

makes payment and informs the ASD, which then voids or destroys the collected printed hardcopy certificate and informs the customer that the sale has been completed. If the verification is not successful, the printed hardcopy certificate is returned to the customer (or held in the ASD), and an explanation is provided to the customer.

[0151] FIG. 17 provides more details of the sell procedure executed by the computer 131 of the ASD 105. As mentioned, the verification is conducted by the ASD 105, and the results are forwarded to the dealing financial institution. The ASD 105 displays a welcome message to start a sell transaction with a customer (Step 1) and prompts a message to invite the customer to insert printed hardcopy certificate into scanner (Step 2). The ASD 105 scans the inserted hardcopy certificate with the print-scan device 163 (Step 3), and gets the original payment details (bank account number, PIN, etc.) via the card reader 165 or the keypad 167 (Step 4). The ASD 105 then starts a transaction with the ASD host 101 (Step 5), sends the scanned certificate and collected payment details to the ASD host 101 (Step 6) via a network, and then receives a reply from the ASD host 101 via the network. (Step 7). If the ASD host's reply indicates the hardcopy certificate is valid and the payment was made by the customer, the ASD 105 informs the customer that the sale is accepted at a market price, prints VOID on the hardcopy certificate, and stores the voided hardcopy certificate locally (Step 8). Alternatively, the ASD 105 voids the hardcopy certificate by destroying (e.g., shredding) the inserted hardcopy certificate. If ASD host's reply indicates hardcopy certificate is invalid, the ASD 105 informs customer the result by displaying a message that certificate is invalid, and returns hardcopy certificate back to customer (Step 9). Therefore, the ASD 105 prints a transaction status on a local printer for record-keeping, ends the transaction with the ASD host 101, and ends the sell transaction with the customer by displaying a message of "transaction completed".

[0152] In another embodiment of the invention, to accommodate situations in which a purchaser sold the physical copy of the certificate to another person without informing the system, the ASD 105 accepts the certificate if the ASD host's reply indicates the hardcopy certificate is valid but the certificate was purchased by another person than the customer. As such, the circulation of the physical certificate is improved.

[0153] A validate operation is provided for the customer to verify the validity of a printed hardcopy certificate (for example, a hardcopy certificate obtained through a third party). Such a validate operation is a modification of a sell operation; instead of voiding the printed hardcopy certificate and transferring funds to the customer's account, the hardcopy certificate is simply returned to the customer after the validate operation.

[0154] An on-line conversion operation is where the customer wants to convert a printed hardcopy certificate to an online certificate to be kept in an online account with a securities dealing financial institution. This is another modification of a sell operation; instead of transferring funds to the customer's account, an on-line version of the document is transferred to the customer's account. In addition, the on-line conversion operation allows a certificate holder to sell the securities at a limit or stop order, rather than a market

price as shown in FIG. 17, at the time of conversion of at a later time when the condition is satisfied. A limit order is an order to buy or sell a stated amount of stock at a specified price or better. A stop order is an order designed to trigger a trade when a stock's price rises or falls to a particular point. The price of a Buy Stop order is set above the current ASK price, and the price of a Sell Stop orders is set below the current BID price.

[0155] The certificate key  $K_B$  is usually different from the key  $K_A$  used to secure communications between the ASD 105 and the ASD 105 host. The securities dealing financial institution can also use different  $K_B$ 's for different classes of certificates (to limit the damage in case a certificate key is compromised).

[0156] The ASD 105 enables customers (1) to buy printed certificates of securities, and (2) to insert printed certificates of securities for sale or conversion to on-line certificates. The novel feature of the ASD 105 is (1) the use of cryptographic checksums to make a printed certificate unmodifiable, and (2) the use of special papers and their scans to make printed certificates unforgeable.

[0157] Investors can purchase the new financial products of the present invention that are neither stocks nor bonds, and seek profits in a new financial market that did not exist before, while business operators can obtain funds using these securities that are neither stocks nor bonds. The financial instruments according to the present invention will dig up latent private funds in private sectors to be invested into public works. Therefore, the present invention will help the national as well as local governments of various countries of the world to improve infrastructures such as roads and healthcare facilities even under a tight financial condition.

[0158] The issuing system of the invention can be applied to issue checks, commercial papers, passports, driver's licenses, identity cards, smart cards, credit cards, etc. with a cryptographic checksum printed thereon. Although the ownership of checks, banknotes, commercial papers, passports, driver's licenses, identity cards, smart cards, and credit cards are not freely transactable or transferable as securities or the fixed rate financing instruments of the invention, an issuing authority or other institutes (such as a bank) can use the cryptographic checksum to verify the authenticity of an issued hardcopy document for renewal. For example, rather than transacting securities and the fixed rate financing instruments of the invention, a bank can accept a request for issuing and renewing a cashier's check (e.g., with a new expiration date) via the issuing machine of the invention. As another example, a motor vehicle authority can accept a citizen's request for issuing and renewing a driver's license via the issuing machine of the invention.

[0159] The cryptographic checksum of the invention can be applied to academic transcripts, etc. Although these documents have no ownership issues, the issuing authorities may need to verify the documents later. A school may put a cryptographic checksum on an academic transcript, then verify a copy faxed to it to see if there is any information printed thereon being modified.

[0160] The invention can be applied in conjunction with the prior art techniques, such as those previously described to generate unforgeable hardcopy documents. For example,