

Sept. 22, 1936.

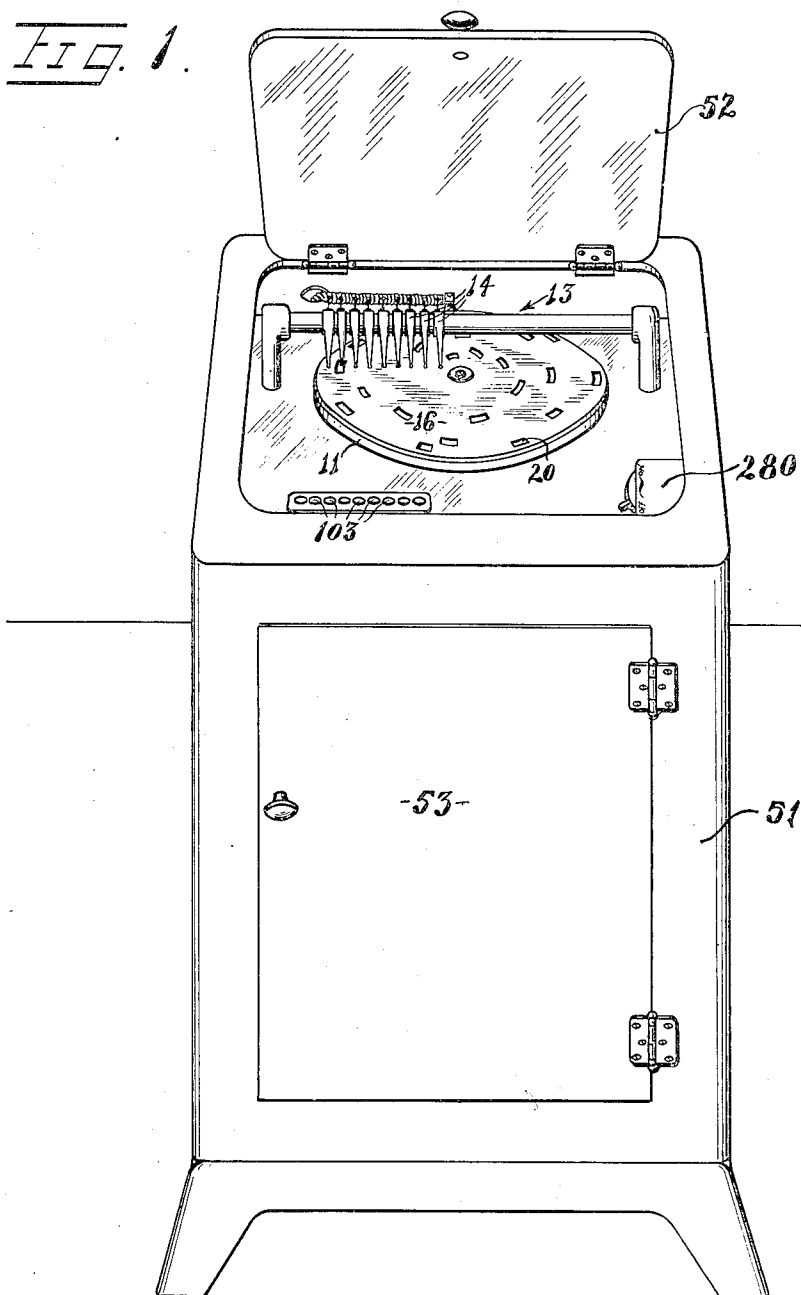
W. B. HUTCHINGS

2,055,031

TIMER WITH INTERCHANGEABLE FORMULA FOR CONTROLLING  
MACHINES HAVING SERIES OF OPERATIONS

Original Filed Nov. 7, 1930 11 Sheets-Sheet 1

Fig. 1.



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TIMER WITH INTERCHANGEABLE FORMULA FOR CONTROLLING  
MACHINES HAVING SERIES OF OPERATIONS  
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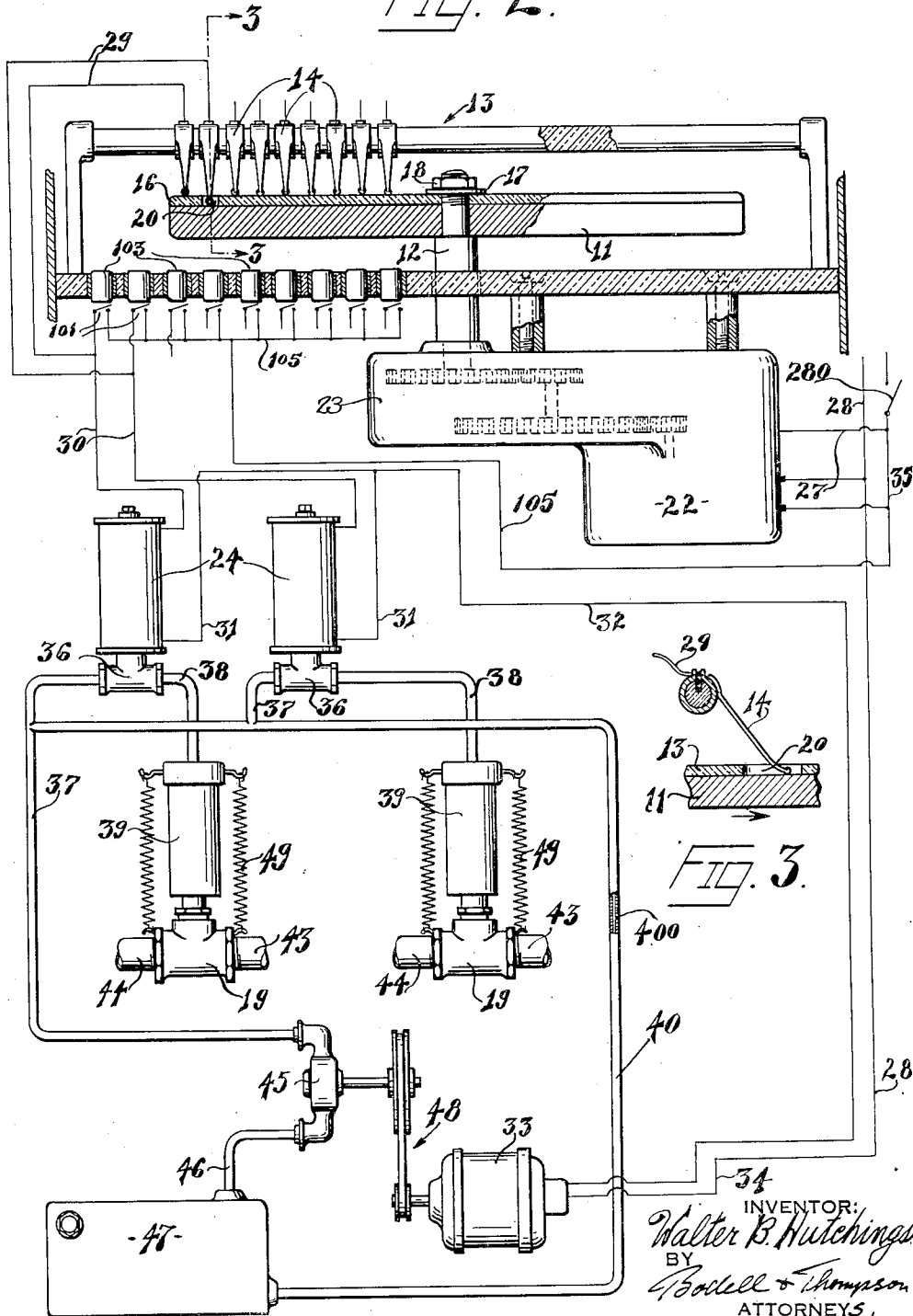
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TIMER WITH INTERCHANGEABLE FORMULA FOR CONTROLLING  
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FIG. 2.



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TIMER WITH INTERCHANGEABLE FORMULA FOR CONTROLLING

MACHINES HAVING SERIES OF OPERATIONS

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FIG. 4.

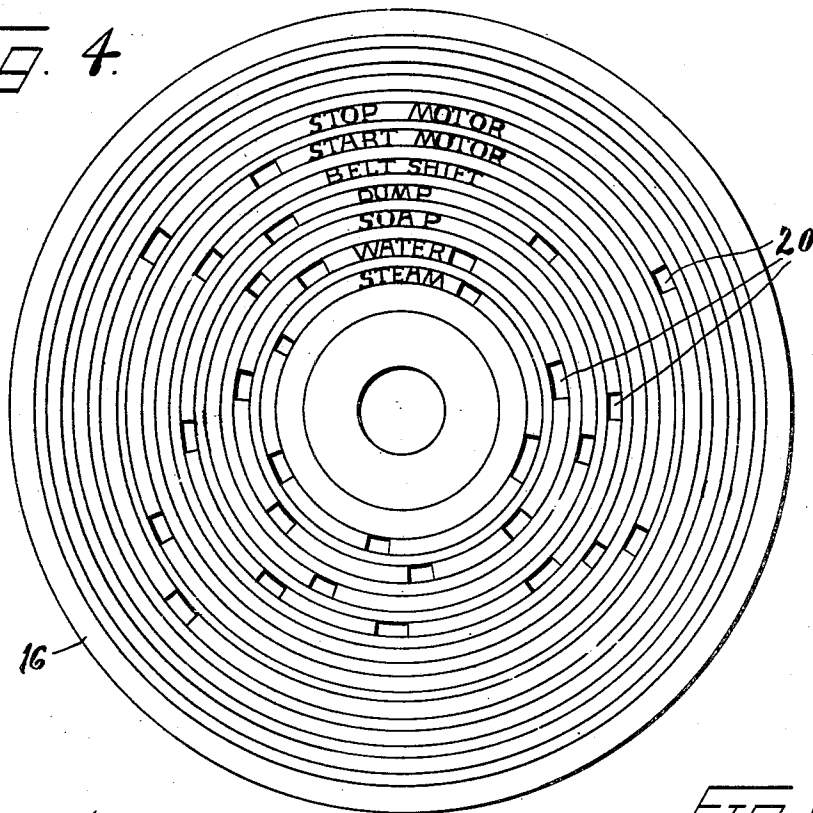


FIG. 5.

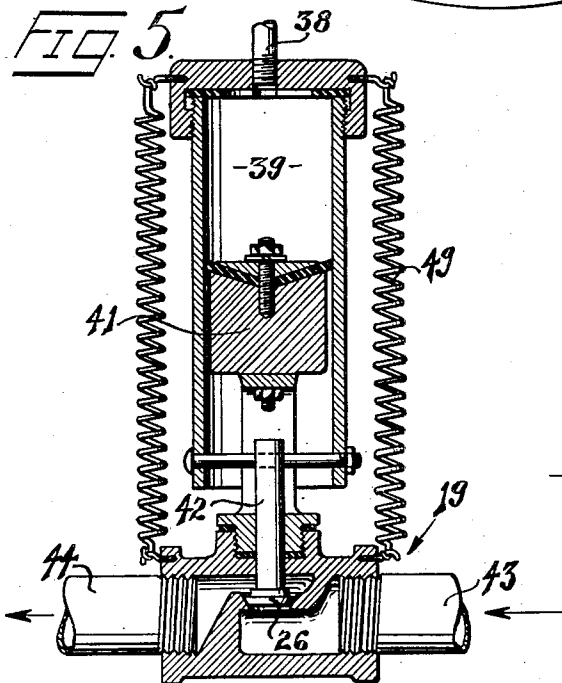
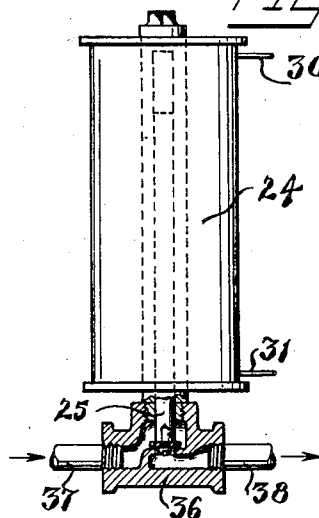


FIG. 6.



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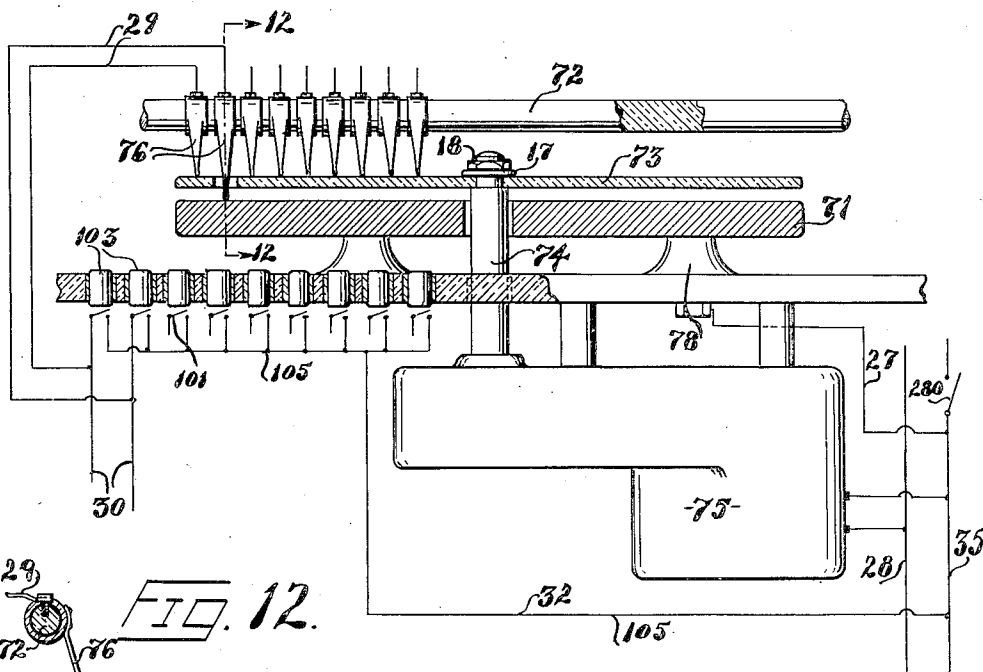
**Sept. 22, 1936.** **W. B. HUTCHINGS** **2,055,031**  
 TIMER WITH INTERCHANGEABLE FORMULA FOR CONTROLLING  
 MACHINES HAVING SERIES OF OPERATIONS  
 Original Filed Nov. 7, 1930 11 Sheets-Sheet 5

**2,055,031**

# MACHINES HAVING SERIES OF OPERATIONS

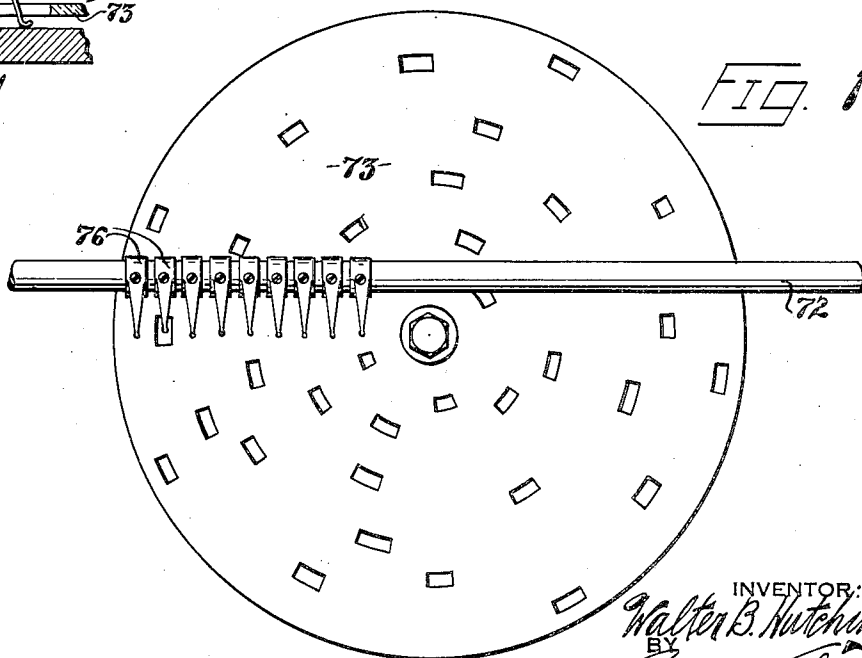
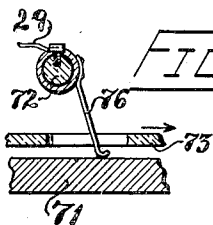
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**FIG. 10.**



29

FIG. 12.



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TIMER WITH INTERCHANGEABLE FORMULA FOR CONTROLLING

MACHINES HAVING SERIES OF OPERATIONS

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FIG. 13.

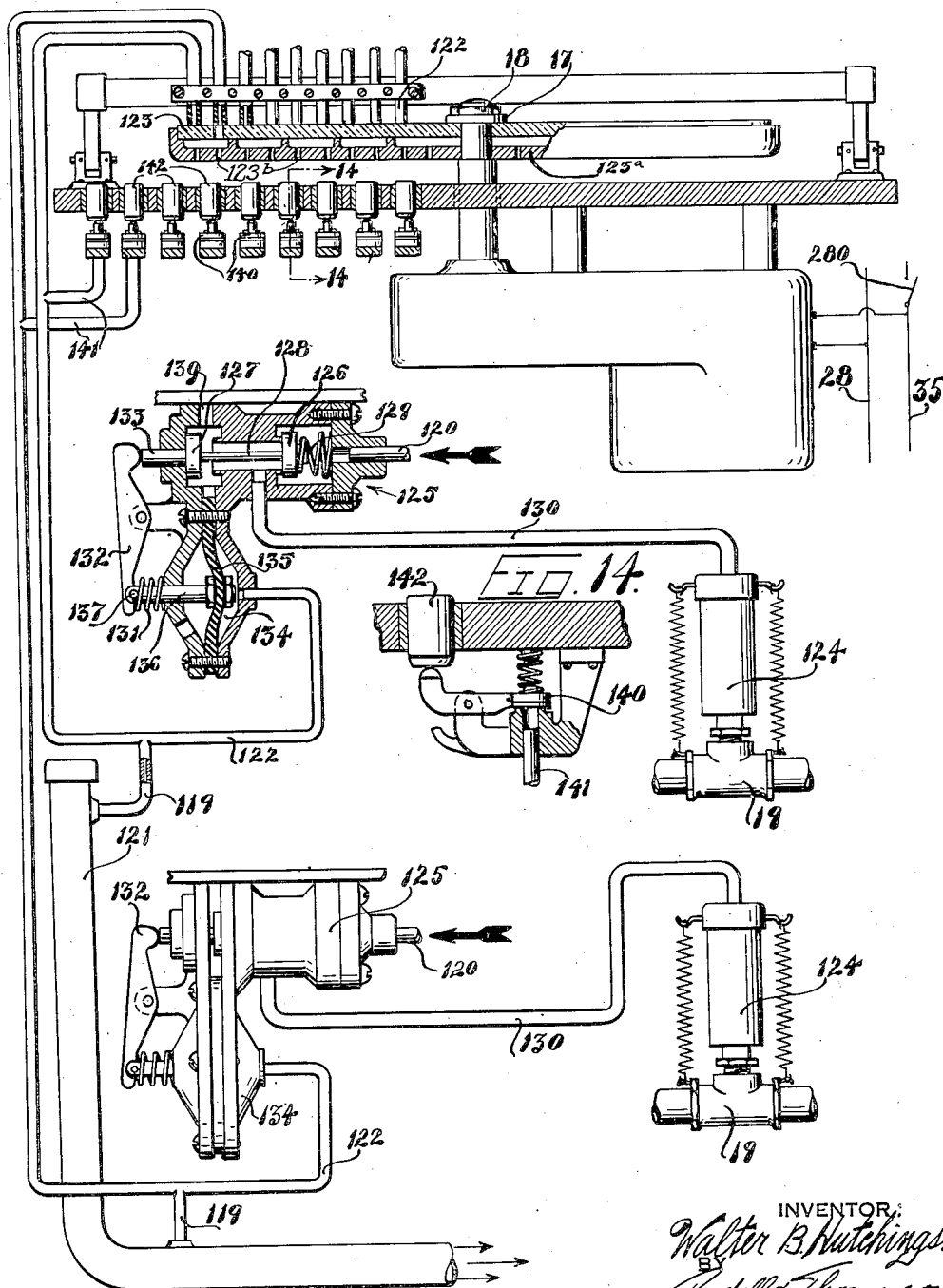
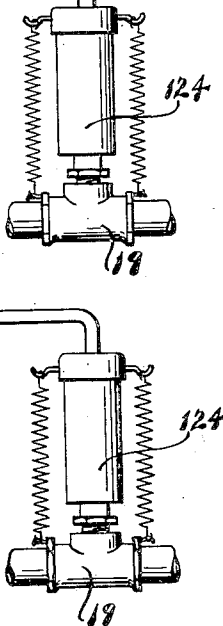


FIG. 14.



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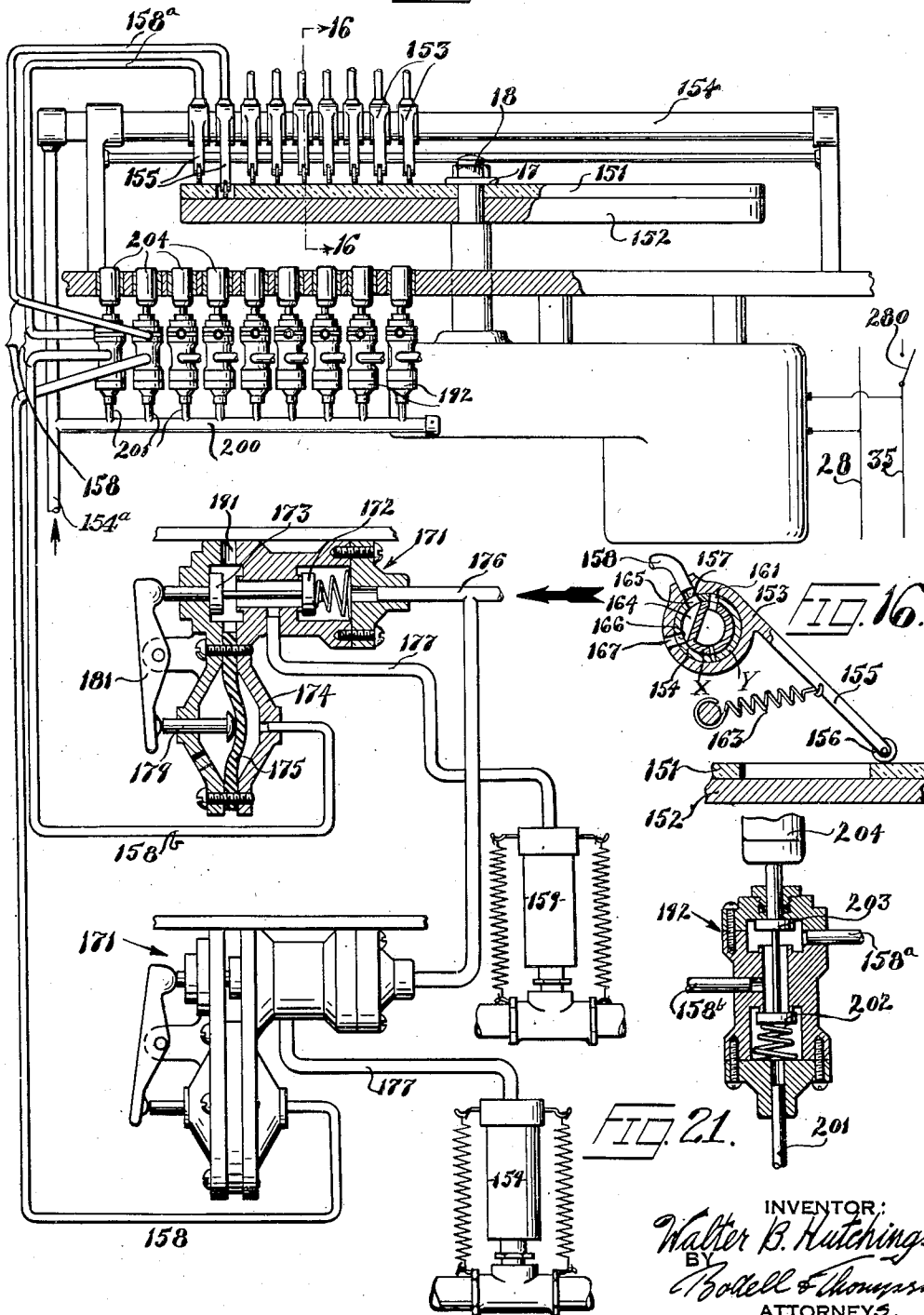
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TIMER WITH INTERCHANGEABLE FORMULA FOR CONTROLLING

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FIG. 15.



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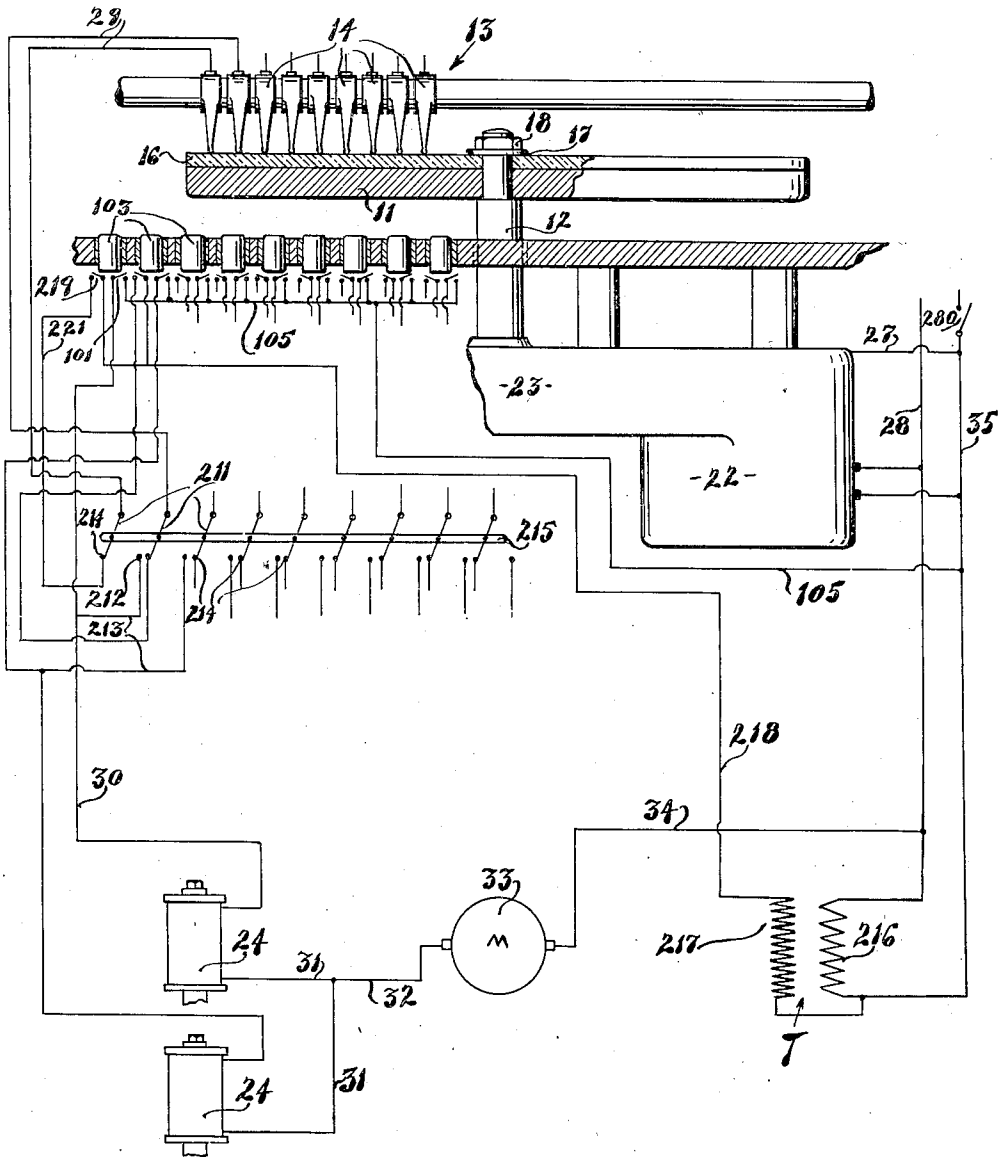
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TIMER WITH INTERCHANGEABLE FORMULA FOR CONTROLLING  
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Original Filed Nov. 7, 1930 11 Sheets-Sheet 8

**2,055,031**

# MACHINES HAVING SERIES OF OPERATIONS

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**FIG. 17.**



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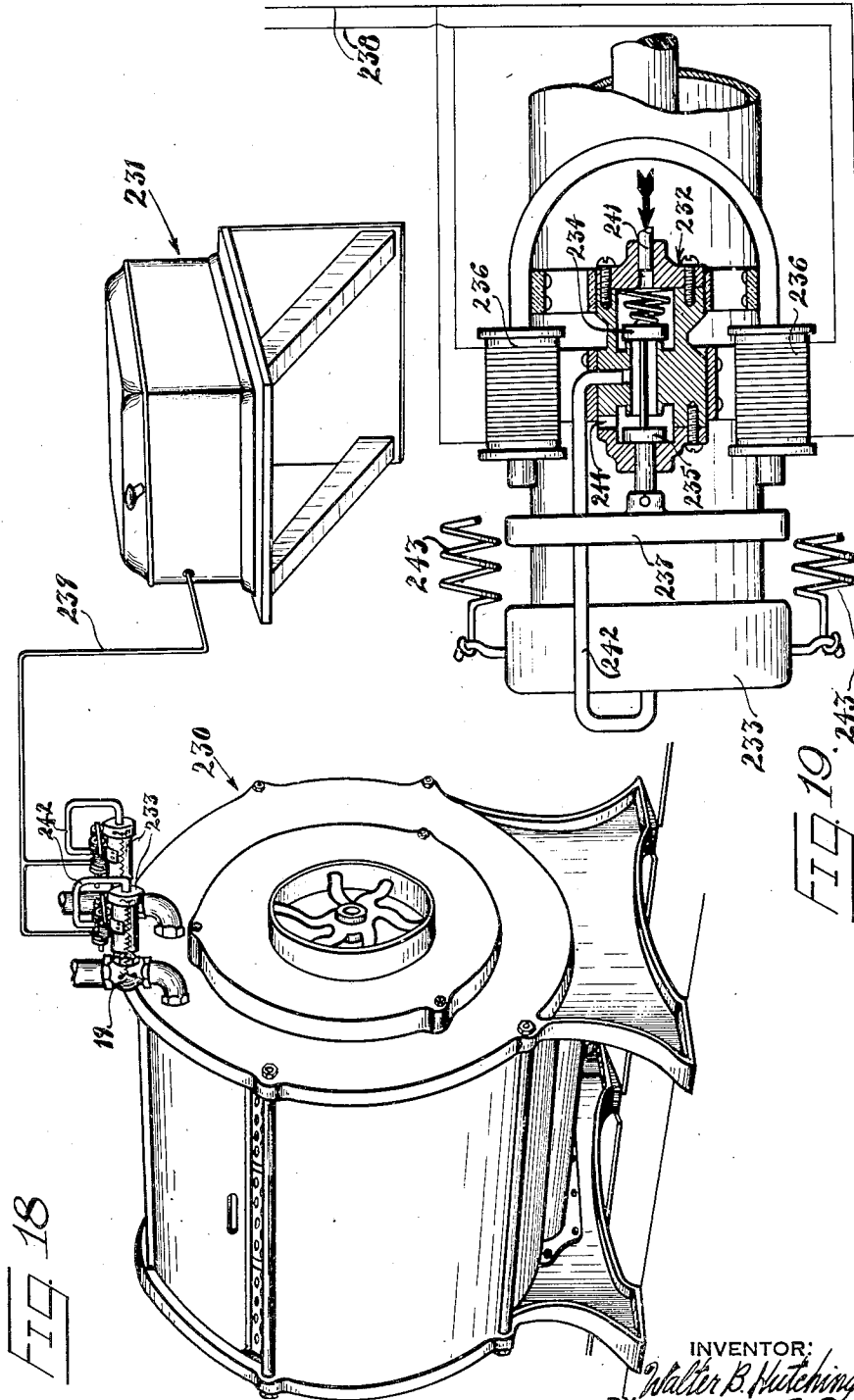
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TIMER WITH INTERCHANGEABLE FORMULA FOR CONTROLLING  
MACHINES HAVING SERIES OF OPERATIONS

Original Filed Nov. 7, 1930 11 Sheets-Sheet 9



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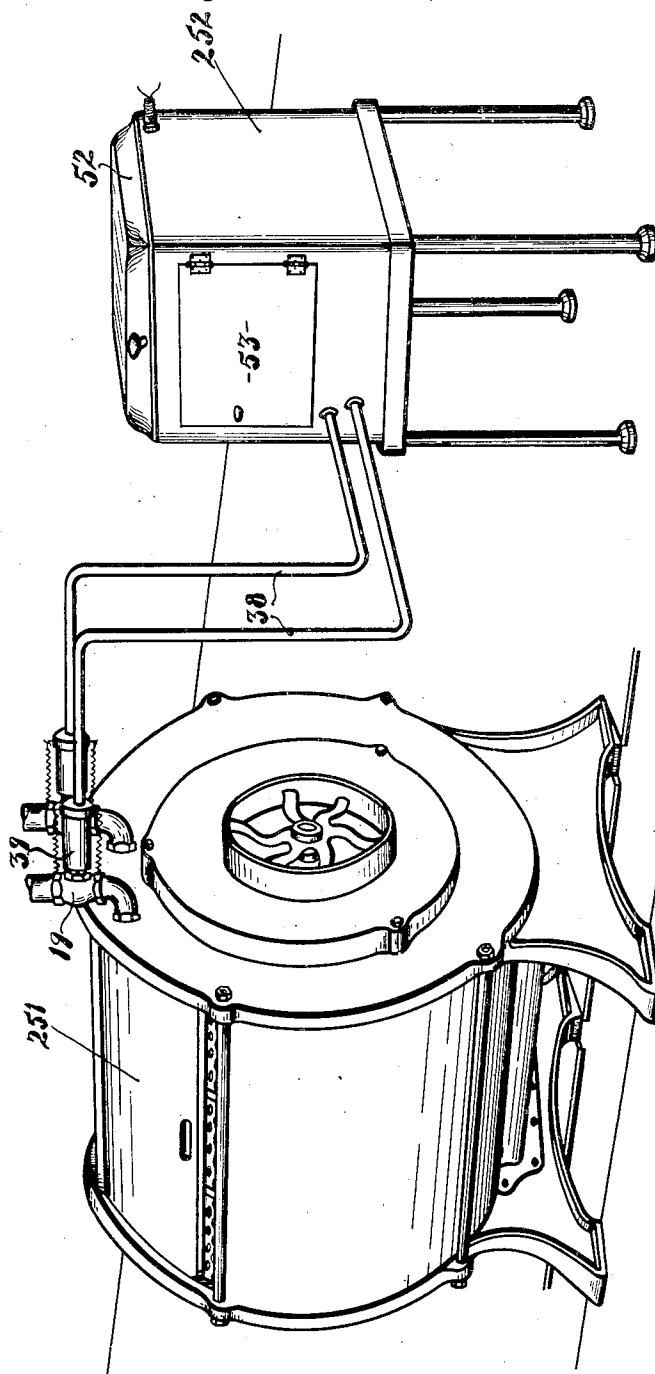
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TIMER WITH INTERCHANGEABLE FORMULA FOR CONTROLLING

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FIG. 20.



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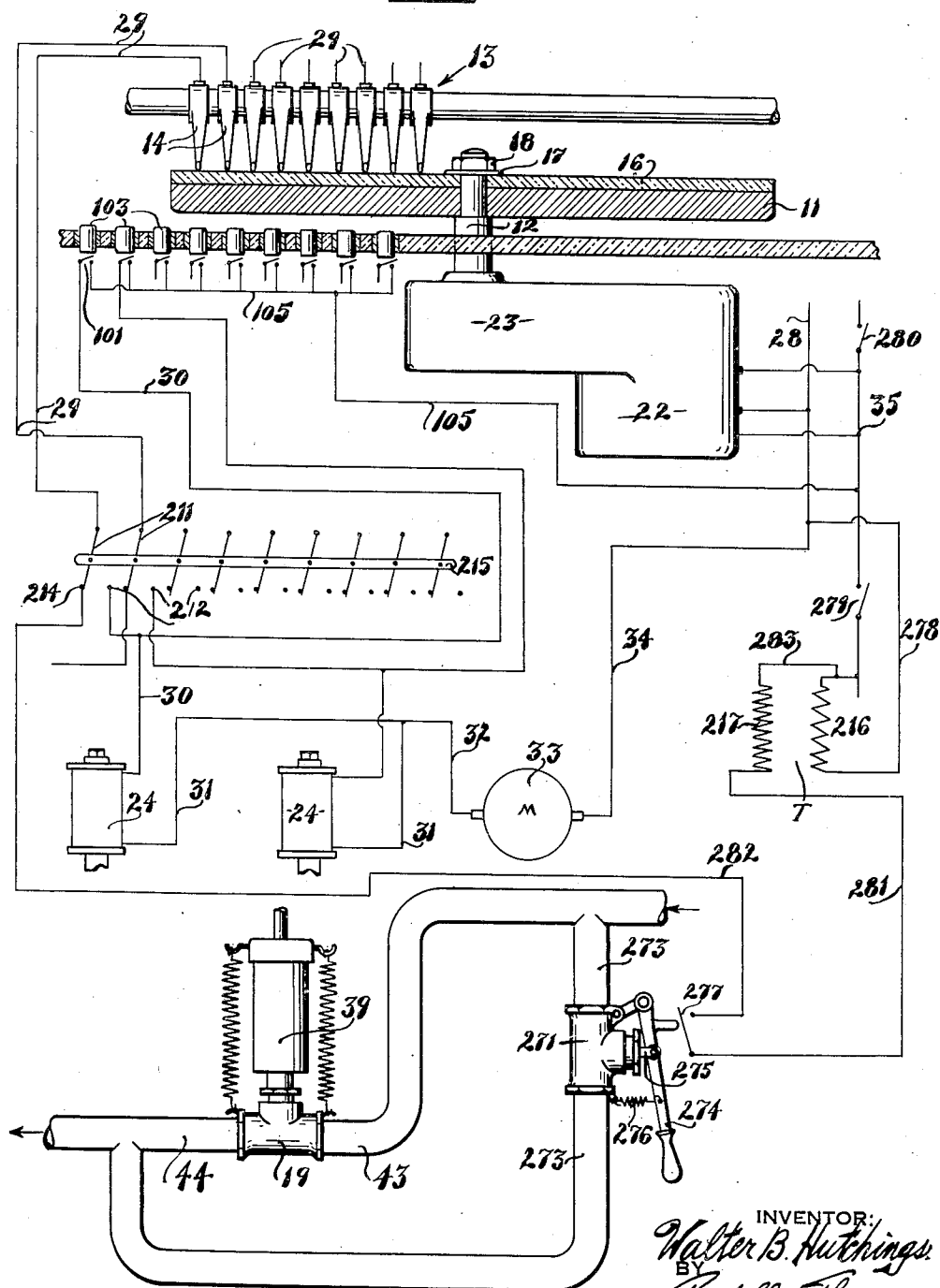
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TIMER WITH INTERCHANGEABLE FORMULA FOR CONTROLLING  
MACHINES HAVING SERIES OF OPERATIONS

Original Filed Nov. 7, 1930 11 Sheets-Sheet 11

FIG. 22.



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## UNITED STATES PATENT OFFICE

2,055,031

## TIMER WITH INTERCHANGEABLE FORMULA FOR CONTROLLING MACHINES HAVING SERIES OF OPERATIONS

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Application November 7, 1930, Serial No. 494,176  
Renewed July 3, 1935

6 Claims. (Cl. 68—18)

This invention relates to timers for automatically timing and controlling the operation of the control parts of machines having a series of operations, as for instance, washing apparatus, such as are used in commercial laundries, and has for its object, a timer mechanism utilizing a removable formula sheet placeable in the timer to form an element thereof to operate, or control the operation of control parts at timed intervals, and means by which the laundryman can lay out or prepare a formula sheet from a blank formula sheet interchangeable in the timer with a prepared sheet.

It also has for its object, a particularly simple and efficient timer mechanism in which a sheet constitutes the controlling element of the timer, and in which one sheet is readily substituted for another when it is desired to change the operating or washing formula.

Other objects will appear throughout the specification.

The invention consists in the novel features and in the combinations and constructions hereinafter set forth and claimed.

In describing this invention, reference is had to the accompanying drawings, in which like characters designate corresponding parts in all the views.

Figure 1 is a perspective view of a unitary structure embodying this timer, and associated parts.

Figure 2 is a diagrammatic view of the timer, some of the valves of the washer and the mechanism operated by the timer to control the valves, the timer being shown partly in section.

Figure 3 is a fragmentary, sectional view on line 3—3, Figure 2.

Figure 4 is a plan view of one of the formula sheets.

Figure 5 is a detail, sectional view of one of the valves of the washer, and the actuating means therefor.

Figure 6 is a detail view of one of the solenoid operated valves operated by the timer.

Figure 7 is a view, somewhat similar to Figure 2, of another form of this timer, in which the contact arm revolves instead of the turntable, as in Figure 2.

Figure 8 is a plan view, partly broken away, of parts seen in Figure 7.

Figure 9 is a sectional view on line 9—9, Figure 7.

Figure 10 is a view similar to Figures 2 and 7, of a third form of timer in which the sheet is rotated by the motor, and the contacts and the table element are stationary.

Figure 11 is a plan view of parts seen in Figure 10.

Figure 12 is a sectional view on line 12—12, Figure 11.

Figure 13 is a view, similar to Figure 2, of a fourth form of timer, in which the timer controls a power medium as air to operate the valves, instead of an electric current.

Figure 14 is an enlarged, fragmentary, sectional view on line 14—14, Figure 13.

Figure 15 is a view, similar to Figure 2, of a fifth form of timer, wherein the formula sheet acts to mechanically operate valves operated by the contact members of the timer, which valves operate mechanism to control the flow of a power, as air, to the operating mechanism of the washer valves.

Figure 16 is an enlarged, sectional view on line 16—16, Figure 15.

Figure 17 is a view of a timer, similar to that shown in Figure 2, showing means for indicating on a blank timer sheet, the positions and extent of the perforations when the valves of the washer are operated by means of manually operated push buttons correlated or paired with the contact fingers of the timer.

Figure 18 shows a conventional type of washer and timer cabinet in perspective, the instruments operated by the timer being mounted on, or self contained with, the washer, or the valves thereof.

Figure 19 is a detail, sectional view of the operating instruments for the valves shown in Figure 18.

Figure 20 is a view, similar to Figure 18, where the operating instruments are located for the most part, in the timer cabinet.

Figure 21, Sheet 7, is an enlarged, sectional view of the by-pass valve of the timer shown in Figure 15.

Figure 22 is a view similar to Figures 2 and 17, illustrating means for controlling the cycle of operations of the machine independently of the timer by manuals remote from the timer, or adjacent the machine, and also means similar to that shown in Figure 21 for marking on the blank formula sheet in the timer, or making on the blank timer sheet a graph of the cycle of operation.

Although I have shown the invention as controlling the cycle of operations of a laundry washing machine, it is capable of use in other situations, although it is particularly adapted to laundry washing and dry cleaning machines. As is well understood, the loads to be washed in commercial laundries are classified. Different laundrymen use slightly different classifications,

and the personal element always enters into the making of the classifications, and into the timing and extent of the washing operations, and the use of the fluids, chemicals, and other agents used during the series of operations.

The loads may be classified as follows:

1. White load.
2. Medium color load.
3. Underwear load.
4. Dark color load.
5. Socks.
6. Silks.

Some laundrymen may classify together the white load and the medium color load. The dark colored load and socks may be classified together. Variations in the classifications are within the choice of the laundryman.

The different loads require different washing formulas. Also, a load, for instance of 150 pounds, requires a different formula than a load of the same class weighing 200 pounds, and the character of the formula in each instance depends upon the judgment of the laundryman, or the washroom foreman, and each load regardless of its character requires, for obtaining the best results, a slightly modified formula from others of different weight. Although the weights of the loads can be standardized and hence, standard formulas used, nevertheless, there are always exceptions to the standard rule to be adapted to automatic formula control. These exceptions can, within limits, be standardized or classified.

Timers have been used to time the washing operations, but the timers are more or less fixed, or inelastic, and do not permit very much adjustability to vary the washing operations, and such adjustability as has been provided involves expensive and complicated timers, which are not entirely suitable to the conditions existing within commercial laundries, because conditions are constantly changing within the same laundry, and conditions in different laundries are not the same. The personal element is always present. Systems requiring adjustable cams, or the substitution of one timer for another, are not only too expensive to be practical, but are also not flexible enough to conform to the conditions existing in laundries. None of them permits complete flexibility, or permits the laundryman making his own formula to suit the conditions. All of them disregard the personal element.

An illustrative example of a washing process for a white load, say of 200 pounds, is as follows:

After the load is placed in the washing machine, a valve of the washer is opened to permit water to enter the washing machine, the valve being closed after the required amount of water for that load has passed into the washer. The load is then subjected to about a five minute breaking process, that is, a rinsing or soaking process. Then, washing soda is added to the water, or the water may be dumped by opening an outlet valve and again closing it when the water is drained out, and another valve or valves opened to admit water and washing soda. After a predetermined period, say five minutes, the dumping or drain valve is opened, and the machine emptied of the water and soda, and a valve opened admitting water at about 150° F., or a little warmer than luke-warm, and soap added to produce suds, and the machine continues to operate for about ten minutes, then the dumping valve is again opened, until the washing fluid has

drained out, and the water valve opened to admit warm water and soap, and the machine operated for another ten minutes during this second suds operation.

The water is then drained out by opening the drain valve, and the clothes subjected to another sudsing operation with hotter water up to 200°, and during this operation, a bleaching agent may be added. The machine is then again drained, and the clothes rinsed in hot water for about five minutes. The machine is again drained, and then the clothes subjected to additional three, four or five rinsing operations. The last rinsing operation being cold water. Also, bluing may be added during one or more of the rinsing operations, and a sour added during the last rinse. After each rinsing operation, the machine is drained. The bluing is usually added with a luke-warm water, or cold water rinse.

The above operation is merely illustrative, and different classifications require different processes, and also loads of different weight and degree of soiling of the same classification require different processes.

The washing machine may be of any of the well known types including the usual drain valve or valves, water intake valve, or valves, and valves which control the flow of the soap, alkali, and other agents used during the washing process. The machine has provision for starting and stopping, and for reversing to agitate and tumble the clothes. It is usually in constant operation however, except when the clothes are being loaded, and removed from the machine.

This invention comprises a timer mechanism for controlling the opening and closing at timed intervals, of the various valves, and other control parts of a machine having a series of operations, said timer mechanism including a formula sheet which can be made up by the attendant, and when once made, can be used in the timer as a control element thereof, as standard for all other similar loads, or operations, and also, means by which a blank formula sheet can be laid out by the attendant, for loads or operations, that do not come under a general classification, or means for controlling the operations independently of the timer, but with the timer in operation with a blank formula sheet thereon, so that while the load is being operated on, the blank formula sheet can be laid out to be used in the timer when another similar load is to be treated. Thus, the laundryman will accumulate standard formula sheets which he can select and place in the timer to work on almost any classification, and when an odd classification does come in, he can make the formula while the classification is being treated or operated on, and have that formula for use in the future.

The invention comprises primarily, a formula sheet provided with means which coact with other elements of the timer to automatically control the opening and closing of the various control valves, or the operation of other control parts, of the washer at predetermined intervals, and in addition, manual means correlated with the timer to operate the control parts or the valves independently of the timer, and while the timer is in operation, so that the position and extent of the control means of a blank formula sheet in the timer can be located, or laid out, the blank sheets being interchangeable in the timer with the prepared formula sheets.

More specifically, the timer mechanism comprises opposing elements, and a third control

element consisting of a sheet having a plurality of means, in most instances and preferably, a plurality of rows of perforations, one of said opposing elements consisting of a plurality of members, one member for each control valve or part of the washer, the opposing elements being connected respectively in branches of a power line having instruments connected therein operable by the power medium passing through said line, there being one of such instruments for each of said members, and there being a row of perforations for each of said members. In most cases, the full portion of the sheet between the perforations normally prevents the flow of an energizing medium from one of the opposing elements to the other, and hence, to the instruments in the power line which operate, or control the operation of, the valves, or control parts of the washer, and the perforations permit the flow of the power medium from one of the opposing elements to the other, or from the members or branches of one opposing element to the other opposing element, whereby said instruments are operated, and the corresponding control part or parts, as a valve or valves operable or opened and held operated or open as long as the perforations are in register with the respective members, and means for effecting relative movement of said elements to bring said perforations and said opposing elements into registration at predetermined intervals. As will be seen later, the full portions may effect the flow of power, and the slots or perforations prevent the flow of power.

Also, a feature of the invention is the control of a fluid under pressure for operating the control devices or valves of the washer or apparatus, by electrically operated valves controlled by the timer; and also by the manual means operable independent of the timer.

Also, more specifically, the timer includes means including manually operated members, one for each valve, or control part, of the washer, and for each of the members of one of the opposing elements of the timer, for by-passing or shunting the power medium around the intermediate element or formula sheet, so that the various control valves or parts can be operated individually and independently of the timer.

Thus, with a blank formula sheet on the timer, the attendant can operate the valves, or control parts, of the machine, while the timer is in operation, and by marking on the blank sheet on the timer, the position of the member as a contact finger 14 of the timer when he operates the corresponding manually operable member or push button 103, and also by marking on the sheet the position of the timer member when he releases the corresponding manually operated member 103, will locate the position and also the size or length of the perforation to be cut in the sheet, thus, preparing a formula sheet for repeating the same operations automatically in the future. Or, as will be shown later, the position and extent of the perforations may be automatically laid out while the attendant is operating the washer valves, or parts, by means of manuals correlated with the contact members of the timer.

Preferably, the energy is an electric current, and the opposing elements of the timer are respectively, a terminal, and contacts in an electric circuit, there being usually a plurality of contacts, one for each valve, or control part, to be operated, and the intermediate element or sheet, is of paper, or other suitable insulating

material, and normally holds the contacts from engaging the terminal, and the perforations permit the contacts one by one to temporarily contact with the terminal, and close an electric circuit having an electro-responsive device therein which controls the actuation or opening and closing of one control part or valve of the washer, there being one contact, one branch circuit, and one electro-responsive device for each valve, or other control part, of the washer.

The relative movement of the elements of the timer may be effected in any suitable manner, and in the embodiment of my invention shown in Figures 1 and 2, the terminal member is movable and supports the formula sheet, and the contact members are stationary, and also preferably, the relative movement is a rotary one, and the terminal element is a disk, or turntable moving about an axis. The formula sheet is also discoidal and fixed over the face of the turntable.

In Figures 1, 2 and 3; 11 designates the terminal element of the timer, which is preferably a turntable, or is discoidal in general form and mounted upon a rotatable spindle 12.

13 designates generally, the contact element, Figures 1, 2, 3 and 4, this having a plurality of contacts 14 thereon suitably insulated from each other, and 16 designates a formula sheet which is secured in any suitable manner on the face of the disk, or turntable 11, as by a clamping washer 17 mounted on the end of the spindle 12, and clamped against the face of the formula sheet 16, as by a nut 18. The contacts are insulated from each other, owing to the fact that their support 13 is of insulating material.

19 designates two of the valves of the washer, although it will be understood that there may be several valves, or control parts, including the dump or drain valve, hot and cold water valves, and in some instances, these valves may be for different degrees of hot water, and valves, or their equivalents, which control the flow of soap, alkali, and other agents used. Some of the control parts are in some cases, belt shifters, or start and stop devices which control the motor means which actuates the movable parts of the washer, or machine. It will be understood that there is preferably, a contact member 14 for each valve, and other control part, and that the valves, or other control parts, may be of any suitable form, size and construction.

The turntable is actuated by any timed movement. It is here shown as actuated by an electric motor located within a suitable housing 22, and a reduction gearing located in a housing 23 between the motor and the spindle 12. It will be understood that an electric motor will run fairly steady, and with the current adjusted, will run practically as accurate as a clock movement, without the use of a clock movement. The motor may be of any suitable type, as for example, an adjustable synchronous induction disk motor.

In the embodiment of my invention shown in Figure 2, the valves 19 of the washer are actuated or opened by a fluid under pressure, as oil, and are closed by springs, and the flow of motive fluid to the valve operating means is controlled by electro-responsive devices, as electro-magnets 24, and the energization of, or the flow of the current to the coils of these magnets controlled by the formula sheet 16. The terminal element, or turntable 11, as here shown (Figure 2) is connected by a wire 27 to a feed wire 35, the wire 27 being electrically connected to the spindle 12, 75

through the housings 22, 23, or in any suitable manner, and each of the contact members 14 is connected by a wire 29 to a wire 30, which is connected to one end of the coils of the corresponding magnet 24, the other end of the coils being connected by a wire 31, to a wire 32, which is connected to an electric motor 33, the purpose of which will be presently described, and from the motor through a wire 34 to the other feed line 28.

Each electro-magnet 24 is a solenoid, and the core 25 thereof operates a valve 36 in a pipe line 37 for a hydraulic fluid or fluid under pressure, the valve 36 being normally closed. When the solenoid 24 is energized, the valve 36 is opened, permitting the fluid under pressure to flow past the open valve 36, through a pipe 38, to a pressure chamber, as a cylinder 39 having an element therein, as a piston 41.

The piston 41, as shown, is stationary, and the cylinder 39 movable and connected to a stem 42, the inner end of which is formed with a valve head 26. The cylinder 39 is actuated to open the valve 19 against the action of returning springs 49. Thus, the springs act against the pressure and prevent hammering of the valve when it closes.

The valve 19 is connected by suitable pipes 43, 44 to a supply of water, or any other agent used in the washing process, or the valve 19 may be the drain valve of the washer. The fluid supply pipe 37 is connected to the outlet end of a pump 45, the inlet end of which is connected by a pipe 46 to a supply 47 of hydraulic fluid. The rotor of the pump is actuated from the motor 33, through suitable motion transmitting connections, designated generally 48. A return pipe and header 40 for all cylinders 39 is provided. This is provided with a restricted portion 400 in order to cause the pressure to build up in the cylinder 39 when the corresponding solenoid valve 36 is opened.

The provision or means on the formula sheet for operating the contacts is preferably rows of perforations 20, one row for each contact, the perforations of each row being spaced apart, and the full portions of the sheet normally holding the contacts out of engagement with the terminal 11, and the perforations permitting them to engage through the perforations. The perforations determine the timing and the extent of time the corresponding valves, or control parts, are operated, and the full portions between the perforations indicate the period of a particular operation. In washing machines, this may be ten minutes for a sudsing operation, or five minutes for a rinsing operation, or five minutes for a bluing operation etc. These time elements all vary in different formulas, and the extent and location of the perforations differ in different formulas.

In operation, when a contact 14 comes in register with one of the perforations 20 of the formula sheet so that the contact is free to engage the terminal member 11, obviously the current will pass from the feed line 35, through the terminal member 11, contact 14, wires 29 and 30, to the corresponding solenoid 24, thus opening the valve 36, and the current will pass from the solenoid, through the wires 31, 32, through the motor 33 and wire 34, to the feed line 28, thus starting the motor, the solenoid 24 opening the valve 36 a little before the motor gets under way. Upon the opening of the valve 36 and the starting of the motor, the pump 45 pumps the oil from the supply 47, through pipe 46, pump 45, pipe 37, through the now open valve 36, and pipe 38, to the

corresponding cylinder 39 of the washer control part or valve, opening the valve 26 against the action of the returning springs 49, thus permitting the fluid controlled by the washer valve, that is operated, to flow into the washer while the contact member 14 is in register with the perforation in the formula sheet, or in the event, it is the drain valve that is opened, the drain valve will remain open as long as the contact is in register with the perforation. Preferably, the timer and all the parts operated thereby, with the exception of the valves of the washer, which are adjacent the washer, are located in a suitable cabinet 51, the timer mechanism including the turntable 11, formula sheet, contact members 14 being located in the upper portion of the cabinet where they are accessible by opening a door 52 in the top of the cabinet.

The solenoids and valves operated thereby, the motor 33, pump 45, and the piping from the pump to the various valves 36, operated by the solenoids, are located in the lower portion of the cabinet, and accessible through a door 53. Thus, the entire timer mechanism and associated parts are a unitary structure which can be applied to any washer by supplying the washer with valves and control devices, which can be mechanically or automatically operated, and leading the pipes 38 from the cabinet to the operating means for the washer valves, or control devices. The solenoids and valves operated thereby, and the fluid pressure operated valves of the washer, are one preferable means of operating the valves, or other control parts, controlled by this timer. It is obvious, that various other means may be employed.

As seen in Figures 7 and 8, the terminal element 61 corresponding to the terminal element 11, and the formula sheet 62 may be stationary, and the contacts 63, corresponding to the contacts 14, may be movable relatively to the formula sheet, these contacts being shown as carried by an element or arm 65 having a spindle 66 which is actuated by the motor in the housing 67 corresponding to the motor housing 22, through suitable reduction gearing located within the casing 68.

In Figure 7, the terminal element 61 consists of a plurality of conductor rings 70 insulated from each other, one ring for each washer valve, or control part, and for each contact member 63, and the contacts 63 are not insulated from each other. When a contact 63 makes contact through a perforation of the formula sheet 62, with the underlying ring 70, the current passes from the feed line 35, wire 27, housings 67, 68, spindle 66, contact arm 65, the contact 63 in line with a perforation, underlying ring 70, thence, to the solenoid and pump motor, as in Figure 2.

Or, as seen in Figures 10, 11 and 12, both of the opposing elements 71, 72 corresponding to the elements 11 and 13, may be stationary, and the formula sheet 73 movable relatively to both the elements 71, 72, the formula sheet being shown as mounted on a rotatable spindle 74 which is actuated by a motor in housing 75 corresponding to the motor housing 22. As the formula sheet 73 is rotated by the motor, the perforations of the rows are brought into alignment with the contact members or fingers 76 permitting the fingers to engage the terminal element 71, Figure 12. The current then passes from feed wire 35, wire 27, post 78, terminal element or disk 71, contact or finger 76 engaged therewith, wires 29, 30, to the corresponding solenoid, as in Figure 2.

In any form of my invention, each formula sheet is detachable and interchangeable with other formula sheets.

One of the features of this invention, and a feature which is of great importance to the laundryman, is means by which laundrymen can lay out on a blank formula sheet, a new formula to fit a new job, which blank formula sheet is interchangeable in the timer with prepared formula sheets. This means comprises a provision whereby various valves and control parts of the washer can be operated individually and independently of the timer while the timer is in operation, and comprises means for permitting a motive fluid to flow to the washer valve operating means, or other control parts, independently of the timer, and manually operable members for controlling the flow of the motive fluid. This means includes preferably by-passes around the blank formula sheet.

In electrically operated machines, these by-passes are shunt electric circuits cutting out the contacts 14, and the terminal member 11, and the manually operable members are switches in the shunt circuits.

101 is illustrative of the switches, there being one switch for each contact member 14, and each control valve, or control part of the washer and hence, for each solenoid 24. The switches are shown as operated by manuals, as push buttons 103. One side of each switch 101 is connected to the wire 30 of the corresponding solenoid. The other terminal of each switch is connected by a wire 105 to the feed line 35. These switches are preferably mounted in the cabinet 51, with the push buttons exposed in the top of the cabinet near the turntable 11. Obviously, when the push button corresponding to any one contact member 14 is depressed, the current will be shunted around the formula sheet which insulates the opposing elements of the timer from each other, so that the washer valve, or control part, corresponding to the push button depressed, will be operated. For instance, depressing of the push button 103 will close the switch 101, so that the solenoid 24 will be operated, and hence, the valve 26 opened and the motor 33 started, permitting oil to flow to the cylinder 39 of the corresponding valve 19 of the washer.

Assume that a laundryman has no formula sheet for a load in the washer, and wants to prepare one, it being understood that the laundryman, or the wash-room foreman, or some other person, determines from the character of the load, the washing formula required, and that in making the formula he has to exercise his judgment and keep fairly close watch of the washing operations. Therefore, in order to prepare a formula for this new, or odd load, which formula can be used in the future for similar loads, the laundryman places a blank formula sheet in the timer. Now for instance, suppose that the first contact member controls a water valve for the soaking or breaking operation. The operator first makes a mark at the end of the contact member 14 on the formula sheet. He then depresses the button 103 corresponding to the terminal 14, and holds it down until in his judgment, there is a proper amount of water in the washer. During this time, the turntable and blank formula sheet have been turning. He then makes another mark on the blank formula sheet at the end of the terminal 14. The distance between these two marks indicates the size, or length, of the hole or slot, to be cut out in pre-

paring the formula sheet to hold open the valve the same length of time in the future when the same washing operation is being performed automatically with the formula sheet now being prepared. The breaking process then goes on as long as the laundryman desires, and then another perforation is marked out in the same way for operating another valve. This valve in the washing operation is the dump valve of a washing machine. It will be understood that all washing machines have a conventional dump valve. In the same way, the positions and extent of the perforations in the other rows for perforations are marked out from the corresponding contact members 14. Thus, at the end of the washing operation controlled by depressing the buttons 101, a complete formula sheet will be laid out for future use, it being only necessary for the laundryman to cut out slots between the marks he has placed on the blank formula sheet.

It will be understood that conditions in different laundries vary, and a set of formula sheets for one laundry would be undesirable in another laundry, or a set of formula sheets for one washer would not be adaptable for another washer, due to natural variations in the operation of the washers. Also, there are other elements, such as temperature of the water, character of the soap, and the chemicals etc., all of which must be taken into consideration by the laundryman, and their use subject to the judgment of the laundryman. Thus, any one laundryman can prepare formulas that are standard to his particular conditions and scheme of business. That is, the weights of the loads etc., can be to a certain extent standardized, and each laundry owner would standardize his loads as near as possible to suit the conditions in his laundry. Whenever an odd load comes in requiring a new formula, the laundryman can make a new formula sheet, and have this for future use. Eventually, the laundryman will accumulate formulas which will fit nearly all the conditions arising in his laundry but at the same time, when it is necessary to wash an odd load independently of the timer, he can do so by means of the buttons 101, and can also, if he desires, prepare a formula sheet for the odd load for future use. As will be hereinafter described, means may be employed for automatically indicating the location and length of the perforations on the blank formula sheet while the attendant is holding down the buttons 103.

Instead of utilizing an electric current as the power, air may be used as seen in Figure 13, wherein 122 is the element consisting of branches or members, one for each valve, or control part, to be operated, and 123 is a perforated formula sheet element opposed to the branches, it having a row of perforations, or slots for each of the members or branches of the element 122. The relative movement of the elements is effected preferably by moving the formula sheet as in Figure 2. The branches of the element 122 are pipes which communicate with a pipe 121 in which suction is created by any suitable exhausting means. The full portions of the formula sheet normally close the branches or passages of the element 122, and are held against the branches to close them by the suction. When a perforation comes in line with one of said passages, obviously, the air will be drawn through that perforation and that passage, and cause the operating means for the corresponding valve, or control part, of the washer to be actuated. The valve, 75

or control part operating means here illustrated, is as follows:

The formula sheet may be supported by a support 123<sup>a</sup> in the form of a wheel or spindle, or formed open, or with holes 123<sup>b</sup> so as not to interfere with the flow of air through the perforations of the sheet.

124 is a cylinder similar to the cylinder 39, Figure 5, except that it is operated by air pressure. 125 is a valve casing connected at one end to a pipe 120 connected to a source of compressed air. 126, 127 are a normally closed intake valve, and a normally open exhaust valve respectively. The valves are connected by a stem 128 so that they act as a unit, or as a two-way valve, and are pressed to their normal position by a spring 129. The casing is connected to the cylinder 124 by a combined intake and exhaust pipe 130. The valves may be operated, the intake to open position, and the exhaust to closed position by suitable mechanisms, as by a spring 131 acting on one end of a rocker arm 132, the other end of which acts on a stem 133 of the exhaust valve 127. The spring 131 is stronger than the spring 129.

The rocker arm 132 is normally held from actuation by the spring 131, by the action of the vacuum created in the pipe 121, and each branch 122, as follows:

Each branch 122 is connected to a diaphragm chamber 134 having a diaphragm 135 therein connected to a sliding rod 136 pivoted at 137 to the rocker arm 132. While a full portion of the formula sheet is closing the end of any pipe 122, the air will be exhausted from the vacuum side of the diaphragm chamber 134, and thus hold the rocker arm 132 from actuation by the spring 131, and permit the spring 129 to hold the intake valve 126 closed, and the exhaust valve 127 open. When however, a perforation or slot of the formula sheet 123 registers with one of the pipes 122 of the timer, the vacuum in the corresponding diaphragm chamber will be broken, the spring 131 free to react and close the exhaust valve 127 and open the intake 126, thus permitting air to flow from the pipe 120, through the valve casing 125, pipe 130, to the cylinder 124, and operate the washer valve, or control part. The air passes through holes 123<sup>b</sup> in the support or turn-table 125<sup>a</sup> and thence through the perforation in the formula sheet and the corresponding pipe 122 in register with that perforation. The vacuum in the diaphragm chamber will be broken because the pipe 122 is of greater capacity than the pipe 119 connecting the pipe 122 to the vacuum pipe or chamber 121. Thus, the air can not flow through the pipe 119 as fast as it comes through the pipe 122 and some of the air enters the diaphragm chamber 134 to break the vacuum therein. When the perforation of the formula sheet passes out of register with the pipe or member 122, the vacuum will be restored in the diaphragm chamber 134, causing the rocker arm 132 to be restored against the action of the spring 131, and the spring 129 is free to react to close the intake valve 126 and open the exhaust 127. Hence, the air can exhaust from the cylinder 124, through the pipe 130, valve casing 125, out through port 139. It will be understood that there is a pipe 122, valve casing 125, and row of perforations in the formula sheet for each washer valve, or control part.

In order that the laundryman may lay out a blank formula sheet, normally closed, spring pressed valves 140 are provided to open branch pipes 141 connected in each of the branches 122.

These are opened by manuals, as push buttons 142 correlated or paired with the pipes or members 122. There is one valve 140, one push button 142 for each washer valve, or control 124. The valves 140 thus open by-passes around, the blank record sheet, which by-passes are normally closed by the valve 140. The formula sheet can be laid out on a blank sheet in a manner similar to that described in connection with the switches 101, and push buttons 103, Figure 2.

In Figure 15, another embodiment of my invention is shown, in which the formula sheet 151 acts to mechanically operate controls which cause a motive fluid, as compressed air, to operate the control parts, as valves of the machine.

152 is a carrier or element, preferably a turntable operated by a synchronous motor or timed movement, as in Figure 2. 153 are contact members corresponding to the members 16, Figure 2, one for each control part of the machine, these having hubs rotatably mounted on a hollow element or pipe 154, and arms 155 provided with followers or rollers 156 movable over the formula sheet, and into the perforations therein as the sheet advances and the perforations or slots register therewith. The hub of each member 153 has a port 157 connected by a pipe 158 to means which control the flow of motive fluid to the diaphragm chamber 174, operating means for the companion valve or control part. The carrier or pipe 154 is formed with a port 161, one for each member 153. The ports 157 and 161 are normally out of alignment when the followers 156 are riding on the full portions of the formula sheet between the perforations. When the follower 156 drops into a perforation, the port 157 of the corresponding member 153 moves into alignment with the companion port 161 of the pipe or carrier 154.

This pipe or carrier 154 is connected to a suitable supply of motive fluid, as compressed air. Hence, when the ports 157, 161, come into alignment, the air passes out through the pipe 158 to the operating means for the companion washer valve 159, or other control part, as long as the follower 156 is riding on the disk carrier 152 through a perforation or slot in the formula sheet. The arms 155 are urged against the formula sheet and into the perforations by springs 163, one spring for each arm.

The carrier 154 is also formed with a duct 164 extending lengthwise thereof, and with ports 165 and 166 opening into the opposite ends of each duct. The hub of each member 153 is also formed with a port 167 normally aligned with the port 166. The port 167 in the member 153 is normally aligned with the port 165. Owing to the duct 164, and the ports 165, 166 and 167, the air is normally free to exhaust from the pipes 158, and when the roller or follower 156 moves into a slot or perforation of the formula sheet, the port 167 moves out of alignment with the port 166 and hence, the duct 164 is closed against the outlet of air. Also, the port 157 moves out of alignment with the port 165, and into alignment with the port 161. For convenience, in forming the carrier member 154 with the duct 164, this pipe 154 is made up of inner and outer conduits or pipes X Y, as shown in Figure 16. Air is supplied to the carrier 154 through the supply pipe 154<sup>a</sup>.

The operating means for the washer valve, or other control part, as here illustrated, comprises a valve casing 171, one for each washer valve, or

other control part, a normally closed, spring pressed intake valve 172, and a normally open exhaust valve 173 in each casing, these being connected together by a stem, so that they act as a unit, or as a two-way valve, a diaphragm chamber 174 having a diaphragm 175 therein, the pressure side of which is connected to one of the pipes 158, and motion transmitting means between the diaphragm and the valves 172, 173.

The intake end of the casing 171 is connected to a supply pipe 176 for a motive fluid, as compressed air, and the casing is connected by a combined intake and exhaust pipe 177 to the cylinder 159 of the companion washer valve, or control part mechanism, the mechanism being practically the same as in Figure 2. The motion of the diaphragm is transmitted through a sliding stem 179 to one end of a rocker arm 181, the other end of which thrusts against the stem of the exhaust valve 173. When a follower or member 156 enters a perforation of the formula sheet, the port 157 aligns with the port 181, so that air flows from the carrier or pipe 154, through said aligned ports, and the corresponding pipe 158, to the diaphragm chamber operating the diaphragm therein to close the corresponding exhaust valve 173, and open the intake valve 172, so that motive fluid, or air will flow from the pipe 176, through the valve casing 171, and pipe 177, to the companion cylinder 159, and operate the valve, or other control part. The valves in the casing 171 are in effect relay valves, and may be omitted by connecting the pipes 158 directly to the cylinders 159.

When the follower 156 rides out of the slot, or perforation of the formula sheet, the air will exhaust from the diaphragm chamber, back through the pipe 158, through the duct 184, and out through the aligned ports 166 and 167, permitting the valves 172 and 173 to return under the influence of their common spring, to their normal positions, so that the air from the corresponding cylinder 159 is free to exhaust back through the pipe 177, valve casing 171, and out through the exhaust port 191, controlled by the valve 173, and also permitting the washer valve, or other control part, to return to its normal or closed position under the influence of the returning springs connected to the cylinder 159, these being similar to the springs 49, Figure 2. Each pipe 158 has a valve casing 192 therein, and this valve and its purpose will now be described.

In order to make a formula sheet from a blank sheet, there is a cut-out passage, or by-pass for each terminal or contact member 153, and each valve, or other control part of the machine being operated, and the valve casings 192 form part of these by-passes. In addition, these by-passes include a header 200 connected to a suitable source of supply of motive fluid, it being here shown as connected to the feed pipe of the hollow carrier 154. 201 are branches leading from the header to the casings 192 respectively. Each of the casings 192 has a normally closed, spring pressed intake valve head 202, and a normally open exhaust valve 203, these being connected by a stem, so that they act as a two-way valve, or as a unit. The section 158<sup>a</sup> of the pipe 158, which section leads from the companion member 153, opens into the casing 192 adjacent the exhaust valve, and the other section 158<sup>b</sup> of the pipe 158, which leads to the diaphragm chamber 174, leads from the valve casing 192 between the valves 202, 203. The valves 202 and 203 are operated by suitable manuals, as push buttons 204, which

thrust against the stem of the exhaust valve 203. It will be understood that there is one valve casing 192, and one push button for each washer control part, and each member 153.

Normally, when a prepared formula sheet is on the timer, the air passing through the pipes 158 from the carrier 154, passes into the valve casing 192, through pipe 158<sup>a</sup>, and out through pipe 158<sup>b</sup>, to the diaphragm chamber, and also, the air exhausts from the diaphragm chamber in the reverse order. When however, a blank formula sheet is to be laid out, the selected button 204 is depressed, and the air passes from the header 200, through the corresponding branch pipe 201, into the valve casing 192, past the now open intake valve 202, and out through the pipe section 158<sup>b</sup> to the diaphragm chamber 174 to operate the valves of the relay valve casing 171, and the exhaust port 203 being closed, the air can not pass out through the pipe 158<sup>a</sup>. When the button 204 is released, obviously, the air will exhaust from the diaphragm chamber back through the pipe 158<sup>b</sup>, valve casing 192, pipe 158<sup>a</sup>, and out through the ports 167, 165, duct 164, and ports 166, 167.

By indicating on the blank sheet the position of the follower 156 of the contact member 153 corresponding to the push button 204 depressed when the push button is depressed, and when released, the length of the slot to be cut in the prepared formula sheet is determined.

Reference has been previously made herein to means for automatically marking the length of the slot or perforation while a push button is being held depressed. This automatic marking means will now be described. This primarily involves the bringing of a marker into play when the push button or equivalent manual is operated.

In Figure 17, one form of marker is shown in connection with the form of the invention shown in Figure 2. In Figure 17, the same reference numerals are used insofar as applicable, as in Figure 2.

The marking is controlled by the manuals or push buttons 103, that is, the depression of any one push button 103 causes the corresponding marker to operate, and the release of the push button causes the marker to cease to act. The push buttons and their switches, it will be understood, have ordinary means to return them when released, to normal position. Preferably, the contact members 14 are used as markers or styli, rather than employ connections between the push buttons and additional pencils or markers. The contact members 14 are utilized to act as markers by cutting them into a high tension circuit to cause them to perforate a line or slit in the blank formula sheet when the corresponding push buttons are depressed. These slots or perforations so indicated, can afterwards be cut out the proper width and the length of the perforated line or slit.

With a prepared formula sheet in the timer, the operation is for the most part as in Figure 2, that is, the current passes from the feed wire 35, through wire 27, housings 22, 23, spindle 12, turntable 11, any contact 14 in a perforation, wire 29, to a change over switch 211 which normally engages with a contact 212, thence through wire 213, leading to the corresponding magnet 24.

When a blank formula sheet is in the timer, and the attendant performs the washing operation in accordance with his own judgment by operating the push buttons 103, he first shifts the change over switches 211 into engagement with terminals 214, or in the position shown in Figure 21. There is one change over switch for each

contact member 14, and each solenoid 24 or washer valve 19, or control part. All of the change over switches are operated by a member or cross head 215 common to all of them.

5 With the change over switches 211 in the position shown in Figure 17, in contact with the terminals 214, the current will pass, upon depression of a push button 103, from one side of the feed line, say from wire 35, through wire 10 105, through switch 101, wire 30, solenoid 24, wires 31, 32 to motor 33, wire 34, to the other feed wire 28. The primary winding 216 of an induction step-up transformer T is connected in the feed line between the feed wire 35 and the 15 feed wire 28. The secondary circuit of the transformer is as follows, from secondary coil 217, to feed wire 35, and at its other end, by a wire 218, to a switch member 219 paired with each switch 101, and operated by the same push button. When the switch member is closed, the 20 current passes therethrough to wire 221, through change over switch 211, wire 29, to the correlated contact 14, thence the current jumps through the blank formula sheet to turntable 11, 25 through wire 27, and back to feed wire 35. The secondary high voltage circuit may be completed in any other suitable manner.

The transformer produces a high tension current sufficient to cause the current to jump from 30 the contact 14, through the blank formula sheet to the terminal element, or turntable 11, then back to the feed line 35, through spindle 12, housings 23, 22, and wire 27.

35 The jumping of the current at the end of the contact member 14 cuts or marks on the blank formula sheet, a line or slit which indicates the length of the slot or perforation to be cut out to complete a prepared formula sheet for future use. Before the marked blank formula sheet is 40 removed from the timer, or before a prepared formula sheet is placed in the timer, the change over switch 211 should be reversed, or reset, so that they are in contact with the terminals 212.

In Figure 18, a timer is shown as connected to 45 operating means for the washer valves where the timer only is located in the cabinet, one form of conventional laundry washer being shown, and but two valves being shown.

230 designates the washer, and 231 the timer 50 cabinet.

The valves are of the construction shown in Figure 5, but are operated by air pressure.

The flow of air is controlled by valves in a casing 232 mounted on each cylinder 233 corresponding to cylinder 39 (Figure 5) of each washer valve. 55

This valve casing 232 contains a two-way valve of any suitable construction, that here shown consisting of valve heads 234, 235 connected by a stem so that they act as a unit. The valve head 60 234 is a normally closed, spring pressed intake valve, and the head 235 a normally open exhaust valve. They are operated by electro-magnets 236 having an armature 237 connected to the stem of the exhaust valve head. The energization of the magnets is controlled by the timer 65 located in the cabinet 231, through wires 238 leading from the cabinet to the magnets through conduits 239. The intake end of the valve casing 232 is connected to a source of supply of motive fluid, as air, through a pipe 241, and the casing 232 is connected to the cylinder 233, 70 through a combined intake and exhaust pipe 242. The pipes 239, 241 having enough flexibility to 75 yield during the movement of the cylinder 233.

In operation, when the timer in the cabinet 231 closes the circuit to the magnet 236 of any valve, that magnet is energized, its armature attracted and shifted, thus closing the exhaust valve 235, and opening the valve 234, so that air 5 passes from the pipe 241, through the valve casing 232, pipe 242, to the cylinder, and slides the cylinder relative to its stationary piston against the action of returning springs 243, corresponding to springs 49, Figure 5. When the circuit 10 is broken by the timer, the spring acting on the valve head 234 reacts and returns the armature to its starting position closing the intake valve 234, and opening the exhaust valve 235, so that the air exhausts from the cylinder 233, through 15 pipe 242, casing 232, and exhaust port 244. The timer is of the construction shown in Figure 2. All mechanism, except the timer and correlated manuals or push buttons 103, is located on the washer. 20

In Figure 20, all the mechanism shown in Figure 2, except the washer valve, or control part, operating mechanisms, that is, the cylinder 39 and associated parts, are located in the cabinet. A washer 251 of the type shown in Figure 25 18 is shown, and a cabinet 252 of the type shown in Figure 1. The reference numbers used in Figures 1 and 2 designate corresponding parts in Figure 20.

Various modifications of the formula sheet 30 can be made without departing from the spirit of this invention.

In Figure 22, means is shown for operating the valves, or other control parts of the washer by operating members located adjacent or 35 mounted on the washer, and also connections by which the location and extent of the perforations are indicated while the washer is being operated, or in other words, a graph made on the blank formula sheet of the operation of the control parts mounted on the washer. Insofar as 40 applicable, the same reference numerals are used in Figure 34, as in Figures 2 and 17.

The control parts of the washer are operated independently of the timer by manuals associated with the washer, and each manual is shown 45 as operating a valve 271 located in a by-pass 273 around the valve 19 of the washer. Each valve 271 is normally closed, and is operated by a manual, here shown as a lever 274 connected to the stem 275 of the movable member of the valve 50 271, the movable member being normally held in its closed position by suitable means, as a spring 276. Obviously, when any lever 274 is pulled outwardly, the corresponding valve 271 will be 55 opened, and the fluid will flow into the washer around the corresponding timer controlled valve 19.

With this construction, the laundryman may watch the operation of the washer and operate 60 the various control parts by means of the levers 274 in accordance with his judgment, and can signal an attendant at the timer to mark on the blank formula sheet in the timer, the beginning and end of the operations, as the formula sheet 65 passes the particular contact member 14. Or, assuming the push buttons 103 and the parts operated thereby are omitted, the laundryman can stand at the timer, and make the markings and 70 call, or signal to the attendant what handle 274 to operate and when to operate it, and release it. However, means is preferably provided for making a graph of the operation on the blank formula sheet in the timer when each handle 274 75

is operated, and this means is substantially the same as shown in Figure 17.

In operation, the operator places a blank record sheet on the turntable 11, and upon the operation of any handle 274 operates a companion control part or valve 271. A switch 277 is closed in a high tension line having a transformer T therein, the secondary winding of which is connected in circuit with the contacts 14. When the switch 277 is closed, the current passes from the feed wire 23, through a wire 276, primary winding 216 of the transformer T, to the other feed wire 35, and from the secondary winding 217 of the transformer, through wire 281, switch 277, wire 262, to the terminal 214 of the reversing switch 211, thence through the movable switch member 211, through wire 29, to the corresponding contact 14, where the current jumps through the blank formula sheet to the terminal member 11, thence, back through the turntable and housings of the motor and reduction gearing and return wire, to the other feed wire 35 which is connected by wire 283 to the other end of the secondary winding. The wiring is immaterial, it being merely necessary to cut in the transformer, and any form of wiring may be used to do so.

In the form shown in Figure 22, the push buttons 103 and their companion switches and wiring is the same as in Figure 2, so that the operator can operate the washer valve 10, as in Figure 2. Hence, the remote controls for the control parts of the machine are located adjacent the timer, and remote controls for the formula marking mechanism of the timer are located adjacent the washer. Obviously, the remote control associated with the timer including the buttons 103 may also have a wiring and switches similar to that shown in Figure 17, so that the laundryman can control the washer from the timer, but independently of the timer, and make a graph of the formula at the same time, or can operate the washer by means of the handles 274, and make a graph of the formula on the blank formula sheet in the timer, the handles 274 being remote controls for the graph mechanism, and located adjacent the washer. When the handles 274 are used, and it is desired to make a graph of the formula used, the switch 279 must be closed, and the reversing switch 211 shifted into the position shown in Figures 21 or 34, and after the load is washed, and the graph made, the switch 279 must be opened, and the reversing switch 211 shifted back so that it engages the contacts 212.

In any form of this invention, the operation of the washer is controlled by a formula sheet forming part of the timer, and readily interchangeable with other formula sheets, and a formula to suit any new condition can be prepared by inserting a blank formula sheet in the timer, and laying out the perforations or other means on the blank formula sheet while operating the control parts manually through members correlated with the timer mechanism. The formula sheet is usually paper, but may be of any suitable material.

The general operation is as follows:

A suitable switch 280 is closed in the feed circuit, and the formula sheet selected and placed on the timer. The timer will control the operations of the washer valves, or control parts, to carry out the predetermined operations of the formula sheet.

In the event there is no formula sheet prepared for an odd or exceptional load of laundry, the

laundryman can prepare such a formula sheet for future use by operating the push buttons 103, or the valves 271 while watching the operation of the washer and exercising his judgment as a laundryman.

The employee, who weighs and sorts the batches of laundry, has sufficient knowledge to determine the formula that should be used for the weight and the class of the load, and either selects the formula sheet at that time placing it with the load, or indicates the formula sheet to be used, and when the load reaches the wash-room, the washman places the formula sheet in the timer, and starts the washing operation. When the formula is to be made on a blank sheet, the wash-room man operates the washer and control part valves by means of the remote controls 103, during the washing operations while making a formula for future use, and can with the form shown in Figure 17, make a graph of the formula on the blank sheet in the timer. Or, in the form shown in Figure 22, he may operate the washer controls directly making a blank formula sheet, either by calling or signalling the operations to an attendant at the timer, so that the attendant can make the graph on the blank sheet in the timer, or he can cut in the marker mechanism so that the graph is made automatically, and the graph making mechanism controlled by remote controls adjacent the washer.

Although I have shown a timer embodying a formula sheet with perforations, nevertheless it is obvious that various changes may be made in the formula sheet, and the means for controlling the operation of the valves, and other parts, and also, means, other than perforations, may be used without departing from the spirit of this invention, an essential feature of which is interchangeable formula sheets for controlling the operation of the controlling members of an apparatus having a series of operations.

Although I have illustrated my timer as applied to laundry washers, obviously it is equally useful in timing the operations in any other situation requiring a series of timed operations.

What I claim is:

1. In a work cycle timer for controlling a series of operations of an apparatus, the combination with a support, the support having means for providing contacts for cooperating with a series of contact fingers, said contact fingers connected respectively in branch electric circuits and when engaged with the contact means of the support closing the respective branch circuits, and means for effecting relative feeding movement of the support and the fingers; of shunt circuits connected in the feed and branch circuits around said contacts, each shunt circuit having a normally open manually operable switch therein, there being one shunt circuit for each contact finger.

2. A work cycle timer for controlling the operation of the control parts of an apparatus having a series of operations, said timer including in combination, a series of members, one for each of said parts for effecting the operation of the control parts, and a member common to all the former members coacting therewith, means associated with the common member for holding the series of members from coaction with the common member and having means thereon for enabling the series of members to coact with the common member at predetermined intervals, means for effecting relative movement of the common member and the series of members, and means correlated with the series of members, one

for each, for operating said control parts individually and independently of the timer, when the timer is in operation.

3. A work cycle timer for controlling the operations of the control parts of an apparatus having a series of operations, said timer having means for movably supporting a blank formula sheet, a series of contact fingers engaging said sheet, one finger for each operation of the series and manually operable means for operating said control parts individually and independently of the timer while the supporting means and sheet thereon is being moved, and thereby locating on the blank sheet the position and the extent of the relative movement of the fingers and the blank supporting means during the operation of the timer.

4. A work cycle timer for controlling the operation of the control parts of an apparatus having a series of operations, said timer having a terminal element, a contact element adjacent said first element having a plurality of contact fingers connected in branch electric circuits, each branch circuit having an electro-responsive device therein for operating the control parts respectively, an intermediate element consisting of a sheet interposed between the terminal and the contact fingers and engaging the latter, means for effecting relative movement of the sheet and contact fingers, additional branch circuits connected to the electro-responsive devices independently of the contact fingers, a manually operable, normally-open switch in each additional branch circuit, operating means for the switch, a transformer for producing a high tension current, branches connecting the transformer to each of the contact fingers, a switch operated by each of the operating means for the switch in each additional circuit for closing the transformer circuit and thereby causing a high tension circuit to jump from the contact fingers through the blank sheet to the terminal element and thereby mark the locations and extent of the perforations to make a complete formula sheet.

5. In a work cycle timer for controlling a series

of operations of an apparatus, the combination with a support, a series of contact fingers, the support having electric contact means for co-operating with the series of contact fingers, a feed circuit in which the contact means is connected, said contact fingers being connected respectively in branch electric circuits and when engaged with the contact means of the support closing the respective branch circuits and means for effecting relative feeding movement of the support and the fingers; of pressure operated devices associated with the apparatus and conduits for a pressure medium connected to a source of supply and to said pressure operated devices, valves for controlling the conduits leading to said devices, one valve for each conduit, and electro-responsive devices for operating said valves respectively, said electro-responsive devices being connected respectively in the branch circuits.

6. In a work cycle timer for controlling a series of operations of an apparatus, the combination with a support, a series of contact fingers, the support having electric contact means for co-operating with the series of contact fingers, a feed circuit in which the contact means is connected, said contact fingers being connected respectively in branch electric circuits and when engaged with the contact means of the support closing the respective branch circuits and means for effective relative feeding movement of the support and the fingers; of pressure operated devices associated with the apparatus and conduits for a pressure medium connected to a source of supply and to said pressure operated devices, valves for controlling the conduits leading to said devices, one valve for each conduit, electro-responsive devices for operating said valves respectively, said electro-responsive devices being connected respectively in the branch circuits, and shunt circuits connected in the feed and branch circuits around said contacts, each shunt circuit having a normally open, manually operable switch therein.

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