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Europäisches Patentamt
European Patent Office
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(11) Publication number:

0 613 731 A1

(12)

EUROPEAN PATENT APPLICATION(21) Application number: **94200381.5**(51) Int. Cl.⁵: **B07C 3/18, G06K 9/36**(22) Date of filing: **14.02.94**(30) Priority: **05.03.93 NL 9300403**(43) Date of publication of application:
07.09.94 Bulletin 94/36(84) Designated Contracting States:
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NL-2716 LX Zoetermeer (NL)(54) **Mail routing system.**

(57) Mail routing system comprising an input system (1), a postal transmission system (2) and an output system (3). Electronic replicas are made of the addressing information of the items of mail, which replicas are then converted into control codes which are used to drive routing elements (10). On the input side - at least in the case of items of mail for which the conversion into control codes is relatively time-consuming - only the most significant part of the control code, necessary for routing the items of mail to the correct output system, is generated. During

transport, or upon arrival, the less significant part of the control code is then additionally generated. The conversion elements (8) form, by means of a network (12, 13), a conversion pool, as a result of which the conversion capacity can be spread optimally over the various input channels (a...n) and various input and output systems. An interpretation element (14) derives from the conversion results of the various conversion elements (8), by comparing and supplementing, the most likely control code.

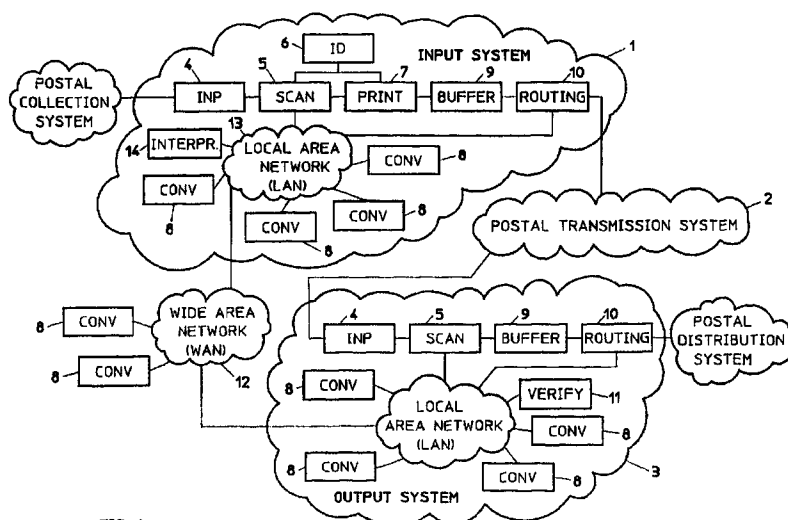


FIG. 1

Where necessary, the content of the European Patent Application EP 92200444.5 and the European Patent Application EP 92201486.5, both in the name of the Applicant, are deemed to be part of the present application.

A. BACKGROUND OF THE INVENTION

The invention relates to a mail routing system comprising an input system (1), a postal transmission system (2) and an output system (3), the input system being provided with input means (4) for inputting items of mail, scanning means (5) for scanning the addressing information, such as post-code and destination address, which is physically present on the items of mail, and converting it into electronic or optical replicas, an identification code generator (6) for assigning identification codes to each input item of mail and corresponding replica, and means (7) for applying to each item of mail such an identification code in machine-readable form, the input system comprising conversion means (8) or being connected thereto, for converting said replicas into machine-readable control codes, and both the input system and the output system being provided with routing means (10) for routing, under the control of such machine-readable control codes, the items of mail to the place of destination. Such a system is disclosed by the European Patent Application EP 92200444.5 in the name of Applicant. This application, in particular, deals with the possibilities offered by electronic control codes, namely the ability to mutate or change them, in order to be able to manipulate items of mail remotely and, for example, to cause an item of mail to be delivered at an address different from that stated by the original addressing information, or to cause the item of mail to be delivered in a particular period of time. The object of the present invention is to guarantee an improved passage of the items of mail to be routed through the routing system. Another object of the invention is to reduce the percentage of items of mail whose addressing information cannot be converted automatically, the "rejects".

B. SUMMARY OF THE INVENTION

The invention is based on the insight that, for those cases where on the input system side the address data of the items of mail cannot be converted automatically and in a short time into complete control codes (in electronic or optical or alternatively in bar code form) it is sufficient to use an incomplete control code as long as this is capable of driving the first routing step, the routing means of the input system, correctly. If that control code is sufficient to send the item of mail, by means of the

routing means of the input system, into the right main direction (to the correct output system), the information which (only after considerable time) is necessary for driving the routing means in the output system, can be sent afterwards or even generated in that output system itself based on the "raw" information (the original addressing information or a replica thereof) which is sent to the output system by the input system. In other words, the invention is based on the insight that in the input system as little processing time as possible should be used for generating control codes which only need be used at a later stage, namely in the output system, and which, as sending the item of mail does after all take considerable time, can be generated more effectively during that sending time. A further consideration on which the invention presented below is based is that the present-day transmission techniques of electronic or optical signals make it possible to carry out the operations required for the automatic routing of items of mail, in particular the derivation of machine-processable control codes from the original address information of the items of mail or from electronic or optical replicas thereof, in a time-distributed or location-distributed manner. A further advantage in so doing is that the load on the conversion elements can be distributed more uniformly and flexibly over the various points in the input system and the output system where that conversion is required. It is also possible for conversion, in particular manual conversion of "difficult" postal addresses (for example without postcodes) to be farmed out to "home-workers". The invention therefore comprises a mail routing system comprising an input system (1), a postal transmission system (2) and an output system (3), the input system being provided with input means (4) for inputting items of mail, scanning means (5) for scanning the addressing information, such as postcode and destination address, which is physically present on the items of mail, and converting it into electronic or optical replicas, an identification code generator (6) for assigning identification codes to each input item of mail and corresponding replica, and means (7) for applying to each item of mail such an identification code in machine-readable form, the input system comprising conversion means (8) or being connected thereto, for converting said replicas into machine-readable control codes, and both the input system and the output system being provided with routing means (10) for routing, under the control of such machine-readable control codes, the items of mail to the place of destination, according to the invention the output system comprising a verification element (11) for verifying the machine-readable control codes originating on the input side, for suitability and completeness for controlling the

routing means on the destination side, and also conversion means (8) for converting said address information, which is physically present on the items of mail, or a replica thereof into machine-readable control codes in the case where the machine-readable control codes transmitted from the input system to the output system are missing or are found to be unsuitable for controlling the routing means of the output system.

In more detail, the mail routing system according to the invention preferably comprises transmission means (12) for transmitting said replicas from the input system to the output system, and an output system which likewise comprises conversion means (8) for converting, at least in the case where the machine-readable control codes originating from the input system are missing or are found to be unsuitable for controlling routing means of the output system, such transmitted replicas or a part thereof into machine-readable control codes for controlling said routing means of the output system.

Preferably, the mail routing system is characterized in that said conversion means are formed by a network (13) to which a number of conversion elements (8) of various types are connected, to whose inputs said replicas of the original addressing information present on the items of mail are transmitted via said network, and whose output signals, likewise via the same network, are presented to an interpretation element (14) which derives from the output signals of said various conversion elements the most likely machine-readable control code and emits this to the downstream routing means. The fact that both the input systems and the output systems comprise conversion elements - namely, in the input system, for generating the control information for at least the routing means within that input system, and in the output system for generating, where required, supplementary control information for the routing means of the output system - makes it eminently possible for the input system and the output system to be essentially identical and both to comprise said input means, said scanning means, said identification code printer, said conversion means, said interpretation element, said verification element and said routing means.

In more detail, provision is preferably made for the items of mail to be input in the input system (1) or in the output system (3), via different, physically separated channels (a...n) and for each channel to be provided with said scanning means (5) for scanning addressing information present on the items of mail and converting this into replicas of said addressing information, while the replicas thus formed, originating from all the input channels, are presented via said network to the various conver-

sion elements.

Apart from the fact that the invention - generating (by conversion of the addressing information) at least the most significant part of the control code on the input side and only then generating that part of the control code which is necessary for routing on the output side - is applicable to items of mail which are relatively difficult to process, and to rejects, the present invention also supports another mail-processing policy, namely that which involves generating, in the input system, only the most significant part of the control code for all items of mail - the part required for driving the routing means on the input side. Thus the conversion time on the input side is minimized for all items of mail, rather than, as in the above, keeping within limits only the processing time (waiting time) of the items of mail which are relatively difficult to convert. That part of the control code which is only used on the output side, then has to be converted when the item of mail is en route to the output system defined by the most significant part of the control code. The result is that, in the processing of all items of mail, the conversion time on the input side is minimized and that, for the purpose of generating the control codes important to the output system, there is considerable freedom in timing, as a result of which the capacity requirement of conversion means is minimized. Making use of this processing policy, the invention therefore comprises a mail routing system as indicated in the preamble, which is characterized in that the input system (1) comprises conversion means (8), or is connected thereto, for converting said replicas into machine-readable control codes for exclusively driving the routing means (10) in said input system, while the output system (3) likewise comprises conversion means (8), or is connected thereto, for converting the addressing information physically present on the items of mail, or converting a replica thereof into machine-readable control codes for controlling the routing means (10) of the output system.

It is furthermore possible to connect the conversion elements of the various input/output systems to one another into one conversion pool, as a result of which the conversion capacity of the total mail routing system can be allocated over the various input/output systems in an optimum manner.

C. ILLUSTRATIVE EMBODIMENTS

FIG. 1 shows a preferred embodiment of a mail routing system according to the invention.

FIG. 2 shows a more detailed elaboration of the input system of the mail routing system of FIG. 1.

FIG. 1 shows a mail routing system which is formed by three main components, viz. an input

system 1, a (postal) transmission system 2 and an output system 3. The essence of the invention is retained in the input system and the output system. These systems may, as will be discussed in more detail in connection with FIG. 2, be essentially identical to one another, as most functions are used both for input processing and for output processing.

The input system 1 is formed by an input element 4 which is connected to the "postal collection system", formed by letterboxes, pillarboxes and local post offices, via which letters and other items of mail are presented to the mail routing system. Connected to the postal transmission system 2 there are various input and output systems. In practice, an input system 1 can be used as an output system 3 and vice versa. The input systems and output systems are accommodated in so-called "HUBs", large postal "processing factories", in which, in each 24-hour period, many millions of items of mail are processed (in the Netherlands at present approximately 17 million of items of mail per 24-hour period). The incoming stream of mail is received by the input element 4 which sends the items of mail on to a scanning element 5, in present-day practice a video camera with ancillary equipment, which makes an electronic, digitalized replica of the address information on the items of mail, in particular the postcode, but also of possible further destination, processing or sender codes. It can be envisaged that instead of an electronic replica, an optical replica is also possible, which may be stored, for example, on an optical-memory disc and which can be transferred via an optical network. To each item of mail, a unique identification code is assigned which is both applied to the item of mail, printed by a printer 7, and appended to said replica as a "label", so that each replica can be linked to the associated item of mail. The items of mail are then buffered temporarily in a buffer 9, before they are routed by a routing element 10, in practice one or more automatic mail sorting machines, to a particular main destination - a particular output system. The digital replicas are fed to a number of conversion elements 8 via a broad-band "local area network" (LAN) 13. These conversion elements 8 serve to convert the digital video images into control codes which are suitable for driving the routing element 10 of the input system 1. The control codes need not per se already be suitable for controlling routing element 10 in the output system 3. If the addressing information, in particular the postcode, is present on the items of mail in, for example, OCR characters, these can be converted readily and rapidly into a (digital) control code. The conversion of addresses present in normal typescript requires slightly more processing time, while handwritten addresses will

generally mostly have to be processed manually. Incidentally, methods and aids are being developed at present to allow even handwritten postcodes to be converted automatically, inter alia by using - in the case of letter post - detection codes such as "postcode frames", for machine detection of the location and the content of the postcodes (see Application EP 92201486.5 in the name of the Applicant). The "most difficult" addresses are those addresses where the postcode is missing (the postcode, after all, forms the most important information for the mail routing process). The conversion of this address information must be carried out manually and is very time - consuming. The conversion elements 8 consist of various types, namely one or more for converting OCR characters, one or more for converting typescript, one or more for converting handwritten characters within a "postcode frame", one or more for converting handwritten characters without "postcode frame" and one or more for converting "difficult addresses", the addresses in which the postcodes are entirely missing; this last type is at present formed by coding stations which are operated manually. All these types of conversion elements are connected to the LAN 13. The electronic replica is presented to all conversion elements, but not to the coding stations; these coding stations are only presented with those replicas which do not provide a usable result via the other conversion elements 8 ("rejects"). Whether or not a conversion result is usable is checked by an interpretation element 14 which is connected, via the LAN 13, to each conversion element 8. This interpretation element 14 serves as the control element for the conversion process. Only if the conversion result meets certain criteria is that conversion result, an electronic (or, if the LAN is an optical LAN, an optical) control code transmitted via the LAN to the routing element 10. The assessment criteria used by the interpretation element 14 are, for example: the resulting control code must meet a formal requirement, such as first a series of four digits, then a space and then a series of two letters. Since (in the Netherlands) the left-hand digits are the most significant code elements, the interpretation element 14 is preferably set in such a way that, if the left-hand two code elements already consist of digits, the control code is already transmitted to the routing element 10 (of the input system), as that element does not require more than these first two code elements for routing the item of mail to the correct output system. Incidentally, the conversion elements 8 are generally given a certain time for converting the replicas supplied, a time which in many cases is sufficient for converting the complete postcode. The interpretation element 13 also compares the conversion results of the various conversion elements

8 and is, for example, set in such a way that a conversion result is approved only if there are at least two conversion elements which give the same conversion result, with respect to the entire post-code or to the first two code elements. Another possibility is for the interpretation element still to derive from the conversion results of different conversion elements, even if these differ from one another, the most likely postcode, for example if a number of conversion elements emit the same first three code elements and a few other conversion elements emit the same last three code elements; the interpretation element 13 will then select, as the most likely postcode, a control code which is formed by the first three code elements on which the first mentioned conversion elements agreed, and the last three code elements on which the last mentioned conversion elements agreed.

The control codes thus generated are transmitted both to the routing element 10 and, via the WAN 12 to the output system. Connected to this WAN 12 there are, incidentally, also a number of conversion elements 8, namely a number of operator-operated coding stations which therefore process, in particular, those replicas which have been rejected by the interpretation element 14, the rejects. If the first two code elements, required for controlling the routing element 10 of the input system, were approved by the interpretation element 14, but the further code elements were not, the associated item of mail can be routed by the routing element 10 to the correct output system 3, and the item of mail is thus transferred to the output system 3 via the postal transmission system 2. The postal transmission system 2 is formed by a transport system, consisting of containers, lorries, trains etc.

The output system 3 comprises, like the input system 1, an input element 4, a scanning element 5, conversion elements 8, a buffer 9 and a routing element 10. As in the input system 1, the conversion elements 8 are connected to the scanning element 5 via a LAN 13, and the routing element 10 is likewise connected to this LAN 13. The LAN 13 is further connected to the WAN 12 (Wide Area Network), via which the control codes of the items of mail sent to the output system 3 are transmitted from the input system 1. The LAN further has connected to it a verification element 11 for verifying the completeness and validity of the control codes received and, if necessary, for supplementing or correcting conversion - via the conversion elements 8 of the output system 3 - of the replicas of the items of mail received. These replicas may be generated (again) by the scanning element 5 of the output system 3 or, like the control codes, have been transmitted to the output system 3 via the WAN 12.

It should be noted that it is possible to the control codes which are generated in the input system 1 (by the conversion elements 8) also to be apply to the item of mail by means of a printer 7, which then therefore prints both the identification code and the conversion result, the control code, on the item of mail; in that case it is not necessary per se to transmit the control code in electronic form as well (or in the case of an optical LAN, in optical form). In both cases, the control code is generated in machine-readable form and first transmitted to the routing element 10 of the input system 1 and then to the output system 3. In the one case, the control code, printed on the item of mail itself, is therefore transmitted to the output system 3 via the postal transmission system 2, and in the other case, which was assumed in the above and will be assumed below, as an electronic or optical code signal via the WAN 12.

On the side of the output system 3, the item of mail is presented, via the input element 4, to the scanning element 5. Said scanning element 5 detects the identification code applied to the item of mail in the input system 1. If the control code has been applied to the item of mail itself, the scanning element also detects this control code. If the control code has been converted in the input system 1 into an electronic (or optical) control code, the identification code detected by the scanning element 5 is used in the output system 3 by the verification element 11 for looking up, in a database (not shown), the control code - which was transmitted by system 1, via the WAN 12, to the output system 3 - associated with the item of mail. Thus it is possible, if on the input side there was not enough processing time to obtain a complete correct control code - for example, because there was agreement among the conversion elements only on the first two code elements of the control code and the rest of the addressing information therefore had to be converted manually - for that part of the control code which was not per se necessary for driving the routing element 10 on the input side, to have been converted (in this case manually) and transmitted to the output system during the time in which the item of mail was en route via the postal transmission system to the output system 3. The verification element 11 checks whether the transmitted control code is correct for controlling the routing element 10 of the output system 3. While in the case of the input system 1 the correctness of the most significant part of the control code was important - and, if required, was sufficient for driving the routing element 10 there - in the case of the output system the correctness of the least significant part of the control code is important, since that part has to drive the routing element 10 - consisting of one or

more sorting machines for the sorting, in terms of district or even road, of the items of mail - of the output system 3. If the verification element 11 concludes that the control code of an item of mail is incorrect, an action is initiated for regenerating the control code. This can be done on the basis of the original address information on the item of mail itself, or on the basis of the replica which - linked to the identification code of the item of mail - was transferred from the side of the input system 1 to the output system 3. If this replica was not transferred, it is necessary to make a new replica in the output system 3, by means of the scanning element 5. Either the transferred replica or the newly produced replica are presented via the LAN 13 of the output system 3 to the conversion elements 8 of the output system 3. In the same way as was the case in the input system, control codes are derived from the replicas by the conversion elements 8, which are then presented to the routing element 10, after which the routing element 10 "frees" the items of mail stored in the buffer 9 and routes them on. It should be noted that the conversion of replicas at the output system 3 can likewise be effected by employing conversion elements 8 (for example "home-workers") connected to the WAN 12. It is even possible to employ the conversion elements 8 of the input system 1 for the conversion in the output system 3 and also, vice versa, the conversion elements 8 of the output system 3 for the conversion in the input system 1. The processing of items of mail is a cyclic process with a cycle time of 24 hours. In practice, as much as possible of the equipment of the input system 1 is used as the input system for a particular portion of a 24-hour period, and for the other part of that 24-hour period is used as an output system.

FIG. 2 shows a more detailed elaboration of the system 1 as it has been represented hereinabove as the input system. This system can be used both as an input system and as an output system and, as has already been indicated, can be used, during a first part of the processing cycle, as an input system 1 for mail to be presented to the postal transmission system, and during a second part of the processing cycle, as an output system 3 for mail delivered by the postal transmission system. The system is formed by all the system parts which have already been dealt with in the above, with the exception of a control element 16 which serves for coordinating the action of the various system components. From the postal collection system, a stream of items of mail is supplied to the system via a number of input channels a...n. Each channel is provided with input elements 4, scanning 5, printers 7 and buffers 9. All these elements are connected to the LAN 13 and are controlled - via said LAN 13 - by the control element 16. Each

item of mail is assigned, from an identification code generator 6, a unique identification code which is printed on the item of mail by a printer 7. The scanning elements 5 make replicas which, via the LAN 13 (and via the WAN 12) are presented to the conversion elements 8. The control codes generated by the conversion elements are checked for correctness by the interpretation element 14 and are then transmitted to the routing element 10. The identification codes, replicas and control codes are transmitted, via the LAN 13 and the WAN 12, to the output system (not shown). Owing to the conversion elements 8 being connected - via the LAN 13 - to the scanning elements of all n input channels, optimum utilization of the conversion elements is obtained and the average throughput time is minimized. If the system of FIG. 2 is used as an output system, the stream of items of mail - coming from various input systems 1, supplied via the postal transmission system 2 - is fed to the system via the input channels a...n and is presented, via the input elements, to the scanning elements 5 where the printed identification codes are read and passed to the verification element 11, which element looks up the control codes belonging with the identification codes in a database - where the control codes transmitted to the output system 3 are stored - and checks whether they are suitable for driving the downstream routing element 10. Incorrect control codes are still generated by means of reconversion of the replicas likewise stored in the database or newly produced. Correctness of these newly generated control codes is monitored by the interpretation element 14.

In the above it was assumed that it is the intention to generate on the input side, where possible, complete and correct control codes (converted postcodes). A different processing policy, however, is to deliberately generate in the input system only that (most significant) part of the control code which is absolutely necessary for driving the routing element 10 on the input side. This method therefore minimizes the conversion time on the input side for all items of mail and not only, as was suggested in the above, those items of mail which are relatively difficult to convert. The remainder of the postcode, the part which is only important on the output side, then has to be converted when the item of mail, which has already been routed to the correct output system 3 by the input system 1, is en route to that output system 3. This means that there is considerable freedom in time for generating those control codes of (all) the items of mail which are important to the output system, as a result of which load peaks in the use of the conversion elements are avoided as far as possible and, in fact, there is a minimum capacity requirement of conversion elements (and, for manual pro-

cessing, operators) for processing the mail streams. Moreover, it is highly feasible in this arrangement to link together the LANs 13 and the WANs 12 (these are, in fact, all the conversion elements of the various input/output systems and are technically identical to one another, as expounded hereinabove) - in other words, all the conversion elements 8 may form one pool, making it possible to allocate optimally the conversion capacity required over all the conversion elements 8 of all the input/output systems (HUBs) belonging to the mail routing system.

D. REFERENCES

European Patent Application EP 92200444.5
European Patent Application EP 92201486.5

Claims

1. Mail routing system comprising an input system (1), a postal transmission system (2) and an output system (3), the input system being provided with input means (4) for inputting items of mail, scanning means (5) for scanning the addressing information, such as postcode and destination address, which is physically present on the items of mail, and converting it into electronic or optical replicas, an identification code generator (6) for assigning identification codes to each input item of mail and corresponding replica, and means (7) for applying to each item of mail such an identification code in machine-readable form, the input system comprising conversion means (8) or being connected thereto, for converting said replicas into machine-readable control codes, and both the input system and the output system being provided with routing means (10) for routing, under the control of such machine-readable control codes, the items of mail to the place of destination, characterized in that the output system comprises a verification element (11) for verifying the machine-readable control codes originating on the input side, for suitability and completeness for controlling the routing means on the destination side, and also conversion means (8) for converting said address information, which is physically present on the items of mail, or a replica thereof into machine-readable control codes in the case where the machine-readable control codes transmitted from the input system to the output system are missing or are found to be unsuitable for controlling the routing means of the output system.

2. Mail routing system according to Claim 1, characterized by transmission means (12) for transmitting said replicas from the input system to the output system, and an output system which likewise comprises conversion means (8) for converting, at least in the case where the machine-readable control codes originating from the input system are missing or are found to be unsuitable for controlling routing means of the output system, such transmitted replicas or a part thereof into machine-readable control codes for controlling said routing means of the output system.

3. Mail routing system according to Claim 1, characterized in that said conversion means are formed by a network (13) to which a number of conversion elements (8) of various types are connected, to whose inputs said replicas of the original addressing information present on the items of mail are transmitted via said network, and whose output signals, likewise via the same network, are presented to an interpretation element (14) which derives from the output signals of said various conversion elements the most likely machine-readable control code and emits this to the downstream routing means.

4. Mail routing system according to Claim 3, characterized in that the input system and the output system are essentially identical and both comprise said input means, said scanning means, said identification code printer, said conversion means, said interpretation element, said verification element and said routing means.

5. Mail routing system according to Claim 1, characterized in that, in the input system (1) or in the output system (3), the items of mail are input via different, physically separated channels (a...n) and in that each channel is provided with said scanning means (5) for scanning addressing information present on the items of mail and converting this into replicas of said addressing information, while the replicas thus formed, originating from all the input channels, are presented via said network to the various conversion elements.

6. Mail routing system comprising an input system (1), a postal transmission system (2) and an output system (3), the input system being provided with input means (4) for inputting items of mail, scanning means (5) for scanning the addressing information, such as postcode and destination address, which is physically

present on the items of mail, and converting it into electronic or optical replicas, an identification code generator (6) for assigning identification codes to each input item of mail and corresponding replica, and means (7) for applying to each item of mail such an identification code in machine-readable form, the input system comprising conversion means (8) or being connected thereto, for converting said replicas into machine-readable control codes, and both the input system and the output system being provided with routing means (10) for routing, under the control of such machine-readable control codes, the items of mail to the place of destination, characterized in that the input system (1) comprises conversion means (8), or is connected thereto, for converting said replicas into machine-readable control codes for exclusively driving the routing means (10) in said input system, while the output system (3) likewise comprises conversion means (8), or is connected thereto, for converting the addressing information physically present on the items of mail, or converting a replica thereof into machine-readable control codes for controlling the routing means (10) of the output system.

7. Mail routing system according to Claim 1 or 6, characterized in that said conversion means (8) for the input system and the conversion means (8) for the output system are connected to the input system and the output system by means of an electrical or optical transmission network (12, 13).

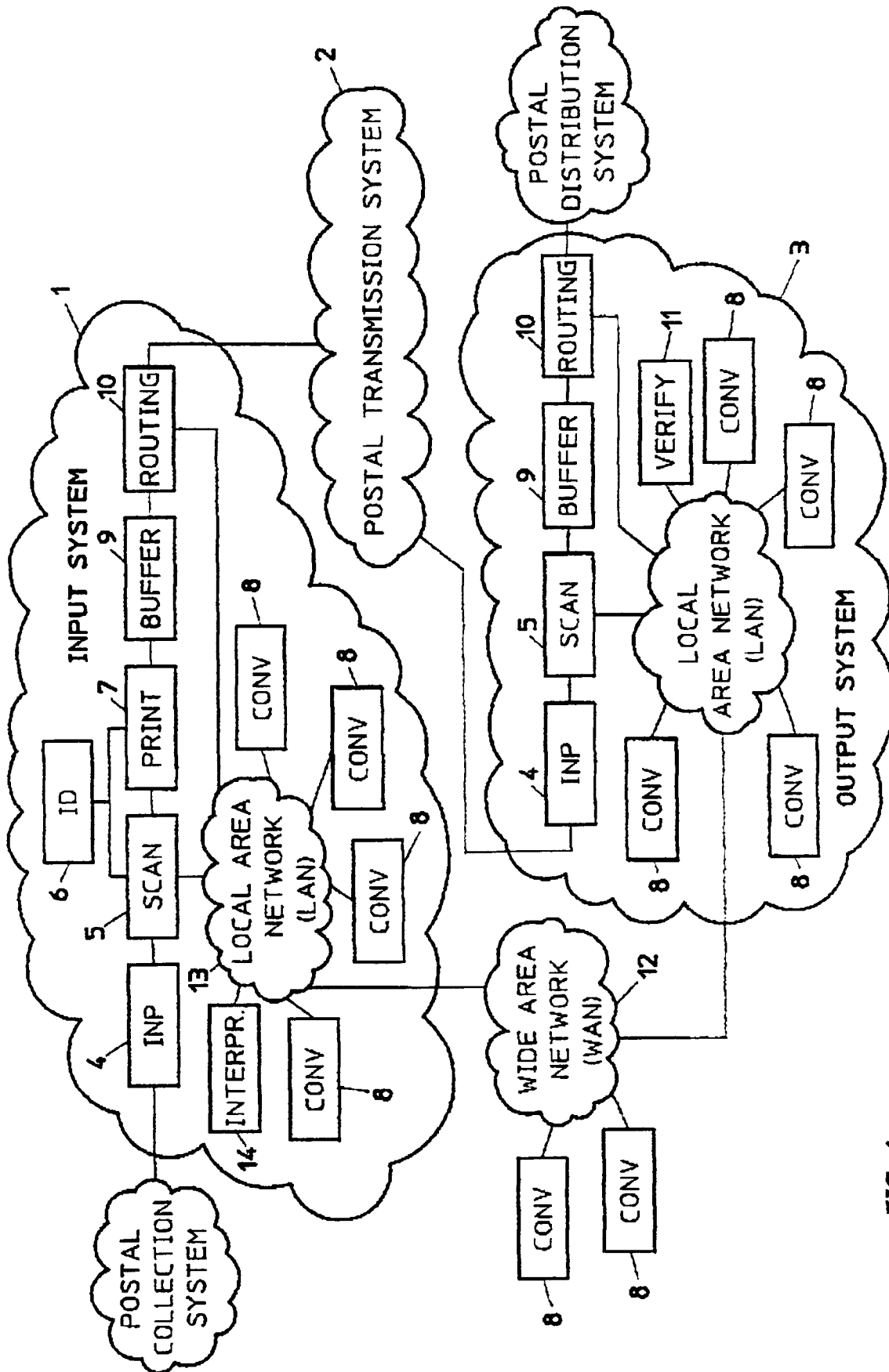


FIG. 1

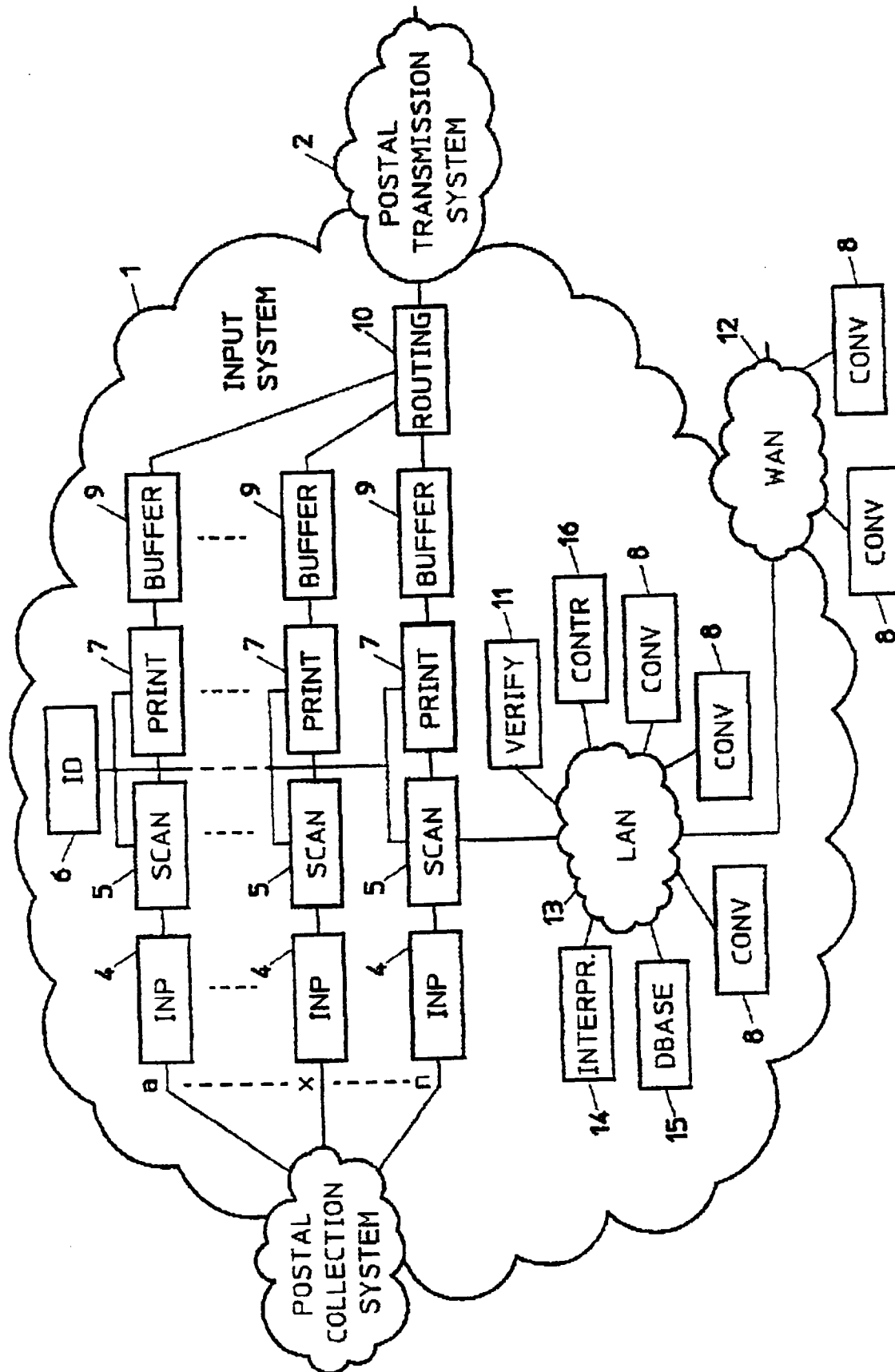


FIG. 2



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 20 0381

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	EP-A-0 424 728 (IBM) * the whole document *	1-4, 6, 7	B07C3/18 G06K9/36
A	WO-A-90 12660 (BERTIN & CIE) * the whole document *	5	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			B07C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 2 June 1994	Examiner Forlen, G
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			