, if the location of the switch 6 controlling the water fill is such that its cam follower, with the machine at the start of a cycle, rests between cam tracks 63 and 62, then without some means for limiting the travel of the cam when the coin slide is slammed forward, it would be possible for that cam to rotate under its momentum and to carry its cam track 64 completely under the cam follower of switch 6 coming later to rest between cam tracks 62 and 60. In such a case the timer for the initial water fill would be substantially eliminated.

While the present invention is particularly well suited for commercial installations in which the reduction in time of completing the washing cycle is more important economically than adhering to a cycle which uses a minimum amount of water, the overflow of water which takes

place in the described cycle has even another significant purpose. As is apparent from the foregoing disclosure, in the beginning of the wash cycle, agitation is commenced as soon as a sufficient quantity of water, less than full tub capacity, is reached, and this serves to give a high mechanical action with a relatively low water level in the tub. Moreover, the initial water fill is then continued for a time sufficient to cause a reasonable overflow of the wash water, thus discharging the high suds level and eliminating excess soap which may have been introduced into the tub by the user.

Also of significance, it has been found that water line pressures vary considerably in different installations at which the washing machine may be used. While various automatic compensating means incorporating flow control washers on the water supply valves may be used to take care of reasonable variations of water pressures, these are found to be unsatisfactory under abnormal conditions which may be encountered. However, by using the adjustable sleeve members for cam track portions 61 and 62, as described, even under exceptionally low or high water line pressures, an appropriate amount of water is supplied for the initial wash, supplementary wash, and rinse fill steps.

In the case of high water pressures, the adjustment of the cam track used in the initial water fill becomes necessary in order to prevent too great an overflow, the most detrimental effect of which would be to reduce the necessary soap concentration in the wash water. The supplementary wash fill, that is, the overflow fill at the end of the wash cycle, could, however, be of any amount of overflow since at this time the water is serving in a diluting function which is preparing the clothes for the succeeding rinse cycle. This may also be said of the overflow during the rinse fill.

The adjustment of the cam track used in the rinse fill is of particular value in locations which may have not only a high water pressure, but also a limited waste water disposal facility. When waste water is to be discharged into modified septic tanks, or the like, health and conservation requirements may dictate a reduction of soap concentration, through dilution, before such waste products are allowed to discharge back into the earth.

Various features of the invention not specifically described above may now be noted. As in conventional domestic types of automatic washing machines, if the lid 12 is not closed, or if the clothes are so unevenly distributed as to cause dynamic unbalance, the switch 74 operates to open the main circuit to the machine across terminals G¹ and H¹. This condition may be rectified by closing the lid or redistributing the clothes, as the case may be, followed by pushing reset switch 17 after a lapse of a short time in case the machine does not restart automatically. As will be understood, the thermal protector 77 serves to open reset switch 17 when the machine is overloaded with clothes and to cause light 19 to illuminate.

It is particularly to be noted that in accordance with invention a separate coin-slide and timer unit having a wiring harness selectively attachable to the washing machine itself, is provided. This unit is indicated diagrammatically in FIG. 7 by the dotted rectangle 125 and the several contacts A to H, inclusive, housed in male connector 28 form the only electrical connection between the unit and the machine itself. The complementary terminals for the electrical connections contained in the washing machine structure are housed in the female connector 126 as seen in FIGS. 6 and 10 and bear the designations A¹ to H¹, inclusive. As will be understood by those skilled in the art, a conventional 30-minute cycle machine can accordingly be converted to the present 18-minute cycle machine merely by connecting its line conductors 70 and 71 to terminals G¹ and B¹, respectively; by connecting its lid and unbalance switch to terminals H¹ and G¹; by connecting its hot and cold water valve

solenoids 87 and 107 to terminals A¹ and B¹ and terminals C¹ and B¹, respectively; and by connecting its starting winding of the motor to terminals E¹ and F¹ and its run winding of that motor to terminals D¹ and B¹. No mechanical changes in any of the washing machine parts is required except that should the water supply valves have too low a flow capacity, they must be changed to permit a flow capacity of about 5 gallons per minute. Since substantially all present day machines contain these essential components, the present invention therefore provides a substantially universal type of adapter suitable for use with machines of many different manufacturers.

While in accordance with the patent statutes there has been described what at present are considered preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is intended, in the appended claims, to cover all such changes and modifications as fall within the true spirit of the invention.

What is claimed is:

1. In an automatic clothes washing machine, a timer for controlling a predetermined cycle of operation of said machine and comprising a timing motor, a rotatable cam member mounted loosely upon a stationary rod and driven from said motor through a lost-motion connection therewith, a plurality of switches mounted in proximity to said member, each of said switches having a cam follower extending outwardly therefrom and located on a radius of different length from the axis of rotation of said member, said cam followers serving to make and break contacts of their respective switches upon movement of said followers, a plurality of concentrically arranged cam-follower-actuating means corresponding to the number of said cam followers and positioned upon a surface of said member for causing movement of said followers during rotation of said member, manual means for engaging said cam member to impart rotary movement thereto at the beginning of said cycle and to establish a momentum therefor as said cam member rotates loosely upon said rod in its lost-motion relation to said motor, and means mounted adjacent said member, and initially out of contact therewith and adapted to be struck by said member, for absorbing excess momentum imparted to said member by said manual means, thereby to prevent shortening of the predetermined cycle of operation of said machine resulting from excess angular free travel of said cam member upon said rod.

2. A timer as defined in claim 1 wherein said manual means comprises a coin slide.

3. A timer as defined in claim 1 wherein said means for absorbing momentum comprises an inertia pendulum.

4. In an automatic clothes washing machine, a timer for controlling a predetermined cycle of operation of said machine including a wash fill step, a timing motor, a rotatable cam member mounted loosely upon a stationary rod and driven from said motor through a lost-motion connection therewith, a plurality of switches mounted in proximity to said member, each of said switches having a cam follower extending outwardly therefrom and located on a radius of different length from the axis of rotation of said member, said cam followers serving to make and break contacts of their respective switches upon movement of said followers, a plurality of concentrically arranged cam-follower-actuating means corresponding to the number of said cam followers and positioned upon a surface of said member for causing movement of said followers during rotation of said member, one of said cam followers and one of said cam-follower-actuating means corresponding to the water filling operation of said machine, adjustable means attached to said one of said cam-follower-actuating means and serving selectively to lengthen and shorten the contact of said one cam follower with said one cam-follower-actuating means thereby to

establish selectively the amount of liquid supplied during said wash fill step, manual means for engaging said cam member to impart rotary movement thereto at the beginning of said cycle and to initiate operation of said timing motor and to establish a momentum in said cam member as said member rotates loosely upon said rod in its lost-motion relation to said motor, and means mounted adjacent said member, and initially out of contact therewith and adapted to be struck by said member, for absorbing excess momentum imparted to said member by said manual means thereby to prevent shortening of the predetermined cycle of operation of said machine resulting from excess angular free travel of said cam member upon said rod.

5. A timer as defined in claim 4 wherein said one cam-follower-actuating means includes spaced portions corresponding respectively to a wash fill step and a rinse fill step in the operation of said machine and said adjustable means includes separate members attached to said spaced portions and serving selectively to lengthen and shorten the contact of said one cam follower with each of said spaced portions of said one cam-follower-actuating means.

6. A timer as defined in claim 4 wherein said one cam-follower-actuating means is mounted adjacent the periphery of said cam member and comprises the cam-follower-actuating means located at the greatest distance from the axis of rotation of said member thereby to provide for ready adjustment of said adjustable means.

7. For use with an automatic clothes washing machine having an electrical circuit comprising complementary first and second portions forming a complete circuit and with said first circuit portion including terminals and supported on said machine; a coin meter and timer unit comprising a wiring harness serving as a second circuit portion and including contacts for engagement with the respective terminals of said first circuit portion and for establishing therewith a complete electrical circuit for operating said machine through a predetermined washing cycle, timing means incorporated in said unit and including a timing motor and a cam member driven by said motor and controlling said cycle, said cam member being loosely mounted upon a stationary rod and driven from said motor through a lost-motion connection therewith, a coin slide engageable with said member for initiating operation of said motor, and for imparting momentum to said cam member as it rotates loosely upon said rod in its lost-motion relation to said motor, and means for absorbing excess momentum of said member following contact of said slide with said member thereby to prevent shortening of the time of the cycle controlled by said member resulting from excess angular travel of said member upon said rod.

8. For use with an automatic clothes washing machine having an electrical circuit comprising complementary first and second portions forming a complete circuit and with said first circuit portion including terminals and supported upon said machine; a coin meter and timer unit comprising a wiring harness serving as a second circuit portion and including contacts for engagement with the respective terminals of said first circuit portion and for establishing therewith a complete electrical circuit for operating said machine through a predetermined washing cycle requiring substantially less than thirty minutes duration, timing means incorporated in said unit and including a timing motor and a cam member driven by said motor and controlling said cycle, said cam member being loosely mounted upon a stationary rod and driven from said motor through a lost-motion connection therewith, said cam member including separate cam portions controlling respectively the wash filling, wash agitating, wash overflow, suds spinning, rinse filling, and rinse agitating steps of said cycle, a coin slide engageable with said member for initiating operation of said motor and for imparting momentum to said cam member as it rotates loosely upon said rod in its lost-motion relation to said motor, and means for absorbing momentum of said member following contact of

said slide with said member thereby to prevent shortening of the time of the cycle controlled by said member resulting from excess angular travel of said member upon said rod.

9. Apparatus as defined in claim 8 wherein said cam portions controlling said wash filling and said wash agitating are arranged upon said cam member in overlapping time relation thus to provide for overlapping operation whereby a shortened overall washing cycle may be secured.

10. Apparatus as defined in claim 8 wherein said cam portions controlling said wash agitating and said wash overflow are arranged upon said cam member in overlapping time relation thus to provide for overlapping operation whereby a shortened overall washing cycle may be secured.

11. Apparatus as defined in claim 8 wherein said cam portions controlling said wash overflow and said suds spinning are arranged upon said cam member in time relation such that said suds spinning begins at the time said wash overflow ceases whereby a shortened overall washing cycle may be secured.

12. Apparatus as defined in claim 8 wherein said cam portions controlling said suds spinning and said rinse filling are arranged upon said cam member in time relation such that said rinse filling begins at the time said suds spinning ceases whereby a shortened overall washing cycle may be secured.

13. Apparatus as defined in claim 8 wherein said cam portions controlling said rinse filling and said rinse agitating are arranged upon said cam member in overlapping time relation thus to provide for overlapping operation whereby a shortened overall washing cycle may be secured.

14. An automatic clothes washing machine having a casing, a coin meter and timer unit having a housing supported upon said casing, a wiring harness for said unit forming a second portion of the electrical circuit for said machine and terminating in a connector having a plurality of contacts, a complementary first portion of the electrical circuit for said machine disposed within said casing and terminating in a connector having a plurality of terminals corresponding to the contacts of said harness, a stationary plate mounted in said housing, a stationary rod extending from said plate, a timing motor mounted upon said plate and including in said second circuit portion, a plurality of switches mounted upon said plate and included in said second circuit portion, each of said switches having a cam follower extending outwardly therefrom and located on a radius of different length from said rod, said cam followers serving to make and break contacts of their respective switches upon movement of said followers, a rotatable cam member loosely mounted on said rod and having a plurality of concentrically arranged cam-follower-actuating means corresponding to the number of said cam followers and positioned to cause movement of said cam followers as said cam member rotates, a gear rotatably journaled on said rod and driven by said motor, lost-motion means on said cam member engageable with said gear for driving said member therefrom, a projection extending from said cam member, manual means mounted in said housing and selectively engageable with said projection to establish a momentum in said member and to move said member angularly about said stationary rod into position assuring starting of said timing motor, and an arm swingably mounted on said plate and adapted to hang in the path of movement of said projection as said member is moved by said manual means thereby to absorb excess momentum of said cam member as imparted thereto by said manual means and to prevent shortening of the cycle of said machine resulting from excess angular free travel of said cam member upon said rod.

15. Apparatus as described in claim 14 wherein said gear includes a recess therein and said means on said cam member includes a pin engageable in said recess with a lost motion whereby movement of said manual means in start-

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ing said machine may be effected without causing shock to
said timing motor.

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