(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 323 811 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **88830454.0**

(51) Int. Cl.4: **G08C 15/06 , G08C 25/02**

(22) Date of filing: **28.10.88**

(30) Priority: **30.10.87 IT 4855587**

(43) Date of publication of application:
12.07.89 Bulletin 89/28

(84) Designated Contracting States:
AT BE DE ES FR GB NL

(71) Applicant: **MENBER'S S.p.A.**
Via Ghiacciaia, 1
I-37045 Legnago (Verona)(IT)

(72) Inventor: **Giunti, Giorgio**
Via Enrico Toti, 33
I-37045 Legnago VR(IT)

(74) Representative: **Cavattoni, Fabio et al**
Cavattoni & Raimondi Viale dei Parioli, 160
I-00197 Roma(IT)

(54) Device for the remote serial transmission of commands and/or information by wire, in particular between mobile means such as a tractor and trailer.

(57) The device of the invention comprises a command and/or information signal generator (1), a clock oscillator (3) cooperating with a binary counter and a multiplex generator (2), the output of the multiplex generator (2) being connected by a single conductor (4) to a receiver (6) located for example on board a trailer, the receiver (6) comprising means for separating the clock signal from the signals constituting the command or information data, said means being connected to power actuators (11) for said commands and/or information.

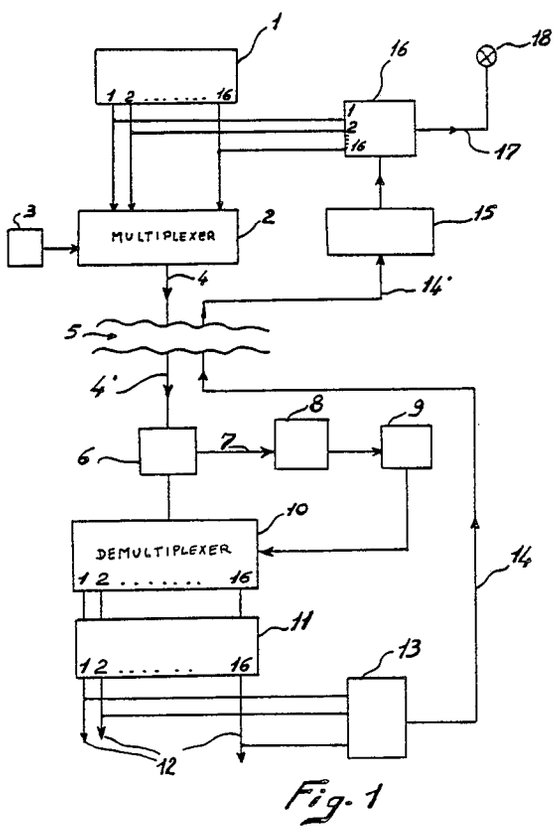

Fig. 1

EP 0 323 811 A2

Device for the remote serial transmission of commands and/or information by wire, in particular between mobile means such as a tractor and trailer

This invention relates to a device for the remote serial transmission of commands and/or information by wire.

The invention is particularly directed towards the transmission of commands and/or information between mobile means, such as a road tractor and trailer.

It is often necessary to transmit a multiplicity of commands and/or information over a distance. The solution to this problem in basic terms can consist of a plurality of electric wires or double cables in a number corresponding to the number of signals and commands. Historically, for reasons of economy and to simplify the transmission means (electric cables), the solution has been to utilize combinations taken from a plurality of wires, so that by conveniently using one or more wires in accordance with predetermined rules, it is possible using n wires to transmit 2^n command signals (for example with four wires sixteen different combinations can be obtained, i.e. $2^4 = 16$).

In this case there is however the drawback that if one or more of the wires develope a fault (short or interrupted circuit), inaccurate combinations or coding can result, which can cause serious damage.

Another method is to feed a plurality of commands and/or information serially from point to point to effect code translations or combinations with time rather than between physical electric wires. In this manner it is not possible for combination or code transpositions to occur. In the case of a fault (short or interrupted circuit) in the single transmission wire, there will be a total absence of transmissions, indicating a "catastrophic" fault but without any false combination or code transmission occurring which could result in damage far more serious than the total absence of commands.

The present invention relates to a system for the serial transmission of commands and/or information which is particularly suitable for application to a vehicle composed of a tractor and trailer, which ensures better functional interconnection between the two vehicles and results in appreciable economy in terms of the number of connection conductors, with consequent reduction in the cost of cables and in particular of connectors.

According to the present invention, in the stated application provision is also made for the remote retransmission of the command or information to its point of origin to provide a control check to verify that the transmission is correct and has been received, thus providing maximum safety of operation.

The present invention therefore provides a system for the transmission of commands and/or information operating serially with synchronism and data signals along a single conductor, and cooperating with a reception system able to separate the synchronism signals from the control and/or information signals, said reception system being associated with a plurality of power transducers for conversion from the electrical signal level to the electrical actuator operation level. The reception system is associated with an auxiliary return transmission system which by means of a comparator checks that correct transmission and reception of the commands and/or information has occurred, and possibly that said commands or information have resulted in correct execution of the required action, so that a tractor operator has a complete panorma of the remote situation on a trailer.

A preferred embodiment of the present invention is described hereinafter by way of non-limiting example with reference to the figures of the accompanying drawings in which:

Figure 1 is an overall block diagram of the device for the remote serial transmission of commands and/or information by wire according to the present invention;

Figure 2 is a detailed block diagram of the device of Figure 1; and

Figure 3 shows wave forms for describing the operation of the circuit arrangement shown in Figure 2.

With reference to the drawings and in particular to Figure 1, a command and/or information generator 1 which in the example is shown as having sixteen different outputs is located on board the tractor. The sixteen outputs are connected to the input of a multiplexer 2 controlled by a start and clock generator 3. A wire 4 leaves the multiplexer 2 and leads to the apparatus disposed on the trailer through the connection indicated diagrammatically at 5. The conductor 4′ on the trailer leads to a circuit 6 for separating the synchronism signals from the data signals. The synchronism signals flow through the conductor 7 to a binary counter 8 which operates a decoder 9 controlling a demultiplexer 10. The demultiplexer 10 also has sixteen outputs which are connected to an assembly 11 of power transducers for operating the controlled members, indicated overall by 12. The outputs of the block 11 are connected to a return trasmitter 13 analogous to that already described and connected by a return wire 14, 14′ to a receiver similar to that

already described and to a comparator which compares the return data with the data originating from the block 1 and in the case of discord emits an alarm signal along the wire 17 to activate a malfunction indicator 18.

The operation and structure described in relation to Figure 1 will now be described in greater detail with reference to Figures 2 and 3.

With reference to Figures 2 and 3, the block 20 originates the commands and/or information on board the tractor, these being sixteen in number in the illustrated example but can be increased or decreased in number at will by methods well known to the expert of the art.

On the tractor side there is provided a start and clock signal generator 21 for a start, a pause and clock signals indicated by C1, ... C16 as shown in line A of Figure 3. Said clock signals operate a binary counter 22 the outputs of which (four outputs for a sixteen count) control a decoder circuit 23 of the "one in sixteen" type which sequentially activates the outputs 1, 2, 16 of the circuit 23. The outputs 1, 16 of the circuit 23 are combined with the outputs 1, 2, 16 of the circuit 20 in the AND gates A1, A2, ... A16 to have either an output or the absence of an output from these gates in register with the commands and/or information leaving the block 20. The outputs of the AND gates A1, A2, A16 are added in the OR gate P1, P2, P16 to give a signal consisting of the sum of command and/or information signals and clock pulses. The output signals from the OR gates P1, P2, P16 are combined in an adder gate P17 and have the appearance indicated on line B of the wave forms shown in Figure 3, in which it can be seen that the command signals K1, K2, ... have a certain time duration, whereas the start and clock signals L1, L2, L3, ...have a very short time duration. The output signals from the gate 17 can be fed to a power amplifier or buffer 21.

The said conductor 4 leaves the possible power amplifier 21 and after passing through the transmission space 5 continues as 4′ to reach two filters 24, 25, namely a low-pass filter and high-pass filter respectively. The two low-pass and high-pass filters 24, 25 separate the start and clock pulses from the command and/or information pulses. The output of the low-pass filter 24 is shown at D in Figure 3, while the output of the high-pass filter 25 is shown at C in Figure 3.

At this point the separated signals take two different paths. The signals from the high-pass filter 25 reach a binary counter 26 similar to the binary counter 22. The counter 26 operates a decoder circuit 27 analogous to the already mentioned decoder circuit 23. The six outputs from the decoder 27 are fed to a selector to reconstruct the signals 1′, 2′, 16′. The outputs of the decoder 27 are indicated at E in Figure 3 and the outputs of the selector 28 are indicated at F in Figure 3. In this manner the signals initially transmitted by the block 20 located on the tractor are reconstructed. The outputs of the circuit 28, still at signal level, can be fed to an assembly of power amplifiers or transducers indicated overall by 29. These amplifiers can be solid state switches or relays according to requirements.

The outputs of the block 29 are fed to a trasmitter block 30 similar to that already described, and leading along a wire 14, 14′ to a receiver block 31 similar to that described. The receiver block 31 controls a circuit similar to the described circuit 28. The outputs of the circuit 32 are fed to the first inputs of a digital comparator 33, the other inputs of which receive the output signals from the block 20, i.e. the original command and/or information signals. If the system operates correctly, the comparator 33 gives no output. If there is a discrepancy between the "digital words" fed to the inputs of the comparator 33 an output signal will appear and will operate a detector 34 which operates a warning lamp 35 or other alarm device, to indicate lack of correspondence between the signal originating from the tractor and the signal received by the trailer.

In this manner the system is "fail safe" in that any fault in either the outward or return path is immediately indicated to the operator on the tractor, who can then take the necessary action.

The described device has been illustrated in terms of "random" logic circuitry, which can pertain to any of the very numerous logic families available to a manufacturer. The choice of logic family will be determined by circuit optimization in each case.

It should be noted that the entire system can be equally implemented, without leaving the scope of the present invention, by a dedicated microprocessor system programmed to effect in firmware the operation described heretofore.

A currently preferred embodiment of the present invention has been described by way of non limiting example only, in that modifications can be applied in practice by an expert of the art but without leaving the scope of protection thereof.

Claims

1. A device for the remote serial transmission of commands and/or information by wire particularly between mobile means such as a tractor and trailer, characterised by comprising a commands and/or information signal generator (1), a clock oscillator (3) cooperating with a binary counter and a multiplex generator (2), the output of the mul-

tiplex generator (2) being connected by a single conductor (4) to a receiver (6) located on board the trailer, the receiver (6) comprising means for separating the clock signal from the signals constituting the command or information data, said means being connected to power actuators (11) for said commands and/or information.

2. A device according to claim 1, characterised in that the outputs (12) of said power actuators (11) are connected to a serial transmitting unit 13) transmitting along a return wire (14, 14′) to the tractor, said return wire (14, 14′) being connected to a serial-parallel receiver unit 15), the outputs of said receiver unit (15) being connected to first inputs of a digital comparator (16) the second inputs of which are connected to said command and/or information signal generator (1), the arrangement being such that a warning alarm (18) is activated if there is discrepancy between the transmitted signals and the received signals.

3. A device according to claim 2, characterised in that said transmitter (13) and receiver (15) units for the return signals are identical to that used for the outward path of said command and/or information signals.

4. A device according to one or more of the preceding claims, characterised in that said means for separating the clock signals from the effective command and/or information signals are a high-pass filter (25) and a low-pass filter (24) respectively.

5. A device according to one or more of the preceding claims, characterised in that the signal processing means are a dedicated microprocessor controlled by firmware which duplicates the operation of the described hardware.

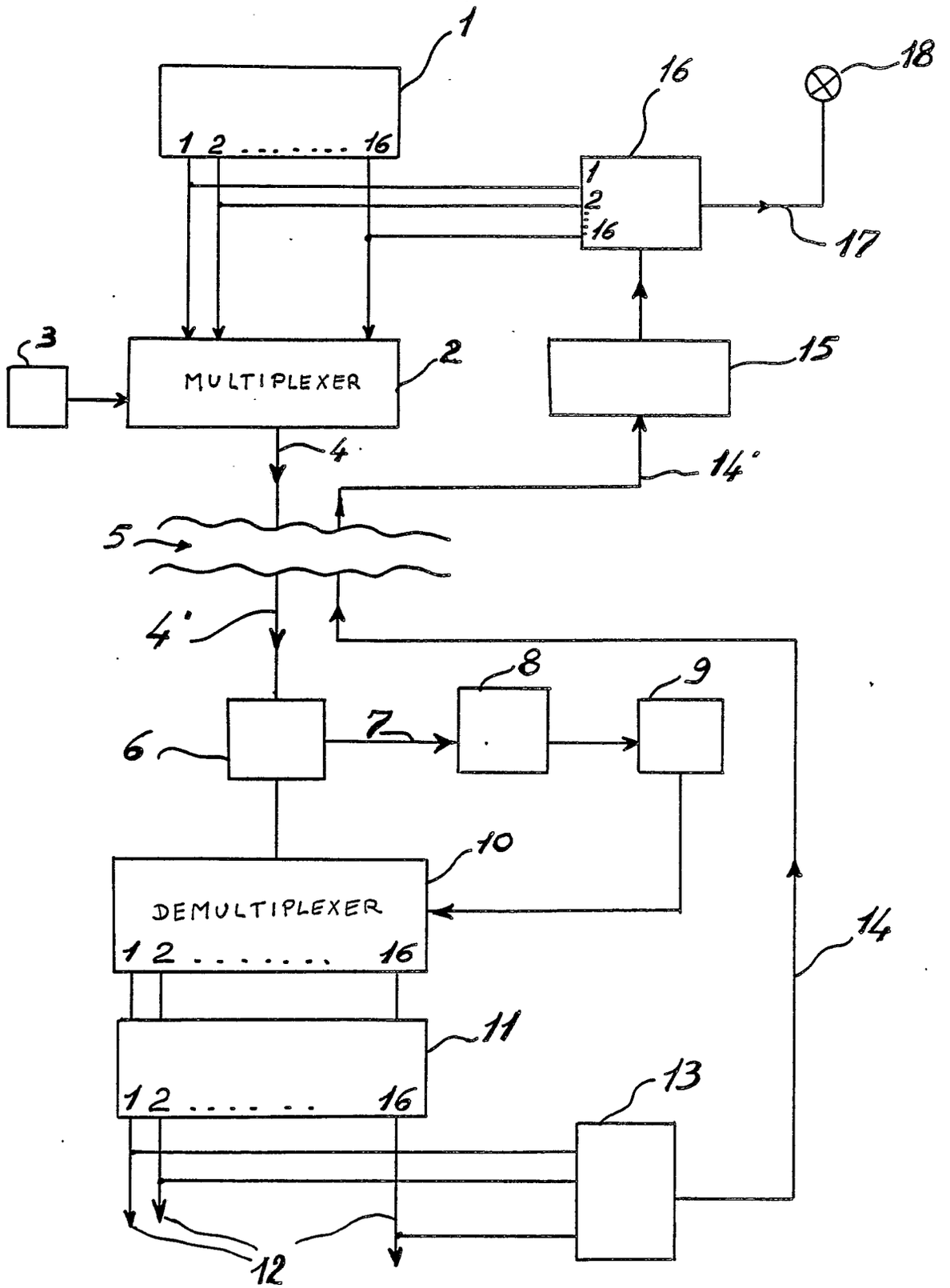
1
1 2 16
16
1
2
16
18
17
3
MULTIPLEXER
2
15
4
14'
5
4'
8
9
6
7
10
DEMULTIPLEXER
1 2 16
14
11
1 2 16
13
12

Fig. 1

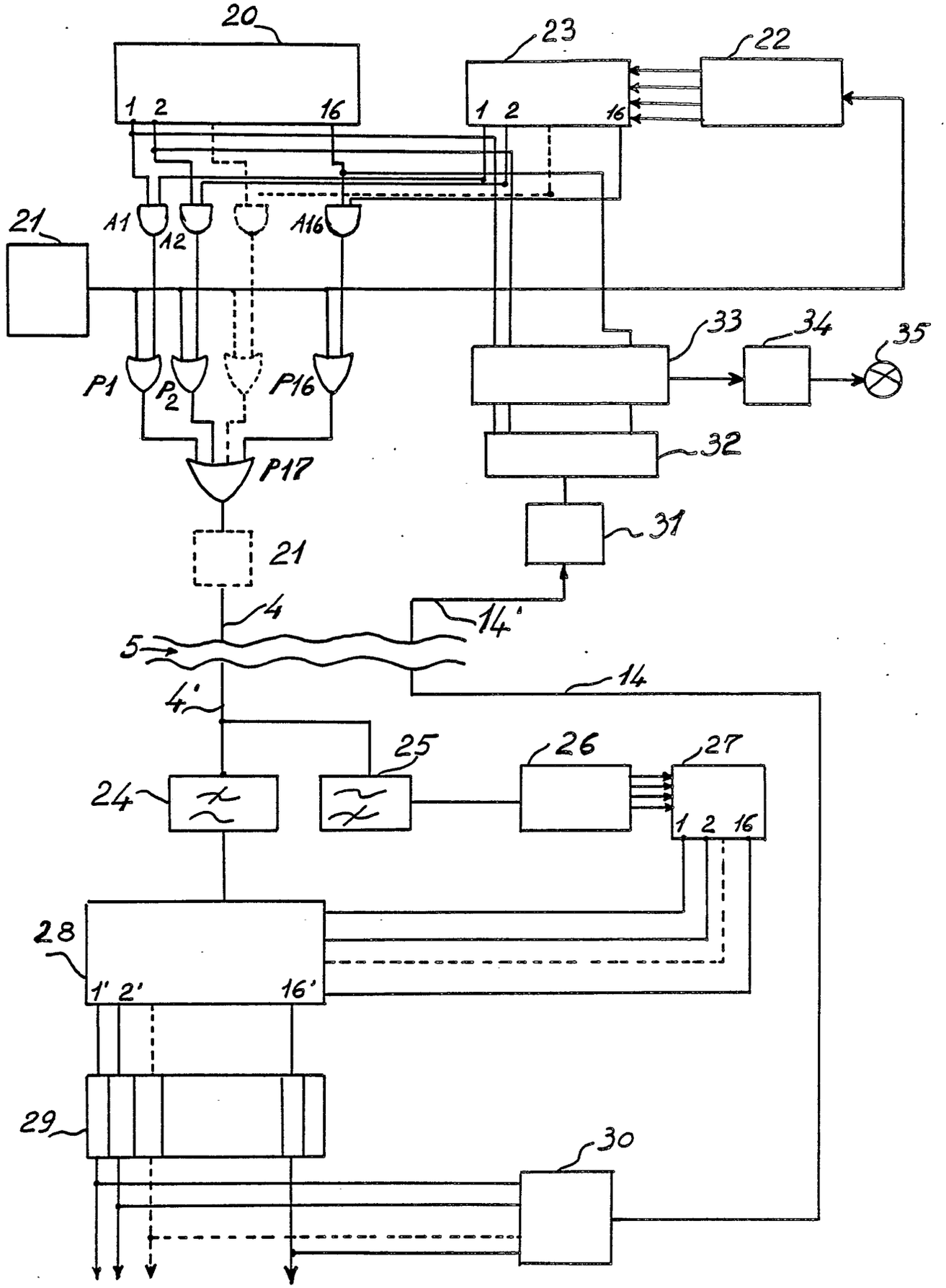
20
23
22
1 2
16
1 2
16
21
A1
A2
A16
P1
P2
P16
P17
33
34
35
32
31
21
4
14'
5
14
4'
25
26
27
24
1 2 16
28
1' 2'
16'
29
30

Fig. 2

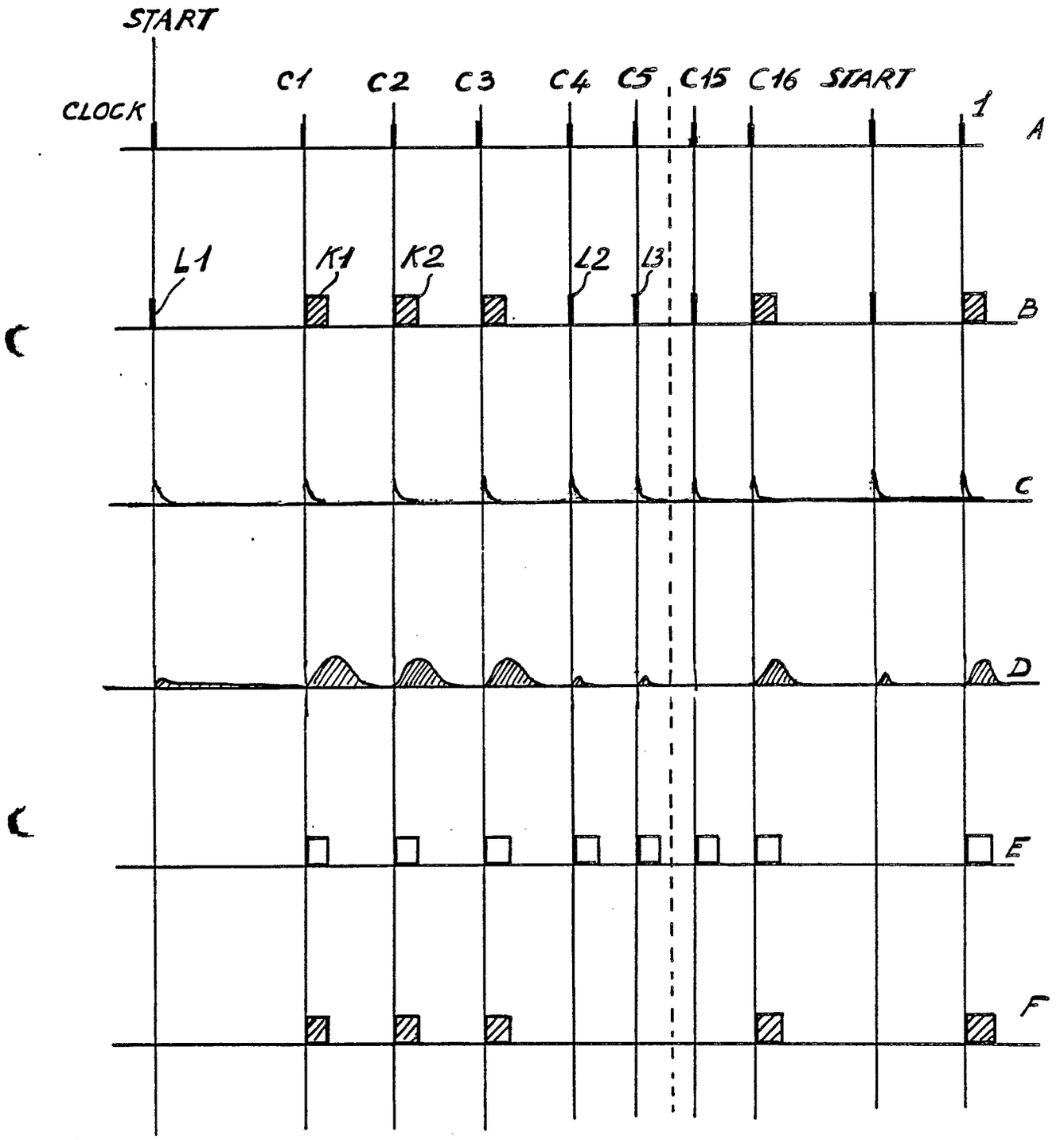

Fig. 3