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The Journal of Gear Manufacturing

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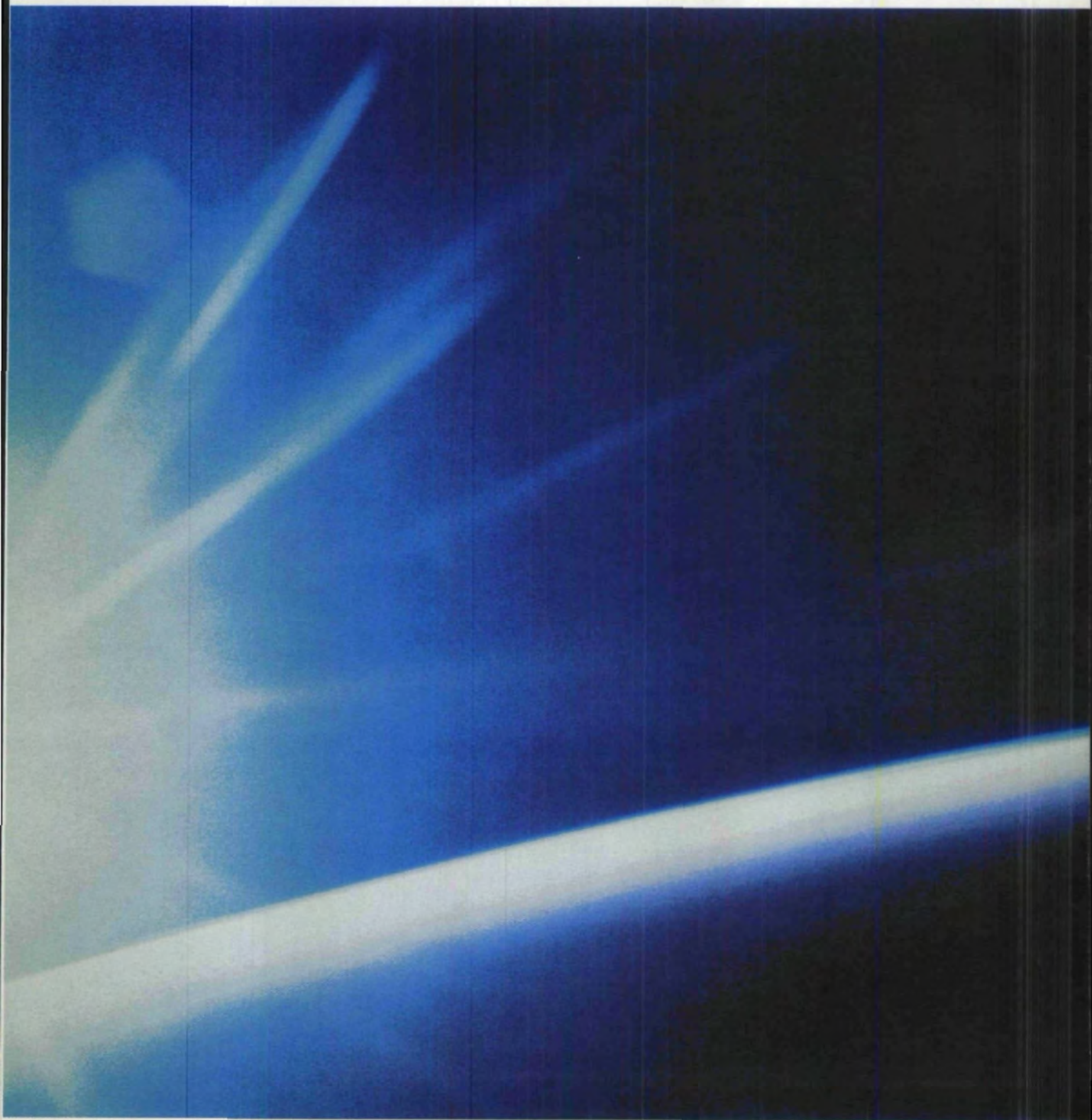
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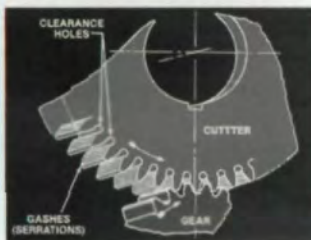
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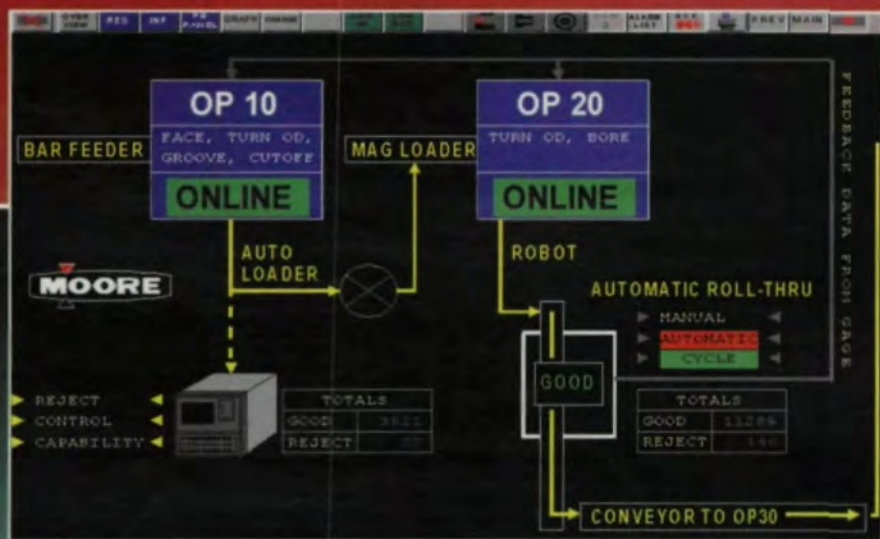
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Good-Bye, Dad

Harold Goldstein, 1917–1997

I sat down to write this editorial about my father, Harold Goldstein, as he approached his 80th birthday in October. I had meant it to be a celebration of his nearly 65 years in the machine tool business. Unfortunately, on August 26, as I was working on it, my father passed away after a long battle with emphysema. This editorial has now become a memorial as well as a celebration.

In many ways, my father's story was that of his generation. He entered his teenage years at the beginning of the Depression and spent his young manhood in a world shattered by war. He had to leave high school in his second year to earn money to help support his family and never knew the easy security that comes from having (or at least believing one has) a guaranteed lock on one's fair share of the good things in life.

But these early experiences strengthened him. Along the way, he made sure his own children had some of the important things he'd missed in the formative stages of his life; not so much material things, although he took care of that as well, but a strong sense of the importance of family, togetherness, love and caring.

He was self-taught. He turned himself into a very well-read, articulate individual, and his knowledge of accounting, business law, sales and marketing came on the job. In 1950, he struck out on his own from the business he ran with his father and founded Cadillac Machinery.

Dad also earned the trust and respect of his colleagues. Along with his father, he was one of the founding members of the Machinery Dealers National Association (MDNA) and became its national president in 1967-8. Later, in 1971 he was awarded the organization's Randolph K. Vinson Award for outstanding contributions to the industry. But he was particularly proud that he, with no formal education, was selected to represent the machine tool industry and the MDNA to give testimony before the House Ways and Means Commission with respect to the Investment Tax Credit.

He placed a tremendous importance on education as a tool to help us move through our lives, and he always stressed that importance to his children.

And it wasn't just "book learning" he impressed on my brothers and sister and me. In spite of all his early disadvantages and the hardships he faced during his formative years, there were certain admirable personal truths he lived out and taught his children, lessons which have helped to give my life some focus and direction. . .

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To help his children to have a wider vision of any given situation, my dad would constantly tell us, "You don't know what you don't know."

Throughout my life, I have found this last statement to be particularly insightful. It's taught me to look beneath the surface of situations; to assume that, most of the time, there's more going on than first meets the eye; that things are generally deeper and more complex than they first appear. It's helped me to avoid making superficial judgments, not to be too cocky too early in the game and to do my homework.



Harold and his wife, Susan.

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PUBLISHER'S PAGE

Working with and for my dad, I learned about industriousness, leadership, tenacity, ambition, self-confidence and perseverance. Dad could be a tough boss, but he was a fair one, and I was fortunate to have mostly his praise and admiration as I went through my own career.

He provided a tower of strength for our companies, Cadillac Machinery and Randall Publishing. Even after he was no longer strong enough to come into the office, he had a seemingly inexhaustible supply of interest and enthusiasm for the business. I spoke to him nearly every day, and he always had the same questions: What did we buy today? What did we sell? What new projects were we working on?

And he had the same kind of interest and concern for the larger industry and for both our immediate and extended families. He was a patriarch in the truest and best sense of the word.

The end of his life, like the beginning, was not easy, but even when he was quite ill, he continued to teach us by example. He put his affairs in order quietly and efficiently so his family would be spared the burden of tying up the loose ends. He called those close to him together to say his good-byes, an act of closure that's been deeply meaningful to me these past few weeks. He met his end with a courage, grace and dignity that made me even prouder to be his son. His job was done, he was rightfully proud of what he accomplished, and he went in peace.

Once this summer, reflecting on the number of his family and friends throughout the world who called or came to visit with him, he said, "I guess I did something right."

Dad, you did so many, many things right. We're going to miss you.



Michael Goldstein
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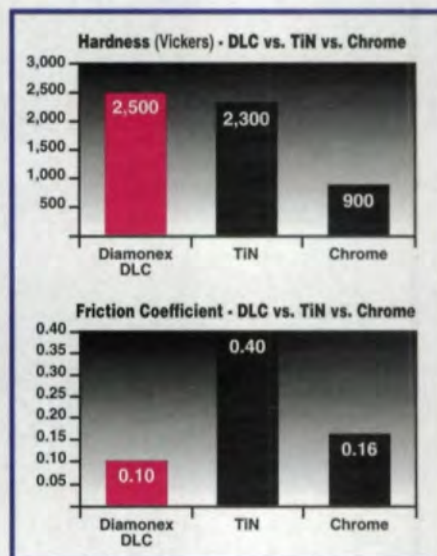
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Rock Valley Apprenticeship Program To Graduate First Class

The first group of seven students will complete their training in the Rock Valley College Manufacturing Youth Apprenticeship Program next spring. Upon graduation, they will have earned their Associate of Arts degrees from Rock Valley College or their journeyman's card from the Rockford Tooling and Machine Association.

The Rock Valley Apprenticeship Program is part of the nationwide Tech Prep program. It is modeled on the German apprenticeship program, which combines academic study with on-the-job training.

Students begin their training in their junior year of high school. The program is a combination of classroom and on-the-job training, including an extensive summer school program between the junior and senior high school years. After com-

pleting high school, students go on to a four-year apprenticeship program.

The apprenticeship training facility is located at the Pfauter-Maag Cutting Tools facility in Loves Park, IL, and Pfauter-Maag was one of the original sponsoring companies of the program.

Twenty-eight manufacturing companies in the Rock Valley/Rockford area are involved. Since 1993, some 140 students have participated in the program, which boasts a 70% retention rate.

M & M Precision Systems Acquires New Product Line

M & M Precision Systems Corp., manufacturer of gear inspection systems, has acquired the product lines of Apeiron, Inc. of Bloomington, MN. M & M will manufacture these laser dimensional measurement systems and market them worldwide under the M & M name. These non-contact laser measurement systems can accurately and rapidly identify dimensions on surfaces that cannot be measured by traditional contact methods.

Bison Gear Opens New Facility

Bison Gear and Engineering has officially opened its new world headquarters and gear motor manufacturing plant in St. Charles, IL. The 115,000 sq. ft. facility on 9.7 acres brings all the Bison operations under one roof.

The new building, designed and built to Bison's specifications, houses administration, finance, sales and marketing, research and development, warehousing and manufacturing. Special amenities include a gear technology center, a fitness center for employees and training facilities for professional and personal advancement. It has high technology equipment for hobbing, machining, gear inspection and assembly and testing.

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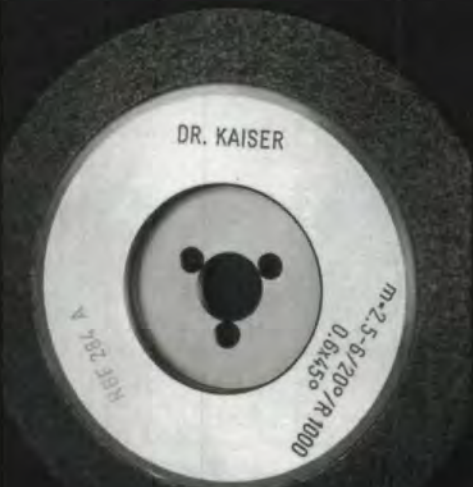
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Capitalizing on Your Human Capital

Skill levels, productivity and labor availability all affect your bottom line.

Dr. Michael D. Bradley

A fundamental characteristic of the gear industry is that it is capital intensive. In the last decade, the gear manufacturing industry has been undergoing an intense drive toward improving and modernizing its capital equipment base. The Department of Commerce reports that annual sales of gear cutting equipment have increased nearly 60% since 1990. While this effort has paid off in increased competitiveness for the American gear industry, it is important to remember that there is another capital crucial to manufacturing success—"human capital."

Human capital is the set of skills, knowledge and abilities that makes an individual productive. The higher an individual's skill level, the more productive he will be and the more he will earn. This is exactly parallel to a new machine generating a higher rate of return than an older, less productive machine. Human capital is generally acquired through education and training. An engineer, for example, dramatically increases his or her human capital by going to college.

A gear manufacturer's human capital stock is mea-

sured by adding together the individual human capital of all its workers. Just as the total productive capacity of the physical capital stock is measured by adding up the physical capacities of the individual pieces of equipment, so too is the human capital stock measured.

Unfortunately, this sometimes doesn't get done. For one reason, acquisition of human capital doesn't typically require the outlay of a single huge pile of cash; a gear company makes payments gradually to workers through time. These gradual payments take away a natural point of focus in analyzing the human capital stock.

Another reason the human capital stock is less closely monitored may be that the state of human capital is more difficult to assess than that of machinery. Finding standards that measure and describe the status of human capital in an industry is often hard.

Fortunately, this latter problem is being remedied in the gear industry. The American Gear Manufacturers Association annually produces a comprehensive study of the state of human capital in the gear industry, called "Wage and Benefit Survey." This survey provides insight

into the three important aspects of human capital stock which gear manufacturers should be monitoring. These are the expense of hiring the labor, the training and skill level of the labor force and the availability of skilled labor, both in the present and future.

The expense of hiring labor shows up in the quarterly bottom line, and it is this aspect of human capital that gets the most attention. According to the AGMA study, the average hourly wage paid to a direct worker in the gear industry is \$12.65. Adding average hourly benefits of \$7.20 per hour gives an average total hourly compensation of \$19.85, or an average cost of \$40,000 per year or \$1.2 million during the worker's potential employment. Moreover, this represents the average direct employee's wages, including both low and high skilled employees. When just skilled workers, like tool makers or CNC machinists are considered, the lifetime compensation cost can climb to more than \$1.5 million. Viewed in this way, it is clear that gear manufacturers make a substantial investment in their workers.

The average gear manu-

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facturer is small—less than half have more than 100 direct workers—but even with just 100 employees, the annual cost of compensation can exceed \$4 million. Moreover, this sum does not include additional indirect labor costs like training, administration and other non-direct human resource activities. It also does not include selling costs, engineering costs or management costs. In addition, compensation is even higher at unionized gear manufacturers, with between one quarter

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THE GEAR BUSINESS

and one third of gear firms being unionized. Compensation is about 30% higher at unionized firms, so the compensation cost at a unionized, 100-worker gear company can exceed \$5 million a year.

Given the size of these costs, it is important for gear manufacturers to control their growth. One area in which they have been successful is in health care costs. The AGMA study shows that, after years of rapid growth, the annual average health care cost per employee has grown little in recent years. In fact, annual employee health care cost has grown by only 3% over the last two years, a rate that is less than that of inflation. Gear firms have achieved this success by aggressively pursuing cost-saving strategies, such as by switching to managed care, switching carriers, increasing employee contributions to premiums and increasing deductibles.

Worker's compensation is another example. After several years of sharp increase in premiums, about half of gear firms have undertaken safety plans that reduce accidents. This has two benefits: It reduces worker's compensation premiums, and it reduces the lost productive output from injured workers. The point is, when a human capital issue comes to the attention of gear manufacturers, they can take successful steps to address it.

The worker's compensation issue also helps to reveal the dual nature of the human capital issue for gear manufacturers. While the level of compensation is obviously important, it is only half of the human capital story.

High wages by themselves are not necessarily a burden for a firm. In fact, some firms that pay the highest wages are the most profitable.

The other half of the human capital story is the productivity of the labor. The higher the human capital content of the labor force, the greater its skills and abilities, and the more productive it will be. A useful summary of the important relationship between a firm's compensation cost and the productivity of its labor is given by a measure called "unit labor costs." Like the internal rate of return to physical capital, this is a measure that helps a gear firm figure out how well it is managing its labor force.

The unit labor cost measure recognizes the two parts of labor costs. It accounts for both the rate of compensation to workers and the amount of labor required to produce output. In this sense, it is the mirror image of productivity. When productivity rises, output-per-labor-hour rises. When productivity rises, the labor hours required to produce a single unit of output falls. This mirror image of productivity is called the labor content of output, and it falls as productivity rises.

Unit labor cost is derived by multiplying this measure of labor content by the rate of average hourly compensation, and is, therefore, a dollar measure of the labor cost of producing a unit of output. When unit labor costs are falling, productivity is rising faster than wages, indicating that the gear manufacturer is doing a good job managing its human capital. Falling

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CIRCLE 126

THE GEAR BUSINESS

unit labor costs also help profitability because declining unit labor costs mean that profits will rise without an increase in prices. This is crucial during a period of intense competition.

While unit labor costs measure how quickly labor productivity is rising relative to compensation, it tells us nothing about efforts to improve labor productivity. Even in an economy with modest inflation, wages tend to rise every year, and without an increase in productivity, higher wages mean higher unit labor costs and lower profitability. Therefore gear manufacturers must try to continuously improve the productivity of their work force.

The primary way gear manufacturers accomplish this for direct workers is through training. While there are some bright spots, this is an area in which the American gear industry is not particularly strong. For example, less than a quarter of gear manufacturers have apprenticeship programs. These programs are the fundamental way in which relatively new workers can rapidly increase their productivity through organized programs of skill transfer. This lack of apprenticeship programs stands in marked contrast to gear industries in other countries that tend to have well-established and successful apprenticeship programs.

It is true that several gear manufacturers have started partnerships with local community colleges. These programs include donations of old equipment, the establishment of scholarships for studying gear manufacturing

and the creation of coordinate work/study programs. Unfortunately, these programs are still the exception rather than the rule.

Gear manufacturers have begun to offer incentives for workers to get skills and become more productive. For example, the AGMA study reveals over the last three years a dramatic increase in the number of gear firms that "pay for knowledge." In 1994, less than 10% of the gear firms offered this incentive plan, but by 1996 more than 25% were offering it. Pay-for-knowledge programs provide financial compensation for the acquisition of additional skills. For example, some gear firms pay a premium to workers who can operate multiple machines. To be effective, this premium must be substantial, and it is averaging about 85 cents per hour among the gear manufacturers that use them.

Another incentive for workers to increase their productivity is through profit-sharing plans. In these plans, a worker's total compensation is linked to the performance of the firm. Usually, the firm's contribution to the worker's pension program depends upon firm performance, but 17% of

**TIGHT LABOR
MARKETS
IMPLY RISING
WAGES THAT
WILL DRIVE UP
LABOR COSTS.**

gear manufacturers have profit-sharing programs in which workers' current pay depends upon current profits.

Of course, no incentive plan will work unless the gear manufacturer has the employees to work. The third important aspect of human capital in the gear industry is the availability of skilled workers. Given the rapid economic expansion in the gear industry in the last five years and the paucity of training programs, it is not surprising that many gear firms are having difficulty finding and hiring skilled workers. Some gear firms have reported that a shortage of skilled labor is currently limiting their capacity to produce. In other words, these firms have the machinery available to expand production, but simply cannot find the additional skilled workers to run the equipment.

The AGMA study tracks labor scarcity, and this problem has clearly become more severe in recent years. As recently as 1994, over a quarter of gear firms reported that grinder machinists were readily available, but by 1996, this percentage has fallen to just over 11%. Similarly 93% of gear companies reported that in 1996, toolmakers were scarce and difficult to hire.

This problem is unlikely to improve as time passes. The industry work force is relatively old, and as older skilled workers retire, finding the new workers to replace them will be difficult. Forty-three percent of gear manufacturing workers are more than 45 years old, and 82% are more than 30 years old. In an industry where a

current shortage of skilled labor already exists, this age profile foreshadows a continuing problem over the next two decades. Tight labor markets imply rising wages that will drive up unit labor costs. Unless productivity rises continuously, the labor shortage could provide an ongoing drag on the industry's profitability.

The American gear industry has made impressive strides in the last ten years to recapitalize itself and become world-class. However, not forgetting the "other" capital, human capital, is important. Labor costs remain a substantial part of gear firms' total costs, and the pressure to improve labor productivity continues. When we combine these factors with the current, and probable future shortages of skilled labor, the human capital dimension of gear manufacturing presents a persistent challenge for the future. ⚙

Michael D. Bradley

is Professor of Economics at the George Washington University in Washington, D.C. He has been a consultant to the gear industry for twelve years, and in 1996 he won AGMA's Executive Committee Award for "his efforts to enhance the art of management in the gear industry."

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Cyclo System Also New Technology

As always, I enjoyed reading your magazine. It was interesting and enjoyable to read your article about Mr. E. K. Buckingham, who I highly regard as an exceptional authority in the field of gearing in the U.S. His views sometimes do not conform with mainstream practices, opinions and standards as represented by AGMA. I strongly believe it is important to have individuals like him to avoid viewing things too one-sidedly.

I was somewhat disappointed that, according to your article, Mr. Buckingham says "only two new technologies come directly from the gear industry in the last 50 years," namely the Spiroid system and Novikov-Wildhaber gearing.

These two developments are certainly significant. However, I feel that the CYCLO gear system is a much more important new technology. Next to the numerous unique technical and practical advantages of this gear system, no other could achieve a real, economic success in the last 50 years. The CYCLO system, however, became the backbone of close to a billion-dollar gearbox/gear motor industry and is the only significant competitive system to classical involute spur/helical gears.

It is also odd that AGMA is not interested in devoting attention to this system. It seems to me sometimes that the classical gear manufacturers hope: "If we ignore the CYCLO system, it will go away." However, the CYCLO system is being continuously updated, refined and is gaining market share worldwide.

Gerhard Antony, PhD.
Vice President,

Sumitomo Machinery Corp. of America

The Kish Hunting Mesh Method

The Kish method for determination of hunting mesh, (Vol. 14, No.4) looks remarkably like Euclid's algorithm for finding the greatest common divisor of two numbers. Euclid invented his algorithm some 2,300 or so year ago, and here it is in your latest issue, still being useful.

Jules Kish is an estimable engineer, and I am more than glad to call it, as you do, the Kish method, but I think that Euclid deserves at least a nod and, from me, a wink when I do so.

Ron Mosier
Applied Mathematician
Chrysler Corp.

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Gear Crack Propagation Investigations

David G. Lewicki and Roberto Ballarini

Introduction

A common design goal for gears in helicopter or turboprop power transmissions is reduced weight. To help meet this goal, some gear designs use thin rims. Rims that are too thin, however, may lead to bending fatigue problems and cracks. The most common methods of gear design and analysis are based on standards published by the American Gear Manufacturers Association. Included in the standards are rating formulas for gear tooth bending to prevent crack initiation (Ref. 1). These standards can include the effect of rim thickness on tooth bending fatigue (Ref. 2). The standards, however, do not indicate the crack propagation path or the remaining life once a crack has started. Fracture mechanics has developed into a useful discipline for predicting strength and life of cracked structures.

Ahmad and Loo (Ref. 3) applied fracture mechanics to gear teeth to illustrate the procedure and estimate crack propagation direction. Honda and Conway (Ref. 4) also applied fracture mechanics to simulate tooth crack propagation, compute threshold loads and calculate tooth life. Flasket and Jezernik (Ref. 5) applied fracture mechanics to gear teeth to estimate stress intensity factors and gear life. Researchers at Tohoku University in Japan performed a series of analyses and experiments to determine the effect of residual stress on crack initiation and propagation (Refs. 6, 7). Also, Daniewicz et al. (Ref. 8) developed a comprehensive, self-contained analysis package to refine the spur gear bending fatigue theory using fracture mechanics. Lastly, Flasket and Pehan (Ref. 9) described their method for calculating crack propagation in gear teeth using fracture mechanics. Much of the work of the above references considered only an initial crack, and propagation paths were not considered. Many of the references that did consider crack propagation assumed the propagation occurred in a straight path. In addition, experimental validation of the cited analyses was sparse. Finally, no work using fracture

mechanics was performed for thin-rim gears.

The objective of this study was to determine the effect of gear rim thickness on crack propagation life. From an extensive study (Ref. 10), linear elastic fracture mechanics was used to analyze gear tooth bending fatigue in standard and thin-rimmed gears. Finite element computer programs were used to determine stress distributions, estimate stress intensity factors and model crack propagation. Various fatigue crack growth models were used to estimate crack propagation life. Experimental tests were performed to validate predicted crack propagation results.

Fatigue Crack Growth

Many machine elements, such as gear teeth, are cyclically loaded in application. The overall fatigue life of such components may be represented by three distinct phases: 1) crack initiation, 2) crack propagation and 3) final failure. Once crack initiation has occurred, fracture mechanics may be used to estimate crack propagation fatigue growth rate and time to final failure.

The most universally used method to calculate crack propagation crack growth was postulated by Paris and Erdogan (Ref. 11). Purely Mode I loaded specimens subjected to cyclic load were considered. Unstable crack growth such that the stress intensity factor grew with increasing crack size was also considered. Paris postulated that the rate of crack growth with respect to number of stress cycles was a logarithmic relationship with the stress intensity factor range as

$$\frac{da}{dN} = C(\Delta K)^n \quad (1)$$

where da is the change in crack length for dN number of stress cycles, ΔK is the range of the Mode I stress intensity factor at a given time and C and n are material constants. The material constants C and n must be determined by some experimental means.

Further research of fatigue crack growth has shown three important factors not considered in the Paris model. First was the

effect of load ratio R on crack growth ($R =$ minimum cyclic load/maximum cyclic load). Second was the instability of crack growth observed when the stress intensity factor range approached the material's fracture toughness index, K_{IC} . Third was the presence of a stress intensity threshold factor ΔK_{th} . The stress intensity threshold factor is the highest stress intensity factor in which no crack growth would occur. The Collipiest crack growth model (Ref. 12) accounts for these effects where

$$\frac{da}{dN} = C(K_{IC}\Delta K_{th})^{n/2} \cdot$$

$$\exp \left\{ \ln \left(\frac{K_{IC}}{\Delta K_{th}} \right)^{n/2} \cdot \tanh^{-1} \left[\frac{\ln \left(\frac{\Delta K^2}{(1-R)K_{IC}\Delta K_{th}} \right)}{\ln \left(\frac{(1-R)K_{IC}}{\Delta K_{th}} \right)} \right] \right\} \quad (2)$$

In addressing applications to gears, Inoue et al. (Ref. 7) describe fatigue crack growth of gear bending fatigue tests. Here, crack growth equations were derived as a function of crack depth through a gear tooth. The expression derived for crack growth rate da/dN , as a function of stress intensity range ΔK was

$$\frac{da}{dN} = \begin{cases} \frac{\lambda}{(1-\alpha^n)} (\Delta K^n - \Delta K_{th}^n) & \text{for } \Delta K_{th} \leq \Delta K \leq \Delta K_C \\ \frac{\lambda}{(1-\alpha^n)} \frac{\Delta K^n K_{IC}^n}{(K_{IC}^n - \Delta K^n)} & \text{for } \Delta K_C < \Delta K < \Delta K_{IC} \end{cases} \quad (3)$$

where the parameters K_{IC} , α , ΔK_C , ΔK_{th} , η and λ were all estimated as a function of tooth hardness (Ref. 7).

Crack Propagation Simulation

The analysis of the current study used the FRANC (FRacture ANalysis Code) computer program described by Wawrzynek (Ref. 13). FRANC is a general purpose finite element code for the static analysis of cracked structures. FRANC is designed for two-dimensional problems and is capable of analyzing plane strain, plane stress or axisymmetric problems.

Among the variety of capabilities, a unique feature of FRANC is the ability to

model a crack in a structure. FRANC uses a method called "delete and fill" to accomplish this. To illustrate, the user would first define an initial crack by identifying the node of the crack mouth and coordinates of the crack tip. FRANC will then delete the elements in the vicinity of the crack tip. FRANC will next insert a rosette of quarter-point, six-node triangular elements around the crack tip to model the inverse square-root stress singularity (Refs. 14, 15). Finally, FRANC will fill the remaining area between the rosette and original mesh with conventional six-node triangular elements. The user can then run the finite element equation solver to determine nodal displacements, forces, stresses and strains.

A further unique feature of FRANC is the automatic crack propagation capability. After an initial crack is inserted in a mesh, FRANC models a propagated crack as a number of straight line segments. For each segment, FRANC models the crack tip using a rosette of quarter-point elements. FRANC then solves the finite element equations, calculates the stress intensity factors and calculates the crack propagation angle. After the crack propagation angle is determined, FRANC then places the new crack tip at the calculated angle and at a user-defined crack increment length. The model is then remeshed using the "delete and fill" method described above. The procedure is repeated a specific number of times as specified by the user. In the current study, the stress intensity factors were determined from the calculated nodal displacements using the displacement correlation method (Ref. 16). The method of Erdogan and Sih (Ref. 17) was used in the current study to determine the crack propagation angle.

Once the stress intensity factors are determined for each segment, the predicted number of crack propagation cycles can be estimated using the fatigue crack growth models. Regardless of the model used, the crack growth rates da/dN , were of the form

$$\frac{da}{dN} = g(\Delta K) \quad (4)$$

where $g(\Delta K)$ is given by Eq. 1 for the Paris relationship, Eq. 2 for the Collipriest relationship or Eq. 3 for Inoue's method. The predicted number of crack propagation cycles for the i_{th} crack segment, N_p , was estimated by

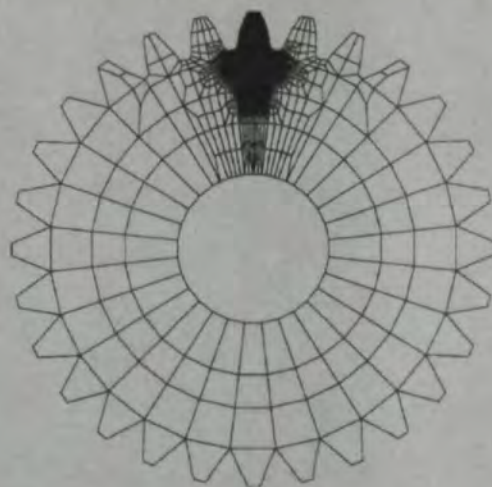


Fig. 1 — Finite element model of gears used in crack propagation studies, solid model, $m_B = 3.3$.

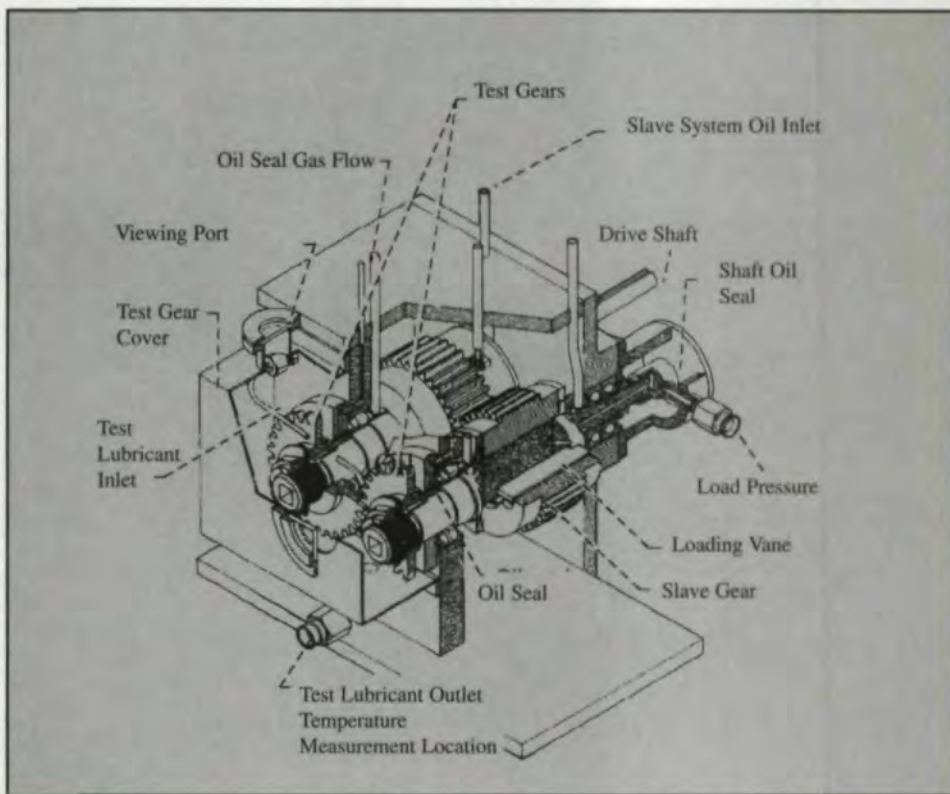


Fig. 2 — NASA Lewis Spur Gear Fatigue Rig.

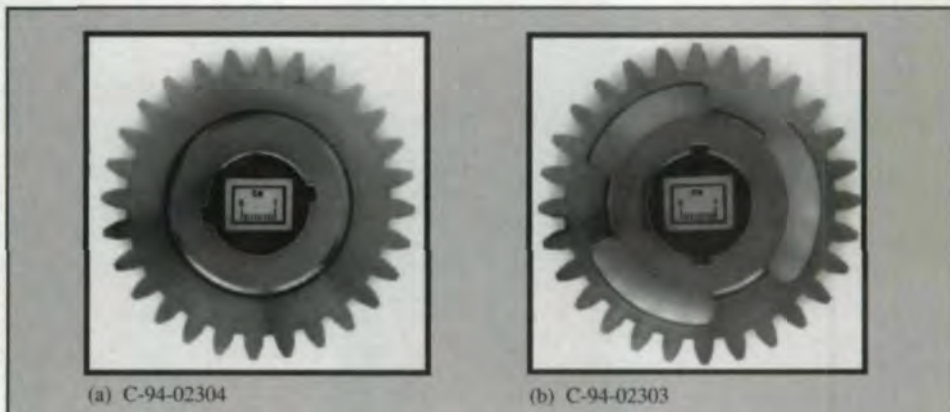


Fig. 3 — Test gears used to determine effect of rim thickness on crack propagation. (a) $m_B = 3.3$, (b) $m_B = 0.3$.

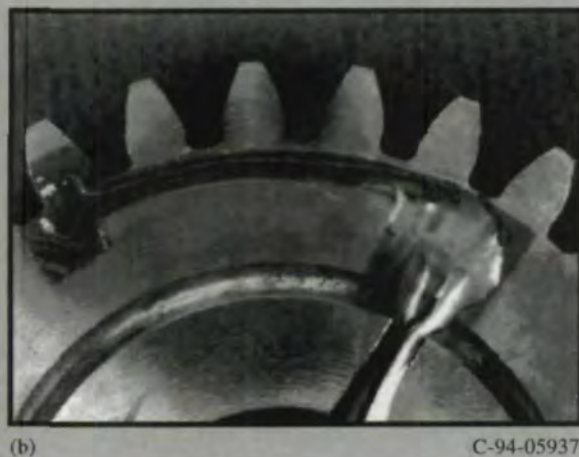
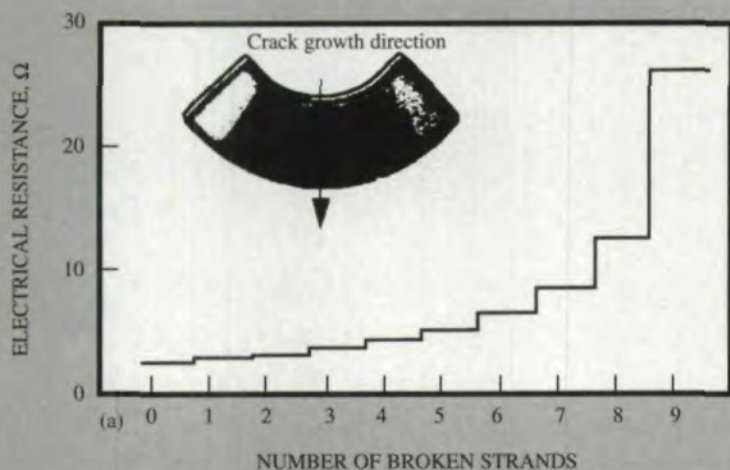


Fig. 4 — Specialized crack propagation gages for gear tooth crack growth measurements. (a) Increase in gage electrical resistance as the number of broken strands increases. (b) Installation of crack propagation gage on test gear.

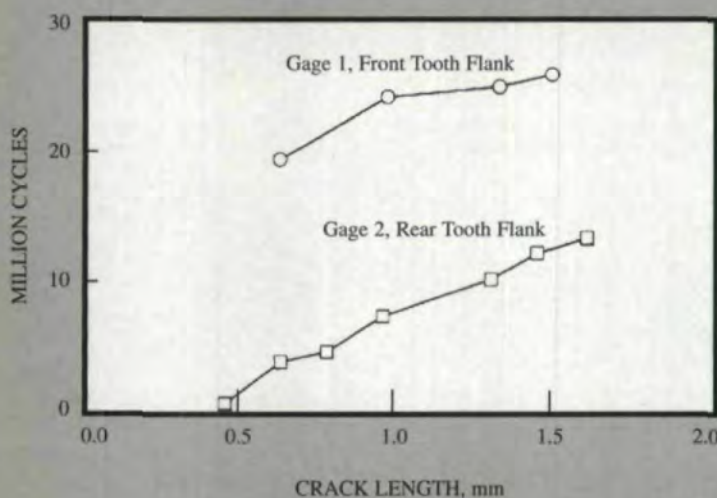


Fig. 5 — Crack propagation fatigue growth for Test 1, $m_B = 0.3$.

$$N_i = \frac{a_i - a_{i-1}}{g(\Delta K_i)} + N_{i-1} \quad (5)$$

where a_i was the crack length of the i_{th} segment, a_{i-1} was the crack length of the $(i-1)_{th}$ segment, N_{i-1} was the number of cycles of the $(i-1)_{th}$ segment and $g(\Delta K_i)$ was the average crack growth rate of the i_{th} and $(i-1)_{th}$ segments. Note that a_1 was the initial crack length, and $N_1 = 0$ and i varied from 2 to the total number of segments.

Gear Finite Element Modeling

Basic gear tooth geometry data was input to a tooth coordinate generation computer program. The tooth coordinate generator program used the method of Hefeng et al. (Ref. 18) to determine the tooth coordinates. The output was tooth coordinate and rim coordinate data which defined a single tooth sector of a gear. This output was used by a commercially available pre- and post-processing finite element analysis software package (Ref. 19). This package created the finite element mesh of the complete gear. FRANC then used this mesh and performed crack propagation simulations.

Fig. 1 shows a sample finite element mesh of an uncracked gear. The tooth geometry used modeled that of the test gears of the NASA Lewis Spur Gear Fatigue Rig (described in the following section). The analysis used 8-node, plane stress, quadrilateral finite elements. The mesh was refined in the region of the loaded tooth for improved accuracy. The model of Fig. 1 had 2,353 elements and 7,295 nodes. Material properties used were that of AISI 9310 steel. The tooth load was placed at the highest point of single tooth contact. For boundary conditions, four hub nodes were fixed. In addition, gears with various rim thicknesses were modeled. The parameter describing the rim thickness was the backup ratio m_B , where

$$m_B = \frac{b}{h} \quad (6)$$

where b was the rim thickness, and h was the tooth whole depth. Gears with various backup ratios were modeled by incorporating slots in the model. All cases used the same finite element mesh for the loaded tooth.

Test Facility

Crack propagation experiments were performed in the NASA Lewis Spur Gear Fatigue Rig (Fig. 2). The test stand operated on a torque regenerative principle in which

torque was circulated in a loop of test gears and slave gears. Oil pressure was supplied to load vanes in one slave gear which displaced the gear with respect to its shaft. This produced a torque on the test gears, slave gears and connecting shafts proportional to the amount of applied oil pressure. A 19 KW (25 hp), variable-speed motor provided speed to the drive shaft using a belt and pulley. The lubricant used for the gears, bearings and loading systems was a synthetic paraffinic oil. The test gear lubricant was filtered through a 5-micron fiberglass filter.

Test Gears

The test gears were 28-tooth, 8-pitch, 20° pressure angle external spur gears with a face width of 6.35 mm (0.25"). The teeth had involute profiles with linear tip relief starting at the highest point of single tooth contact and ending at the tooth tip at an amount of 0.013 mm (0.0005"). All test gears used in the experiments were fabricated and machined from a single batch of material. The test gear material was vacuum-melted, consumable-electrode AISI 9310 steel. The gears were case carburized and ground. The teeth were hardened to a case hardness of R_c 61 and a core hardness of R_c 38. The effective case depth (depth at a hardness of R_c 50) was 0.81 mm (0.032"). Two different test gear designs were considered. The first was a thick-rimmed gear with a backup ratio of $m_B = 3.3$ (Fig. 3a). The second was a thin-rimmed gear which incorporated slots (Fig. 3b). The backup ratio of the thin-rimmed gear was $m_B = 0.3$.

It was believed that tooth bending fatigue cracks would be difficult to initiate based on the load capacity of the test rig. Due to this, notches were fabricated in the fillet region (loaded side) on one tooth of each of the test gears to promote crack initiation. The notches were fabricated using electrical discharge machining (EDM) with a 0.10 mm (0.004") diameter wire electrode. The nominal notch dimensions were 0.20 mm (0.008") in length and 0.13 mm (0.1005") in width along the full face width of the tooth. The notches were located at the same location for both test gears. This location was at a radius of 40.49 mm (1.594") on the fillet, which was the position of the greatest tensile stress for the solid gear ($m_B = 3.30$). The notches produced a stress concentration factor of approximately three as determined using a finite element analysis.

Instrumentation

The standard test rig instrumentation monitored test gear speed, oil load pressure, test gear and slave gear oil pressure and oil temperatures. Also, overall test stand vibration was monitored using an accelerometer mounted on the top housing. In addition to the standard facility vibration sensor, an advanced vibration processing diagnostic system was installed in the test stand to help assist in crack detection. Crack propagation gages were used in the experiments to determine fatigue crack growth. Special gages were fabricated for installation in the tooth fillet region of the test gears. The gages had ten circular strands with an inner radius of 1.52 mm (0.060") and an outer radius of 3.05 mm (0.120") (Fig. 4). The strands were designed to break as the crack propagated through them, which in turn increased the electrical resistance of the gage (Fig. 4a). Fig. 4b shows the installation of a gage in the fillet region of a notched tooth. A gage was installed on each side of the tooth flank for each gear instrumented with crack gages. The electrical resistance of the crack gages was monitored along with the load cycle count to estimate cycles as a function of crack length. The information from the rotating crack gages was transferred through brush-type slip rings. Also, an infrared tach sensor was used to measure number of load cycles.

Measured Gear Fatigue Crack Growth

The thin-rimmed gear was used in Test 1. The test was run at 89 Nm (786 in/lb) torque and 10,000 rpm speed for 6.5 hrs., at which time rim fracture occurred. Fig. 5 plots the number of load cycles as a function of the measured crack length. The crack gage results indicated the crack growth was non-uniform throughout the tooth face width. A crack started on the rear flank of the tooth at the tip of the notch and reached an initial size of 0.46 mm (0.018") at 1,060,000 cycles. The crack continued to propagate through the rear flank, but did not reach the front flank until approximately 2,680,000 cycles. At 2,910,000 cycles, the crack reached a size of 0.64 mm (0.025") on the front flank, but completed propagation through the rear gage by this time. Even though the crack initiation time was not uniform throughout the tooth face width, the crack propagation rate was uniform. This was indicated by the similarity in slopes of the curves in Fig. 5 for Gages 1 and 2.

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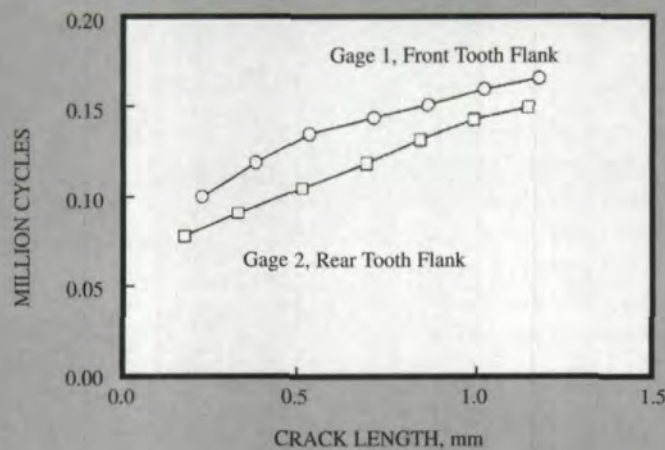


Fig. 6 — Crack propagation fatigue growth for Test 2, $m_B = 3.3$.

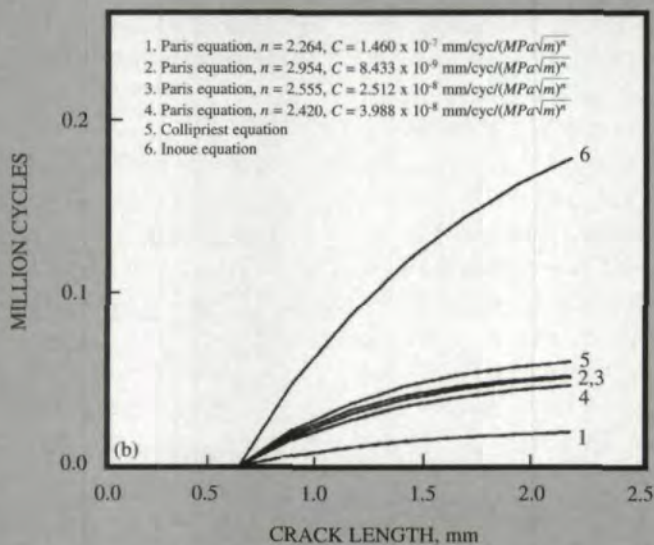
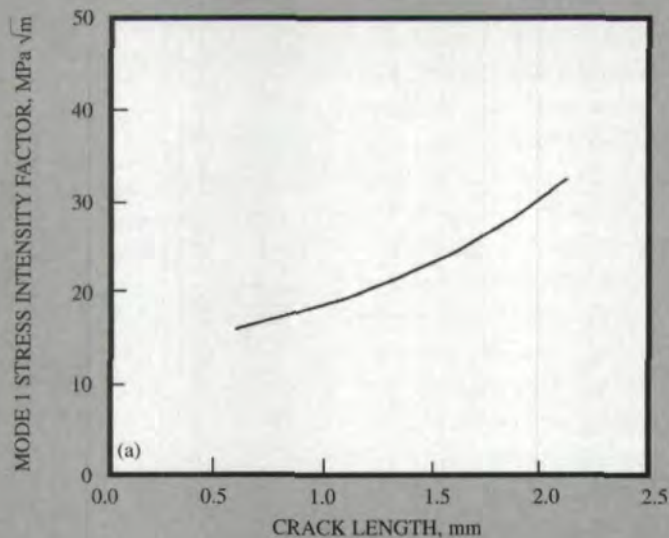


Fig. 7 — Comparison of predicted crack propagation cycles using Paris, Collipriest and Inoue equations. Model for $m_B = 0.3$. (a) Mode I stress intensity factor. (b) Life comparison.

The thick-rimmed gear was used in Test 2. This gear was run at 136 Nm (1200 in/lb) torque and 10,000 rpm speed for 15 minutes, at which time tooth fracture occurred. Fig. 6 gives the processed crack propagation results for Test 2. Note that the crack initiation and crack propagation was fairly uniform throughout the tooth face width for this test.

Comparison of Predicted and Measured Crack Growth

The FRANC computer program was used to simulate crack propagation and calculate Mode I stress intensity factors as a function of crack length. The predicted stress intensity factors were then used with three different fatigue crack growth models (Paris, Collipriest and Inoue) to estimate crack propagation.

A comparison of predicted crack propagation cycles using the Paris, Collipriest and Inoue methods is shown in Fig. 7. For this, the thin-rimmed model ($m_B = 0.3$) was used to simulate the test gear of Fig. 3b. An initial crack of 0.64 mm (0.025") was placed in the tooth fillet at the location of the maximum tensile stress. Crack propagation was then simulated, and the Mode I stress intensity factor as a function of crack length is given in Fig. 7a. From this, six different fatigue growth cases were considered. The first four cases used the Paris equation and material constants of AISI 9310 specimens from experiments of Au and Ke (Ref. 20). The fifth case used the Collipriest equation and AISI 9310 material constants from Forman and Hu (Ref. 21). The load ratio used was $R = 2.6$, as determined from the finite element analysis. The sixth case used Inoue's method and the material constants of the SCM 415 material (SCM 415 is a high-strength Japanese steel with properties similar to AISI 9310). The predicted number of cycles per crack length varied significantly among the cases studied (Fig. 7b). Note that the cycles were defined as the number of crack propagation cycles after an initial crack of 0.64 mm (0.025").

Predicted crack growth for the $m_B = 0.3$ and 3.3 gears was compared to the measured crack growth from the experiments. Again, the six different prediction schemes mentioned above were used. The predicted number of crack propagation cycles using the sixth schemes were, for the most part, extremely low compared to the measured number of cycles from the experiments. To

account for this, the concept of fatigue crack closure was investigated. Elber (Ref. 22) performed crack experiments on aluminum alloys and deduced that residual compressive stresses existed near the crack tip region because of plastic deformation. These residual stresses reduced the effective stress intensity factor range (and thus, increased crack propagation life) and provided a better fit to experimental data than other empirical expressions. Elber proposed an effective stress intensity range ratio U such that

$$\Delta K_{eff} = U(\Delta K) \quad (7)$$

where ΔK_{eff} was the effective stress intensity factor range. Elber then used the effective stress intensity factor range in the Paris fatigue crack growth model. In addition, Elber defined U through experimental studies as a linear function of the load ratio R .

The concept of fatigue crack closure was applied to the current gear crack experiments and predictions. A study was conducted to estimate the effective stress intensity factor range ratio for the experiments. The predicted number of crack propagation cycles using the same six schemes were plotted versus crack length at a variety of arbitrarily chosen U ratios. For the Paris equation and material constants $n = 2.954$ and $C = 8.433 \times 10^{-9} \text{ mm/cyc}/(\text{MPa}\sqrt{\text{m}})^n$, good correlation between predicted crack cycles and the experiments occurred when: 1) $U = 0.4$ for $R = 2.6$, and 2) $U = 0.8$ for $R = 0.1$. Assuming a linear relation between U and R produced

$$U = 0.82 + 0.16(R) \quad (8)$$

Fig. 8 shows a sample comparison of predicted and measured crack growth when the fatigue crack closure concept was used. The cycles were defined as the number of crack propagation cycles after an initial crack of 0.64 mm (0.025"). It should be noted that good correlation was also achieved when the Collipriest equation was used with certain U values. This produced a relationship similar to Eq. 8, but with different coefficients (Ref. 10).

Fig. 9 displays the effect of rim thickness on predicted Mode I stress intensity factors and predicted crack propagation cycles. The stress intensity factors were determined from FRANC using the appropriate finite

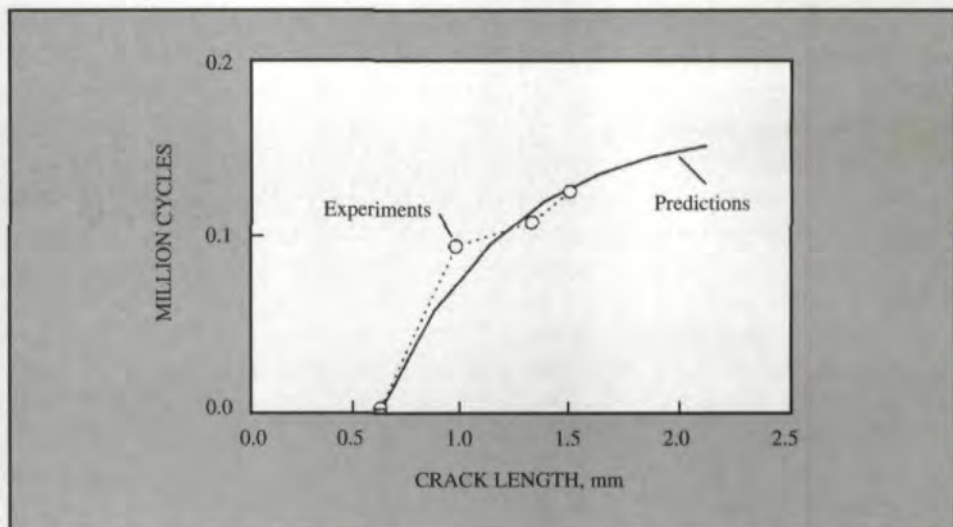


Fig. 8 — Comparison of predicted crack propagation cycles to experiments. Paris fatigue crack growth model, $n = 2.954$, $C = 8.433 \times 10^{-9} \text{ mm/cyc}/(\text{MPa}\sqrt{\text{m}})^n$, $R = -2.6$, $U = 0.4$, used for predictions. Test 1, Gage 1, front flank, for experiments.

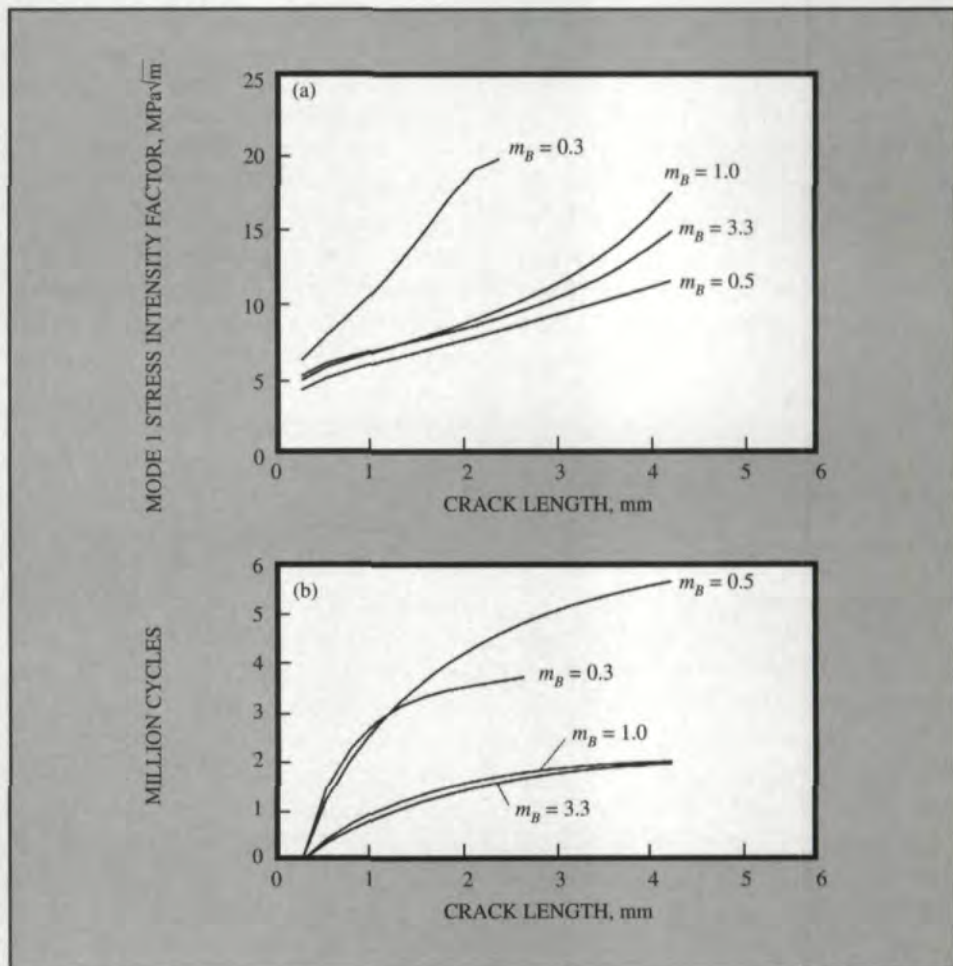


Fig. 9 — Effect of backup ratio on stress intensity factors and crack propagation cycles. (a) Mode I stress intensity factors. (b) Crack propagation cycles, Paris fatigue crack growth model, $n = 2.954$, $C = 8.433 \times 10^{-9} \text{ mm/cyc}/(\text{MPa}\sqrt{\text{m}})^n$, $U = 0.82 + 0.16 R$.

element models. The Paris equation was used along with the effective stress intensity range ratios of Eq. 8. The initial cracks of the various models were placed at the location of the maximum tensile stress in the tooth fillet. The stress intensity factors were lowest for the $m_B = 0.5$ case. This gave the

highest predicted number of cycles for the cases studied. The cycles were all defined as the number of crack propagation cycles after an initial crack of 0.28 mm (0.011"). The stress intensity factors were highest for the $m_B = 0.3$ case. However, the predicted life for this was somewhere between the case of

$m_p = 0.5$ and 1.0 due to the fatigue crack closure effect. The cases of $m_p = 3.3$ and 1.0 gave nearly the same predicted life.

Conclusions

Based on these analytical and experimental studies, the following conclusions were made: 1) Good correlation between predicted and measured gear crack growth was achieved when the predictions used the Paris crack growth equation and the concept of fatigue crack closure. 2) For thin rims, a decrease in rim thickness caused an increase in both the stress intensity factor and the compressive cyclic stress in the gear tooth fillet region. The increase in stress intensity factor promoted crack growth, while the increase in cyclic compressive stress tended to retard crack growth and increase the number of propagation cycles to failure. ⚙

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References:

1. "Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth." ANSI/AGMA 2001-B88, American Gear Manufacturers Association, Alexandria, VA, 1990.
2. Drago, R. J. and R. V. Lutthans. "Combined Effects of Rim Thickness and Pitch Diameter of Spur Gear Tooth Stresses." *Journal of the American Helicopter Society*. Vol. 28, July, 1983, pp. 13-19.
3. Ahmad, J. and F. T. Loo. "On the Use of Strain Energy Density Fracture Criterion in the Design of Gears Using Finite Element Method." ASME Paper No. 77-DET-158. Presented at the Design Technical Conference, Chicago, IL, Jun., 1977.
4. Honda, H. and J. C. Conway. "An Analysis by Finite Element Techniques of the Effects of a Crack in the Gear Tooth Fillet and Its Applicability to Evaluating Strength of the Flawed Gears." *Bulletin of the JSME*, Vol. 22, No. 174, Dec., 1979, pp. 1848-1855.
5. Flasker, J. and A. Jezernik. "The Comparative Analysis of Crack Propagation in the Gear Tooth." *Proceedings of the Int.*

Conf. of Application of Fracture Mechanics to Materials and Structures, Freiburg, Germany, June, 1983. pp. 971-982.

6. Kato, M. et al. "Strength Evaluation of Carburized Gear Teeth Based on Fracture Mechanics." *Proceedings of the KSME/JSME Joint Conference "Fracture and Strength '90"*, Seoul, Korea, 1990, pp. 248-253.

7. Inoue, K. et al. "Fracture Mechanics Based Evaluation of Strength of Carburized Gear Teeth." *Proceedings of the JSME International Conference on Motion and Power Transmissions*. Hiroshima, Japan, Nov., 1991, pp. 801-806.

8. Daniewicz, S. R. et al. "The Stress Intensity Factor and Stiffness for a Cracked Spur Gear Tooth," *Journal of Mechanical Design*, Vol. 116, No. 3, Sept., 1994.

9. Flasker, J. and S. Pehan. "Crack Propagation in Tooth Root with Variable Loading." *Communications in Numerical Methods in Engineering*, Vol. 9, No. 2, Feb., 1993, pp. 103-110.

10. Lewicki, D. G. "Crack Propagation Studies to Determine Benign or Catastrophic Failure Modes for Aerospace Thin-Rim Gears." Ph.D. Dissertation, Case Western Reserve University, May, 1995.

11. Paris, P. C. and F. Erdogan. "A Critical Analysis of Crack Propagation Laws." *Journal of Basic Engineering*, Vol. 85, 1963, pp. 528-534.

12. Collipriest, J. E. "An Experimentalist's View of the Surface Flaw Problem." *The Surface Crack: Physical Problems and Computation Solutions*, American Society of Mechanical Engineers, 1972, pp. 43-61.

13. Wawrzynek, P. A. "Discrete Modeling of Crack Propagation: Theoretical Aspects and Implementation Issues in Two and Three Dimensions." Ph.D. Dissertation, Cornell University, 1991.

14. Henshell, R. D. and K. G. Shaw. "Crack Tip Finite Elements Are Unnecessary." *International Journal for Numerical Methods in Engineering*, Vol. 9, 1975, pp. 495-507.

15. Barsoum, R. S. "On the Use of Isoparametric Finite Elements in Linear Fracture Mechanics." *Journal for Numerical Methods in Engineering*, Vol. 10, No. 1, 1976, pp. 25-37.

16. Tracey, D. M. "Discussion of 'On the Use of Isoparametric Finite Elements in

Linear Fracture Mechanics' by R. S. Barsoum." *International Journal for Numerical Methods in Engineering*, Vol. 11, 1977, pp. 401-402.

17. Erdogan, F. and G. C. Sih. "On the Crack Extension in Plates Under Plane Loading and Transverse Shear." *Journal of Basic Engineering*, Vol. 85, 1963, pp. 519-527.

18. Hefeng, B. et al. "Computer Modeling of Rack-Generated Spur Gears." *Mechanism and Machine Theory*, Vol. 20, No. 4, 1985, pp. 351-360.

19. *P3/PATRAN User Manual*. PDA Engineering, Costa Mesa, CA, 1993.

20. Au, J. J. and J. S. Ke. "Correlation Between Fatigue Crack Growth Rate and Fatigue Striation Spacing in AISI 9310 Steel." *Fractography and Materials Science*, ASTM STP 733, 1981, pp. 202-221.

21. Forman, R. G. and T. Hu. "Application of Fracture Mechanics on the Space Shuttle." *Damage Tolerance of Metallic Structures*, ASTM STP 842, 1984, pp. 108-133.

22. Elber, W. "The Significance of Fatigue Crack Closure." *Damage Tolerance in Aircraft Structures*, ASTM STP 486, 197, pp. 230-242.

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Gear Shaving Basics – Part I

John P. Dugas

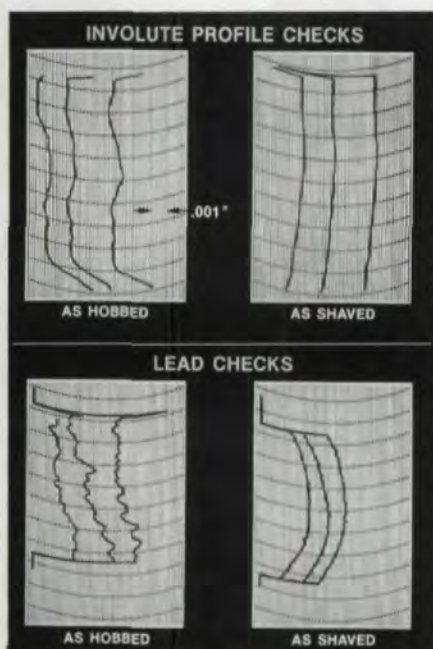


Fig. 1 — Charts showing improvement in profile and lead, 5.7 NPD, 20°, NPA, 3.85" P.D., crowned shaved with stock removal of 0.011" over pins.

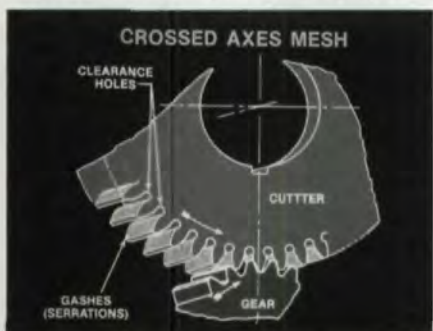


Fig. 2 — Work gear in crossed-axes mesh with rotary shaving cutter mounted above.

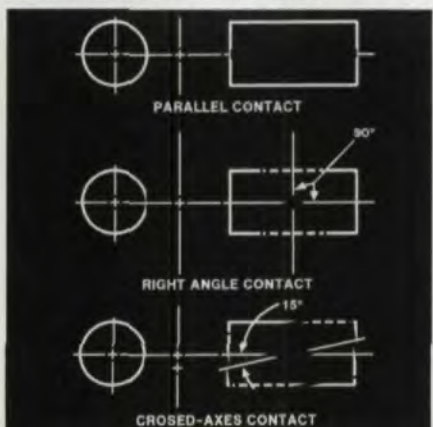


Fig. 3 — Contact between cylinders change as crossed axes are varied.

Gear shaving is a free cutting gear finishing operation which removes small amounts of metal from the working surfaces of gear teeth. Its purpose is to correct errors in index, helix angle, tooth profile and eccentricity (Fig. 1). The process also improves tooth surface finish and eliminates by means of crowned tooth forms the danger of tooth end load concentrations in service. Shaving provides for profile modifications that reduce gear noise, increase a gear's load carrying capacity, its factor of safety and its service life. Gear finishing (shaving) is not to be confused with gear cutting (roughing). They are essentially different. Any machine designed primarily for one cannot be expected to do both with equal effectiveness or with equal economy.

Gear shaving is the logical remedy for the inaccuracies inherent in gear cutting. It is equally effective as a control for those troublesome distortions caused by heat treatment.

The form of the shaving cutter can be reground to make profile allowance for different heat treat movements caused by varying heats of steel. The shaving machine can also be reset to make allowance for lead change in heat treatment.

Rotary gear shaving is a production process that utilizes a high speed, hardened and ground, ultra-precision steel shaving cutter. The cutter is made in the form of a helical gear. It has gashes in the flanks of the teeth which act as the cutting edges.

The cutter is meshed with the work gear in a crossed-axes relationship (Fig. 2) and rotated in both directions during the work cycle while the center distance is reduced in small increments. Simultaneously the work is traversed back and forth across the width of the cutter. The traverse path can either be parallel or

diagonal to the work gear axis, depending on the type of work gear, the production rate and finish requirements. The gear shaving process can be performed at high production rates. It removes material in the form of fine hair-like chips.

Machines are available to shave external spur and helical gears up to 200" in diameter. Other machines are also available for shaving internal spur and helical gears. For best results with shaving, the hardness of the gear teeth should not exceed 30 Rockwell C scale. If stock removal is kept to recommended limits, and the gears are properly qualified, the shaving process will finish gear teeth in the 7 to 20 pitch range to the following accuracies: involute profile, 0.0002"; tooth-to-tooth spacing, 0.0003" and lead or parallelism, 0.0002".

In any event, it should be remembered that gear shaving can remove 65–80% of the errors in a hobbed or shaped gear. It will make a good gear better. The final quality of the shaved gear is dependent to a large degree upon having good hobbed or shaped gear teeth.

Excellent surface finish is achieved with gear shaving. A value of approximately 25^o is the normal finish obtained with production gear shaving, although much finer finishes are possible by slowing the process. In some cases, shaving cutters will finish up to 80,000 gears before they need sharpening. They may generally be sharpened from four to ten times.

To a gear designer, the shaving process offers attractive advantages in the ability to modify the tooth form. If a crowned tooth form or a tapered tooth form are desired to avoid end bearing conditions, these can be easily provided by shaving.

If modifications are desired in the involute profile, these can be made by suitable modifications in the ground cutter tooth form. If heat treatment distur-

GEAR FUNDAMENTALS

tions can be kept to a minimum, the most inexpensive way to produce an accurate, quiet, high-performance gear is to specify hobbing followed by gear shaving. The shaving process uses a variety of standardized production equipment ranging from hand loading to fully automatic loading and unloading.

Basic Principles

The rotary gear shaving process is based on fundamental principles. This process uses a gashed rotary cutter in the form of a helical gear having a helix angle different from that of the gear to be shaved. The axes of the cutter and the gear are crossed at a predetermined angle during the shaving operation. When the cutter and the work gear are rotated in close mesh, the edge of each cutter gash shaves a fine hair-like chip as it moves over the surface of a work gear tooth. The finer the cut, the less the pressure required between tool and work, eliminating the tendency to cold-work the surface metal of the work gear teeth.

This process is performed in a shaving machine, which has a motor-driven cutter head and a reciprocating work table. The cutter head is adjustable to obtain the desired crossed axis relationship with the work. The work carried between live centers is driven by the cutter. During the shaving cycle, the work is reciprocated parallel to its axis across the face of the cutter and upfed an increment into the cutter with each stroke of the table. This conventional shaving cycle is one of several methods.

The Crossed-Axis Principle

To visualize the crossed-axis principle, consider two parallel cylinders of the same diameter (Fig. 3). When brought together under pressure, their common contact surface is a rectangle having the length of a cylinder and width which varies with contact pressure and cylinder diameter.

When one of these cylinders is swung around so that the angle between its axis and that of the other cylinder is increased up to 90°, their common plane remains a parallelogram, but its area steadily decreases as the axial angle increases. The same conditions prevail when instead of the two plain cylinders, a shav-



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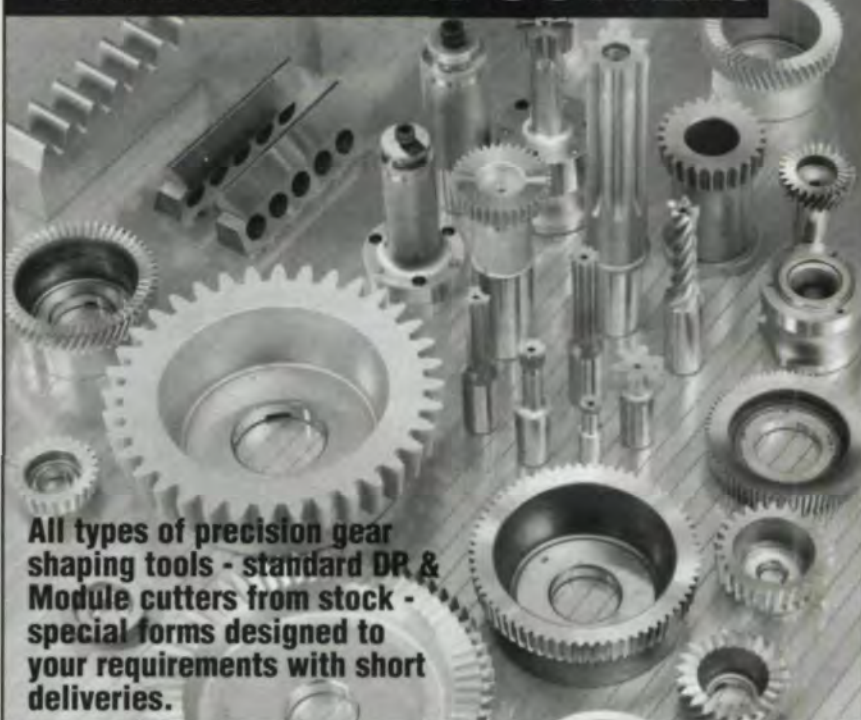
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ing cutter and a work gear are meshed together. When the angle between their axes is from 10° to 15°, tooth surface contact is reduced, and the pressure required for cutting is small. As the work gear is moved away axially from the point of intersection of the axes, backlash develops. Conversely, as it is returned to the point of axial intersection, backlash decreases until the two members engage in tight mesh with the teeth of the cutter wedging between those of the work gear. Thus, each succeeding cutting edge sinks deeper into the work gear tooth until the point of axial intersection is reached.

For shaving, the cutter and work gear axes are crossed at an angle usually in the

range of 10° to 15° or approximately equal to the difference in their angles.

Crossing the axes produces reasonably uniform diagonal sliding action from the tip of the teeth to the root. This not only compensates for the nonuniform involute action typical of gears in mesh on parallel axes, but provides the necessary shearing action for stock removal.

Relationship Between Cutting & Guiding Action

Increasing the angle between the cutter and work axes increases cutting action, but, as this reduces the width of the contact zone, guiding action is sacrificed. Conversely, guiding action can be increased by reducing the angle of

crossed axes, but at the expense of cutting action.

Preparation Prior to Shaving

The first consideration in manufacturing a gear is to select the locating surfaces and use them throughout the process sequence. Close relationship between the locating surface and the face of the gear itself must be held. Otherwise, when the teeth are cut and finished with tooling that necessarily contacts the gear faces, the teeth will be in an improper relationship with the locating or related surface on which the gear operates. Gears that locate on round diameters or spline teeth must fit the work arbors closely or these critical hole-to-face relationships will be destroyed.

Typical manufacturing tolerances for gear blanks prior to cutting of the teeth are shown in Table 1.

Once the gear blank has been manufactured, it is necessary to cut the gear teeth. The most common methods today for rough-cutting gear teeth are hobbing and shaper cutting. Of primary concern to the shaving cutter manufacturer is the fillet produced by the roughing operation. The tips of the shaving cutter teeth must not contact the gear root fillet during the shaving operation. If such contact does occur, excessive wear of the cutter results, and the accuracy of the involute profile is affected.

The shaving cutter just finishes the gear tooth below its active profile. Thus, the height of the fillet should not exceed the lowest point of contact between the shaving cutter teeth and the teeth on the work gear.

Protuberance type hobs and shaper cutters are often used prior to shaving to produce a slight undercut or relief near the base of the gear tooth. This method assures a smooth blending of the shaved tooth profile and the unshaved tooth fillet, as well as reducing shaving cutter tooth tip wear (Fig. 4). The amount of undercut produced by the protuberance type tool should be made for the thin end of the tooth. The position of the undercut should be such that its upper margin meets the involute profile at a point below its contact diameter.

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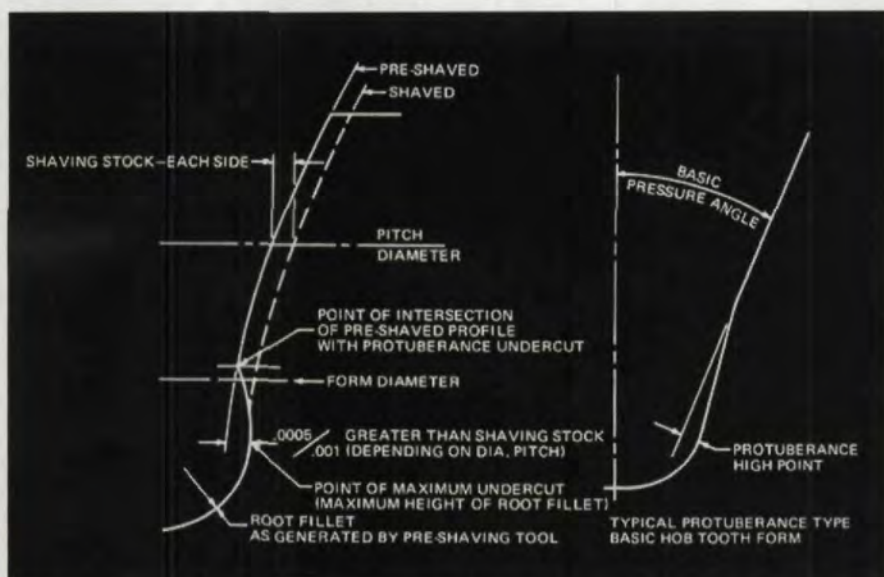


Fig. 4 — Undercut produced by protuberance hob and basic hob tooth form.

TABLE 1 — TYPICAL GEAR BLANK TOLERANCE

Blank Dia. In.	Face Runout In.	Hole Size In.	Hole Tape In./In.	Hole Roundness In.-Max.	O.D. In.-Max.	O.D. Runout In.
Up to 1	0.0003—	0.0003—	0.0002—	0.0002—	0.003	0.003
1-in Thick	0.0005	0.0006	0.0003	0.0003		
1-4, up to 1 in.	0.0004—	0.0005—	0.0002—	0.0003—	0.005	0.005
Thick	0.0008	0.001	0.0003	0.0005		
4 to 8	0.0006— 0.0012	0.0008— 0.0012	0.0002— 0.0003	0.0004— 0.0006	0.005	0.007
8 to 12	0.001— 0.002	0.001— 0.0015	0.0002— 0.0003	0.0005— 0.0007	0.005	0.008

TABLE 2 — RECOMMENDED SHAVING STOCK AND UNDERCUT FOR PRESHAVED GEARS.

Normal Diametral Pitch	Shaving Stock (In. per Side of Tooth)	Total Undercut (In. per Side of Tooth)
2-4	0.0015-0.0020	0.0025-0.0030
5-6	0.0012-0.0018	0.0023-0.0028
7-10	0.0010-0.0015	0.0015-0.0020
11-14	0.0008-0.0013	0.0012-0.0017
16-18	0.0005-0.0010	—
20-48	0.0003-0.0008	—
52-72	0.0001-0.0003	—

Shaving Stock

The amount of stock removed during the shaving process is a key to its successful application. Sufficient stock should be removed to permit correction of errors in the preshaved teeth. However, if too much stock is removed, cutter life and part accuracy are effectively reduced.

Table 2 shows the recommended amounts of stock to be removed during the shaving operations and the corresponding amount of undercut required. ⚙

Acknowledgement: Presented by National Broach & Machine at the Society of Manufacturing Engineers 1st International Advanced Gear Processing & Manufacturing Conference, June, 1996.

The second half of this article, covering shaving methods and design, will appear in our Jan/Feb, 1998, issue.

John P. Dugas

for many years was the Chief Tool Engineer at National Broach & Machine. He is the author of numerous papers and presentations on gear subjects. He is now retired.

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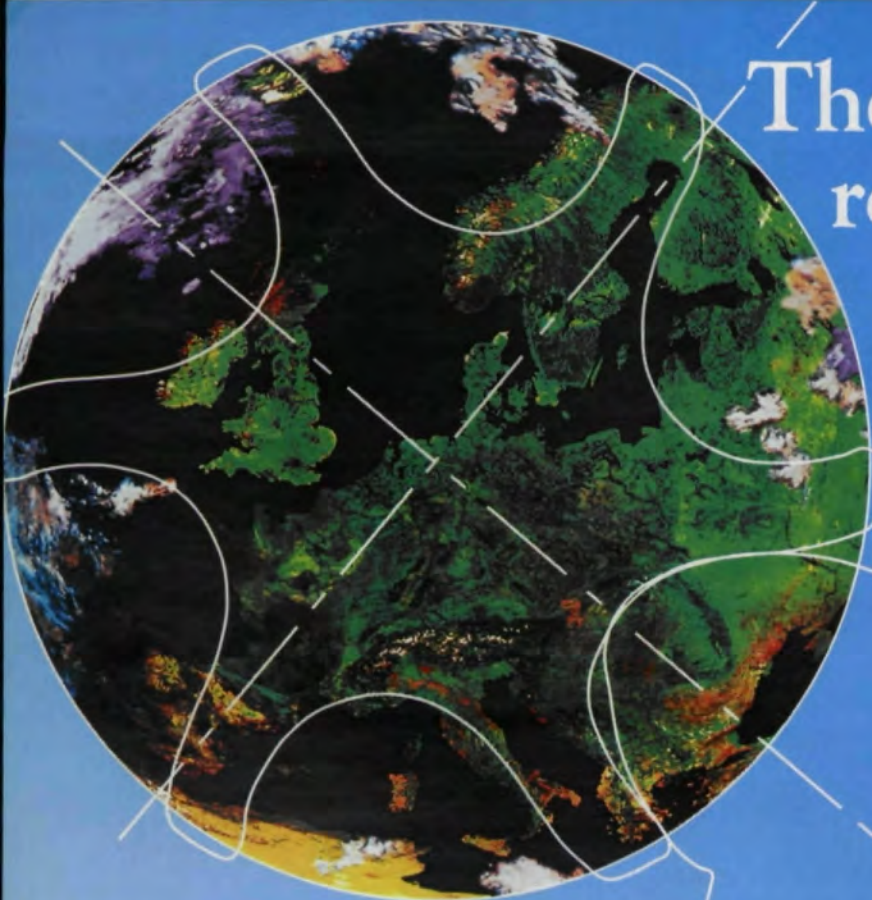
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Intl. Headquarters: Harbour Lane North,
Milnrow, Rochdale OL16 3LQ. England

Telephone: (44) 01706 526590

Telex: 635772 Holryd G Fax: (44) 01706 353350

USA Office: RLH Associates, Inc., P.O. Box 807.3302 Hwy. 74 West Unit C, Monroe, NC 28111

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CIRCLE 121



PRODUCTS & SERVICES INDEX

Welcome to the 1998 *Gear Technology* Buyers Guide Product & Services Index. Use this index to locate the names of companies according to the products and services they provide. The complete mailing address, phone and fax numbers and e-mail and Web site addresses of each company are listed in the Company Index. *Gear Technology* advertisers are shown in boldface type. To find the pages on which their ads appear, see the Advertisers Index on page 68.

While we have made every effort to ensure that company names and addresses are correct, we cannot be held responsible for errors of fact or omission.

If your company is not listed and you would like to be included in next year's directory, e-mail people@geartechnology.com, call 847-437-6604, or fax 847-437-6618, and we will add you to our mailing list.

GEAR & DRIVE MANUFACTURERS

Differentials

Bevel Gears (India)
Engelhardt Gear Co.
Euclid Universal Corp.
Fleet Tools Ltd.
Gajra Gears Ltd.
Grupos Diferenciales
ITW Spiroid
Indiana Power
Transmission Systems
Nissei Corp. of America
Sri Venkateshwara Gear

Gear Boxes, Gear Drives & Speed Reducers

ACR Industries
ATA Gears Inc.
Adobe Precision Gear, Inc.
Advance Gear & Machine
Aero Gear, Inc.
Allied Devices Corp.
Alpha Gear Drive, Inc.
Amarillo Gear Co.-Amarillo
Amarillo Gear
Co.-Russellville
American Metric Corp.
Andantex USA
Anderson International
Aplus Engineering Inc.
Arrow Gear Co.
Ashot Ashkelon Indust.
Ashot USA Inc.
Axicon Technologies
Bevel Gears (India)
Bison Gear & Engineering
Blanchat Machine Co.
Bonfiglioli Riduttori
Bonfiglioli U.K.
Boston Gear
C-B Gear & Machine, Inc.
CMD (UK) Ltd.
Calicut Eng. Works Ltd.
Channel Power
Transmission, Inc.
Charles Bond Co.
Chicago Gear-D. O. James
Ciateq, A. C.
The Cincinnati Gear Co.
Circle Gear & Machine
Columbia Gear Corp.
Cone Drive Operations
Curtis Machine Co. Inc.
Cyclo Transmissions Ltd.
Davall Gear Co. Ltd.
Dayton Gear & Tool
Delroyd Worm Gear
Dynamic Tool Grinding
Electra-Gear
Engelhardt Gear Co.
Engranes Industriales
Rivera
Euclid Universal Corp.

Fairfield Mfg. Co.
Falk Corp.
Fleet Tools Ltd.
Flender Corporation
Flender-Graffenstaden
Foote-Jones/Illinois Gear
GW Plastics
Gajra Gears Ltd.
Gear Products Inc.
Gear Systems Inc.
The Gear Works-Seattle
Gears & Drive Systems
Geartronics Industries
Great Gear Co.
Greenshpon Engineering
Works Ltd.
Grove Gear
Grupos Diferenciales
Hamilton Gear
Harder Precision
Components
Harmonic Drive
Technologies
Harnischfeger
Hico
Horsburgh & Scott
Hub City, Inc.
ITW Spiroid
Indiana Power

Transmission Systems
Indiana Tool/Indiana Gear
Insc Corporation
Labeco
Lufkin Industries Gear
Repair
MO Star Gear & Machine
Maquinaria Ral, S.A.
Merit Gear Corp.
Micron Instrument Corp.
Milwaukee Gear Company
Mitrapak Power
Transmission Products
Moore Gear Mfg. Co.
Moore Machine & Gear
Nanchang Gear Works
Nissei Corp. of America
Nord Gear Corporation
Nuttall Gear Corp.
Ohio Gear
Ontario Drive & Gear
Overton Gear & Tool
PIC Design
Penn Machine Company
Pennsylvania Gear Corp.
Philadelphia Gear
Corp.-King of Prussia
Philadelphia Gear
Corp.-Houston
Power Eng. & Mfg. Ltd.
Precipart Corp.
Precision Gear Inc.
Precision Gears Inc.
The Purdy Corporation
R. Cushman & Associates
Rapid Gear
Reliance Gear Co. Ltd.
Reliance Gear Corp.

Renold Power
Transmission Corp.
Rexnord Corporation
Rj Link International
Rockwell Automation /
Dodge
Ronson Gears Pty. Ltd.
Santasalo Gears Service
Shin Shin Enterprises
Sri Venkateshwara Gear
Sterling Electric
Sumitomo Machinery
Sussex Gear Company
Torque Transmission
Trogetec Inc.
United States Gear
Von Ruden Mfg.
Walter Machine Co., Inc.
Wedin Intl. Inc.
Wes-Tex Gear Inc.
Westech Gear
Westerman Companies
Weyers Bros (FT) Ltd.
Winsmith
ZF Industrial Drives
Zenith Sintered Products
Zero-Max, Inc.

Gear Couplings

Amarillo Gear
Co.-Russellville
Harmonic Drive
Technologies
Lovejoy Inc.
TB Wood's, Inc.

Gear Motors

Bison Gear & Engineering
Bonfiglioli Riduttori
C-B Gear & Machine, Inc.
Channel Power
Transmission, Inc.
Euclid Universal Corp.
Fleet Tools Ltd.
Greenshpon Engineering
Works Ltd.
Groschopp
Grove Gear
Hub City, Inc.
Nissei Corp. of America
Nord Gear Corporation
Ohio Gear
Renold Power
Transmission Corp.
Rexnord Corporation
Ronson Gears Pty. Ltd.
Sri Venkateshwara Gear

Gear Reducers

American Metric Corp.
Andantex USA
Channel Power
Transmission Inc.

Gears-Helical

ACR Industries
Acme Gear Co.

The Adams Company
Adobe Precision Gear, Inc.
Advance Gear & Machine
Aero Gear, Inc.
Aerocom Industries Inc.
Allied Devices Corp.
Allied Gear Co.
Amarillo Gear Co.-Amarillo
Amarillo Gear
Co.-Russellville
American Gear & Eng.
American Mach. & Gear
American Precision Gear
Andantex USA
Aplus Engineering Inc.
Arrow Gear Co.
Ashot Ashkelon Indust.
Ashot USA Inc.
Axicon Technologies
Barit International Corp.
Bengal Industries Inc.
Bevel Gears (India)
Bilgram Gear Co.
Bonfiglioli Riduttori
Bonfiglioli U.K.
Boonville Mining Services
Boston Gear
Bourn & Koch
Boxx Gear Mfg.
Buckeye Gear Co.
Bucyrus International, Inc.
Burgess-Norton Mfg. Co.
C-B Gear & Machine, Inc.
CMD (UK) Ltd.
Calicut Eng. Works Ltd.
Capstan Atlantic
Carbon City Products
Caterpillar Industrial
Products Inc.
Channel Power
Transmission, Inc.
Chardam Gear Co.
Charles Bond Co.
Chicago Gear-D. O. James
Chicago Gear Works
Ciateq, A. C.
The Cincinnati Gear Co.
Circle Gear & Machine
Cloyes Gear & Products
Columbia Gear Co.
Commercial Gear &
Sprocket
Crown Gear B.V.
Curtis Machine Co. Inc.
Dabko Industries Inc.
Davall Gear Co. Ltd.
Dayton Gear & Tool
Dearborn Gear & Tool Co.
E.C. Machining, Inc.
EMCO Gears
Electra-Gear
Electretex Ltd. (India)
Engelhardt Gear Co.
Engranes Industriales
Rivera
Engrecon S.A.

Euclid Universal Corp.
Fairfield Mfg. Co.
Falk Corp.
Federal Gear Corp.
Fleet Tools Ltd.
Flender Corporation
Foote-Jones/Illinois Gear
Forest City Gear Co.
Franke Gear Works Inc.
GW Plastics
Gear Company of America
Gear Products Inc.
Gear Systems Inc.
The Gear Works-Seattle
Gears & Drive Systems
Geartronics Industries
General Gear Corporation
Generated Gear &
Machine
Global Gear
Globe Gear Co.
Great Gear Co.
Greenshpon Engineering
Works Ltd.
HMC
Hamilton Gear
Hanover Gear Mfg. Co.
Harder Precision
Components
Harnischfeger
Hico
Holroyd Machine
Horsburgh & Scott
Hua Yang Machine
Hub City, Inc.
Insc Corporation
Intech Corp.
Invo Spine Inc.
J&E Hofmann Eng.
Jackson Gear Co.
Jade Precision Gear Co.
KA-Wood Gear
Keller Machine Co.
Kreiter Gearteck
Krupp Engineering Inc.
L + H Welding & Machine
Lawler Gear Corp.
Lufkin Industries Gear
Repair
Lyon Gear
M.J.H. Gear & Tool Co.
MO Star Gear & Machine
Maquinaria Ral, S.A.
Mascotech-Braun
Merit Gear Corp.
Micron Instrument Corp.
Midwest Gear
Midwest Gear & Tool
Milford Gear Works
Milwaukee Gear Company
Molon Gear & Shaft
Moore Gear Mfg. Co.
Moore Machine & Gear
Murray Brothers Mfg.
Nanchang Gear Works
National Broach
Niagara Gear Corp.

Nissei Corp. of America
Nixon Gear
Nord Gear Corporation
Nordberg Lokomo OY
Nuttall Gear Corp.
Oliver Gear
Omni Gear & Machine
O'Neill Gear
Ontario Drive & Gear
Overton Gear & Tool
PIC Design
Patterson Gear & Machine
Penn Machine Company
Pennsylvania Gear Corp.
Penntech
Perry Technology
Philadelphia Gear
Corp.-King of Prussia
Philadelphia Gear
Corp.-Houston
Poly Hi Solidur
Power Eng. & Mfg. Ltd.
Precipart Corp.
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Precision Gear Inc.
Precision Gears Inc.
Presrite Corp.
Process Industries
Production Gear & Broach
Progressive Engineering
The Purdy Corporation
Qualicast Corp.
R.L. Wagner & Assoc.
Rapid Gear
Rawling Gear
Reliance Gear Co. Ltd.
Reliance Gear Corp.
Riley Gear Corp.
Riverside Spine & Gear
Rj Link International
Ronson Gears Pty. Ltd.
STD Precision Gear &
Instrument, Inc.
Santasalo Gears Service
Satellite Gear
Schafer Gear Works Inc.
Sri Venkateshwara Gear
Sterling Electric
Stock Drive Prod./Sterling
Instrument
Tech Sales Inc.
Textile Parts & Machine
Tifco Gage & Gear
Trojan Gear Inc.
United States Gear
Von Ruden Mfg.
Walter Machine Co., Inc.
Wedin Intl. Inc.
Wes-Tex Gear Inc.
West Industries Inc.
Westech Gear
Western Spine Gage
Worcester Gear Works
Worrall Grinding Co.
Xtek Inc.
Zenith Sintered Products

Gears-Herringbone

Adobe Precision Gear, Inc.
American Mach. & Gear
Anderson International
Aplus Engineering Inc.
Axicon Technologies
Bilgram Gear Co.
Boonville Mining Services
C-B Gear & Machine, Inc.
CMD (UK) Ltd.
Calicut Eng. Works Ltd.
Chicago Gear-D. O. James
Ciateq, A. C.
The Cincinnati Gear Co.
Circle Gear & Machine
Dayton Gear & Tool
Engelhardt Gear Co.
Engranes Industriales
Rivera
Falk Corp.
Federal Gear Corp.
Foote-Jones/Illinois Gear
The Gear Works-Seattle
Gears & Drive Systems
Globe Gear Co.
Great Gear Co.
HMC
Hamer Gear
Horsburgh & Scott
Intech Corp.
J&E Hofmann Eng.
Kreiter Gearteck
L + H Welding & Machine
Lufkin Industries Gear
Repair
Maquinaria Ral, S.A.
Midwest Gear
Moore Gear Mfg. Co.
Nordberg Lokomo OY
Oliver Gear
Penn Machine Company
Philadelphia Gear
Corp.-Houston
Precision Gear Inc.
Process Industries
Progressive Engineering
Qualicast Corp.
Rapid Gear
Santasalo Gears Service
Shin Shin Enterprises
Wes-Tex Gear Inc.
Westech Gear
Westerman Companies
Xtek Inc.

Gears-Hypoid

ACR Industries
ATA Gears Inc.
Aero Gear, Inc.
Amarillo Gear
Co.-Amarillo
Amarillo Gear
Co.-Russellville
Arrow Gear Co.
Ashot Ashkelon Indust.
Ashot USA Inc.
Astron Midwestern Inc.
Bevel Gears (India)
Bonfiglioli Riduttori
Bonfiglioli U.K.
Caterpillar Industrial
Products Inc.
Channel Power
Transmission, Inc.
Davall Gear Co. Ltd.
Engelhardt Gear Co.
Engrecon S.A.
Fairfield Mfg. Co.

Foote-Jones/Illinois Gear
Globe Gear Co.
Great Gear Corp.
Grupos Diferenciales
Hamilton Gear
Midwest Gear & Tool
Moore Gear Mfg. Co.
Nissei Corp. of America
Ohio Gear
Philadelphia Gear
Corp.-King of Prussia
Precision Gear Co.
Presrite Corp.
Qualicast Corp.
Rawling Gear
Reliance Gear Corp.
Santasalo Gears Service
United States Gear
Wedin Intl. Inc.
West Industries Inc.
Westech Gear

Gears-Internal

ACR Industries
Acme Gear Co.
The Adams Company
Adobe Precision Gear, Inc.
Advance Gear & Machine
Aero Gear, Inc.
Aerocom Industries Inc.
Allied Devices Corp.
Allied Gear Co.
Amarillo Gear
Co.-Russellville
American Gear & Eng.
American Mach. & Gear
American Precision Gear
Aplus Engineering Inc.
Arrow Gear Co.
Axicon Technologies
Bengal Industries Inc.
Bevel Gears (India)
Bilgram Gear Co.
Blanchat Machine Co.
Boston Gear
Boxx Gear Mfg.
Buckeye Gear Co.
CMD (UK) Ltd.
Calicut Eng. Works Ltd.
Carbon City Products
Caterpillar Industrial
Products Inc.
Chardam Gear Co.
Charles Bond Co.
Chicago Gear-D. O. James
Chicago Gear Works
The Cincinnati Gear Co.
Circle Gear & Machine
Cloyes Gear & Products
Columbia Gear Co.
Commercial Gear &
Sprocket
Davall Gear Co. Ltd.
Dayton Gear & Tool
Dynamic Tool Grinding
EMCO Gears
Engelhardt Gear Co.
Engranes Industriales
Rivera
Engrecon S.A.
Fairfield Mfg. Co.
Federal Gear Corp.
Fleet Tools Ltd.
Foote-Jones/Illinois Gear
Forest City Gear Co.
Frank Gear Works Inc.
Gear Company of America
Gear Products Inc.

The Gear Works-Seattle
Geartronics Industries
Generated Gear &
Machine
Globe Gear Co.
Greenshpon Engineering
Works Ltd.
HMC
Hamilton Gear
Hanover Gear Mfg. Co.
Harder Precision
Components
Harnischfeger
Highway Machine Co.
Horsburgh & Scott
Hua Yang Machine
ITW Spiroid
Indiana Tool/Indiana Gear
Intech Corp.
Invo Spline Inc.
J&E Hofmann Eng.
Jackson Gear Co.
Jade Precision Gear Co.
KA-Wood Gear &
Machine
Kreiter Gearteck
Krupp Engineering Inc.
L + H Welding & Machine
Lawler Gear Corp.
Lyon Gear
M.J.H. Gear & Tool Co.
MO Star Gear & Machine
Maquinaria Ral, S.A.
Mascoetech-Braun
Micron Instrument Corp.
Midwest Gear
Midwest Gear & Tool
Milford Gear Works
Milwaukee Gear Company
Modified Gear & Spline
Moore Gear Mfg. Co.
Moore Machine & Gear
Nanchang Gear Works
Nissei Corp. of America
Nixon Gear
Nordberg Lokomo OY
Oliver Gear
Omni Gear & Machine
O'Neill Gear
Ontario Drive & Gear
Orlandi Gear Company
Overton Gear & Tool
Patterson Gear & Machine
Penn Machine Company
Pennsylvania Gear Corp.
Penntech
Perry Technology
Philadelphia Gear
Corp.-Houston
Philadelphia Gear
Corp.-King of Prussia
Power Eng. & Mfg.
Precipart Corp.
Precision Gear Co.
Precision Gear Inc.
Precision Gears Inc.
Process Industries
Production Gear & Broach
Progressive Engineering
The Purdy Corporation
Rapid Gear
Rawling Gear
Reliance Gear Co. Ltd.
Reliance Gear Corp.
Riley Gear Corp.
Riverside Spline & Gear
Rj Link International
Ronson Gears Pty. Ltd.

STD Precision Gear
Santasalo Gears Service
Satellite Gear
Schafer Gear Works Inc.
Shin Shin Enterprises
Sri Venkateshwara Gear
Textile Parts & Machine
Tifco Gage & Gear
Trogetec Inc.
Trojon Gear Inc.
United States Gear
Von Ruden Mfg.
Wedin Intl. Inc.
West Industries Inc.
Westech Gear
Winzeler Gear
Worcester Gear Works
Xtek Inc.

Gears-Master

ACR Industries
Amarillo Gear
Co.-Russellville
American Mach. & Gear
Arrow Gear Co.
Barit International Corp.
Boston Gear
CMD (UK) Ltd.
The Cincinnati Gear Co.
Davall Gear Co. Ltd.
Dayton Gear & Tool
Delroyd Worm Gear
Engelhardt Gear Co.
Engranes Industriales
Rivera
Fairfield Mfg. Co.

Fellows Corp.

Fleet Tools Ltd.
Forest City Gear Co.
The Gear Works-Seattle
Generated Gear &
Machine

Holroyd Machine

ITW Heartland
ITW Spiroid
Invo Spline Inc.

M&M Precision Systems

Mahr Corporation
Modified Gear & Spline
Nanchang Gear Works

National Broach

Nixon Gear
Perry Technology

Philadelphia Gear
Corp.-Houston
Philadelphia Gear
Corp.-King of Prussia

Precision Gage Co.
Precision Gear Inc.

The Purdy Corporation

Russell, Holbrook & Henderson

SRP Tools Ltd.
SU America Inc.
Santasalo Gears Service

Shin Shin Enterprises
Spline Gauges Ltd.

Tifco Gage & Gear
Trogetec Inc.

Westerman Companies
Western Spline Gage

Gears-Miter

Adobe Precision Gear, Inc.
American Gear & Eng.
American Precision Gear
Hub City, Inc.
Santasalo Gears Service

Gears-Non-Circular

Advance Gear & Machine
Bengal Industries Inc.
Bilgram Gear Co.
Calicut Eng. Works Ltd.
Cunningham Industries
GW Plastics
Gear Company of America
Generated Gear &
Machine
Globe Gear Co.
Horsburgh & Scott
J&E Hofmann Eng.
Krupp Engineering Inc.
Merit Gear Corp.
Midwest Gear & Tool
Perry Technology
Precision Gear Inc.
Trogetec Inc.
Wedin Intl. Inc.
Worcester Gear Works

Gears-Planetary

Acme Gear Co.
Adobe Precision Gear, Inc.
Amarillo Gear
Co.-Russellville
American Gear & Eng.
American Precision Gear
CMD (UK) Ltd.
Capitol Stampings Corp.
Greenshpon Engineering
Works Ltd.
Rapid Gear
STD Precision Gear
Santasalo Gears Service

Gears-Plastic

Acme Gear Co.
Allied Devices Corp.
American Gear & Eng.
American Mach. & Gear
American Precision Gear
Andantex USA
Arrow Gear Co.
Bengal Industries Inc.
Bilgram Gear Co.
Boston Gear
Buckeye Gear Co.
Calicut Eng. Works Ltd.
Capitol Stampings Corp.
Chicago Gear-D. O. James
Chicago Gear Works
Commercial Gear &
Sprocket
Dabko Industries Inc.
EMCO Gears
Engranes Industriales
Rivera
Forest City Gear Co.
GW Plastics
Gear Company of America
Gear Systems Inc.
The Gear Works-Seattle
Gears & Drive Systems
Geartronics Industries
Generated Gear &
Machine
Globe Gear Co.

Great Gear Corp.

Intech Corp.
J&E Hofmann Eng.
KA-Wood Gear &
Machine
Keller Machine Co.
M.J.H. Gear & Tool Co.
Martin Sprocket & Gear
Midwest Gear

Midwest Gear & Tool

Moore Gear Mfg. Co.
Moore Machine & Gear
Murray Brothers Mfg.
Omni Gear & Machine
PIC Design
Perry Technology
Philadelphia Gear
Corp.-Houston
Precision Gear Co.
Precision Gears Inc.
Process Industries
Progressive Engineering
Putnam Precision
Molding, Inc.
R.L. Wagner & Assoc.
Rapid Gear
Reliance Gear Corp.
Riley Gear Corp.
Shin Shin Enterprises
Textile Parts & Machine
Tifco Gage & Gear
Trogetec Inc.
Trojon Gear Inc.
Wedin Intl. Inc.
Winzeler Gear
Worcester Gear Works

Gears-Powder Metal

Aplus Engineering Inc.
Asco Sintering Co.
Ashot USA Inc.
BestMetal Corp.
Burgess-Norton Mfg. Co.
Capstan Atlantic
Carbon City Products
Cloyes Gear & Products
Dabko Industries Inc.
The Gear Works-Seattle
Great Gear Corp.
ITW Spiroid
Keystone Powdered Metal
Lyon Gear

M&M Precision Systems

Martin Sprocket & Gear
Metal Powder
Components
Moore Gear Mfg. Co.
Pennsylvania Pressed
Metal Inc.
Precision Gear Co.
St. Marys Carbon Co.

Shin Shin Enterprises

Tifco Gage & Gear
Trogetec Inc.
Zenith Sintered Products

Gears-Racks

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Allied Devices Corp.
American Mach. & Gear
American Metric Corp.
American Precision Gear
Andantex USA
Anderson International
Aplus Engineering Inc.
Asco Sintering Co.
Bevel Gears (India)
Boonville Mining Services
Boston Gear
C-B Gear & Machine, Inc.
Capstan Atlantic
Carbon City Products
Charles Bond Co.
The Cincinnati Gear Co.
Circle Gear & Machine
Commercial Gear &
Sprocket

Cornell Forge Co.
 Dabko Industries Inc.
 Davall Gear Co. Ltd.
 Dayton Gear & Tool
 EMCO Gears
 Engelhardt Gear Co.
 Engranes Industriales
 Rivera
 Federal Gear Corp.
Fellows Corp.
 Fleet Tools Ltd.
 Foote-Jones/Illinois Gear
 Franke Gear Works Inc.
 GW Plastics
 Gear Company of America
 The Gear Works-Seattle
 Gears & Drive Systems
 Geartronic Industries
 Generated Gear &
 Machine
 Globe Gear Co.
 HMC
 Harder Precision
 Components
 Harnischfeger
 Highway Machine Co.
 Hua Yang Machine
 Intech Corp.
 J&E Hofmann Eng.
 Jade Precision Gear Co.
 Keystone Powdered Metal
 Krupp Engineering Inc.
 Lawler Gear Corp.
 MO Star Gear & Machine
 Maquinaria Ral, S.A.
 Martin Sprocket & Gear
 Modified Gear & Spline
 Moore Gear Mfg. Co.
 Moore Machine & Gear
National Broach
 Nixon Gear
 Oliver Gear
 Patterson Gear & Machine
Perry Technology
 Pitch Templates, Inc.
 Ply-Mar Tool Co
 Poly Hi Solidur
 Precipart Corp.
 Progressive Engineering
 Pulley Manufacturers Inc.
 Qualicast Corp.
 Rapid Gear
 Reliance Gear Co. Ltd.
 Riley Gear Corp.
 Riverside Spline & Gear
 Ronson Gears Pty. Ltd.
 STD Precision Gear
 Satellite Gear
Shin Shin Enterprises
 Sri Venkateshwara Gear
 Trogetec Inc.
 Trojon Gear Inc.
 Wedin Intl. Inc.
 Worcester Gear Works
 Xtek Inc.

Gears-Ring

Acme Gear Co.
 Amarillo Gear
 Co.-Russellville
 American Gear & Eng.
 American Precision Gear
 Boonville Mining Services
 C-B Gear & Machine, Inc.
 Circle Gear & Machine
 Davall Gear Co. Ltd.
 Delroyd Worm Gear
 Engelhardt Gear Co.

Hamilton Gear
 Indiana Tool/Indiana Gear
 Inco Corporation
 Jade Precision Gear Co.
 MO Star Gear & Machine
 Nissei Corp. of America
 Overton Gear & Tool
 Production Gear & Broach
 Rapid Gear
 Rawling Gear
 Reliance Gear Co. Ltd.
 Ronson Gears Pty. Ltd.
 STD Precision Gear
 Santasalo Gears Service
 Sri Venkateshwara Gear

Gears-Segment

Acme Gear Co.
 Amarillo Gear
 Co.-Russellville
 American Precision Gear
 C-B Gear & Machine, Inc.
 Circle Gear & Machine
 Davall Gear Co. Ltd.
 Delroyd Worm Gear
 Engelhardt Gear Co.
 Euclid Universal Corp.
 Hamilton Gear
 ITW Spiroid
 Nissei Corp. of America
 Production Gear & Broach
 Rapid Gear
 Rawling Gear
 Ronson Gears Pty. Ltd.
 STD Precision Gear
 Sri Venkateshwara Gear

Gears-Spiral Bevel

ACR Industries
ATA Gears Inc.
 Advance Gear & Machine
 Aero Gear, Inc.
Amarillo Gear
 Co.-Amarillo
 Amarillo Gear
 Co.-Russellville
 Arrow Gear Co.
 Asco Sintering Co.
 Ashot Ashkelon Indust.
 Astron Midwestern Inc.
 Blanchat Machine Co.
 Bonfiglioli Riduttori
 Bonfiglioli U.K.
 Boston Gear
 Bourm & Koch
 Burgess-Norton Mfg. Co.
 CMD (UK) Ltd.
 Carbon City Products
 Caterpillar Industrial
 Products Inc.
 Channel Power
 Transmission, Inc.
 Chicago Gear-D. O. James
 Ciateq, A. C.
 The Cincinnati Gear Co.
 Curtis Machine Co. Inc.
 Davall Gear Co. Ltd.
 Electrex Ltd. (India)
 Engelhardt Gear Co.
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 Micron Instrument Corp.
Midwest Gear & Tool
 Milford Gear Works
 Moore Gear Mfg. Co.
 Nanchang Gear Works
 Nissei Corp. of America
 Ohio Gear
 PIC Design
 Philadelphia Gear
 Corp.—Houston
 Philadelphia Gear
 Corp.—King of Prussia
 Precision Gear Co.
Presrite Corp.
The Purdy Corporation
 Rawling Gear
 Reliance Gear Corp.
 Riverside Spline & Gear
 Santasalo Gears Service
Shin Shin Enterprises
 Tech Sales Inc.
 United States Gear
 Von Ruden Mfg.
 Wedin Intl. Inc.
 West Industries Inc.
 Westech Gear
 Winzeler Gear

Gears-Spur

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 Acme Gear Co.
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 Advance Gear & Machine
 Aero Gear, Inc.
 Aerocom Industries Inc.
 Albro Gear & Instrument
 Allied Devices Corp.
Allied Gear Co.
 Amarillo Gear
 Co.—Russellville
 American Gear & Eng.
 American Mach. & Gear
 American Metric Corp.
 American Precision Gear
 Aplus Engineering Inc.
 Arrow Gear Co.
 Asco Sintering Co.
 Ashot Ashkelon Indust.
 Ashot USA Inc.
 Axicon Technologies
Barit International Corp.
 Bengal Industries Inc.
 Bevel Gears (India)
 Bilgram Gear Co.
 Blanchat Machine Co.
 Bonfiglioli U.K.
 Boonville Mining Services
 Boston Gear
 Bourn & Koch
 Boxx Gear Mfg.
 Buckeye Gear Co.
 Bucyrus International, Inc.
 Burgess-Norton Mfg. Co.
 C-B Gear & Machine, Inc.
 CMD (UK) Ltd.
 Calicut Eng. Works Ltd.
 Capstan Atlantic

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 Products Inc.
 Channel Power
 Transmission, Inc.
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 Charles Bond Co.
 Chicago Gear-D. O. James
 Chicago Gear Works
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 Cloyes Gear & Products
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Crown Gear B.V.
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 Curtis Machine Co. Inc.
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 Dabko Industries Inc.
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 Dearborn Gear & Tool Co.
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 EMCO Gears
 Electrex Ltd. (India)
 Engelhardt Gear Co.
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 Rivera
 Engrecon S.A.
 Euclid Universal Corp.
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 Federal Gear Corp.
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 Gear Systems Inc.
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 Great Lakes Industry, Inc.
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 Hand Screw Machine
 Hanover Gear Mfg. Co.
 Harder Precision
 Components
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 Lufkin Industries Gear
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 Lyon Gear
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 MO Star Gear & Machine
 Maquinaria Ral, S.A.
 Martin Sprocket & Gear
 Merit Gear Corp.
 Micron Instrument Corp.
Midwest Gear
Midwest Gear & Tool
 Milford Gear Works
 Milwaukee Gear Company
 Mobile Pulley & Machine
 Modified Gear & Spline
 Molon Gear & Shaft
 Moore Gear Mfg. Co.
 Moore Machine & Gear
 Murray Brothers Mfg.
 Nanchang Gear Works
Niagara Gear Corp.
 Nissei Corp. of America
 Nixon Gear
 Nordberg Lokomo OY
 Oliver Gear
 Omni Gear & Machine
 O'Neill Gear
Ontario Drive & Gear
 Orlandi Gear Company
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 Patterson Gear & Machine
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 Pennsylvania Gear Corp.
 Pennsylvania Pressed
 Metal Inc.
 Penntech
Perry Technology
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 Philadelphia Gear
 Corp.—King of Prussia
 Poly Hi Solidur
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 Progressive Engineering
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 Molding, Inc.
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 Rawling Gear
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 Reliance Gear Corp.
 Riley Gear Corp.
 Riverside Spline & Gear
 Rj Link International
 Ronson Gears Pty. Ltd.
 Ryle Manufacturing Co.
 STD Precision Gear
 Santasalo Gears Service
 Satellite Gear
 Schafner Gear Works Inc.
Shin Shin Enterprises

Sri Venkateshwara Gear
 St. Marys Carbon Co.
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Western Spline Gear
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Gears-Straight Bevel

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 Aero Gear, Inc.
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Allied Gear Co.
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 American Mach. & Gear
 American Metric Corp.
 American Precision Gear
 Arrow Gear Co.
 Asco Sintering Co.
 Ashot Ashkelon Indust.
 Ashot USA Inc.
 Astron Midwestern Inc.
 Bengal Industries Inc.
 Bevel Gears (India)
 Bilgram Gear Co.
 Bonfiglioli Riduttori
 Bonfiglioli U.K.
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 Burgess-Norton Mfg. Co.
 C-B Gear & Machine, Inc.
 CMD (UK) Ltd.
 Calicut Eng. Works Ltd.
 Carbon City Products
 Caterpillar Industrial
 Products Inc.
 Channel Power
 Transmission, Inc.
 Chardam Gear Co.
 Charles Bond Co.
 Chicago Gear-D. O. James
 Chicago Gear Works
 Ciateq, A. C.
 Circle Gear & Machine
 Commercial Gear &
 Sprocket
 Cornell Forge Co.
 Curtis Machine Co. Inc.
 Dabko Industries Inc.
 Davall Gear Co. Ltd.
 Dayton Gear & Tool
 Engelhardt Gear Co.
 Engranos Industriales
 Rivera
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 Fleet Tools Ltd.
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 The Gear Works-Seattle
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Great Gear Corp.
 Grupos Diferenciales
 Hamilton Gear
 Hua Yang Machine
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 J&E Hofmann Eng.
 Jackson Gear Co.
 Keystone Powdered Metal
 Krupp Engineering Inc.
 Lawler Gear Corp.
 M.J.H. Gear & Tool Co.
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 Martin Sprocket & Gear
 Mascotech-Braun
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 Milford Gear Works
 Mitrpak Power
 Transmission Products
 Moore Gear Mfg. Co.
 Moore Machine & Gear
 Nanchang Gear Works
 Nissei Corp. of America
 Nixon Gear
 Nord Gear Corporation
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 Oliver Gear
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 Reliance Gear Co. Ltd.
 Reliance Gear Corp.
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Shin Shin Enterprises
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Instrument
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 Trogetec
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Gears-Worm

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 Bilgram Gear Co.
 Blanchat Machine Co.
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 Bonfiglioli U.K.
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 Grove Gear
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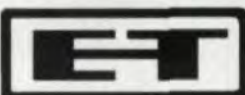
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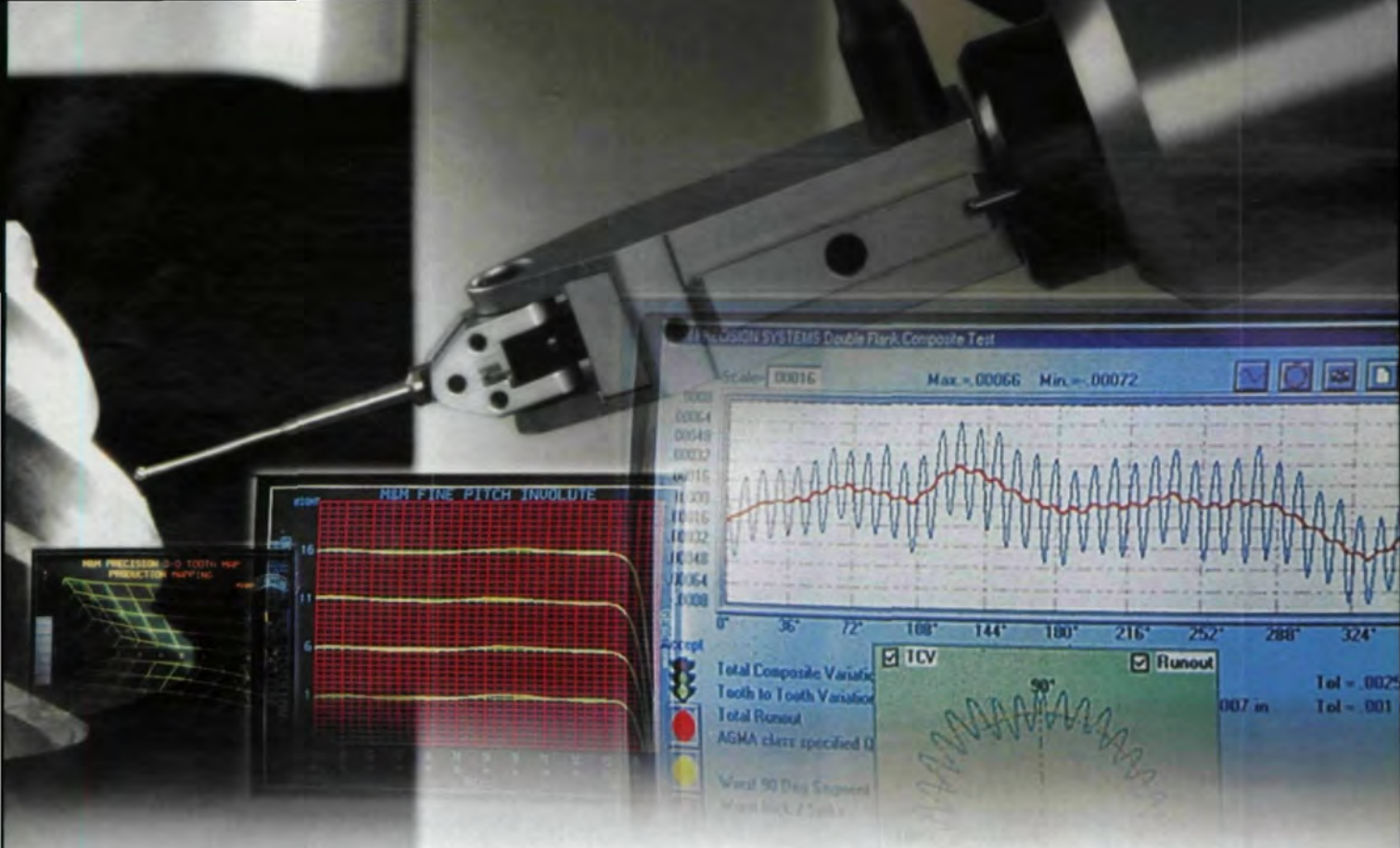
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 Sri Venkateshwara Gear—*Traction Drives*
 Sussex Gear Company—
Linear Actuators
 Trogetec Inc.—*Cycloidal Gears & Harmonic Gearing*
 United States Gear—*Curvic Couplings*
 Wedin Intl. Inc.—*Ground*

Gears to AGMA 14
 Westech Gear—*Specials*
 Wohler Corp.—*Flywheel Starter Ring Gears*
 Worral Grinding Co.—
Film Sprockets
 Zero-Max, Inc.—*Torque Limiters*

GEAR MANUFACTURING MACHINES

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American Broach
 Colonial Tool Group Inc.
 Detroit Broach Co.
 Elmass North America
Fässler
 General Broach & Eng.
 Jack Dustman & Assoc.
 Kingsford Broach & Tool
 Miller Industrial Service
 Mitts & Merrill L.P.
National Broach
 The Ohio Broach & Machine Co.
 Sales Consultants
 Ty Miles Inc.

Chamfering Machines

American Wera Inc.
**Ataka Engineering—
 Basic Incorporated Group**
 Best Engineering Co., Inc.
 Bourm & Koch
Chamfermatic, Inc.
 Eltech Inc.
 GMI
 Jack Dustman & Assoc.
National Broach
 Ravjeet Eng. Specialties
 Redin Corporation
 SU America Inc.
 Schenck Turner
 V & R Associates
 WMW Machinery

Deburring Machines

Basic Incorporated Group
 Best Engineering Co., Inc.
 Burlytic Systems
 Eltech Inc.
 GMI
Holroyd Machine
 Jack Dustman & Assoc.
 Progressive Technologies
 Redin Corporation
 SU America Inc.
 Schenck Turner

EDM Machines

Basic Incorporated Group
 Bluegrass Precision Machinery
 Charmilles Technologies
 Easco-Sparcatron
 Hansvedt Industries Inc.
 KGK International Corp.
 Makino
 Mecatool USA Ltd.
 Okamoto Corp EDM Div.
 Raycon Corporation
 Sales Consultants

Generating Machines

American Pfauter, L.P.
**Ataka Engineering—
 Basic Incorporated Group**

The Gleason Works
 Sigma Pool-Liebherr
 V & R Associates
 WMW Machinery

Grinding Machines

American Broach
American Pfauter, L.P.
Basic Incorporated Group
 Bluegrass Precision Machinery
 Bourm & Koch
 Eltech Inc.
 GTI Technologies Inc.
The Gleason Works
Gleason-Pfauter Maschinenfabrik
 Hermes Machine Tool
 Höfler Maschinenbau
 Hoglund Technology
Holroyd Machine
 Lapmaster Intl.
 Meccanica Nova Corp
 Miller Industrial Service
Mitsubishi Machine Tool National Broach
Normac Inc.
 Okamoto Corp EDM Div.
 Reishauer Corp.
 SU America Inc.
 Sales Consultants
 Sigma Pool-Liebherr
 USACH Technologies
 WMW Machinery

Heat Treating Equipment

Ajax Magnethermic Corp.
 Bluegrass Precision Machinery
 Can-Eng Furnaces Ltd.
 Contour Hardening Inc.
Engineered Heat Treat
 The Grieve Corporation
 Holcroft
 Inductoheat Inc.
 K.H. Huppert Co.
 McEnglewan Industrial Furnace
 Pacific Industrial Furnace
 Pillar Industries
 Quench Press Specialists
Radyne Corporation
Surface Combustion Inc.
 TOCCO Inc.
 Therm Alliance Co.
 Welduction Corporation

Hobbing Machines

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 Bourm & Koch
 Fayscott Co.
The Gleason Works
Gleason-Pfauter Maschinenfabrik
 Hermes Machine Tool
Ikegai America Corp.
Koepfer America L.L.C.
Mitsubishi Machine Tool National Broach
Parker Industries
 Reishauer Corp.
 Sales Consultants
 Sigma Pool-Liebherr
 V & R Associates
 WMW Machinery

Honing Machines

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Basic Incorporated Group
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 Bluegrass Precision Machinery
 Engis Corp.
Fässler
 GMI
The Gleason Works
National Broach
 Reishauer Corp.

Inspection Machines

Alpha Precision Inc.
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Basic Incorporated Group
 Best Engineering Co., Inc.
 Bluegrass Machinery
 Bourm & Koch
D.I.G.I.T.
Dyer Company
 FGT Gage & Systems Inc.
Giddings & Lewis
The Gleason Works
ITW Heartland
 Jack Dustman & Assoc.
 Kokusai Inc.
M&M Precision System
Mahr Corporation
 Manufactured Gear & Gage
 Miller Industrial Service
Moore Products Co.
National Broach
 NewAge Industries Inc.
 Ono Sokki Technology
 Precision Gage Co.
Profile Engineering
 Progressive Technologies
 Reishauer Corp.
 Roto-Technology Inc.
 Sigma Pool-Liebherr
 Spline Gauges Ltd.
United Tool Supply

Keyseating Machines

Basic Incorporated Group
 Colonial Tool Group Inc.
 Elmass North America
 Mitts & Merrill L.P.
 The Ohio Broach & Machine Co.

Lapping Machines

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 Engis Corp.
The Gleason Works
 Lapmaster Intl.
 Sigma Pool-Liebherr

Measuring Machines

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 Best Engineering Co., Inc.
 Bluegrass Precision Machinery
Holroyd Machine
 Krautkramer Branson
Mahr Corporation
 Miller Industrial Service
 Ono Sokki Technology
 Precision Gage Co.
Profile Engineering
 Roto-Technology Inc.

Sigma Pool-Liebherr
 Spline Gauges Ltd.
United Tool Supply

Shaping Machines

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 Bourm & Koch
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Fellows Corp.
The Gleason Works
Gleason-Pfauter Maschinenfabrik
 Hermes Machine Tool
Mitsubishi Machine Tool
Parker Industries Inc.
 Sigma Pool-Liebherr
 WMW Machinery

Shaving Machines

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 Elmass North America
The Gleason Works
Gleason-Pfauter Maschinenfabrik
National Broach

Spline Rolling Machines

Colonial Tool Group Inc.
 General Broach & Eng.
 Micromatic Textron
Mitsubishi Machine Tool
Moore Products Co.
National Broach

Testing Machines

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The Gleason Works
Holroyd Machine
ITW Heartland
 Krautkramer Branson
 Labeco
M&M Precision Systems
Mahr Corporation
 Manufactured Gear & Gage
 NewAge Industries Inc.
 Ono Sokki Technology
Parker Industries Inc.
 Precision Gage Co.
Profile Engineering
 Sigma Pool-Liebherr

Turning Machines

Basic Incorporated Group
 Bluegrass Precision Machinery
 Hermes Machine Tool
 J&E Hofmann Eng.
 Jack Dustman & Assoc.
 Miller Industrial Service
Mitsubishi Machine Tool
 Sales Consultants
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 WMW Machinery

Worm Milling Machines

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Basic Incorporated Group

Eltech Inc.
 GTI Technologies Inc.
Koepfer America L.L.C.
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 WMW Machinery

Other Gear Manufacturing Machines

American Broach—*CNC Broach Sharpeners*
**American Wera Inc.—
 Polygon Cutting (Profiling)**
**Ataka Engineering—
 Cutter Sharpening Machines**
 Cold Forming Technology—*Spline Rolling Automatic Loaders*
**Diamondex—
 Gear Coating Systems**
D.I.G.I.T.—Gear Data Gages
 DoAll—*Sawing Machines & Blades*
**Dyer Company—
 Machine Vision**
 GMI—*Tooth Rounding & Pointing Machines*
 GTI—*Cutter Sharpeners*
**Giddings & Lewis—
 Coordinate Measuring Machines**
**Gleason-Pfauter Maschinenfabrik GmbH—
 Spline Millers & Grinders, Shobbers, Milling Machines**
 Hoglund Technology Corp.—*Computerized Wheel Dressers*
**ITW Heartland—
 Burnishing Machines**
**Ikegai America Corp.—
 Hob Sharpeners**
**Kapp Sales & Service—
 Gear & Form Grinding Machines**
LMT-Fette Inc.—Stow-Rack Millers & Cutters
Mahr Corporation—Hand Held Gear & Spline Inspection Tools
 Manufacturing Technology Inc.—*Friction Welding Machines*
 Mitsubishi Laser—*Laser Cutting Machines*
 NewAge Industries Inc.—
Hardness Testers—Auto Traverse
**Parker Industries, Inc.—
 Cutter Sharpeners**
 Progressive Technologies—
Surface Treatment
 Raycon Corporation—
Laser Welders
 Reishauer Corp.—
Thread and Worm Grinding Machines
**Sytec Corp.—
 End Finishing**

United Tool Supply--Gages
Welduction Corporation--
Induction Heating Equipment

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Elmass North America
The Gear Works--Seattle
Generated Gear & Machine
Globe Gear Co.
Harder Precision Components
Horsburgh & Scott
Howard's Machine Shop
Intech Corp.
L + H Welding & Machine
Lufkin Industries Gear Repair
Milford Gear Works
Mobile Pulley & Machine
Moore Machine & Gear
PIC Design
Penntech

Perry Technology

Portland Forge
Power Eng. & Mfg.
Precipart Corp.
Presrite Corp.
Process Industries
Qualicast Corp.
Rj Link International
Satellite Gear
Schafer Gear Works Inc.
Stock Drive
Products/Sterling Instrument

Trogetec Inc.
Wohlert Corp.
Worrall Grinding Co.

Plastics

Dayton Gear & Tool
The Gear Works--Seattle
Globe Gear Co.
Hochst Celanese Corp.
Howard's Machine Shop
Intech Corp.
Trogetec Inc.

Powdered Metals

Asco Sintering Co.
Burgess-Norton Mfg. Co.
Carbon City Products
The Gear Works--Seattle

Steels

Crucible Service Centers
Dayton Gear & Tool
Disston Precision Inc.
Elmass North America
Forging Specialties
The Gear Works--Seattle
Globe Gear Co.
Impact Strategies Inc.
Latrobe Steel Company
Lovejoy Steel

Company--Charlotte
Lovejoy Steel
Company--Cincinnati
Lovejoy Steel
Company--Streetsboro
Lovejoy Steel
Company--York
Moore Machine & Gear
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Other Materials

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Dura-Bar--Continuous Cast Iron Barstock
Intech Corp.--*Plastic/Metal Composite*
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Carbon City Products
Ciateq, A. C.
The Cincinnati Gear Co.
Contour Hardening Inc.
Dabko Industries Inc.
Dayton Gear & Tool
Drive Systems Technology
Dynamic Metal Treating
Engrenas Industriales

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Fairfield Mfg. Co.
GMI
GW Plastics
Gary P. Mowers, Inc.
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Tecnologia de Engrenagens

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Horsburgh & Scott
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Impact Strategies Inc.
Intech Corp.
J&E Hofmann Eng.
Jack Dustman & Assoc.
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McGinty Gear
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Maquinaria Ral, S.A.
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Milford Gear Works
Moore Machine & Gear
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NCADT

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Packer Engineering
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Powertrain Engineers
Precision Engineering
Precision Gear Inc.

Profile Engineering

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Riley Gear Corp.
SBR Consulting
Sales Consultants
Satellite Gear
Society of Manufacturing Engineers

Software Engineering Service

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Cryogenics

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Ashot Ashkelon Indust.
Ashot USA Inc.
Aston Metallurgical
Ciateq, A.C.
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 Reilly Engineering Inc.
 Surface Technology, Inc.
 Technimet Corp.
 Trogetec Inc.

Universal Technical Systems
 Wes-Tex Gear Inc.
 Westech Gear

Gear Design

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 Advance Gear & Machine
 Aero Gear, Inc.
 Allied Devices Corp.
 Aplus Engineering Inc.
 Applied Mechaniques
 Arrow Gear Co.
 Ashot Ashkelon Indust.
 Ashot USA Inc.

Axicon Technologies
 BestMetal Corp.
 Blanchat Machine Co.
 Boston Gear
 C-Dot Engineering
 CMD (UK) Ltd.
 Carbon City Products
 Caterpillar Industrial Products Inc.
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 Electra-Gear
 Engranes Industriales Rivera
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 Gearesearch Assoc.
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 Milwaukee Gear Company
 Moore Machine & Gear
 NASA Lewis Research O'Neill Gear
Ontario Drive & Gear PC Enterprises
 Packer Engineering
 Pennsylvania Gear Corp.
 Penntech
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 Riley Gear Corp.
 SBR Consulting
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 Sussex Gear Company
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 Wedin Intl. Inc.
 West Industries Inc.
 Westech Gear
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 Xtek Inc.

Drive Systems Technology
 Dynamic Tool Grinding
 EMCO Gears
 Electra-Gear
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 Gear Research Institute
 The Gear Works-Seattle
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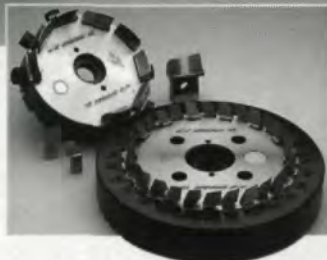
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Ashot Ashkelon Indust.
Ashot USA Inc.
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Blanchat Machine Co.
Boston Gear
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The Cincinnati Gear Co.
Dayton Gear & Tool
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Dyer Company
Engranes Industriales Rivera
Fairfield Mfg. Co.
Federal Gear Corp.
Gear Company of America
The Gear Works-Seattle
Generated Gear & Machine
Hamilton Gear
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Höfler Maschinenbau
Horsburgh & Scott
Inco Corporation
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Kreiter Geartech
Lawler Gear Corp.
Lufkin Industries Gear Repair
Lyon Gear
Meccanica Nova Corp
Merit Gear Corp.
Midwest Gear
Milwaukee Gear Company
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NCADT
National Broach
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Trogetec Inc.
USACH Technologies
Wedin Intl. Inc.
Westech Gear
Xtek Inc.

Heat Treating

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American Metal Treating
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Applied Process Inc.
Arrow Gear Co.
Ashot Ashkelon Indust.
Ashot USA Inc.
Axicon Technologies
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Boston Gear
Caterpillar Industrial Products Inc.
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Shore Metal Technology
Surface Technology, Inc.
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Xtek Inc.

Inspection

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Aerocom Industries Inc.
Allied Devices Corp.
Alpha Precision Inc.
American Stress Technologies
Aplus Engineering Inc.
Ashot Ashkelon Indust.
Ashot USA Inc.
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Giddings & Lewis
Harder Precision Components
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Interstate Tool Corp.
Invo Spline Inc.
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Lyon Gear
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Manufactured Gear & Gage
Merit Gear Corp.
Midwest Gear
Modern Industries Inc.
NCADT
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Qualicast Corp.
Riley Gear Corp.
Riverside Spline & Gear
Roto-Technology Inc.
Satellite Gear
Schafer Gear Works Inc.
Scott Machine Tool Co.
Spline Gauges Ltd.
Tifco Gage & Gear
Trogetec Inc.
Ultron Incorporated
Wedin Intl. Inc.
West Industries Inc.
Westech Gear
Xtek Inc.

Shot Peening

ACR Industries
Ashot Ashkelon Indust.
Ashot USA Inc.
Blanchat Machine Co.
Dayton Gear & Tool
Fairfield Mfg. Co.
Harder Precision
Components
Hydro Honing
Laboratories, Inc.
J&E Hofmann Eng.
Kreiter Geartech
Metal Improvement Co.
NASA Lewis Research
Center
Patterson Gear & Machine
Paulo Products Company—
Memphis
Penntech
Pennsylvania Gear Corp.
Progressive Technologies
U. S. Axle Inc.
West Industries Inc.

Tool Coating

Balzers Tool Coating Inc.
Best Engineering Co., Inc.
Dynamic Metal Treating
Eltech Inc.
Fellows Corp.
General Magnaplate Corp.
The Gleason Works
LMT-Fette Tool
Systems—Brookfield
Multi-Arc Inc.
P. F. Markey Inc.
Pfauter-Maag Cutting
Tools, L.P.
Reid Tool Service Inc.
Richter Precision Inc.
Star Cutter Co.
Surface Technology Corp.

Other Services

ASM International—
Training, Education,
Books
Abrasive Technology Inc.—
Gear Honing
American Brazing—
Brazing

American Broach—
Broach Sharpening
American Metal Treating
—Induction Hardening
American Stress
Technologies—X-Ray
Stress Testing, Non-
destructive Testing
Aston Metallurgical—
Metallurgical/
Mechanical/Chemical
Testing
Bourm & Koch—Hobbing
The Cincinnati Gear Co.—
Gearbox Overhaul &
Field Service
Detroit Flame Hardening—
Flame Hardening
Diamond Black—
Boron Carbide Gear
Coating
Diamonex—Gear Coating
Eltech Inc.—
Hob Sharpening
The Gleason Works—
Tool Sharpening/Tool
Reconditioning
Globe Gear Co.—
Cut Teeth, Reverse
Engineering
Hamer Gear—
Custom Gear
Manufacturing
Horsburgh & Scott—
Gear Drive Rebuilding
(All Manufacturers)
Intech Corp.—
Gear Durability
Calculation
J&E Hofmann Eng.—
On-Site Gear
Installation
James Reid Gear Services—
European Fine Pitch
Machine Specialist
Kolene Corporation—
Molten Salt Bath Heat
Treating
Koro Sharpening
Service—HSS, &
Carbide Hob
Sharpening
McGinty Gear—
Spline Design
Manufacturing Technology—
Friction Weld Gears
Together
Mechanical & Structural
Design & Software—
Gear Failure Analysis
Modern Industries Inc.—
Metallurgical
Evaluation
Moore Products Co.—
Program Management
Gage Systems
NASA Lewis Research
Center— Gear and
Transmission Testing
NCADT—
Conditioned-Based
Maintenance
Nye Lubricants Inc.—
Synthetic Lubricants
for Gears
Packer Engineering—
Failure Analysis &
Testing

Paulo Products Company—
St. Louis—Brazing
Pfauter-Maag Cutting
Tools, L.P.—
Sharpening
Precision Engineering—
Error Analysis of
Backlash—Position
Error for Gears &
Entire System
SIFCO Selective Plating—
Job Shop Plating
Spline Gauges Ltd.—
Plotting & Analysis of
Gear Stresses
Star Cutter Co.—
Hob Sharpening &
Recoating
Surface Technology
Corp.—
Deburring, Gear
Coating
Sussex Gear Company—
Gear Box & Actuator
Design
Tri-Wire, Inc.—
Wire EDM Job Shop
Trogetec Inc.—
Feasibility and/or
conceptual gear
design & mfg.

GEAR SOFTWARE

Custom Software

American Stress
Technologies
Aplus Engineering Inc.
C-Dot Engineering
Ciateq, A.C.
Gearesearch Assoc.
Hoglund Technology
I.S.P.J.A.E.
Koepfer America L.L.C.
Moore Products Co.
Roto-Technology Inc.
Scott Machine Tool Co.
Software Engineering
Service
Trogetec Inc.
Universal Technical
Systems
User Solutions Inc.
Van Gerpen-Reece Eng.

Gear Design Software

AGMA
Bluegrass Precision
Machinery
C-Dot Engineering
Ciateq, A.C.,
Dabko Industries Inc.
Fairfield Mfg. Co.
GW Plastics
Gearesearch Assoc.
Geartech Ltda.—Tecnologia
de Engrenagens
The Gleason Works
I.S.P.J.A.E.
Lemur Enterprises
Mechanical & Structural
Design & Software
NASA Lewis Research
Center
Software Engineering
Service
Stock Drive Prod/Sterling
Instrument

Trogetec Inc.
Universal Technical
Systems
Van Gerpen-Reece Eng.
Inspection Software
Alpha Precision Inc.
American Machinery
Brighton Industries Corp.
GW Plastics
Gearesearch Assoc.
Giddings & Lewis
The Gleason Works
Krautkramer Branson
Lufkin Industries Gear
Repair
M&M Precision Systems
Moore Products Co.
NCADT
Precision Gage Co.
Roto-Technology Inc.
Scott Machine Tool Co.
Sigma Pool-Liebherr
Software Engineering
Service
Trogetec Inc.
Worrall Grinding Co.

Shop Management Software

Best Engineering Co., Inc.
The Gleason Works
JobBoss Software Inc.
Manufacturers Technologies
Power Eng. & Mfg.
Scott Machine Tool Co.
U.S. Tech Corp.
User Solutions Inc.

Other Software

American Gear Mfgs.
Assn.—Gear Rating,
Gear Capacity
American Pfauter, L.P.—
HobTime Software
Bourm & Koch—
Gear Manufacturing
D.I.G.I.T.—
SPC Programs
Drive Systems
Technology—
Software Available
Through Seminars
Euro-Tech Corporation—
Spline Inspection
Software
Extrude Hone—
Surface Finish
Measurement
Software
GB Gear Shop Tools—
Calculations
Gearesearch Assoc.—
Gear Scoring Analysis
Geartech Ltda.—Tecnologia
de Engrenagens—
Mechanical Design
The Gleason Works—
HobTime Software
Hoglund Technology —
Gear Manufacturing
Software License
Krautkramer Branson—
Inspection Data
Management
Meccanic Nova Corp.—
Grinding Machine
Software

Mechanical
& *Structural*
Design & Software
Strength & Fatigue
Analysis Software
NASA Lewis Research
Center—
Bearing/Seal
Normac Inc.—
Form Grinding
Pfauter-Maag Cutting
Tools, L.P.
HobTime
Trogetec Inc.—Shop Floor
Gear Design &
Manufacturing Software
User Solutions Inc.—
Quality
Van Gerpen-Reece Eng.—
Tooling Recycling

GEAR TOOLING & ACCESSORIES

Abrasives

Abrasive Technology Inc.
Best Engineering Co., Inc.
Bluegrass Precision
Machinery
Clipper Diamond Tool Co.
Dianamic Abrasive
Products Inc.
Engis Corp.
Ernst Winter & Son Inc.
Extrude Hone
GMI
Lapmaster Intl.
Meccanica Nova Corp
Meister Grinding Tech.
P. F. Markey Inc.
Redin Corporation
Reishauer Corp.
Rex-Cut Products Inc.
Sidley Diamond Tool Co.
Universal Superabrasives
W. E. Litwin Assoc.

Broaching Tools

American Broach
American Machinery
Apex Broach & Machine
Barit International Corp.
Best Engineering Co., Inc.
Brighton Industries Corp.
Colonial Tool Group Inc.
Detroit Broach Co.
Elmass North America
Fässler
GTI Technologies Inc.
General Broach &
Engineering Co., Inc.
Jack Dustman & Assoc.
Kingsford Broach & Tool
LMT-Fette Tool
Systems—Stow
Miller Industrial Service
National Broach
The Ohio Broach &
Machine Co.
P. F. Markey Inc.
Parker Industries Inc.
Ply-Mar Tool Co
Reid Tool Service Inc.
Ty Miles Inc.

Chamfering Tools

Best Engineering Co., Inc.
Chamfermatic, Inc.

GMI
The Gleason Works
P. F. Markey Inc.
Pfauter-Maag Cutting
Tools, L.P.
Ply-Mar Tool Co
Ravjeet Eng. Specialties
Redin Corporation
Reid Tool Service Inc.
SU America Inc.
Schenck Turner

Deburring Tools

Best Engineering Co., Inc.
Burlytic Systems
Chamfermatic, Inc.
Extrude Hone
The Gleason Works
GMI
JRM International Inc.
Jack Dustman & Assoc.
P. F. Markey Inc.
Pfauter-Maag Cutting
Tools, L.P.
Progressive Technologies
Redin Corporation
Reid Tool Service Inc.
Rex-Cut Products Inc.
SU America Inc.
Schenck Turner

EDM Tooling & Supplies

Bluegrass Precision
Machinery
Charmilles Technologies
Easco-Sparcatron
Extrude Hone
Hangsterfer's Labs
KGK International Corp.
Mecatool USA Ltd.
Perry Technology

Form Grinding Wheels

Abrasive Technology Inc.
Best Engineering Co., Inc.
Bluegrass Precision
Machinery
Brighton Industries Corp.
Clipper Diamond Tool Co.
Dianamic Abrasive
Engis Corp.
Ernst Winter & Son Inc.
The Gleason Works
GMI
Hoglund Technology
Kapp Tech L.P.
Meccanica Nova Corp
Meister Grinding Tech.
P. F. Markey Inc.
Pfauter-Maag Cutting
Tools, L.P.
Sidley Diamond Tool Co.
Star Cutter Co.
Wendt Dunnington

Gages

A/W Systems Company
Automated Precision Inc
Best Engineering Co., Inc.
Colonial Tool Group Inc.
Comtorgage Corp.
D.I.G.I.T.
Dyer Company
Euro-Tech Corporation
Globe Gear Co.
Invo Spline Inc.
JRM International Inc.

M&M Precision Systems
MTI Corporation (Mitutoyo)
Mahr Corporation
Moore Products Co.
P. F. Markey Inc.
Parker Industries Inc.
Perry Technology
Ply-Mar Tool Co
Precision Gage Co.
Reid Tool Service Inc.
Russell, Holbrook & Henderson
Spline Gauges Ltd.
Sytec Corp.
Trogetec Inc.
United Tool Supply
Western Spline Gage

Hobs
Axicon Technologies
Barit International Corp.
Best Engineering Co., Inc.
Chowgule Matrix Hobs
Eltech Inc.
Fellows Corp.
GMI
The Gleason Works
Great Gear Corp.
Interstate Tool Corp.
JRM International Inc.
Koepfer America L.L.C.
Kromhard Twist Drill Co.
LMT-Fette Inc.—Stow
LMT-Fette Tool
Systems—Brookfield
Mitsubishi Machine Tool
National Broach
P. F. Markey Inc.
Parker Industries Inc.
Pfauter-Maag Cutting
Tools, L.P.
Ply-Mar Tool Co
Rebco Industrial Products
Reid Tool Service Inc.
Russell, Holbrook & Henderson
SRP Tools Ltd.
SU America Inc.
Sigma Pool-Liebherr
Star Cutter Co.

Keyseat Cutters
Best Engineering Co., Inc.
Colonial Tool Group Inc.
Elmass North America
LMT-Fette Tool
Systems—Brookfield
Mitts & Merrill L.P.
P. F. Markey Inc.
Reid Tool Service Inc.
Star Cutter Co.
Trogetec Inc.
W. E. Litwin Assoc.

Lapping Compounds
Dianamic Abrasive
Engis Corp.
GTI Technologies Inc.
Hangsterfer's Lab
Lapmaster Intl.
National Broach
P. F. Markey Inc.
Reid Tool Service Inc.
Sidley Diamond Tool Co.

Lubricants/Coolants
Abrasive Technology Inc.
D. A. Stuart Co.

DoAll
Engis Corp.
Etna Products Inc.
Hangsterfer's Labs
Houghton International
Klubber Lubrication
Lapmaster Intl.
Lubriplate
Meccanica Nova Corp
P. F. Markey Inc.
Nye Lubricants, Inc.
Texaco Lubricants Co

Shaper Cutters
American Machinery
Barit International Corp.
Best Engineering Co., Inc.
Chowgule Matrix Hobs
Elmass North America
Eltech Inc.
Fellows Corp.
GMI
The Gleason Works
Interstate Tool Corp.
JRM International Inc.
Koepfer America L.L.C.
Kromhard Twist Drill Co.
Mitsubishi Machine Tool
National Broach
P. F. Markey Inc.
Parker Industries Inc.
Pfauter-Maag Cutting
Tools, L.P.
Ply-Mar Tool Co
Rebco Industrial Products
Reid Tool Service Inc.
Russell, Holbrook & Henderson
SRP Tools Ltd.
SU America Inc.
Sigma Pool-Liebherr
Star Cutter Co.
Tri-Wire, Inc.

Shaver Cutters
American Machinery
Barit International Corp.
Best Engineering Co., Inc.
Eltech Inc.
Fellows Corp.
GMI
The Gleason Works
JRM International Inc.
LMT-Fette Tool Systems—
Brookfield
Micromatic Textron
National Broach
P. F. Markey Inc.
Parker Industries Inc.
Pfauter-Maag Cutting
Tools, L.P.
Ply-Mar Tool Co
Rebco Industrial Products
Reid Tool Service Inc.
SRP Tools Ltd.
SU America Inc.
Star Cutter Co.
Tri-Wire, Inc.

Worm Milling Cutters
Barit International Corp.
Best Engineering Co., Inc.
Chowgule Matrix Hobs
GMI
The Gleason Works
Interstate Tool Corp.
JRM International Inc.
Koepfer America L.L.C.

LMT-Fette Tool
Systems—Brookfield
Pfauter-Maag Cutting
Tools, L.P.
Ply-Mar Tool Co
Rebco Industrial Products
Reid Tool Service Inc.
Russell, Holbrook & Henderson
Star Cutter Co.

Other Tooling & Accessories
A/W Systems Company—
Spiral Gear Cutters
Bates Technologies Inc.—
Honing Tools
Best Engineering Co., Inc.—
Maag Type Rack Cutters
Cold Forming Technology—
Spline Rolling Tools
D.I.G.I.T.—
Variable Force Plastic Gear Data Gages
Fässler—Diamond Wheels, Honing Stones
GMI—*Diamond Dressing Tools*
General Broach & Engineering Co., Inc.—
Gear Rolling Tools
The Gleason Works—
Bevel Gear Cutters, Milling Cutters, Band Saw Cutters
Hermes Machine Tool—
Tooling Packages for Specific Machine Tool Purchase

ITW Heartland—
Burnishing Dies
Interstate Tool Corp.—
Rotary Gear Cutters, Maag Cutters
JRM International Inc.—
Hydroloc Clamping
Kapp Tech L.P.—
CBN Gear & Form Grinding Wheels
Koolant Coolers Inc.—
Industrial Liquid Coolers
Manufacturers Technologies Inc.—
Cost Estimating & Process Planning
Mastertech Diamond Products—
CBN Inserts
Mayfran International—
Filtration Equipment, Conveyors, Chip Processing Equipment
Meccanica Nova Corp—
In-/Post-Process Machine Gages
Micromatic Textron—
Spline Rolling Tools
Multi-Arc Inc.—
Coating Services
Oberlin Filter Co.—
Coolant Filtration Equipment

Parker Industries, Inc.—
Cutting Tools for Bevel & Spiral Bevel Gears
Pfauter-Maag Cutting
Tools, L.P.—*Milling Cut-*



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CIRCLE 122

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*Pitch Template
Inspection Racks*
Portland Forge—*Forgings*
Reishauer Corp.—*Diamond
Dressing Rolls*
SIFCO Selective Plating—
*Brush Plating
Equipment &
Solutions*
S.L. Munson—
*Diamond Gear
Dresser*
SRP Tools Ltd.—*Rotary
Coniflex Cutters*
Sensor Products, Inc.—
*Film used to detect
pressure distribution
and magnitude for
measuring gear tooth
contact.*
Sidley Diamond Tool Co.—
*Diamond Dressing
Tools, Rolls, CBN
Plated Wheels*
Spline Gauges Ltd.—
*Powder Metal Gear &
Spline Form Tool Sets*
Star Cutter Co.—
Thin Coatings
Wendt Dunnington—
*Diamond Dressing
Rollers, Dressing
Equipment*

GEAR WORKHOLDING & FIXTURING

Arbors

Alpha Precision Inc.
American Pfauter, L.P.
Best Engineering Co., Inc.
Bluegrass Precision
Machinery
Boum & Koch
Emuge Corp.
Euro-Tech Corporation
Fellows Corp.
The Gear Works—Seattle
The Gleason Works
Harder Precision
Components
Hermes Machine Tool
Invo Spline Inc.
JRM International Inc.
Jack Dustman & Assoc.
Koepfer America L.L.C.
LeCount Inc.
M&M Precision Systems
Mahr Corporation
Manufactured Gear &
Gage
Maquinaria Ral, S.A.
National Broach
P. F. Markey Inc.
Parker Industries Inc.
Profile Engineering
Reid Tool Service Inc.
Reishauer Corp.
Schunk Inc.
Spline Gauges Ltd.
Tifco Gage & Gear
Toolink Engineering
W. E. Litwin Assoc.
Western Spline Gages

Chucks

Alpha Precision Inc.
American Pfauter, L.P.
Best Engineering Co., Inc.
Bluegrass Precision
Machinery
Brighton Industries Corp.
Emuge Corp.
Euro-Tech Corporation
The Gleason Works
Harder Precision
Components
Hermes Machine Tool
Invo Spline Inc.
Jack Dustman & Assoc.
Manufactured Gear &
Gage
P. F. Markey Inc.
Reid Tool Service Inc.
Schunk Inc.
Star Cutter Co.
Tifco Gage & Gear
Toolink Engineering
Trogetec Inc.
W. E. Litwin Assoc.

Modular Fixtures

Alpha Precision Inc.
Best Engineering Co., Inc.
Bluco Corp.
Bluegrass Precision
Machinery
Emuge Corp.
Hermes Machine Tool
JRM International Inc.
Jack Dustman & Assoc.
Koepfer America L.L.C.
Meccanica Nova Corp
Moore Products Co.
P. F. Markey Inc.
Paul W. Marino Gages Inc.
Scott Machine Tool Co.
Sigma Pool-Liebherr
Sytec Corp.
Trogetec Inc.
W. E. Litwin Assoc.

Toolholders

Alpha Precision Inc.
Best Engineering Co., Inc.
Bluegrass Precision
Machinery Brighton
Industries Corp.
Elmass North America
Emuge Corp.
Euro-Tech Corporation
General Broach & Eng.
Hermes Machine Tool
Interstate Tool Corp.
JRM International Inc.
Jack Dustman & Assoc.
Mahr Corporation
P. F. Markey Inc.
Miller Industrial Services
Reid Tool Service Inc.
SU America Inc.
Schunk Inc.
Toolink Engineering
Trogetec Inc.
W. E. Litwin Assoc.

Other Fixturing & Workholding

A/W Systems Company—
*Cutter Bodies for
Spiral Gears*
Apex Broach & Machine
Broach Holders/Fixtures

Bluco Corp.—*Expanding
Mandrels For Broaches*
Detroit Broach Co.—
*Workholders for
Broaches*
**Euro-Tech Corporation—
Compensating
Washers for Hobs
Meccanica Nova Corp—
*Custom Grinding
Fixturing &
Workholding*
**Schunk Inc.—
Hydraulic Tool
Holders
**Sytec Corp.—
Pitch Line Workhold-
ing Roller Cages
Trogetec Inc.—
*Single & Double
Eccentrics*******

MACHINERY/EQUIP- MENT DISTRIBUTORS

American Machinery—
*Fellows, Apex Broach,
Höfler, Star*
**American Wera Inc.—
Wera Werk, Hurth
Modul, Samag
Ashot USA Inc.—
*Ashot Ashkelon
Industries*
**Ataka Engineering—
Saikuni Mfg. Co., Ltd.**
Best Engineering Co., Inc.—
ITW Heartland
Bluegrass Precision
Machinery—
Mitsubishi
Brighton Industries Corp.—
Normac Inc.
Commercial Gear &
Sprocket—
U.S. Tsubaki
Eltech Inc.—
*Kapp, Niles, SU
America, MGF
GmbH*
**Euro-Tech Corporation—
Frenco, Mytec**
Geartech Ltda. -
*Tecnologia de
Engrenagens—
Hexagon Software*
Harder Precision
Components—
H.P.C. Components
J&E Hofmann Eng.—
Klüber Gear Lubricants
**JRM International Inc.—
Kesel, Saazor,
Schrem**
Meccanica Nova Corp—
Meccanica Nova S.P.A.
Miller Industrial Service—
Tornos Technologies,
National Metrology—
Metronics
Ohio Broach & Machine—
*Tesa Measurement
Systems, UVA
Machine Co.*
**Ontario Drive & Gear—
KTR**
Paul W. Marino Gages
Inc.—*Alufix, Koba-Stet***

Precision Gage Co.—
Vari-Roll gear testers
Reid Tool Service Inc.—
Fellows Corp.
Sigma Pool-Liebherr—
*Liebherr, Lorenz,
Oerlikon, Klingenberg*
Spline Gauges Ltd.—
*M & M Precision
Systems, Inc.*
Tech Sales Inc.—
Arrow Gear Co.
Toolink Engineering—
König-MTM GmbH
V & R Associates—
Laschet & Partner
W. E. Litwin Assoc.—
*Speedgrip Chuck
Professional Tool
Grinding*

TRAINING & EDUCATION

Colleges/Universities

I.S.P.J.A.E.
Mississippi State Univ.
NCADT

Gear Schools

AGMA
American Pfauter, L.P.
Aplus Engineering Inc.
Best Engineering Co., Inc.
Boston Gear
Drive Systems Technology
Educational Systems
Workshops

Euro-Tech Corporation

The Gleason Works
Hane Industrial Training
Hy-Mech Systems Inc.
I.S.P.J.A.E.

Koepfer America L.L.C.
Lufkin Industries Gear
Repair

M & M Precision Systems
Manufacturers

Technologies Inc.

National Broach

**Pfauter-Maag Cutting
Tools, L.P.**

Philadelphia Gear Corp.

Roto-Technology Inc.

Salem Company

Van Gerpen-Reece Eng.

Xtek Inc.

Research Institutions

Ciateq, A.C.
Gear Research Institute
Gearesearch Assoc.
I.S.P.J.A.E.
Mississippi State Univ.
NASA Lewis Research
Center
NCADT

Trade Associations

ASM International
American Gear Mfgs.
Association
Metal Powder Industries
Federation
Society of Manufacturing
Engineers

COMPANY INDEX

Welcome to the 1998 *Gear Technology* Buyers Guide Company Index. Use this index to locate contact information for each company listed in the Product & Services Index. *Gear Technology* advertisers are shown in boldface type. To find the pages on which their ads appear, see the Advertisers Index on page 68.

While we have made every effort to ensure that company names and addresses

are correct, we cannot be held responsible for errors of fact or omission.

If your company is not listed and you would like to be included in next year's directory, e-mail people@geartechnology.com, call 847-437-6604, or fax 847-437-6618 and we will add you to our mailing list.

A

ACR Industries, Inc.
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Macomb MI 48042
Ph: 810-781-2800
Fax: 810-781-0152

ASM International
Materials Information
Materials Park OH 44073
Ph: 216-338-5151
Fax: 216-338-4634
mem-serv@po.asm-intl.org

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River Square Plaza
19645 Detroit Rd.
Rocky River OH 44116
Ph: 216-356-0284
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Fax: 248-544-3922

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8400 Green Meadows Dr.
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Fax: 614-548-7617

Accurate Specialties Inc.
N12 W24360 Bluemound Rd.
Waukesha WI 53188
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Fax: 414-547-5892

Acme Gear Co., Inc.
130 W. Forest Avenue
Englewood NJ 07631
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Fax: 201-568-0282
info@acmegear.com
www.acmegear.com

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Dubuque IA 52001
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Fax: 319-583-8048

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211 W. Wood
P.O. Box 520
Carlsbad NM 88220
Ph: 505-885-8322
Fax: 505-885-1568
adobe@caverns.com
www.gears.com

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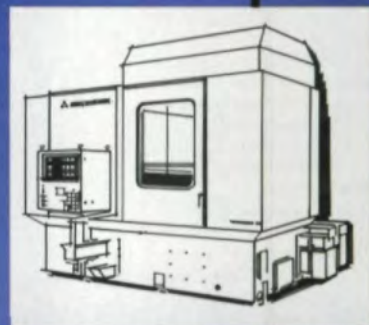
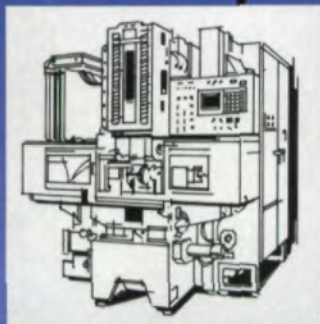
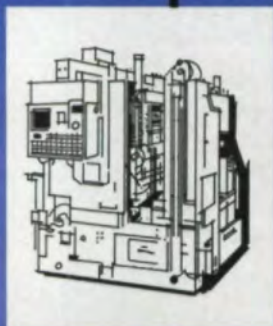
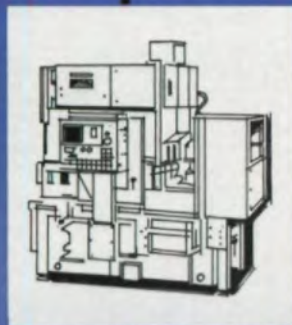
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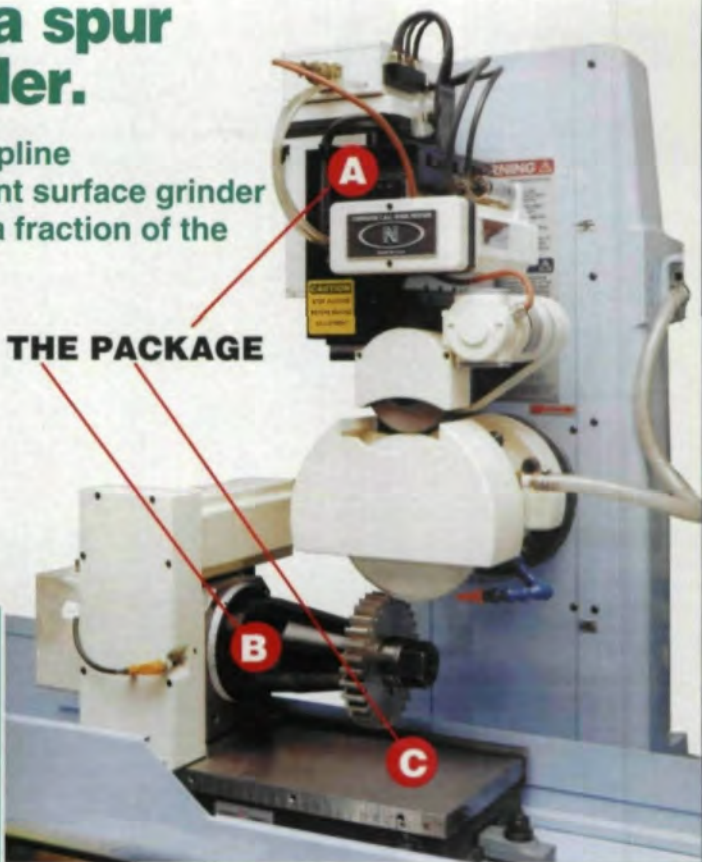
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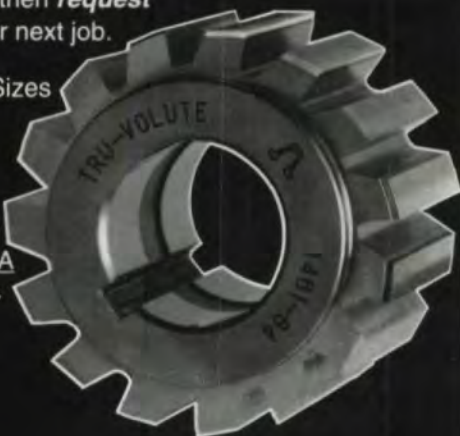


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Guide for Gear Giving

Gear Technology's bimonthly aberration — gear trivia, humor, weirdness and oddments for the edification and amusement of our readers. Contributions are welcome.

The Addendum team hates to admit it, but we're coming up hard on the holiday season again, and that means straining the old brain cells to come up with a good gift list. Once you've taken Aunt Maude's fruit cake brick out of the freezer to recycle it to the least-favorite person on your list, things start to get tricky. Then there's the concern that you're going to end up getting yet another ugly sweater, body-of-steel home exercise gadget (special TV offer; three payments of \$29.95; no CODs, please) or commemorative Elvis plate.

But never fear. As a public service, the Addendum Shopping Team has been scouring the landscape for the season's "must-have" items for gear giving and receiving. Put these items on your list, or circle your favorites and leave the column where your own personal Santa will find it.

For the serious-minded among you (and who's not serious about gears, besides the Addendum Team, that is?), there's the *Maag Gear Book*. This staple of the gear engineering library is in print and available from Global Engineering Documents for \$95.00. (Call 800-854-7179.) If that's not serious enough for you, remember that major technical

societies like AGMA, SME and ASM have big catalogs of all sorts of engineering books, CD-ROMs and software. ASM is offering four volumes of its massive metals *Handbook*® on CD for \$443.00. The entire twenty volumes will be available by December of next year.

For a bit less strenuous reading, our book review editor recommends a little gem called *Longitude* by Dava Sobel (Walker & Company, New York). This is the true story of John Harrison, the self-taught carpenter, clock-maker, mechanic and engineer who solved the problem of calculating longitude, one that had stumped such luminaries as Galileo, Edmund Halley, Christiaan Huygens and Robert Hooke. The crux of the problem is that to calculate longitude, you need to be able to tell time precisely in two places at once, no mean feat in a time before electronic communications and satellites. The story is not just one of engineering ingenuity, but politics, professional jealousy, idealism, class struggle and lots of money.

If your tastes run to the more unusual (like the Addendum staff's), you will want to check out the catalog from American Science & Surplus (847-982-0870 or www.sciplus.com). Here you can order everything from a tabletop-sized dry pellet steam plant to a "talking duck faucet," which apparently is just what it sounds like, an animal-shaped plastic spout to be attached to your regular faucet to make "more or less appropriate" animal sounds when the water flows through. Other must-have items include neon-colored sand paper, make-your-own slime & ooze kits, small motors and gearboxes, French Foreign Legion uniform buttons, army-green "pocket spittoons" and your very own Archimedes pump (for pumping up dead Greek scientists?). Many items are sold in quantity and are remarkably



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