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(54) AUTOMATIC GENERATION OF AN ORDER IN AN INSTRUMENT IN A SPECIFIED CURRENCY

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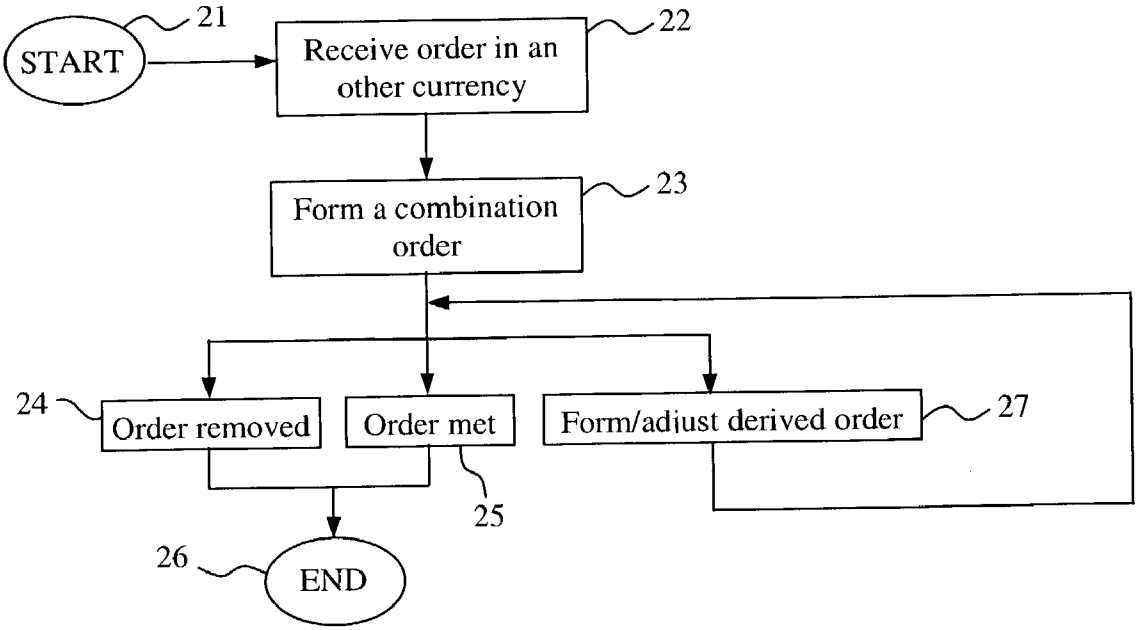
(57) **ABSTRACT**

In an automated trading system wherein orders in an instrument in a specified currency are received and a trade in the instrument is performed when, for a certain volume of the instrument, a bid price matches an ask price, a method is provided for automatically generating an order in the instrument in said specified currency. The method comprised the steps of receiving from e.g. a currency market or a market maker a current exchange rate between a currency other than said specified currency and the specified currency; receiving from a trader an order in the instrument in said other currency; calculating a price of the order in the specified currency based on the received order and the current exchange rate; and generating the order in the instrument in the specified currency.



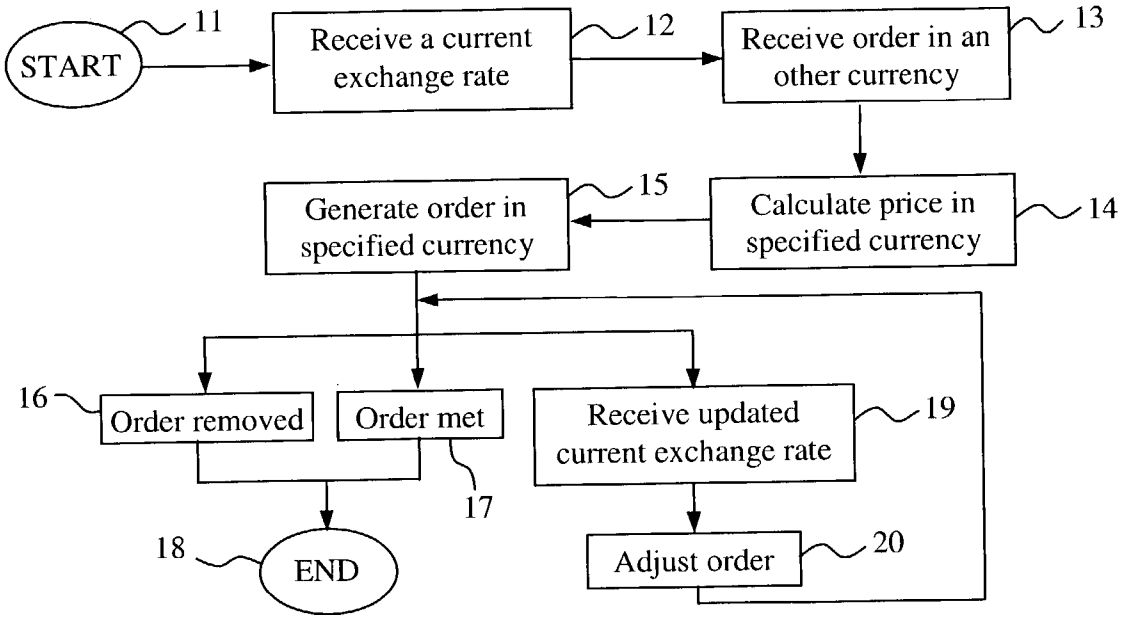

START
11
Receive a current exchange rate
12
Receive order in an other currency
13
Calculate price in specified currency
14
Generate order in specified currency
15
16
Order removed
Order met
17
Receive updated current exchange rate
19
18
END
Adjust order
20

Fig. 1

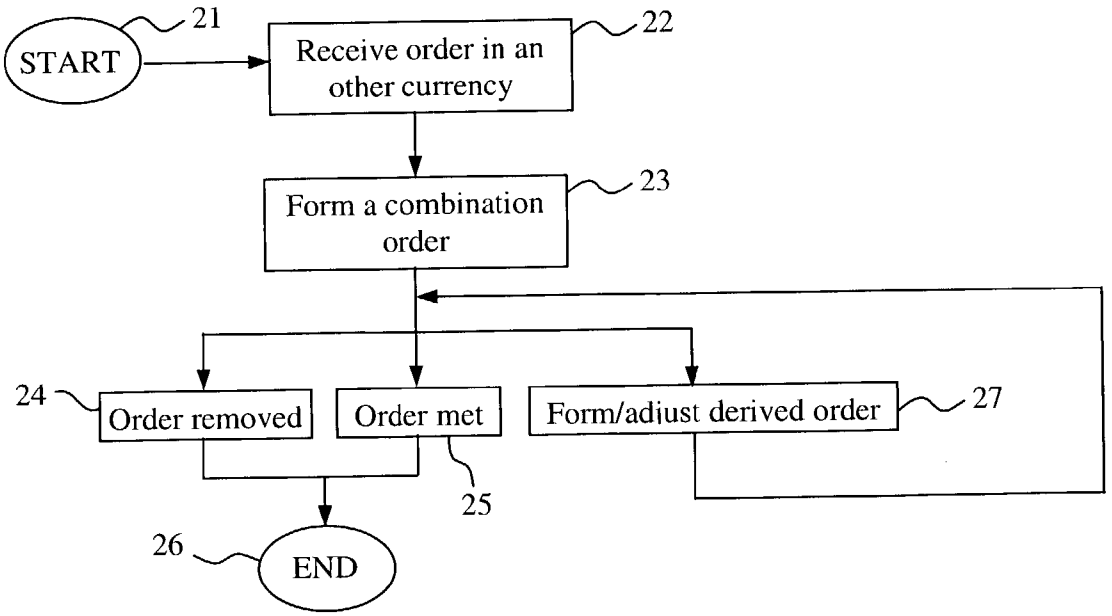

START
21
Receive order in an other currency
22
Form a combination order
23
24
Order removed
Order met
Form/adjust derived order
27
25
26
END

Fig. 3

Instrument A			
Bid (EUR)	Depth	Ask (EUR)	Depth
110	2000	111	2400
109	4000	112	6000
108	8000	113	12000

Fig. 2a

Instrument A			
Bid (EUR)	Depth	Ask (EUR)	Depth
110	2600	111	2400
109	4000	112	6000
108	8000	113	12000

Fig. 2b

Instrument A			
Bid (EUR)	Depth	Ask (EUR)	Depth
110	2000	111	2400
109	4600	112	6000
108	8000	113	12000

Fig. 2c

Instrument A			
Bid (EUR)	Depth	Ask (EUR)	Depth
110	2000	111	1800
109	4000	112	6000
108	8000	113	12000

Fig. 2d

Instrument A			
Bid (EUR)	Depth	Ask (EUR)	Depth
110	2000	111	2400
109	4000	112	6000
108	8000	113	12000

Currency EURO			
Bid (USD)	Depth	Ask (USD)	Depth
1.066	200000	1.076	240000
1.064	400000	1.078	600000
1.062	800000	1.080	1200000

Fig. 4a

Instrument A			
Bid (EUR)	Depth	Ask (EUR)	Depth
110.5	600	111	2400
110	2000	112	6000
109	4000	113	12000
108	8000		

Currency EURO			
Bid (USD)	Depth	Ask (USD)	Depth
1.072	66600	1.076	240000
1.066	200000	1.078	600000
1.064	400000	1.080	1200000
1.062	800000		

Fig. 4b

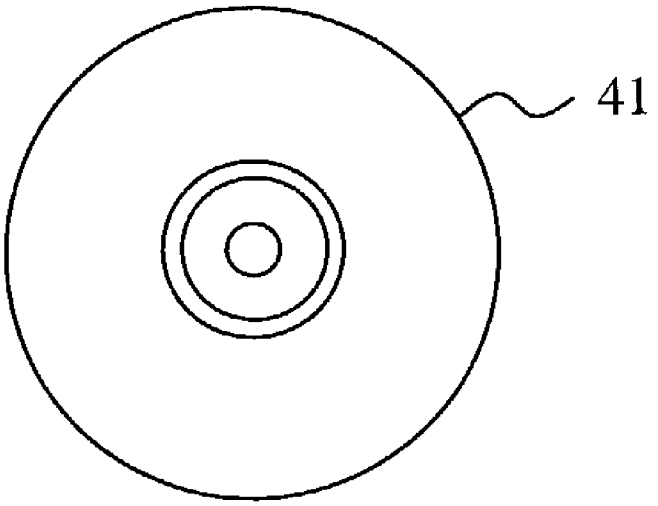


Fig. 5

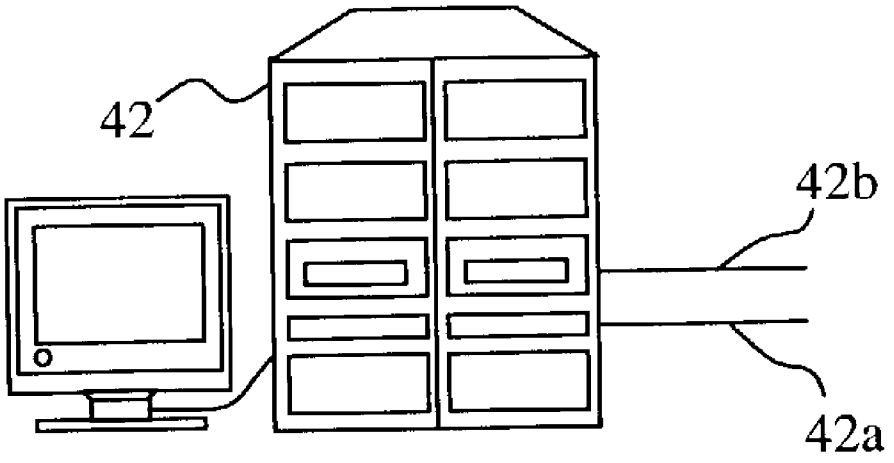


Fig. 6

AUTOMATIC GENERATION OF AN ORDER IN AN INSTRUMENT IN A SPECIFIED CURRENCY

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates generally to trading and more specifically to methods for automatically generating an order in an instrument in a specified currency, to computer program products for performing the methods, and to automated trading systems having the methods implemented.

DESCRIPTION OF RELATED ART AND BACKGROUND OF THE INVENTION

[0002] When trading shares and other financial instruments in an automated trading system, both buyers and sellers want to be capable of buying and selling instantly and to get the best possible price. Thus, a very liquid market is desirable since such a market provides for instantaneous trading, low spread, and a price, which reflects the market at each instant.

[0003] Sometimes a trader may want to sell or buy a specified volume of a particular financial instrument in another currency than the one used for that instrument in the automated trading system. Typically, the trader has then to give a price in the currency used for that instrument, and then, provided that the order is met on the market, his broker sells or buys the currency used for that instrument depending on whether a sale or a purchase has been made.

[0004] Usually, the trader does not have knowledge in advance of the exchange rate for such currency transaction, nor may the trader give conditional orders depending on the exchange rate obtainable. Further, it is believed that the trader does not obtain a price of the exchange rate, which always is the best possible price at the exact moment of the sale or purchase. Typically, the currency transaction and the sale or purchase are performed at different times, and a minor trader may often only obtain a current exchange rate on a day-to-day basis.

SUMMARY OF THE INVENTION

[0005] A solution to the problems identified above would be to modify the automated trading system to be capable of receiving orders in each instrument in a plurality of currencies and to form an order book for each one of the instruments in each one of the plurality of currencies.

[0006] The inventors of the present invention have noted that such a modified automated trading system, even in the case that only two different currencies are supported, leads to a very illiquid market in all but one of the currencies supported.

[0007] It is therefore an object of the present invention to provide a method in an automated trading system, which overcomes the problems associated with the prior art and which allows a trader to give an order in an instrument in a currency that is different from the currency normally used for orders in that instrument, and which order is matched with orders received in the currency normally used.

[0008] It is in this respect a particular object of the invention to provide such a method, which increases the liquidity on the market.

[0009] It is a further object of the invention to provide such a method, which makes use of one order book only for each instrument traded.

[0010] It is yet a further object of the invention to provide such a method, which is easy to implement in existing trading systems.

[0011] It is still a further object of the invention to provide a software product loadable into the internal memory of a computer for performing the above-identified method when the software product is run on the computer.

[0012] It is yet a further object of the present invention to provide an automated trading system for receiving orders in an instrument in a specified currency, and for performing a trade in that instrument when, for a certain volume of the instrument, a bid price matches an ask price, which solves the problems associated with the prior art.

[0013] These objects among others are, according to the present invention, attained by methods, computer program products and automated trading systems as claimed in the appended patent claims.

[0014] An advantage of the present invention is that the number and sizes of the orders in an instrument, which according to the present invention can be given in a plurality of currencies, will increase. The overall trading will increase to the benefits of the sellers and buyers. Only one order book for each instrument will exist, and thus no fragmentation of liquidity is performed.

[0015] Further characteristics of the invention, and advantages thereof, will be evident from the following detailed description of preferred embodiments of the present invention given hereinafter and the accompanying **FIGS. 1-6**, which are given by way of illustration only, and shall thus not limit the scope of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] **FIG. 1** is a schematic flow scheme of a method according to a preferred embodiment of the present invention.

[0017] **FIGS. 2***a-d* are schematic highly simplified extracts of an order book of a trading system for a single instrument illustrating principles of the method as illustrated in **FIG. 1**.

[0018] **FIG. 3** is a schematic flow scheme of a method according to a further preferred embodiment of the present invention.

[0019] **FIGS. 4***a-b* are schematic highly simplified extracts of order books of a trading system for an instrument and for a currency, respectively, illustrating principles of the method as illustrated in **FIG. 3**.

[0020] **FIG. 5** illustrates a storage medium storing a computer program product for performing any of the methods of the present invention when run on a computer.

[0021] **FIG. 6** illustrates a computer system, in which an automated trading system according to the present invention is implemented.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0022] With reference to **FIG. 1**, which is a schematic flow scheme of an algorithm for method for automatically

generating an order in an instrument in a specified currency, a preferred embodiment of the present invention will be described. The illustrated algorithm is implemented in an automated trading system wherein bids and offers in instruments in specified currencies are received and entered into an order book, and a trade in one of the instruments is performed when, for a certain volume of that instrument, a bid price matches an ask price.

[**0023**] In a step **11**, the algorithm is started, and in a step **12**, a current exchange rate between a currency, which is different from a specified currency for a particular instrument, is received. The specified currency is the currency in which the instrument is traded. In a step **13**, an order is received in the particular instrument in a currency different from the specified currency from a trader.

[**0024**] Typically, an updated exchange rate between the different currency and the specified currency is received repeatedly and automatically from the currency market or the market maker, and the last received updated exchange rate between the different currency and the specified currency at the time of receiving the order is used as the received current exchange rate. The frequency, at which the updated exchange rate between the different currency and the specified currency is received, may be from several times a second down to once an hour, or even more infrequently.

[**0025**] If the updated exchange rate between the different currency and the specified currency is received repeatedly and automatically from a market maker, this market maker guarantees to perform a currency transaction based on the last received updated exchange rate. Thus, the updated exchange rate as received may be viewed upon as a real time feed of guaranteed exchange rates. Upper limits of the size of the guaranteed currency transaction may exist.

[**0026**] Next, in a step **14**, a price of the order in the specified currency is calculated based on the received order and the current exchange rate, and, in a step **15**, the order in the instrument is generated in the specified currency and put on the market, i.e. entered into the order book for that instrument.

[**0027**] Three different possible actions may then be performed. The order may, in a step **16**, be removed from the order book, e.g. in response to a request made by the trader. Alternatively, the order is, in a step **17**, met by another order on the market, whereupon a trade in the instrument and a currency transaction are performed concurrently. After the order has been removed or been met the inventive algorithm is, in a step **18**, ended.

[**0028**] A third possibility is that, in a step **19**, an updated exchange rate between the different currency and the specified currency is received while the order is in the order book. In such instance, the generated order is, in a step **20**, adjusted to reflect the updated exchange rate received, i.e. the earlier order is removed from the order book and the adjusted order is entered into the order book, after which the algorithm is returned back to a position immediately after step **15**. The steps **19** and **20** comprise a loop for adjusting the generated order each time an updated exchange rate between the different currency and the specified currency is received.

[**0029**] The order received from the trader may be a bid and in such instance the exchange rate between the different currency and the specified currency is a buying price for buying the specified currency (with payment effectuated in the different currency). Correspondingly, if the order received from the trader is an offer, the exchange rate between the different currency and the specified currency is a selling price for selling the specified currency.

[**0030**] It shall be appreciated by the man skilled in the art that the present invention may provide for receiving orders in a selected group of currencies for each different instrument traded. An updated exchange rate is received for each combination of different currency and specified currency supported. Typically, the invention may provide for that orders in some or all of the instruments traded in the automated trading system can be receive in about 2-5 currencies.

[**0031**] It shall further be appreciated that the trader may continuously follow the updated exchange rates in order to also be capable to initiate an order depending on the current exchange rate, i.e. a favorable exchange rate may encourage the initiation of an order, whereas a less favorable exchange rate may restrain the initiation of the order.

[**0032**] By means of the inventive algorithm described, including the steps of receiving the current exchange rate between the currency other than the specified currency and the specified currency, and generating an order in the specified currency based on an order received in the other currency, and the current exchange rate, a method is obtained, by which more orders, as compared to prior art methods, can be handled. As a result a more liquid market with more conclusions of trades is obtained. The inventive algorithm is particularly useful when the instrument involved has a low turnover rate.

[**0033**] With reference now to **FIGS. 2***a-d*, which are schematic highly simplified extracts of an order book for a single instrument A traded in euros, an example of the method as illustrated in **FIG. 1** will be highlighted.

[**0034**] **FIG. 2***a* illustrates a typical situation during a trading day: a number of bids and offers exist. Each bid price and each ask price has an order depth given by the number and sizes of orders at that price.

[**0035**] At this point a bid order is received from a trader: "buy 600 of instrument A for a maximum bid price of 119 US dollars". The inventive method of **FIG. 1** supports orders in US dollars (USD) for this instrument, and it is assumed that the last received exchange rate is 1.08 USD/EUR. The method calculates a price of the order in euros and generates the bid order in euros: "buy 600 of instrument A for a maximum bid price of 110 euros", and since no ask price of EUR110 is available, the order is entered into the order book. The result of this is shown in **FIG. 2***b*: the order depth for a bid price of EUR110 has increased from 2000 to 2600.

[**0036**] Assume now that an updated exchange rate of 1.09 USD/EUR is received. The bid order is now adjusted to "buy 600 of instrument A for a maximum bid price of 109 euros" to reflect the received updated exchange rate. The result of this adjustment is shown in **FIG. 2***b*: the order depth for a bid price of EUR110 has decreased from 2600 to 2000, whereas the order depth for a bid price of EUR109 has increased from 4000 to 4600.

[**0037**] Assuming now that an updated exchange rate of 1.07 USD/EUR is received, the bid order is adjusted to "buy

600 of instrument A for a maximum bid price of 111 euros" to reflect the received updated exchange rate. This order is met by one or several offers as shown at the ask price of EUR111 in **FIG. 2***c*. As a result a trade of 600 of instrument A at a price of EUR111 and a currency transaction of an amount corresponding to the size of the trade at an exchange rate of 1.07 USD/EUR are performed concurrently. In **FIG. 2***d* is shown the resulting appearance of the order book: the order depth for a bid price of EUR109 has decreased from 4600 to 4000, and the order depth for an ask price of EUR111 has decreased from 2400 to 1800.

[**0038**] With reference next to **FIG. 3**, which is a schematic flow scheme of an algorithm for method for automatically generating an order in an instrument in a specified currency, a further preferred embodiment of the present invention will be described.

[**0039**] This embodiment is similar to the **FIG. 1** embodiment, but differs in how the exchange rate is received. Further, this embodiment is implemented in an automated trading system wherein not only orders in an instrument in a specified currency are received but also orders in the specified currency are received and a trade in the specified currency is performed when, for a certain amount of the specified currency, a bid price matches an ask price. In other words the automated trading system comprises an automated currency exchange market system.

[**0040**] The algorithm of **FIG. 3** is, in a step **21**, started, and, in a step **22**, an order is received in a particular instrument in a currency, which is different from the specified currency in which that particular instrument is traded, from a trader.

[**0041**] Next, in a step **23**, a combination order comprising one order in the instrument in the specified currency and one order in the specified currency in the different currency are formed based on the received order in the instrument in the different currency.

[**0042**] Three different possible actions may then be performed depending on the circumstances. The order may, in a step **24**, be cancelled, e.g. in response to a request made by the trader. Alternatively, the combination order is, in a step **25**, met by other orders on the markets, whereupon a trade in the instrument and in the specified currency are performed simultaneously. After the order has been cancelled or been met the inventive algorithm is, in a step **26**, ended.

[**0043**] A third possibility, provided that the combination order is not immediately met by other orders, is to, in a step **27**, form a derived order in the instrument or in the specified currency, wherein the derived order is formed so that provided that the derived order will be met by another order, the other order of the combination order will automatically be met by still another order, and trades in the instrument and the specified currency can be performed simultaneously. The derived order, which may also be referred to as a bait, is entered into the order book for that instrument or currency, after which the algorithm is returned back to a position immediately after step **23**.

[**0044**] When the market changes, the derived order may become obsolete, i.e. it does not fulfill the above-mentioned requirement. In such instance, the derived order has to be adjusted according to the subsisting market at each instant, i.e. the obsolete derived order is removed from the order book and the adjusted derived order is entered into the order book. This is an integral portion of the step **27** as illustrated. The step **27** thus forms a loop for forming/adjusting a derived order, which at each instant is up to date with the market.

[**0045**] It shall be appreciated that a derived order may be formed not only in the instrument or in the specified currency, but in both. This increases the possibility of having the combination order met.

[**0046**] It shall further be appreciated that this embodiment has to take the sizes of the orders in the specified currency into account, and hence this solution calls for a more complex algorithm. For instance, when forming a derived order in the instrument or the specified currency the best price provided in the other one of the instrument or the specified currency may not have sufficient order depth and in such instance the second best price, and optionally the third best price, have to be considered.

[**0047**] With reference next to **FIGS. 4***a-b*, which are schematic highly simplified extracts of order books for a single instrument A traded in euros and for the currency euro as traded in US dollars, respectively, an example of the method as illustrated in **FIG. 1** will be highlighted.

[**0048**] **FIG. 4***a* illustrates a typical situation during a trading day: a number of bids and offers exist in each order book. Each bid price and each ask price has an order depth given by the number and sizes of orders at that price. The order depth for the instrument A is given in the volume of that instrument and the order depth for the currency euro are given in euros.

[**0049**] At this point a bid order is received from a trader: "buy 600 of instrument A for a maximum bid price of 119 US dollars". The inventive method of **FIG. 3** supports orders in US dollars for this instrument, and thus forms a combination order "buy 600 of instrument A and xx euros for the combined price of 119 US dollars, where xx euros are sufficient to buy the 600 of instrument A".

[**0050**] It is checked whether the best ask price for 600 of instrument A, i.e. EUR111, and the best ask price for 600×EUR111=EUR66600, i.e. 1.076 USD/EUR, match the combination order. In this case it does not match the combination order and as a consequence two derived orders are formed to increase the probability of having the combination order met in the near future.

[**0051**] A derived order for buying 600 of instrument A is formed from the best ask price for euros in a sufficient amount, i.e. 1.076 USD/EUR. USD119 divided by 1.076 USD/EUR gives EUR110.5. Thus a derived order is formed as an order for buying 600 of instrument A at EUR110.5. Provided that the derived order is met, the complete combination order is met. If the best ask price of 1.076 USD/EUR is increased, the bid price of the derived order has to be decreased correspondingly.

[**0052**] Similarly, a derived order for buying 66600 euros at a price of 1.072 USD/EUR (USD119/EUR111) is formed from the best ask price for instrument A in a sufficient amount, i.e. EUR111. Provided that the derived order is met, the complete combination order is met. As soon as one of the derived orders is met, the corresponding trades are performed and the other derived order is immediately cancelled.

[0053] In **FIG. 4***b* these two derived orders are underlined for illustrative purposes, even if they appear to other traders as ordinary orders.

[0054] Finally, **FIG. 5** illustrates a storage medium **41**, which stores a computer program product for performing any of the methods of the present invention, and **FIG. 6** illustrates a computer system **42**, in which an automated trading system according to the present invention is implemented.

[0055] Such automated trading system may comprise a module for receiving orders in an instrument in a specified currency via an input line **42***a*; a module for performing a trade in that instrument when, for a certain volume of the instrument, a bid price matches an ask price; a module for receiving an order in the instrument in another currency from a trader via line **42***a*; a module for repeatedly receiving an exchange rate between the other currency and the specified currency via an input line **42***b*; a module for calculating a price of the order in the specified currency based on the received order and the last received exchange rate; and a module for transferring the order in the instrument in the specified currency to the module for receiving orders in an instrument in a specified currency.

What is claimed is:

1. In an automated trading system wherein orders in an instrument in a specified currency are received and a trade in said instrument is performed when, for a certain volume of said instrument, a bid price matches an ask price, a method for automatically generating an order in said instrument in said specified currency, comprising the steps of:

receiving a current exchange rate between a currency other than said specified currency and said specified currency;

receiving from a trader an order in said instrument in said other currency; and

calculating a price of said order in said specified currency based on said received order and said current exchange rate; and

generating said order in said instrument in said specified currency.

2. The method of claim 1 wherein, provided that said generated order in said instrument in said specified currency is met by another order, a trade in said instrument and a currency transaction are performed concurrently.

3. The method of claim 1 wherein an updated exchange rate between said other currency and said specified currency is received repeatedly and automatically, and the last received updated exchange rate between said other currency and said specified currency at the time of calculating said price is defined as said received current exchange rate.

4. The method of claim 3 wherein, provided that an updated exchange rate between said other currency and said specified currency is received subsequent to said step of generating said order in said instrument in said specified currency, said generated order is adjusted to reflect said updated exchange rate received subsequent to said step of generating said order.

5. The method of claim 4 wherein said generated order is adjusted each time an updated exchange rate between said other currency and said specified currency is received subsequent to said step of generating said order to reflect the respective updated exchange rates received.

6. The method of claim 3 wherein said updated exchange rate between said other currency and said specified currency is received repeatedly and automatically from a market maker, which guarantees to perform a currency transaction based on said received current exchange rate.

7. The method of claim 3 wherein

said updated exchange rate between said other currency and said specified currency is received repeatedly and automatically from a currency market, in which bids and offers in currencies are received and a trade in a currency is performed when, for a certain amount of that currency, a bid price matches an ask price; and

said received updated exchange rate is determined based on bids or offers in said specified currency.

8. The method of claim 1 wherein said order received from said trader is a bid and said current exchange rate between said other currency and said specified currency is a buying price for buying said specified currency.

9. The method of claim 1 wherein said order received from said trader is an offer and said current exchange rate between said other currency and said specified currency is a selling price for selling said specified currency.

10. The method of claim 1 wherein said other currency is selected from a group of available currencies.

11. A computer program product loadable into the internal memory of a computer, comprising software code portions for performing the method of claim 1 when said product is run on said computer.

12. An automated trading system comprising:

means for receiving orders in an instrument in a specified currency;

means for performing a trade in said instrument when, for a certain volume of said instrument, a bid price matches an ask price;

means for receiving from a trader an order in said instrument in another currency;

means for receiving a current exchange rate between said other currency and said specified currency;

means for calculating a price of said order in said specified currency based on said received order and said current exchange rate; and

means for transferring said order in said instrument in said specified currency to said means for receiving orders in an instrument in a-specified currency.

13. The automated trading system of claim 12 comprising means for repeatedly and automatically receiving an updated exchange rate between said other currency and said specified currency, wherein the last received updated exchange rate between said other currency and said specified currency at the time of calculating said price is defined as said received current exchange rate.

14. The automated trading system of claim 13 comprising means for, provided that an updated exchange rate between said other currency and said specified currency is received subsequent to the generation of said order in said instrument in said specified currency, adjusting said generated order to reflect said updated exchange rate received subsequent to the generation of said order.

15. The automated trading system of claim 14 wherein said means for adjusting is adapted to adjust said generated order each time an updated exchange rate between said other currency and said specified currency is received subsequent to the generation of said order to reflect the respective updated exchange rates received.

16. In an automated trading system wherein orders in an instrument in a specified currency are received and a trade in said instrument is performed when, for a certain volume of said instrument, a bid price matches an ask price; and wherein orders in said specified currency are received and a trade in said specified currency is performed when, for a certain amount of said specified currency, a bid price matches an ask price; a method for automatically generating an order in said instrument in said specified currency, comprising the steps of:

receiving from a trader an order in said instrument in another currency;

forming a combination order comprising one order in said instrument in said specified currency and one order in said specified currency in said other currency based on said received order in said instrument in said other currency; and

provided that said combination order is met by other orders performing trades in said instrument and said specified currency simultaneously.

17. The method of claim 16 wherein, provided that the said combination order is not met by other orders, a derived order in said instrument or in said specified currency is generated, wherein said derived order is formed so that provided that said derived order will be met by another order, the other order of said combination order will automatically be met by still another order, and trades in said instrument and said specified currency will be performed simultaneously.

18. In a client-based trader system connectable to a server-based trading system wherein orders in an instrument traded in a specified currency are received in said specified currency and in a currency other than said specified currency; an exchange rate between a currency other than said specified currency and said specified currency is received repeatedly; and, provided that an order in said instrument in said other currency is received from a trader, a price of said order in said specified currency based on said received order and the last received exchange rate is calculated, said order in said instrument is generated in said specified currency, and if said order in said instrument generated in said specified currency is met by another order, a trade in said instrument and a currency transaction are performed concurrently, a method for automatically trading in said instrument in said currency other than said specified currency, comprising the steps of:

sending to said server-based trading system a buy or sell order in said instrument in said other currency;

receiving information of said buy or sell order in said instrument as generated in said specified currency by said server-based trading system; and

if said buy or sell order in said instrument as generated in said specified currency is met on the market, receiving information of a trade in said instrument and a currency transaction as performed concurrently by said server-based trading system.

* * * * *