TELEDYNE REPORT

For the Year 1973

High-Speed Steels: Cutting Edge for Modern Industry

ON THE COVER:

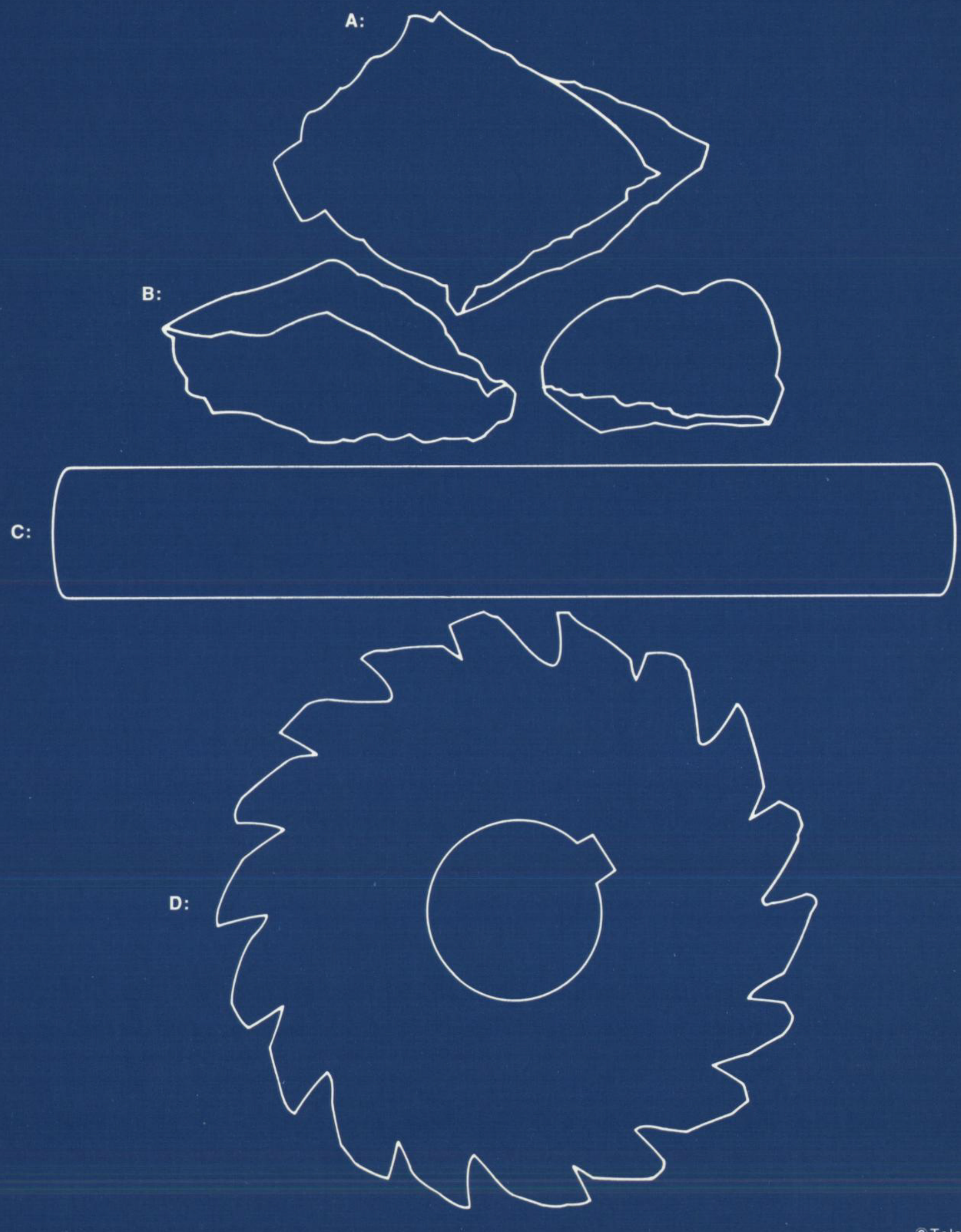
The composition of high speed steel and its use is symbolized on the cover of this report. Shown are:

A: Wolframite ore, an important source of tungsten metal, one of the most important ingredients in high speed steels.

B: Two fragments of ferromolybdenum, a semi-refined form of molybdenum metal, also widely used in high speed steels.

C: A short sample section of centerless-ground high speed steel bar manufactured by Teledyne Vasco.

D: A heavy duty industrial milling cutter made of a Teledyne Vasco high speed steel.



HIGH SPEED TOOL STEELS

These precision, premium-priced alloys are vital to the production of virtually every commodity we use in modern life.

A steel company executive once characterized high speed tool steels as the filet mignon of the steel industry. The aptness of this phrase becomes apparent when you compare the prices of various kinds of steels.

Low-carbon "tonnage" steels—the kind that go into automobiles, appliances, buildings and most other common steel products—sell for $150 to $500 a ton.

Tool steels, which range from garden variety low alloy tool steels, through high alloy steels, to the top of the line high speed steels, can cost from $1,500 to $16,000 a ton. As might be expected, however, tool steels are rarely sold by the ton. A pound is the usual unit of pricing and can cost from $.75 to $8.00.

As the generic name "tool steel" implies, this broad class of steels is primarily used as the raw material for tools that cut, saw, shear, drill, bore, ream, mill, broach, stamp, forge, and otherwise form metals and other materials of all types.

Because tool steels are required to cut and shape other materials, they must be hard, tough and wear-resistant. In many cases, they must be able to withstand high heat without losing those qualities.

Kinds of Tool Steels

The individual properties of tool steels assume varying importance in different applications. Metallurgists have worked for years developing formulas for combinations of elements that provide desired properties for specific uses.

Consequently, there are hundreds of different tool steel alloys in common use today, each differing from the others in chemical composition, physical properties, applications, and manufacturing costs.

High speed steels are the top of the tool steel family. They get their name from the fact that drills, lathe bits and many other tools made of these alloys can be used to cut metals at high rates of speed.

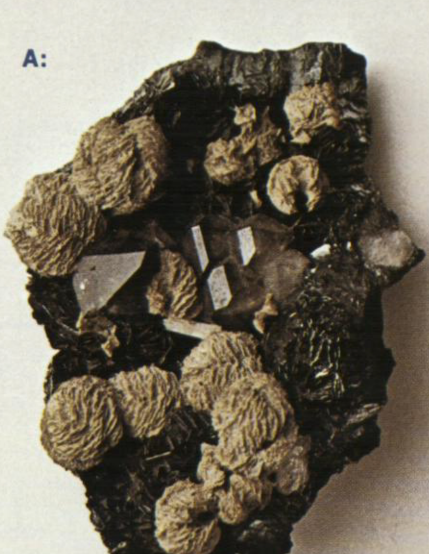
At high cutting speeds, more heat is generated by cutting friction. Thus, high speed steels must be able to maintain their strength and hardness at high temperatures. Tools made of these alloys are often operated at red heat for prolonged periods of time. Lesser alloys would fail quickly in this type of heavy-duty industrial service.

The Development of High Speed Steels

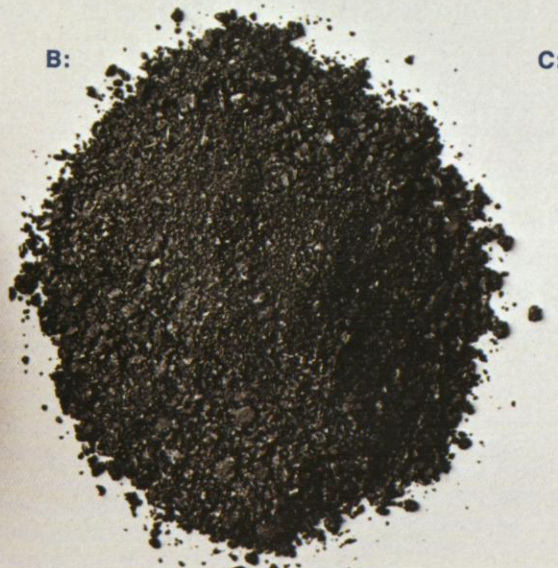
All steels are alloys of iron and carbon. Small amounts of carbon dissolved in molten iron give the resulting metal greater strength and permit it to be hardened by heating it—usually to a red heat—and then cooling it abruptly in water or other liquid. More than about one percent carbon, however, makes the steel too brittle for most uses.

In the late 1800's, attempts were made to improve the properties of carbon steel by adding various other metallic and non-metallic alloying

A:



B:



C:

A: Hematite, an important iron ore.

B: Carbon, a necessary ingredient of all steels.

C: Wolframite ore, source of tungsten metal.

elements. The first major discovery was that tungsten greatly increased the hardness of steel by forming tungsten carbides, produced finer grained steel, and gave it great stability at high temperatures. This last property has made tungsten the most important ingredient in one of the two major classes of high speed steels. (Shortages of tungsten during World War II led to the development of molybdenum-based high speed steels, which form the second major class.)

By the turn of the century, a variety of other elements had been tried in steel, including manganese, nickel, chromium, cobalt and silicon.

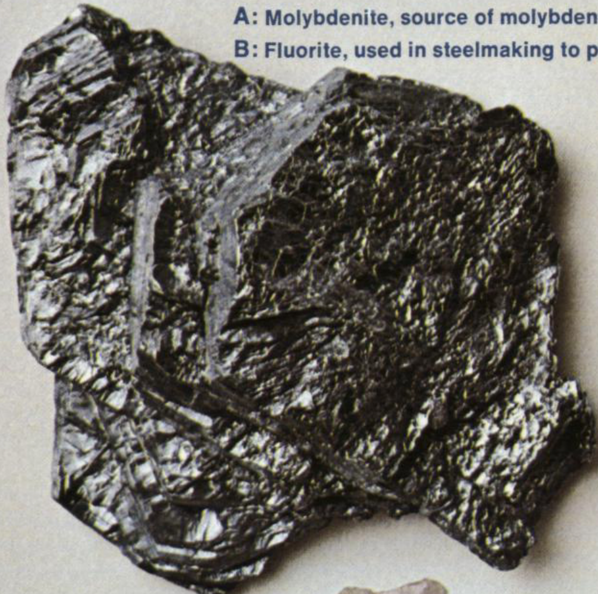
About 1900, one of the last of the metals tried in steel was the newly-discovered element vanadium. It was found that small amounts of this costly metal—as little as one-tenth of a percent—made dramatic improvements in the properties of steel, refining its grain, making it tougher, and enhancing the beneficial effect of other elements such as chromium. By 1910 it was common to add two-tenths of a percent vanadium to high speed steels.

In 1910 the Vanadium Alloys Steel Company was founded to capitalize upon the discovery that an increased vanadium content of up to one percent was of great value in improving the cutting efficiency of high speed steels. This company later became Teledyne Vasco.

The first fifty years of this cen-

A: Molybdenite, source of molybdenum metal.
B: Fluorite, used in steelmaking to produce slag.

A:



B:

tury were years of extremely active exploration of the metallurgy of special steels. Vasco played a very important part in this research and achieved a world-wide reputation as a leader in the field.

Vasco was the first specialty steel company to establish a metallurgical laboratory for the research and development of alloys, and through this work developed many proprietary families of steels that have become the staples of the high speed and specialty steel field.

To meet wartime alloy shortages, for example, Vasco developed Vasco M-2, an improved molybdenum grade high speed steel that today ranks as one of the most popular high speed steels on the market. It contains about six percent tungsten, five percent molybdenum and two percent vanadium.

Just prior to World War II, Vasco metallurgists discovered that as much as four percent vanadium was beneficial to high speed steel if the carbon content was simultaneously raised to about one and a quarter percent. Carbon and vanadium form vanadium carbide, one of the hardest substances known. This compound, finely distributed throughout Vasco's various proprietary high speed steels gives them exceptional qualities of wear resistance and hardness.

This four percent vanadium, high-carbon alloy, put on the market under the trade name Neatro, was the

C: Ferrovanadium.
D: Three fragments of ferromolybdenum.
E: Ferrotungsten.
All are semi-refined forms of these metals used in high speed steel production.

first super high speed steel, and is still widely used.

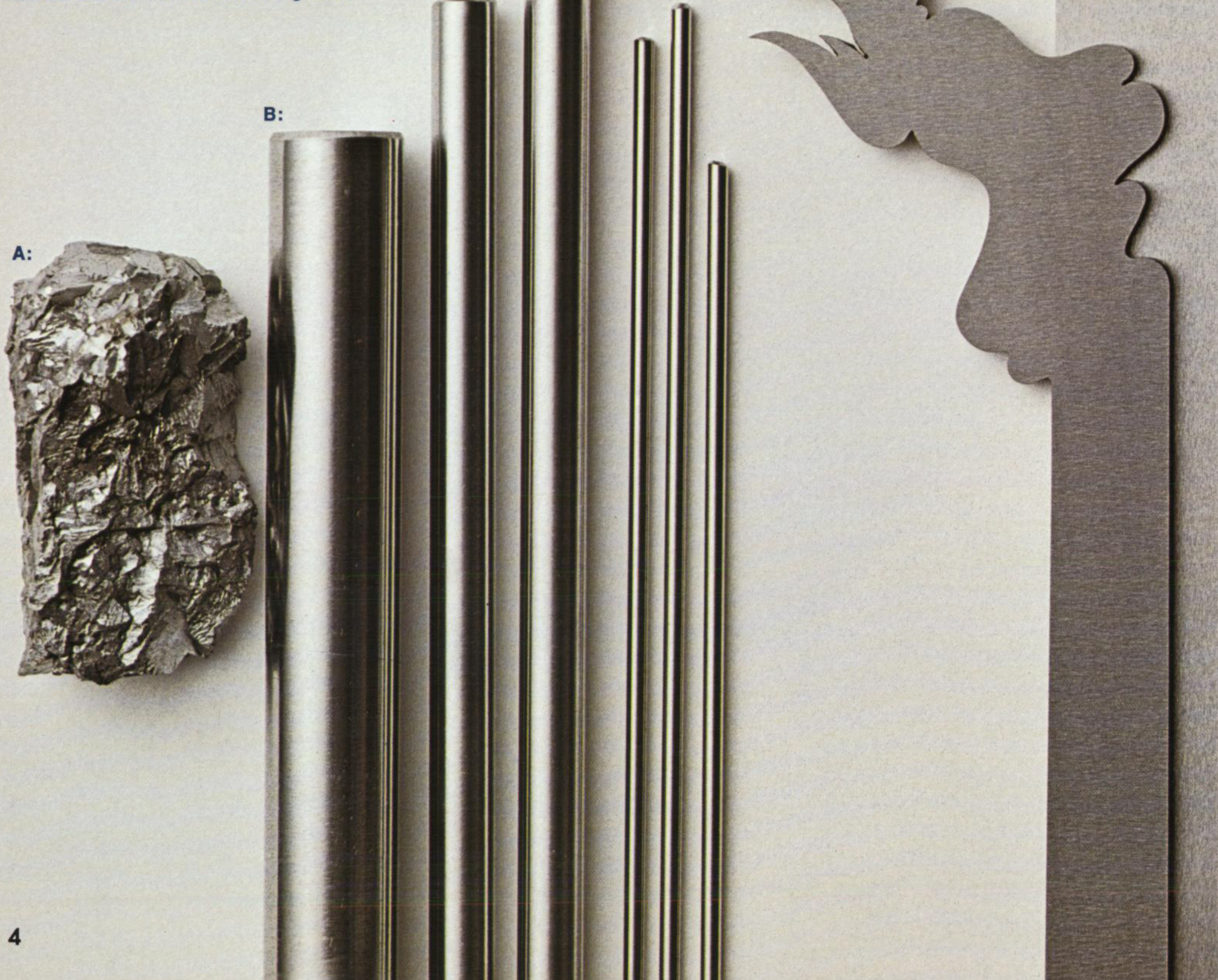
Just after World War II, a further improvement in high speed steel performance was made with the introduction of Vasco Supreme, a five percent vanadium, one and a half percent carbon super high speed steel.

The aforementioned are just a few of the dozens of high speed and specialty steels developed by Vasco. The company can literally be said to have written the book on tool steels. Teledyne's president, George A. Roberts, who was formerly chief metallurgist of Vasco, and later its president, co-authored the book *Tool Steels*, which is still regarded today as the basic authority in this field.

The High Speed Steel Industry

The high speed steel industry is a narrow specialization within an already specialized area of the general steel industry. The specialization is so extreme that the high speed steel segment bears little resemblance to the steel industry as a whole.

To put this into perspective, consider the following: Total annual production of the U.S. steel industry in recent years has been about 100,000,000 tons. Of this, specialty steels accounted for about 1,000,000 tons, or roughly one percent of the total. Tool steels accounted for about 1/10th of that or 100,000 tons. And finally, within that last category, high speed steels accounted for about 25,000 tons of production.



A: Ferrochromium, another widely used alloying material in high speed steels.
B: Samples of centerless ground high speed steel bar and drill rod used in making tools.

This difference in scale is one of the main characteristics of the high speed steel industry. While tonnage steel can be produced in batches of 200 tons at a time, high speed steels are made in quantities as low as several hundred pounds, and rarely in batches of more than 15 tons.

The technical nature of the product is another major difference. High speed steels are precision alloys, produced with careful metallurgical control, with tight limitations on the type and amount of impurities, and requiring unusual care in processing, finishing and heat treating.

Consequently, a great deal more metallurgical research, as well as manufacturing and quality control, is required to produce a small batch of high speed steel, than is required to produce very large batches of common tonnage steels.

Producing high speed steels also requires a great deal of skill, craftsmanship and seasoned judgment on the part of the men who melt, hot work and finish the product.

Because of the amount of operator judgment and control required in making high speed steels, the process does not lend itself easily to automation. This fact further differentiates high speed steel production from the general steel industry.

The Market for High Speed Steels

High speed steels are used primarily for cutting tool applications where the ultimate in hardness at

C: Cut off samples of high speed steel bar showing various shapes produced.
D: Industrial end mill made of high speed steel.
E: Small and large high speed steel lathe cutting bits.

high temperatures, toughness and wear-resistance are required. This makes metalworking industries the prime customers for these alloys. Lathe bits, drills, milling cutters, taps, dies and other cutting tools made of high speed steel are used in large quantities to manufacture virtually every metal product.

The market for these products is self-renewing because tooling of this type is a consumable product. Some cutting tools can be resharpened a number of times but eventually they must be replaced. Obsolescence of tooling because of model changes is another stimulus to high speed steel consumption.

Consumption of high speed steels in the U.S. has been in the range of 22 to 35,000 tons per year. The steel industry as a whole has shown an average growth of about 2 percent per year, but year to year fluctuations of as much as 40 percent have been known in the high speed steel area due to changes in demand by the metalworking industries.

The late 1960's and the first years of the 70's were depressed years as far as consumption of high speed steels was concerned, due to declines in the aerospace and other industries. During this same period, imports of low-priced foreign-made high speed and other specialty steels increased drastically, causing a severe decline in the domestic production of these alloys.

In 1964, imports accounted for

A: High speed steel milling cutter.
B: Industrial reamer.
C: Assorted high speed steel drills.

about 10 percent of total apparent consumption of high speed steel in the U. S. By 1970 they had reached a peak of 23 percent of the total. In 1969, certain countries entered into voluntary trade restraint agreements with the U. S. on steel products. On the whole, these agreements have not been honored in the area of specialty steel products.

In 1969, the voluntary limitation level for all tool steel alloys was exceeded by 60.5 percent, and in 1970 by 77.1 percent. In 1971 the limit was exceeded by only 21.7 percent, but this was due more to decrease in U. S. demand than restraint on the part of foreign exporters.

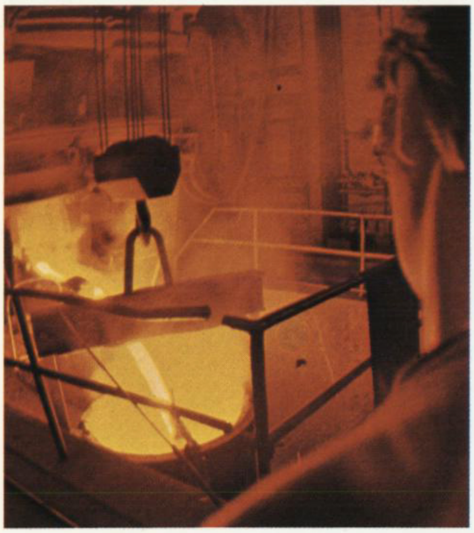
Recent devaluations of the dollar and inflation in various foreign countries have made imports of high speed steels less competitive in the U. S., but pressure on our domestic industry still continues.

U. S. demand for high speed steels also increased considerably in 1973, which has improved the market picture for U. S. producers.

While the effect of low-priced imports has had a strong impact on all manufacturers, Teledyne Vasco has been fortunate in its strong proprietary position, its great depth of technical expertise, and its long-standing reputation for the highest quality products and integrity. These factors, in conjunction with close cost controls, have enabled the company to maintain its strong position in the world market.

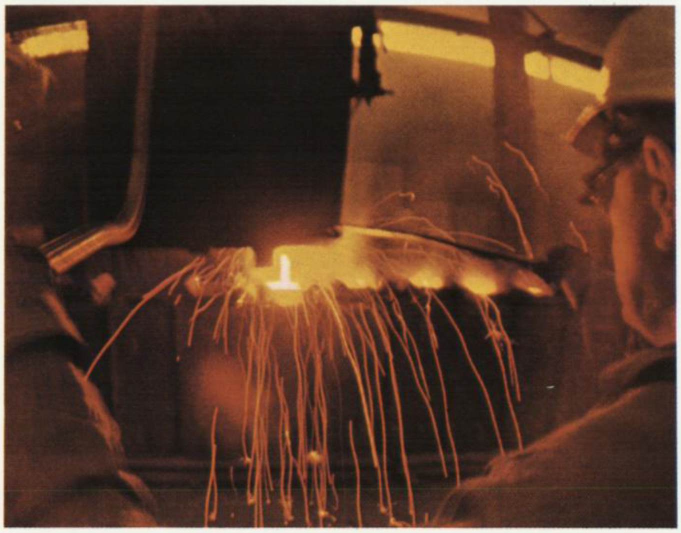
D: Threading die.
E: Industrial hacksaw blades.
F: Threading tap.

1



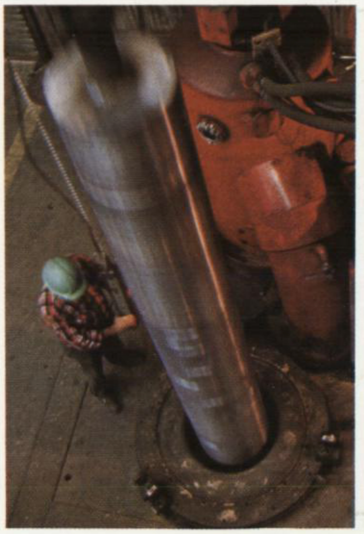
High speed steels are almost universally made in basic electric arc furnaces. Many different elements are combined in careful proportions and melted with various slag-forming materials to achieve the exact chemical analysis needed. After several hours, the melt is ready and the entire furnace is tilted on trunnions to pour the metal into a pre-heated teeming ladle, as shown above.

2



The steel is held in the teeming ladle for a short time to let any slag which has become mixed into the metal rise to the top, and to allow the temperature of the metal to drop slightly. A waiting row of ingot molds is then filled from the ladle. This is accomplished by mechanically lifting a stopper rod inside the ladle so that the molten metal can flow out through the bottom. Bottom pouring helps eliminate ingot defects caused by slag inclusions, since the lighter slag floats on the metal.

3



Some special steel alloys, for critical applications where higher strength, purity and reliability are required, are cast into special long ingots for remelting under vacuum conditions. Called consumable arc vacuum melting, the process remelts the ingot by means of an electric arc using the end of the ingot itself as the electrode. The ingot is thus melted and solidified in a water-cooled copper mold. Gases and undesirable impurities are eliminated by this process because it is carried out under high vacuum.

HOW HIGH SPEED STEEL IS MADE

High speed steel is made in relatively small batches or heats in modern basic electric arc furnaces. Raw materials are melted by the discharge of intense electric arcs between three carbon electrodes and the surface of the metal.

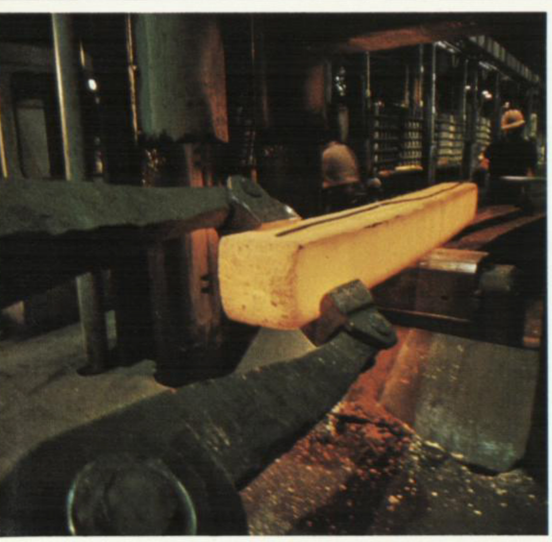
Raw Materials

Because of the scarcity of many of the alloying elements used in high speed steels, and the large amounts required, much of the raw material, up to half of each charge, consists of recycled high speed steel of known analysis arising from worn out cutters and tools of all sorts.The balance is made up of low carbon steel and certain special alloying metals that are needed to provide the desired chemical composition.

These metals are charged into the electric arc furnace along with selected fluxing chemicals to protect the charge during melting. An electric arc is struck and the intense heat of the arc transforms the charge into a molten "bath" in one and a half to two hours. The fluxing agents float to the top of the bath to form slag and the melter adds measured amounts of chemicals to the slag to obtain required reactions.

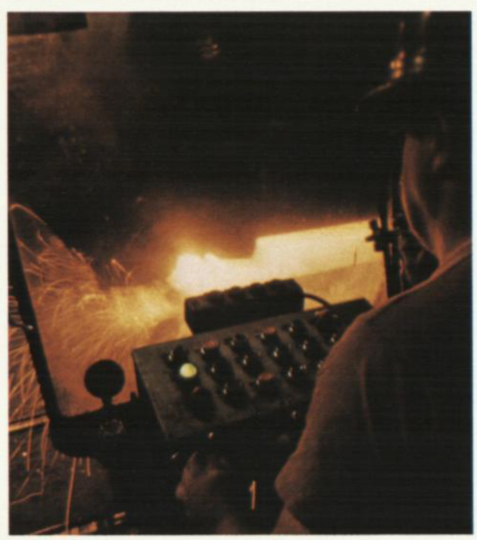
Additions to the slag can include such materials as fluorspar, burnt lime, calcium carbide and graphite. Part of the skill of an experienced melter lies in his ability to judge the composition of the slag by taking a

4



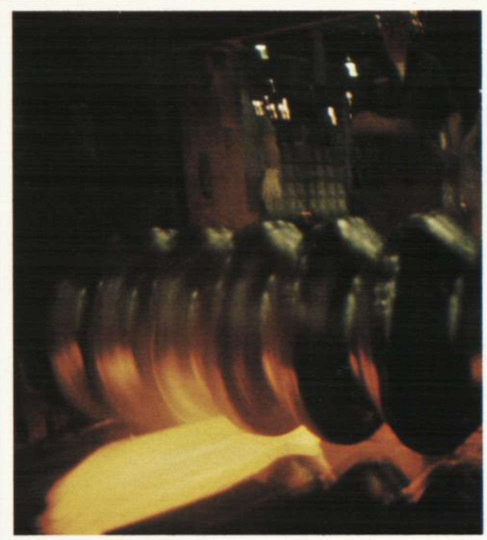
First step in the conversion of ingots is the production of billets by forging, pressing or rolling them into smaller sizes. Here a 2000-ton forging press is being used to shape a large billet that is held in a mechanical manipulator. The conversion process not only forms the metal into a more desirable size for further processing, but in the process, refines and improves its internal structure.

5



Before billets are further reduced, surface defects that have formed during hot working are removed by surface grinding. This "skinning" of the billets maintains the quality of the product being rolled during further processing. It also permits inspection of the metal for surface cracks or other defects. Inspection techniques such as fluorescent dye penetrant and magnetic particle examination may be carried out.

6



Billets are further reduced in size by rolling. The shaped rolls of the mill maintain the metal in a square cross section while reducing it in size. In this 16-inch mill, a billet is reduced to a cross section as small as 1⅛ inches square and its length is increased. The resulting piece is then cut into shorter lengths for further processing.

small sample, and cooling and examining a fractured piece of it.

In the early part of the melt, an oxidizing slag is desired. Later, a reducing slag helps return expensive alloying metals, which have become part of the slag as oxides, back to the molten metal.

This refining process can be carried on for several hours. As it progresses, small test samples of the molten metal are removed, chilled and sent to the metallurgical laboratory for exact analysis. Spectrographic and x-ray diffraction equipment gives precise analyses in a matter of a few minutes.

Final Additions

Any final additions of alloying elements necessary to bring the heat to the precise composition required are made just prior to bringing the heat to the prescribed tapping temperature. The heat is then tapped into a waiting, pre-heated ladle by tilting the entire furnace.

Teeming

The metal is "teemed" or poured from the ladle into a waiting row of ingot molds by opening a valve that allows the metal to flow out from the bottom of the ladle.

Design of the ingot molds is an art and science in itself, as the mold determines the rate and manner in which the ingot solidifies. Proper design prevents any voids or piping in the center of the ingot due to shrinkage of the metal as it cools.

When the ingots have cooled to a solid form, they are stripped from the molds and moved into soaking furnaces where they are reheated to 1800-2000°F and held until internal stresses are relieved. They are then heated further in preparation for rolling, forging, or pressing into slabs or billets.

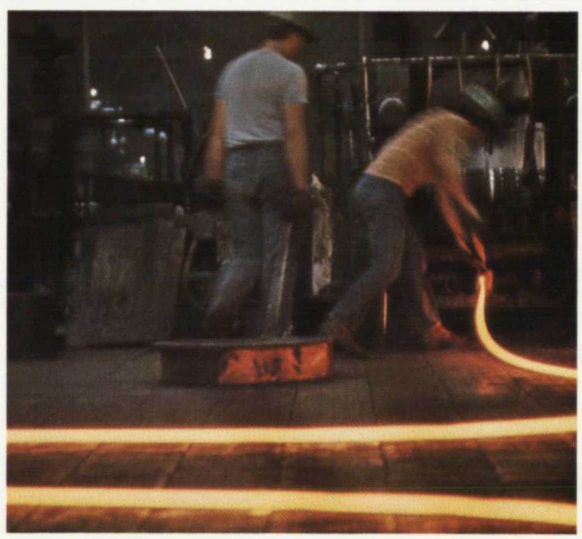
These hot forming operations are the first steps in the process of reshaping ingots into useful forms such as bars or sheets and each such operation not only reshapes the metal but also improves its properties.

After the billets have cooled from the hot forming operations, they are

7

High speed steel is often formed into specific shapes such as discs and rings for use by toolmakers. This forging started out as a square length of metal cut from a billet. Skilled craftsmen, handling the hot metal with tongs, deftly manipulate it beneath the blows of a hammer to form discs of the diameter and thickness required. Rings are similarly formed using a mandrel much as a blacksmith would use the horn of his anvil to produce a similar shape.

8



The final hot-working step in producing high speed steel rod and bar is performed on a finishing mill. Small billets are reduced in cross section by passing them back and forth through progressively smaller rolls until they are as small as ¼ inch in diameter. In this process, a 9-foot billet can become up to 500 feet of small diameter rod. Round cross sections are commonly rolled, as well as square bars, flat bars, and special shapes.

9

High speed steel is commonly sold to toolmakers in the form of finished bars ranging from $\frac{1}{64}$ to 6 inches in diameter, and in lengths of 10 to 12 feet. These are finished by centerless grinding on automatic equipment, and carefully checked for uniform diameter and size tolerance. High speed steel in smaller sizes is reduced from larger diameter coil by wiredrawing techniques before grinding, for use as drill rod.

"skinned" or surface ground to remove any defects.

From this point on the product can be reduced to several different forms. Reheated billets can be rolled to produce round, square, rectangular, or specially shaped bars. Bars can be further reduced by drawing them through dies to produce rods as small as 1/64th inch in diameter. Round bars and rods can be further finished by precision grinding.

Discs and rings of high speed steel are produced by upset forging of slugs cut from billets. Discs up to twenty-four inches in diameter and six inches thick are produced by this method. Rings are made in sizes up to thirty-two inches in diameter and one to five inches in thickness. These shapes are used by toolmakers for producing a variety of products such as milling cutters and gear-hobbing tools.

High speed steel is also prepared in sheet form for the manufacture of hacksaw blades. Forged slabs are hot rolled into sheet ranging from .025 inch up to 1/8th inch thick.

Heat Treating

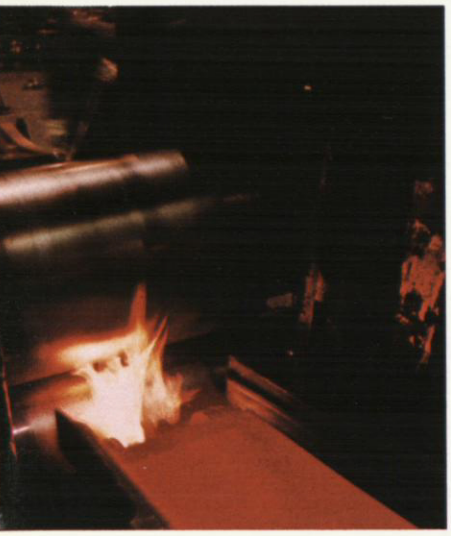
Most high speed steel products are delivered to toolmakers in a relatively soft condition. This is achieved through a process called annealing. Annealing provides a uniform internal structure with minimum hardness that permits the material to be cold worked and machined quite readily.

Annealing is typically achieved by heating the metal to 1400 to 1650°F, holding it there until the temperature is uniform throughout, and then cooling it at a slow rate of 20 to 50°F per hour.

After the high speed steel is made into a tool, it must be further heat treated to give it the desired properties of hardness and toughness.

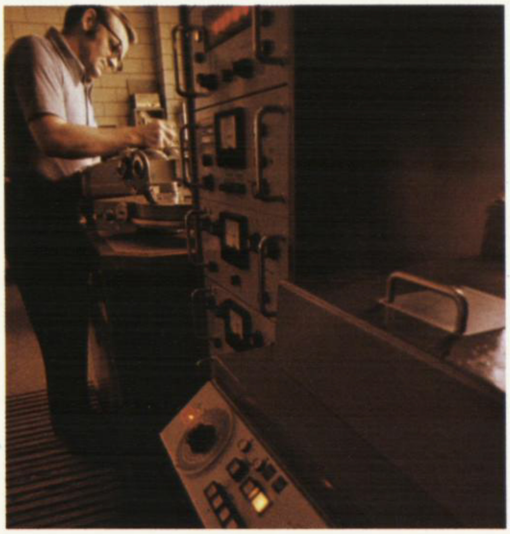
Heat treating is a very complex and highly developed art, and proper procedures are essential to long-lasting high-quality tools. Teledyne Vasco provides detailed heat treating information and assistance for all its alloys.

10



Another important use of high speed steel is in the manufacture of high speed hacksaw blades. The steel is hot rolled into sheet ranging from .025 to .125 inch thick in widths up to 24 inches and lengths of 8 feet. Due to the nature of these steels, the sheet must be reheated and frequently annealed during this reduction process to relieve internal stresses and facilitate further rolling.

11



The name of the game in high speed alloys is precision control of chemical composition and physical properties. This is accomplished at Teledyne Vasco through the use of modern analytical instrumentation such as this x-ray diffractometer. With it, it is possible to determine the exact content of any given chemical element in the sample under study.

12

A variety of other analytical instruments and procedures is used in controlling the quality of the finished alloys. Wet chemistry, microscopic metallographic examination, and spectrography are some of the other methods used. In this picture, a small metal sample is placed in a graphite crucible for insertion into an automatic gas analyzer. The instrument will give a digital readout of the oxygen and nitrogen content in the sample in less than two minutes.

Review

LETTER TO SHAREHOLDERS

Results for fiscal year 1973 were the best in Teledyne's history, with new records being set in sales, net income, and earnings per share.

Net income reached $65.4 million, a 14 percent improvement over the $57.4 million of the previous year. Earnings per share, after adjustment for the three percent stock dividend payable in April 1974, were $2.45 compared to $1.58 on the larger number of average shares outstanding in 1972. Sales of consolidated companies were $1.455 billion, a 20 percent increase from the $1.216 billion of a year ago. Consolidated assets at year end were $1.230 billion compared to $1.126 billion last year.

Combined revenues of unconsolidated insurance and finance subsidiaries rose to $601 million from $513 million in 1972. Equity in net income of the unconsolidated subsidiaries was little changed for the year, amounting to $24.6 million and $24.2 million for fiscal 1973 and 1972 respectively. Investment in unconsolidated subsidiaries was $401 million at year end, and total assets of the unconsolidated subsidiaries were $1.339 billion.

The consolidated companies, consisting of product manufacturing, sales and service organizations, accounted for 62.4 percent of Teledyne's net income, while the unconsolidated insurance and finance subsidiaries contributed 37.6 percent.

The improved economic climate during the year benefited most of Teledyne's major product lines, with the principal exception of consumer products, where efforts to expand television and stereo sales continued to be costly and made little progress. The company's special metals business improved sharply as a result of the generally high level of industrial activity during the year. Order input for zirconium to be used in nuclear power generation was particularly strong. Shipments of tool and die steels increased during the year, and Teledyne's tool and die steel activity is described in the feature article in this Teledyne Report. Improvement in demand was noted for electronic components, in both foreign and domestic markets. The company's oil exploration activity was also well ahead of last year.

Subsequent to the end of the year, the company offered to buy 4,000,000 shares of its common stock at $14 per share. The offer expires January 28. The Board of Directors also declared a three percent stock dividend payable April 26, 1974 to shareholders of record February 19.

With respect to the energy shortage, we have taken measures to conserve fuel and to utilize the available energy in the most efficient manner. Because of the shortage, it appears that certain of our products such as general aviation engines and swimming pool heaters may face declining sales in the months ahead. But our oil and gas exploration and drilling activities and our materials for nuclear reactors are experiencing increased demand. The ultimate effect of the energy shortage on Teledyne's operations is not clear to us at this time, but we do not expect to suffer any competitive disadvantage compared to other companies.

Henry E. Singleton

Chairman of the Board of Directors

George A Roberts

President

EXPANDED OFFSHORE OIL SERVICES

Teledyne Movible Offshore has expanded its offshore oil drilling services to a worldwide basis with the completion of Movible Rig 16 in Singapore. This jack-up type rig will be used exclusively in the Eastern Hemisphere and will soon be joined by Movible Rig 17, now under construction.

Since its founding in 1957, Teledyne Movible Offshore has provided the oil industry with expanding offshore services in drilling, workover and construction. In addition to Movible Rig 16, the company operates derrick barges ranging from 40 to 500 tons, a fabrication yard with facilities for the construction of deep water offshore platforms, two mobile drilling rigs and ten platform drilling and workover rigs.

PRODUCTION OF SYNTHETIC NATURAL GAS

Teledyne Farris Engineering safety-relief valves are being used extensively in the first U.S. commercial synthetic natural gas plant, which went on stream in March 1973 at Harrison, New Jersey. With the supply of natural gas being rapidly depleted in this country, the production of synthetic natural gas has become an important alternate energy source.

The Teledyne Farris safety-relief valves have been used throughout to provide maximum plant safety. They were installed to prevent explosions arising from excessive overpressuring of vessels. These valves are also specially designed for tightness to prevent environmental pollution.

The plant itself is semi-automatic. All necessary functions are displayed in a control room for monitoring, control, and signal alarm under view of trained experts. The plant's output is 20 million cubic feet of synthetic natural gas per day.

INCREASING OIL PRODUCTION

A new consulting service for oil companies, aimed at increasing the production and operating efficiency of oil wells, is now available from Teledyne Merla.

Teledyne Merla specializes in "gas lift" equipment and technology, a method whereby the amount of oil produced by existing oil wells is increased by injecting high pressure gas into the wells under carefully controlled conditions.

The new consulting service encompasses the entire spectrum of gas lifting, from initial design of new systems, to troubleshooting existing installations, with conservation of the lift gas as a primary objective.

Teledyne Merla has computer programs available to assist in complete engineering studies to determine the requirements for maximum production. For day-to-day operations, a troubleshooting computer program is also available to help locate causes of failures. It permits field personnel, without expensive instrumentation, to feed operational data into a computer and get immediate results.

SEAL RINGS FOR SPACE SHUTTLE PROGRAM

Teledyne Aero-Cal is presently producing high pressure metal seals for cryogenic and high temperature applications in the space shuttle program, which has its first flight scheduled for 1980.

Using a newly patented method, Inconel 718 is formed to produce a seal of high reliability. Seals produced to date range from 1.1 to 24 inches outside diameter, although diameters to 60 inches are entirely feasible. They are suitable for use in temperature ranges from −423°F to +1200°F.

Initial tests were run at pressures of 8900 pounds per square inch and they performed without leakage. The seals are plated with silver, gold, rhodium or various combinations of these metals, depending on the application they are intended for.

The space shuttle program itself involves a reusable space vehicle which will land on orbiting space stations. The vehicle will make approximately 780 shuttle flights carrying scientific payloads between the years 1980 and 1991.

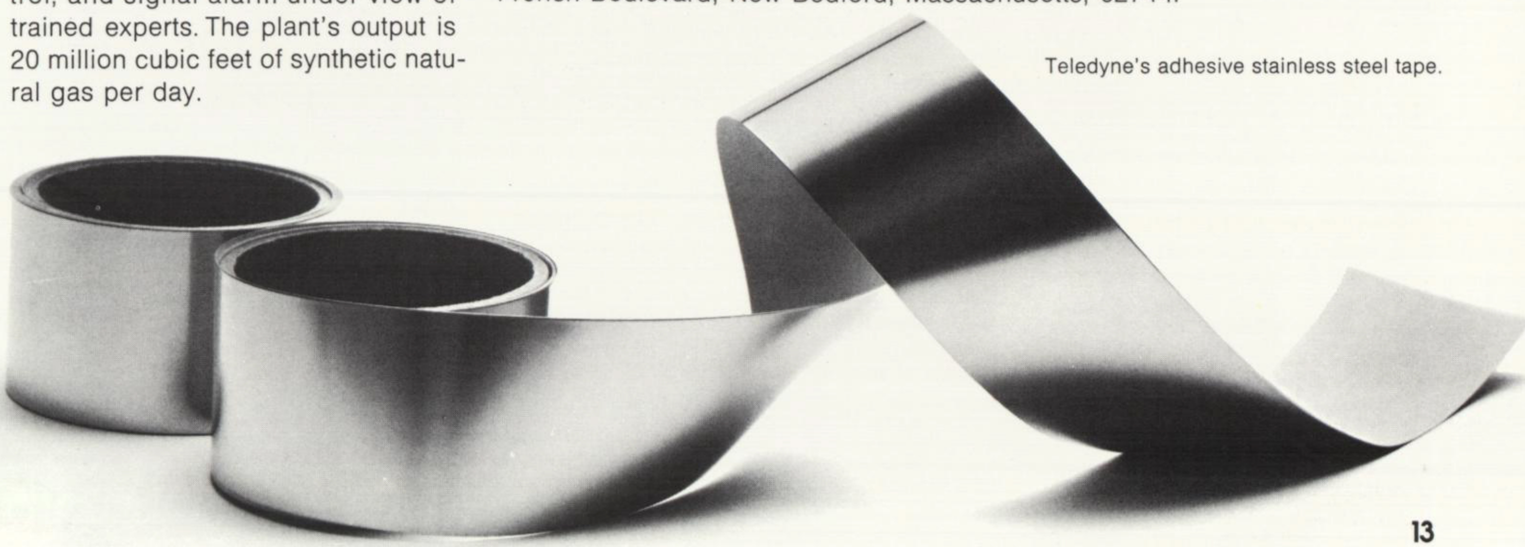
STAINLESS STEEL TAPE

Adhesive-backed stainless steel tape in widths from two to twenty-four inches has been introduced for consumer and industrial use by Teledyne Rodney Metals. The tape can be used on any smooth, clean surface to provide a cladding of stainless steel for decoration, corrosion resistance, heat or light reflectivity, or low-friction properties.

The strip is applied by simply removing the peelable backing paper and pressing it into place. The adhesive is waterproof and resistant to grease and most commonly known corrosive environments. It can withstand temperatures from −40° to +250°F. Bonding strength of the adhesive increases with age.

The tape is made of Series 300 stainless steel alloy in four thicknesses ranging from .00275 inch to .010 inch, and is available in lengths of 25 to 600 feet.

For further information, contact Teledyne Rodney Metals, 1357 East Rodney French Boulevard, New Bedford, Massachusetts, 02744.



Teledyne's adhesive stainless steel tape.

CERAMICS FOR GAS TURBINES

Application of ceramic materials to various parts of a gas turbine engine has been successfully carried out under Air Force contract by Teledyne CAE. The ceramic materials, silicon carbide and silicon nitride, were used in conjunction with a columbium metal shroud in the inlet nozzle of a full-size jet engine, which underwent a series of operational tests.

The inlet nozzle is subjected to the highest temperatures reached in a gas turbine, ranging in excess of 2500°F. Metal parts must be specially cooled to withstand these temperatures. The ceramic materials eliminated this requirement through their superior high temperature properties.

The tests are believed to be the first such application of these materials to this section of a full-size engine, operating at temperatures in excess of 2500°F. In addition to their ability to withstand high temperatures, these materials were evaluated as to their resistance to stresses and vibrations incurred during manufacturing and while running in an engine.

Work is continuing toward the application of these materials for the first stage turbine rotor blades in the turbojet engines.

Utilization of ceramics in the hot sections of turbine engines could lower engine costs to one-third of their present level and permit wider application of turbine power.

MORE RELIABLE POLLUTION CONTROL

Reliability of electrostatic precipitation equipment used in industrial pollution control can be improved by a new line of high-voltage DC power supplies now being marketed by Teledyne Crittenden Transformers. The new equipment will help industrial users to meet the increasingly strict clean air standards which are becoming mandatory throughout the country.

The new Teledyne power supplies employ a unique high reactance transformer to limit short circuit current during precipitation sparking. This system is being used in place of the series line reactor and separate transformer now in general use.

Output voltages range up to 60 KV with average current ratings from 300 to 2000 milliamperes.

DIE CASTING APPLICATION

Costs of producing precision ball bearing retainers were lowered 90% by Teledyne Mt. Vernon Die Casting through the use of modern die casting techniques.

Produced for the manufacturers of precision linear ball bearings in several sizes, the nine-piece retainer is diecast in zinc metal and chromium plated. Die casting was the only possible way to produce the part to close tolerances at low cost without the need for costly secondary machining. Prior to plating, the parts are finished by trimming and tumbling them.

ENGINE RELIABILITY PROGRAM

Teledyne Continental Motors' General Products Division and the U.S. Army are jointly taking part in a program to improve tank engine performance.

The program, termed RISE (Reliability Improvement of Selected Equipment), is working toward improving the average mileage between failures and the average mileage to overhaul, thus increasing the total availability of tanks. This has been accomplished through a redesign of major engine components.

Teledyne's General Products Division manufactures the air-cooled diesel supercharged 12 cylinder power plant which has powered both the U.S. Army's M48A3 Tank and M60 Main Battle Tank since 1960. Foreign countries have also used it to repower older gasoline fueled tanks.

Under the new program, the mean time between failure on Teledyne's tank engines is currently 131 hours, as compared to the previous figure of 50.7 hours. The mean time to overhaul has been improved from 3180 miles to 3682 miles, with the availability of tanks increased from 76.9 percent to 95.3 percent. This impressive success is based upon over 3600 hours of durability testing, and 9000 miles of vehicle performance tests. An additional 400 hours of dynamometer durability tests and 45,000 miles of vehicle tests are planned for the coming year to further validate this early data.

ENERGY SAVING DEVICE

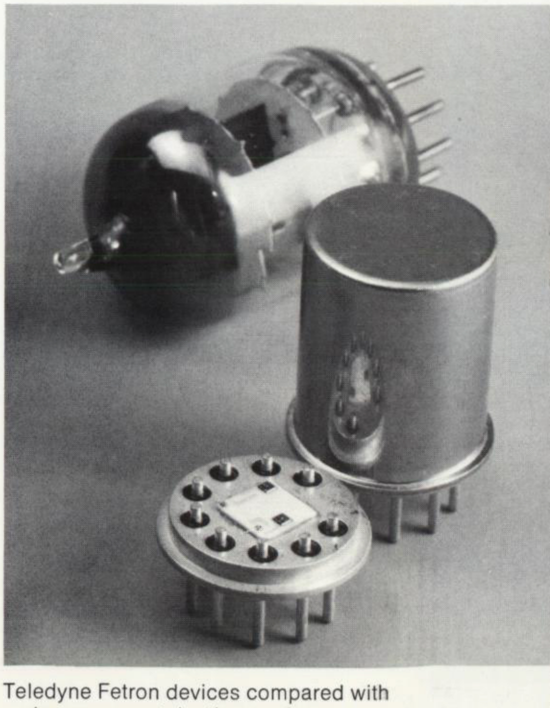
A solid-state electronic device called the Fetron, introduced by Teledyne Semiconductor in 1972 (See Teledyne Report, Second Quarter 1972) can potentially save the nation billions of kilowatt hours of electrical energy annually by replacing certain vacuum tubes now widely used in telephone networks and other equipment.

The Teledyne Fetrons use about 3 watts less power than the 6AK5 and 12AT7 vacuum tubes they replace. Multiplied by the estimated number of these tubes now in use in the U.S. telephone network alone (about 100,000,000) a savings of over seven million kilowatt hours per day, or two and one half billion kilowatt hours per year could be realized.

The same types of vacuum tubes are also widely used in military, governmental and civilian electronics equipment of all types. Replacement of these tubes with the Teledyne Fetron device could realize further large savings in energy consumption.

One of the major advantages of the Fetron is that it can be plugged directly into the same tube sockets used for the vacuum tubes, without major modification to the circuitry.

Fetrons are junction-field-effect devices specially designed for high breakdown voltages ranging from 200 to 300 volts. This permits them to be used in conventional vacuum tube circuits where high plate voltages exist.



Teledyne Fetron devices compared with a glass vacuum tube they replace.

AEROSPACE TECHNOLOGY TO HELP PROBE BRAIN

Technology originally developed for an aerospace program by Teledyne Ryan Aeronautical has been applied to a new instrument that may help medical researchers unlock some of the secrets of how the brain functions at the neuron level. Called a multiple microprobe, the instrument was developed by Teledyne Ryan engineers for scientists at the University of Pittsburgh who are investigating the neuron activity of the brain under a grant from the National Science Foundation.

The device permits several tiny electrodes to be precisely positioned within brain tissue and moved in controlled increments of one micron (approximately 1/25,000th of an inch). Each electrode consists of a fine tungsten wire core encased in a thin glass sheath. They are so small they can hardly be seen with the unaided eye. The purpose of the electrodes is to monitor the electrical activity of a single neuron and several of its neighboring neurons in an effort to understand the complex electrical interactions that take place within the brain. The electrical activity detected can be displayed on an oscilloscope for observation, and fed to a computer for analysis.

Previous equipment for positioning the tips of the tiny 1/2000th inch diameter electrical wires was not precise enough and was too bulky to permit handling more than one electrode at a time.

The Teledyne Ryan multiple microprobe uses the piezoelectric phenomenon as the motive force for moving each individual electrode in precise increments. Certain natural crystalline substances and some manmade ceramic materials exhibit a minute change in length when an electrical voltage is applied to them. This change in dimension has been coupled through a clutch and brake mechanism to move the individual electrodes.

At present, four electrodes are housed in the cylindrical instrument and project through a hollow protective needle that is inserted into the brain tissue. Each electrode can be moved individually through a range of about one millimeter. Current design will permit up to about 20 electrodes to be housed in a single instrument, and an ultimate goal of as many as 100 is projected.

The principle of the piezoelectric drive mechanism was originally developed by Teledyne Ryan for the Air Force for use in aerial photography. In this application the same method is used to advance film in a camera in precise, evenly spaced increments of as little as one micron. The system, which can be operated over a wide range of speeds, permits building up an image on the film from a series of evenly spaced scan lines.

The new multiple microprobe which uses this same principle will be used initially at the University of Pittsburgh to study neuron systems in monkey brains. It is anticipated that this research will provide a better understanding of the brain and may ultimately lead to improvements in the medical treatment of epilepsy and various brain disorders.

Other applications that have been foreseen for this proprietary piezoelectric mechanism include monitoring of air pollution particles, remote micropositioning of objects in vacuum chambers or other inaccessible areas, and injection of dyes into blood vessels for x-ray examination.

SEMICONDUCTOR ENTERS CMOS MARKET

Teledyne Semiconductor has announced its entry into the rapidly-growing complementary metal oxide silicon semiconductor market. CMOS technology, as it is referred to, is an extension of the MOS, metal oxide silicon, technology that has been widely developed in the last few years.

Teledyne's first semiconductor products using this new technology will be a line of digital products referred to as the 74C series. Introduction of these products will be followed by other proprietary CMOS devices for both digital and linear applications.

Some of the advantages of CMOS devices are lower power requirement, wider power supply voltage range, lower noise generation during switching, and higher noise tolerance. These features and the circuit simplifications they permit should significantly reduce system costs.

METRIC CONVERSION SYSTEM FOR MACHINE TOOLS

In compliance with the proposed ten-year voluntary conversion to the metric system which has already begun in many U.S. businesses and industries, Teledyne Gurley has developed a digital readout system for machine tools which permits working in either the English or metric system. The worktable position readout system converts milling machines or other machine tools to either metric or English units at the flip of a switch. It also makes the machines up to 30 percent more productive on short run work where jigs and fixtures are not economical.

By installing a system with the English/metric switching option to his existing machine, the owner can avoid the cost of a new machine or replacement lead screws made to metric standard. In addition, it will make his existing machine more flexible, so that he can work in either system during the many years it will take to convert the country completely to metric.

The system consists of an enclosed glass scale with precisely positioned lines which is mounted to the side of the work table. An electro-optical reading head counts these lines as the table moves and sends the counts to a readout panel, which converts them into a numerical display of the work table position. Usually, there are two scale assemblies supplied, one for each axis of motion of the work table.

The basic digital readout system sells for as little as $1300 and the English/metric switching option costs only $275 extra. Teledyne Gurley is currently selling over half of its systems with the metric option. It is estimated that there are over 500,000 machine tools in the U.S. alone to which the system can be applied.

SAVINGS IN TURF CARE

A Teledyne Wisconsin Motor engine supplies the power for a nationally known power lawn mower which is substantially reducing monthly maintenance costs for turfs in parks and golf courses through quicker, more efficient operation. The heavy-duty air-cooled 12.5 horsepower engine runs at 3200 RPM and has 38.5 cubic inch displacement.

Highlights of Financial History

	Consolidated Sales	*Net Income*	*Net Income Per Share (1)*	*Consolidated Assets*	*Shareholders' Equity*	*Average Common Shares (1)*
1973	$1,455,499,000	$65,363,000	$2.45	$1,229,622,000	$534,109,000	25,872,770
1972	1,215,991,000	57,444,000	1.58	1,126,401,000	481,873,000	35,088,278
1971	1,101,872,000	56,179,000	1.49	1,065,732,000	606,872,000	36,325,486
1970	1,216,448,000	61,864,000	1.69	1,035,746,000	577,137,000	35,509,285
1969	1,294,775,000	58,119,000	1.67	1,110,878,000	501,961,000	34,123,643
1968	874,905,000	45,161,000	1.40	766,680,000	362,780,000	32,210,247
1967	777,745,000	34,164,000	1.10	601,037,000	272,042,000	30,364,093
1966	700,211,000	31,693,000	1.06	437,845,000	229,372,000	28,680,120
1965	559,680,000	27,044,000	0.96	371,131,000	205,762,000	26,711,356
1964	465,304,000	20,195,000	0.76	311,667,000	173,069,000	24,527,344
1963	423,246,000	15,917,000	0.61	284,493,000	155,844,000	23,594,785
1962	388,420,000	11,291,000	0.43	259,247,000	134,536,000	22,643,294
1961	297,564,000	5,678,000	0.19	199,128,000	118,599,000	21,510,483

(1) Fully diluted and adjusted for a 3% stock dividend payable April, 1974.

Revenues by Product Line

	1973		1972	
Industrial	$ 487,775,000	23.7%	$ 404,262,000	23.4%
Aviation and Electronics	408,899,000	19.9	366,515,000	21.2
Specialty Metals	375,706,000	18.3	287,152,000	16.6
Consumer and Other	183,119,000	8.9	158,062,000	9.1
Subtotal	1,455,499,000	70.8	1,215,991,000	70.3
Insurance and Finance	601,488,000	29.2	512,621,000	29.7
Total	$2,056,987,000	100.0%	$1,728,612,000	100.0%

Net Income by Product Line

	1973		1972	
Industrial	$14,158,000	21.7%	$15,704,000	27.3%
Aviation and Electronics	12,684,000	19.4	8,344,000	14.5
Specialty Metals	15,744,000	24.1	8,068,000	14.1
Consumer and Other	(1,827,000)	(2.8)	1,085,000	1.9
Subtotal	40,759,000	62.4	33,201,000	57.8
Insurance and Finance	24,604,000	37.6	24,243,000	42.2
Total	$65,363,000	100.0%	$57,444,000	100.0%

Consolidated Balance Sheets

October 31, 1973 and 1972

Assets

	1973	1972
Current Assets:		
Cash, including certificates of deposit of $36,706,000 in 1973 and $7,305,000 in 1972	$ 77,613,000	$ 55,992,000
Marketable securities, at cost which approximates market	25,301,000	9,504,000
Receivables, less reserve of $7,691,000 in 1973 and $7,356,000 in 1972	180,818,000	164,254,000
Inventories (Note 3)	201,505,000	185,881,000
Prepaid expenses	11,175,000	11,495,000
Total current assets	496,412,000	427,126,000
Investments in Unconsolidated Subsidiaries (Note 9):		
Unicoa Corporation (Note 10)	184,673,000	166,115,000
Argonaut Insurance Company (Note 11)	204,944,000	184,219,000
Other	11,831,000	13,425,000
	401,448,000	363,759,000
Property and Equipment, at cost:		
Land	16,755,000	16,652,000
Buildings	104,978,000	101,830,000
Equipment and improvements	418,365,000	400,921,000
	540,098,000	519,403,000
Less—accumulated depreciation and amortization	254,934,000	233,614,000
	285,164,000	285,789,000
Other Assets:		
Cost in excess of net assets of purchased businesses	33,681,000	33,681,000
Other	12,917,000	16,046,000
	46,598,000	49,727,000
	$1,229,622,000	$1,126,401,000

The accompanying notes are an integral part of these balance sheets.

Liabilities

	1973	1972
Current Liabilities:		
Accounts payable	$ 82,275,000	$ 53,087,000
Accrued liabilities	97,467,000	85,707,000
Accrued income taxes	11,800,000	3,500,000
Current portion of long-term debt	15,832,000	21,815,000
Total current liabilities	207,374,000	164,109,000
Long-Term Liabilities:		
Long-term debt (Note 4)	310,907,000	302,595,000
Deferred income taxes	29,200,000	32,500,000
Other	24,060,000	10,580,000
Subordinated Debentures (Note 4)	123,972,000	134,744,000
Shareholders' Equity:		
Preferred stock (1973 liquidation preference $35,389,000—Note 6)	692,000	714,000
Common stock (Notes 4, 5, 6 and 12)	32,339,000	32,303,000
Additional paid-in capital	418,310,000	419,758,000
Retained earnings (Notes 4 and 6)	262,012,000	215,571,000
	713,353,000	668,346,000
Less—common stock in treasury, at cost (9,129,009 shares in 1973 and 9,330,494 shares in 1972)	179,244,000	186,473,000
Total shareholders' equity	534,109,000	481,873,000
	$1,229,622,000	$1,126,401,000

Consolidated Statements of Income

For the Years Ended October 31, 1973 and 1972

	1973	1972
Consolidated Sales	$1,455,499,000	$1,215,991,000
Consolidated Costs and Expenses:		
Cost of sales	1,171,347,000	978,720,000
Selling and administrative expenses	186,358,000	169,476,000
Interest expense (Notes 4 and 9)	17,338,000	6,969,000
Interest income	(8,178,000)	(4,175,000)
Provision for currency translation (Note 9)	6,275,000	—
Provision for income taxes	41,600,000	31,800,000
	1,414,740,000	1,182,790,000
Income of Consolidated Companies	40,759,000	33,201,000
Equity in Net Income of Unconsolidated Subsidiaries, after allocated expenses (Notes 4 and 9)	24,604,000	24,243,000
Net Income	$ 65,363,000	$ 57,444,000
Net Income Per Share of Common Stock and Common Stock Equivalents (equal to net income assuming full dilution—Note 2)	$2.52	$1.62
Adjusted for 3% stock dividend payable April, 1974 (Note 12)	$2.45	$1.58

Consolidated Statements of Retained Earnings

For the Years Ended October 31, 1973 and 1972

	1973	1972
Balance, Beginning of Year	$234,156,000	$199,223,000
Adjustment for difference between cost and book value of Unicoa treasury stock (Note 9)	(18,585,000)	(9,974,000)
Balance, Beginning of Year (as adjusted)	215,571,000	189,249,000
Add or (Deduct):		
Net income	65,363,000	57,444,000
Fair value of common stock dividends (Note 6)	(13,743,000)	(18,720,000)
Dividends on preferred stock	(3,684,000)	(3,791,000)
Difference between cost and book value of Unicoa treasury stock (Note 9)	(1,495,000)	(8,611,000)
Balance, End of Year	$262,012,000	$215,571,000

The accompanying notes are an integral part of these statements.

Consolidated Statements of Capital Stock, Additional Paid-in Capital and Common Stock in Treasury *For the Years Ended October 31, 1973 and 1972*

	Preferred Stock ($1 Par Value)	*Common Stock ($1 Par Value)*	*Additional Paid-In Capital*	*Common Stock In Treasury*
Balance, October 31, 1971	$714,000	$30,985,000	$393,253,000	$ 7,329,000
Common stock dividend	—	918,000	17,787,000	—
Stock option and purchase plans (Note 5)	—	212,000	4,263,000	—
Additional consideration for purchased business	—	188,000	4,455,000	—
Purchase of treasury stock (8,962,136 shares)	—	—	—	179,144,00
Balance, October 31, 1972	714,000	32,303,000	419,758,000	186,473,000
Common stock dividend (691,268 shares)	—	—	(77,000)	(13,815,000)
Stock option and purchase plans (Note 5)	—	35,000	700,000	(1,357,000)
Redemption of Series C preferred stock	(21,000)	—	(2,071,000)	—
Conversion of preferred stock	(1,000)	1,000	—	—
Purchase of treasury stock (557,700 shares)	—	—	—	7,943,000
Balance, October 31, 1973	$692,000	$32,339,000	$418,310,000	$179,244,000

The accompanying notes are an integral part of these statements.

Auditors' Report

To the Shareholders and
Board of Directors, Teledyne, Inc.:

We have examined the consolidated balance sheets of TELEDYNE, INC. (a Delaware corporation) and subsidiaries as of October 31, 1973 and 1972, and the related statements of income, capital stock, additional paid-in capital and common stock in treasury, retained earnings and changes in financial position for the years then ended. Our examinations were made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances. We did not examine the consolidated financial statements of Unicoa Corporation and subsidiaries, which are summarized in Note 10 to the financial statements. These statements were examined by other auditors whose reports thereon have been furnished to us and our opinion expressed herein, insofar as it relates to the amounts included for Unicoa Corporation and subsidiaries, is based solely upon the reports of the other auditors.

In our opinion, based upon our examinations and the reports of other auditors referred to above, the accompanying consolidated financial statements present fairly the consolidated financial position of Teledyne, Inc. and subsidiaries as of October 31, 1973 and 1972, and the results of their operations and changes in their financial position for the years then ended, all in conformity with generally accepted accounting principles consistently applied during the periods.

ARTHUR ANDERSEN & CO.

Los Angeles, California,
December 5, 1973.

Consolidated Statements of Changes in Financial Position

For the Years Ended October 31, 1973 and 1972

	1973	1972
Working Capital Was Provided By:		
Net income	$ 65,363,000	$ 57,444,000
Equity in net income of unconsolidated subsidiaries before allocated expenses	(36,325,000)	(29,763,000)
Depreciation and amortization	46,305,000	36,434,000
Provision for currency translation	13,400,000	—
Change in deferred income taxes	(3,300,000)	100,000
Working capital provided from operations	85,443,000	64,215,000
Issuance of long-term debt	63,858,000	179,893,000
Issuance of common stock:		
Employees' stock purchase and option plans	2,092,000	4,475,000
Additional consideration for purchased business	—	4,643,000
Dispositions of property and equipment	5,936,000	3,786,000
Other, net	2,465,000	1,538,000
	159,794,000	258,550,000
Working Capital Was Applied To:		
Purchase of treasury stock	7,943,000	179,144,000
Additions to property and equipment	50,877,000	42,842,000
Reduction in long-term and subordinated debt	66,318,000	22,818,000
Investments in unconsolidated subsidiaries, less $2,095,000 property contributed in 1972	2,859,000	18,557,000
Redemption of preferred stock	2,092,000	—
Purchase of businesses, net of working capital acquired	—	9,982,000
Dividends on preferred stock	3,684,000	3,791,000
	133,773,000	277,134,000
Increase (Decrease) in Working Capital	$ 26,021,000	$(18,584,000)

	1973	1972
Working Capital Increase (Decrease):		
Cash, including certificates of deposit	$ 21,621,000	$ 2,456,000
Marketable securities	15,797,000	2,615,000
Receivables	16,564,000	6,111,000
Inventories	15,624,000	1,224,000
Prepaid expenses	(320,000)	(1,784,000)
Accounts payable	(29,188,000)	(4,018,000)
Accrued liabilities	(11,760,000)	(11,850,000)
Accrued income taxes	(8,300,000)	3,000,000
Current portion of long-term debt	5,983,000	(16,338,000)
	$ 26,021,000	$(18,584,000)

The accompanying notes are an integral part of these statements.

Notes to Consolidated Financial Statements

(1) Summary of significant accounting policies. *Principles of consolidation.* The consolidated financial statements of Teledyne, Inc. include the accounts of all its subsidiaries except its insurance and finance companies. The investments in unconsolidated subsidiaries, which include advances, are accounted for by the equity method. All material intercompany accounts and transactions have been eliminated.

Currency translation. Current assets and current liabilities of foreign subsidiaries are expressed at the rates of exchange in effect at year end, and exchange adjustments are charged or credited to income. Non-current assets and liabilities are expressed at rates in effect at the time of the transactions. In 1973, the Company provided for the estimated effect of changes in exchange rates applicable to long-term debt repayable in foreign currencies.

Inventories. Inventories are stated at the lower of cost (first-in, first-out and last-in, first-out methods) or market, less progress payments received. Sales and related costs are recorded as products are delivered and as services are performed, including products and services under long-term contracts. Any foreseeable losses are charged to income when determined.

Depreciation and amortization. Buildings and equipment are depreciated on straight-line and declining balance bases. Estimated useful lives are 5 to 45 years for buildings, and 3 to 20 years for machinery and equipment. Leasehold improvements and patents are amortized on a straight-line basis over the life of the lease or patent. Maintenance and repairs are charged against income as incurred and betterments and major renewals are capitalized. Cost and accumulated depreciation of property sold or retired are removed from the accounts and the resultant gain or loss is included in income.

Cost in excess of net assets of purchased businesses. Cost in excess of net assets of purchased businesses, all of which originated prior to October 31, 1970, is not being amortized.

Research and development. Company funded research and development costs are expensed as incurred. Costs related to customer funded research and development contracts are charged to income as sales are recorded.

Pension expense. Pension expense is accrued at amounts equal to normal cost plus interest on unfunded prior service cost, and for certain plans, a portion of prior service costs.

Income taxes. Provision for income taxes includes state, Federal and foreign income taxes. Deferred income taxes are provided for timing differences in the recognition of income and expenses, income of the domestic international sales corporation not currently taxed, and undistributed earnings of subsidiaries. The investment tax credit is amortized over the estimated lives of the related assets.

(2) Computation of net income per share. Net income per share is based on the weighted average number of common shares and equivalents outstanding during each year (25,119,194 shares in 1973 and 34,066,289 shares in 1972), including all convertible debt, Series B preferred stock and all dilutive options and warrants. Each common stock equivalent has been considered outstanding from the beginning of each year or date of issuance, and the related dividend requirement or interest has been eliminated.

(3) Inventories.

	1973	1972
First-in, first-out method	$126,988,000	$131,848,000
Last-in, first-out method	110,354,000	84,704,000
	237,342,000	216,552,000
Less — progress billings	35,837,000	30,671,000
	$201,505,000	$185,881,000

Inventories stated on the last-in, first-out method are at amounts which are $37,129,000 and $30,887,000 less than their first-in, first-out values in 1973 and 1972.

(4) Long-term debt and subordinated debentures.

	1973
Long-term debt —	
7½% Term Notes due 1982, $15,000,000 payable annually commencing in 1979	$ 75,000,000
6¼% to 6½% Notes due 1974 to 1979	60,130,000
Variable Rate (currently 8¾%) Notes due December 1, 1975	60,000,000
7¼% Notes due 1979 to 1988	31,264,000
7⅞% Sinking Fund Debentures due 1994, $1,400,000 payable annually commencing in 1975	29,750,000
6½% Sinking Fund Debentures due 1992, $1,350,000 payable annually	25,321,000
7% Promissory Notes due 1989, $1,500,000 payable annually	24,250,000
Other (including $10,726,000 secured by land and buildings) due in various installments to 1984	21,024,000
	326,739,000
Less — current portion	15,832,000
	$310,907,000
Subordinated debentures —	
3½%, due 1992, $3,000,000 payable annually commencing in 1978 (convertible into common stock at $50.88 per share)	$ 51,898,000
6½%, due in annual installments from 1979 to 1983	35,250,000
7%, due 1999, $1,871,000 payable annually commencing in 1989	36,824,000
	$123,972,000

Long-term debt is payable $15,832,000 in 1974, $6,036,000 in 1975, $71,618,000 in 1976, $11,503,000 in 1977 and $42,770,000 in 1978. Interest expense was $37,104,000 in 1973 and $20,618,000 in 1972, of which $19,766,000 in 1973 and $13,649,000 in 1972 was allocated to unconsolidated subsidiaries.

Under the various borrowing agreements, the Company has agreed to maintain minimum amounts of working capital and net worth, and has agreed to certain restrictions with respect to borrowings, purchase and sale of assets and capital stock and payment of dividends. At October 31, 1973, these agreements were complied with and retained earnings of $141,526,000 were not restricted as to payments of dividends.

The Company has reserved 1,020,007 shares of common stock for issuance upon conversion of the subordinated debentures.

(5) Stock options and warrants. At October 31, 1973, 392,627 common shares were reserved for issuance under outstanding options at prices from $12 to $40 per share (options for 93,201 shares were exercisable) and 551,436 common shares were reserved for the granting of additional options. At October 31, 1972, 318,046 common shares were reserved for issuance under outstanding options and 630,539 common shares were reserved for the granting of additional options. During 1973, options to purchase 145,673 common shares were granted; options to purchase 4,522 shares were exercised; and options covering 66,570 shares were canceled.

At October 31, 1973, 395,606 shares of common stock were reserved for issuance under warrants, each of which provides for the purchase of 10.55 shares at $47.44 per share until October, 1978. In addition, 17,705 shares were reserved for issuance under other warrants.

(6) Capital stock. At October 31, 1973 and 1972, the Company's capital stock consisted of the following shares:

	Authorized	*1973*	*1972*
Cumulative convertible preferred stock, $1 par value	15,000,000		
Issued and outstanding —			
$6 series		517,336	517,339
Series B		174,819	175,256
Series C		—	20,922
Common stock, $1 par value	60,000,000		
Issued		32,338,904	32,303,008
Outstanding		23,209,895	22,972,514

The 1972 financial statements and related notes, except for shareholders' equity, have been restated to reflect a 3% stock dividend paid in March, 1973.

The holders of the $6 series preferred stock are entitled to voting rights and cumulative annual dividends at the rate of $6.00 per share. Such stock is redeemable at $100 per share after April 22, 1978, and is convertible at any time into 1.34 shares of common stock. The holders of the Series B preferred stock are entitled to voting rights and cumulative annual dividends at the rate of $3.20 per share. Such stock is redeemable at $80 per share and is convertible at any time into 2.47 shares of common stock. The Series C preferred stock was redeemed in January, 1973. The Company has reserved 1,125,033 shares of common stock for conversion of all preferred shares.

At October 31, 1973, 84,832 shares of common stock were reserved for issuance to employees under a stock purchase plan.

(7) Rentals. Total rental expense was $17,274,000 and $15,559,000 in 1973 and 1972, respectively. Annual rentals under long-term leases are $8,652,000 in 1974, $7,053,000 in 1975, $5,708,000 in 1976, $4,408,000 in 1977, and $3,498,000 in 1978. Aggregate rentals for 1979 through 1983 are $9,413,000, 1984 through 1988 $2,463,000, 1989 through 1993 $758,000, and $1,267,000 in total thereafter.

(8) Pensions. Total pension expense was $15,095,000 in 1973 and $12,982,000 in 1972. The Company contributes accrued pension costs on a current basis. During 1973, the benefits provided under certain plans were increased, and at October 31, 1973, the actuarially computed value of vested benefits for all plans exceeded the total of the pension funds and balance sheet accruals by approximately $56,000,000.

(9) Investments in unconsolidated subsidiaries. Equity in net income of unconsolidated subsidiaries after allocated expenses was as follows:

	1973	*1972*
Equity in net income of —		
Unicoa Corporation (Note 10)	$20,039,000	$11,811,000
Argonaut Insurance Company (Note 11)	18,323,000	17,783,000
Other	(2,037,000)	169,000
	36,325,000	29,763,000
Allocated expenses —		
Interest expense	(19,766,000)	(13,649,000)
Provision for currency translation	(7,125,000)	—
Related income tax credit	15,170,000	8,129,000
	$24,604,000	$24,243,000

Interest expense was allocated to unconsolidated subsidiaries based on Teledyne's cash investment in these subsidiaries of $195,600,000 in 1973 and $184,100,000 in 1972 and cash advances of $3,500,000 in 1973 and $500,000 in 1972. Beginning in 1973, the Company also allocated interest expense to unconsolidated subsidiaries relating to a portion ($49,000,000) of the investment in the Company's treasury stock based on the ratio of its equity represented by its investment in unconsolidated subsidiaries to total equity. Interest rates for allocated interest averaged 8.2% in 1973 and 7.5% in 1972. The provision for currency translation relating to long-term debt was allocated on the same bases as interest expense.

The Company's equity in the net assets of its unconsolidated subsidiaries, including advances, was $204,574,000 in 1973 and $185,274,000 in 1972. The investment in Unicoa has been restated in 1972 to give effect to the difference between Unicoa's cost and book value of treasury stock acquired in prior years.

(10) Unicoa Corporation and subsidiaries. The following condensed statements summarize the consolidated financial position and operating results of Unicoa Corporation and subsidiaries. Teledyne owned 90.2% and 85.1% interests at October 31, 1973 and 1972, respectively.

Consolidated Balance Sheets

	September 30	
	1973	*1972*
Assets:		
Bonds, at amortized cost (market: 1973—$186,000,000; 1972—$164,000,000)	$206,621,000	$186,407,000
Stocks, principally at cost (market: 1973—$49,000,000; 1972—$49,000,000)	56,617,000	53,709,000
Mortgage loans	148,239,000	152,301,000
Real estate, at cost less accumulated depreciation	42,478,000	46,340,000
Loans to policyholders	10,254,000	9,597,000
Cash, including certificates of deposit	22,592,000	6,919,000
Premiums deferred and uncollected	26,187,000	18,068,000
Deferred policy acquisition costs	74,931,000	61,729,000
Cost in excess of net assets of purchased businesses	14,919,000	9,132,000
Other assets	17,132,000	14,364,000
	$619,970,000	$558,566,000
Liabilities:		
Policy reserves and liabilities	$457,233,000	$413,278,000
Notes payable to bank	6,393,000	7,672,000
Mortgage loan payable	9,630,000	10,232,000
Subordinated debentures	22,600,000	22,600,000
Other liabilities	40,468,000	36,755,000
Shareholders' equity —		
Common stock	18,732,000	18,732,000
Additional paid-in capital	1,975,000	1,975,000
Retained earnings	131,890,000	109,879,000
	152,597,000	130,586,000
Less — treasury stock, at cost	68,951,000	62,557,000
Total shareholders' equity	83,646,000	68,029,000
	$619,970,000	$558,566,000

Consolidated Statements of Income

	Year Ended September 30	
	1973	*1972*
Income:		
Premiums and other insurance income	$215,405,000	$191,181,000
Investment income less expenses	23,414,000	18,691,000
Other income	3,156,000	3,317,000
	241,975,000	213,189,000
Expenses:		
Benefits paid or provided	117,299,000	101,555,000
Insurance expenses	93,630,000	85,994,000
Provision for income taxes	8,575,000	6,979,000
	219,504,000	194,528,000
	22,471,000	18,661,000
Loss on Sale of Investments, Less Applicable Income Tax Credit	460,000	936,000
Net Income	$ 22,011,000	$ 17,725,000

Unicoa recognizes revenues from life insurance premiums when they become due and revenues, benefits and expenses on accident and health insurance over the period to which the premiums relate. Deferred taxes are provided for timing differences in the recognition of income and expenses.

During 1973, Unicoa adopted accounting principles prescribed for stock life insurance companies by the American Institute of Certified Public Accountants in December, 1972. These principles require Unicoa to provide policy reserves based on experience rather than statutory formulae and to defer and amortize costs of acquiring new insurance business rather than expensing costs as incurred. The financial statements of Unicoa for 1972 have been restated to give retroactive effect to the adoption of such principles. Previously reported net income for the year ended September 30, 1972 was $14,718,000 and total shareholders' equity at September 30, 1972 was $69,563,000. Teledyne's financial statements have not been restated since its equity in the restatements is not material.

A portion of life insurance company income is not subject to Federal income tax until such amount exceeds certain limitations or is distributed to stockholders as dividends. At September 30, 1973, up to $48,000,000 (at current tax rates) would be required for possible Federal income taxes which might become due, in whole or in part, in future years if any portion of $100,000,000 of the gains from operations since January 1, 1959, becomes includable in taxable income as a result of such limitations, including distributions in excess of $13,000,000 as dividends.

(11) Argonaut Insurance Company and subsidiaries. The following condensed statements summarize the consolidated financial position and operating results of Argonaut Insurance Company and subsidiaries.

Consolidated Balance Sheets

	September 30	
	1973	*1972*
Assets:		
Bonds, at amortized cost (market: 1973–$424,000,000; 1972–$318,000,000)	$405,320,000	$309,036,000
Stocks, at cost (market: 1973–$70,000,000; 1972–$61,000,000)	67,890,000	57,993,000
Agents' balances and uncollected premiums	58,483,000	47,542,000
Other receivables	23,224,000	20,353,000
Deferred policy acquisition costs	25,260,000	22,536,000
Property and equipment, at cost, less accumulated depreciation	12,042,000	11,261,000
Cash	4,864,000	6,822,000
Investment in unconsolidated subsidiary	20,730,000	19,352,000
Cost in excess of net assets of purchased businesses	8,589,000	8,589,000
	$626,402,000	$503,484,000
Liabilities:		
Loss and claim reserves	$281,211,000	$211,341,000
Accrued loss adjustment expenses	46,179,000	34,370,000
Unearned premiums	121,430,000	104,220,000
Accrued income taxes	3,854,000	2,478,000
Other liabilities	32,127,000	28,496,000
Shareholders' equity	141,601,000	122,579,000
	$626,402,000	$503,484,000

Consolidated Statements of Income

	Year Ended September 30	
	1973	*1972*
Income:		
Net premiums earned	$311,033,000	$261,711,000
Investment income less expenses	26,525,000	19,908,000
	337,558,000	281,619,000
Expenses:		
Losses and loss adjustment expenses	248,108,000	198,685,000
Underwriting expenses	77,038,000	66,229,000
Provision for income taxes (credit)	(4,753,000)	195,000
	320,393,000	265,109,000
	17,165,000	16,510,000
Loss on Sale of Investments, Less Applicable Income Tax Credit	220,000	360,000
Income of Consolidated Companies	16,945,000	16,150,000
Equity in Net Income of Unconsolidated Subsidiary	1,378,000	1,633,000
Net Income	$ 18,323,000	$ 17,783,000

The above statements have been prepared on the basis of generally accepted accounting principles which differ from statutory insurance accounting practices. Premium income, policy acquisition costs, and policyholder dividends are recognized ratably over the period to which the premiums relate. Losses and loss adjustment expenses are provided at the estimated amounts necessary to settle outstanding claims. Reserves are provided for catastrophe losses. Deferred taxes are provided for timing differences in the recognition of income and expenses.

The 1972 statements have been restated to reflect Teledyne's contribution of a wholly-owned unconsolidated subsidiary to Argonaut in 1973.

(12) Subsequent events. In December, 1973, the Board of Directors declared a 3% common stock dividend payable April 26, 1974, to shareholders of record February 19, 1974. The Company also offered to buy 4,000,000 shares of its common stock at $14 per share. The offer expires January 28, 1974. The financial statements and related notes have not been adjusted to reflect these events.

This Teledyne Report describes the activities of Teledyne Vasco, originally founded in 1910 as the Vanadium Alloys Steel Company. Teledyne Vasco is one of the largest producers of high speed steel alloys used for tooling in virtually every type of industry to produce products ranging from automobiles and appliances, to aerospace and military equipment.

The company has always been a leader in developing and producing high speed and other tool steels. In addition to the steels discussed in this issue, Teledyne Vasco also makes other highly specialized alloys used for critical applications by many industries. These specialty products include maraging steels, matrix steels, and a number of other proprietary alloys.

For further information on these products, contact Teledyne Vasco, P.O. Box 151, Latrobe, Pennsylvania 15650. Telephone (412) 537-5551.

Teledyne Report, featuring subjects of particular interest from Teledyne activities, is issued on a quarterly basis. Previous topics include:

Energy Crisis in the Computer Room: As the quality of utility electrical power falls off and brownouts and blackouts become more common, the incidence of computer crashes goes up. Solid-state Uninterruptible Power Systems can solve the problem.

Raydist: This ultraprecise electronic navigation system can pinpoint locations at sea with a sensitivity of one and a half feet at ranges of up to 250 miles from base stations.

Welding: One of industry's most versatile production techniques, welding is used in the manufacture of virtually every type of fabricated metal product made today.

General Aviation Engines: Propeller driven aircraft powered by conventional piston engines are not only alive and well more than 30 years after the advent of the jet, they dominate air activity today.

Consumer Electronics: Sparked by the American public's love affair with television, the consumer electronics industry has tripled its sales since 1960, and more growth is predicted through innovations in products and technology.

Rubber: Rubber compounds are being called on to do new technological jobs in applications ranging from industrial tires to Teledyne's new automotive bumper system that will dissipate 5 mile-per-hour impacts.

Loran: Loran was one of the first all-weather electronic navigation systems. Recent Teledyne innovations have lowered costs and greatly improved its range and accuracy.

Seismology: This relatively young science has expanded from the classic study of earthquakes to become an important tool in oil and mineral exploration, detection of underground nuclear explosions and earthquake hazard reduction.

Casting: The simple process a small boy uses when he casts a tin soldier is the basis of a high technology industry that produces items ranging from high temperature turbine blades to 90-ton steel mill rolls.

AIDS: Aircraft Integrated Data Systems keep a running record of the vital functions of the new jumbo jets and provide airlines with an important tool for lowering costs associated with maintenance, fuel management and crew proficiency testing.

Thermoelectrics: Generators that convert heat directly into electricity are providing a practical new power source for applications ranging from space exploration to remote unattended weather stations.

Thin Metals: Less becomes more when space-age metals are rolled out into thin strip and foil. These new materials, already being used in thousands of products, are making new metal-working techniques possible.

The Reproduction of Music: Men began experimenting with methods of recording sound over 150 years ago, but it remained for electronics and some very recent developments to allow music to be reproduced with concert-hall realism.

The Crowded Spectrum: The lower portion of the radio spectrum is already overcrowded with hundreds of wireless services. Microwave devices such as the traveling wave tube are opening higher frequencies for practical use.

Science and Cinematography: Modern techniques of slow motion cinematography let scientists and engineers analyze actions and events that happen too fast for the eye to follow.

Superalloys: Materials that retain high strength at temperatures approaching 2000°F make the jet age possible.

Jets of Water for Dental Health: Studies show that high-pressure pulsed jets of water are a valuable aid in the care of teeth and gums.

The Last Eight Miles: The controlled descent to the surface of the moon was accomplished through use of a century-old principle called the Doppler effect.

TELEDYNE, INC.

Board of Directors

HENRY E. SINGLETON, *Chairman*

ROBERT C. JACKSON

GEORGE KOZMETSKY

GEORGE A. ROBERTS

ARTHUR ROCK

CLAUDE E. SHANNON

Officers

HENRY E. SINGLETON,
Chief Executive Officer and
Chairman of the Board of Directors

GEORGE A. ROBERTS, *President*

ROBERT S. BELL, *Vice President*

A.V. HOLMLUND, *Vice President*

FREDERICK A. KAUFMAN, *Vice President*

RUSSELL L. KIERNAN, *Vice President*

LEO W. KILLEN, *Vice President*

JAY T. LAST, *Vice President*

G. WILLIAMS RUTHERFORD, *Vice President*

TECK A. WILSON, *Vice President*

JERROLD V. JEROME, *Treasurer*

THEMISTOCLES G. MICHOS, *Secretary*

Corporate Offices

1901 Avenue of the Stars

Los Angeles, California 90067

Transfer Agents

Bank of America

111 West Seventh Street

Los Angeles, California 90014

United States Trust Company of New York

45 Wall Street

New York, New York 10005

Registrars

Security Pacific National Bank

124 West Fourth Street

Los Angeles, California 90013

First National City Bank

111 Wall Street

New York, New York 10015

TELEDYNE, INC.
1901 Avenue of the Stars
Los Angeles, Calif. 90067