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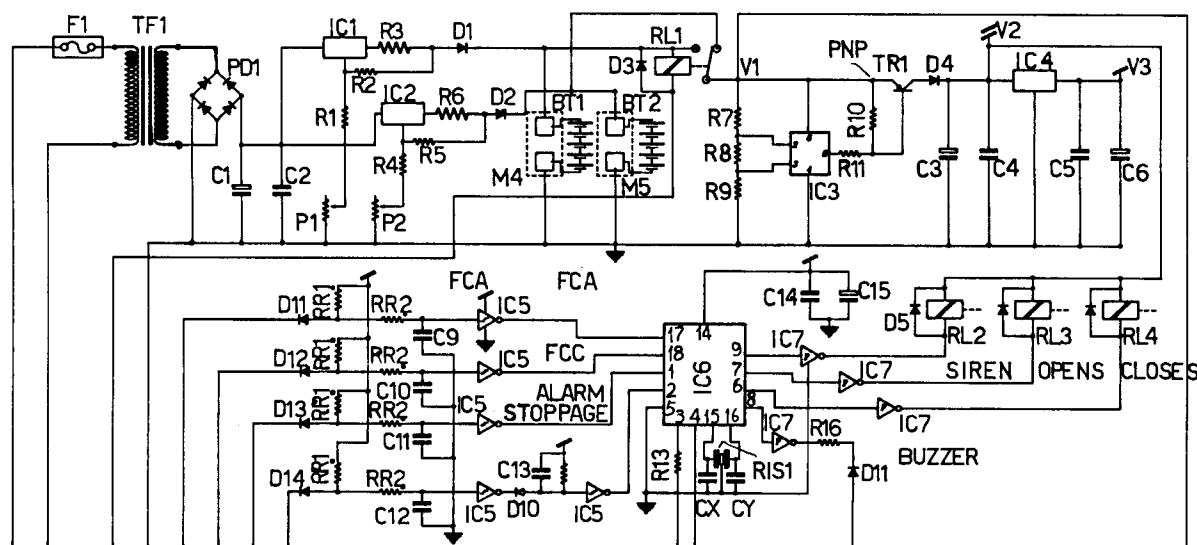
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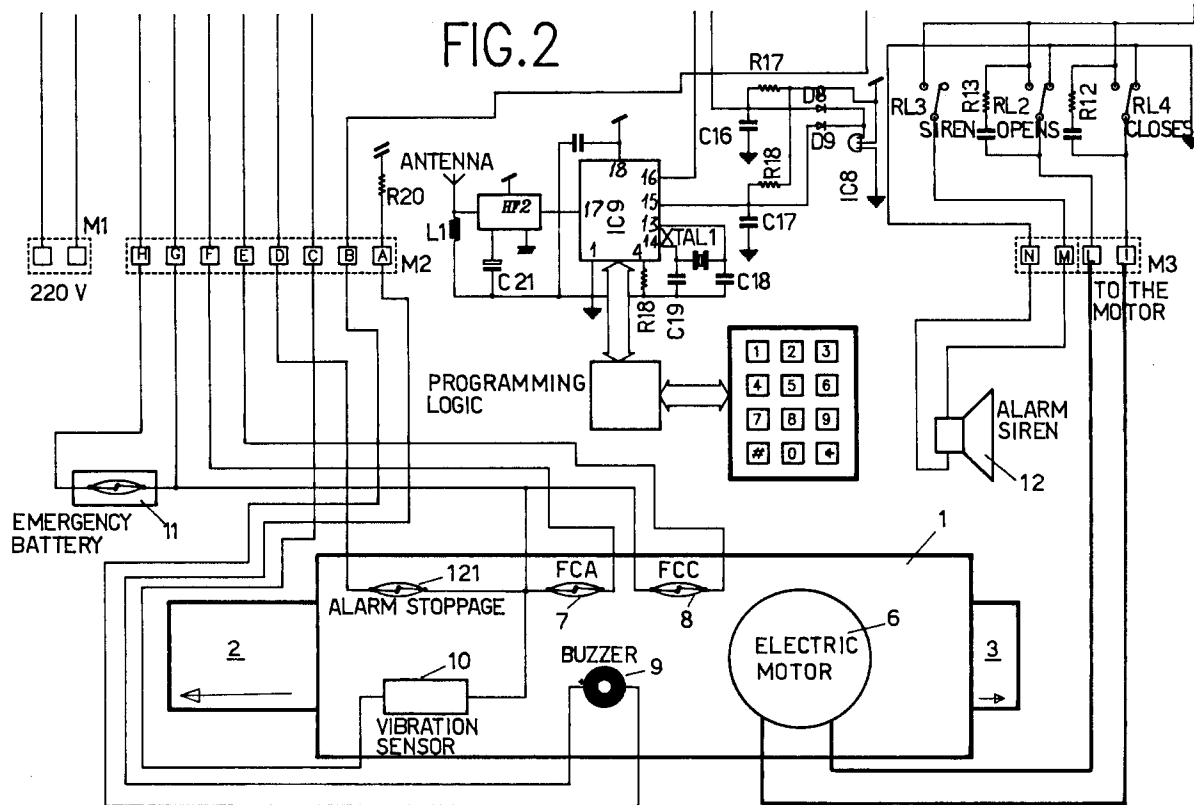
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(54) **Control system for locks.**

(57) A lock control system of the type comprising lock operating means governed by an electrical actuator (6) controlled by an electronic circuit incorporating a receiver (HF2) for encoded radio-frequency signals emitted by a portable transmitter (HF1) comprises a first microprocessor (IC6) activated by a second microprocessor (IC9) programmed to decode and compare the encoded radio-frequency signal and to activate said first microprocessor on recognizing said encoded signal, said first microprocessor, once activated, being arranged to process data received from magnetic sensors (7,8) sensing when the lock is completely unlocked and completely locked and to cause the electrical actuator to operate in one direction or the other.

**FIG.1****EP 0 598 430 A1**



This invention relates generally to fastening systems, and in particular to a double bolt lock for use in one- or two-leaf residential access doors.

Said lock consists of two parallel bolts arranged to slide symmetrically into a locked position in which they project from the sides of the lock, and into a neutral or unlocked position in which they are retracted towards the lock centre.

They are operated by a central pinion which simultaneously engages in two opposing facing racks each provided on a respective bolt.

The pinion is operated by an electric motor, which can rotate in the two directions to cause the bolts to extend and retract.

The pinion can obviously also be operated by a linear actuator via a suitable transmission.

The object of the present invention is to control the unlocking and locking of the lock.

A further object is to provide a tamper-proof control system.

A further object is to provide such a control system with suitable safety and alarm devices.

These and further objects are attained by the control system defined in the claims.

The system uses a key consisting of encoded pulses transmitted in radio-frequency.

This eliminates the need for material access to the lock from the outside of the door, which is perfectly smooth and gives no indication of the position of the lock on the other side of the door. The possibility of obtaining casts or the like and of using counterfeit keys is automatically excluded.

It comprises an electronic circuit with a power section maintaining at least one dry battery charged to provide the energy necessary to power the motor which operates the lock, and to power an alarm siren.

The unlocking, locking and alarm commands are fed by a first microprocessor which processes the data received from the devices installed on the lock, and the data received from a second microprocessor which decodes the radio-frequency signals.

These latter are transmitted by the person who wishes to open the door, and after they have been received by a radio-frequency receiver they are decoded by said second microprocessor which feeds the unlocking or locking input to said first microprocessor.

The first microprocessor also receives the signals emitted by a vibration sensor, which causes the alarm to operate if tampering attempts are made.

In addition the programming of said first microprocessor is such that the alarm trips automatically to operate the siren if it is not deactivated within a short time after opening the door.

The second microprocessor has its own access code which enables the user, via a keyboard, to enter programming mode enabling him to key-in the recognition codes for new remote commands or to cancel already stored codes relative to remote commands no longer in use.

It is programmed such as to automatically vary its recognition code at each radio-frequency signal received.

Said code variation also takes place automatically in the transmitter operated by the user, in accordance with the same calculation algorithm.

The invention will be apparent from the detailed description given hereinafter by way of non-limiting example with reference to the figures of the accompanying drawings, which show a preferred but not exclusive embodiment thereof.

Figure 1 shows part of the electronic circuit of the fixed part of the invention.

Figure 2 is a schematic diagram showing the lock provided with the invention plus the other part of the electronic circuit of Figure 1.

Figure 3 is a schematic diagram of the radiotransmitter.

Figure 1 shows a steel casing 1 to be fixed to the inside of a door by way of a rear steel plate. It receives two slidable bolts 2 and 3, on each of which there is provided a rack portion, not shown. The two rack portions are faced and engaged by the same central pinion connected to the shaft of a direct current electric motor 6.

One of the two bolts is provided with two limit switches, 7-FCA for unlocking and 8-FCC for locking, they being of adjustable magnetic type.

A buzzer 9, a vibration sensor 10, an emergency battery 11 and an alarm siren 12 with the relative alarm stoppage control 121 are fixed to the door in proximity to the casing 1.

All said devices are connected to two terminal blocks M2 (A-H) and M3 (I-N) in accordance with the scheme of Figures 1 and 2.

The operation of the said devices is controlled by the electronic circuit shown in Figures 1 and 2.

Said circuit comprises a power unit connected to the 220V alternating current mains to provide a 12V pulsating current via the transformer TF1 and the diode bridge PD1.

Two 12V dry batteries, connected in parallel and isolated from each other by the relay RL1, are kept charged by the mains current transformed as stated, to provide energy to the system.

The relay RL1 is operated by moving a magnet towards the outer surface of the door in a position corresponding to a reed switch, not shown in the figures, located on the inside of the door.

5 More specifically, the two batteries are charged by the circuit composed of IC1-R3-R2-R1-P1-D1 in the case of the emergency battery and the circuit composed of IC2-R6-R5-R4-P2-D2 in the case of the working battery.

10 The pulsating voltage originating from PD1 and filtered by the capacitors C1-C2 is applied to the integrators IC1 and IC2. The charging voltage is set by the trimmers P1-P2, the maximum current being limited by R3 and R6.

Downstream of the relay RL1 there is a voltage V1 which under the control of the relays RL2, RL3 and RL4 operates the electric motor 6 both for unlocking and locking, and the alarm siren 12.

15 The circuit composed of the resistors R7, R8, R9, the integrated circuit IC3, the resistors R10 and R11, the PNP transistor TR1, the diode D4, the stabilizer IC4 and the capacitors C3, C4, C5 and C6 provides two voltages V2 and V3 which power that part of the circuit operating the relays RL2, RL3 and RL4 and other system accessories, as will be apparent hereinafter.

Specifically, the purpose of the circuit composed of R7-R8-R9-R10-R11-IC3-PNP TR1-D4 is to interrupt power and hence halt current absorption from the batteries if the voltage falls below a threshold value. This circuit protects the batteries.

20 This latter circuit part comprises a first microprocessor IC6 which receives signals from the unlocking limit switch 7-FCA, from the locking limit switch 8-FCC and from the vibration receiver 10. Each input of the microprocessor IC6 is protected and filtered against overvoltages and disturbances of the circuit composed of D11-RR1-RR2-C9 etc.

The oscillating circuit of IC6 is composed of RIS1-CK-CY.

25 The received signals are processed by IC6 and fed via the integrated circuits IC7 to the relays RL2, RL3 and RL4.

A further signal is fed to the buzzer 9 via a further integrated circuit IC7, the resistor R16 and the diode D11.

The microprocessor is powered by the voltage V3 via a circuit composed of C14 and C15.

30 It is programmed such that when activated as described hereinafter it causes the bolts 3 to extend or retract by means of the motor 6.

IC6 also activates the buzzer 9 for the time during which the motor is in operation.

35 If within a predetermined time after operation of the unlocking limit switch 7-FCA the control 121 for stopping the alarm is not operated manually, the microprocessor IC6 causes the siren 12 to operate via the relay RL2.

The first microprocessor IC6 is activated by the second microprocessor IC9, the oscillator of which is composed of XTAL1-C19-C18. This latter is connected to a radio-frequency signal receiver HF2 which receives signals from the remote controller HF1 (Figure 3).

40 This transmitter for unlocking and locking the electrical lock (see Figure 3) comprises a high frequency part and a logic part which generates a recognition code. The high frequency part consists of a stabilized oscillator, a resonator SAW 1 which stabilizes the operating frequency, and a logic switch TR101 which switches the oscillator on and off. The transmission system is therefore of the carrier suppression type. The purpose of the microprocessor IC20 is to generate the recognition code and to calculate, by an algorithm identical to that of the receiver, the value of the new code which always changes at each transmission. The transmitter is able to generate four different code calculations and to control four different receivers. The appropriate code is generated by the microprocessor IC20 which identifies which of the four pushbuttons (PS1..PS4) has been activated. The power is generated by two lithium button batteries BT10, BT20 of 3V each, connected in series to provide a total voltage of 6V.

50 The remote controller HF1 emits its own recognition code, comprising a fixed identification code and a variable identification code which changes automatically on each operation of the remote controller. The microprocessor IC9 can be programmed by the user to recognize different codes.

The complete electronic scheme of Figures 1, 2 and 3 together with the data of the following table make a more detailed description superfluous for the expert of the art.

TABLE

	TRANSFORMER	TF1	L2
5	FUSE	F1	1A

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	TERMINAL BLOCK	M1	2 POLE
	DIODE BRIDGE	PD1	WL005
5	ELECTROLYTIC CAPACITOR	C1	1000 μ F 35V
	CAPACITOR	C2	0.1 μ F
	STABILIZER	IC1	LM317
	STABILIZER	IC2	LM317
10	RESISTOR	R1	1K
	RESISTOR	R2	270 OHM
	RESISTOR	R3	0.47 OHM 3W
	POTENTIOMETER	P1	2K2
15	RESISTOR	R4	1K
	RESISTOR	R5	270 OHM
	RESISTOR	R6	0.47 OHM 3W
20	POTENTIOMETER	P2	2K2
	1A DIODE	D1	1N4004
	1A DIODE	D2	1N4004
	BATTERY	BT1	12V
25	BATTERY	BT2	12V
	RELAY	RL1	012-Z-1
	1A DIODE	D3	1N4004
30	RESISTOR	R7	470K
	RESISTOR	R8	4M7
	RESISTOR	R9	680K
	INTEGRATED CIRCUIT	IC3	MAX8212
35	RESISTOR	R10	22K
	RESISTOR	R11	22K
	PNP TRANSISTOR	TR1	BC327
	1A DIODE	D4	1N4004
40	ELECTROLYTIC CAPACITOR	C3	100 μ F
	CAPACITOR	C4	0.1 μ F
	STABILIZER	IC4	78L05
45	CAPACITOR	C5	0.1 μ F
	ELECTROLYTIC CAPACITOR	C6	47 μ F
	RESISTOR	R12	150 OHM
	RESISTOR	R13	150 OHM
50	CAPACITOR	C7	0.1 μ F
	CAPACITOR	C8	0.1 μ F

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	TERMINAL BLOCK	M3	4 POLE
	RELAY	RL4	012-Z-1
5	RELAY	RL3	012-Z-1
	RELAY	RL2	SRU
	1A DIODE	D7	1N4004
	1A DIODE	D6	1N4004
10	1A DIODE	D5	1N4004
	TERMINAL BLOCK	M2	8 POLE
	1A DIODE	D11	1N4004
	1A DIODE	D12	1N4004
15	1A DIODE	D13	1N4004
	1A DIODE	D14	1N4004
	RESISTIVE NETWORK	RR1	4X472
20	RESISTIVE NETWORK	RR2	4Y470K
	CAPACITOR	C9	0.1 μ F
	CAPACITOR	C10	0.1 μ F
	CAPACITOR	C11	0.1 μ F
25	CAPACITOR	C12	0.1 μ F
	INTEGRATED CIRCUIT	IC5	40106
	DIODE	D10	1N4148
	CAPACITOR	C13	0.1 μ F
30	RESISTOR	R14	47K
	MICROPROCESSOR	IC6	PIC16C54XT
	CAPACITOR	C14	0.1 μ F
35	ELECTROLYTIC CAPACITOR	C15	47 μ F
	RESONATOR	RIS1	500K
	CAPACITOR	CX	
	CAPACITOR	CY	
40	INTEGRATED CIRCUIT	IC7	L203
	RESISTOR	R16	1K
	1A DIODE	D11	1N4004
	RESISTOR	R15	4K7
45	INTEGRATED CIRCUIT	IC8	34064
	DIODE	D8	1N4148
	DIODE	D9	1N4148
50	RESISTOR	R17	470K
	CAPACITOR	C16	0.1 μ F

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	CAPACITOR	C17	0.1 μ F
	RESISTOR	R18	470k
5	MICROPROCESSOR	IC9	R31010DWA
	CAPACITOR	C20	0.1 μ F
	RESISTOR	R19	10K
	QUARTZ CRYSTAL	XTAL1	4.00M
10	CAPACITOR	C19	39 pF
	CAPACITOR	C18	39 pF
	HIGH FREQUENCY COUPLING	HF2	306 MHz
15	ELECTROLYTIC CAPACITOR	C21	10 μ F
	AIR-WOUND COIL	L1	W.COIL
	ANTENNA WIRE	ANT.	30 CM
20	TERMINAL BLOCK	M4	2 POLE
	TERMINAL BLOCK	M5	2 POLE
	RESISTOR	R20	1K
	LITHIUM BATTERY	BT10	3V
25	LITHIUM BATTERY	BT20	3V
	DIODE	D101	BAV56
	DIODE	D102	BAV56
30	DIODE	D103	BAV70
	DIODE	D104	BAV56
	DIODE	D105	BAW99
35	OSCILLATOR	XTAL100	4 MHz
	SURFACE-WAVE OSCILLATOR	SAW1	306 MHz
	RESISTOR	R101	10K
	RESISTOR	R102	100K
40	RESISTOR	R103	5K6
	CAPACITOR	C101	100 μ F
	TRANSISTOR	TR101	BC847
45	MICROPROCESSOR	IC20	424648

The invention is not limited to the foregoing particular description, and modifications and improvements can be made thereto without leaving the scope of protection of the following claims.

Claims

1. A lock control system of the type comprising lock operating means governed by an electrical actuator controlled by an electronic circuit comprising a receiver for encoded radio-frequency signals emitted by a portable transmitter, characterised by comprising a first microprocessor activated by a second microprocessor programmed to decode and compare the encoded radio-frequency signal and to activate said first microprocessor on recognizing said encoded signal, said first microprocessor, once activated, being arranged to process data received from magnetic sensors sensing when the lock is

completely unlocked and completely locked and to cause the electrical actuator to operate in one direction or the other.

2. A system as claimed in claim 1, characterised in that said first microprocessor is always activated to
5 cause an alarm siren to operate in response to the pulse of a vibration sensor positioned on the door on which the lock is mounted.

3. A system as claimed in claim 1, characterised by comprising a power circuit consisting of a
10 transformer, a diode rectifier bridge, at least one dry battery providing the energy for the entire system, and at least one normally disconnected emergency battery able to unlock the lock if the dry battery is spent, and connectable to the system by approaching with a magnet a suitable operator (reed switch) positioned on the inside of the door.

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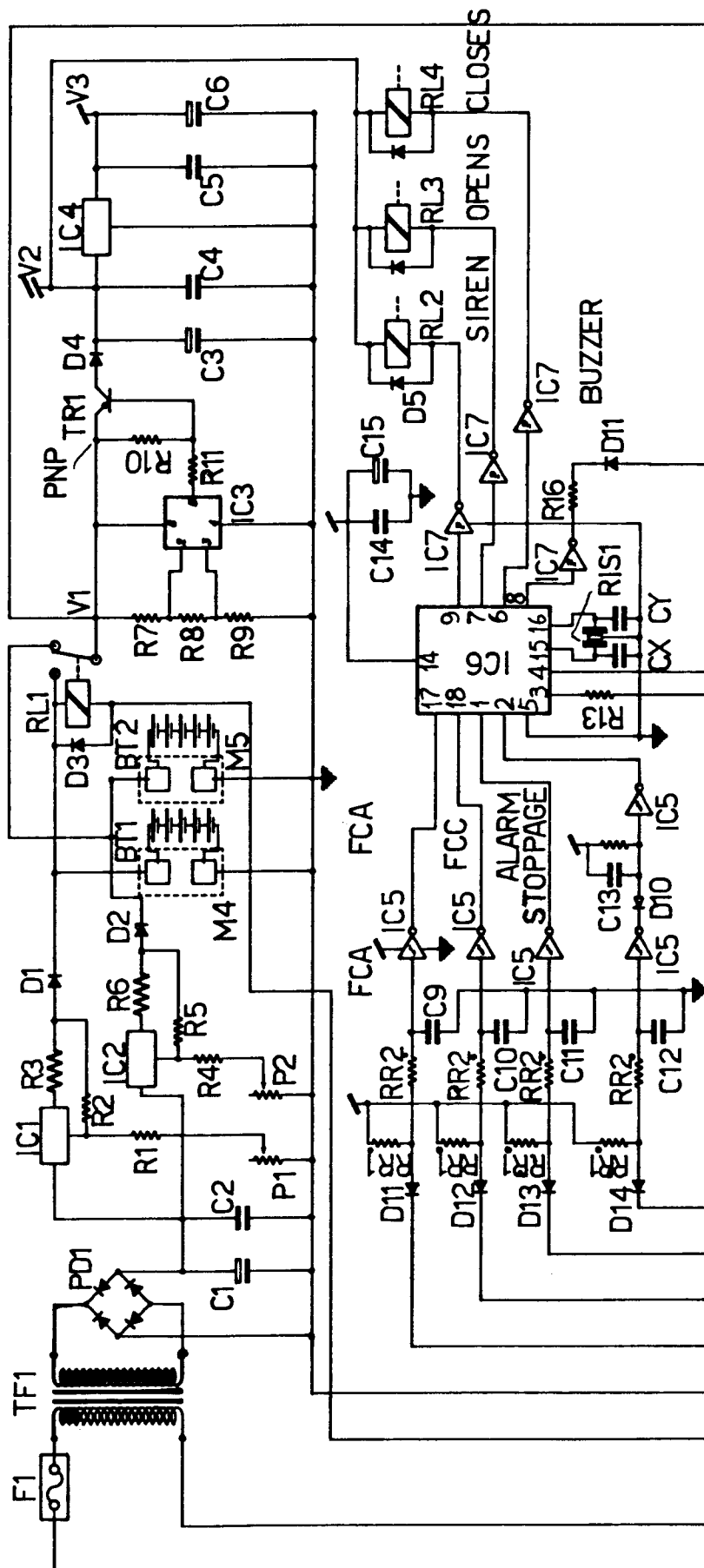
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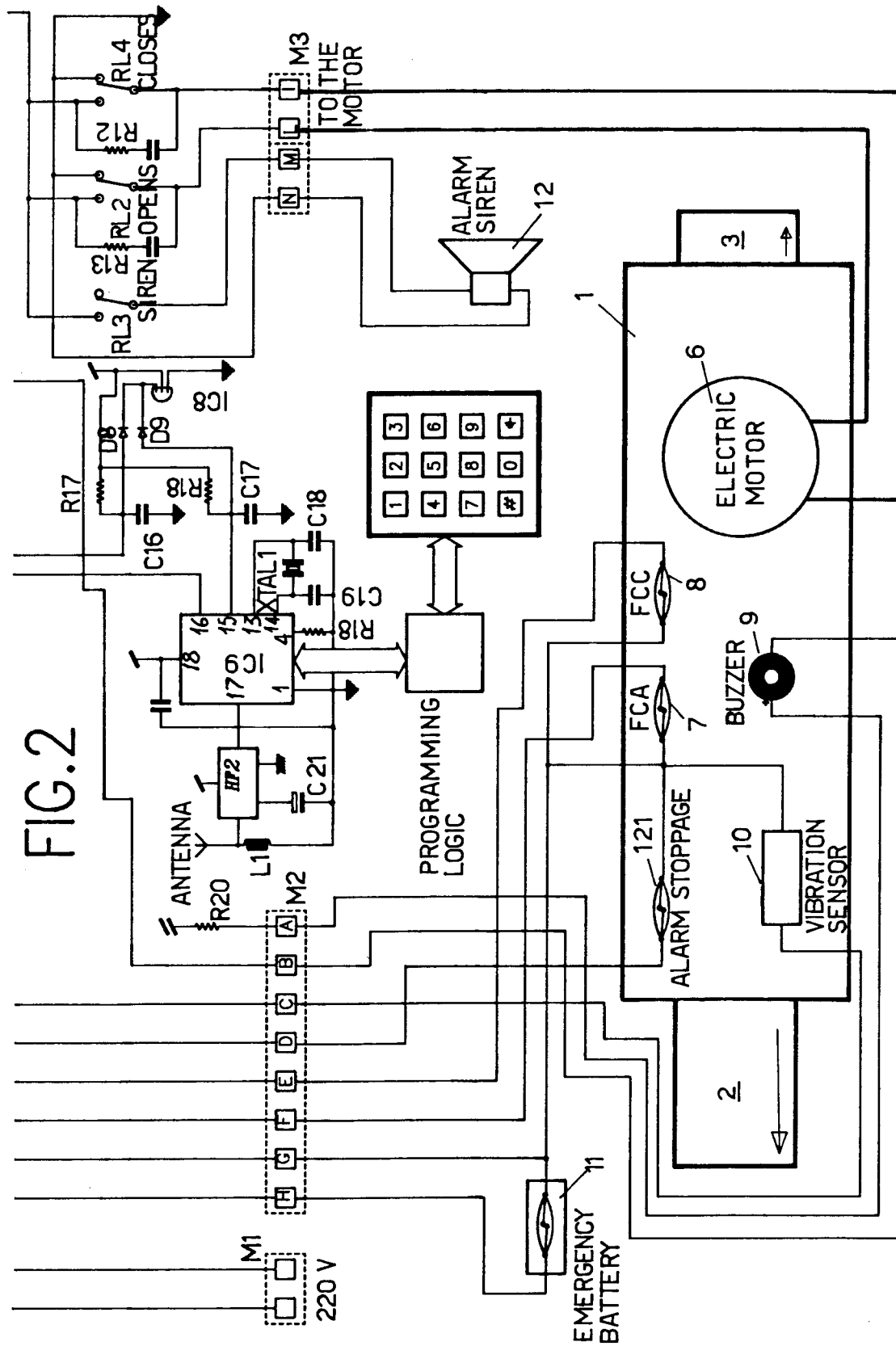
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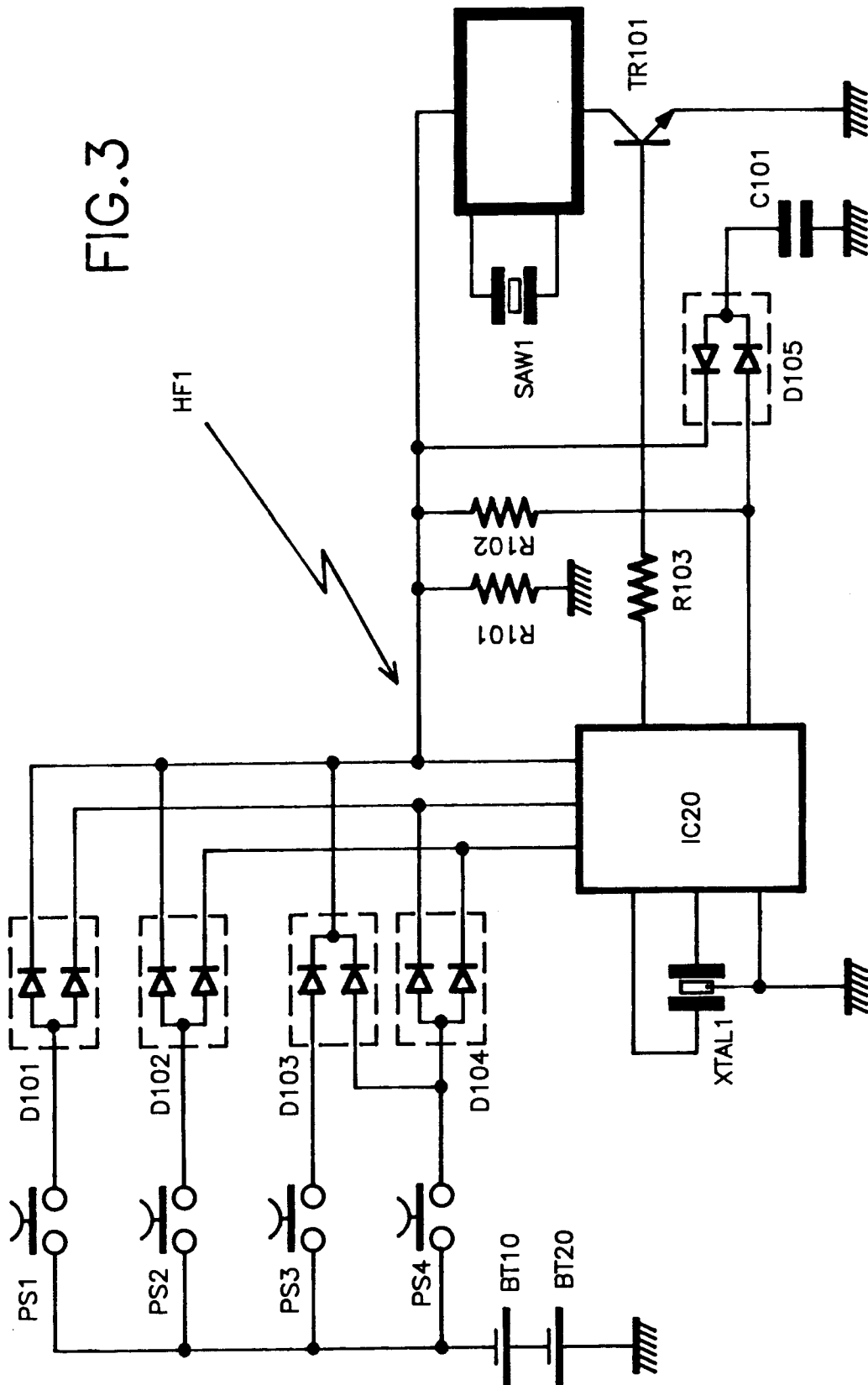
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EUROPEAN SEARCH REPORT

Application Number
EP 93 20 3079

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	US-A-4 744 021 (KRISTY) * column 3, line 50 - column 5, line 25; figures 1-3 *	1	E05B49/00

A	US-A-5 113 182 (SUMAN,ZEINSTRA) * column 3, line 10 - column 7, line 30; figures 1-4 *	1,2	

A	EP-A-0 202 146 (FERCO INTERNATIONAL) * page 3, line 30 - page 4, line 15; figure 1 *	2	

A	DE-A-34 21 540 (FORNOFF,ROSSIE,HEUWIESER,SARNEZKI) * page 6, line 17 - page 8, line 14; figures 1-3 *	3	

			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			E05B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 25 February 1994	Examiner Herbelet, J.C.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			