

[54] ARRANGEMENT FOR RECORDING PULSES 3,587,112 6/1971 Hill 346/79 X

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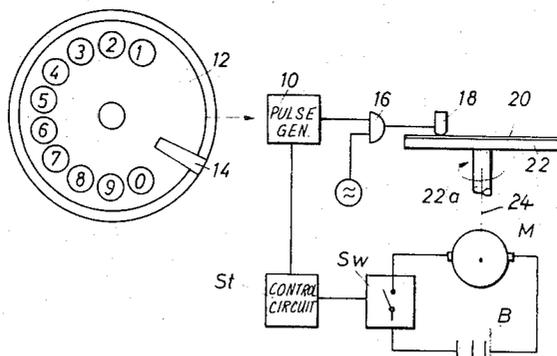
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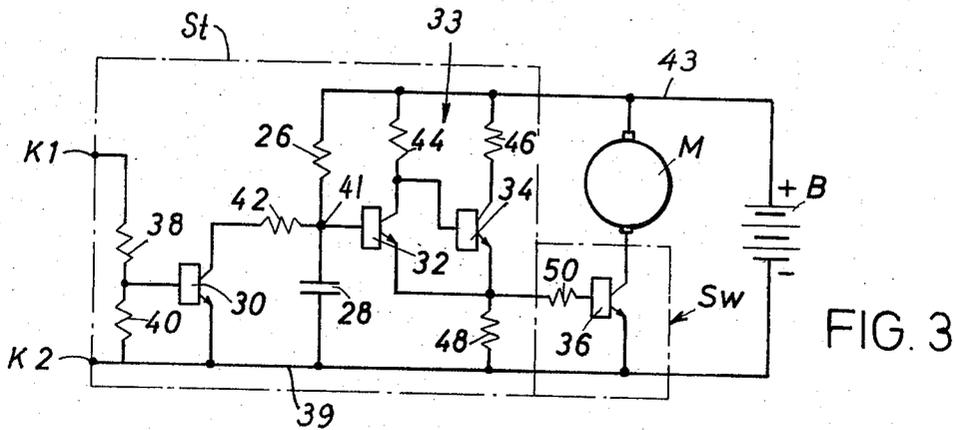
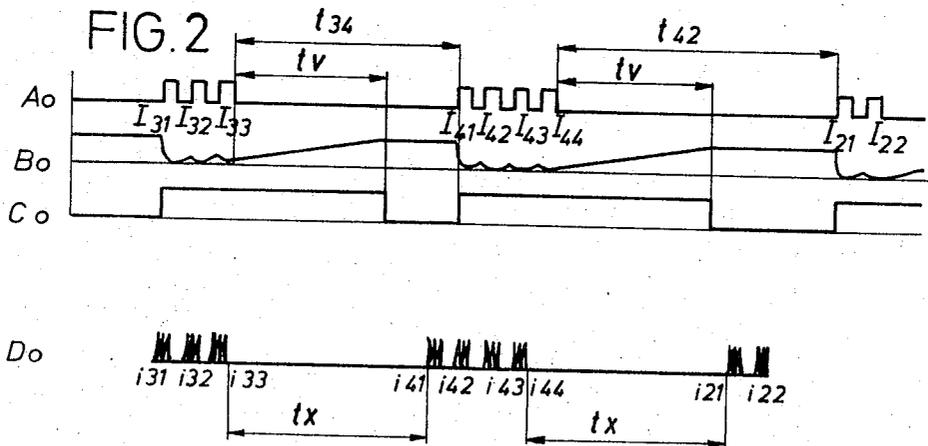
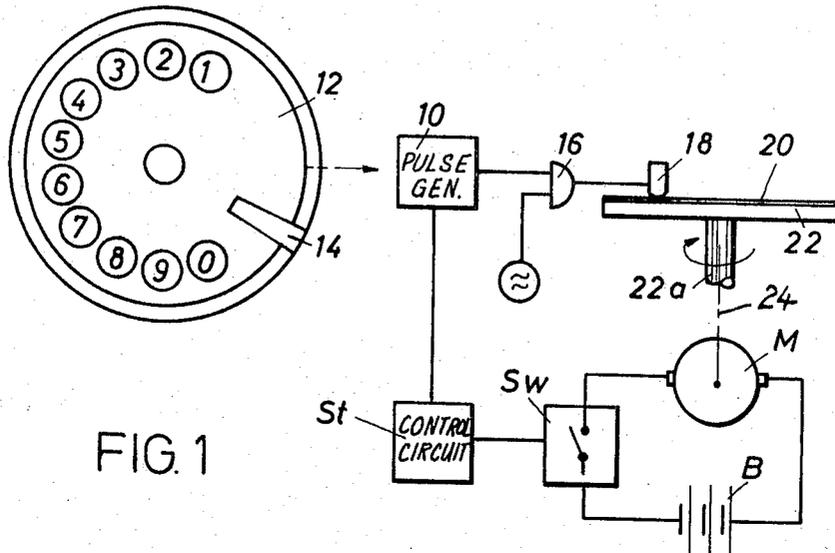
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[57] ABSTRACT

An arrangement for recording electrical pulses or pulse sequences on a storage device, preferably a magnetic tape or a magnetic foil driven by an electric motor. The pulses are produced by a pulse generator and transmitted to the storage device by a recording member. A switching circuit is provided to control the energization of the electric motor and is controlled by a control circuit coupled both to the switching circuit and the pulse generator so that at the beginning of the first pulse, the switching circuit effects an energization of the motor and deenergizes the motor only after the expiration of a predetermined constant interval of time following the last to occur pulse in the pulse sequence.

5 Claims, 3 Drawing Figures





ARRANGEMENT FOR RECORDING PULSES

FIELD OF THE INVENTION

This invention relates to an arrangement for recording electrical pulses or pulse sequences on a storage means, preferably a magnetic tape or a magnetic foil, driven by an electrical motor, the pulses being produced from a pulse generator by an actuating device which passes through different datum positions and being transmitted to the storage means by means of a recording member.

BACKGROUND OF THE INVENTION

In arrangements of this kind, there is a time lapse during the operation of the storage means in which no recording takes place each time the actuating device is moved from its rest position into a fresh datum position for the next pulse generation, this time lapse varying with the length of travel of the actuating device. As a result there are unused and empty intervals of varying size between the individual recordings on the storage means, so that only a very limited number of pulse sequences can be applied to and stored in a storage means having given capacity.

It is an object of the present invention to reduce these variable-size empty intervals between the pulse recordings to a minimum constant size, thereby substantially increasing the number of recordings which can be made on the storage means. This object is achieved in the present invention by the fact that associated with the circuit of the electric motor is a switch circuit which is operated by a control circuit coupled to the pulse generator in such a way that at the beginning of the first pulse of a pulse sequence, it closes the circuit of the motor and only re-opens it again after the termination of a predetermined constant interval of time after the termination of the last pulse of the said pulse sequence. Thus it is advantageously contrived that the storage means is driven only during the recording of the pulse sequence and during the ensuing constant interval, in contrast to the time that it remains stationary when the actuating device is being moved to a new datum position.

In accordance with a further feature of the invention, which can be implemented with a very small number of components, the switch circuit comprises a transistor in the circuit of the electric motor, and this transistor is brought alternately into conductive and into nonconductive condition by the control circuit which is in the form of a mono-flop arrangement having an input characteristic similar to a conventional monostable multivibrator circuit and having an adjustable time delay period.

A preferred embodiment of use of the arrangement for this invention is in the recording of a specific number or specific combination of numbers, for example telephone numbers, in an automatic telephone number selecting appliance. In such a situation, and in a preferred embodiment of the invention, the arrangement is so devised that the actuating device is in the form of a digit dial of a telephone set and, the dial moves when back from the dialed (datum) position into the rest position, causes the pulse generator to produce a series of pulses at regular intervals and of a number corresponding to the selected digit.

An example of embodiment of the invention is described below with reference to the accompanying drawing, in which,

FIG. 1 is a schematic illustration of an arrangement, particularly a block wiring diagram of the associated electrical connections;

FIGS. 2A₀, 2B₀, 2C₀ and 2D₀ are diagrams relative to the pulse circuit and recording circuit, and;

FIG. 3 is a diagram of the control circuit associated with the pulse circuit.

DETAILED DESCRIPTION

In FIG. 1, a pulse generator 10 is of a known form having associated therewith an actuating device 12 in the nature of a telephone number selector dial. When a number has been chosen and the dial 12 is drawn in the clockwise direction towards the abutment 14 and thereafter released, the selector dial 12 moving back from the abutment or dialed (datum) position towards its normal at rest position operates the pulse generator 10 to generate a pulse sequence composed of a plurality of d.c. voltage pulses. For example, if the number 3 is chosen, the pulse sequence is composed of three pulses at equally spaced intervals, for example, of a 100 ms duration. Choice of the number combination 342 produces the pulse sequence shown in FIG. 2 on the base A₀. The d.c. voltage pulses are converted into alternating voltage pulses by a transformer 16 connected to pulse generator 10 and these are recorded on a magnetic foil 20 mounted on a rotary plate 22 by means of a recording head 18. The plate 22 is rotatably driven by an electric motor M through a drive train 24, which has only been diagrammatically depicted, connecting the drive shaft of the motor M with the rotary shaft 22a of the plate 22.

The motor M is energized by a battery B through a switch circuit Sw. A control circuit St is coupled to the pulse generator 10 and with circuit Sw in such a way that when a first pulse is received from the pulse generator 10, the control circuit St closes the control circuit Sw and holds it closed until a predetermined constant period of time has elapsed following the last pulse of the pulse sequence. Only then is the switch circuit Sw opened again. Thus, it is advantageous that the magnetic foil 20 is driven by motor M only so long as a pulse sequence is being recorded and thereafter a selected time delay period is imposed.

FIG. 3 illustrates the components of a control circuit St of this character which functions as a mono-flop arrangement which can be triggered several times during its operation and having a characteristic similar to a monostable multivibrator. This circuit St is coupled to the pulse emitter 10 through terminals K1 and K2. The time delay RC circuit of the connection is defined by the adjustable resistance 26 and condenser 28 which can be short circuited and discharged through a transistor 30 which functions as a switch. A pair of resistors 32 and 34 define a trigger circuit having regenerative bistable characteristic as does a Schmitt trigger, while another transistor 36 defines the switch Sw for the circuit controlling the motor M. More specifically, a pair of series connected resistors 38 and 40 are connected between the terminals K1 and K2 to define a voltage divider. The base electrode of the transistor 30 is connected to a junction between the resistors 38 and 40. The emitter electrode of the transistor 30 is connected to the terminal K2 through a line 39. The collector

electrode of transistor 30 is connected through a resistor 42 to a junction point 41. The condenser 28 is connected between the junction point 41 and the line 39. A variable resistor 26 is connected through line 43 to the positive terminal of a battery B. The negative terminal of the battery B is connected to the line 39.

The trigger circuit 33 including the transistors 32 and 34 is arranged so that the base electrode of the transistor 32 is connected to the junction point 41. The collector electrode of the transistor 32 is connected to the line 43 through a resistor 44 and to the base electrode of the transistor 34. The collector electrode of the transistor 34 is connected through a resistor 46 to the line 43. The emitter electrodes of both transistors 32 and 34 are connected through a resistor 48 to the line 39 and through a resistor 50 to the base electrode of the transistor 36. The emitter electrode of the transistor 36 is connected to the line 39. The motor M is connected in circuit between the line 43 and the collector electrode of the transistor 36.

OPERATION

The operation of the device embodying the invention will be described in detail hereinbelow for a better understanding of the invention.

When the switching system is at rest, the transistor 30 is nonconducting and, therefore, the transistor 36 is also nonconducting and the motor M is deenergized. When the first pulse I_{31} (see diagram A₀ in FIG. 2), produced by choosing the number 3, arrives at the base electrode of the transistor 30, the latter becomes temporarily conductive so enabling the condenser 28 to discharge therethrough (diagram B₀). The transistor 36 is rendered conductive by the trigger circuit 33 so that the circuit of the motor M becomes energized and starts to rotate the plate 22 (diagram C₀). The pulses I_{32} and I_{33} , subsequently received, prevent the recharging of condenser 28 and the motor continues to operate to rotate the plate 22. It is only after a predetermined time interval t_v , determined by the RC circuit, after the end of the final pulse I_{33} of this first sequence that the condenser 28 is charged to its break voltage and the trigger circuit 33 flops over and transistor 36 is rendered nonconductive again. Motor M then becomes deenergized. The duration of t_v is appreciably longer than the period of time between each of the pulses I_{31} , I_{32} , I_{33} or I_{41} , I_{42} ... etc.

The choice of the number 4 and then 2 will effect a repeat of the above procedure because the further pulse sequences produce in analogous fashion like pulses I_{41} ... I_{44} and I_{21} ... I_{22} , respectively. It is here to be noted that the time interval t_{34} (between the end of the pulse I_{33} and the commencement of pulse I_{41}) is not equal to the interval t_{42} (between the end of pulse I_{44} and the commencement of pulse I_{21}). This peculiarity arises from the fact that the lengths of travel of the selector dial 12 to the abutment position (at 14) are different. The difference in the intervals t_{34} and t_{42} is also influenced by the question of whether the selector dial 12 is released quickly after it has been drawn to the dialed (datum) position or whether it is so released only after a time delay.

These deviations do not however in any way influence the intervals between the pulses recorded on the magnetic foil 20 (diagram D₀) because the various idle times (t_{34} minus t_v or t_{42} minus t_v) are eliminated by reason of the fact that the motor M is stationary in the re-

ording sequence D₀. The intervals t_x between the recorded pulse sequences i_{31} ... i_{33} , i_{41} ... i_{44} and i_{21} ... i_{22} are here always constant.

A fast rotation motor is used as the drive motor M, so that the reception of the first pulse can follow almost instantaneously the commencement of movement of the storage means 20.

Finally it is pointed out that the invention is not to be limited to a use in the embodiment illustrated dealing with recording on a magnetic foil. The principle of the invention, namely the exclusion of idle times during pulse recording, can be used in a similar way in connection with other forms of storage means, for example, in relation to photo-electric recording.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A signal recording arrangement for recording signals from an actuating device which passes through different datum positions, comprising:

electrical signal storage means;

an electric motor for driving said storage means;

pulse generator means responsive to said actuating device for producing electrical pulses or pulse sequences, said pulses being transmitted to said storage means by means of a recording member;

means defining a capacitor charging circuit including a chargeable capacitor and energy source means for energizing said capacitor charging circuit and charging said chargeable capacitor to a fully charged condition prior to the generation of said electrical pulses or pulse sequences;

means defining a discharge circuit for discharging said capacitor, said discharge circuit means being responsive to said electrical pulses or pulse sequences from said pulse generator means to effect a discharge of said capacitor immediately upon receipt;

regenerative bistable circuit means normally in one of two conditions and producing a first output signal in response to a discharge of said capacitor caused by a change of condition of said regenerative bistable circuit means to the other condition, said regenerative bistable circuit means being also responsive to a charging of said capacitor to return said regenerative bistable circuit means to said one condition to effect a generation of a second output signal; and

switching means connected to said motor and adapted to effect a control on the energization of said motor, said switching means being responsive to said first and second output signals from said regenerative bistable circuit means to turn said motor completely on and completely off, the time period for charging said capacitor determining a constant time interval between two different pulses or series of pulses in said storage means.

2. The improvement according to claim 1, wherein said switching means comprises a transistor connected in circuit with said electric motor, said regenerative bistable circuit means effecting a control on said transistor by rendering it alternately completely conductive and completely nonconductive, said regenerative bistable circuit means including an adjustable time delay period.

3. The improvement according to claim 1, wherein said pulse sequences identify a specific number or spe-

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cific combination of numbers, for example telephone numbers on an automatic telephone number selecting appliance; and

wherein said actuating device in the form of a digit dial of a telephone set and, when it moves back from the dialed position into the at rest position, causes the pulse generator portion of said pulse generator means to produce a series of pulses at regular intervals and of a number corresponding to the selected digit.

4. A signal recording arrangement according to claim 1, wherein said electrical signal storage means includes

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a signal storage device and support means for supporting said signal storage device for rotation; and wherein said electric motor is adapted to drive said storage means for rotation.

5. A signal recording arrangement according to claim 1, wherein said capacitor discharge circuit means includes a transistor, the collector-emitter path of which is connected in parallel therewith, the base electrode thereof being responsive to said electrical pulses or pulse sequences from said pulse generator means.

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