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**1**  
**GETS**  
**YOU**  
**10**

**... and your customers win, too!**

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*"Nothing is more difficult to carry out, nor more doubtful of success, nor more dangerous to handle than to initiate a new order of things."*

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● Over four hundred years ago, Machiavelli clearly saw the frailties of his fellow men in the remark attributed to him, above. That observation is valid even today and it is a special reminder to those in industry that "change", though seemingly inevitable, too often is given lip service—that ideas of themselves are meaningless without implementation.

To Jesse Straw, manager of value analysis at Sheffield Corp., Dayton, O., the foregoing motto, which hangs on his wall, reminds him daily that individuals and groups, to achieve common goals, must willingly cooperate. Without this mutual desire behind it, he says, value analysis are empty words.

Straw's perceptive understanding of the role of the value analyst—that of guide, mediator, conciliator and above all, catalyst, of cost-saving ideas advanced through value analysis—explains the remarkable success of VA at Sheffield. With the program in its third year, the ratio of return on value analysis expense is more than ten to one!

From \$28,000 invested in VA for the two-year period

ending October, 1965, savings on eight major projects in the total amount of \$250,000 have been obtained, with an additional \$174,000 potentially realizable. A cost reduction of up to 25% was realized on six other projects which have no fixed price as a product, the basic designs of which are specially arranged to customer requirements. In all, 47 projects were completed, eight others were not approved and the balance are awaiting approval or are in the process of implementation.

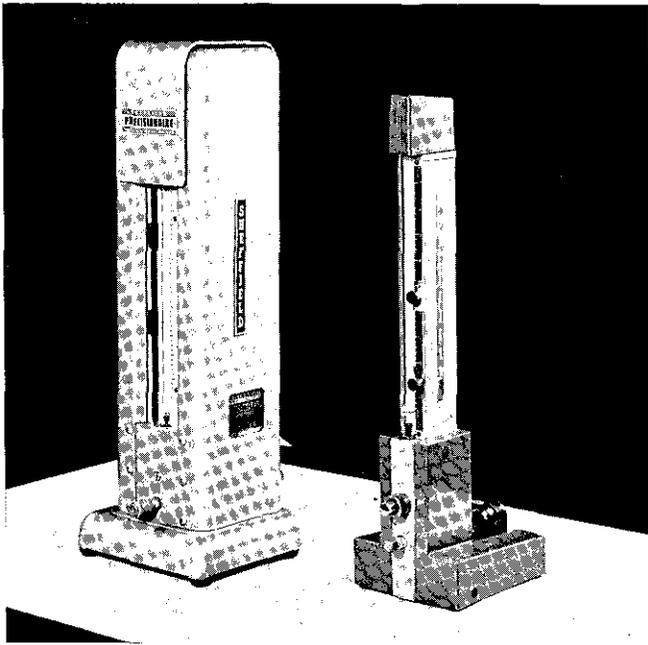
The company has realized savings not only on such mass-produced products as dimensional air gages, but also on low-volume products such as machine tools, measuring and inspection machines, and instruments. The fact that the VA effort has yielded ideas even from unlikely sources within the company, the Legal Department, for example, proves the existence and importance of teamwork among the company's personnel and the soundness of the VA idea.

Two examples show the kinds of results produced thus far:

The first item exposed to value analysis—the company's "bread-and-butter" line of column type air gages—became a classic example of cost reduction. The project, which required 64 hours of investigation and analysis, resulted in a complete redesign along modular (and simplified) lines. Cost savings were substantial enough to allow the company to pass along a \$40 price reduction to customers, down to \$180 per unit. In addition, modular design provides job adaptability. Standard modular columns make into single or multiple dimension gages in minutes. Depending upon user need, components can be stocked; assembled, torn down and re-assembled as required. Previously, multiple column gages were permanent assemblies and the number of columns could not be changed.

The gage project provided manufacturing savings by reducing stamping and machining costs and assembly time, the latter down from two hours to one hour. The previous one-column gage consisted primarily of a die-cast aluminum core containing the gage elements, a cast iron base, and four stampings which were blanked, formed, pierced, deburred and assembled that were used as covers for the column. In addition, 37 drilled and tapped holes were required to keep the assembly together.

In the redesigned modular gage, the cover stampings were eliminated, and instead of 37 drilled and tapped holes, only 10 are required. The gage column, a zinc die casting, is press fit and bolted to a zinc die-cast air chamber—zinc being used because of the metal's relative freedom from porosity. On each side of the air chamber, two die-cast zinc "feet" are bolted on. To add one or more gage columns, one of the feet is disconnected, the new columns attached with two connector screws each, and the foot reinstalled. None of the die castings requires machining,



even at the air supply ports. To seal off ports and manifolds, O-ring seals and gaskets are used.

### Overcoming the foreign wage differential

VA principles apply equally as well to new and low-volume, and one-of-a-kind, products as to high-volume items. A case in point is the development of the Cordax measuring machine. When Sheffield decided to build an improved version of an imported coordinate measuring machine in the United States, a four-to-one premium for U.S. wages seemed to dim the possibility of producing a competitively priced unit with American labor. However, VA succeeded not only in producing a competitive machine—it made possible one with improved measuring accuracy and a larger, 19 by 25-in. working range.

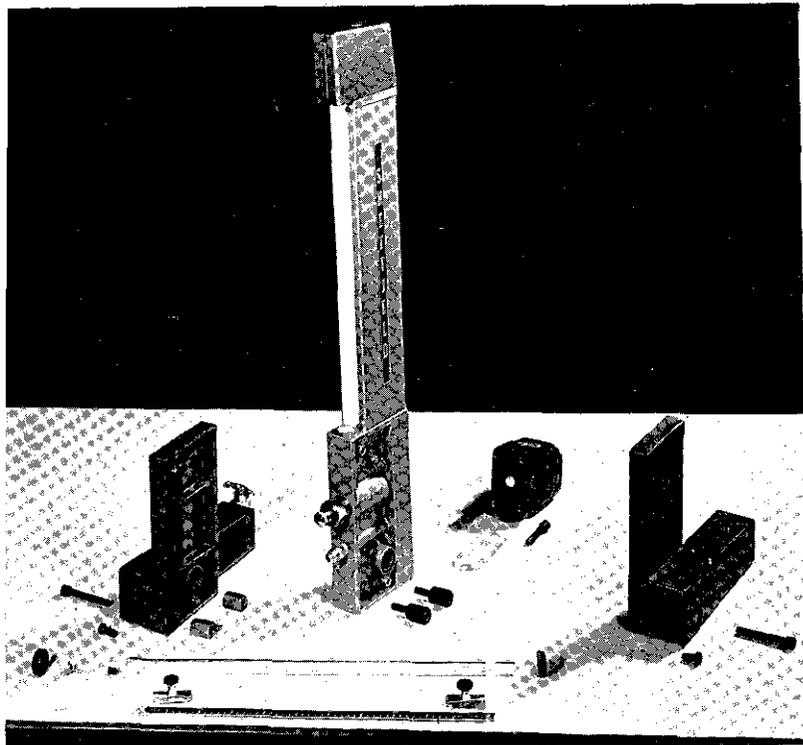
A nine-month VA program succeeded in realizing cost objectives, and the first American-built machine was introduced in May, 1965. Actually, the techniques used to analyze this unit correspond as much with Value Engineering as with value analysis. W. Fay Aller, engineering vice president who directed the measuring machine program, regards VE as a state of “not being satisfied with the first design.”

The new Cordax machine, in fact, proved a brilliant concept to its predecessor's design. For example, the geometry of the X- and Y-carriages—lead screw mechanisms which guide and support the measuring probe—was changed to lighten the load forces impinging on each while increasing measuring accuracy. For one thing, the bearings supporting the X-coordinate carriage were spaced wider apart (from 12 to 24 in.) which effect doubled the positioning accuracy of the probe, to  $\pm .0005$ . In addition, relocating the probe in relation to the Y-carriage and its supporting over-arm brought about a 13 to 1 improvement in actuating torque.

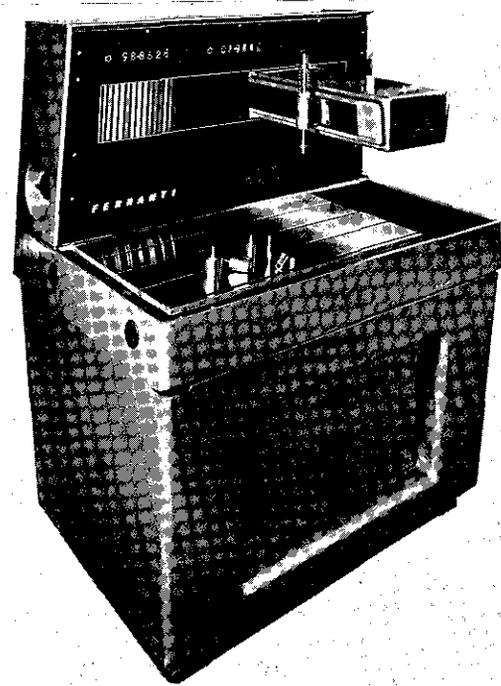
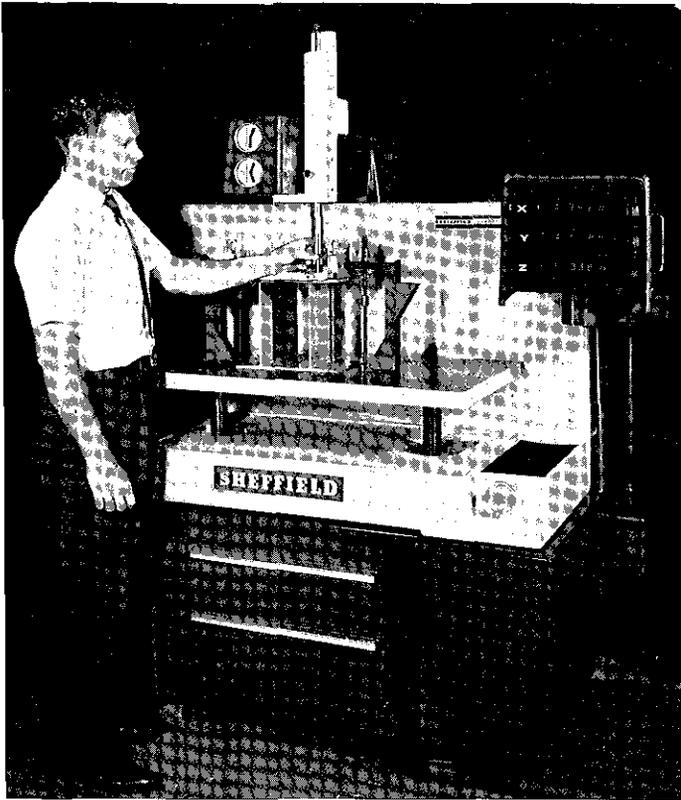
The initial approach to VA led to further redesign of the machine and respecification of materials and manufacturing processes. The machine base, for example, was changed from a one-piece iron casting to a fabricated steel structure, while providing for adjustments on the table and base with jackscrews. Previously, machine accuracy was dependent upon the machined base and assembly, which increased manufacturing cost and caused problems in debugging. With the Cordax design, machine accuracy is obtained by “tuning” the horizontal and vertical elements.

In addition to horizontal axis adjustment, vertical adjustment on the column supporting the over-arm is provided by adjusting screws.

Also, the Y-carriage over-arm was changed from a specially-supplied casting to a mill-supplied rectangular steel tube. And instead of enclosing the carriage in a complex mounting within the over-arm, the carriage and probe now ride atop the tube in a machined vee way. Provision also is made for model changes by using low-cost fiber glass base covers instead of sheet metal. In the



Considered a “classic” example of VA by Sheffield, its column-type air gage was redesigned along modular and simplified lines. In addition to savings realized from elimination of stampings and less machining, the new model (right, top) can be assembled into multiple units. Price was cut \$40



*Overcoming a four-to-one premium in U.S. labor costs, the Cordax measuring machine (left) has a larger working range and improved accuracy over the imported unit*

end result, savings in engineering, fabricating, machining and assembly costs more than overcame the foreign wage advantage.

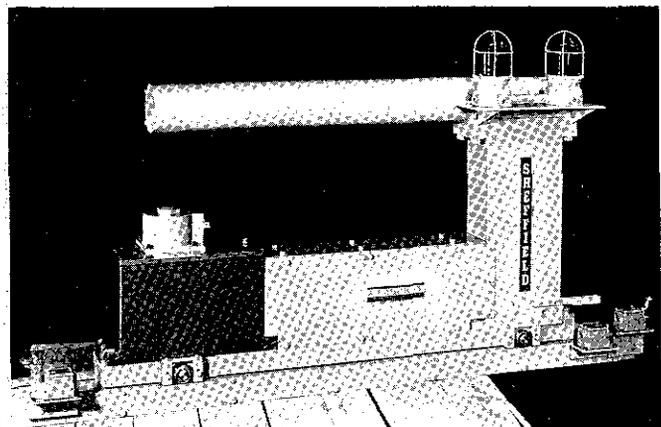
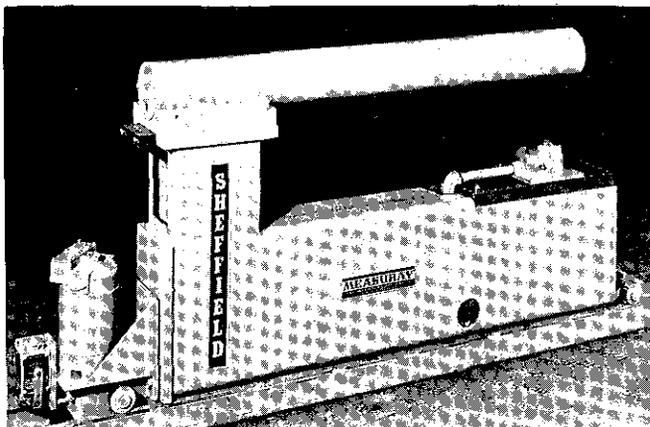
#### **A strong VA program**

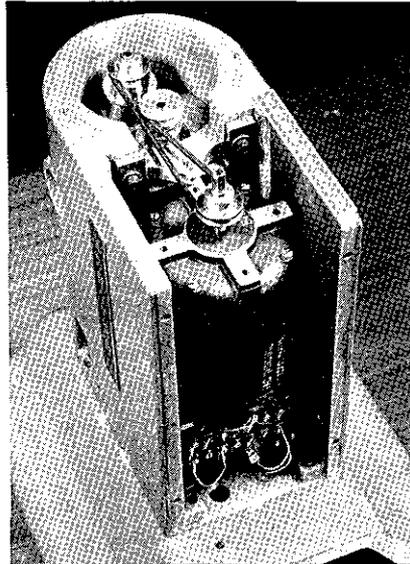
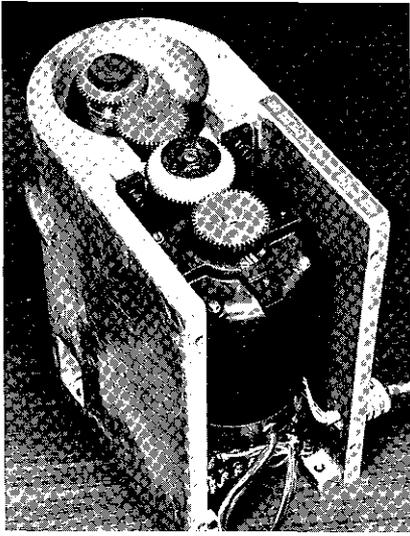
There were actually two beginnings for VA at Sheffield: One when Value Analysis, Inc., a consultant firm, conducted a ten-day seminar on VA techniques for 48 company supervisors and managers; and again when the program was formally begun under Jesse Straw, who previously was staff project engineer. He started with an

office, a desk, a budget and Management's blessing.

Armed with the guidelines learned during the seminar, and reaching into his own experience as an engineer and as a manufacturing man, he set to work. The first products selected for analysis were, of course, major items of manufacture which offered best potential for cost reduction. Four-man VA teams then were selected from the departments dealing primarily with each product. For example, the VA team or committee on the gage project included the engineering group leader on gage design and the manufacturing engineer involved with its manufacture.

*A 23 per cent reduction in cost was achieved in the redesign (right) of this C-frame X-ray measuring machine through an investment of 85 hours by the VA team. The unit's basic structure was changed from a special assembly of rolled and welded steel to one bolted together from common cold-rolled steel plate. A gear motor replaces hydraulic cylinders*





Cost of the parts for the drive train for the power unit of an ultrasonic machine tool was reduced from \$18 to about \$3 and machining and assembly time was cut by over eight hours. The four gears and retaining plate (at top) were replaced by three pulleys and a belt. The redesign eliminated the necessity for grinding mounting surfaces and for machining the pad and shaft hole for the idler

Generally, a committee is represented by Engineering; Manufacturing, including Inspection; Purchasing; Sales; and other specialized departments, from time to time, such as Finance or Legal.

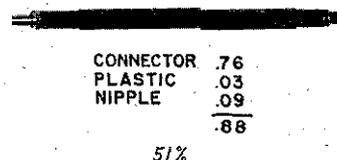
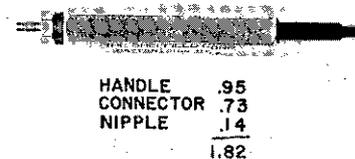
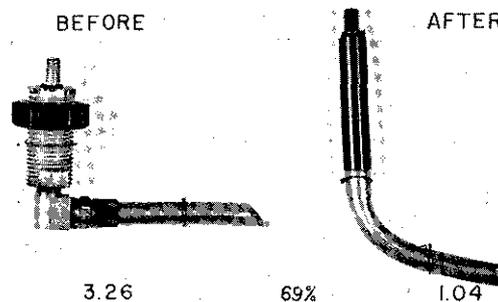
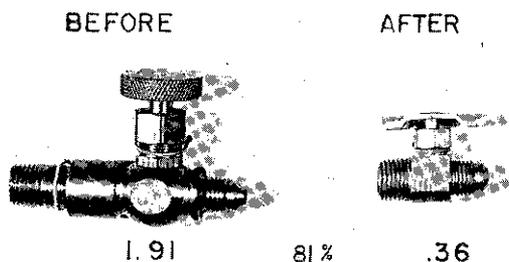
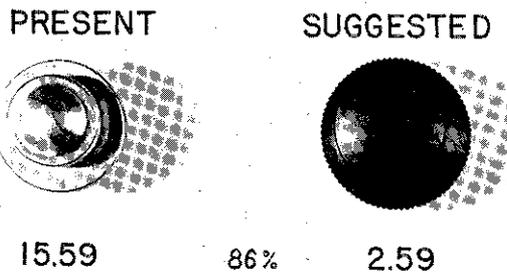
As VA manager, Straw acts as chairman of all committee meetings, which average a half-day or more each per week over the duration of the project. The length of each project varies with its complexity, the ease and speed of gathering data, and the time needed to obtain decisions. Some take as much as 170 hours to complete while others are done within 24 to 36 man hours of seminar analysis.

For committee meetings, the VA manager's function is to provide workpiece materials under investigation, obtain part prints and costs of present and proposed products, maintain liaison with Purchasing while obtaining quotations from suppliers, get standards from Manufacturing and attempt to determine whether tools and equipment in the shop can do the proposed job or whether a "buy" decision is necessary.

VA committee meetings progress through four stages:

*Information phase.* All known facts about the product under consideration are introduced at the meeting. These include production costs, current difficulties in manufacture, the product's function, competitive status, and sales appeal (including customer recommendations).

*Speculative phase.* The most important of the four phases takes place when alternative methods of design and manufacture are proposed. For this reason, the VA manager does not allow negative comments or opinions to dominate the ideas being presented, and all ideas are



Big money from little assemblies: (Top left) Replacement of an aluminum knob (cost 30¢) with a purchased plastic knob (47¢) saved \$13.17 in labor and burden. (Top right) Material for the redesigned spindle adapter cost 5¢ compared with 55¢; labor and burden dropped from \$2.71 to

looked at no matter how far fetched they may appear at the time. It's too early at this point to stifle thinking or harden judgments into decisions. It's a time to do creative thinking, to turn off analytical minds and concentrate on developing new ideas. Adopting the VA "functional approach," the committee looks for better ways of manufacture while reducing cost. Among their lines of investigation, they:

- Scan cost lists of labor, material and production requirements, and isolate parts or components with significant cost factors;
- Investigate cost reduction possibilities in design and manufacture, look for ways to eliminate parts or finishes, reduce and eliminate fasteners and minor components of duplicative or doubtful value;
- Combine functions by changing designs to allow one part to perform the function of several parts;
- Change part shape, to reduce size, thickness or the number of manufacturing steps;
- Loosen manufacturing tolerances consistent with design functions; eliminate unnecessary requirements while reducing cost;
- Substitute materials or finishes—powdered metals for machined metals, plastics for metal, selective grading of materials, aluminum for brass and vice versa;
- Substitute standard commercial parts or assemblies for special or in-house design;
- Substitute high production, low-cost parts for low-production, high-cost parts;
- Redesign to utilize improved manufacturing process—impact extrusions, adhesive fastenings, ultrasonic or cold welding, machine assembly, printed circuits for

complex wire and soldered circuits, cast epoxy resin parts;

- Eliminate unnecessary manufacturing operations—deburring, re-drilling, polishing, reaming, detailing;
- Combine manufacturing operations and substitute facilities—produce parts of more than one design in the same tool, use special multi-operation machines, conveyorize and mechanize operations, separate scrap from parts at the operation, clean automatically at the operation.

*Analytical Phase.* Suggested ideas, each given a dollar value, are reviewed and compared. "Good" and "bad" points of each proposed idea are listed side by side on a T-chart, so that advantages or disadvantages can be seen as to labor, material or sales costs, difficulties in production or tooling and related factors. The T-chart usually points to a logical choice while helping decide where the need is to upgrade the part in quality, performance or safety. The cost reduction goal is 20 per cent for each product.

*Program Planning and Execution Phase.* Committee recommendations, based on complete analysis and review, are forwarded to department heads who may be affected by the proposed changes. These usually include Engineering, Manufacturing, and Sales. Depending upon the relative importance of the recommendation, a management meeting may be required for a decision, and to establish target dates. In other cases, the recommendation is approved and returned to the value analysis manager. It then becomes a routine matter for Engineering to initiate the work order and to develop prototype parts if necessary. ■