



- (51) **International Patent Classification:**
G06F 21/00 (2006.01)
- (21) **International Application Number:**
PCT/EP2009/052612
- (22) **International Filing Date:**
5 March 2009 (05.03.2009)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
MO2008A000111 18 April 2008 (18.04.2008) IT
- (71) **Applicant and**
- (72) **Inventor:** ZANINI, Umberto [IT/IT]; Via Selmi, 92,
I-41100 Modena (IT).
- (74) **Agent:** MODIANO, Micaela; Modiano Gardi Patents
SAS, Via Meravigli, 16, I-20123 Milano (IT).
- (81) **Designated States** (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,

CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ,
EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO,
NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG,
SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA,
UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

- (54) Title:** DIGITAL DOCUMENT FOR SUBSTITUTIVE CONSERVATION OF A PAPER DOCUMENT

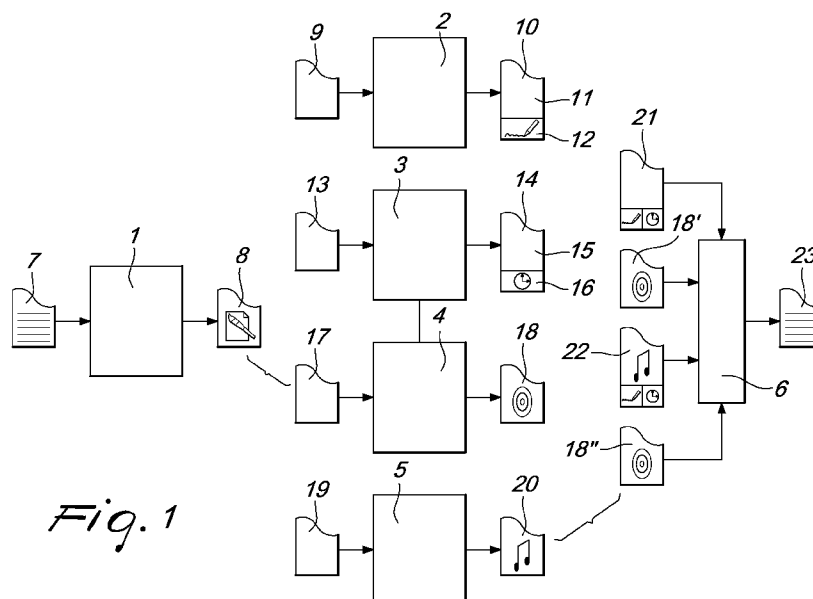


Fig. 1

- (57) Abstract:** A digital document for substitutive conservation of a paper document, comprising a digital image (8) of the paper document, a first digital fingerprint (18'), related to the image, a digital audio recording (20) related to the reading of at least one portion of the content of the image or of the first fingerprint, a second digital fingerprint related to the audio recording.

DIGITAL DOCUMENT FOR SUBSTITUTIVE CONSERVATION OF A PAPER DOCUMENT

Technical Field

The present invention relates to a digital document processing for substitutive conservation of a paper document.

In particular, the present invention relates to the field of the filing in electronic format of paper documents and particularly to the field of the substitutive conservation of documents, i.e., a procedure aimed at guaranteeing the equivalence, for tax and legal purposes, between a paper document and its digital copy.

Background Art

Management of a constantly growing volume of paper documents is currently one of the main areas of inefficiency for companies, professionals and public authorities.

Currently applicable statutory provisions require the conservation of thousands of documents. Even the smallest company is forced to provide shelves, cabinets and whole rooms for these documents. This entails an enormous waste of resources: of paper as well as of spaces that could have other kinds of function.

Moreover, all processes for paper document management are characterized by being excessively onerous, difficulties in sharing and filing, long search times, likelihood of errors, losses and other more or less costly inefficiencies.

Filing documents in electronic format entails many advantages, including a drastic reduction in space occupation: for example, the content of large archives can be transferred to optical or magnetic media of extremely small size. Moreover, the electronic format allows faster searches and updating of data, the possibility to attach multimedia elements, such as pictures, sounds, hypertext links and animations, to a document, and the possibility to transmit data remotely in real time via data communications

networks, particularly via the Internet.

These advantages entail, for companies, a reduction in costs, better customer service, return of personnel to productive work, time saving, higher safety and integrity of the data, better traceability and documentability of activities, better logistic and strategic organization,
5 higher competitiveness.

For these reasons, the issue of dematerialization has currently become highly topical: the public administration, companies and professional firms have long understood the enormous savings in direct and indirect costs that
10 can be achieved with fully computerized document management: people communicate via email, contracts are drawn up online, digital data are exchanged, debates are held in online forums, enormous data banks are filed, and deeds, contracts and statements are sent and received by computerized methods.

15 In order to allow replacement of a paper document with a digital document, a simple electronic filing thereof is not sufficient, but according to the law the digital document must be locked in its form, in its content and in time: one speaks, in this case, of "substitutive conservation". Substitutive conservation is a legal and computer-related procedure that is regulated by
20 law and aimed at ensuring equivalence between a paper document and its digital copy. It allows to conserve documents so that they do not deteriorate and are available over time in their integrity and authenticity. The process thus maintains the legal and fiscal validity of the documents.

In order to ensure this equivalence, the issue of the inalterability of
25 the content and of the certainty of paternity becomes particularly delicate. If these conditions are not guaranteed, the document is in fact exposed to the risk of repudiation of the statement.

In the case of paper documents, this risk is avoided by applying the autograph signature, optionally in the presence of a notary.

30 In the case of electronic documents, this goal is generally achieved by

applying a timestamp and a digital signature.

The term "timestamp" is understood to reference the electronic evidence, certified by authorities established for this purpose, that allows to provide third parties with a time reference, i.e., the information, containing
5 the date and time, associated with an electronic document.

The term "digital signature" is understood to reference a particular type of qualified electronic signature, particularly based on a system of paired asymmetric keys, a public one and a private one, which allows the owner and the recipient to manifest and verify the authenticity and integrity
10 of a document: the owner acts by means of the private key and the recipient acts by means of the public key. This process certifies the authenticity of the sender, the integrity of the signed document and the so-called principle of nonrepudiation, which does not allow to disown what has been signed.

If a user wishes to create a signature for a document, he/she proceeds
15 in the following manner: initially he/she obtains a sort of check code of the document by using a so-called hash function: this is a function adapted to convert a text of arbitrary length into a string of relatively limited fixed length. A hash function is made so as to minimize the likelihood that the same string can be obtained from different texts. Moreover, it is a one-way
20 function, i.e., starting from the fingerprint it is not possible to reconstruct the original document. The string, therefore, is a sort of "digital fingerprint" of a document or of a cleartext, and is known technically as "hash fingerprint".

The user can then use his/her own private key to encode the hash
25 fingerprint: the result of this encoding is the so-called "digital signature". The generated signature depends on the digital fingerprint of the document and therefore on the document itself, as well as on the private key of the user.

At this point, the signature can be attached to the digital document
30 and anyone can verify the authenticity of a document. For this purpose the

signature of the document with the sender's public key is decoded, obtaining the digital fingerprint of the document, and then such fingerprint is compared with the one obtained by applying the same hash function, which is public, to the received document: if the two fingerprints are identical, the authenticity of the document is thus ensured.

Digital signature technology, therefore, allows to attribute paternity to a digital document and make it non-modifiable. Further, if it is associated with a timestamp, it also allows to date with assurance the produced digital document.

It should be noted that a digital signature is entirely different from the digitizing or scanning of an autograph signature, i.e., the transposition of one's own autograph signature into an image. If all the parties involved in a document, for example a contract, have the technology needed to apply a digital signature, such signature can replace fully the autograph signature. Indeed, in various legal systems, a digital signature with asymmetric encryption is in fact recognized and considered equal, for all legal purposes, to an autograph signature on paper.

In many situations, however, it is not possible to adopt this approach because another party, particularly if a private user, may not have the technology needed to apply digital signatures. This is a very common scenario in the banking, financial, insurance, leasing sectors and the like. In such cases, the electronic conservation of documents that bear the autograph signatures of the contracting parties is generally preferred.

However, this solution has considerable critical issues: in case of disownment of one's own autograph signature and of a consequent verification procedure, the handwriting or graphological expert would encounter enormous difficulties, or even impossibility, in producing and issuing an expertise requested by the judge. Such difficulties are due to the impossibility to analyze many technical aspects of the autograph signature that are not present in documents stored in digital format and are instead

present on the paper originals, such as for example the writing pressure, the thickness of the writing mark, the examination and description of the paper and ink, the examination of the writing means. Digital scanning, moreover, makes it impossible to use a microscope and Wood's lamp, for example to
5 reveal the use of chemical eraser or other chemical products.

This criticality, therefore, does not allow to adopt substitutive conservation of paper documents in many sectors in which the presence of autograph signatures is required.

Disclosure of the Invention

10 The aim of the present invention is to overcome the above-mentioned limitations of the background art, by providing a new digital document for the substitutive conservation of paper documents, particularly sensitive paper documents, such as contracts and documents that require signing.

Within this aim, an object of the present invention is to obtain a
15 digital document that can ensure the possibility to certify the veracity of the content, preventing repudiation of paternity of the document by the party that signed it, thus allowing substitutive conservation without risks.

Another object of the invention is to provide a method and a system for providing documents for substitutive conservation that is easy to apply,
20 convenient to use and at low costs.

This aim and these and other objects, which will become better apparent hereinafter, are achieved by a digital document for substitutive conservation of a paper document, comprising: a digital image of the paper document, a first digital fingerprint, related to the image, a digital audio
25 recording related to the reading of at least one portion of the content of the image, of the fingerprint or of other data unambiguously associated with the digital image, a second digital fingerprint related to the audio recording.

The proposed aim and objects are also achieved by a method for generating a digital document for substitutive conservation of a paper
30 document, comprising the steps of: generating a digital image of the paper

document; generating a first digital fingerprint, related to the digital image; generating a digital audio recording, related to the reading of at least one portion of the content of the image or of the first fingerprint or of the digital signature of the image; generating a second digital fingerprint, related to the audio recording; grouping the image, the audio recording, the first and second digital fingerprints in a digital document.

The proposed aim and objects are also achieved by a system for generating a digital document for substitutive conservation of a paper document, comprising: means for generating a digital image of the paper document; means for generating a first digital fingerprint, related to the digital image; means for generating a digital audio recording, related to the reading of at least one portion of the content of the image or of the first fingerprint or of the digital signature of the image; means for generating a second digital fingerprint, related to the audio recording; means for grouping said digital image, said first fingerprint, said audio recording and said second fingerprint in a single document.

The expression "digital image of a paper document" is used, in this text, to reference any digital representation of the paper document in a graphic format, for example in *raw*, *bmp*, *jpeg*, *gif*, *tiff*, *png* or any other format, including proprietary ones, suitable to represent a static image, or in any other non-modifiable format, for example encoded in protected *pdf* format.

Conveniently, the digital image and/or the audio recording can be provided with a digital signature and/or a timestamp.

Advantageously, the digital document also can comprise certification data, which comprise a time stamp and/or a digital signature.

The digital fingerprint of the digital image or of the audio recording are preferably hash fingerprints, calculated with any hash algorithm, such as for example SHA-1, RIPEMD-160, SHA-224, SHA-256, SHA-384, SHA-512, or any other algorithm, even a proprietary one.

The audio recording can be in any format, for example *wav*, *mp3*, *ogg* or other format adapted to play back an audio recording.

The digital document can be stored in a text format, for example *XML* or *txt*.

5 **Brief description of the drawings**

Further characteristics and advantages of the present invention will become better apparent from the following detailed description of a preferred but not exclusive embodiment of a digital document for substitutive conservation of a paper document and a system therefor,
10 illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a block diagram related to a system for generating a digital document according to the present invention;

Figure 2 is a block diagram that illustrates the structure of the digital
15 document filed for substitutive conservation, so-called electronic evidence, according to the present invention;

Figure 3 is a flow chart that illustrates the operation of the system according to the present invention.

Ways of carrying out the Invention

20 An exemplifying architecture of the system according to the present invention is summarized in the block diagram of Figure 1.

Figure 1 illustrates an importing module 1, a signature module 2 for the application of a digital signature, a time stamping module 3 for the application of a timestamp, a module for calculating a hash fingerprint 4, a
25 recording module 5 and a module for creating electronic evidence 6.

Figure 1 also illustrates documents in input and in output with respect to the various modules.

In detail, the importing module 1 can acquire a paper document 7 and save it as a digital image 8. The module 1 can be implemented for example
30 by means of a scanner.

The signature module 2 receives in input a document 9 and applies a digital signature thereto. This module calculates the digital fingerprint of the document, for example a hash fingerprint, and then can use the private key of the party that has to sign in order to encode the digital fingerprint, and
5 obtain as a result of the encoding a digital signature. The result of the processing is a document 10, which thus comprises an original document 11 and a signature 12. The time stamping module 3 can apply a timestamp to a document 13. The module 3 can thus apply to a document a time reference, i.e., the information containing the current date and time, a reference which
10 can be certified by authorities established for this purpose. The result of the processing is a document 14, which comprises an original document 15 and a timestamp 16.

The module 4 is capable of calculating the hash fingerprint of a document 17 received in input by applying one among various hash
15 functions such as: SHA-1, RIPEMD-160, SHA-224, SHA-256, SHA-384, SHA-512. The result of the processing is a hash string 18.

The recording module 5 is a module that is adapted to receive in input a signal 19 of the audio type to generate an audio recording 20, optionally allowing to play back the recording made.

20 Finally, the module 6 is adapted to generate a digital document 23, which groups the digital image 8, optionally signed digitally and/or timestamped 21, a corresponding hash fingerprint 18', a digital recording 22, which is optionally signed digitally and/or timestamped, and a corresponding hash fingerprint 18".

25 A digital document 100 obtained as a result of the processing by the system is shown schematically in Figure 2, which illustrates a first block 200 related to the image document and a second block 300 related to the audio recording.

The block 200 contains, in addition to an image 201, an hash
30 fingerprint 202 and optionally a digital signature 203 and a timestamp 204.

The block 300 related to the audio recording contains, in addition to a recording 301, an hash fingerprint 302 and optionally a digital signature 303 and a timestamp 304.

Finally, the digital document 100 can comprise the electronic
5 evidence, which groups the blocks 200 and 300 and is provided with the digital signature 303 and with the timestamp 304.

The operation of the system according to the invention is now described with reference to the flowchart of Figure 3 and to the components listed in Figures 1 and 2.

10 In step 50, one paper document 7 is imported into the system in the form of image document 201.

In step 51, the image 201 thus acquired is optionally signed digitally, generating the signature 203, and again optionally is timestamped in step 52, generating the timestamp 204. As an alternative, the system can also
15 acquire a digital document that is already signed digitally and timestamped by other systems.

In step 53, the document is sent in input to the module 4, which calculates its hash fingerprint 202. In step 54, the hash fingerprint 202 is passed in input to the recording module 5, which requests the reading of
20 some alphanumeric data of such fingerprint. The quantitative extent of the characters to be read can be managed by the system.

The recording module then records content related to part of the digital document, its fingerprint, its signature or a combination thereof, read by the contracting parties, and generates a digital audio recording 301,
25 which can be stored in various formats, such as for example WAV or MP3.

As for the image, the audio 301 is optionally digitally signed and timestamped in steps 55 and 56 by means of the modules 2 and 3, generating the digital signature 303 and the timestamp 304. The hash fingerprint 302 thereof is then calculated in step 57.

30 In step 58, the image document, the hash fingerprint of the document,

the audio recording and the hash fingerprint of the recording are acquired by the module 5, which groups them into electronic evidence in text format, for example in the XML or TXT format. Optionally, it is possible to include in the electronic evidence additional information, such as the identification data of the parties, for example the first name, surname, identity card number, duration of the audio recording, and data related to the operator who made the recording.

Finally, in steps 59 and 60 the system, by means of the modules 2 and 3, applies to the electronic evidence the digital signature of the person responsible for conservation and the timestamp, in order to conserve everything only in a digital format.

For the sake of greater clarity, a practical example of use of the system during the signing of a contract is described. A paper contract is signed by the contracting parties, and then the paper copy is digitized and acquired by the system; depending on the settings that are present in the system, the digital image is timestamped and signed digitally. The system then displays a screen that contains some alphanumeric characters, for example the hash fingerprint of the file, and requests the parties to read a certain set of characters among those displayed. For example, in the case of two parties, the system can request the first signing party to read the first five alphanumeric characters from the left and can request the second party to read the first five alphanumeric characters from the right, or can request both to read all the alphanumeric characters.

The system thus records the reading by the parties and optionally allows to play back the recording. The digital recording also is optionally time stamped and signed digitally.

The digital image and the audio recording are then grouped into a single text document, which after the application of the digital signature of the person responsible for conservation and for the timestamp, is returned in output.

These steps can be activated automatically or semiautomatically, and in this case the system requires the user only to start the procedure.

Further, it must be noted that in the paper document that is the subject of substitutive conservation, for example a private deed, a contract or an insurance policy, it is possible to insert a clause that specifies the acceptance by the parties, for conservation according to the provisions dictated in terms of substitutive conservation of paper documents, together with the audio recording that contains the reading of the hash fingerprints of the parties.

It has thus been shown that the document, the method and the system according to the invention achieve the proposed aim and objects. In particular, it has been seen that the document thus conceived allows to overcome the qualitative limitations of the background art thanks to the fact that a recording performed by the contracting parties is attached to the digital image of the document, storing everything in a digital document whose content is such as to prevent subsequent repudiation of the statement and disowning of one's own autograph signature. Indeed, the audio recording can be the subject of a legal expertise, and in this case it is substantially impossible for the party that disowned the autograph signature to justify that it read with its own voice the recorded alphanumeric sequence of the first fingerprint, which is conserved together with the image document that is the subject of disowning. The digital document thus generated can therefore replace the paper document for all purposes.

Obviously, numerous modifications will be evident and can be performed promptly by the person skilled in the art without abandoning the scope of the protection of the appended claims. For example, it is obvious for the person skilled in the art to store the data related to the digital document in a single file or in several files, and to use algorithms to define a digital fingerprint that are different from the ones mentioned.

The scope of the protection of the appended claims must not be limited by the illustrations or by the preferred embodiments illustrated in the

description by way of examples, but rather the claims must comprise all the characteristics of patentable novelty that reside within the present invention, including all the characteristics that would be treated as equivalent by the person skilled in the art.

- 5 The disclosures in Italian Patent Application No. MO2008A000111 from which this application claims priority are incorporated herein by reference.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole
10 purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

CLAIMS

1. A digital document for substitutive conservation of a paper document, comprising:

- a digital image of said paper document;
- 5 – a first digital fingerprint, related to said image;
- a digital audio recording related to the reading of at least one portion of the content of said image or of said first fingerprint;
- a second digital fingerprint related to said audio recording.

2. The digital document according to claim 1, characterized in that
10 said digital image and/or said audio recording comprise a digital signature and/or a timestamp.

3. The digital document according to claim 1 or 2, characterized in that it comprises certification data.

4. The document according to claim 3, characterized in that said
15 certification data comprise a timestamp and/or a digital signature.

5. The document according to one or more of the preceding claims, characterized in that said first fingerprint and/or said second fingerprint comprises a hash string.

6. The document according to claim 5, characterized in that said hash
20 string is calculated with a hash algorithm selected from the group that comprises: SHA-1, RIPEMD-160, SHA-224, SHA-256, SHA-384, SHA-512.

7. A method for generating a digital document for substitutive conservation of a paper document, comprising the steps of:

- 25 – generating a digital image of said paper document;
- generating a first digital fingerprint, related to said digital image;
- generating a digital audio recording, related to the reading of at least one portion of the content of said image or of said first fingerprint;
- generating a second digital fingerprint, related to said audio recording;

- grouping said image, said audio recording, said first and second digital fingerprint in a digital document.

8. The method according to claim 7, further comprising one or more of the steps of:

- 5 – providing a digital signature on said digital image;
- providing a timestamp related to said digital image;
- providing a digital signature on said audio recording;
- providing a timestamp related to said audio recording.

9. The method according to claim 7 or 8, further comprising the step
10 of certifying in digital form said digital document.

10. The method according to claim 9, characterized in that said step of certifying the digital document comprises at least one between:

- applying a timestamp to the digital document;
- providing a digital signature on the document.

11. A system for generating a digital document for substitutive
15 conservation of a paper document, comprising:

- means for generating a digital image of said paper document;
- means for generating a first digital fingerprint, related to said digital image;
- 20 – means for generating a digital audio recording, related to the reading of at least one portion of the content of said image or of said first fingerprint;
- means for generating a second digital fingerprint, related to said audio recording;
- means for grouping said digital image, said first fingerprint, said audio
25 recording and said second fingerprint in a single document.

12. The system according to claim 11, characterized in that it further comprises means for applying a digital signature and/or a timestamp to said digital image and/or said audio recording.

13. The system according to claim 11 or 12, characterized in that it

further comprises means for applying data for certifying said digital document.

14. The system according to claim 13, characterized in that said certification data comprise a time stamp and/or a digital signature.

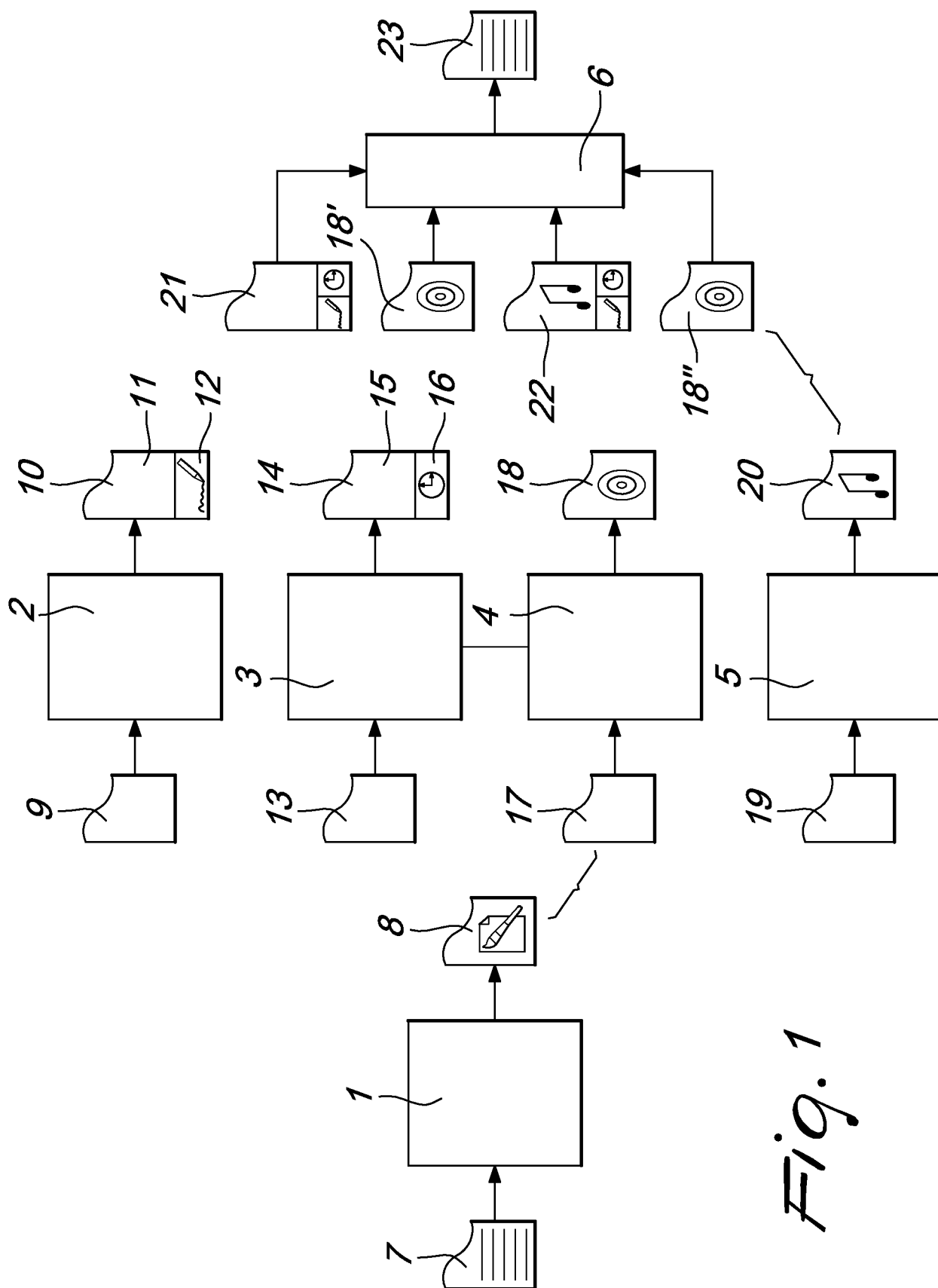
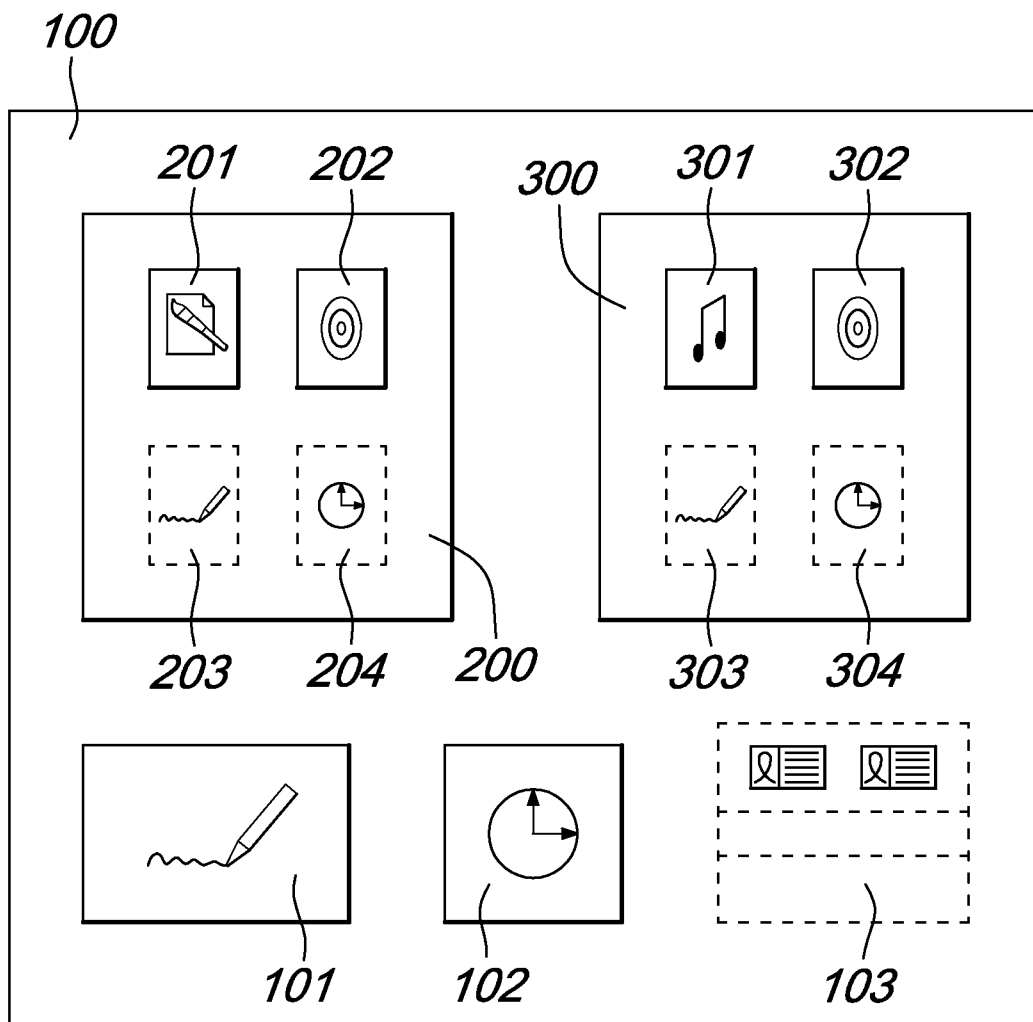
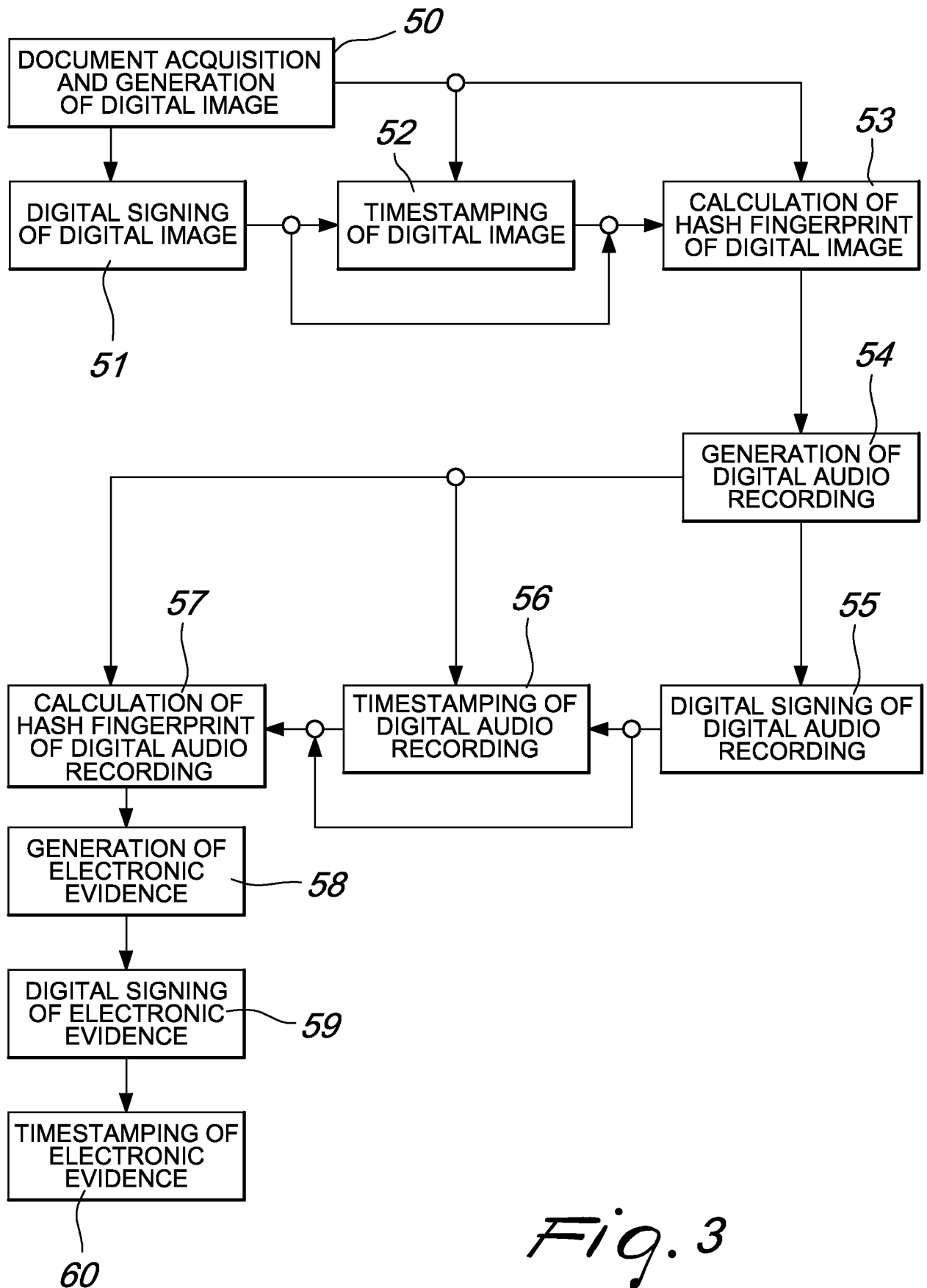


Fig. 1

*Fig. 2*

3 / 3

*Fig. 3*

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/052612

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F21/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G06F G06K H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 1 895 759 A (RICOH KK [JP]) 5 March 2008 (2008-03-05) abstract paragraph [0006] paragraph [0055] paragraph [0061]	1-14
Y	US 6 091 835 A (SMITHIES CHRISTOPHER P K [GB] ET AL) 18 July 2000 (2000-07-18) column 3, line 61 - column 4, line 5	1-14

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- * & * document member of the same patent family

Date of the actual completion of the international search

9 June 2009

Date of mailing of the international search report

22/06/2009

Name and mailing address of the ISA/
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Chabot, Pedro

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2009/052612

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
EP 1895759	A	05-03-2008	JP	2008059591 A	13-03-2008
			US	2008059800 A1	06-03-2008
<hr/>					
US 6091835	A	18-07-2000	US	6064751 A	16-05-2000
<hr/>					