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IN THIS ISSUE

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Feature

Inside the New Stock Timing Knowledge Base 1

Sections

Market Review 4
Stock Analysis 5
Tools of the Trade 6
Data Maintenance 8

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CURRENT RESEARCH AND DEVELOPMENT

NEW STOCK TIMING KNOWLEDGE BASE FOR TRADING EXPERT

By Dr. J.D. Smith

In 1987, the typical AIQ user was following around 350 stocks and paying as much as \$250 a month for stock data. Our users wanted numerous signals, and they wanted signals designed for the big cap stocks on the New York Stock Exchange. Times have changed.

Questionnaire results from our most recent seminar here at Lake Tahoe indicate that the typical AIQ user now follows 1100 stocks and pays from \$25 to \$35 a month for data. Following 1100 stocks means that users are broadening their data base into the mid-cap and lower-cap stocks.

From talking to our users at this seminar, it was clear that many of them include some OTC stocks within their data base. With the increased volatility of these OTC stocks, they have found increased opportunity for substantial returns, and have thus benefited from trading these stocks.

Based on our discussions with AIQ users and questionnaire results, we knew it was time to revisit the stock timing knowledge base within TradingExpert 3.2.

The results of our current research and development effort will soon be available.

DR. J.D. SMITH

Knowledge-Based Expert Systems

Before we look at this new knowledge base, perhaps a quick review of expert systems is warranted.

At the heart of AIQ systems is a knowledge-based expert system. One of the best descriptions that I know of for such an expert system is by Professor Edward Feigenbaum of Stanford University, who defines an expert system as:

...an intelligent computer program that uses knowledge and inference procedures to solve problems that are difficult enough to require significant human expertise for their solution. Knowledge necessary to perform at such a level, plus the inference procedures used, can be thought of as a model of the expertise of the best practitioners of the field.

The knowledge of an expert system consists of facts and heuristics. The "facts" constitute a body of information that is widely

Current Research and Development continued on page 2

shared, publicly available, and generally agreed upon by experts in a field. The "heuristics" are mostly private, little-discussed rules of good judgment (rules of plausible reasoning, rules of good guessing) that characterize expert-level decision making in the field. The performance level of an expert system is primarily a function of the size and the quality of a knowledge base it possesses.

An expert system is based on facts, rules, and an inference process. This is true for the AIQ expert systems. The facts in our stock timing expert system are stock prices and volume and values from the various technical indicators that we use. The form of the rules and the inference process also came from Stanford University, from the MYCIN project.

MYCIN was developed at Stanford in the mid-1970's as a research system to advance the art and the science of expert system modeling. It was designed to assist physicians in the diagnosis and treatment of meningitis and bacterium infections, with the intent to provide attending physicians with the expertise comparable with that of consulting medical specialists. MYCIN was a milestone project because it proved that expert systems were far more than an academic game. The project proved that expert systems

could be extremely valuable in real world situations.

A typical rule from MYCIN was in the following form:

```

IF
  The stain of the organism is gramneg AND
  The morphology of the organism is rod AND
  The patient is compromised host
THEN
  There is suggestive evidence (0.6) that the identity of the organism is pseudomonas
    
```

AIQ uses the same rule structure, organizing a large network of rules. One of the more simple AIQ rules would be in the form:

```

IF
  Prices are at a 21-day high.
AND IF
  Volume Accumulation Percentage is less than zero.
THEN
  Rule fires True. Include rule weight of 0.65 in the Confidence Factor.
    
```

Using facts such as closing prices over the last 21 days and volume accumulation percentage, we can identify non-confirmation situations for a specific stock. The rule says: when prices are at a recovery high but distribution is occurring, a possible downward movement is indicated. The rule weight in this specific case is 0.65, which is a measure of that rule's effectiveness. The rule weight from this rule is then combined in the confidence factor determined from all of the other rules that have previously fired for this stock on this day.

This process of combining rule weights is accomplished by the inference engine. The resulting confidence factor at the end of the process is then normalized into what we call the Expert Rating. The inference engine developed in the MYCIN project is:

```

IF (CFI > 0.0)
  Then Z1 = -nLOG (1.0 - CFI)
  Else Z1 = nLOG (1.0 + CFI)
IF (WT > 0.0)
  Then Z2 = -nLOG (1.0 - WT)
  Else Z2 = nLOG (1.0 + WT)
CFO = 1.0 - (EXP(-(Z1 + Z2)))
    
```

where:

CFI is the incoming Confidence Factor from prior rules in the network of rules.

WT is the rule weight.

CFO is the outgoing Confidence Factor passed to the next rule in the network of rules.

The effect of the inference engine is shown in **Figure 1**. The figure shows the impact of two rules firing, the first with a confidence factor of 0.6 and the second with a confidence factor of 0.4. Starting with 0 certainty, the first rule moves 60% of the way toward total certainty, leaving 40% remaining. The second rule, with a confidence factor of 0.4, then moves 40% of the remaining 40%, with a combined result of 76% certainty. The resulting confidence factor at the completion of our network of rules is normalized to become the Expert Rating.

Improving the Knowledge Base

Changing the knowledge base is not unlike trying to improve a Swiss watch. Fiddling with one gear or spring can have an impact on gears and springs throughout the rest of the watch. In our case, if we fiddle with one rule it can have an impact throughout the knowledge base. Our testing procedure then has to include tests not only of the individual rules, but the whole knowledge base against all stocks in our test suite. And our test suite has been expanded to include more mid-cap and lower-cap stocks than were included in the past.

When Diana Kincade and I first approached the project of improving the stock timing knowledge base, we selected two directions to follow. The

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CURRENT RESEARCH AND DEVELOPMENT *continued . . .*

first was to expand the knowledge base by splitting it into five separate knowledge bases based on Trend Status. The second was to expand the knowledge base by adding new rules which are more sensitive to the lower-cap stocks.

We were certain that splitting the knowledge base into five separate knowledge bases - one for each type of stock trend - would improve the Expert Rating. We used this same approach in the AIQ market timing expert system which AIQ's chief analyst Dave Vomund has used to become one of the top three market timers in the country.

The resulting stock timing knowledge base is illustrated in **Figure 2**. Input data remains the same: high, low, close, and volume. This data is processed with our technical analysis formulas and the result is transferred to the Trend Status rule base. This rule base is a logic table which determines the selection of one of the five possible Trend Status modes. The actual rule base used to determine the Expert Rating depends on the selected Trend Status. The five separate rule bases are:

- Strong Up Trend
- Weak Up Trend
- No Trend
- Weak Down Trend
- Strong Down Trend

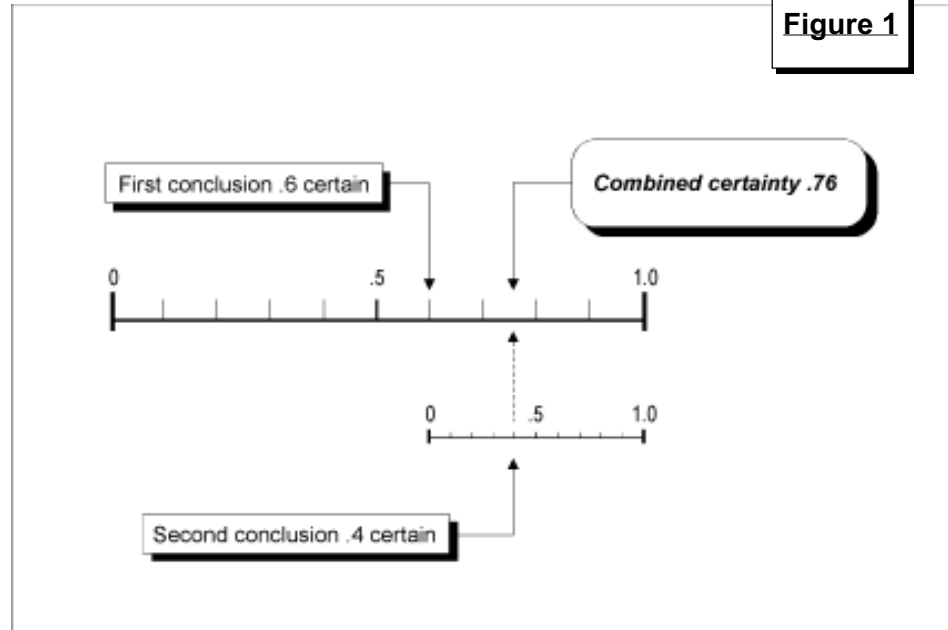


Figure 1

The rule weights that result from analyzing each rule for each stock are then processed by the inference engine to generate the Expert Rating.

The Trend Status rule base shown in Figure 2 is the first step in the process. It is a logic table which includes combinations of Directional Movement Index and Average Directional Movement values as well as the rate of change of both of these technical indicators. All of these indicators are used in the Trend Status module, which has been modified and im-

proved from version 3.2 by extending the smoothing time to 39 days.

With this type of structure within our knowledge base we now can employ specific rules for each Trend Status and vary the weights for the same rule depending, again, on the trend. The result is a more robust and flexible knowledge base.

We have added several new rules. One of my favorites is a combination of Directional Movement Index and

Current Research & Development cont'd on page 4

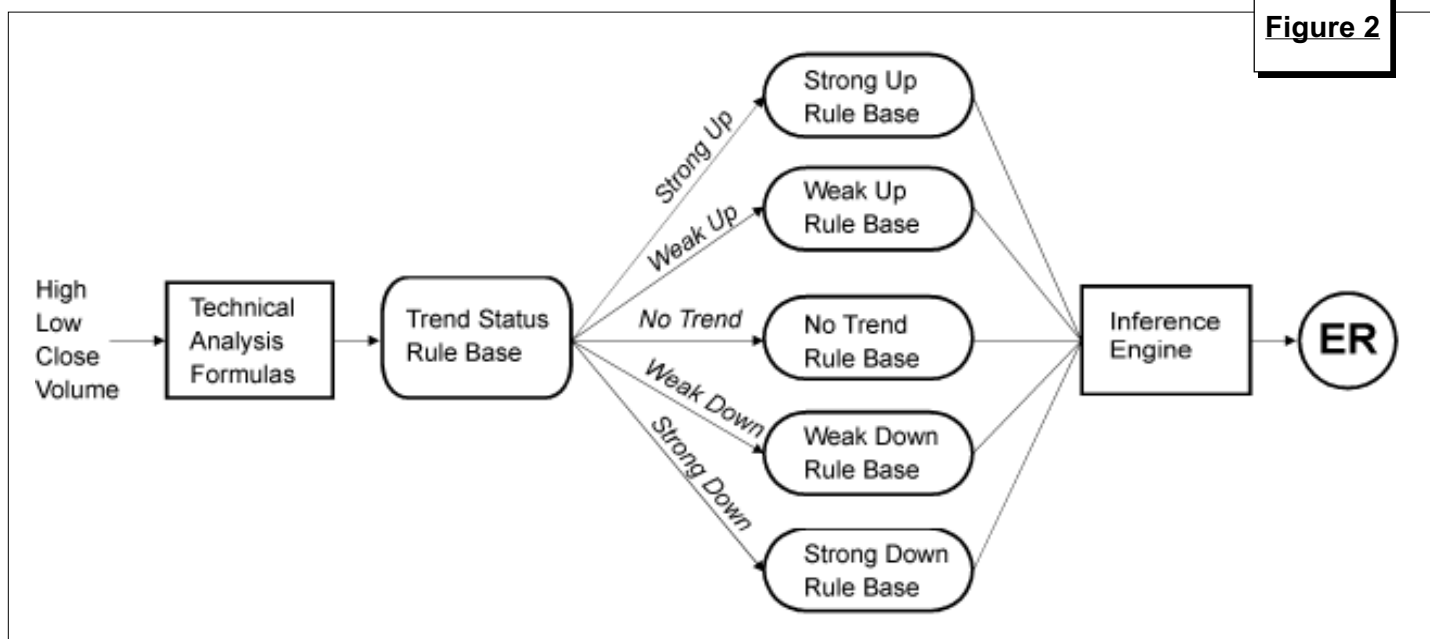


Figure 2

Volume Accumulation Percentage. As one indicator or the other crosses the zero line, the direction and value of the other is examined. If the second indicator is moving in the same direction, then the rule fires.

Diana's favorite rule involves the Stochastic and Money Flow RSI. When Stochastic crosses the 20% line to the upside with an increasing Money Flow RSI, the rule fires up. When Stochastic crosses the 80% line to the downside and Money Flow RSI is decreasing, the rule fires down. The weights for the up and down signals depend again on the Trend Status.

Both of these new rules seem to work well with the smaller cap stocks.

Another new rule is now included in the knowledge base because Dave Vomund insisted that we test it. I for one am glad that he did. This rule identifies inside and outside reversal day chart patterns. Dave wrote an article on this concept in the June 1994 *Opening Bell Monthly*. This rule tested to be very effective in identifying

absolute tops and absolute bottoms. It uses only high, low, and closing prices.

The rule for tops and bottoms is:

Tops: If a prior day close is a 21-day high, and if today's high is greater than or equal to yesterday's high, and today's close is less than or equal to yesterday's low, a top (down signal) is indicated.

Bottoms: If the prior day close is a 21-day low, and if today's low is less than or equal to yesterday's low, and if today's close is greater than or equal to yesterday's high, a bottom (up signal) is indicated.

Dave explains this concept very well in his June article, and I recommend that you read it. We programmed and tested this rule and found it to be very effective in identifying absolute tops and bottoms, and I think it is going to become a favorite for many of our users.

Results

With these new rules, the expanded knowledge base, and the 39-

day Trend Status, the current effectiveness stands just above 70%. This is combined with a 50% reduction in the number of signals generated.

As this new knowledge base is more trend sensitive than earlier versions, most of the very early counter-trend signals have been eliminated. If one is running 1100 stocks, this new knowledge base will substantially reduce the work effort needed to operate TradingExpert.

The new robustness of the knowledge base means we are now able to generate effective signals in a wide class of smaller cap stocks, giving our users increased opportunity for successful trading in today's more volatile markets.

What works for me is the development of the five separate knowledge bases. I already have found that knowing that each rule is weighted for the current trend increases my confidence in the resulting Expert Rating. And increasing my confidence is good for my trading. ■

MARKET REVIEW

By David Vomund

There were three market timing Expert Rating signals since our last issue. AIQ registered a 98 down signal on October 10 with the Dow at 3911. At that time, 75% of the stocks giving unconfirmed signals were on the sell side. A few days later, the market was lower and the number of stocks giving confirmed sell signals was 76%. This is a high value but not the 85% value that we look for. Another sell signal was given on November 1.

On November 7, AIQ gave a 95 up market signal with the Dow at 3809. We didn't see a high percentage of stocks with confirmed signals on the buy side. The market has since moved higher--but not much. The trading range discussed in last month's Market Review still exits. This is leading to more market timing signals and less movement after each signal.

The weakest of the technical indicators is the Advance/Decline Line. At the end of October, with the Dow 50 points from a new high, the Advance/Decline Line was at a new yearly low. As of this writing, it continues to move lower.

The weak market breadth numbers highlight the weakness in the broader market. Phil Rettew, a vice president with Merrill Lynch, ran a study which demonstrates this point. Mr. Rettew reports that an astonishing 98% of the stocks on the NYSE are off 10% from highs reached in the period of Jan. 1, 1993, to March 31, 1994; roughly 78% are down 20% or more; 45% are off 30%; 22% are off 40%; and over 10% have been cut in half or worse. The news is worse for those shares traded on the NASDAQ. An incredible 68% of NASDAQ stocks are 30% or more below their peaks and a third have lost at least half their value. ■

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NEW PRODUCT UPDATE

AIQ GROUP PYRAMID

The AIQ Pyramid, an industry group structure that contains stocks that are highly correlated to their industry groups, has been revised. Owners of the pyramid can purchase this update for \$44. For more information, please phone 800-332-2999.

STOCK ANALYSIS



DAVID VOMUND

CHART PATTERNS, PART I

By David Vomund

AIQ software does a lot of work for you. The Expert Ratings and Color Barometer help to give a quick indication of the strength or weakness of the technical indicators. Reports such as the Weighted Action List or the Group Report enable you to narrow which stocks/groups to examine for a possible trade. The one area that the computer can't be programmed to do well is to look for chart patterns. By knowing a handful of chart patterns, one can apply insightful analysis on top of the work performed by the software. Short term traders often prefer to use daily charts for pattern analysis, while the weekly charts give a longer term picture.

Head & Shoulders

This pattern can mark either the top or bottom of a security's price. A head and shoulders top first forms a local top known as the "left shoulder." After some consolidation, another high is formed called the "head." The security then falls to about the same level as its left shoulder. The right shoulder is formed when the security begins to consoli-

date at this level. It is at this time that the pattern can be recognized. A line drawn through the extreme points of the two shoulders constitutes the "neckline." The pattern is not completed until this neckline is broken. Ideally, the break occurs on heavy volume. **Figure 3** shows a head and shoulders pattern with the left shoulder formed in August, the head in September and the actual break below the neckline in early November.

Right Triangle

This formation looks like a triangle with one horizontal side. In an ascending triangle, there is a set resistance level but each sell-off is less than the previous one. In most cases, the security breaks through the horizontal trendline so an ascending triangle is bullish and a descending triangle is bearish. **Figure 4** shows an example. Prices moved higher until the \$17 level was reached. Three attempts were made at this level but sellers appeared each time. A horizontal trendline is drawn at this level. Meanwhile, each sell-off was less than the previous weakness. The fourth attempt at the \$17 level succeeded and

the breakout came on heavier than average volume.

Rectangle

A rectangle is formed when a security fluctuates back-and-forth in a narrow range. A horizontal line can be drawn connecting the highs and another line can be drawn connecting the lows. The rectangle cannot predict the direction of the ultimate breakout. A trader waits for the breakout before placing a trade. Ideally, the breakout is on heavy volume. **Figure 5** shows a perfect rectangle pattern. Microdyne's price activity stayed in a narrow range for about two years. One trendline is drawn connecting the high points and another is drawn connecting the low points. Only recently did the price move above its rectangle pattern and it did so on heavier than average volume. (More chart patterns next month.) ■

David Vomund is publisher of two advisories for stock and sector fund

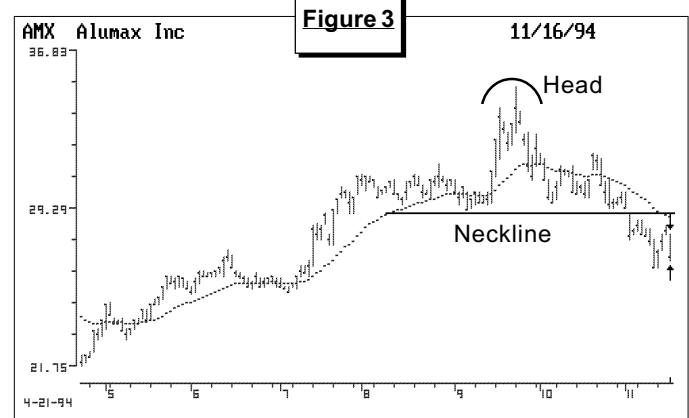


Figure 3

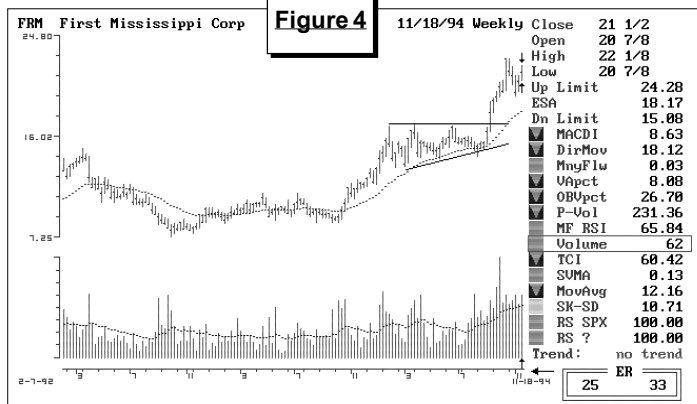


Figure 4

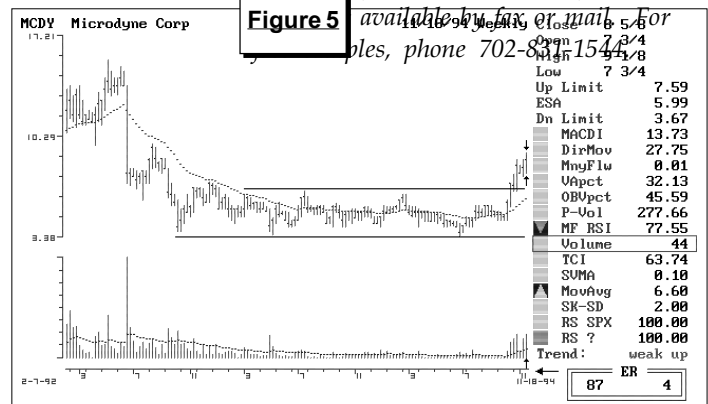


Figure 5

available by fax or mail, for samples, phone 702-835-1548

TOOLS OF THE TRADE

SINGLE CANDLE ANALYSIS

By Carol Tong



CAROL TONG

Most technical analysts have favorite indicators - the moving averages, stochastics and oscillators - on which they rely for information about current market conditions and for insight to the future. However, no single indicator works all the time, in every market. Confirmation by more than one indicator can be useful, especially for avoiding whipsaws in highly volatile times.

With this in mind, technicians continually seek new indicators or tools to improve their trading. Japanese Candlestick charts, used widely since the 1700's, are hardly new, but are not widely used by Western technicians. Interest in Candlesticks, the hot "new" indicator, is growing steadily.

Unlike most Western technical indicators which emphasize the closing price, Candlesticks place great importance on the open. Although Candlestick charts are created using the same pricing information as Western bar charts (open, high, low, and close), Candlestick patterns offer unique signals often not recognized with traditional bar charts.

The Candlestick consists of a body and a shadow. The body (also called the real body) is defined by the open and close. If the close is above the open, signifying the bulls have pushed the stock up, the Candlestick body is white. If the stock closes below the open, indicating bearish sentiment, the body is black. The shadow, drawn as a line extending above and below the real body, is determined by the high and low price, and resembles

the Candle's "wick," hence the name of the chart (see **Figure 6**).

Candlestick patterns are varied**. They can signify reversal or

continuation of trends and can occur over short or longer terms. They can be simple or complex, with a pattern consisting of a single significant Candle, or made up of many Candles.

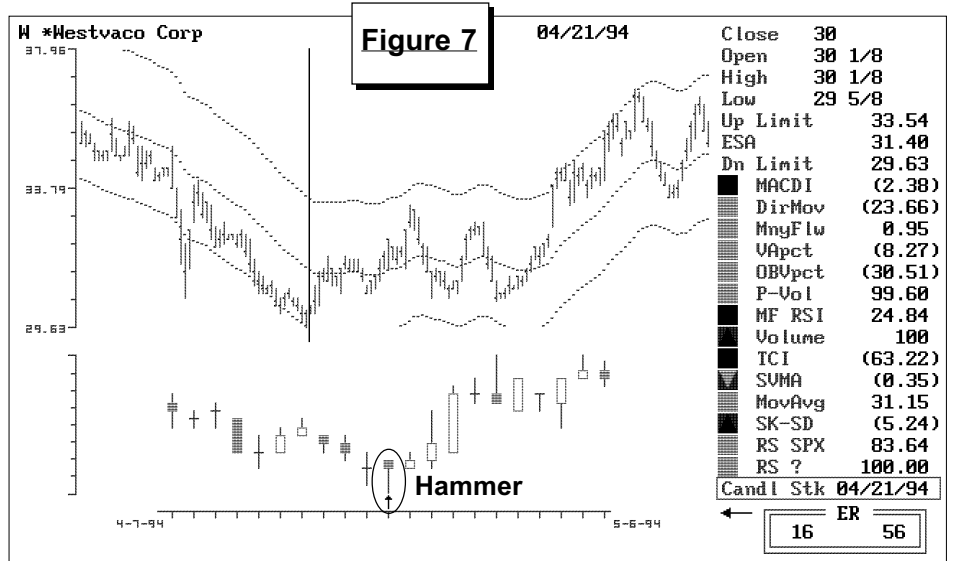
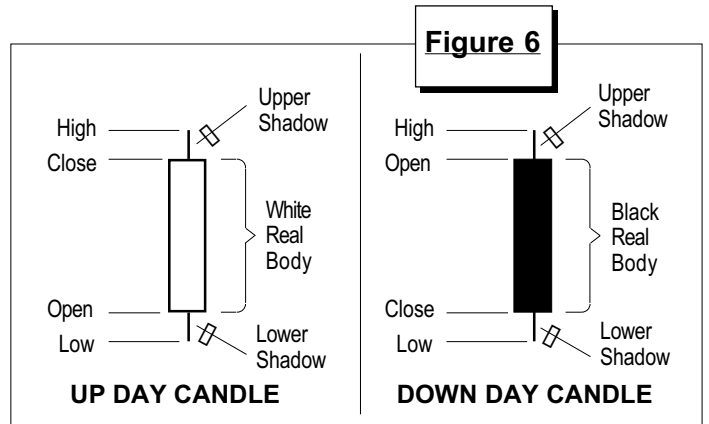
One of the simplest Candlestick patterns is the small body with no (or little) upper shadow and a very long lower shadow (ideally, the lower shadow is at least twice the length of the body). If it occurs during a downtrend, this Candle is known as a Hammer. A Hammer is formed when a stock opens, trades to a much lower price (creating the long lower shadow) then recovers and closes near the open. This indicates the bears could not maintain control and the stock is "hammering out a bottom." Regardless of the color of the small real body, the Hammer is a bullish pattern

which signifies a reversal of the downtrend.

Figure 7 is a daily plot showing Westvaco (W), which had been in a downtrend since early January. A Hammer appeared on April 21 when the stock was valued at 30. Westvaco finally topped out on Sept. 27 at 39.

When occurring during an uptrend, this same Candle can signal the end of the trend, and is called a Hanging Man (the long lower shadow resembles dangling legs of a Hanging Man). The Hanging Man, if followed by a black (bearish) Candle, especially one which gaps down from the Hanging Man's body, is considered bearish.

Figure 8, a weekly plot of Digital Equipment Corp. (DEC), shows an example of a Hanging Man. Early in



TOOLS OF THE TRADE *continued* . . .

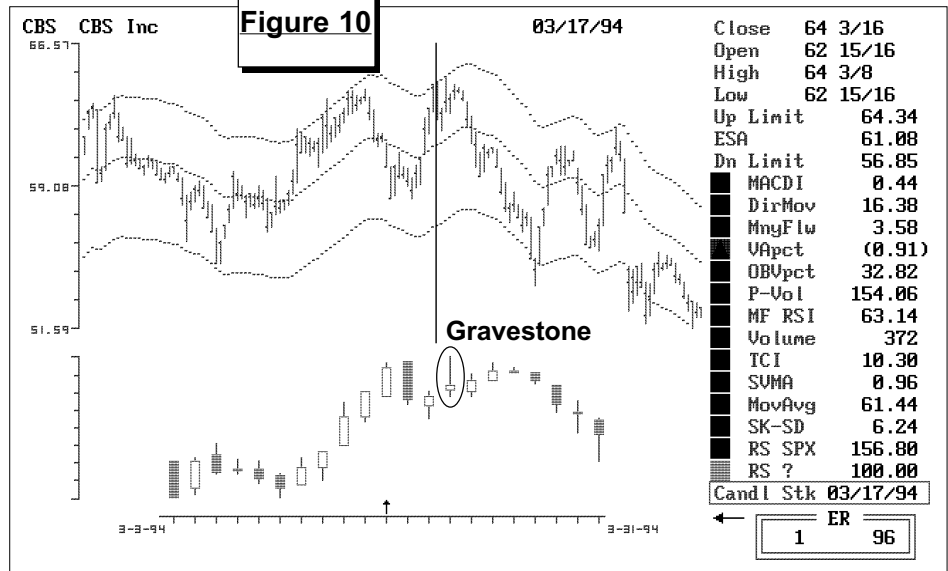
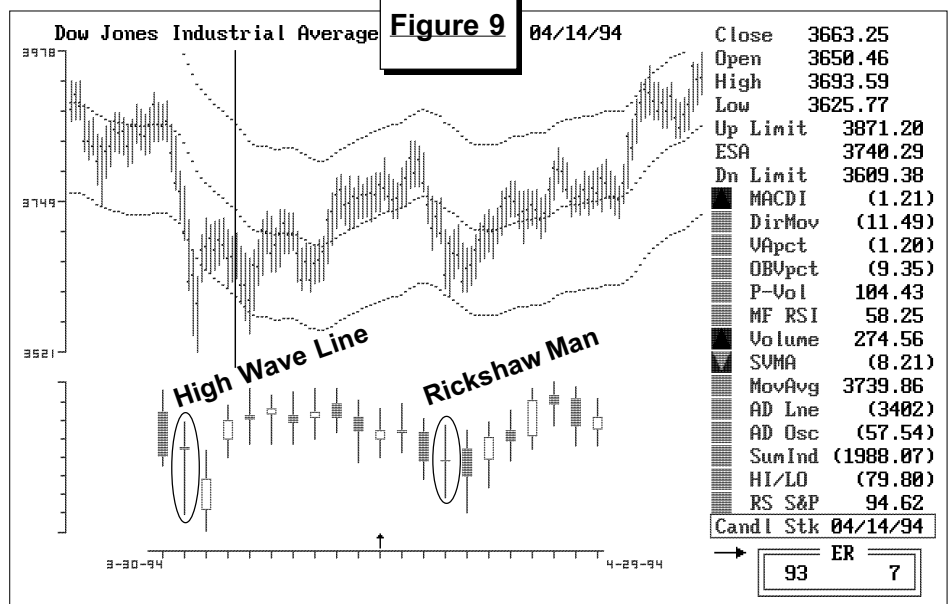
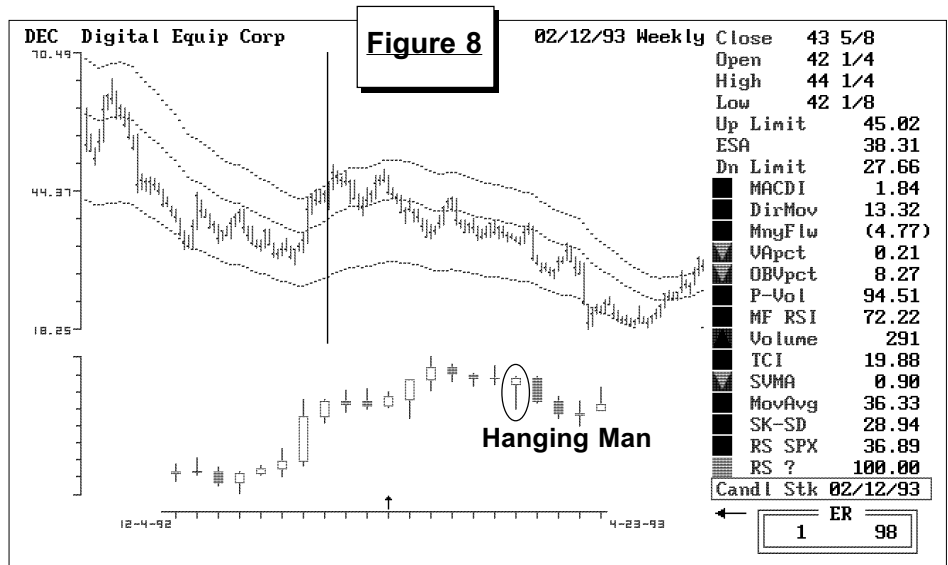
1992, the stock had broken a 10-month downtrend and was testing support in the low 40 range. Would this be the start of an uptrend? Although DEC began a rally in February which took the stock to 47 5/8, a Hanging Man appeared on March 26, 1993 followed immediately by a long black Candle the week of April 2. The bears soon regained control, driving DEC into another prolonged downtrend which lasted until mid-1994 when the stock bottomed at 19.

Similar to the Hammer and Hanging Man is the Doji. A Doji is a Candle in which the open and close price are equal, or nearly equal, so it has no body and the open and close prices appear as a single horizontal line. Doji Candlesticks indicate balance between the bulls and bears, neither side strong enough to move the stock against the other. They are especially notable if occurring infrequently, amongst a pattern of longer real bodies, or during a trend, indicating indecision or instability of that trend.

Doji Candlesticks can vary in appearance, depending on the length of the shadows formed by the high and low price. A Doji with exceptionally long upper and lower shadows and the open and close line centered within is known as a Rickshaw Man. This pattern is indicative of an especially unstable trend. A Doji with a long upper shadow and no lower shadow is called a Gravestone.

Figure 9, a plot of the Dow Jones Industrial Average, contains an example of a Rickshaw Man which occurred on April 19 of this year. More than a month earlier (on March 24) TradingExpert gave a 100 sell signal with the DJIA at 3821. On March 31, after a 185 point correction, a Candle known as a High Wave line appeared. This Candle is very similar to a Rickshaw Man, except the open and close are not quite equal so the Candle has a small body within the long shadows. Following this Candle, the DJIA rebounded slightly, only to test the 3600 support level once again.

Three weeks later our Rickshaw Man appears, signaling the turning point.



TOOLS OF THE TRADE *continued* . . .

market tops (although it may appear elsewhere). At a top, the Gravestone occurs when the market rallies sharply, only to fall back and close at (or near) the opening price. It's evident that this is a very bearish signal.

In **Figure 10**, CBS exhibits a Gravestone three days after a 96 sell signal was generated by AIQ. This Gravestone is a significant, though not perfect, formation. It has the long upper shadow characteristic of a Gravestone, but is not truly a Doji, as there is a small body (open and close are not quite equal) and a tiny lower shadow is present. As with all charting indicators, some latitude in interpretation is necessary.

Next month we will discuss multiple day patterns.

** For this article, I have used the pattern names most commonly used by Western analysts and popularized by S. Nison in his book *Japanese Candlestick Charting Techniques*. However, different names are noted in other texts, such as:

for Hammer or Hanging Man:
"Karakasa" (paper umbrella)

for Rickshaw Man: "Long Legged Shadows Doji"

for High Wave Line: "Tonbo"
(dragonfly)

for Gravestone: "Tohbo" (a wooden symbol of a Buddhist stupa) ■

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STOCK DATA MAINTENANCE

The following table shows past and future stock splits and large dividends:

Stock	Ticker	Split/Div.	Date
TSX Corp	TSX	2:1	11/07/94
Perle Systems	PERLF	2:1	11/08/94
Microchip Tech	MCHP	3:2	11/08/94
Bell Industries	BI	5%	11/10/94
Keystone Heritage	KHGI	5:4	11/11/94
Briggs & Stratton	BGG	2:1	11/15/94
Laurel Capital	LARL	5:4	11/16/94
Helix Tech	HELX	2:1	11/16/94
York Financial	YFED	10%	11/16/94
SPS Transaction Svs	PAY	2:1	11/17/94
Iomega Corp	IOMG	5:4	11/25/94
Community Financial	CFFC	2:1	11/25/94
America Online	AMER	2:1	11/28/94
Molex Inc.	MOLX	5:4	11/29/94
MCN Corp	MCN	2:1	11/29/94
American Superconductor	AMSC	3:2	11/29/94
Sunglass Hut Int'l	RAYS	2:1	12/01/94
Allied Bankshares	ABGA	5:4	12/02/94
Allied Bank Capital	ABCI	2:1	12/05/94
Clayton Homes	CMH	5:4	12/06/94
C-Cor Elect	CCBL	2:1	12/06/94
Archer Daniels Midland	ADM	3:2	12/06/94
Rowe Furniture	ROW	3:2	12/06/94
Maxim Integrated	MXIM	2:1	12/08/94
Regal Cinemas	REGL	3:2	12/09/94
Pioneer Group	PIOG	2:1	12/12/94
Peoplesoft Inc.	PSFT	2:1	12/12/94
Carnival Corp	CCL	2:1	12/15/94
AGCO Corp	AGCO	3:2	12/16/94
National Beverage	POPS	4:1	12/16/94
Stepan Co.	SCL	2:1	12/16/94
First Charter	FCTR	4:3	12/19/94
Sun Bancorp	SUBI	3:2	12/19/94
Nat'l Gas & Oil	NLG	3:2	12/20/94
Air Express Int'l	AEX	3:2	12/21/94
Printronix Inc.	PTNX	3:2	12/22/94

Name/Ticker Symbol Changes:

National Intergroup (NII)	to	Foxmeyer Health Corp (FOX)
Cincinnati Gas & Electric (CIN)	to	CINergy (CIN)
IMC Fertilizer (IFL)	to	IMC Global (IGL)