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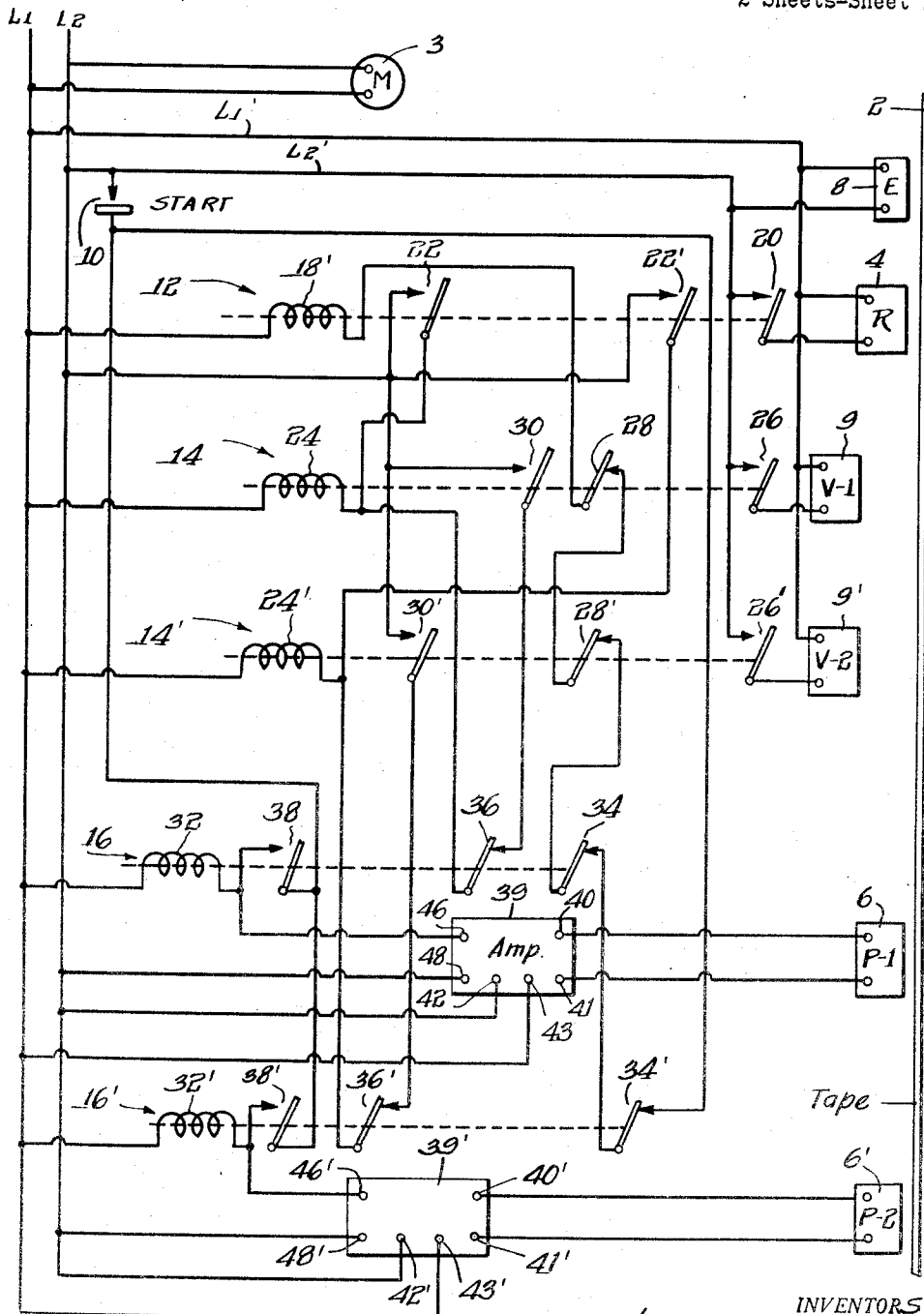
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2,934,701

TIMER

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2,934,701

TIMER

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This invention relates to timing apparatus which controls the duration of operation of one or more devices; more particularly, it relates to such apparatus which finds use in situations where the time intervals during which the device or devices operate are to be held within close tolerances.

Consider, for example, an automatic perfume bottle filling machine where small perfume bottles are machine fed to a filling station. In such case, the bottles may be successively moved against a start control switch which initiates a filling operation where a predetermined amount of one or more perfume ingredients are fed into the perfume bottles. In the interest of process efficiency, the length of time for filling should be held to a minimum, and the time during which the filling device or devices operate must necessarily be small and precisely controlled to prevent overfilling with consequent wastage of valuable ingredients, or underfilling, or incorrect percentages of the ingredients where two or more ingredients are fed from separate sources of supply to the bottles.

In accordance with this invention, a timing and control system is provided which is instantaneously operative to initiate operation of one or more devices, and which simultaneously initiates operation of a magnetic recording unit which records a start pulse on a moving magnetic record medium and which terminates operation of such device or devices when the recorded pulse reaches a pick-up unit spaced from the recording unit a given predetermined amount. This simultaneous initiation of operation of both the device to be ultimately controlled and the magnetic timer reduces the time for a cycle of operation of the system compared to the system disclosed in U.S. Patent No. 2,558,249 granted June 26, 1951, to Hewlett et al., where a timing pulse having the desired timing duration is first formed on a magnetizable disc, tape or drum in response to a start signal, and then the pulse is used to control the duration of operation of a device.

Using the perfume filling machine above described as an exemplary environment in which the present invention may be used, the recording unit is momentarily energized to record a short pulse on the magnetic recording medium as soon as a perfume bottle is brought into position against the aforementioned start control switch. Simultaneously with a recording of a pulse, the feed valve is opened. The end of the filling operation occurs when the recorded pulse arrives opposite a pick-up head which is spaced a given predetermined distance from the recording head to provide a precisely determined time interval corresponding to the time in which the feed valve is to remain opened during a single filling operation. The signal generated in the pick-up head is utilized to shut or close the feed valve to terminate the filling operation. As soon as the filled perfume bottle is removed from the start button or switch, the system is immediately ready to receive another bottle and to initiate another timed filling operation. Since only a narrow timing pulse appears on the magnetic recording medium, this operation

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may proceed almost immediately after the pulse reaches the pick-up head. This would not be feasible if it took an appreciable time for the pulse to pass the pick-up head, as in the aforementioned patented system.

5 Since the timing and control apparatus above described is responsive to the actuation or closing of the start control button, some difficulty could arise following completion of a filling operation if the bottle thereafter remained held against the start switch. A new filling and recording cycle could be started before the filled bottle 10 was removed from the switch if the apparatus could not sense the difference between a filled bottle and an empty bottle held against the switch. To avoid this difficulty, this invention disables operation of the recording and feed 15 apparatus following termination of a filling operation until the filled bottle is removed from the start switch.

In the preferred form of the invention, a record control relay is operated by the closing of the start switch to operate a recording unit. The record control relay 20 is provided with an energization circuit which includes the aforementioned start switch and contacts of a start control relay and a stop control relay which respectively control the opening and closing of the valve. As the record relay is operated by the start switch, contacts of this relay close to energize immediately the start control 25 relay which opens the aforementioned feed valve. Operation of the start control relay breaks the energization circuit of the record relay to disable or stop operation of a recording-head to limit the recorded signal to a pulse of short duration relative to the filling interval. 30 The start control relay locks-in until the recorded pulse reaches the pick-up head whereupon the stop control relay is energized and locks-in. Contacts of the stop control relay then break the holding circuit of the start control relay and also maintain the energization circuit of the record relay open. The holding circuit of the stop 35 control relay is broken when the start switch is opened, as when the filled perfume bottle is removed therefrom. Then, and only then, is the record control relay and the start control relay prepared for a new cycle of operation. 40

Where two or more ingredients are to be fed simultaneously to the bottles for different lengths of time, additional start and stop control relays are added to the circuit which additional relays are each associated with a 45 separate feed valve and pick-up head. Contacts of these various relays are placed in the energization circuits of other relays to provide the aforementioned disabling functions so that only a single pulse of short duration can be recorded each filling cycle and so that a new filling cycle 50 cannot begin until all of the relays have completed their normal functions in the manner above explained.

Other objects, advantages and features of the invention will become apparent upon making reference to the 55 specification to follow taken in conjunction with the claims and drawings wherein:

Fig. 1 is a schematic circuit diagram of a timing and control system which provides one precisely timed control interval per cycle of operation;

60 Fig. 2 is a modified schematic diagram which provides two precisely controlled time intervals per cycle of operation; and

Fig. 3 is an end elevational view showing suitable mechanism for providing a variation in the lengths of 65 such intervals.

Refer now to the embodiment shown in Fig. 1. As there shown, a receiving means, preferably in the form of a magnetizable tape, drum or disc 2, is moved at a fixed predetermined rate of speed by a synchronous motor 3. A recording head 4 and a pick-up head 6 are spaced 70 along the record-receiving means 2, the spacing of the pick-up head from the record head being variable to

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provide a number of selectable precise, predetermined time intervals. Behind the recording head 4 is a conventional erasing head 3 which erases any magnetic record on the magnetizable means 2 before the portion thereof involved reaches the recording head 4. The device to be controlled is generally indicated by a reference numeral 9, and may be an electrically operated feed valve in the aforementioned perfume filling machine.

The electrical circuit associated with the aforementioned elements includes a start control switch 10 which is closed at the beginning of a timing and control operation. This switch, for example, may be the switch against which the perfume bottle is held during the filling operation above described. In a manner to be explained, the closing of the start switch 10 initiates the recording of a relatively small pulse upon the magnetizable medium 2 and substantially simultaneously opens or initiates the opening of the valve 9 or other device to be controlled. When the magnetic pulse reaches the pick-up head 6, the circuit shown terminates operation of the valve 9. The circuit also include a record control relay circuit 12, a start control relay circuit 14 and a stop control relay circuit 16, which respectively initiate energization of the recording head 4, opening of the valve 9, and closing of the valve 9.

The record control relay circuit 12 includes a record control relay 18 having two sets of normally open contacts 20 and 22. The start control relay circuit 14 includes a relay 14 with a normally open set of contacts 26, a normally closed set of contacts 28 and a normally open set of contacts 30. The stop control relay circuit includes a stop control relay 32 having normally closed sets of contacts 34 and 36 and a normally open set of contacts 38.

The energization circuit for the record control relay 18 can be traced from a power line L1, through relay coil 18, normally closed contacts 28 and 34 of the start and stop control relays respectively and through the start switch 10 leading to the other power line L2. Thus, closing of the start switch 10 will energize the record control relay 18. Energization of relay 18 closes the contacts 20 which are in series with the recording head 4 and branch lines L1'—L2' leading to the main power lines L1—L2. When the recording head 4 is thereby energized, the magnetizable medium 2 is magnetized in a well-known manner to provide a signal pulse thereon.

Closing of the other set of contacts 22 of the record control relay 18 results in the energization of the start control relay 24. The energization circuit of the latter relay can be traced from the power line L1 and through the coil of relay 24, and the then closed contacts 22 of the relay 18 leading to the other power line L2. The start control relay 24 locks in through a holding branch circuit extending from a terminal 25 of the relay 24. This holding branch includes normally-closed contacts 36 of the stop control relay 32 and holding contacts 30 of the relay 24 leading to the other power line L2. As the relay 24 is energized, its normally-closed contacts 28 in the energization circuit of the record control relay 18 opens to de-energize the latter relay which terminates energization of the recording head 4 almost as soon as the latter is initially energized. The record control relay 18 is thus only energized for a short duration and remains disabled for the duration of the timing cycle. As relay 24 is energized, its normally-open contacts 26 close. The latter contacts are in series with the valve device 9 to be controlled and with the branch power lines L1'—L2' so that closing of the contacts 26 will open the valve device 9 substantially simultaneously with recording of the magnetic signal pulse upon the magnetizable medium 2.

The operating interval of the valve device 9 terminates when the recorded pulse reaches the pick-up head 6 where, in a well-known manner, a voltage pulse is generated in the output of the pick-up head 6. This output voltage may be fed to a suitable amplifier 39 diagram-

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matically illustrated. The amplifier has input terminals 40 and 41 leading to the output of the pick-up head 6, power terminals 42—43 leading to the power lines L1—L2, and output terminals 46—48 which respectively lead to a terminal 49 of the relay coil 32 and the power line L2. The other terminal of the relay coil 32 leads to the power line L1. The presence of an amplified voltage pulse in the output of the amplifier 39 will energize the relay 32. Upon energization of the relay 32, its normally-closed contacts 34 in the energization circuit of the record control relay 18 open to maintain the latter relay de-energized. The normally-closed contacts 36 in the holding circuit of the start control relay 24 open to de-energize the start relay 24 which closes the valve device 9 upon the opening of the contacts 26.

The relay 32 locks-in through a holding branch circuit extending from terminal 49, through the then closed holding contacts 38 of the relay circuit 16 and through the start switch 10 leading to the line L2. Thus, as long as the start control switch 10 remains closed, the stop control relay 32 will remain energized. If the stop control relay 32 were not maintained in its energized state until the start switch 10 is opened, as soon as the pulse generated in the pick-up head 6 terminates, both the record control relay and the start control relay would become energized to initiate prematurely another recording and control operation. In such case, a perfume bottle held against the aforementioned start control button would overflow with loss of valuable perfume.

Refer now to the modified circuit of Fig. 2 which in many respects is similar to the circuit just described except that an additional valve 9' to be controlled has been added and a pick-up head 6' has been added so that two overlapping time-controlled intervals per cycle of operation of the equipment is provided. In this circuit, closing of the start control switch 10 results in the recording of a single magnetic pulse of short duration on the magnetizable medium 2 and substantially simultaneously with this both valve devices 9 and 9' are opened. When the recorded pulse later reaches the pick-up head 6, valve device 9 is closed, and, subsequently, when the same pulse reaches the pick-up head 6', the other valve device 9' is closed.

The relay control circuit there shown accordingly includes an additional start control relay circuit 14' which controls operation of the valve device 9' and an additional stop control relay circuit 16' which is responsive to the output signal of the second pick-up device 6'. The circuits 14' and 16' include start and stop control relays 24' and 32' respectively which have contacts which operate in substantially the same way as the correspondingly numbered contacts of the start and stop relays 24 and 32 previously described.

The record control relay 18' in this circuit operates in the same manner as relay 18 in Fig. 1 and is maintained de-energized after its initial momentary energization until completion of the timing cycle above described, and accordingly its energization circuit includes the normally-closed contacts of all of the above mentioned start and stop control relays in series circuit relation with each other and with the start control switch 10. The record control relay 18' is provided with an additional set of contacts 22' over that found in the record control relay 18 in Fig. 1. Closing of switch 10 energizes the relay 18' which results in the energization and locking in of the first start control relay 14 as contacts 22 and 30 close. The additional set of contacts 22' are required to initiate energization of the second start control relay 24' whose energization circuit includes the contacts 22' in series therewith and with the power lines L1 and L2.

Energization of relay 24' results in the closing of a lock-in branch circuit including a set of normally-closed contacts 36' of the second stop control relay 32' and the holding contacts 30' thereof. The energization of the relays 24 and 24' results in the opening of the energization

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circuit of record control relay 18' as their contacts 28 and 28' open and also in the closing of their contacts 26 and 26' in series with the devices 9 and 9' to initiate operation of the same. Thus a short pulse is recorded upon magnetizable medium 2. When the signal pulse recorded upon the magnetizable medium 2 reaches the first pick-up head 6, the stop control relay 32 is operated by the output pulse generated therein in the same manner previously described in connection with the embodiment of Fig. 1 to establish a locking circuit therefore upon closing of the holding contacts 38, to maintain the energization circuit of the record control relay 18' open upon the opening of contacts 34, and to break the holding circuit of the first start control relay 24 upon opening of the contacts 36. This closes the valve device 9 in a manner previously explained.

In a like manner, when the signal on the magnetizable record medium 2 reaches the second pick-up head 6', the voltage generated in the output of the head 6' is fed to the input terminals 40'—41' of an amplifier 39'. The amplifier is energized through its connection with the lines L1 and L2 connecting with the power terminals 42'—43', and has output terminals 46' and 48' leading respectively to the right terminal of the stop control relay 32' and line L2 respectively. The left terminal of relay 32' is connected to line L1. Upon initial energization of the relay 32', a holding circuit is established which includes holding contacts 38' of the relay 32' connected in series with the start control switch 10. Opening of the normally-closed contacts 36' of the relay 32' breaks the holding circuit of the associated start control relay 24' which opens contacts 26' to de-energize the device 9'. The normally-closed contacts 34' of relay 32' also open to maintain the energization circuit of the record control relay 8' open. Then, when the start control switch 10 is opened, the holding circuits of both stop control relays 32 and 32' open to de-energize the associated relays to prepare the circuit for a new cycle of operation when the start switch 10 is subsequently again closed.

Refer now to Fig. 3 which shows an end elevational view of the magnetic recording and playback apparatus schematically shown in Fig. 2. The magnetizable means 2 is there shown as a flat circular disc mounted for rotation about a horizontal axis at 50. The erasing and recording heads 8 and 4 are shown supported by an arm stationary 52 which extends from frame support 54.

The pick-up heads 6 and 6' are mounted upon extension arms 53 and 55 of axially spaced discs 57 and 58 which are adjustably mounted for relative turning movement for a little less than 360 degrees about the axis 50 inside of the stationary extension arm 52. To this end, the discs have confronting annular slots 59 and 60 which are centered about the axis 50, and a bolt shank 60' having a head on the inside of the inner disc 58 passes through the slots 59 and 60 and receives a locking wing nut 61 which clamps the discs in any of their adjusted positions.

In the present invention, since the timing pulse is recorded at the same time the devices 9—9' are operated and the operating intervals thereof end when the pulse reaches the corresponding pick up heads, almost the entire 360 degrees of movement of the pick-up devices 6—6' can be used for adjustment of the operating intervals of these devices. For a given speed of revolution of the disc 2, this means that with the present invention a much greater variation in the adjustment of the operating time intervals is possible as compared with a system where a timing pulse of a length of the operating interval is recorded before the controlled device is operated.

The present invention has thus provided a timing and control system where the over-all period of time required for timing and control is a minimum, where the apparatus may be readily varied over wide limits to provide different precisely controlled timing intervals, and

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wherein various safety features are provided insuring reliability of operation.

It should be understood that numerous modifications may be made of the preferred forms of the invention above described without deviating from the broader aspects of the invention.

It is claimed as new and desired to be protected by Letters Patent of the United States.

1. Timer and control apparatus comprising: record start means for initiating a timing operation when actuated and which remains actuated during the operation to be controlled, record-receiving means, means for moving said record-receiving means, recording means located along the path of travel of said record-receiving means and responsive to the actuation of said record start means by effecting a localized signal record on said record-receiving means, start control means for starting the operation of a device to be operated for a predetermined time, means for initiating operation of said start control means substantially simultaneously with the actuation of said record start means to start the operation of said device, stop control means for terminating the operation of said device and including signal pick-up means located along the path of travel of said record-receiving means, said pick-up means being responsive to the arrival opposite thereto of the signal recorded on said record-receiving means, and means responsive to detection of the signal by said pick-up means for operating said stop control means to terminate operation of said device, and means responsive to the operation of the record start means and to the operation of said start and stop control means for disabling operation of the recording means upon initial actuation of said record start means until the record start means is returned to its unactuated condition and said start and stop control means have been operated.

2. Timer and control apparatus comprising: record start means for initiating a timing operation when actuated and which remains actuated during the operation to be controlled, record-receiving means, means for moving said record-receiving means, recording means located along the path of travel of said record-receiving means and responsive to the actuation of said record start means by effecting a localized signal record on said record-receiving means, start control means for starting the operation of a device to be operated for a predetermined time, means for initiating operation of said start control means substantially simultaneously with the actuation of said record start means to start the operation of said device, stop control means for terminating the operation of said device and including signal pick-up means located along the path of travel of said record-receiving means, said pick-up means being responsive to the arrival opposite thereto of the signal recorded on said record-receiving means, and means responsive to detection of the signal by said pick-up means for operating said stop control means to terminate operation of said device, and means responsive to operation of said stop control means and to actuation of said record start means for disabling operation of said start control means until the actuation of said record start means has been terminated.

3. A timer comprising: record start means for initiating a timing operation when actuated, record-receiving means, means for moving said record-receiving means, recording means including means located along the path of travel of said record-receiving means and responsive to the actuation of said record start means by effecting a localized signal record on said record-receiving means, first start control means for starting the operation of a first device to be operated for a fixed predetermined interval of time, means for initiating operation of said first start control means upon the actuation of said record start means to start the operation of said first device, second start control means for starting the operation of a second device to be operated for a second predetermined time interval greater than said first-mentioned

time interval, means for initiating operation of said second start control means upon the actuation of said record start means to start the operation of said second device, first stop control means for terminating the operation of said first device and including first pick-up means located along the path of travel of said record-receiving means, second stop control means for terminating the operation of said second device and including pick-up means located at a different point along the path of travel of said record-receiving means than said former pick-up means, both of said pick-up means being responsive to the arrival opposite thereto of said signal record placed on said record-receiving means, means responsive to detection of a signal record by the first pick-up means for operating said first stop control means to terminate operation of said first device, and means responsive to detection of said signal record by said second mentioned pick-up means for operating said second stop control means to terminate operation of said second device.

4. A timer comprising: record start means for initiating a timing operation when actuated and which may remain actuated during the operation to be timed, record-receiving means, means for moving said record-receiving means, recording means including means located along the path of travel of said record-receiving means and responsive to the actuation of said record start means by effecting a localized signal record on said record-receiving means, first start control means for starting the operation of a first device to be operated for a fixed predetermined interval of time, means for initiating operation of said first start control means upon the actuation of said record start means to start the operation of said first device, second start control means for starting the operation of a second device to be operated for a second predetermined time interval greater than said first-mentioned time interval, means for initiating operation of said second start control means upon the actuation of said record start means to start the operation of said second device, first stop control means for terminating the operation of said first device and including first pick-up means located along the path of travel of said record-receiving means, second stop control means for terminating the operation of said second device and including pick-up means located at a different point along the path of travel of said record-receiving means than said former pick-up means, both of said pick-up means being responsive to the arrival opposite thereto of said signal record placed on said record-receiving means, means responsive to detection of a signal record by the first pick-up means for operating said first stop control means to terminate operation of said first device, and means responsive to detection of said signal record by said second mentioned pick-up means for operating said second stop control means to terminate operation of said second device, and means responsive to said record start means and to the operation of said first and second start and stop control means for disabling operation of the recording means upon initial actuation of said record start means until the record start means is returned to its unactuated condition and said first and second mentioned start and stop control means have been operated.

5. Apparatus for controlling the duration of operation of a device comprising: actuable signal switch means which is to remain actuated during the operation to be controlled, movably mounted magnetizable record-receiving means, means for moving said record-receiving means at a fixed rate of speed, recording means including means located along the path of travel of said record-receiving means and means for momentarily energizing said recording means upon actuation of said signal switch means to provide a localized magnetization of said record-receiving means, pick-up means located along the path of travel of said record-receiving means in which a control signal is induced by the passage thereby of said localized

magnetization start control relay means having an active and an inactive condition of operation, means for operating said start control relay means from its inactive to its active condition substantially instantaneously with the energization of said recording means, means controlled by said start control relay means for starting the operation of said device when said start control relay means is in its active condition, stop control relay means having active and inactive conditions of operation, means for normally operating said stop control means to its inactive condition, means for holding said start control relay means in said active condition until said stop control relay means is actuated to its active condition, and means coupling the control signal induced in said pick-up means to said stop control relay means for operating the latter to its active condition when the magnetic record produced on said record-receiving means arrives at said pick-up means, and means for holding said stop control relay means in its active condition until said start switch means is moved to its unactuated position.

6. Apparatus for controlling the duration of operation of a device comprising: actuable signal switch means, movably mounted magnetizable record-receiving means, means for moving said record-receiving means at a fixed rate of speed, recording means including means located along the path of travel of said record-receiving means and means for momentarily energizing said recording means upon actuation of said signal switch means to provide a localized magnetization of said record-receiving means, pick-up means located along the path of travel of said record-receiving means in which a control signal is induced by the passage thereby of said localized magnetization start control relay means having an active and an inactive condition of operation, means for operating said start control relay means from its inactive to its active condition substantially instantaneously with the energization of said recording means, means controlled by said start control relay means for starting the operation of said device when said start control relay means is in its active condition, stop control relay means having active and inactive conditions of operation, means for normally operating said stop control means to its inactive condition, means for holding said start control relay means in said active condition until said stop control relay means is actuated to its active condition, and means coupling the control signal induced in said pick-up means to said stop control relay means for operating the latter to its active condition when the magnetic record produced on said record-receiving means arrived at said pick-up means.

7. Apparatus for controlling the duration of operation of a device comprising: record-receiving means, means for moving said record-receiving means, recording means and pick-up means respectively located at different points along the path of travel of said record-receiving means for respectively providing a localized signal record on said record-receiving means and for sensing the passage of such signal record, start switch means, voltage source means, record relay control means for controlling the operation of said recording means, an energization circuit for said record relay means including said voltage source means, said record relay means having a first and a second set of contacts, start control relay means, an energization circuit for said start control relay means including said voltage source means, said start control relay means having means for starting said device to be controlled and a first and second set of contacts, stop control relay means having a first, second and third set of contacts, the energization circuit of said record relay means including said first sets of contacts of said start and stop control relay means and said start switch means arranged to actuate said record control relay means to an active condition when said start and stop control relay means are in respective inactive conditions and said start switch is actuated and to operate or maintain the record control

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relay means in its inactive position when either said start or stop control relay means are in their active condition, said first set of contacts of said record control relay means being in circuit between said recording means and voltage source means to energize the recording means when the record relay means is in said active condition, said energization circuit of said start control relay means including a branch having said second set of contacts of said record relay means therein arranged to operate said start control relay means to an active condition when the record relay means is in its active condition, the energization circuit of said start control relay means including another branch having said second set of contacts of said stop control relay means and said second set of contacts of said start control relay means arranged to hold the start control relay means in its active condition while said stop control relay means is in an inactive condition, said starting means of said start control relay means starting operation of said device to be controlled when said start control relay means is in its active condition, means coupling said pick-up means to said stop control relay means for

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initially operating the latter to its active condition when said signal on said record-receiving means arrives at the pick-up means, and the energization circuit of said stop control relay means including said third set of contacts of said latter relay means and said start switch means arranged to hold said stop control relay means in its active condition until said start switch means moves to its un-actuated position.

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