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[54] **APPARATUS FOR CONSERVING THE USE OF WATER ELECTRICITY, AND THE LIKE IN AUTOMATIC FILM PROCESSORS**

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[51] **Int. Cl.** **G03d 3/02**

[58] **Field of Search** ..... 95/89 R; 354/299, 322, 354/324, 319, 297; 134/46, 57 R

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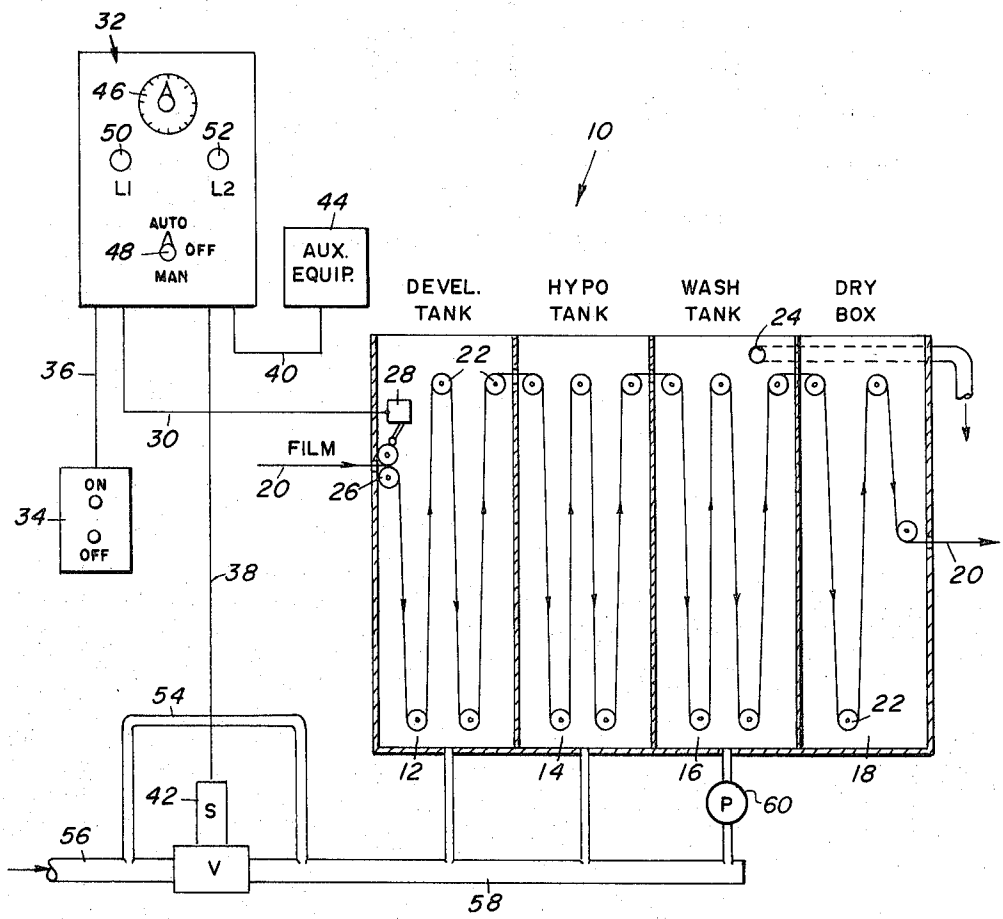
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[57] **ABSTRACT**

An electronic switch monitors the arrival of a film element to a photographic film processor and transmits a signal to an electronic unit which controls the flow of water into said processor. When a piece of film enters said processor the electronic unit begins a timing cycle at the end of which the water to said processor is turned off. If a subsequent piece of film enters the processor during the timing cycle, then the electronic unit is reset to the beginning and the timing cycle is re-initiated. The water to the processor is turned off only after a predetermined period of time has elapsed after the entry into the processor of the last element of film. The electronic unit is provided with a switch for selecting an automatic or manual mode of operation.

10 Claims, 2 Drawing Figures



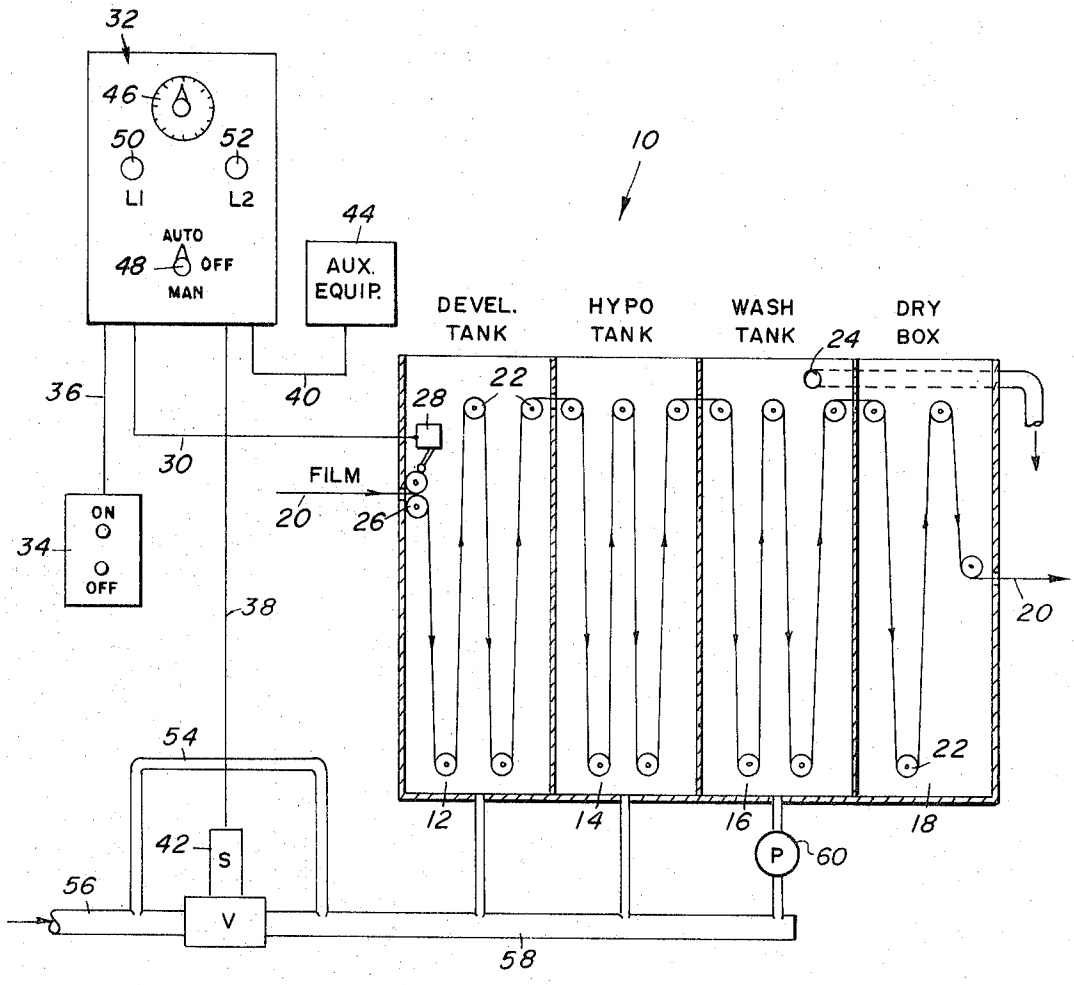

32
46
50
52
LI
L2
AUTO
48
OFF
MAN
44
AUX. EQUIP.
10
DEVEL. TANK
HYPO TANK
WASH TANK
DRY BOX
24
22
28
36
40
30
FILM
20
26
34
ON
OFF
38
20
54
22
42
S
12
14
16
18
P
60
56
V
58

FIG. 1

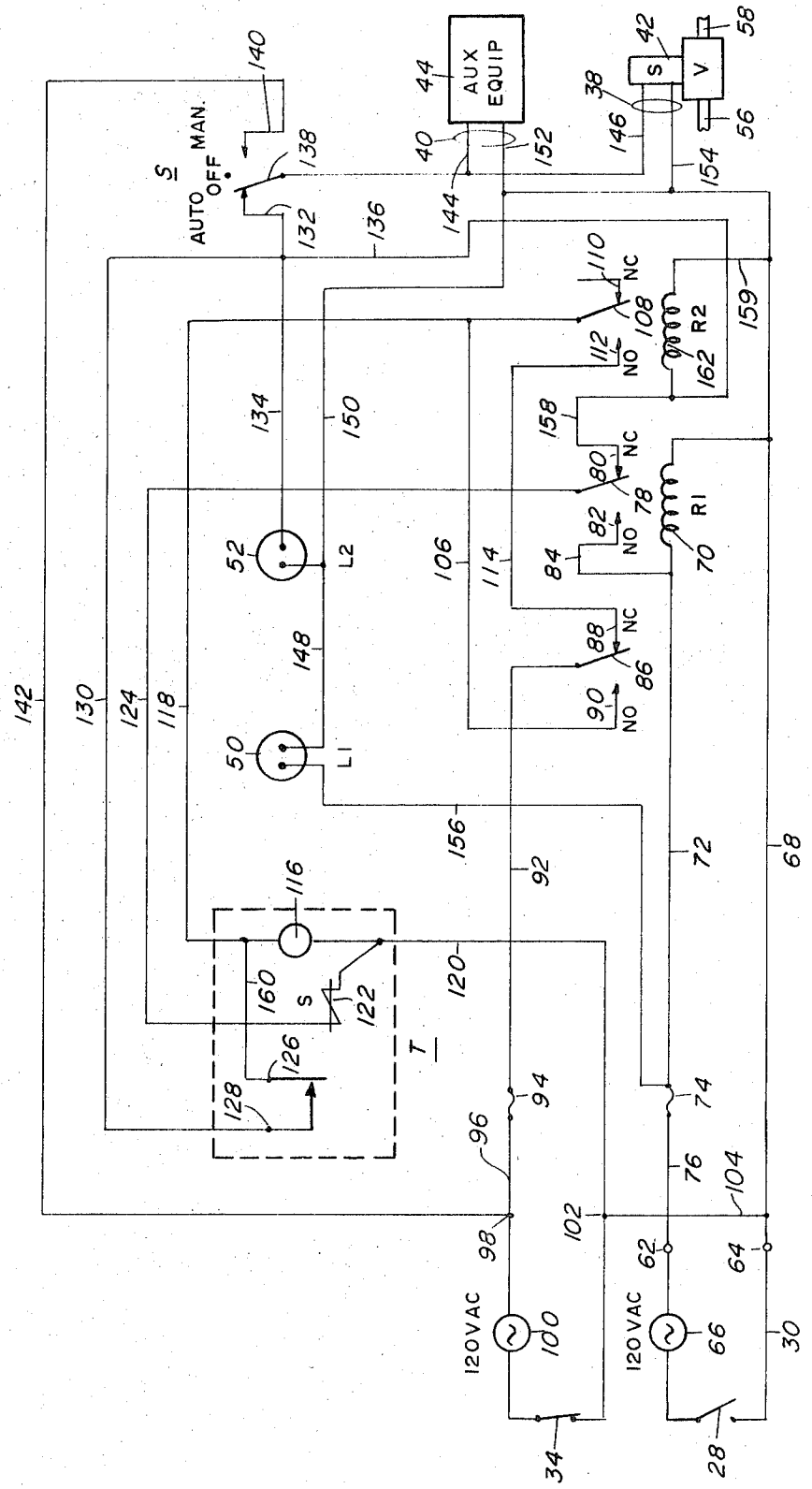


FIG. 2

APPARATUS FOR CONSERVING THE USE OF WATER ELECTRICITY, AND THE LIKE IN AUTOMATIC FILM PROCESSORS

BACKGROUND OF THE INVENTION

1. Field of the Invention

Disclosed in an electronic device for conserving the water, power and fuel used in processing photographic film.

2. Description of the Prior Art

Most photographic processing equipment does not process film in a continuous manner. Instead, the processing machine operator will turn the processor "ON" when coming on duty thereby initiating a flow of water to the processor and the start of auxiliary equipment associated with that processor. However, during the period that the machine is "ON" it may get only intermittent use, that is, film will not be continuously processed while all the equipment is running. This results in a great loss of water and an added burden on sewage facilities as well as the needless operation of auxiliary equipment. Often a silver recovery unit is used as auxiliary equipment with a film processor for extracting the silver particles which are removed from the film during the developing and fixing steps of the processing.

Because the intermittent use of the film processing equipment produces a lot of waste and inefficiency, a solution was sought whereby water and auxiliary equipment to the processor could be shut off automatically a short period of time after the last piece of film enters the processor. The present invention offers a constructive and simple solution to this problem.

SUMMARY OF THE INVENTION

Disclosed is a method and apparatus for conserving the water and auxiliary equipment associated with photographic film processing machinery. An electronic microswitch located on a roller detects the entry of a piece of film into the processing equipment. The microswitch is connected directly to an electronic water saver device including a timer element responsive to said microswitch. Each time a piece of film passes over the roller connected to the microswitch the timer in the automatic electronic water saver is reset and begins a timing cycle. If no new piece of film triggers the microswitch during the timing cycle, then the timer will time out and close an electronically operated solenoid valve which controls the flow of water into the photographic processing equipment. In this manner, the photographic equipment will shut off automatically if no new film is fed to it within a certain time period. However, if another piece of film should arrive at the processor and trip the microswitch, then the automatic electronic water saver timer will be reset to zero and begin to time again. In this manner, the solenoid valve will be kept open until the time between pieces of film entering the processor is greater than the length of the timing cycle. The automatic electronic water saver will also turn off auxiliary equipment such as the associated silver recovery unit at the same time the solenoid valve is closed. Other equipment such as sewage controls, electricity, and heating fuels may also be regulated by the automatic electronic saver.

It is an object of the present invention to provide a simple and improved method and apparatus for automatically controlling the flow of water into a photographic film processor.

It is another object of the present invention to control the auxiliary equipment associated with photographic film processing machinery. Typically, such equipment would include silver recovery units, heating apparatus, and other electrical and mechanical equipment. Such auxiliary equipment also includes pumps and fans within the processor itself.

It is a still further object of the present invention to turn off the water and auxiliary equipment associated with a photographic film processor a predetermined period of time after the last piece of film has entered the processing apparatus. If a piece of film enters the apparatus while the timer in the automatic water saver is going through its time cycle, then the timer is automatically reset to zero and the timing cycle is reinitiated.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of the automatic electronic water saver device used in conjunction with a photographic film processor; and

FIG. 2 is an electronic schematic drawing of the components associated with the automatic electronic water saver.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows a film processing machine **10** comprising four separate sections including, in order, a developer tank **12**, a fix or hypo tank **14**, a wash tank **16**, and a dry box **18**. The film **20** enters the developer tank and proceeds through the processor while being guided by a system of rollers **22**. Tanks **12**, **14** and **16** include overflow apertures **24** which catch the excess liquids in the tanks and carry them to suitable sewage disposal facilities.

The entering film **20** passes over a special roller **26** which is connected to the sensing arm of a microswitch **28**. The signal from microswitch **28** is carried over line **30** to the automatic electronic water saver unit **32**. Water saver **32** includes an input from the ON-OFF switch **34** of the processor. The signal from processor ON-OFF switch **34** is communicated to water saver **32** via line **36**. Water saver **32** also has two output control lines **38** and **40** which lead to a solenoid valve **42** and to auxiliary equipment **44**, respectively. Water saver unit **32** includes a motorized timer dial **46**, an AUTOMATIC OFF-MANUAL toggle switch **48** and two visual display lights L-1 and L-2- **50** and **52**. Solenoid operated valve **42** is by-passed by a 3/16 inch copper tube **54** that allows a small flow of temperate water to operate the heat exchanger whereby the solution in the processing machine tank will always be at operating temperature. An input line **56** feeds solenoid operated valve **42** which discharges into line **58** which serves as a water feed input to the processor **10** after passing through a wash pump **60**.

Whenever a piece of film **20** enters the processor **10** it trips special roller **26** and therefore microswitch **28**. The signal that film is present is transmitted to the automatic electronic water saver unit **32** which will begin a timing cycle each time a piece of film enters the processor **10**. As long as the water saver **32** is somewhere in its timing cycle, then solenoid operated valve **42** is open and water from input line **56** flows into output line **58** and through wash pump **60** into the processor.

Therefore, water will continue to flow into the processor for a predetermined period of time after the film has tripped microswitch **28.** If no new film reaches the processor during the timing cycle of unit **32,** then the timer **46** times out and solenoid operated valve **42** is closed thereby shutting off the flow of water to processor **10.** This, of course, insures that water will not be wasted while there is no film being processed in the processor. If, however, a subsequent piece of film reaches the processor before the time cycle has elapsed, then timer **46** is reset and the time cycle will continue until the time between pieces of film becomes greater than the length of the timing cycle itself.

FIG. **2** is an electronic schematic of the component arrangement within the automatic electronic water saver unit **32.** Unit **32** consists principally of relays R-**1** and R-**2,** timer unit T, AUTOMATIC-OFF-MANUAL switch S, and indicator lights L-**1** and L-**2.**

Microswitch **28** is connected via line **30** to input contacts **62** and **64.** A source of 120 volts alternating current **66** is connected in series with switch **28.** Input contact **64** is connected to a common line **68** which is connected to one end of relay coil **70,** the other end of which is connected via line **72** to fuse **74** and to the other microswitch input contact **62** through line **76.** Relay R-**1** includes a set of double pole, double throw contacts which are illustrated in their normally closed condition. In the unactivated state, arm **78** makes a closed circuit with contact **80** and forms an open circuit with respect to contact **82.** Contact **82** is directly connected to one end of relay coil **70** via line **84.** Likewise, on the other set of contacts, arm **86** completes a normally closed circuit with contact **88** when relay coil **70** is deactivated and no electrical circuit is completed between arm **86** and contact **90** during the same period of time. Briefly described, contacts **80** and **88** are the normally closed contacts and contacts **82** and **90** are the normally open contacts.

Contact arm **86** is connected via line **92** to a fuse **94** and via line **96** to ON-OFF contact **98.** The ON-OFF processor control switch **34** is connected through a **120** volt alternating current source **100** to said contact pole **98.** The other pole of the ON-OFF switch **34** is connected to the other input contact point **102** which is electrically connected directly to contact point **64** and common line **68** via line **104.**

Contact **90** of relay R-**1** is connected via line **106** to arm **108** of relay R-**2.** Relay R-**2** controls a single pole, double throw set of contacts **110** and **112.** When R-**2** is closed, arm **108** is in the normally closed relationship with contact **110.** During the same period of time, contact **112** is in the normally open position. Contact **112** is connected directly to contact **88** of relay R-**1** via line **114.**

Arm **108** is connected to the timer T motor coil **116** via line **118.** The other side of the timer motor coil winding **116** is connected via line **120** to the AC input contact **102.** A solenoid **122** is also connected to line **120.** The other lead of solenoid **122** is connected via line **124** to arm **78** of relay R**1.** Contacts **126** and **128** are controlled by solenoid **122** and the timing motor **116** of the timer T. Output control contact **128** is connected via line **130** to contact **132** of the AUTOMATIC-OFF-MANUAL switch S. Contact **132** is also connected via line **134** to one input of lamp L-**2** and via line **136** to one side of relay coil R-**2.** Switch S is shown in the AUTOMATIC operating position with arm **138** in contact with **132.** Contact **140** of switch S is connected directly via line **142** to AC input contact **98.** When armature **138** is touching contact **140,** then the AUTOMATIC-OFF-MANUAL switch is in the MANUAL position and AC power source **100** is connected directly to output terminals **144** and **146.**

The second terminal of lamp L-**2** is connected via line **148** to a first terminal of L-**1** and via line **150** to output terminals **152** and **154.** The second terminal of L-**1** is connected via line **156** to the junction of fuse **74** and line **72.** Relay coil R-**2** has one side of its relay winding connected directly to the common line **68** via line **159** and the other side of its winding connected via line **158** to contact **80** of R-**1.**

In operation, a piece of film **20** is inserted in the load end of processor **10.** The presence of the film is detected by microswitch **28** which impresses the full 120 volts AC of source **66** across the winding **70** of relay R-**1.** Therefore, every time a piece of film enters the processor, relay R-**1** is energized causing arm **86** to engage contact **90** and causing arm **78** to engage contact **82.** When arm **86** engages contact **90** a circuit is closed through timer motor **116.** The circuit includes ON-OFF switch **34, 120** volt AC source **100,** input contact **98,** line **96,** fuse **94,** line **92,** arm **86,** contact **90,** line **106,** arm **108,** line **118,** timer motor **116,** line **120,** input contact **102,** and back to ON-OFF switch **34.** In this fashion, timer T is energized whenever ON-OFF switch **34** is closed and microswitch **28** detects the presence of film entering processor **10.** At the same time that arm **86** engages contact **90,** arm **78** engages contact **82** and completes another circuit through solenoid **122.** When arm **78** engages contact **82** a circuit is completed through closed microswitch **28, 120** volt AC source **66,** input contact **62,** line **76,** fuse **74,** line **72,** line **84,** contact **82,** arm **78,** line **124,** solenoid **122,** line **120,** input contact **102,** line **104,** input contact **64,** and line **30** back to microswitch **28.** The voltage on solenoid **122** causes the device to operate and starts the delay timing motor which is pre-set to a developing time, usually five or six minutes in the standard developer. It is to be understood that the length of the timing cycle is usually set to the developing time of the processor but may be set to any time desired.

The **120** volt AC imposed upon timer motor coil **116** via arm **78** and contact **84** is transmitted to contact **126** via a line **160.** Contact **126** normally engages contact **128** until the pre-set time cycle has elapsed. When contacts **126** and **128** are in the make position the 120 volts AC is imposed across the relay coil **162** of relay R-**2** via lines **130** and **136** through the relay **162** and to ground **68.** The energization of relay R-**2** causes arm **108** to engage contact **112.** All of this happens in a relatively short period of time while the film is still being introduced into processor **10.** When no more film arrives at processor **10** microswitch **28** opens, then arm **86** of relay R-**1** returns to contact **88** in its normally closed position. Since timer T is in a timing mode, relay R-**2** is still energized and arm **108** engages contact **112.** In this manner, the power that was transferred to contact **90** is now transferred through contacts **88** and **112** to the timer, as follows: power from the **120** volt AC source **100** passes through input contact **98,** line **96, fuse 94,** line **92,** arm **86,** contact **88,** line **144,** contact **112,** armature **108,** line **118,** timer motor winding **116,** line **120,** input contact **102,** line **36,** and ON-OFF switch **34** back to the 120 volt AC source **100.** In

this manner, power is kept on the timer mechanism during the timing cycle when microswitch **28** is no longer engaged by a piece of film. During the timing cycle, the power that is imposed across the relay winding **162** of relay R-2 is also imposed across the two output sets of contacts **144–152** and **146–154.** In this manner, energy is always supplied to the solenoid valve **42** and the auxiliary equipment **44** during the timing cycle during which film is being treated in the processor.

When relay R-1 is deenergized there is a short period of travel time during which arm **78** swings between contacts **82** and **80.** During the travel time of arm **78** there is a hiatus during which contact is made with neither contact **82** or **80** and the electrical circuit is broken. This feature is important because it allows solenoid **122** to release and reset the timing cycle.

Since arm **86** of relay R-1 is a make before break process, voltage will remain on lines **106** and **114** until the release of relay R-1 is completed. The release of R-1 allows voltage from line **92** to flow through arm **86** and contact **88** to maintain voltage to the timer. Likewise voltage is supplied to contacts **126** and **128** through line **130** to maintain the operation of Relay R-2 and therefore output to the solenoid for the water flow and the auxiliary equipment.

The processor will continue to operate after each piece of film travels past the microswitch until such a time that no film is inserted during the preset timing cycle. At the expiration of the preset timing cycle terminals **126** and **128** of timer T will open and release, i.e., deenergize relay R-2 so that arm **108** returns to its normally closed position engaged with contact **110.** This, of course, breaks the circuit that includes arm **86** of relay R-1, contact **88,** line **114,** contact **112,** and arm **108** of relay R-2. This open circuit deenergizes timer T and, in turn, removes the power from output terminals **144–152** and **146–154.** Since operating power to the solenoid valve and auxiliary equipment has been removed at the end of the timing cycle, both of these pieces of equipment will be deenergized. When solenoid valve **42** is deenergized the flow of water to the water processor is shut off.

The electronic water saver is ready again to begin the above-described operation whenever a piece of film is inserted in the load end of the processing machine and will continue its operation until the last piece of film for the day has been processed and the processor ON switch has been turned OFF by the operator on duty.

Panel light L-1 is wired across the microswitch **28** circuit and gives an indication that a piece of film is entering the processor unit **10.** Panel light L-2 is turned on whenever power is applied to the output terminals and indicates that the solenoid valve and the auxiliary equipment are being supplied with electrical energy.

Briefly described, the automatic water saver serves to provide electrical energy to the solenoid valve and the auxiliary equipment whenever film enters the processor and for a predetermined time period after that. If, however, a new piece of film arrives at the processor during the timing cycle intiated by the previous piece of film, then the electronic water saver is reset and the timing cycle begins anew and does not elapse until the timer has gone through its timing cycle uninterrupted by a new piece of film.

It would be obvious to one of ordinary skill in the art that modifications and variations can be made in this equipment. For instance, it would be entirely possible to make the electronics associated with the electronic water saver out of solid state devices. In this manner, relays R-1 and R-2 could be replaced by suitable electronic gates such as silicon control rectifiers or field effect transistors. Moreover, other equipment can be run by the electronic device such as lights, heating elements, etc..

In a general manner, while there has been disclosed effective and efficient embodiments of the invention, it should be well understood that the invention is not limited to such embodiments as there might be made changes in the arrangement, disposition, and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

I claim:

1. An apparatus for conserving the resources consumed by a conventional photagraphic processor in which a plurality of film elements are treated, comprising:

a mechanically operable switch means for detecting the presence of a film element as it enters said processor;

an electronic unit actuatable by said switch means; and

a valve means responsive to said electronic unit for controlling the flow of water into said processor, said electronic unit including:

a resettable motorized timer means; and

a relay type means including means for resetting said resettable motorized timer means when said switch means detects the presence of another film element as it enters said processor;

wherein said electronic unit controls the duration of the flow of said water through said valve means.

2. The apparatus of claim **1** wherein said valve means is a solenoid operated valve.

3. The apparatus of claim **1** wherein said electronic unit further controls the fuel consumed by said processor.

4. The apparatus of claim **1** wherein said electronic unit further controls the electric power consumed by said processor.

5. The apparatus of claim **1** wherein said electronic unit controls the power to a silver recovery unit.

6. The apparatus of claim **1** wherein said valve means includes a bypass means for maintaining the temperature in said processor above a predetermined level.

7. The apparatus of claim **1** wherein said mechanically operable switch means is a limit type switch.

8. The apparatus of claim **7** wherein said mechanically operable limit type switch means includes the switch that normally initiates the actuation of said conventional photographic processor.

9. The apparatus of claim **1** wherein said relay type means further includes:

a means for maintaining power to said resettable motorized timer means for a predetermined period of time after said switch means detects the presence of a film element as it enters said processor.

10. The apparatus of claim **1** wherein said relay type means comprises at least:

a first relay having a first and a second set of relay contacts each having a normally closed and a normally open condition responsive to said mechanically operable switch means, said resettable motor-

ized timer means being responsive to the first set of contacts of said first relay means when said first set of contacts are closed in the normally open condition thereby initiating a timing cycle; and

a second relay responsive motorized to said resettable timer means for maintaining electric power to said resettable motorized timer means during said timing cycle when said first set of contacts is in the normally closed condition and, wherein said electronic unit further comprises:

at least one pair of output terminals energizable by said resettable motorized timer means for providing electric power to said valve;

wherein said resettable motorized timer means is reset during the period that said second set of contacts change from the normally closed to the normally open condition.

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