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Simonson et al.

[11] **3,709,121**

[45] **Jan. 9, 1973**

[54] **PHOTOGRAPHIC SURVEILLANCE APPARATUS**

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[21] Appl. No.: **134,627**

[52] **U.S. Cl.** ..... **95/11 R**, 95/15, 346/107, 352/39

[51] **Int. Cl.** **G03b 29/00**

[58] **Field of Search** 95/11, 15; 346/107; 352/39

[56] **References Cited**

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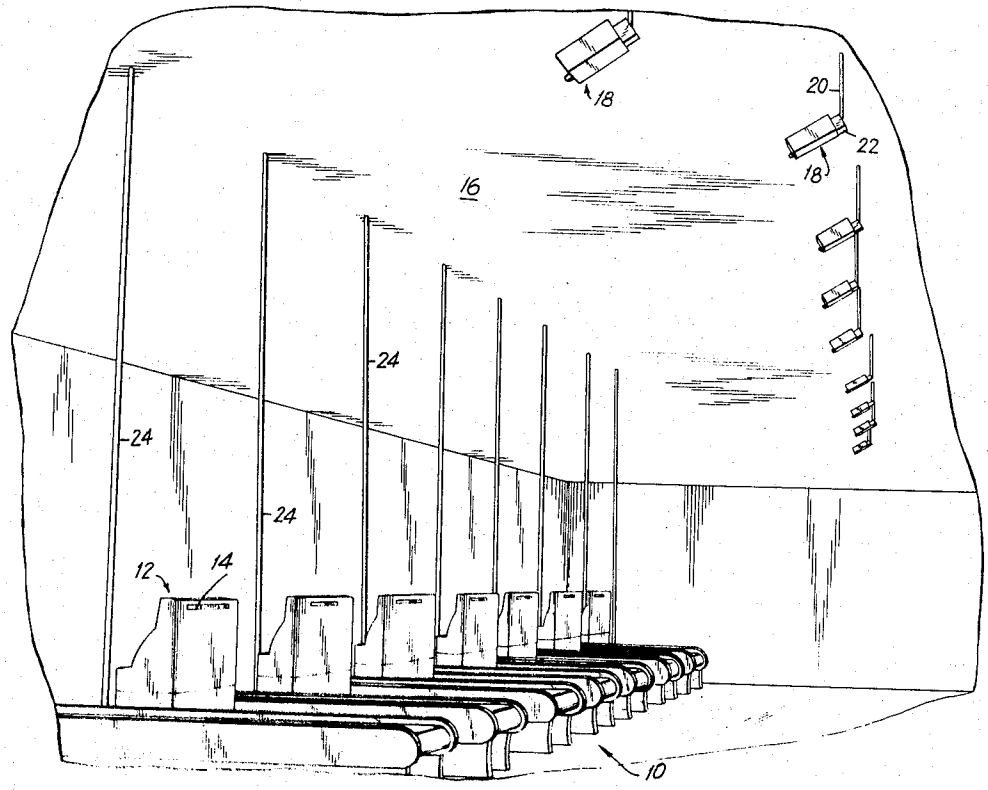
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[57] **ABSTRACT**

A photographic surveillance apparatus for carrying out surveillance of cash register operations. A cash register with goods in the vicinity thereof is photographed by a camera situated at a distance from the cash register sufficiently great to prevent individuals in the vicinity of the cash register from being distracted by the camera. The camera is a motion picture camera which is operated in a single-frame mode at least when the totalizing key of the cash register is operated. In this way the total cost of the items as introduced into the cash register and the items themselves are photographed so that a correlation can be made between the goods and the total cost thereof. The motion picture camera is triggered to expose a single frame by a solenoid actuated through a trigger circuit which in turn is actuated from the cash register, with a delay being incorporated into the operation of the trigger circuit to provide a sufficient interval for the numerals to appear at the cash register before these numerals are photographed.

9 Claims, 10 Drawing Figures



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SHEET 1 OF 6

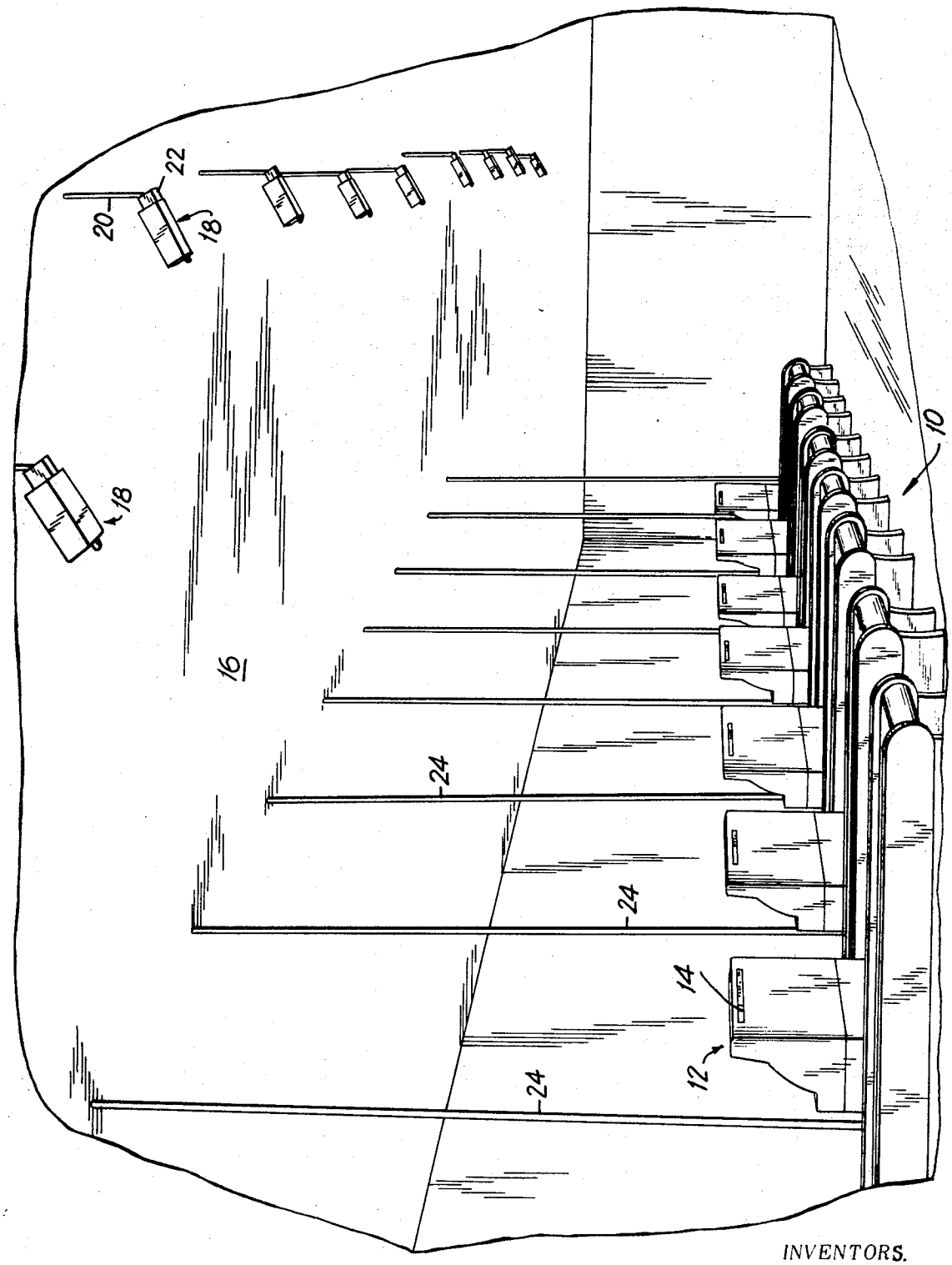


FIG. 1

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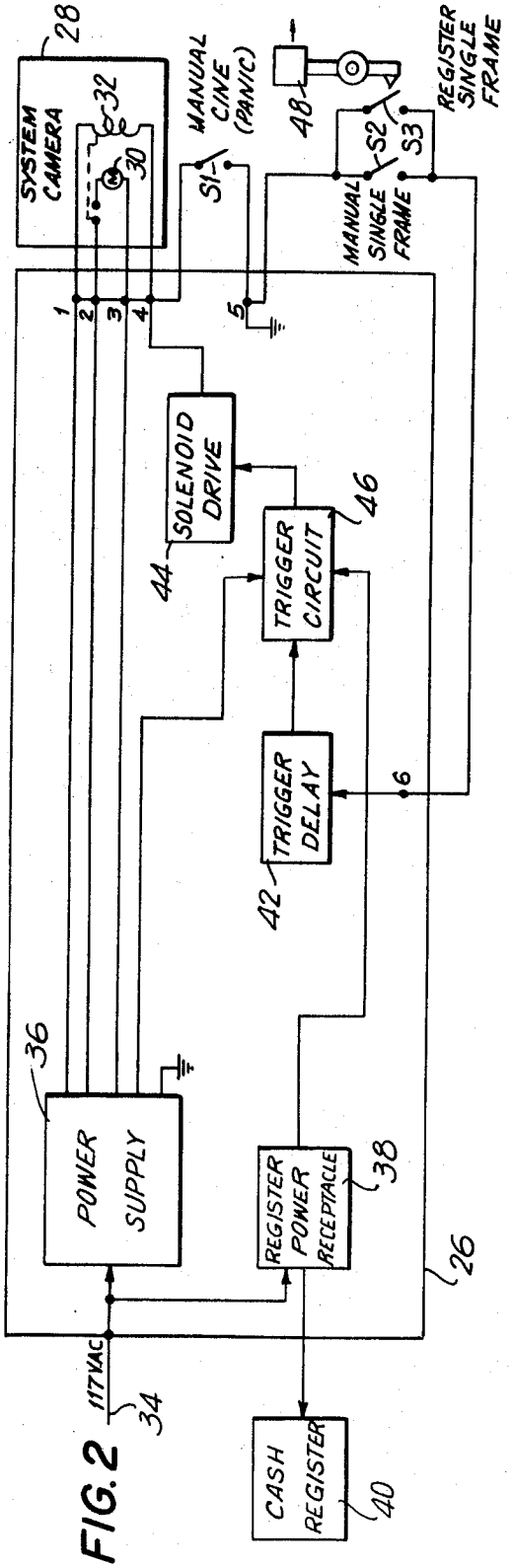


FIG. 2

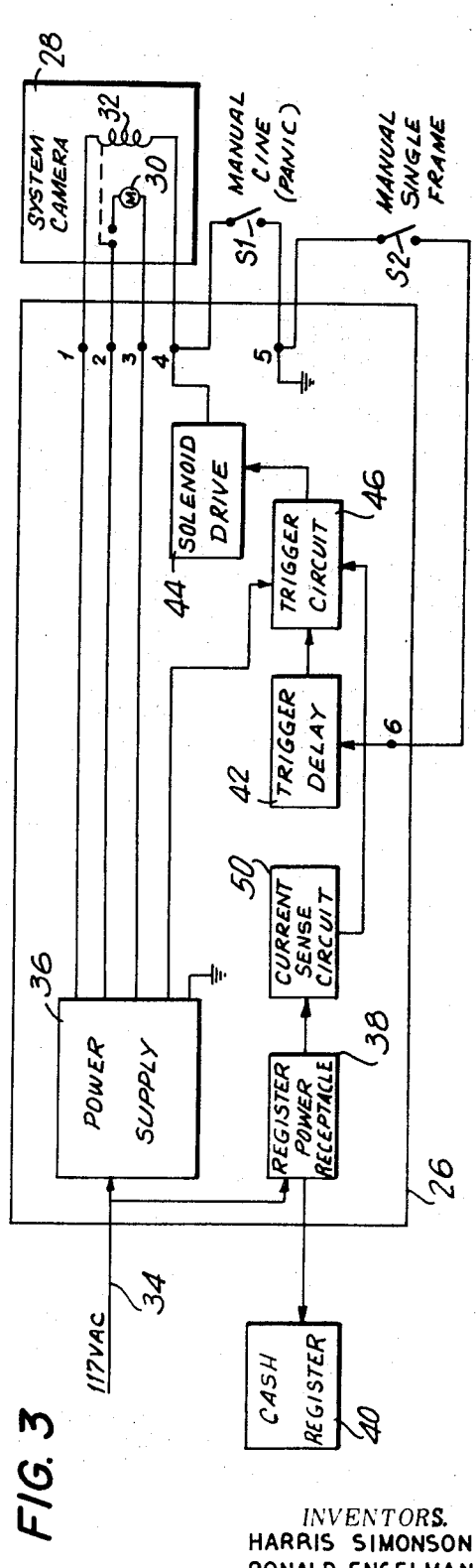


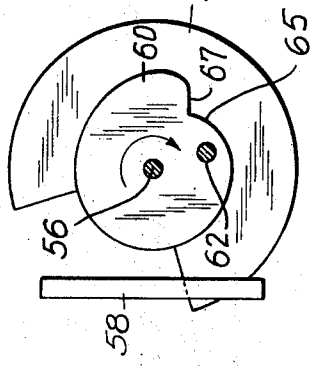
FIG. 3

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FIG. 5



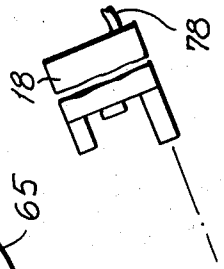
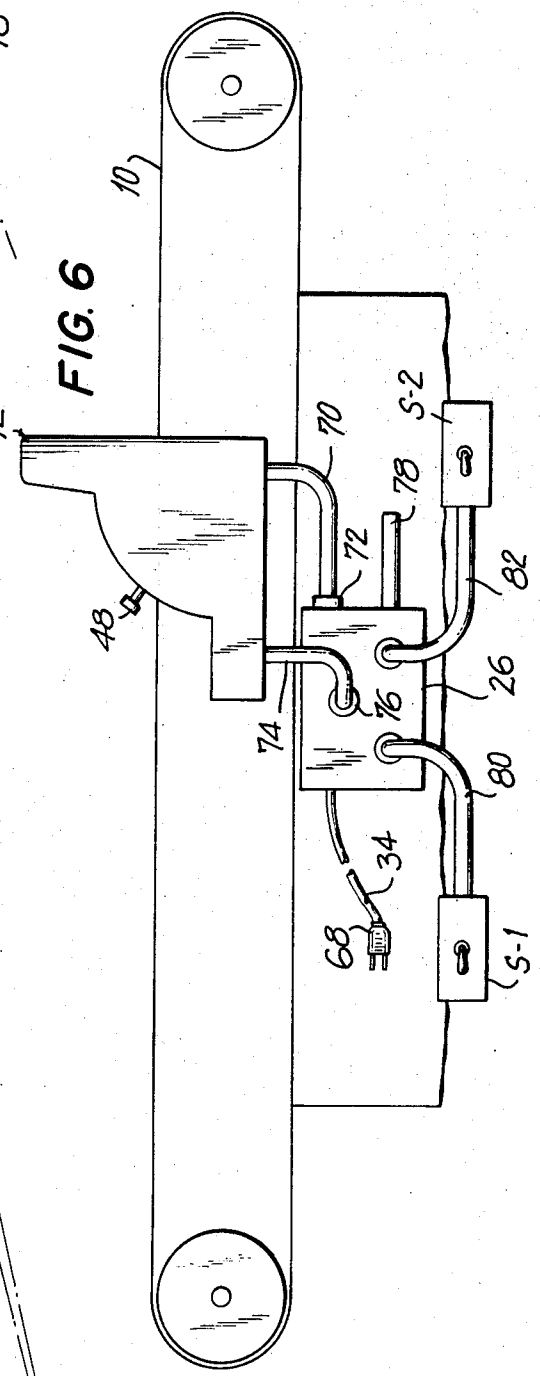


FIG. 6



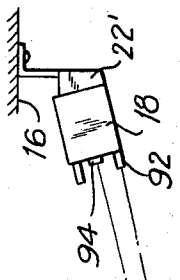


FIG. 4

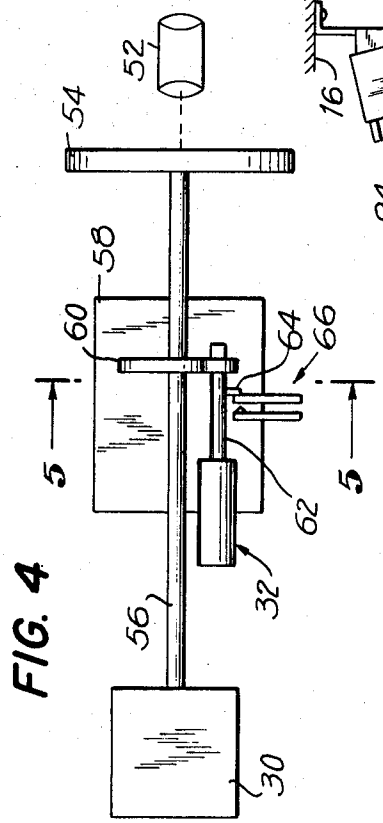
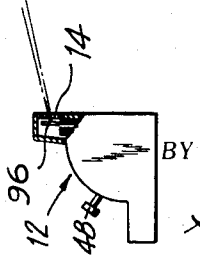


FIG. 10



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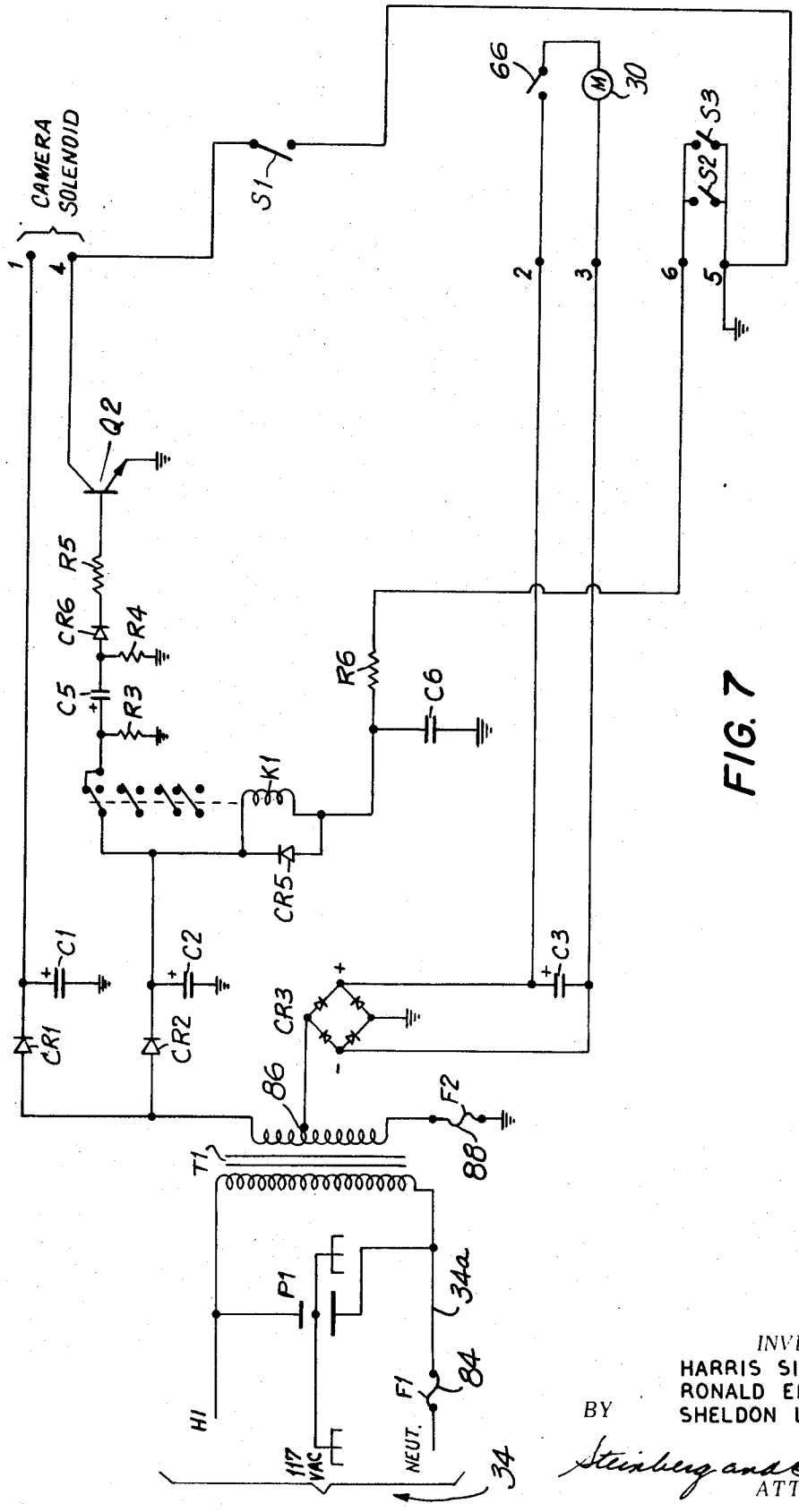


FIG. 7

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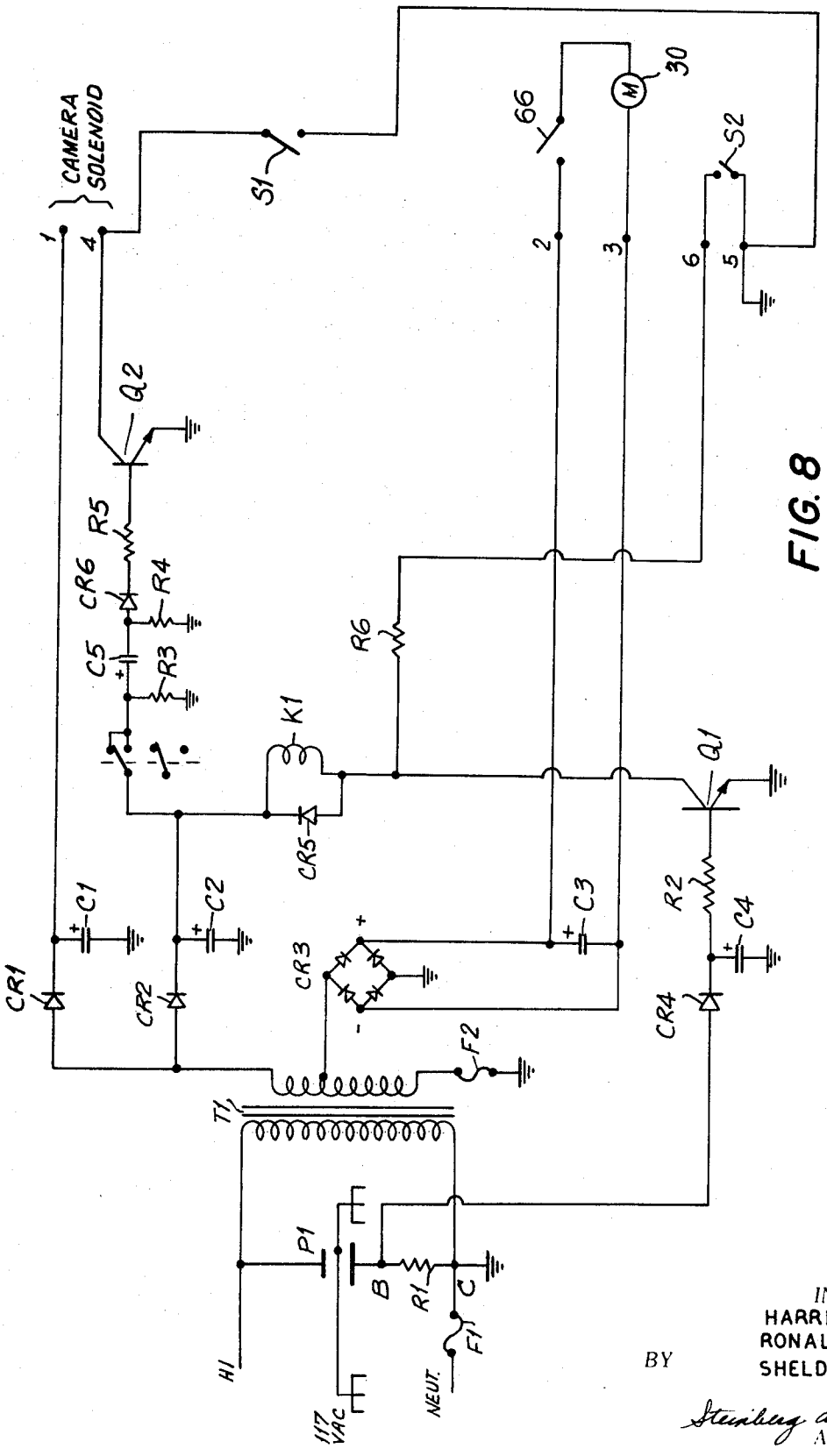


FIG. 8

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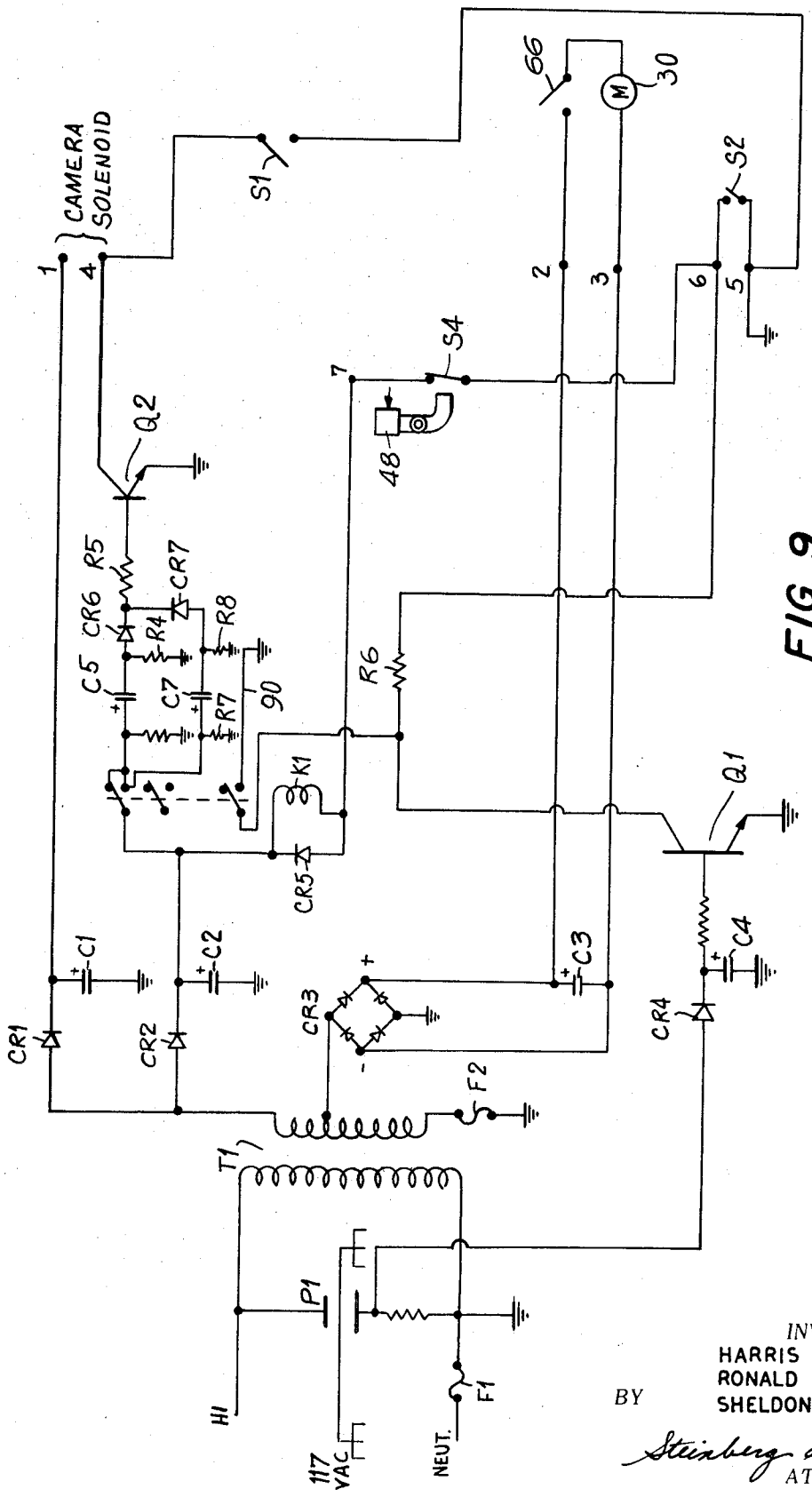


FIG. 9

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PHOTOGRAPHIC SURVEILLANCE APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to photographic surveillance apparatus.

In particular, the present invention relates to apparatus for carrying out photographic surveillance of cash register operation in commercial establishments such as supermarkets and the like.

One of the sources of substantial loss in operation of establishments such as supermarkets is the "sliding" of merchandise by cashiers. Thus, when goods are placed on a checkout counter, the cashier will normally slide each item along the counter as the cost thereof is introduced into the cash register. During these operations it is possible for the operator of the cash register to slide items along the counter without introducing the cost of the items into the cash register. For example, when a personal friend of the cashier is present the cashier can easily manipulate the items in such a way that the cost of only part of the items is introduced into the cash register. The problem of reducing losses which are encountered from such operations has not been solved.

SUMMARY OF THE INVENTION

It is accordingly a primary object of the present invention to provide a photographic surveillance apparatus which will solve this problem.

Thus, it is an object of the present invention to provide a photographic surveillance apparatus capable of achieving photographs of a cash register and the goods of a given transaction in such a way that a correlation can be made between the goods on the counter and the cost thereof introduced into the cash register.

In particular, it is an object of the invention to provide a surveillance apparatus which can achieve such photographs without in any way distracting the normal procedures which take place at the region of a cash register.

Furthermore, it is an object of the present invention to provide a surveillance apparatus which lend themselves to variations so that different types of surveillance can readily be carried out and also permitting surveillance to be made for purposes other than cash register operation.

In addition, it is an object of the invention to provide a photographic surveillance apparatus which is not only completely reliable but which in addition is inexpensive to install and inexpensive and convenient to operate.

According to the invention photographs are made of the cash register operations in such a way that it is possible to correlate at least the totals introduced into a cash register and the goods from which the totals are derived. With the apparatus of the invention a camera is supported at the region of a ceiling, for example, at a location sufficiently distant from a cash register to prevent distraction of individuals at the region of the cash register, and this camera is automatically actuated from the cash register through a control means for making a photograph at least of the total calculated by the cash register and the goods from which the total cost is derived, so that the above correlation can be made. The camera used is a motion picture camera which normally is operated in a single frame mode through a control means which includes a solenoid

tripped by a trigger circuit which is delayed so as to provide before a photograph is made an interval sufficiently great to permit the numerals to appear at the cash register after the totalizing key has been actuated.

BRIEF DESCRIPTION OF DRAWINGS

The invention is illustrated by way of example in the accompanying drawings which form part of this application and in which:

FIG. **1** is a schematic representation of the checkout area of a supermarket illustrating the arrangement of cash registers and checkout counters as well as the arrangement of the surveillance cameras;

FIG. **2** is a block diagram of a system for carrying out the method and apparatus of the invention;

FIG. **3** is a block diagram showing another embodiment of a system according to the method and apparatus of the invention;

FIG. **4** is a schematic representation of a camera and a solenoid arrangement for controlling the camera;

FIG. **5** is a transverse section of the structure of FIG. **4** taken along line **5—5** of FIG. **4** in the direction of the arrows;

FIG. **6** is a schematic side elevation of a cash register and checkout counter, illustrating the arrangement of a camera with respect thereto as well as a control box and cables connected therewith;

FIG. **7** is a wiring diagram of the electrical circuitry corresponding to the system illustrated in the block diagram of FIG. **2**;

FIG. **8** is a wiring diagram showing a variation of the circuitry of FIG. **7**, FIG. **8** corresponding to the block diagram of FIG. **3**;

FIG. **9** shows a further variation of the circuitry of FIG. **8**, and

FIG. **10** is a schematic representation of another embodiment of the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring first to FIG. **1**, there is illustrated therein the manner in which the method and apparatus of the invention are applied to a supermarket. Thus, FIG. **1** shows a series of checkout counters **10** arranged in a conventional manner at a checkout area of a supermarket. Also, FIG. **1** shows how the cash registers **12** are arranged with respect to the checkout counters **10**. FIG. **1** shows in particular the rear windows **14** of the cash registers **12**. The numerals appearing in the rear windows **14** of course correspond to the costs of the items, and at the end of a given transaction the total will appear at the window **14** of each cash register **12**.

FIG. **1** also shows the ceiling **16** of the room illustrated in FIG. **1**. A series of motion picture cameras **18** are situated beneath the ceiling **16** relatively close thereto. These cameras **18** are supported from electrical conduits **20** and by suitable brackets **22** in such a way that the several cameras **18** are focused downwardly upon the several cash registers **12** and checkout counters **10** so that each camera **18** will photograph one cash register **12** and the checkout counter where the cash register is located so that during operation it is possible for each camera **18** to photograph not only the cash register **12**, and in particular the numerals appearing at the window **14** thereof, but also the goods on the checkout counter. Thus, the con-

duits 20 which are supported in any suitable way from the ceiling 16 and the brackets 22 form for each camera 18 a support means supporting the camera in a position focused upon a register and the goods adjacent thereto for photographing not only the goods but also the numerals of the cash register which appear at the window 14.

These cameras 18 are preferably Super 8 motion picture cameras of the type which are freely available for purchase by amateurs. These conventional Super 8 cameras are preferred because it is possible to expose therein cassettes of conventional Super 8 film also freely available to amateurs. Thus it is possible to use with the conventional Super 8 cameras 18 conventional cassettes which are widely available at low cost and which are capable of making color photographs. This particular type of camera is preferred not only because the camera is inexpensive and freely available but also because the film cassettes are freely available and inexpensive and in addition can easily be removed and replaced. Furthermore, these cassettes can be processed through conventional freely available commercial processing establishments without requiring any special measures in connection with the development and printing of the film. Also, in order to project the film conventional projectors for Super 8 film can be used. Thus, the method and apparatus of the invention is not encumbered in any way by requirements of special film, special film processing, or special film projection, and in this way a considerable amount of convenience is achieved while at the same time maintaining the operating costs extremely low.

The conventional Super 8 cameras 18 are modified only with respect to controls to enable them to carry out a single-frame operating mode and with respect to the objectives thereof. The conventional objectives, normally of the zoom lens type, are replaced by high resolution fixed focus objectives suitable for the purposes of the present invention. These objectives which replace the conventional objectives are capable of achieving sharp color photographs with the cameras situated from the registers by a distance which may be on the order of 15 feet. Thus, with such an objective it is possible to focus a camera on a cash register situated approximately 15 feet from the camera and the objective is capable of making a sharp photograph not only of the rear of the register with a clear photograph of the numerals appearing at the window 14 but also of the goods on the counter beside the register so that with such a photograph it is possible to determine the correlation between the goods on the counter and the items introduced into the cash register.

While it is indeed conventional to provide Super 8 motion picture cameras with the option of single-frame operation, the conventional structure for achieving single-frame operation is incapable of withstanding the wear and tear resulting from the constant and repeated single-frame operation required by the method of the present invention. Therefore, in addition to a special objective which replaces the conventional objective the camera used with the apparatus of the invention has a special structure described below for achieving a single-frame mode of operation.

FIG. 1 further illustrates the conduits 24 extending from the region of the several registers to the ceiling 16 for housing the electrical wiring which extends from the region of the cash registers up to the ceiling. This electrical wiring is then situated above the ceiling and is received in the conduits 20 for providing the electrical connections with the several cameras 18.

A functional block diagram of one system of the invention is illustrated in FIG. 2. Thus, FIG. 2 shows a large block 26 which represents the control box and a smaller block 28 representing the camera. Within the box 28 there are schematically illustrated the camera motor 30 and the solenoid 32 for achieving the single-frame mode of operation. The control box 26 is connected to a source of power such as the line 34 providing a supply of 117 VAC from the public utility at a suitable outlet in the room shown in FIG. 1. This power supply through the line 34 is delivered to the unit 36 within the control box 26. The unit 36 converts the power supplied through the line 34 to the various forms required for operation of the camera, the solenoid and the remaining circuitry. The control box 26 contains also a register power receptacle 38 connected electrically to the cash register 40.

From the unit 36 connections are made with the points 2 and 3 for the motor 30 as well as with the points 1 and 4 for the solenoid 32. The point 5 represents a ground connection and the point 6 represents a connection for interconnecting the point 5 with the trigger delay 42.

The solenoid is controlled by a solenoid drive 44 which is actuated from a trigger circuit 46. The operation of the trigger circuit is delayed by the delay 42. It will be noted that the trigger circuit is controlled from the register power receptacle 38 and also receives power from the unit 36.

A manually operable switch S1, which is normally open, is connected between the points 4 and 5, so that whenever the operator closes the switch S1 the solenoid will be maintained energized and the camera can operate continuously to provide conventional motion pictures at will.

The point 5 is electrically connected with the trigger delay 42 through the point 6 with a conductor which includes a manually operable switch S2 which is normally open. This switch is available for manual closing so as to provide for a single-frame exposure at will. In addition the switch S2 is bridged by a switch S3 which is closed in response to operation of the cash register 40. Thus, there is schematically represented in FIG. 2 a key 48 which may be the totalizing key of the cash register. Whenever this key is operated, as by being swung in a clockwise direction, as viewed in FIG. 2, the switch S3 is closed for bringing about also exposure of a single frame.

The operation of the trigger circuit 46 is delayed by the trigger delay 42 for an interval which may be on the order of 0.5 sec. in order to provide an interval long enough to permit the numerals of the cash register to appear in the window 14 when the cash register is actuated. Thus, when the solenoid is energized to release the camera to make an exposure the numerals will already be present at the window 14 to be photographed.

Thus, with an arrangement as shown by the block diagram of FIG. 2, it is possible to carry out three different types of operation. By manually closing the switch S1 it is possible to operate the camera as a con-

ventional motion picture camera. This operation may be desired for certain "panic" situations. For example during progress of a robbery or burglary it may be highly desirable to take motion picture photographs, and through operation of a hidden switch S1 it is possible to operate a camera as a conventional motion picture camera so that for this purpose the progress of a burglary or robbery may be recorded. Also the switch S1 may be used simply to check out the operation of the apparatus.

The manually operable switch S2 provides a second possibility of operating the system manually to provide a single-frame exposure, and this also may be used either for checking the operation of the apparatus or for taking a single-frame photograph whenever desired.

The third type of operation is that provided by way of the register key **48**, which may be the totalizing key, so that whenever all of the goods have had their costs introduced into the cash register and the operator then actuates the totalizing key **48**, the system will be actuated to make a single photograph of the numerals appearing at the window **14** of the cash register and the goods from which these numerals have been derived.

Referring now to FIG. **3**, it will be seen that the block diagram illustrated corresponds generally to that of FIG. **2**. The difference is that the switch S3 is omitted and the control box in this case contains a current sensing circuit **50** connected between the register power receptacle **38** and the trigger circuit **46**. Otherwise, this embodiment is the same as that of FIG. **2**. The embodiment shown in FIG. **3** enables through the current sensing circuit either an operation from the cash register according to which each item introduced into the cash register will be photographed, so that at every actuation of a key of the register a photograph is made, or an operation according to which only the first item introduced is photographed and then the totalizing actuation is photographed so that two photographs, namely that of the introduction of the first item into the cash register and that of the totalizing, are provided. The manner in which the arrangement of FIG. **3** operates to produce these two additional types of operation is set forth in greater detail below in connection with FIGS. **8** and **9**. It will be noted that with the embodiment of FIG. **3** it is still possible to provide for manual operation by way of the switch S1 to achieve motion pictures or by way of the switch S2 to achieve a single frame exposure at will.

Referring now to FIGS. **4** and **5**, there are schematically shown therein various components of the camera **18** and the solenoid structure which forms part of the control means operatively connected with the camera. Thus, FIG. **4** schematically represents the high resolution fixed focus objective **52** situated in front of the rotary shutter **54**. This shutter is fixedly carried by a rotary shaft **56** driven from the motor **30** of the camera. H is to be noted that the motor **30** is driven from the power supply **34** and not by a spring or battery. Thus, this is a further modification of a conventional Super 8 camera. With the invention the power from the public utility used for cash register operation is also used for camera operations so that no inconvenience is involved either with maintaining springs tensioned or with replacing batteries.

The rotary shutter **54** is a conventional sector-shaped shutter behind which is located the cassette **58** with the film which is exposed. This cassette, as was pointed out above, is conventional and is introduced and replaced in a conventional manner. The camera has an indicator which shows when it is necessary to replace a cassette in a fully conventional manner.

In order to provide the single-frame mode of operation the shaft **56** fixedly carries a cam **60** the configuration of which is apparent from FIG. **5**. Within the camera the solenoid **32** is supported in any suitable way. The armature **62** of the solenoid is urged by an unillustrated spring, when the solenoid is unenergized, to the right, as viewed in FIG. **4**, to a position where it extends to the right beyond the cam **60** for blocking the rotary movement thereof. The solenoid **32** is shown in FIG. **4** in a position where the armature **62** is retracted but pressed by the unillustrated spring against the left face of the cam **60** with the spring urging the armature **62** to the right, as viewed in FIG. **4**.

The solenoid armature **62** carries a pin **64** for closing a switch **66** when the solenoid is energized. This switch **66** is connected in series with the motor **30** so that when the switch **66** closes the motor **30** will be energized to rotate the shaft **56**. Thus, upon energizing of the solenoid **32** the armature **62** is retracted in opposition to the spring of the solenoid so as to release the cam **60** and at the same time close the circuit of the motor **30** so that the shaft **56** rotates with the shutter **54**. When the solenoid is unenergized the unillustrated spring presses the free end of the armature **62** against the cam **60**, and this is the position of the parts shown in FIG. **5**. As the cam **60** continues to turn in a clockwise direction, as viewed in FIG. **5**, the edge **65** will move to the left beyond the armature **62** releasing the latter for movement forwardly with respect to the cam **60**, thus opening the switch **66** and terminating the operation after one exposure. It will be apparent that the helical configuration of the edge of the cam **60** is such that when the edge **65** moves to the left beyond the armature **62** the latter will move forwardly and will become situated in the path of the edge **67** to prevent further rotation of the shaft **56** and the shutter **54**. On the other hand, upon energizing of the solenoid the switch **66** closes and the armature **62** retracts sufficiently to permit the cam **60** to turn to an angle sufficient to cause the left surface of the cam **60**, as viewed in FIG. **4**, to prevent return of the armature **62** back to its blocking position until one revolution has been completed.

It will be understood that the film in the cassette **58** is advanced in a conventional manner.

Referring now to FIG. **6**, there is schematically shown a camera **18** and a register **12** at a checkout counter **10**.

The control box **26** is also shown in FIG. **6**. This control box is supported in any suitable way on the structure which supports the counter **10**. The control box **26** has a power supply cable **34** provided with the plug **68** which can be received in the receptacle which normally receives the cable from the register **12**. Thus instead of connecting the register **12** to the power-supply receptacle, the plug **68** is connected to this receptacle and serves to supply the power through the line **34** to the control box **26**. This is a metal tamper-proof control

box. The register cable **70** has its plug **72** introduced into a suitable receptacle carried by the control box **26**, so that it is through the latter that the power is supplied to the register **12**.

FIG. **6** also shows an additional cable **74** leading from the cash register **12** and having a plug **76** received in a receptacle of the control box **26**. This cable **74** provides the connection from the switch **S3** which is actuated by the totalizing key **48** schematically represented in FIG. **6**.

FIG. **6** also shows the cable **78** leading from the control box **26** to the camera **18**. Thus, the wiring which forms the cable **78** will be housed within the conduit **24** so as to extend up to and through the ceiling **16** and will then extend over the latter to the conduit **20** through which this wiring is connected to the camera **18**.

FIG. **6** also illustrates the cable **80** extending from the control box **26** to the switch **S1**, which may be located at any desired location to enable conventional motion picture operation to take place. Thus, the switch **S1** may be located at the floor, for example, to be actuated by the foot of the cashier in the event of a robbery or burglary. However, any other desired location for this switch may be provided. Also, the switch **S1** may be actuated by any existing store burglar alarm.

Finally, a cable **82** extends from the control box **26** to the switch **S2** in order to provide for manual single frame operation as set forth above. This switch also may be situated wherever desired as, for example, in a manager's office to enable the manager to take a photograph whenever it is felt that any unusual circumstances require a photograph to be made.

Because the circuitry described below is of a solid-state transistorized type, it is exceedingly compact and the control box **26** can have relatively small dimensions so that it can be mounted unobtrusively at a location such as that shown in FIG. **6** without in any way interfering with the operations. For example, the tamper-proof metal box which constitutes the control box **26** may have a size of 3 by 4 by 5 inches and may be made of aluminum.

Referring now to FIG. **7**, the three wires of the power-supply cable **34** are connected to a three-prong receptacle **P1**, to provide a grounded connection, and the alternating current is supplied through a conductor **34***a* provided with a safety fuse **84**. The register is also connected to the receptacle **P1** to which the cable **34** is connected.

The power is supplied to the primary of a transformer **T1** where the power of, for example, 117 V AC supplied to the primary is stepped down to a nominal 12.6 V AC, and at the center tap **86** of the secondary there is thus 6.3 V AC. The secondary is provided with a fuse **88**. This fuse **88** may limit the load current to 2 amps, for example.

Connected across the secondary of the transformer is a diode **CR1** and a capacitor **C1**, to provide a half-wave unregulated power supply, thus providing an unloaded 18 V DC nominal output, with reference to circuit ground for operation of the camera solenoid.

The diode **CR2** and capacitor **C2** are also connected across the transformer secondary, to form another **18** V DC nominal half-wave unregulated supply used to provide power for the control circuitry of the control means housed within the box **26** and operatively connected with the camera **18** to control the latter upon actuation by an actuating means in the form, for example, of the totalizing key of the register.

This 18 V DC provided by the diode **CR2** and the capacitor **C2** is also with reference to circuit ground.

The bridge rectifier **CR3** and the capacitor **C3** across the transformer center tap constitute a full wave unregulated supply providing a nominal 8.8 V DC unloaded for the camera motor, with reference to the bridge negative.

The solenoid drive **44** includes the transistor **Q2** which acts as a switch for the camera solenoid. This transistor is normally in a non-conducting (open-switch) state. When emitter-base current is supplied by the trigger circuit **46**, the transistor **Q2** conducts and current from the diode **CR1** and the capacitor **C1** is allowed to flow through the solenoid to the power supply return. The solenoid is therefore energized for the period of time that the emitter-base current is supplied to the transistor **Q2**.

The trigger circuit **46** includes the relay **K1** which may be a four pole double-throw relay as illustrated. In addition to the relay **K1** the trigger circuit **46** includes the resistors **R3** and **R4** and the capacitor **C5**. The diode **CR5** connected across the relay coil is included for transient suppression. The capacitor **C6** forms the trigger delay **42**.

The relay **K1** is shown in FIG. **7** in its quiescent or unenergized condition. In this condition the DC voltage from the diode **CR2** and the capacitor **C2** is applied across the resistor **R3**, and thus the capacitor **C5** is charged in the direction shown. Since this capacitor is charged no base current is supplied to the transistor **Q2** of the solenoid drive **44**. Thus at this time this transistor is non-conducting.

When either the switch **S2** or the switch **S3** are closed, these switches being indicated at the lower right of FIG. **7** connected to the circuit in the manner discussed above in connection with FIG. **2**, then the capacitor **C6**, which was previously charged, is caused to discharge and the coil of the relay is grounded through the resistor **R6**. Thus, the relay will now become energized. The resistor **R6** is included to limit the discharge current through the switch contacts.

With the energizing of the relay the relay contacts will be transferred so as to terminate the supply of voltage to the capacitor **C5**. Thus, the capacitor **C5** will now discharge through the resistors **R3** and **R4**. When either the switch **S2** or the switch **S3** returns to its normally open position the delay capacitor **C6** again charges toward the supply voltage and the relay **K1** will become unenergized. The time required for deenergizing the relay is determined by the resistance of the relay coil and the value of the capacitance of the capacitor **C6**. These parts are designed to provide a delay of approximately 0.5 sec. This interval may be increased or decreased by increasing or decreasing the value of the capacitor **C6**. When the relay **K1** becomes deenergized, the contacts of the relay return to their initial positions and the supply voltage is again delivered to the capacitor **C5**. This capacitor will now charge through the resistor **R4** and the path provided by the resistor **R5** and the emitter base junction of the transistor **Q2**. Therefore, emitter-base current flows and the transistor **Q2** conducts until the capacitor **C5** is

charged. The conducting time of the capacitor Q2 is primarily dependent upon the value of the capacitor C5 and the resistor R5, and these values have been determined to be the average required in order to achieve proper single-frame operation by energizing of the solenoid.

It will be noted that the circuitry of FIG. 7 corresponds in general to the block diagram of FIG. 2. Thus, the solenoid 32 is connected between the points 1 and 4. The camera motor 30 is connected between the points 2 and 3, and FIG. 7 illustrates the switch 66 which is closed upon energizing of the camera solenoid in a manner described above. Also the connection of the switches S2 and S3 across the points 5 and 6 is illustrated in FIG. 7.

Therefore, with this circuitry of FIG. 7 it is possible to achieve the above-mentioned three types of operation according to which the switch S1 may be manually closed to provide for motion picture operation while either of the switches S2 or S3 may be closed to provide for single-frame operation with the delay achieved by the capacitor C6 being great enough to permit the numerals to appear at the window of the cash register.

It is to be noted that while the switch S3 has been disclosed as a normally open switch closed by the totalizing key 48 in the cash register, this particular structure, while it is preferred because of its simplicity and reliability, nevertheless is not essential. For example it is possible to use instead a normally closed switch connected to the same points as the switch S3 but actuated by the drawer of the register. For example when this drawer opens the normally closed switch will be opened so as to arm the trigger while closing of the drawer will permit the switch to return to its closed position and initiate the trigger operation.

Referring to FIG. 8, which corresponds to the block diagram of FIG. 3, it will be seen that the switch S3 is no longer present while the switches S1 and S2 are maintained for optional manual operation as described above. Also, it will be noted that the delay capacitor C6 is not included in the circuit.

Instead this arrangement includes the current sensing circuit 50 referred to above in connection with FIG. 3. This current sensing circuit includes the resistor R1 which is in series with the motor of the cash register. No external register switch S3 is required, although the manual switches may be retained. Thus, each time the register is operated, to operate the motor thereof, there is a voltage drop across the resistor R1. This voltage drop is rectified by the diode CR4 and charges the capacitor C4 of the current sensing circuit 50. The voltage across capacitor C4 causes the transistor Q1 to conduct and thus causes the relay K1 to be energized. The relay will remain energized as long as the register motor continues to run. The resistor R2 limits the emitter-base current to the transistor Q1 and provides a discharge time constant which maintains the relay K1 energized for an interval of 10–50 milliseconds after the register motor has stopped. Then the deenergizing of the relay will trigger the camera solenoid as described above. Otherwise the circuit of FIG. 8 is identical with that of FIG. 7.

This circuitry of FIGS. 3 and 8 may thus be used for photographing each item introduced into the cash register so that every time the cash register is actuated a photograph will be made.

The circuitry of FIG. 8 may be further modified so as to provide an arrangement as shown in FIG. 9. This type of circuit is used with a cash register which does not include change computation capabilities and which is equipped with a normally closed switch S4 actuated by the totalizing button 48.

In this case the current sensing circuit 50 will sense operation of the register when the first item is introduced and this introduction of the first item of the transaction will serve to energize the relay K1. The relay will remain latched in its energized position due to the ground path 90 provided by the bottom contacts of the relay. This latching of the relay in its energized condition will prevent subsequent register operations from triggering the camera until the totalizing key 48 is actuated. This key when actuated will open the normally closed switch S4, causing the relay to become unlatched and deenergized, and the transferal of the relay contacts will again trigger the camera in the manner described above.

It is to be noted that with the embodiment of FIG. 9 the capacitor C5 is duplicated by capacitor C7 and the resistors R3 and R4 are respectively duplicated by the resistors R7 and R8, while the diode CR6 is duplicated by a diode CR7. Thus, through the use of the duplicate trigger circuits of FIG. 9 it is possible to achieve triggering of the camera solenoid both upon energizing and upon deenergizing of the relay K1 to provide for the two photographs referred to above as achieved with this type of circuit.

Thus, with the modification of FIG. 9 the current sensing circuit of FIGS. 3 and 8 is used together with an arrangement which will provide one photograph of the initial item introduced into the cash register and a second photograph of the totalizing operation. Both of these photographs together will provide a correlation giving for a given transaction information in addition to that which may be derived with an arrangement shown, for example, in FIGS. 2 and 7.

It is to be understood that all of the components of FIGS. 7–9 may be enclosed within the box 26. Depending upon the particular type of register and the particular type of operation which is desired it is possible to make suitable connections and disconnections so that one of the circuits shown in FIGS.7–9 may be selected. With all of the embodiments the switches S1 and S2 are included to provide for manual motion-picture or single-frame operation. With the embodiments of FIGS. 2 and 7 the operation will only provide a photograph of the totalizing of each transaction, while with the embodiments of FIGS. 3 and 8 there will be a photograph of each item introduced into the cash register. With the arrangement of FIG. 9 only the first and last cash register operations will be photographed.

FIG. 10 schematically represents an embodiment of the invention according to which it is possible to do away with the conduits 20 and 24 which house the wiring for interconnecting the register and the camera. Referring to FIG. 10 it will be seen that each camera 18 is mounted by a suitable bracket 22' from the ceiling 16. Each camera 18 is connected through suitable wiring to the source of energy, but with this embodiment each camera 18 need not be operated at its solenoid by a switch actuated from the register 12, as through actuation of the totalizing key 48 thereof. Instead each camera 18 is provided with a lamp 92 which is con-

stantly energized as long as the power is turned on for the cameras **18**. From the lamp **92** light travels as schematically represented in FIG. **10** to the window **14** at the rear of the cash register **12** on which the particular camera **18** is focused. The light travels through the window **14** to the interior of the cash register. When a given key of the cash register is actuated, as, for example, the key **48**, a flag such as the total flag **96** will be raised to receive light from the lamp **92**. This flag **96** is provided with a suitable reflecting material which will direct light back to the unit **94** which is carried by the camera **18** of the embodiment of FIG. **10**. While the window **14** is incapable of reflecting light back to the unit **94**, the material of which the flag **96** is composed is indeed capable of reflecting the light back to the unit **94**. Thus, the flag **96** which is raised upon actuation of a key such as the key **48** may carry a highly reflecting mirror or may carry a section covered with a paint or other suitable material the properties of which are such that light from the lamp **92** will be reflected back to the unit **94** only when the flag **96** is raised in response to actuation of a key such as the key **48**.

The unit **94** may, for example, be a suitable photocell which responds only to light reflected from the flag **96** and which through a suitable amplifier is connected to the switch for actuating the solenoid which releases the camera for a single-frame mode of operation as described above. Thus, with this arrangement it is possible to eliminate the conduits **20** and **24** which may not be desirable.

It is to be noted that while a fixed focus lens of high resolution has been referred to above as being provided with the cameras **18**, these cameras may be provided with a standard C-mount for receiving interchangeable lenses which may have their focus adjusted, if desired.

Also, it is possible to provide the cameras with shutters different from rotary shutters and with suitable indicators such as a malfunction indicator which lights a lamp or actuates a buzzer or the like to indicate a malfunction at a particular camera. It is also possible to provide the cameras with a remote indicator such as a lamp or suitable buzzer or the like which indicates when it is necessary to change a cassette at a particular camera.

Furthermore, it is possible to provide the cameras with flash contacts for making exposures with flash illumination, and in this case the cameras will of course be equipped with flash lamps to be energized in order to make an exposure with flash illumination. Such an arrangement is of utility where the cameras are to serve also as surveillance devices for photographing burglaries. Inasmuch as thefts may take place at night when a store is closed and when the room is in darkness, under such conditions a flash lamp may be highly desirable for making it possible to photograph a thief.

It is to be noted that the indicating lamps, buzzers, or the like to indicate malfunctions or the necessity of replacing a cassette at a given camera need not be located at the camera itself but can be located at any desired location such as in a supervisor's office, or the like.

It is apparent, therefore, that the surveillance system of the invention is highly flexible and lends itself to a number of different types of operations and uses.

What is claimed is:

1. In an apparatus for photographic surveillance of cash register operations, a cash register, a motion-picture camera, support means supporting said camera in a position for photographing said cash register at least at the part thereof which includes the cost of items introduced into the cash register as well as for photographing goods in the region of the cash register, control means operatively connected with said camera for operating the latter to expose only a single frame at each actuation of said control means, and actuating means operatively connecting said cash register to said control means for actuating the latter at least when a totalizing key of the cash register is actuated.

2. The combination of claim **1** and wherein said actuating means operatively connects said control means to said cash register to be actuated whenever any key thereof is operated.

3. The combination of claim **1** and wherein said actuating means operatively connects said control means to the cash register to be actuated thereby first when the first item of a given transaction is introduced into the cash register and then when the totalizing key is operated.

4. The combination of claim **1** and wherein a manually operable means is also connected operatively with said control means to actuate the latter independently of said actuating means at will.

5. The combination of claim **4** and wherein said manually operable means includes a pair of switches one of which provides for single-frame operation of the camera and the other of which provides for motion picture operation of the camera.

6. The combination of claim **1** and wherein said camera includes a rotary shutter and said control means includes a solenoid coacting with said shutter for releasing the latter when said solenoid is energized, said control means when actuated by said actuating means releasing said solenoid means for return to a shutter-blocking position when the shutter completes one revolution.

7. The combination of claim **6** and wherein said control means includes in addition to said solenoid a trigger circuit for triggering the operation of said solenoid and a trigger delay for delaying the operation of the trigger circuit for an interval great enough to permit the numerals of the cash register to become photographed upon release of the camera shutter.

8. The combination of claim **7** and wherein said control means is in the form of a transistorized electrical circuit.

9. The combination of claim **1** and wherein said control means provides remote operation of said camera when said actuating means is actuated, so that wires need not extend between said camera and cash register.

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