

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
24 December 2003 (24.12.2003)

PCT

(10) International Publication Number
WO 03/107121 A2

- (51) International Patent Classification⁷: **G06F**
- (21) International Application Number: PCT/US03/18436
- (22) International Filing Date: 11 June 2003 (11.06.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/389,636 18 June 2002 (18.06.2002) US
- (71) Applicant (for all designated States except US): **TRADE-GRAPH, LLC** [US/US]; 3710 Commercial Avenue, Suite #6, Northbrook IL, IL 60062 (US).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): **DUQUETTE, Douglas, Ray** [US/US]; 1225 Colgate Avenue, Wilmette, IL 60091 (US).

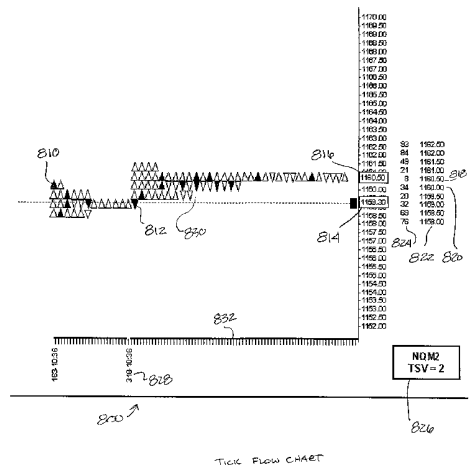
- (74) Agent: **ORMOS, Neil, R.**; Avendia Law Group, Ltd., 2700 S. Briarwood Drive West, Arlington Heights, IL 60005-4603 (US).
- (81) Designated States (*national*): AU, CA, JP, US.
- (84) Designated States (*regional*): European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR).

Published:
— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.



(54) Title: SYSTEM AND METHOD FOR ANALYZING AND DISPLAYING SECURITY TRADE TRANSACTIONS



WO 03/107121 A2

(57) Abstract: A system and methods for processing and charting security exchange trading and market information shows security traders if current transactions originated as buy orders or sell orders, and simultaneously indicates traded quantity. Security exchange trading information is received that includes the price, volume and time of each trade. In addition, security exchange market information is received from buyers, specifying bid prices and quantities, and from sellers, specifying asking prices and quantities. The security exchange trading and market information is processed simultaneously and displayed as a continuously updated real-time chart depicting the exchange auction process whereby buyers and sellers agree to trade at specified prices, including details of individual transactions. The chart is formed by plotting each trade at the price traded, and for each plot point shows a distinctive icon indication whether the transaction was initiated by a buyer or seller.

SYSTEM AND METHOD FOR ANALYZING AND DISPLAYING SECURITY TRADE TRANSACTIONS

FIELD OF THE INVENTION

This application relates to systems and methods for analyzing and displaying securities transactions, and more particularly to systems and methods for displaying the details of securities market transactions and order books in near real-time so as to provide the user with information that closely approximates the quality and quantity of information available to a trader on an exchange floor.

BACKGROUND OF THE INVENTION

A large number of systems have been developed to support securities trading by persons who, for one reason or another, are not present at the floor of an exchange. Early systems delivered information describing transactions to remote locations by telephony or telegraphy. However, the information reported was typically quite limited, and might include, for example, the symbol, price and quantity of a security transaction. In addition, these systems generally employed manual processes and relatively slow information transmission media, such that when markets were busy, transaction reports experienced significant delays, and some transactions were not reported. As information and telecommunications technologies advanced, subsequent systems have improved the timeliness with which information has been delivered.

However, even these later systems have proven inadequate in that they do not provide sufficient detail about the transactions and the market, or fail to usefully present such detail, to enable a trader to understand individual transactions and the trends that streams of such transactions represent, and therefore make rapid, profit-maximizing trading decisions.

The basic technique for making money in securities markets can be summed up in four words: buy low, sell high (or vice-versa for short sellers). A successful investor is a securities trader who can obtain a profit while minimizing exposure to the investment risk of losing a significant amount of capital.

Securities markets are made possible by government authorized and regulated exchanges that bring together buyers and sellers of securities in an auction process whereby trading prices are discovered and trades are executed between the parties. The process of buying and selling of securities occurs at several levels, from the point of origination as individual investors or professional money management organizations, to broker/dealers or futures commission merchants (FCM) acting as market makers, specialists, agents, and clearing firms, to the exchanges and related Electronic Communication Networks (ECN) which serve as the match makers to complete the trading auction process.

Investors may choose a shorter or longer period of time to own a security, with longer investment periods generally exposing an investor to more risks due to unknown or unforeseen changes in circumstances, including the underlying bases for valuation of an investment. As part of investment decision-making, investors may apply basic investment strategies in their effort to try to buy low and sell high: (1) fundamental analysis; (2) technical analysis; or (3) a combination of fundamental and technical analysis.

Investors choosing to hold securities for a longer period of time are likely to use fundamental analysis to determine if the current value of a security is fair and to assess the future potential for the security to produce income, or increase in value for a capital gain. Investors choosing to hold securities for a shorter period of time are likely to use technical analysis to determine if a change in supply or demand will change the value of a security, thereby allowing the investor to trade the security for a quick profit.

Technical analysis uses a variety of displays and statistical calculations to monitor trading prices and trading volumes, usually for fixed time intervals, to assist investors who try to make profits based on the short-term swings of the market. Traders who depend on technical analysis range from market makers, who are continuously trading and making buy and sell orders, to day traders, who try to take advantage of hourly or daily price changes to make a profit, to slightly longer-term investors who track stock price and trading volume fluctuations over a period of a few days or weeks and trade on the basis of recent trends. Technical analysis focuses on patterns that appear on the historical price charts of a security in the belief that historical price patterns may repeat, or that recent price trends may help predict the future price of a security.

Technical analysis, as generally practiced, is based on a review of historical time series data, such as a series of daily closing prices for a security. A number of known statistics have been derived from the processing of time series data, and trading systems have been developed to produce and display them. These statistics include moving averages, support and resistance values, stochastic oscillators, along with specialized quantitative studies such as Bollinger bands, Fibonacci curves, and candlestick charts. Fig. 1 depicts a candlestick chart 100, which incorporates vertical bars 110 representing cumulative trading activity during an interval. The vertical bars have a thin portion, such as bar 112, which represents the range of prices during the interval, and a thick portion 114 which may indicate some other information, such as the direction of price change between the first and last price reported during the interval. Time series data is also summarily displayed in various fixed time intervals, from tens of seconds to minutes, hours, days, months or years. For example, Fig. 2 depicts a line chart 200, on which may be plotted a line 210 showing an aspect of a security, such as daily closing price, over an extended interval. For another example, Fig. 3 depicts a bar chart 300. Each bar, such as 310,

represents a range of trading prices over an interval, and additional markings 312, 314, may represent another parameter, such as opening and closing prices.

Thus, as shown in the examples noted above, most known technical charting systems do not plot each transaction, or 'tick', but instead sample and display a representation of price activity at a periodic rate.

Previously, the most active traders, or market makers, conducted transactions in person on exchange floors, and did not depend on computer systems to interact with each other. Traders present on an exchange floor benefit from the ability to observe individual transactions in a security. In addition, such traders may also observe the number and price of prospective transactions (i.e., bids to purchase or offers to sell) by other participants. This information is sometimes referred to as "order book" or "depth of market" information, and can assist a trader in discerning market trends. Traders present on an exchange floor may also observe many visual and auditory cues relating to the behavior of market participants. The increased use of all electronic market exchanges, however, is pushing market makers off of exchange floors and creating a need for new chart displays to represent market activity for each transaction, or "tick".

One prior-art approach to displaying transaction-related information is to produce a quotation table reporting, for example, the most recent transaction. A tick trend indicator, usually a '+', '-', or '=' sign, is provided to indicate whether the price of the most recent transaction is higher, lower, or the same as the previous transaction. Several trend indicators may be shown, coarsely depicting the history of trend indicators. However, this table arrangement does not show a history of individual transactions in a particular security, and does not represent the transactions in the form of a two-dimensional chart or graph.

Another prior-art approach to displaying transaction-related information is a conventional "tick chart" which shows price levels of transactions as a continuously adjusted line. The chart is arranged so that transaction information is plotted against time, so that individual transactions cannot be easily resolved, particularly where those transactions occur around the same time. When presenting 'tick' charts that display a mark for each transaction, prior art systems typically represent the transaction 'tick' with a dot or colored circle plotted at the price of the transaction. Sometimes the 'tick' dots are connected by a line (see Fig. 6), and other times 'ticks' are transformed into a continuous line that moves horizontally and vertically without showing any dots. However, these systems do not lend themselves to rapid determination of market conditions, because they do not indicate individual transactions, or they do not allow easy, unequivocal determination of order initiation a critical determining factor in price trend detection as defined and shown subsequently hereto.

Fig. 4 shows an alternative form of a tick chart, called the point-and-figure chart 400, which was originally developed by floor traders who kept paper and pencil hand charts for quick reference. This method plots transactions into columns, e.g. 410, for successive trades that maintain an upward or downward trend. If the price trend reverses by a preset arbitrary amount of minimum price increments, the plotting moves to the next column, e.g. 412. Point-and-figure charts alternately plot X's and O's across columns. Point-and-figure charting is unsatisfactory for several reasons: not all transactions are displayed because only transactions that meet filter criteria based on the amount of a price increase or decrease between successive transactions are plotted; there is no indication of trading volume; and buyer/seller order initiation is not indicated.

During trading days, some trading systems monitor and display a variety of general statistics to indicate market breadth and depth. These include such items as number of new highs, number of new lows, number of advancers, number of decliners, volume up, volume down and various ratios applied to said items. The tabular representation can also be presented in chart form when the daily market statistics are shown for larger time intervals. General market statistics are mentioned here in passing because they are frequently cited when describing markets, however such market statistics do not provide detailed information regarding individual transactions occurring in a market.

The prior art technical analysis systems have focused on 'what' happened in security markets--what prices, what volumes, what statistics for a fixed period of time, or some other fixed periodicity method of data sampling, such as tick bar charts that draw a new bar for every n-number of ticks and then samples the results for high, low and close prices. From the observations thus gathered, prior art technical analysis systems attempt to explain 'why' trading occurred in the past according to apparent patterns, and 'why' trading is likely to respond in the future based on a potential repetition of past patterns and to values established from analysis of historical data.

Technical analysis is a somewhat artificial approach to predicting security prices because of the false assumption that past observations are a reasonable basis for determining future actions and results, when in fact the act of functioning security markets is to bring together buyers and sellers and establish mutually acceptable prices for executing transactions in a process that balances supply and demand for a security. It is further hampered by the attempt to use a periodic sampling process as an input database to their calculative output in an attempt to describe the non-periodic, even chaotic, market trading process.

In contrast to technical analysis, academic research compares security trading to a 'random walk' that has no set pattern and no association of historical precedent with future action. While no definitive answer has been obtained as to the validity of technical analysis, a

plausible assumption is that if enough traders use technical analysis as a basis for making trading decisions, then technical analysis will at least to some extent be a self-fulfilling prophecy, by virtue of the fact that if enough trading orders are executed due to a technical event then supply and demand will be affected, and a security price will respond as suggested by the technical analysis. This too is a dubious assumption as any market activity is observed and responded to by various participants, with various motives, over and over again, resulting in a completely random and chaotic system.

Current methods of fixed or periodic data sampling are further limited to the question of "at what specific prices did the market trade during the given interval?" This same question is further limited by the prior art data sampling approaches as the samples are customarily for only the highest/lowest/first/last prices traded during the interval, leaving all other activity unexposed and unavailable for analysis. Using the prior art approaches, the only thing we can know from the outputs of these systems is that at least 1 transaction of unknown characteristics occurred at each of these so called sample prices during the specified time interval.

How an order is initiated is fundamental to the price discovery process that balances supply and demand through the subsequent process of discovering a mutually acceptable trading price. If more orders are initiated as buy orders, both in terms of price and volume, the existing supply of willing sellers is absorbed and suppliers may notice the increase in demand and raise prices to opportunistically increase the proceeds they may realize from entering into a trade. Conversely, if more orders are initiated as sell orders, then some buyers will be absorbed and buyers may notice the increase in supply and lower prices to protect against the possibility of being exposed to a loss from even lower prices after making a purchase. Both activities cause security prices to rise and fall accordingly. This change in price is what creates security trading profit opportunities.

Knowing how orders are flowing into an exchange making a market for a security, either as buy orders or sell orders, is an essential part of the information needed by the participants to the exchange trading process, when trying to assess the balance of supply and demand and the potential for a security price to move up or down. The failure of the prior art of technical analysis to recognize and display for each trade how orders are initiated, and to integrate an indication of the size of said orders, is a significant disadvantage.

One approach to displaying information relating to the source of orders is to display so-called depth of market information. For example, a software package sold under the name "Patsystems J-Trader" displays a depth-of-market window, an example of which is shown in Fig. 5. The depth-of-market display 500 includes separate tables listing a number of pending bids (advertisements to buy) 510 and pending offers (advertisements to sell) 512 at their respective

prices and quantities. Kemp, II, et al, U.S. Publication No. 2003/0023542 discloses an alternative tabular format for depth of market information, in which bids and offers are displayed in separate vertical columns, instead of side-by-side. However, the depth of market information in both of these systems is not integrated with graphical information displaying transaction activity. In addition, discerning whether a transaction has originated as a buy or sell requires intense vigilance on the part of a user in observing that a transaction has occurred at a particular price and noticing a change in the number of units bid or offered at that price.

Fig. 6 depicts the display 600 of a security charting product available under the name "Investor/RT" from Linnsoft Software. "Ticks" (or security transactions) are indicated by circles 610 filled in various colors, e.g., green, red, or brown, corresponding to buyer, seller and undetermined neutral orders, respectively. Trade quantity is presented with separate histogram bars 612 along the bottom of the 'tick' chart. The approach of using filled circles is not satisfactory because it depends on the color coding alone to convey the indication of buyers and sellers, which is not effective when printed in black and white, as with most laser printers, or when shown on monochrome display screens, because the colored circles all appear the same, as seen in the black and white specimen shown in Fig. 6. In addition, the lack of integration in the display of transaction price, order initiation, and transaction size undesirably requires the trader to perform that integration as a manual process. Further, the Investor/RT system does not directly display depth-of-market information or other indicia of pending orders on the transaction display. "4D Genie", commercial product from 4D Trading, 4D Trading Ltd, Unit 11, Riverside Studios, 28 Park Street, London SE1 9EQ, discloses a system that displays a chart of recently traded prices in tick format. The product also displays depth of market information.

Steidlmayer et al. U.S. Patent No. 5,454,104 discloses a financial data event flow analysis system with study conductor display. The system controls and manages "a continuous sequence of data by conducting studies on user-defined segments of the data, and [displays] the study results in a concentrated summary form in vertical pipes on a single display screen." A commercial product sold under the name "Market Profile" and associated with the inventors of the Steidlmayer patent plots so-called "Time Price Opportunities" (TPOs) as letters arranged in vertical columns. Each letter corresponds to a defined time segment, such as a particular half-hour period during the day. The vertical axis corresponds to price, so the vertical width of a letter represents aggregate trading within a relatively small price range, and a vertically contiguous series of a particular letter represents a larger price range formed by the concatenation of the contiguous letters. If a letter appears at a particular price, at least one trade occurred in that price range during the time period represented by the letter. Trading activity is aggregated over numerous time segments, generating a display showing the aggregate

distribution of TPOs over a study period. Because the Steidlmayer system aggregates trades, and displays price ranges, it does not necessarily depict the time, price or quantity of any particular transaction.

Many of the prior-art trading analysis and display systems, including the Steidlmayer system, aggregate or sample transactions over arbitrary periods that may have no relevance to the activity of the market and its participants. As noted earlier, trading of securities involves buyers and sellers in an auction process whereby trading prices are discovered and trades are executed between the parties. Trading usually varies in intensity during a given trading day as traders establish price points and subsequently execute trading orders around said price points. Each such group of trades may be logically grouped and considered to be an auction event within the trading day. An auction event, or series of trades around a price point, register elapsed times which vary randomly from a few tens of seconds to a few hours dependant on participant activity, before a significant change in price point is discovered and a new auction event starts. In the course of a trading day many short auctions can occur in the continuing process of making a market and balancing supply and demand for a security.

Although many prior art trading analysis and display systems have some sort of transaction aggregation or grouping, such systems have provided grouping or aggregation on arbitrary boundaries, rather than boundaries discerned from the actual ebb and flow of trading activities. Accordingly, where the arbitrary aggregation and grouping of a trading system happens to be unaligned with actual trading activity, trends in that activity may be masked or incorrectly interpreted, and false trends may be seen.

Accordingly, the need exists for a high-performance securities trading analysis and display system that integrates the detailed transaction information needed by a trader to make profit-maximizing trading decisions. In addition, the need exists for a system that provides appropriate analysis and display of trend information derived from and aligned with actual transaction activity in the market.

OBJECT AND SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an arrangement for analyzing and displaying security trade transactions that avoids the aforementioned disadvantages of prior-art systems.

A system (and associated methods for use in conjunction therewith) arranged according to the present invention for analyzing and displaying security trade transactions to a user and for receiving from a user security trade orders comprises at least one exchange server, at least one trader administration and risk manager workstation coupled to the exchange server, at least one trader workstation also coupled to the exchange server, appropriate software described further

herein, and appropriate telecommunications and networking facilities to allow communications among the servers and workstations. The servers and workstations may be implemented using industry-standard IBM-PC compatible computers of known design. Although these elements are referred to in the drawings and the text as separate units, one or more of them may be integrated
5 in the same physical computer system. Although the trader workstation and exchanger server is typically mentioned herein in the singular, several of each may be present.

The exchange server is connected to the exchange market data and trading system of at least one securities exchange via conventional high-speed networking and telecommunications facilities, to receive securities trade transaction information (and other related information) on a
10 near-real-time basis, and to transmit securities trade orders. The exchange server reformats data received from various exchanges in disparate formats into a universal format for use by the trader workstations.

The trader workstations provide display processing to present information about securities trade transactions (including analyzed information) for securities selected by the user
15 in three primary display formats. The trader workstations interact with the exchange server to obtain information about the trade transactions in the selected securities, along with other related information, and display it to a user. The trader workstations may optionally provide "echoic" or sound-cue representations of data and events. The trader workstations provide a user interface to enable the user to select securities for display, for controlling parameters of the display and
20 analysis system, such as the criteria for when a new auction is deemed to begin, or the criteria controlling when an echoic indicia is provided. The user interface of the trader workstation may allow a trader to enter an order for a transaction in one of the securities for which information is displayed; the order information is forwarded to the exchange server, and then to the securities exchange.

25 The administrative and risk management workstation controls access to the display and order entry systems, and allows administrative personnel to monitor activity for transactions of interest, including those that may indicate that a trader is engaging in activity which the system operator may consider to carry excessive risk.

The trader workstations may provide three primary displays regarding a selected security:
30 a TICKFLOW display, and optionally, auction summary and auction set displays. The term "TICKFLOW" is a trademark of Tradegraph, L.L.C.

According to an aspect of the invention, a TICKFLOW display indicates the prices of recent transactions, the size of such transactions, and whether such transactions are deemed to be
35 buyer-initiated or seller initiated. The security exchange trading and market information is processed and displayed as a continuously updated chart that plots each trade at the price traded

and for each plot point shows: a triangle, arrow, or similar shape pointed up to indicate a trade initiated by a buyer; a triangle, arrow or similar shape pointed down to indicate a trade initiated by a seller; and a circle, diamond, or other shape, to indicate a trade if buy/sell order origination is not determined.

5 According to a further aspect of the invention, the TICKFLOW chart may also display "market depth" information regarding pending bids and offers for the security including the number of units and price at which such bids and offers are extended. Preferably, the market depth information is integrated with the price axis of the chart on the display screen and includes a list book of bid/ask orders, known as the book or depth-of-market (DOM) for a security,
10 showing the quantity ordered at each bid/ask price level. By integrating a live DOM allowing a trader to enter orders by clicking on displayed DOM prices along side the security price chart, a trader can see and act upon all relevant pricing data at once without looking at different parts of a display to see the data or place orders in separate windows, as is the case in prior-art systems. This is a significant improvement over prior-art systems because it allows traders to speed-up
15 their interpretation of market activity, thereby allowing a trader to more quickly decide on appropriate trade order actions to take, and hopefully allows a trader to be the first to place a trade order before competing market participants also recognize and take advantage of the same trading opportunity.

 By reviewing the chart, traders may determine if trading is composed more by buyers or
20 by sellers, if orders placed by buyers or sellers are larger or smaller, and if the book of bid/ask orders is changing based on buying or selling activity. A trader can conclude that trading is directionally biased into an upward or downward trend based on orders originating from buyers or sellers and increase the probability of making a profit from buying low and selling high.

 According to a further aspect of the invention, a user interface allows a trader to quickly
25 enter limit orders to buy or sell a predetermined quantity of a security by scrolling with a computer pointing device, such as a mouse or track ball, over the depth-of-market bid/ask order listing and clicking or selecting the desired price with the computer pointing device buttons. Generally, a computer mouse is set-up such that one button enters a buy order and the second button enters a sell order. Additional buttons may be assigned related functions, such as
30 canceling limit orders not yet filled by an exchange, so that a trader can quickly re-enter an order with a new limit order price. If the chart is used to display contract prices for future delivery, as may be the case for commodity, energy, financial, index, foreign currency and equity futures contracts, the chart may preferably also include plot points for the traded prices and bid/ask prices for the underlying cash market.