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(54) Title: DIAGNOSIS DEVICE FOR DETECTING FAULTS ON PERSONAL COMPUTER

(57) Abstract

The device enables to analyze the faults of a computer allowing to detect the not operating parts of the circuit. The device consists of an electronic card (1) with analog-to-digital combined circuitry. The card communicates with the under testing electronic (3) through the control of the signals presented on the connectors of the system channel (9) and of the signals of the power connector (11). Characteristic of the device is to control the activities of the testing system with outer control of functional parts. Integrating part of the device is a portable computer (2) connected with the diagnosis card by means of serial interface (6) used for input programs on diagnosis card (1) and for display test results on own video (17) and the print on a connected printer (16). The device is foreseen with separate power (8) to have a proper operation and also to allow the detection of troubles on the system power supply (10).

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+ DESIGNATIONS OF "SU"

Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

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"DIAGNOSIS DEVICE FOR DETECTING FAULTS ON PERSONAL COMPUTER".

The invention relates to a device used for speedy location of bugs of the host system electronic; the device is also used for a precise control of operating systems. Considering the necessity of flexibility of the tests execution and of a clear and immediate interface for the staff operating the controls, the device (fig. 1) consists of the electronic card 1 with the control circuitry and of a portable computer 2 which supplys the sequences of the test programmes to the diagnosis card 1 and presents to the operator the message on video 17 or printed by printer 16.

The portable computer 2 is connected to the diagnosis card 1 through a serial interface which respects the electric levels and what requested by standard V24 and which, on card 1, is carried out with the circuitry 6. Through the interface 6 and checked by unit 4, are charged on memory 15 the diagnosis programs which exercise the functional blocks 12 of the system 3 under diagnosis. Still through the interface 6, the diagnosis card 1 communicates to the portable computer 2 the results carried out on the functional blocks 12 of the host system

3. The portable computer displays on video 17 or prints on paper, by means of printer 16, such results. The diagnosis card 1 is fitted with its own power 8 in order to have a proper operation.

At the power-on of card 1, in order to control its correct functions, an autodiagnosis proceeding is performed fitted on the nonvolatile storages 14 and the result of this is transmitted to the portable computer 2. Therefore the operator can know whether the diagnosis card 1 operates correctly and, consequently go on in the diagnosis of the host system 3. In order to make an efficient control of the systems, the diagnosis card 1 is fitted on the expansion bus 9 of the host system 3 and connected with its power connector 11 so as to probe from inside of the same host system 3 its functional blocks 12 and its power supply 10. The diagnosis device is carried out to perform controls both on functional blocks 12 and on power supply 10 of the system 3 under test. The structure of card 1 carries out, with two separate circuitries 5 and 7, two different tasks. The logic interface 5 controls the communication channel 9 with the host system 3 through the control signals of that channel. Activating the functional blocks 12 it picks up the functional anomalies if any. The results of the controls on the functional blocks 12 are collected by the control unit 4 which transmits them, through the serial interface 6, to the portable computer 2.

As not limiting example are described two preferred acquires activity control of the host system 3 from the diagnosis card 1 with possible selection by the operator. In the first case it is described the acquisition and the control of a channel the architecture of which has become a standard for the manufacturers, introduced by IBM with words AT. The diagnosis circuitry

1, through the interface 5, creates again all the channel functionals carrying out data, addresses and control signals. With the request for an access direct to memory and the issue of signal DMARQ from the diagnosis cards 1, the system 3 answers with the signal DACK of accepted request; after this confirmation the interface 5 activates, towards the system 3, the signal MASTER presents on the communication channel 9. On this signal, the processor of the host system 3 puts itself in HOLD giving up the control of the communication channel 9 which is acquired by the diagnosis card 1. At this point the diagnosis card 1 can start with the host system 3 diagnosis. In the second case, the diagnosis card 1 acquires the control of the host system 3 activity without taking the control of the communication channel 9. The electronic of the host system 3 under test is blocked through the RESET signal of the diagnosis card 1 inserted on the connectors of the communication channel 9. After having completed its own diagnosis and communicated the results to the portable computer 2, the diagnosis card 1 unblocks the electronic of system 3 taking off the RESET signal from the mother board 29 allowing to the system electronic to start. It is supposed that the host system 3 to be equipped with a base program compatible with the IBM AT standard. This standard foresees that, at the end of the RESET signal, the power on diagnostic is carried out and, therefore, the presence of external devices is controlled by scanning the memory addresses assigned to the program memories of optional devices. These program memories are identified by a specific initial code. When the base program of the host system recognizes one of these program memories, it gives up the control to allow the execution of preset programs of the optional device. In this case the diagnosis card 1 presents itself to the host system 3 as an optional device fitted with the program memory 14. At the end of the power on diagnostic of the host system

3, if no troubles occurs which requires to replace the mother board 29, the ROM 14 presents on diagnosis card 1 is recognized. Due the architecture of the AT systems is executed the code program resident on the ROM 14 considered by the system 3 as optional memory which is temporarily replacing the program memories present on the system 3 called BIOS (Basic I/O System). The diagnosis card 1 supervises the control of the system 3 activities by executing the tests residing on its ROM 14 acting as a supervisor of the tests of the functional blocks 12, the results of which are sent through the serial interface 6 to the portable computer 2. The analog interface 7 is applied for the control of the system power supply 10 of host system 3. The analog acquisition circuitry 7 through the power connector 11 read the voltages generated by the power supply 10 and operates with analog-to-digital converters and comparators through which it controls drifts and tolerances on the power supply, both during the operation and at power on / power off. The analog acquisition circuitry 7 lays down the results of the tests on the system power supply 10 in the register 13 which the control unit 4 will read and transmit, through the serial interface 6, to the portable computer 2. The portable computer 2 gets the results concerning the tests carried out on the functional blocks 12 and on the power supply 10 of host system 3 and presents them to the operator on the video 17 and printed on paper by printer 16 by means of proper programs.

As a not limiting example is described the operative activity performed by the diagnosis board 1 to identify what cause a possible trouble on the host system 3: for the operation flow is extensively described the sequence indicated in fig. 3. It hasbeen supposed, as given in fig. 2, that the host system 3 has been built according to a standard consisting of a power

supply 10 and independents circuitries communicating the one with the other through a proper communication channel and defined fuctional blocks 12. These functional blocks, identified by the circuitries 19, 20, 21, 22, 23 and 24 reproduced in the diagram of fig. 2 and displaced on the mother board 29, supervise the communication with the peripherals 18 identified in fig. 2: keyboard 25, video unit 26, mass storage 27 and communication and print unit 28. On end is described the operative sequence of fig. 3. The analog acquisition circuitry through the connector 11 controls the operation of the power supply 10. If the test is negative, through the portable computer 2, the operator is informed that the power supply 10 must be replaced. If the test is positive, the control unit 4 through the interface channel 5 acquires the control on the host system 3. If the control of the system channel turns out impossible, the operator is informed, through a message on the monitor of the portable computer 2, about the fault on the control circuitry of the channel and that the mother board 29 must be replaced. If the acquisition of the activity control is positive, the diagnosis card 1 goes on to control the functional blocks 12. In the case of positive results which do not require replacement of the mother board 29, the keyboard 25 is tested and the operator is requested, by means of a message on the monitor 17 of the computer 2, to control the lights on the keyboard and to digitate some keys. In the case of an error is informed the operator that the keyboard 25 must be replaced. If the test is positive the diagnosis board 1 goes on testing the video 26 and the operator is still informed by means of the monitor of the computer 2; in this case are also requested answers of type YES/NO to introduce on the portable computer 2 by means of the keyboard. If the test is positive and there is no part replacement required, the diagnosis card 1 goes on testing the mass storage 27. If the tests are passed and

no replacement of parts is required are then testing the serial/parallel peripherals 28, if any, connected on the interface 21 of the under diagnosis system 3. In the case of a problem it is communicated the faulty peripheral; if no error is indicated a positive exit message with a report of the made tests is displayed on the monitor of the portable computer 2 and printed on printer 16 connected with it.

Execution version is illustrated in the tables 1, 2 and 3. In table 1 fig. 1 is the block diagram of the device. In table 2 fig. 2 is the host system architecture foreseen according to a standard structure. In table 3 fig. 3 is the operative sequence for testing the host system 3.

Claim.

1) Diagnosis device for detecting faults on personal computer, characterized by the fact that it consists of an electronic card (1), with the control circuitry, and of a portable computer (2) which supplies the sequences of the test programmes to the diagnosis card (1) and presents to the operator the message on video (17) or printed by printer (16). The portable computer (2) is connected to the diagnosis card (1) through a serial interface which respects the electric levels and what requested by standard V24 and which, on card (1),is carried out with the circuitry (6). Through the interface (6) and checked by unit (4) are charged on memory (15) the diagnosis programs which exercise the functional blocks (12) of the system (3) under diagnosis. Still through the interface (6), the diagnosis card (1) communicates to the portable computer (2) the results carried out on the functional blocks (12) of the host system (3). The portable computer (2) displays on video (17) or prints on paper, by means of printer (16), such results. The diagnosis card (1) is fitted with its own power (8) in order to have a proper operation. At the power-on of card (1), in order to control its correct functions, an autodiagnosis proceeding is performed fitted on the nonvolatile storages (14) and the result of this is transmitted to the portable computer (2). Therefore the operator can know whether the diagnosis card (1) operates correctly and, consequently go on in the diagnosis of the host system (3). In order to make an efficient control of the systems, the diagnosis card (1) is fitted on the expansion bus (9) of the host system (3) and connected with its power connector (11) so as to probe from inside of the same host system (3) its functional blocks (12) and its power supply (10). The diagnosis device is carried out to perform controls both on functional blocks (12) and on power supply (10) of the system (3) under test. The structure of card (1) carries out, with two separate circuitries (5 and 7), two different

tasks. The logic interface (5) controls the communication channel (9) with the host system (3) through the control signals of that channel. Activating the functional blocks (12) it picks up the functional anomalies if any. The results of the controls on the functional blocks (12) are collected by the control unit (4) which transmits them, through the serial interface (6), to the portable computer (2).

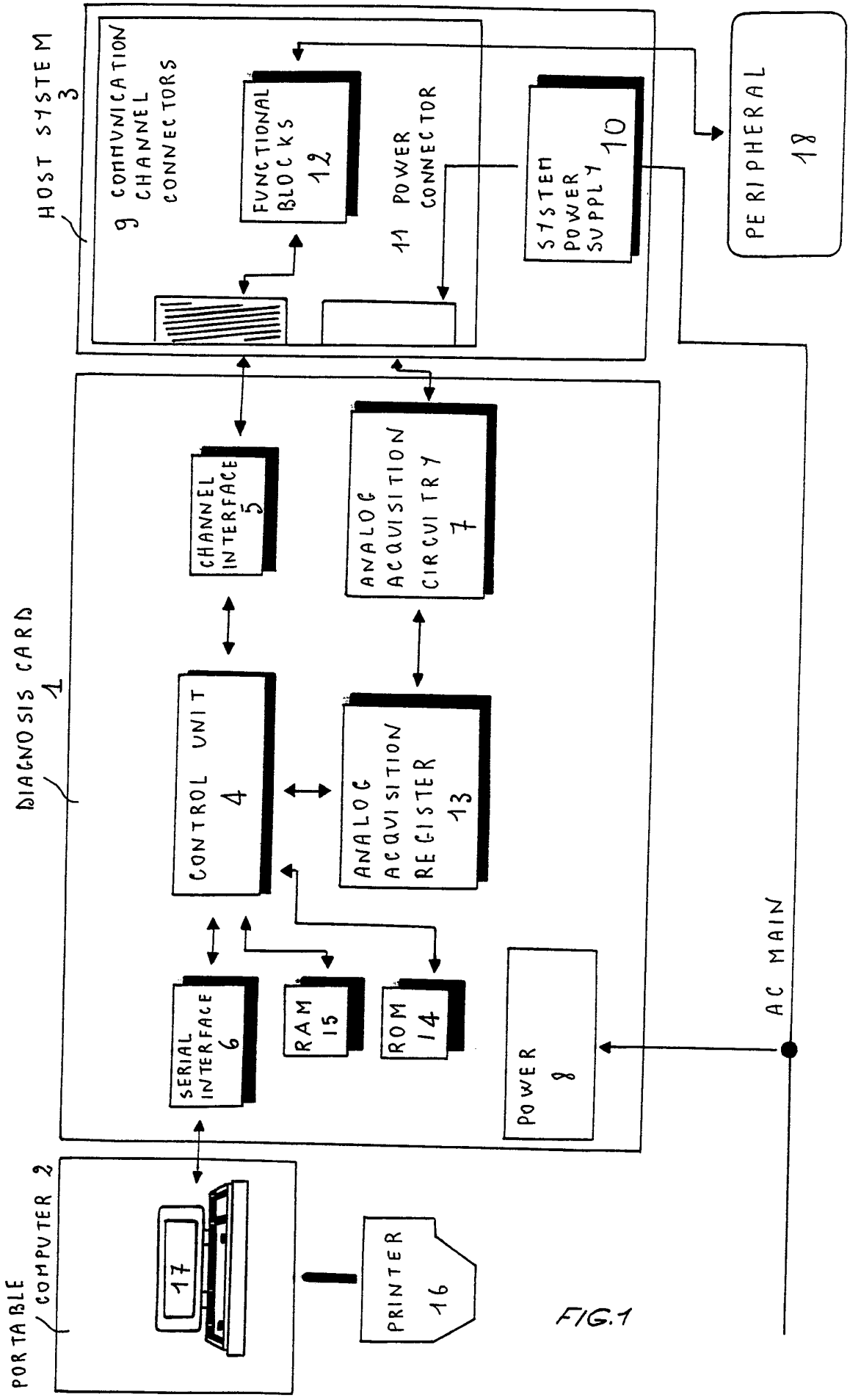
HOST SYSTEM 3
9 COMMUNICATION CHANNEL CONNECTORS
FUNCTIONAL BLOCKS 12
11 POWER CONNECTOR
SYSTEM POWER SUPPLY 10
PERIPHERAL 18
DIAGNOSIS CARD 1
CHANNEL INTERFACE 5
ANALOG ACQUISITION CIRCUITRY 7
CONTROL UNIT 4
ANALOG ACQUISITION REGISTER 13
SERIAL INTERFACE 6
RAM 15
ROM 14
POWER 8
AC MAIN
PORTABLE COMPUTER 2
17
PRINTER 16

FIG.1

HOST SYSTEM 3 ARCHITECTURE 2/3

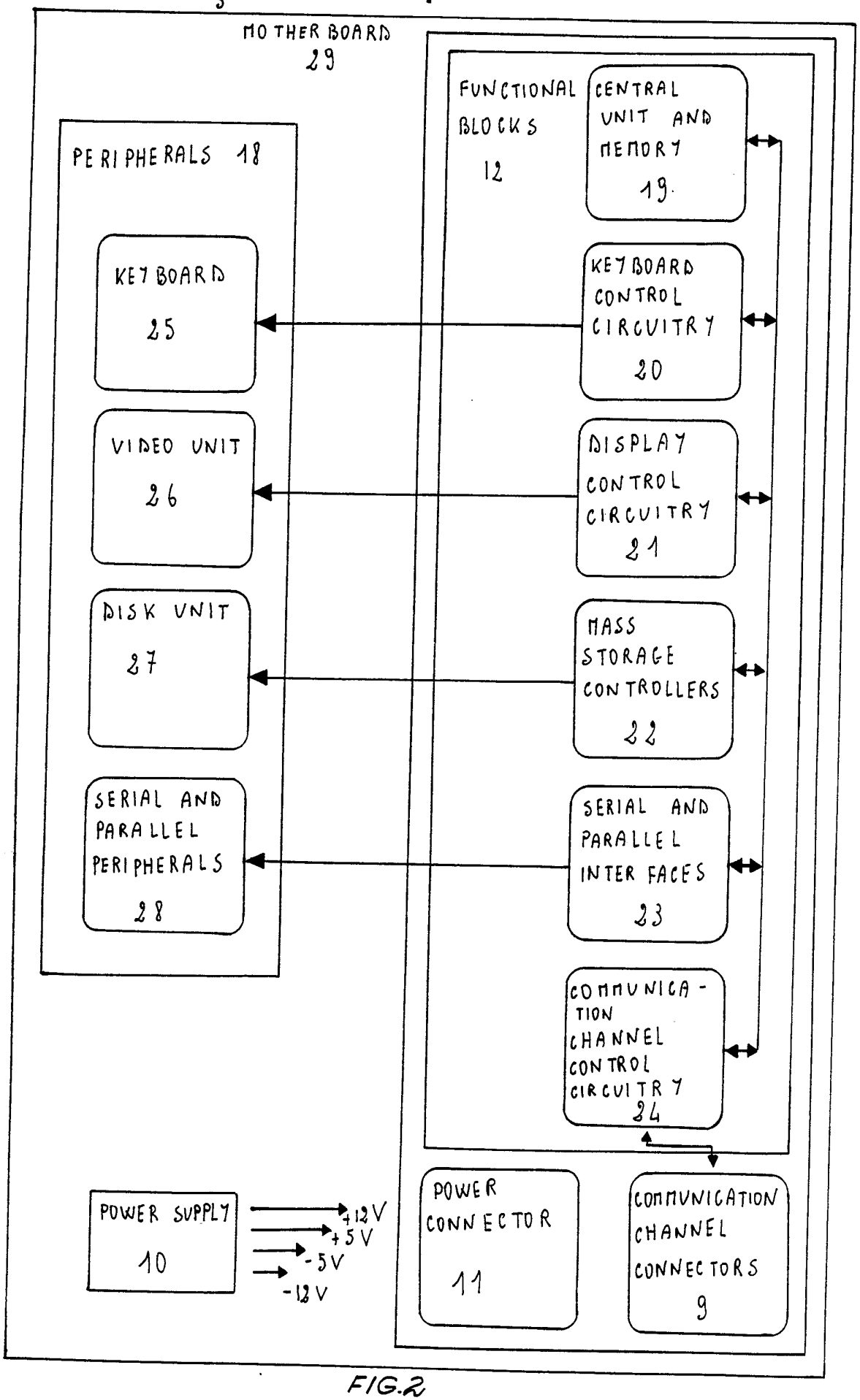

FIG.2

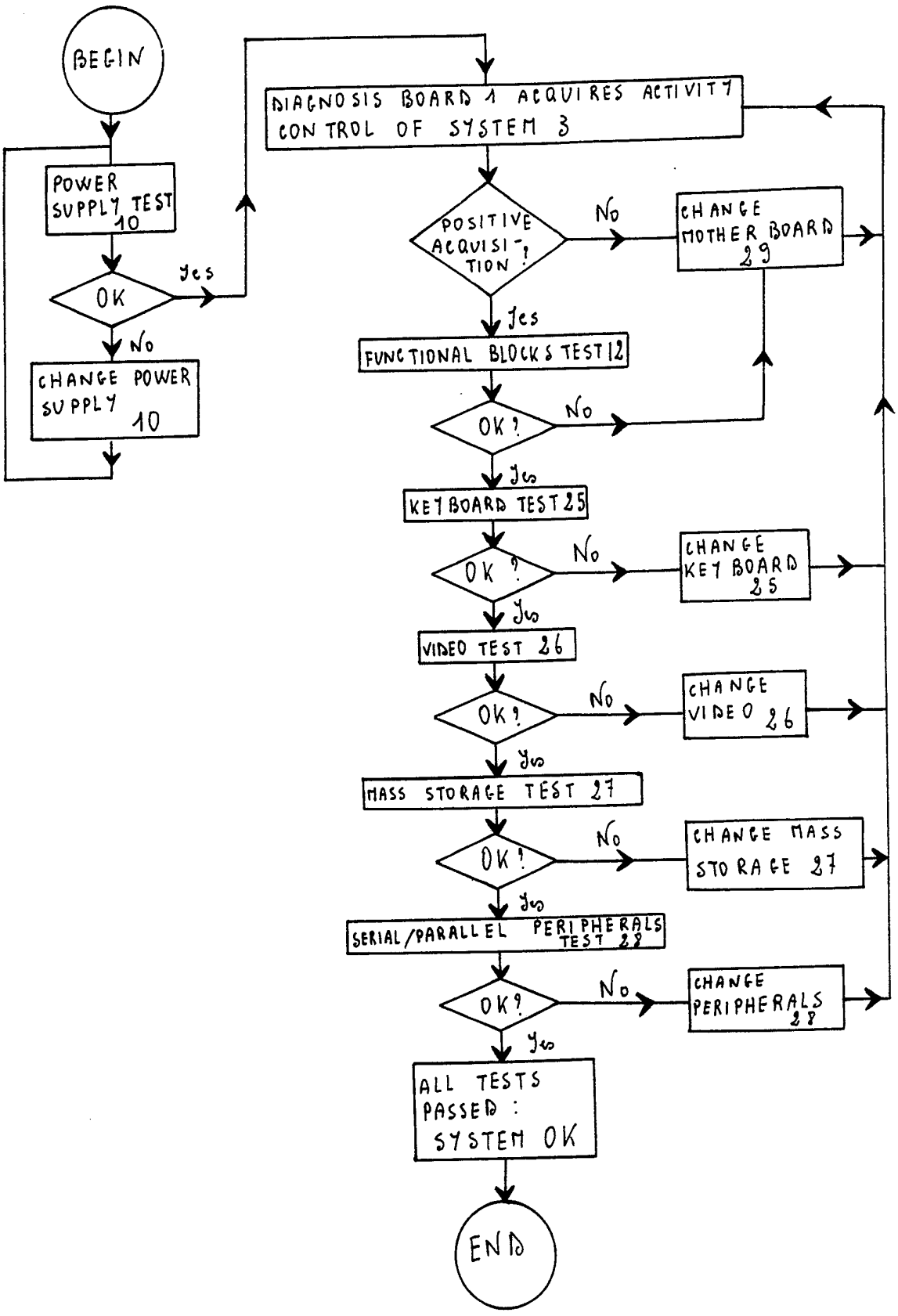
BEGIN
POWER SUPPLY TEST 10
OK
Yes
No
CHANGE POWER SUPPLY 10
DIAGNOSIS BOARD 1 ACQUIRES ACTIVITY CONTROL OF SYSTEM 3
POSITIVE ACQUISITION ?
No
CHANGE MOTHER BOARD 29
Yes
FUNCTIONAL BLOCKS TEST 12
OK ?
No
Yes
KEY BOARD TEST 25
OK ?
No
CHANGE KEY BOARD 25
Yes
VIDEO TEST 26
OK ?
No
CHANGE VIDEO 26
Yes
MASS STORAGE TEST 27
OK ?
No
CHANGE MASS STORAGE 27
Yes
SERIAL/PARALLEL PERIPHERALS TEST 28
OK ?
No
CHANGE PERIPHERALS 28
Yes
ALL TESTS PASSED : SYSTEM OK
END

FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/IT 90/00097

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[5]: G 06 F 11/22

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[5]	G 06 F

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	Electronic Design, vol. 38, no. 2, 25 January 1990, (Cleveland, OH, US) J. Campbell: "Plug-in modules bring low-cost "Teleservicing"", pages 105-106,108 see page 105, lines 9-19; page 106, column 3, line 46 - page 108, column 1, line 9 ---	1
A	IBM Technical Disclosure Bulletin, vol. 21, no. 4, September 1978, (Armonk, NY, US) P.A. Beaven et al.: "Card testing a microprocessor", pages 1664-1665 see the whole article ---	1
A	IBM Technical Disclosure Bulletin, vol. 32, no. 6B, November 1989, (Armonk, NY, US), ./.	1

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
24th June 1991	07 AUG 1991
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	MISS T. TAZELAAR

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages	Relevant to Claim No.
	"Method of executing manufacturing rom code without removing system roms", pages 479-480 see page 480, lines 20-28 ---	