
MESSER GRIESHEIM
MESSER GRIESHEIM 1970

MESSER GRIESHEIM GMBH — a Member of the Hoechst-Group

MESSER GRIESHEIM 1970 REPORT

WELDING TECHNOLOGY
CRYOGENICS
INDUSTRIAL GASES

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Cover photo: color vision—valves on reversing exchanger of an air separation plant model.

Messer Griesheim 1970

Messer Griesheim, one of the member companies of the Farbwerke Hoechst group, operates in the fields of industrial gases, welding products, and cryogenics.

The 1969 economic boom continued in 1970 and, in some areas, even surpassed expectation.

The industrial gas plants were producing to the limit of their capacity and it was not until the fourth quarter that the demand fell off somewhat. The manufacturing plants, producing welding and cutting torches, machines, and accessories, as well as low temperature process plants, were struggling under the heavy work load.

Due to unprecedented demand for a number of welding products, it was not possible to reduce the long delivery times during the first half of 1970. Also, until the middle of the year, raw material deliveries for the manufacturing plants could not be obtained in sufficient volume to meet market demand for finished products. The raw materials situation started to improve during the fourth quarter of the year.

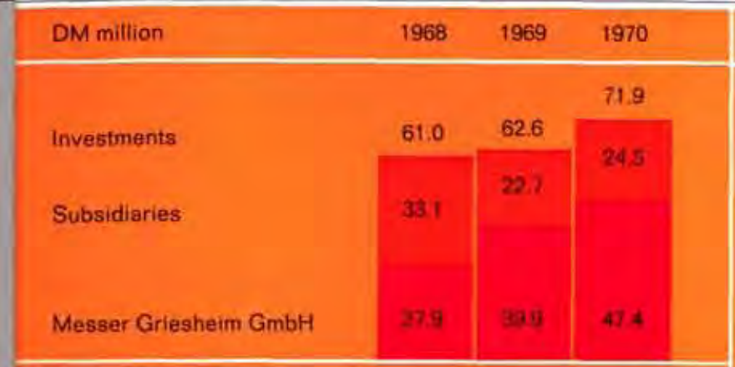
Consolidated sales, including Added Value Tax, were DM 531.9 million, i.e. 24 % higher than during the previous year. Domestic sales amounted to DM 436.3 million, and foreign sales to DM 95.6 million.

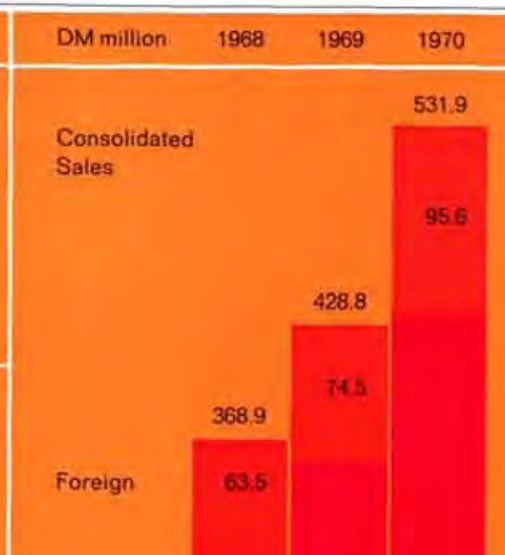
In 1970, Messer Griesheim invested a total of DM 71.9 million, of which DM 37.0 million were financed from depreciations.

In view of the conditions prevailing in the financial market, the long range investment plan was revised but most of the investments planned for 1971 remain unchanged.

DM 24.4 million were spent on technical development. This amount breaks down into spending on research as well as development (D), applications (A), design (Dn), and testing (T.). In the Autumn of 1970, the order backlog of the Welding and Cryogenics Divisions broke all previous records and by the year's end amounted to DM 83.3 million.

MESSER GRIESHEIM in Figures





*) D = Development; A = Applications; Dn = Design; T = Testing.

Consolidated Annual Statement

The consolidated annual statement includes domestic subsidiaries.

With the vigorous business expansion an increase in the balance sheet totals went along. The structure of the balance sheet remained unchanged. The long-term capital (stockholders' equity and long-term liabilities) covers the fixed assets and part of the inventories. Along with approval of the balance sheet, management will seek the approval of the stockholder committee for an increase in capital stock by DM 15 million to DM 75 million and for a charge-over in debts from current to long-term liabilities amounting to DM 20 million.

The overall performance exceeds sales proceeds by increased inventory of products and by activated interdivisional services (in particular the supply of coldboxes for the Industrial Gas Division by the Cryogenics Division). The personnel costs include wages and salaries as well as social security payments and expenditures for pension and benefits. The personnel expenditure per employee has increased by about 50 % over the past five years.

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Balance Sheet

Assets	DM*)	%	Liabilities	DM*)	%
			Stockholders' equity	99.5	22.1
Tangible fixed assets	223.4	49.7			
			Long-term liabilities	178.6	39.9
Financial assets	5.5	1.2			
Inventories	101.7	22.6			
Short-term accounts receivable and other current assets	118.8	26.5	Current liabilities	171.3	38.1
Total	449.4	100.0	Total	449.4	100.0

Statement of Income

Statement of Income	DM*)	%
Total sales	500.6	100.0
Cost of goods sold	209.7	41.9
Gross profit	290.9	58.1
Other income (net)	3.8	0.8
Adjusted gross profit	294.7	58.9
Personnel cost	130.9	26.2
Depreciations	36.0	7.2
Interest	22.6	4.5
Other costs	82.2	16.4
Total expenditures	271.7	54.3
Profit before taxes	23.0	4.6
Taxes on income and property	7.7	1.5
Net income	15.3	3.1
Reserves	3.0	0.6
Adjusted net income	12.3	2.5

*) Millions of DM

Employees

At the end of 1970, Messer Griesheim had 6,165 employees, 5,947 working for Messer Griesheim GmbH and 218 for the subsidiaries. Compared to the previous year, the number of employees in 1970 increased by 11 %. This increase was partially due to assimilation of the personnel of PECO Schweissmaschinen GmbH. The proportion of employees from foreign countries in the German factories, 11.5 % as an average, hardly changed.

During the past business year, many employees celebrated long-term employment anniversaries. On December 31, 1970, one out of every three employees had been with the company for ten years or more.

By the end of the year, 219 apprentices were enrolled in vocational training programs and a new, modern training workshop had been opened at the Völklingen factory. Additional vocational education for adults was also promoted in many ways. In particular, there were advanced seminars for members of the sales staff, as well as for foremen and safety engineers, all of which brought great response.

Testing of control unit of SICOMAT flame cutting machine. Skill, experience, and conscientiousness of Messer Griesheim's employees ensure product quality.

Supervisory Board, Board of Management, Officers

Supervisory Board
Georg Janning, Chairman
Carl Hans Barz, Vice Chairman
Theodor Geuss
Max Edgar Klee
Karl May
Thea Messer
Elisabeth Nitsche, elected March 3, 1971
Hans Röder, deceased November 13, 1970
Manfred Schmidt
Helmut Wagner

Board of Management
Hans Messer, President
Ernst-Adolf Gold
Hans H. Kämpny
Hans Ludwig
Gerd Grabhorn

Officers
Klaus Baumgärtner
Richard Bechtle
Heinz Günther Brandt
Alexander Decker
Paul-Otto Gehlhoff
Hellmut Grosser
Hans Hermann Grube
Hans Heberer
Hans Joachim Henning
Ernst A. Rische
Manfred Voss

Indispensable for manufacturers of fluorescent lamps: re-purified rare gases and mixtures, supplied by Messer Griesheim.

Organization

Based on product lines, Messer Griesheim is divided into three divisions: Welding and cutting, Cryogenics, and Industrial Gases. In addition to these divisions which operate as profit centres, there are corporate departments with centralized functions: personnel and social, accounts and finance, and materials management. Their coordinating activities extend through the three divisions.

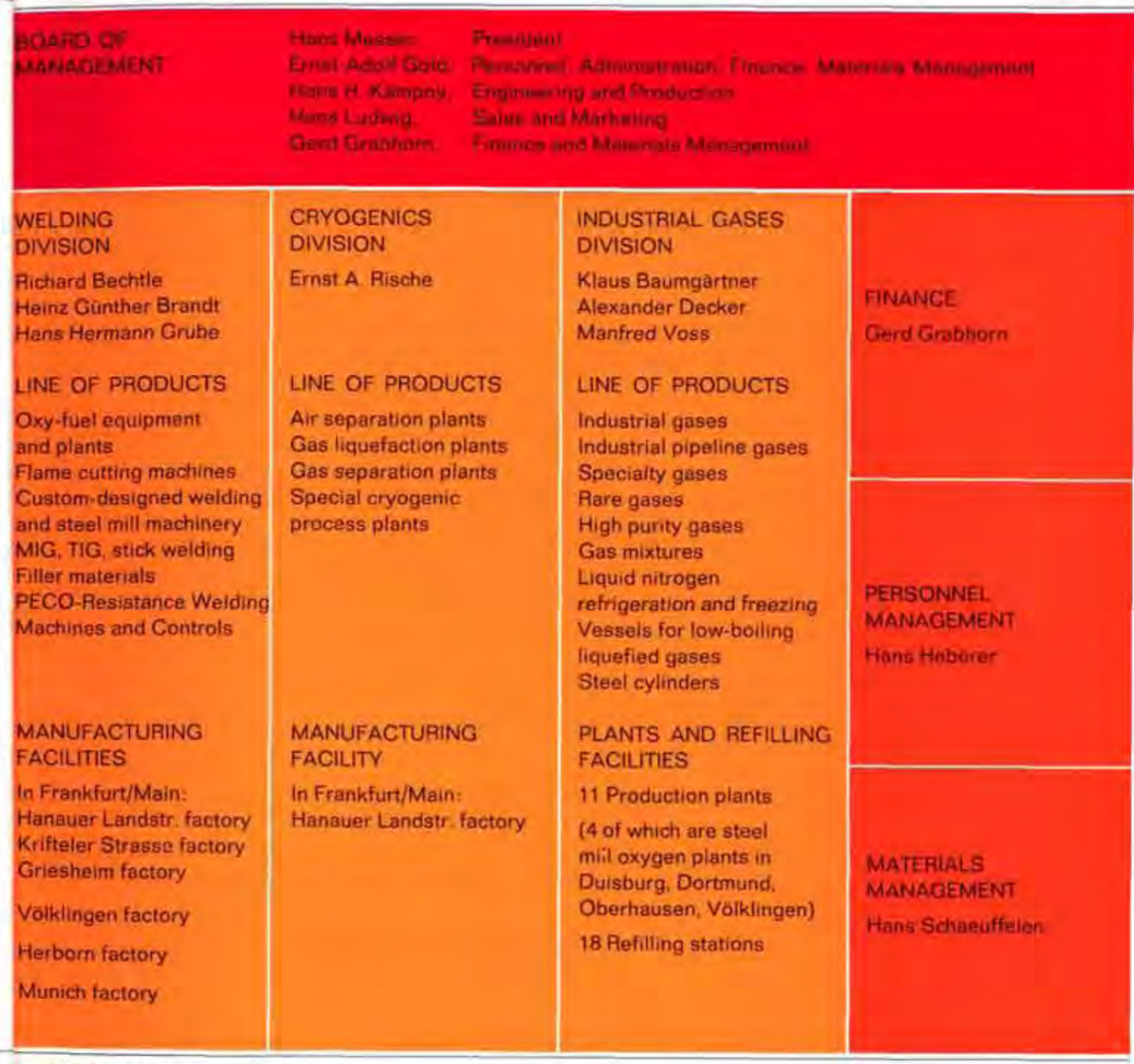
Each division combines all functions essential to business operation: research and development, design, as well as production and marketing.

Besides the three factories in Frankfurt, the Welding Division has production facilities in Herborn, Völklingen, and Munich. The manufacturing facilities of the Cryogenics Division are concentrated at the Hanauer Landstrasse complex in Frankfurt.

The Industrial Gases Division has twenty-nine locations: eleven production plants—four of them steel mill oxygen plants—and eighteen refilling stations.

The domestic sales organization of the Welding Division is divided into four sales regions with a total of twenty-one sales offices and five distributors. For the sale of its products in Germany, the Industrial Gases Division utilizes the facilities and services of approximately five hundred distributors.

In foreign countries all over the world, the three divisions utilize the sales organization of Farbwerke Hoechst AG. In all countries where Messer Griesheim is not represented by its own affiliate, the subsidiary of the parent company takes care of the business, either through its own special department or through representatives.



Hüttensauerstoff GmbH (Hüsa) and Oxysaar Hüttensauerstoff GmbH are active in the financing and construction of air separation plants and industrial gas pipelines. Hüsa's capital stock of DM 20 million is entirely owned by Messer Griesheim GmbH. Of Oxysaar's DM 2 million capital stock, Saarbergwerke AG holds 25 % and Messer Griesheim GmbH 75 %. Hüsa's and Oxysaar's production plants are leased to Messer Griesheim and are operated by the Industrial Gases Division. While the supply of oxygen to the steel mill industry is of principal importance, the significance of nitrogen and oxygen deliveries to the chemical industry is growing.

In Great Britain and the Netherlands, Messer Griesheim is represented by wholly owned subsidiaries and in France and Switzerland by companies in which Messer Griesheim holds a controlling interest. In connection with the expanding business of Messer Griesheim Nederland N.V., the capital was increased by 200,000 Florins within the approved capital of one million Florins.

Messer Griesheim International Comp.mbH is a holding and finance company, managing the assets of Hydroxygen Ges.mbH and Leonarc Ges.mbH in Austria. Hydroxygen produces industrial gases and manufactures oxy-fuel equipment; Leonarc is an electrode manufacturer.

Messer Mexicana S.A. has been renamed Messer Griesheim de Mexico S.A. and its capital increased to 1.2 million Mex.Pesos, one half of which is owned by Quimica Hoechst de Mexico S.A., and the other half by Messer Griesheim GmbH. The company holds a controlling interest in Electrodos y Aleaciones "CyS" S.A. (EyA), a manufacturer of welding electrodes and oxy-fuel equipment in Mexico. For 1971, the manufacturing program of EyA is scheduled to be expanded to include gas-shielded welding equipment and resistance welding machines.

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Farbwerke Hoechst AG 66⅔% Messer Industrie GmbH 33⅓%

Messer Griesheim GmbH

Hüttensauerstoff GmbH Düsseldorf	100%	75%	Oxysaar Hüttensauerstoff GmbH Saarbrücken
Messer Griesheim Ltd. London/Great Britain	100%	55%	Schweißtechnik AG Zurich/Switzerland
MesserGriesheim Nederland N.V. Amsterdam/Netherlands	100%	51%	Hydroxygen Ges. mbH Gumpoldskirchen/Austria
Messer Griesheim International Comp. mbH, Chur/Switzerland	100%	50%	SIG Sauerstoffwerk Frankfurt GmbH Frankfurt am Main
Messer Griesheim SA Paris/France	78%	50%	Messer Griesheim de Mexico S.A. Mexico D.F./Mexico
		33⅓%	Carburos Messer Griesheim Gases Industriales, S.A., Barcelona/Spain
		26%	Leonarc Ges. mbH. Leonstein/Austria

New Production Facilities

The assets and business of PECO Schweissmaschinen GmbH were purchased by Messer Griesheim in 1970. The factory in Munich is operated under the name PECO Elektro-schweisstechnik as a department of the Welding Division. In addition to the previous PECO program of micro-resistance welding and electronic controls, this new department is also responsible for the line of standard resistance welding machines which Messer Griesheim formerly manufactured in Frankfurt.

In mid-1970, the new factory at Völklingen/Saar began manufacturing components for the Welding Division. In 1971, its facilities will be expanded for the production of complete arc welding units. The Krifteler Strasse factory in Frankfurt is undergoing modernization and will become a mass production facility for oxy-fuel equipment.

Now that the Herborn factory has been expanded for the production of small cutting machines, the Hanauer Landstrasse factory will have more capacity available for manufacturing medium-size and large cutting machines and cutting systems, as well as custom-designed welding and cutting machinery. This expansion became necessary mainly due to the 40 to 60 % annual rate of increase in the STATOSEC and SICOMAT lines.

In the steel mill oxygen plant Oberhausen which is located on the grounds of Ruhrchemie AG at Oberhausen-Holten, the second electronic-controled tonnage plant was started up. This plant now has a total hourly capacity of 2,230,000 scf (2050 t/day) oxygen, 1,680,000 scf (1350 t/day) nitrogen, and 45,000 scf (51 t/day) argon. In mid-1970, construction was started on the new factory site at Bremen-Ihlpohl. At the present time, foundations and buildings for an air separation plant are under construction. The expansion of the industrial gas plant Hüttental-Weidenau will be completed in the Spring of 1971.

During the past business year, installations for liquefaction of hydrogen and helium and for generation of acetylene went into operation at the industrial gas plant in Frankfurt.

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The VARIOMIG system proved a success: the right gas-shielded welding system for any welding application—assembled from a few components. The rising demand was met by expanding the facilities of the Völklingen manufacturing facility.

Industrial Gases Division

In 1970, the Industrial Gases Division increased its sales by 13.4 % to DM 243.5 million. This was made possible mainly by the expansion in production capacity of the steel mill oxygen plants. Messer Griesheim's large production capacity practically guarantees each customer's supply. The particularly large increase in supply of oxygen through pipelines is due to the expansion of the pipeline network.

The economical delivery of liquefied gases to consumers was also improved in 1970. Consumers installed several hundred storage facilities, using regasifiers and stationary tanks manufactured by Messer Griesheim. The fleet of tank trucks for transportation of liquefied gases by road and rail was increased to 250.

New products—such as liquid hydrogen, hydrocarbon gases and radioactively tagged gases and gas mixtures—complement the sales program of the Industrial Gases Division.

Of growing significance is the OXISORB® system for the removal of minute traces of oxygen and other contaminants from gases. Large companies, who have central supply systems for high purity gases, operate stationary OXISORB® purification systems in combination with driers to assure the highest purity gases.

New processes and products are the goal of research and development teams and applications engineers. The applications department with its far-reaching programs takes on any problem which could be solved more economically by the utilization of industrial gases. This includes the development of special processes for pollution control.

A large fleet of modern tank trucks ensures safe and dependable transportation of industrial gases produced by Messer Griesheim.

The Growing Pipeline Network

Modern methods of distribution contribute to economizing the supply of products. To an increasing extent, large consumers of oxygen and nitrogen are supplied direct from the producing plant through pipelines. The consumptions required by several connected customers are combined in a pipeline network and supplied by plants of optimum capacity. For customers with large consumption this is the most economical supply method.

Messer Griesheim's own long-distance oxygen pipelines, totalling about 160 miles, in the Ruhr area and other heavily industrialized regions, supply the steel and chemical industries. A capacity of 5,600,000 scf (5150 t/day) per hour of oxygen is presently available to Messer Griesheims's connected customers. Also connected to the long-distance pipelines are large oxygen plants operated steel mills and chemical companies for their own production (see pipeline routing plan, pages 56 and 57).

The use of nitrogen as an inert gas is increasing in the chemical and petroleum industries. To satisfy this growing requirement and at the same time meet the demand of the metal working and glass producing industries, Messer Griesheim is expanding the long-distance nitrogen pipelines.

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Oxygen distribution and metering station of a steel mill oxygen plant.

Variety and Quality

The demand for rare and specialty gases is continuously growing in variety and extent. Therefore, in 1970, Messer Griesheim again added numerous new products to its program.

Liquid hydrogen and helium have become items of topical interest. New installations for the liquefaction of these gases were started up at the industrial gas plant in Frankfurt. Liquefied hydrogen and helium are transported in super-insulated shipping containers and special tankers.

The semiconductor industry is an important consumer of highest purity gases which must be free of oxygen. Therefore, OXISORB® gas purification systems are of particular significance for this field of application. In cooperation with Knapsack AG, doping gases such as diborane and silane are produced for the semiconductor industry.

Radioactive gaseous isotopes are another adddition to the sales program of the Industrial Gases Division. The use of radioactive isotopes is of interest to many areas of research in natural science and industry.

Highly sophisticated analytical and measuring instruments guarantee an always constant, certified quality of the many products.

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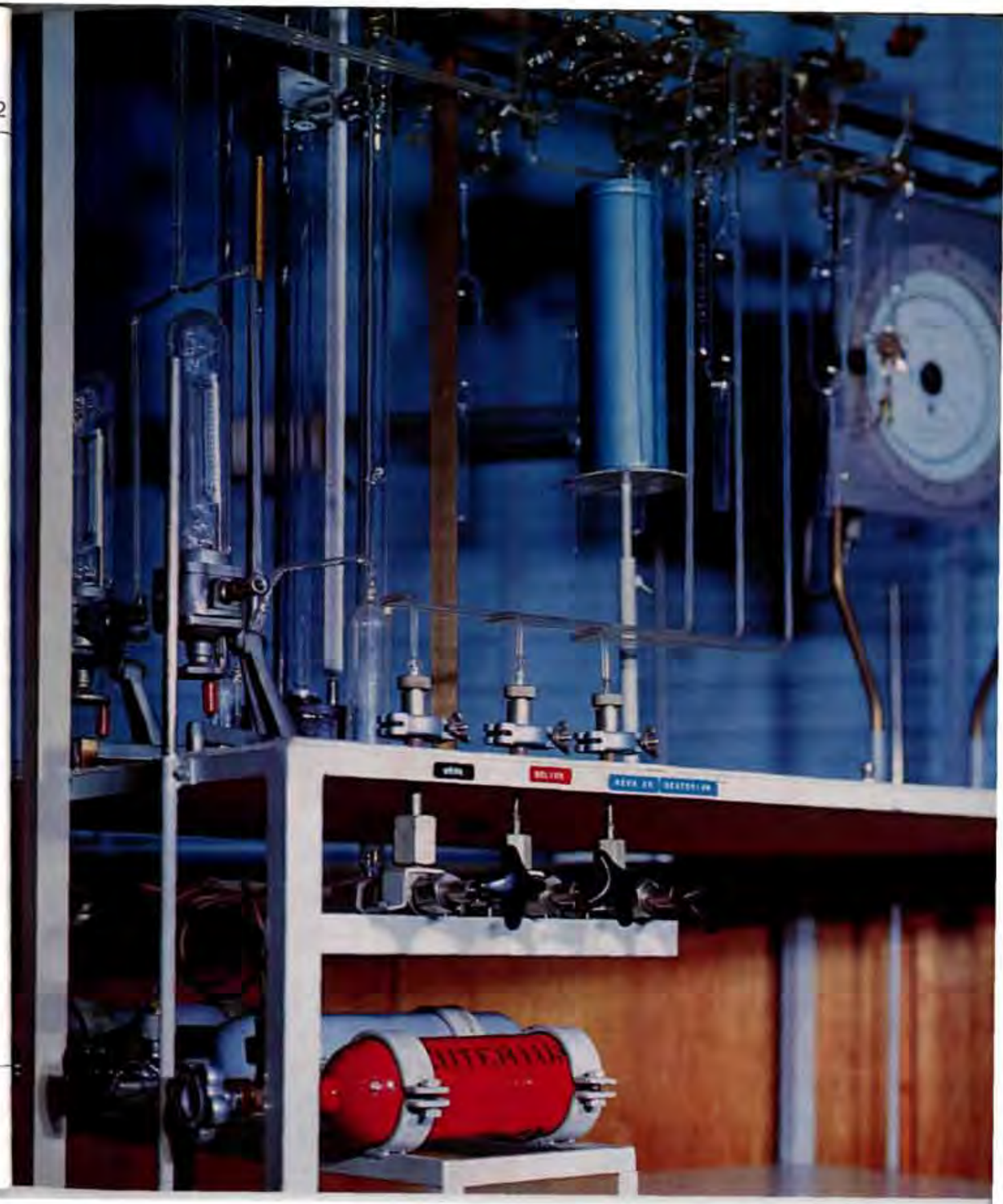


Filling device for re-purified gases and stable isotopes which are available in various degree of purity and numerous mixtures.

Gas Mixtures - an Inexhaustible Field

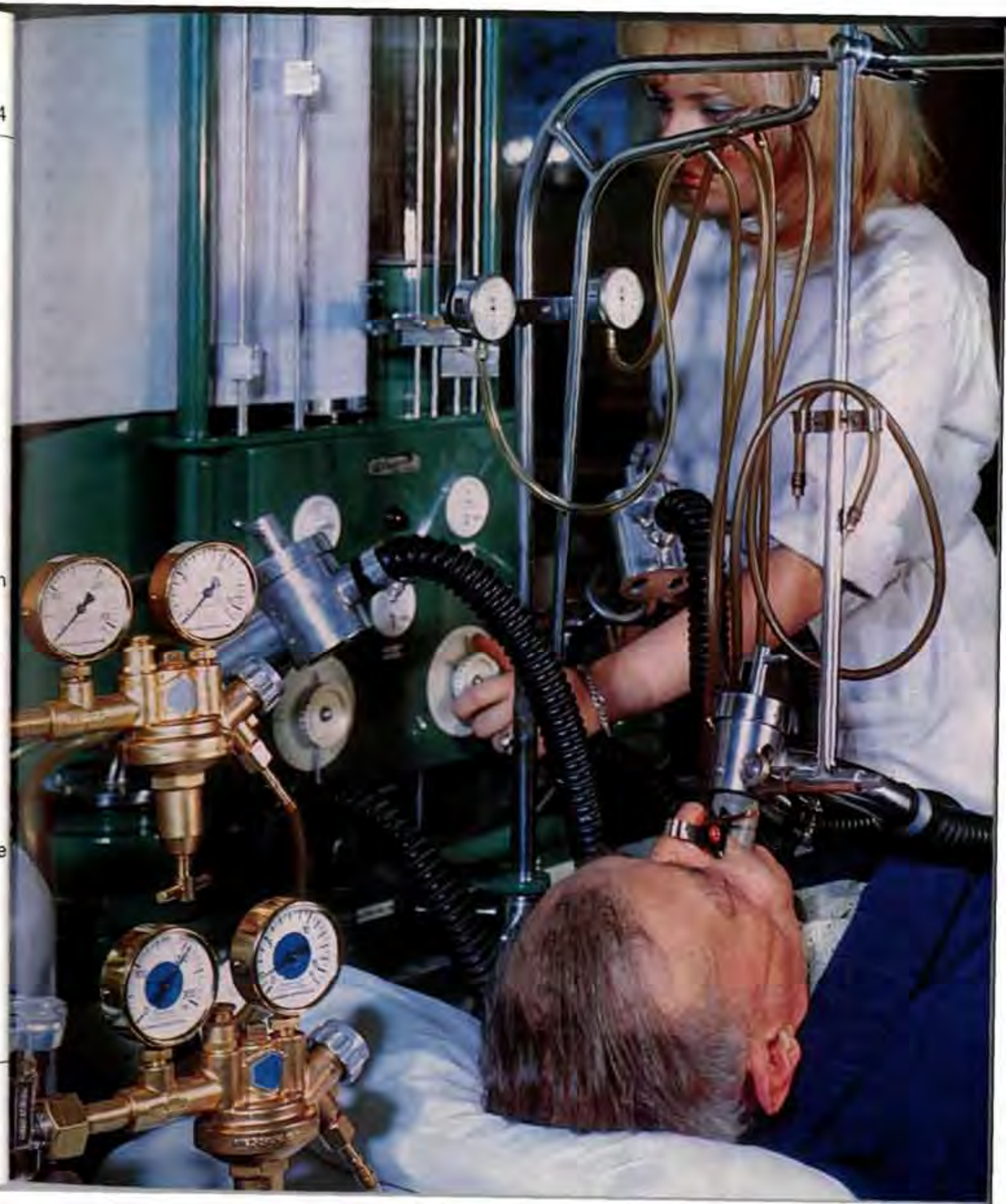
Highly purified component gases must be used for the production of gas mixtures. Messer Griesheim offers gas mixtures containing a multitude of components. The exact composition of the gas mixture is determined by precision analysis and certified by an analysis certificate.

Unless ruled out for reasons of safety or chemical incompatibility of the components, any desired gas mixture can be supplied. Mixtures for technical applications, respiration and other medical applications, biological applications, instrumentation, and special mixtures for the lighting industry are just examples of the broad range of products available.

Messer Griesheim is the first company in Germany to produce gas mixtures with radioactive components. In cooperation with the radio-chemical laboratory of Farbwerke Hoechst, the gaseous radioactive isotopes tritium and krypton 85 can be added in the desired concentration to all rare gases, hydrogen, nitrogen, and carbon dioxide.

Radioactive gas mixtures are particularly suited for application in the lighting industry. They improve the properties of various gas-filled discharge lamps. They are also used as tracers in determining flow distributions, in leak detection, and in medical science.

Gas mixtures and pure respiratory gases are used for diagnostic and therapeutic purposes. Together with Farbwerke Hoechst AG, Messer Griesheim is working on new potential applications for highest purity gases and rare gases in medical technology.



Shielding Gases for Welding

For economic reasons, manual and automated gas-shielded welding are becoming more and more popular. In TIG and MIG/MAG welding*) the electric arc and the weld pool are shielded from the surrounding atmosphere by a protective gas jacket.

There are inert and active shielding gases. Among the inert shielding gases are the rare gases argon and helium. Some of the active gases are carbon dioxide, hydrogen and oxygen. The individual properties of the inert and active shielding gases can be utilized to achieve optimum shielding gas properties by mixing various components.

For MAG welding, shielding gas mixtures of argon with oxygen or carbon dioxide and, in some instances, triple-component mixed gases have become widely accepted. Special welding problems can be solved by means of Messer Griesheim's argon mixtures ARGOMIX®, KRYSAL® or Corgon.

In gas-shielded welding the combination of wire and gas plays an important part. Through extensive development and application work Messer Griesheim has established the prerequisites to solving even difficult welding problems. Gas-shielded welding is used mainly in machine fabrication, steel construction, shipbuilding, vessel and container fabrication, as well as in the automobile industry.

For large consumers of shielding gases it may prove beneficial to mix the gases at the consumption site. Gas mixing units of various capacities have been developed for this purpose. They keep the composition of the shielding gas constant regardless of fluctuating consumption.

*) TIG = Tungsten-Inert-Gas; MIG = Metal-Inert-Gas; MAG = Metal-Active-Gas

Regasifier for liquefied gases. Above a certain consumption rate, it is much more economical to use liquefied gas which assumes only a fraction of its gaseous-state volume, than to use gas from steel cylinders.

New Processes for the Application of Gases

The applications department is working on new potential applications for gases. Various examples show that many new production processes and methods could be developed and implemented only through the use of gases.

Messer Griesheim designed oil-oxygen burners for increasing the smelting capacity in industrial furnaces. By burning gases at high velocities at extremely high temperatures it is possible to shorten considerably the smelting time in metallurgical furnaces.

The development of the rubber deflashing process progressed through extensive testing. In an automatic installation formed parts of rubber and plastic are quickly cooled to embrittlement temperature by means of liquid nitrogen. Thus, the time required for deflashing is considerably reduced as compared to the customary methods. The very cold nitrogen causes embrittlement of all types of rubber, including the rubber mixtures less susceptible to low temperatures which are preferred by the automobile industry. This method does not affect the life of the deflashed parts.

During heat treatment of metals, atmospheric oxygen causes surface oxidation and edge decarbonization on the annealed material. To achieve better quality, annealing takes place under an inert or reducing shielding gas atmosphere. Nitrogen of high purity or mixtures of nitrogen and hydrogen are replacing the shielding gases previously generated by partial combustion or ammonia decomposition. Depending on the volume needed, the nitrogen/hydrogen shielding gas is supplied ready-mixed or is mixed by the consumer by means of automatic mixers.

Oil-oxygen burner: Flame is up to 6-½ feet long and reaches temperatures of 3600 to 5400° F.

Flash-Freezing and Intransit Refrigeration

CRYOGEN®-Rapid is a process for flash-freezing foods with liquid nitrogen. The freezing installation consists of a well-insulated tunnel, a built-in food conveyer, a spraying device and a nitrogen tank.

After only a few minutes, foods frozen by the CRYOGEN®-Rapid process reach the desired low temperatures. Nitrogen does not affect color, taste or flavor. The inert nitrogen atmosphere prevents oxidation of fats and flavorings. Thus, the quality of flash-frozen foods is fully maintained, even after defrosting.

Messer Griesheim's refrigerated shipping system CRYOGEN®-Trans has been found dependable and economical even on hot summer days. This simple, reliable system provides refrigeration for perishable goods by spraying liquid nitrogen into the refrigeration compartment of the vehicle. Since the refrigeration is immediately available, the cargo space can be cooled to the required temperature within a very short time. The combination of refrigeration and inert shielding gas atmosphere protects the quality of the goods being shipped.

CRYOGEN®-Trans has passed the test of severe competition from conventional refrigeration processes, both in local distribution service and in long-distance trucking. In Germany hundreds of refrigerated vehicles equipped with CRYOGEN®-Trans are in service. The extensive network of service stations for liquid nitrogen available to long-distance transporters is continually being expanded.

For the first time in Germany Messer Griesheim utilized liquid nitrogen to provide an optimum storage atmosphere in order to increase the storage life of fruit.

A considerable amount of applications work is aimed at the development of products and processes for environmental control.

Ozone performs very well in waste water and sewage treatment. By means of the patented OZ ozonator, ozone can be produced from the air as well as from pure oxygen. Ozonization is used to produce crystal-clear drinking water, to sterilize swimming pool water and in sewage treatment.

Due to the continually growing rubbish disposal problem, incineration of waste materials is becoming more important. Messer Griesheim has developed a process in which the air in rubbish incinerators is enriched with oxygen. The resultant combustion temperatures are so high that even materials with low calorific value will burn up into harmless residue.

For the problem of emission and immission control, a number of specially developed test gases are available. This includes in particular test gases for the calibration of gas analysers which are used in checking motor vehicle exhaust fumes in accordance with various American and European tests.

Due to its patented electrode arrangement, Messer Grieheim's OZ ozonator is capable of producing considerably more ozone per tube length. It also requires less power and space than conventional ozonators.

Welding Division

Sales of the Welding Division increased by 36.1 % to DM 195.7 million due primarily to the improved economic development in the steel and iron working industry.

When the market settled down toward the end of the business year the incoming orders stabilized at a high level. Expansion of production capacities and commissioning of new manufacturing facilities has improved the delivery situation.

The necessity for higher productivity in many industrial countries increased the demand for semi-automatic and automatic equipment and machinery. Therefore, Messer Griesheim is paying special attention to the requirements of this particular market.

Parallel to the expansion of production and warehouse facilities the distribution and customer service organization was enlarged. To an increasing extent, industrial supply houses are taking part in the distribution of standard welding products. In this connection, a special program of personnel training, publicity and other appropriate measures will be put into effect in 1971. Simultaneously, additional technical personnel will be hired to reinforce the consulting teams for the distribution of specialty products.

Economical fabrication of mass-produced welded parts is possible only through automatic welding. Within seconds this multiple spot welding machine cuts, aligns, and bends wires and welds them to sheet metal facings to form seatback frames.

Welding Under the Microscope

Micro-resistance welding, unknown ten years ago, is now a familiar practice in the electrical, precision-mechanical and optical industries. It was space travel that provided the decisive impulse for the rapid development of micro-joining. The satellite program required electrically sound but crownless joints of metal wires finer than a woman's hair. Micro-resistance welding provided the solution to this problem.

Currently, micro-resistance welding is used for fabrication of electric and electronic modules and circuits where metallic materials of the greatest variety of alloys must be joined. In addition to mechanical precision, accurate setting and control of the welding energy is a prerequisite to micro-resistance welding. Messer Griesheim's micro-resistance welding systems work extensively with line voltage compensation or by the impulse process through storage capacitors. For special applications, it is possible to use a direct current power source.

Plasma micro-welding systems are used for welding of extremely thin foils and wires. Due to current stabilization on main and auxiliary arcs and because the required current can be accurately set and reproduced, it is possible to perform extremely exact welds on thicknesses ranging from 0.002 to 0.02 inches.

Messer Griesheim's department PECO Elektroschweisstechnik in Munich is researching the wide field of applications open to micro-resistance welding.

PECO micro-resistance welding machines are used mainly in the fabrication of electronic modules and electrical equipment for joining the most dissimilar metals down to a thickness finer than a woman's hair (20 mμ).

Oxy-Fuel Torches - the "New Generation"

The welding and cutting torches of the "New Generation" are technically outstanding tools for the classic oxy-fuel joining and cutting processes. Careful selection of materials and new internal design features, as well as clean and functional appearance, make welding easier for the operator. Maintenance is reduced to a minimum and requires no special skills. By variable combinations of their components, the torches can easily be adapted to different code regulations and various customer requirements in any country.

The ESSEN torch, already well-established in the industry, has been supplemented by several variations. A torch with an upright handle, particularly suitable for shipyard use, complements the ESSEN line.

The STARLET welding and cutting torch is a new and technically sophisticated design. Valves no longer protrude from the handle and get in the way whenever pipes must be welded on the wall. Instead, maintenance-free valves without stuffing boxes are recessed into the handle. Special welding attachments provide the soft flame preferred by the pipe welder. It does not penetrate through the weld bed or blow the liquid metal out of the joint. Flexible welding attachments were developed for welding in confined spaces. Hand tightening of the union nut is sufficient to ensure a good gas-tight fit between the shaft and the cutting or welding attachment.

The gas supply hoses were made invisible by trick photography. Even the "New Generation" oxy-fuel torches do need oxygen and fuel gas.

Requirements of strength, corrosion resistance and electrical properties of materials have become ever more exacting. Industrial fabrication uses more and more stainless steel as well as nonferrous metals and special alloys. Conventional fabricating methods are unsatisfactory and uneconomical for these materials. Therefore, Messer Griesheim developed the art of plasma welding and cutting to a high degree of technical perfection.

Plasma torches were also redesigned in 1970. The new torches are slim and compact. In spite of their small size they are ruggedly built and suited for continuous operation. Gas and energy consumption are low and there is little development of smoke. Intense focusing of the plasma jet results in high cutting capacity with narrow kerf and clean, parallel edges.

Messer Griesheim's PCW 100 plasma unit for cutting up to 1-$^1/_2$" and welding to $^1/_8$" fills a gap in the line of equipment available on the market. This reasonably priced unit has opened the doors of small and medium size shops in the sheet metal working industry to plasma welding and cutting. Plasma cutting systems developed specifically for shipbuilding and vessel fabrication are models PC 250 and PC 500 which may be combined with Messer Griesheim guide carriages. The cutting range is from $^3/_{32}$" to 4".

In spite of its size, the PCW 100 torch is eminently suited for mass production. This photograph shows the FG 4 cutting machine with plasma torch cutting gear wheels from stainless steel plate.

Flame Cutting with Numerical Control

OMNIMAT® and SICOMAT numerically controlled flame cutting machines, built by Messer Griesheim for more than ten years, are well-known throughout the world. The one hundredth cutting system with numerical control will be in operation shortly.
The advantages of numerically controlled flame cutting machines are numerous. As compared to machines with photo-electric control, the data carriers can be produced faster, more accurately and more economically. In the shipbuilding industry in particular it is possible to increase production efficiency further by the addition of computers.

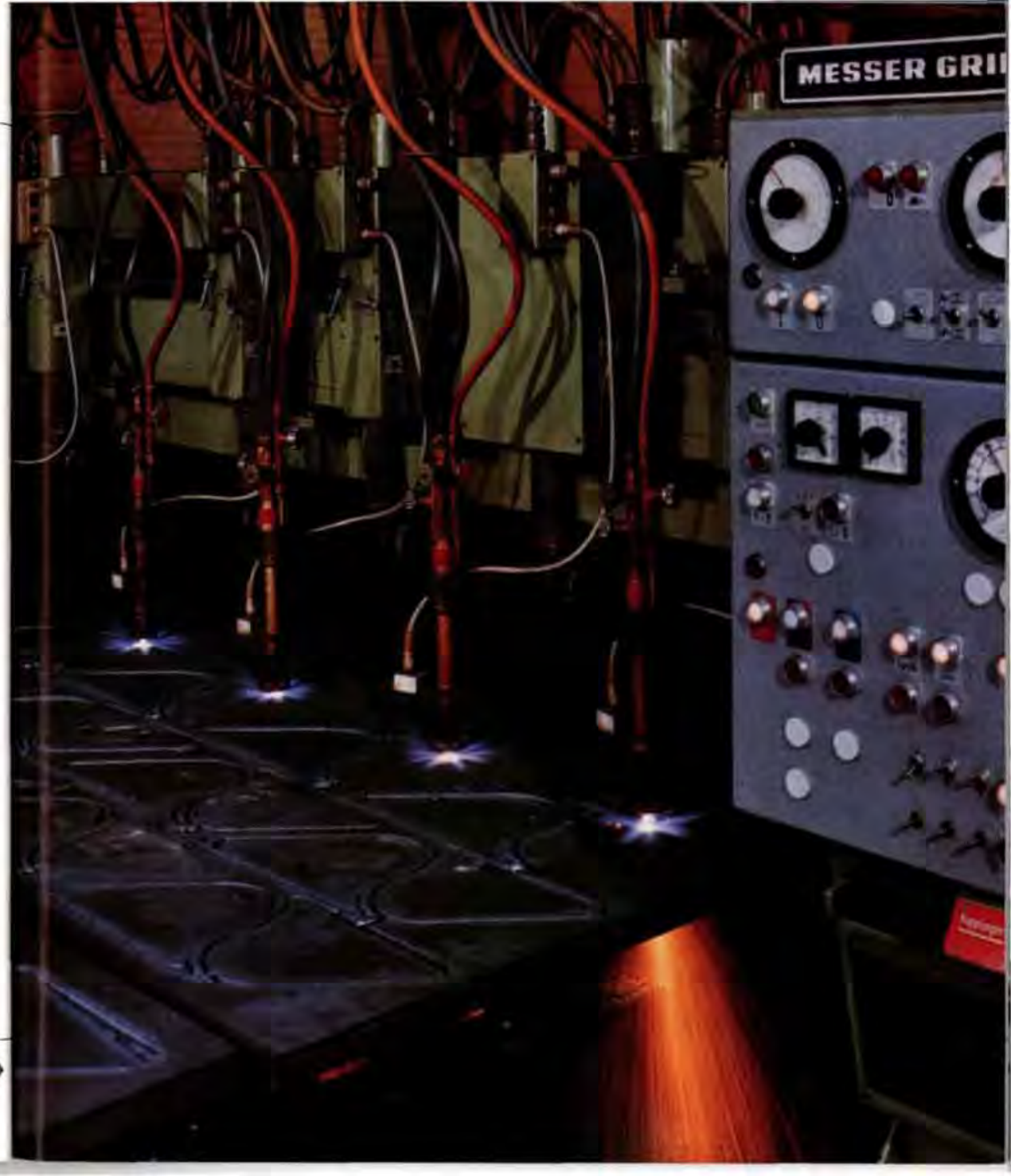
The range of applications is diversified by the use of various tools. Automatically rotating triple bevel units are used for single-pass plate edge preparation on parts of any shape. Plasma torches are used on stainless steel and non-ferrous metals. Electro-pneumatically operated marking tools automatically mark weld locations and bending lines and punch centering points for subsequent drilling which results in reduction of man hours, transportation times and related costs.

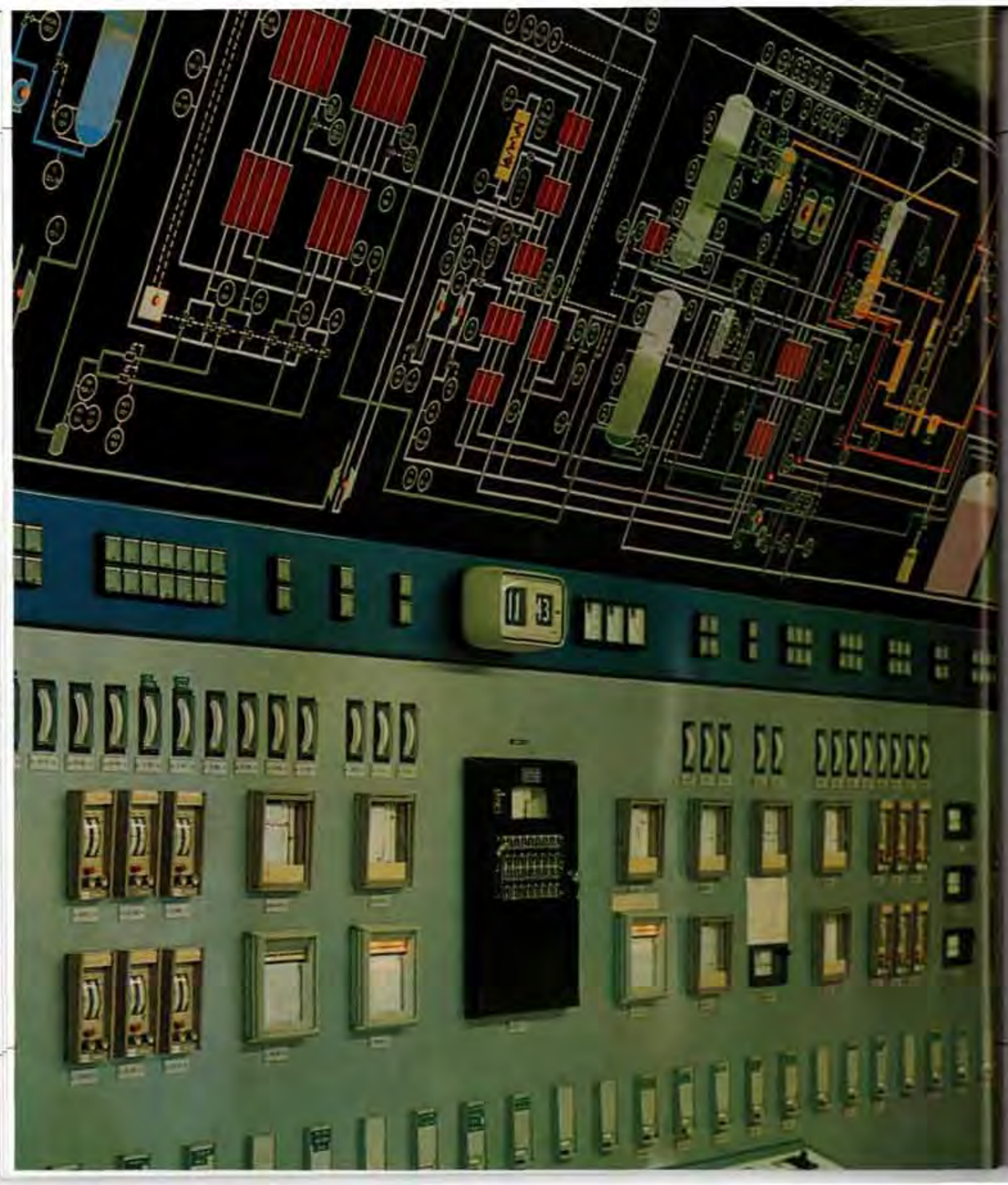
The advantages of numerical control have induced shipyards to use larger and larger machines. A working width of 43 ft. and greater is no longer unusual. A machine of this size can work simultaneously on four plates of 10 ft. width each. Messer Griesheim has delivered some machines with a track gauge of more than 66 ft. for edge preparation on flat panels in shipyards.

Shipyards and other large factories of the metal working industry are not the only users of numerically controlled flame cutting systems. Steel service centers are installing machines of this type in order to extend their activities to include custom-cutting of materials to the buyer's specifications.

Simplified design as well as reduction of the electrical equipment and utilization of lower-priced standard control units have reduced the cost of numerically controlled flame cutting machines to the point where they have become a worthwhile investment even for relatively smaller shops.

The high guiding and reproducing accuracy of Messer Griesheim flame cutting machines provides for the closest tolerances. Consequently, flame cutting can now be used also for parts which previously could be cut only mechanically.





Cryogenics Division

In 1970, plant sales of the Cryogenics Division reached DM 47.1 million. This figure does not include the fabrication of tanks, regasifiers, and air separation plants for the Industrial Gas Division.

General cost increases affected the profit situation. In the international engineering business, it is becoming increasingly customary to demand long payment terms which represent an additional burden in the form of higher cost of loans. In some countries, exportation of investment goods is subsidized by the government, a practice which distorts the competitive situation with regard to plant financing.

Again, a number of air separation and gas separation plants were started up at home and abroad, among them the second tonnage plant for natural gas upgrading installed in France. This plant serves for removal of nitrogen from natural gas in order to adjust the combustion properties and calorific value of Dutch natural gas to the natural gas from Southern France. Moreover, pure liquid helium is recovered from the natural gas.

In a German steel mill, a plant was started up whose specific energy consumption of 0.0097 KWH/scf of oxygen guarantees the highest degree of economy. The use of oxygen is also becoming increasingly important in other areas of metallurgy, as indicated by the commissioning of a second air separation plant for a nickel/iron mill in Greece.

◀ Due to automatic operation of all important controls, Messer Griesheim air and gas separation plants are safe, easy to operate, and economical.

Shop-Assembled Cold Box

Shop-assembly of low temperature plants is a tradition with Messer Griesheim. Complicated plant components are mounted into the coldbox shell at the shop. This was no problem with the small plants of the past. However, with higher capacities, plant dimensions have become considerably larger, thus adding to the technical problems of shop-assembly.

Where, formerly, complete coldboxes were shop-assembled in the form of cylindrical towers, the logical next step led to sectional preassembly of low temperature plants, a practice which has been utilized successfully for many years. The coldbox is divided into individual sections which are prefabricated at the shop. The structural steel frame of each coldbox section contains all the completely assembled vessels, pipings, and fittings.

The individual sections of the coldbox are put together at the plant site. Joining of the coldbox sections is the only assembly work that remains to be done in the field. This solution permits preassembly of air separation plants up to an oxygen capacity of 450,000 scfh (410 t/day). For larger plants with capacities up to 1,680,000 scfh (1,550 t/day) one must resort to field assembly, since the dimensions of these large coldbox sections exceed the transport limits from workshop to plant site.

Coldbox of an air separation plant in a Belgian steel mill which was assembled in the field from prefabricated sections.

More Valuable Natural Gas

Over the past few decades, energy consumption has increased tremendously throughout the world. To a growing extent, energy is being supplied by natural gas which is transported from the well through an extensive pipeline system or in liquefied form.

Cryogenic processes are used for upgrading of natural gas. Since most of the components of natural gas boil at low temperatures, the basic methods of separating gas mixtures by cooling and condensation are suitable for this application.

Natural gas from different wells contains different percentages of nitrogen. The nitrogen content is undesirable for several reasons: in chemical processes it reduces the product yield and in fuel gas it affects the combustion properties and decreases the calorific value. Wherever natural gas must be transported over long distances it is more economical to remove the nitrogen which is nothing but ballast in the combustible gas, yet increases the cost of pipeline and compression.

Messer Griesheim has developed a new patented process for nitrogen removal and simultaneous helium recovery from natural gas. This process is particularly interesting as it permits upgrading of the natural gas without necessitating previous removal of the carbon dioxide.

A public utility company in France is operating two natural gas separation plants for improvement of the calorific value by nitrogen removal and for recovery of high purity helium. Both plants are processing 4,850,000 scf (2,600 t/day) of natural gas per hour.

The low temperatures utilized in cryogenic processes during the past few years have been approaching absolute zero. The generation and maintenance of these extremely low temperatures involves considerable expenditure.

Effective insulation is a prerequisite to working at extremely low temperatures. Particularly efficient is a vacuum insulation which consists of an alternating succession of metal foil (good reflectivity) and plastic foil (poor conductivity). The full insulation effect depends on a carefully developed and skillfully executed winding technique.

In separate facilities, set aside specifically for insulation work, specially trained personnel apply the many insulation layers under strict observance of the rules for absolute cleanliness.

Long-term storage and transportation of low-boiling gases in liquid form are examples of the areas of application that cryogenic engineering has tapped by the development of super-insulation.

Low temperature gas separation plants are increasingly utilized for the production of synthesis gases and for recovery of pure gases.
The photograph shows a plant for recovery of high-purity hydrogen for hydrogenation.

Outlook

The fifth upswing in the economy in twenty-five years passed its peak at the end of 1970. Rates of increase in production and sales have gone down. Reduction of extensive inventories has begun. Although the market situation has changed, the economy must anticipate higher costs once again in 1971 with limited posibilities for increasing productivity. As of now, it is not possible to foretell whether or not a normalization of the economic situation will actually be achieved.

It is difficult to arrive at a forecast based on uncertain factors. Nevertheless, satisfactory progress of the company is anticipated in 1971. The dependability and high engineering standards of Messer Griesheim products are being appreciated throughout the world. The product line encompasses basic welding and cutting equipment as well as numerically controlled flame cutting systems, air and gas separation plants, and a wide range of industrial and specialty gases. In order to stay abreast of this extensive production program, continued expansion of the distribution and customer service network will be necessary. Present efforts assure Messer Griesheim of a leading position in its working fields in Europe, and create the foundation for further progress on the road to international recognition.

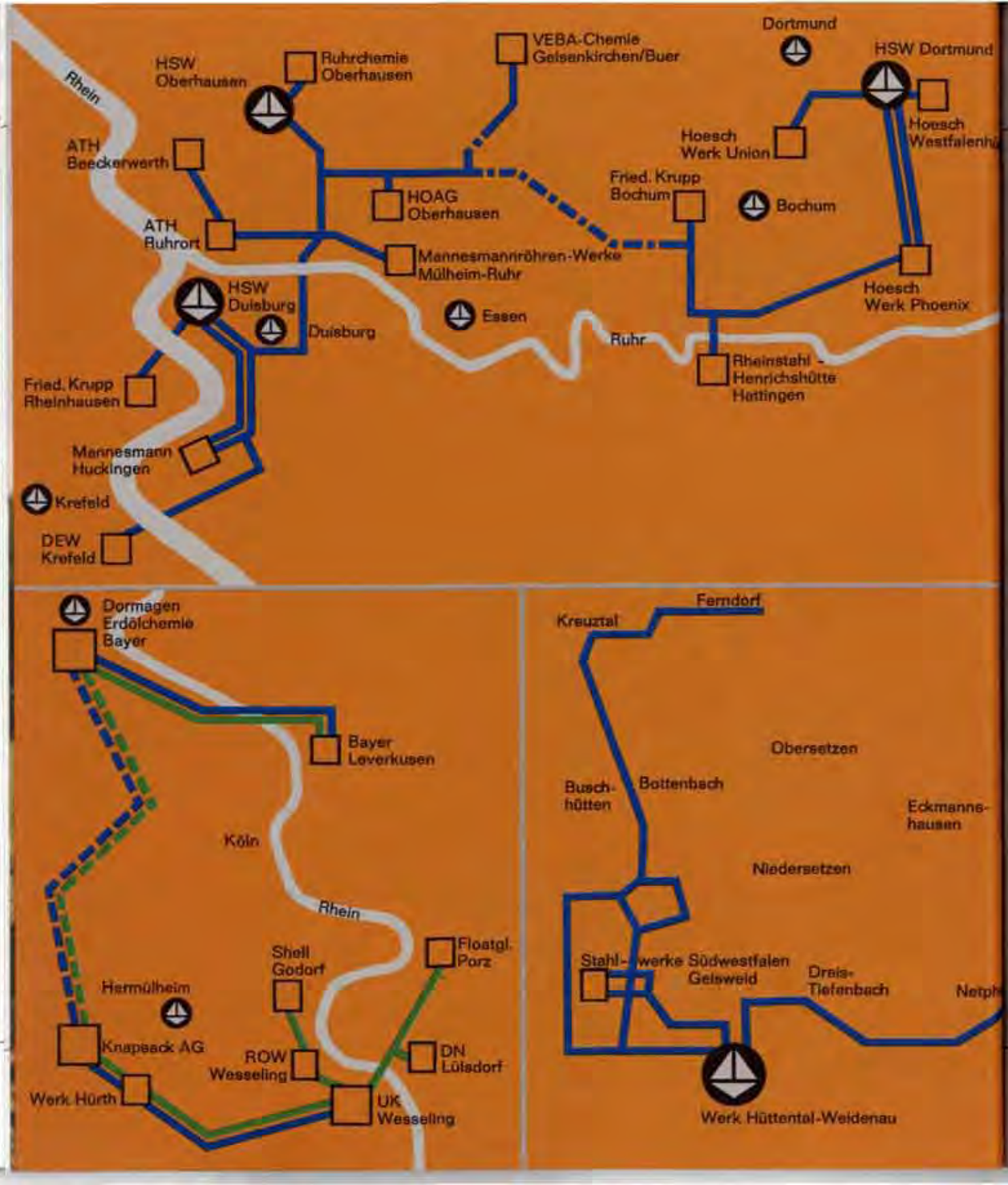
In conclusion, Messer Griesheim wishes to extend a word of thanks to business friends at home and abroad for their continued confidence in Messer Griesheim products and services.

New field of application for the MICOR light beam process: In lining truck doors with sound-absorbing cardboard, more than 50 % of the per piece cost can be saved. Moreover, the investment sum is considerably lower as compared to conventional methods.

Messer Griesheim's pipeline network for oxygen and nitrogen is continually being expanded.

Pipeline Network

Oxygen and nitrogen pipeline in the Ruhr area, Saarland, Cologne region and Siegerland serving the iron, steel and chemical industries.



Oxygen Pipeline

Existing	Under Construction	Projected

Nitrogen Pipeline

Existing	Projected

Steel mill oxygen plant

Refilling station

Oxy-Fuel Equipment and Acetylene Producing Plants

Torches for welding, cutting, edge planing, scarfing, descaling, heating, soldering, brazing, surfacing. Powder torches and lances for cutting, piercing, dressing.

Underwater cutting equipment
Pressure regulators, gas heaters, cylinder valves, fittings, flashback arresters, water seals, cylinder banks. Propane fittings and vaporizers.

Layout and supply of pipeline systems and gas distribution facilities for all industrial gases with pressure regulating and measuring instruments.

Acetylene generating plants for welding and for the chemical industry.
Dissolved acetylene generating, compressing, and filling plants.

Thermoplastic Welding Equipment

Systems for welding of plastic materials.
Hot-ring butt welding systems for plastic pipes of any standard diameter.

Flame Cutting Machines

Portable flame cutting machines.
Hinged-arm flame cutting machines, manually or mechanically guided

Stationary profiling machines:
Drive by one motor via drive wheel or via magnetic roller;
Mechanical or photo-electric controled
Coordinate drive with two motors;
Photo-electric control using patterns of various scales or numerical control

Flame cutting machines for plate edge preparation and strip cutting
Engineering and supply of complete flame cutting systems of any size for profiling, plate edge preparation, and strip cutting.

For profiling: photo-electric control, using actual size or scale patterns, or numerical control

Special purpose attachments such as automatically rotating triple bevel units, automatic marking tools.

Custom-Designed Welding Machines and Steel Mill Machinery

Strip welding systems,
Tooling for automated welding.
Multiple spot welding systems.
Engineering and supply of special purpose automatic welding machines for one or more welding processes.
Engineering and supply of complete continuous production lines.
Ingot and slab flame cutting machines,
Mechanical or photo-electric control.
Automatic continuous strand cutting
Scarfing machines.
Engineering and supply of complete installations for cutting and scarfing of crude ingots, continuous strand castings, and semi-finished products from solidification to room temperature.

Arc Welding

TIG welders and MIG/MAG welders and accessories
Plasma systems for cutting, welding, melting, material testing, research purposes, aerodynamic studies

Welding transformers,
Welding rectifiers,
Welding generators,
Welding generators, driven by diesel or gasoline engine.

PECO Elektroschweißtechnik

Resistance welders for spot, seam and projection welding,
Butt welders,
Foil butt welders,
Portable spot welders,
Micro spot welders,
Table-mounted seam welders,
Impulse welders,
Micro welders
Thyristor weld timers for resistance welders,
Instruments for resistance welders.

Weld Filler Materials

Coated electrodes for manual arc welding
Welding rods for TIG welding,
Wire for submerged arc welding,
Welding rods for oxy-fuel welding
Wire for MIG/MAG welding,
Wire form submerged arc welding,
Wire for gas-shielded welding,
Metal powder for gas/powder hardfacing,
Brazing rods,
Flux for welding and brazing

GRICON® for structural steel, shipbuilding steel, boiler plates, steel pipes, fine-grain structural steel,
GRIDUCT® for fine-grain structural steel, heat resistant steel,
GRILOY® for rust-resistant steel,
GRINOX® for corrosion-resistant steel, heat-resistant steel,
GRINI® for nickel and nickel alloys,
GRICU® for copper and copper alloys,
GRILUMIN® for aluminium and aluminium alloys,
GRICAST® for cast iron,
GRIDUR® for hardfacing,
GRILOT® for brazing,
GRIFLUX® flux for welding and brazing.

New Products

MICOR light beam torches for soldering and heating without contact
Lasers for cutting, joining, and stripping of metallic and non-metallic materials.

Accessories

For any welding process.

Complete Plants

Air separation plants for recovery of oxygen, nitrogen, argon, helium, krypton, neon, xenon

Gas liquefaction plants for storage and transportation of large quantities of gases such as oxygen, nitrogen, hydrocarbons, natural gas (peak shaving)

Gas separation plants for recovery of hydrogen, carbon monoxide, methane, ethylene, ethane, propane, argon, helium, and synthesis gas mixtures

Revaporization plants for liquefied gases

Refrigeration plants for generation of temperatures approaching absolute zero, for industrial and scientific purposes.

Vessels and Machinery for Cryogenic Applications

Rectifying columns, heat exchangers, adsorbers, filters

Insulated vessels for liquefied gases, stationary or for transportation

Insulated piping, rigid or flexible, for liquefied gases

Regasifiers for storage and regasification of
Vaporizers for liquefied gases

Pumps for liquefied gases

Expansion engines.

Engineering Services

Process engineering for gas liquefaction, air and gas separation, generation of refrigeration

Design, planning, and construction supervision for complete low and ultra-low temperature plants.

Industrial Gases
Compressed Air, Oxygen, Nitrogen, Hydrogen.

Pure Gases
of various degrees of purity up to highest purity:

Rare Gases
Argon, such as welding grade Argon, Argon for spectrometry

Highest Purity Gases
Helium, Krypton, Neon Xenon.
Stable gaseous isotopes: Helium 3, Neon 20 and 22, Argon 36, Krypton 86, Oxygen 18, Deuterium
Radioactive gaseous isotopes: Tritium, Krypton 85
Carbon Dioxide, such as welding grade Carbon Dioxide,
Carbon Monoxide, Oxygen, Sulfur Dioxide, Nitrogen, Nitrogen Dioxide Nitrogen Monoxide, Hydrogen.

Low-Temperature Liquefied Gases
ARGOMIX® D + S, Argon, Helium, Air, Neon, Oxygen, Nitrogen, Hydrogen.

Gas Mixtures
For welding:
Argon-Helium, ARGOMIX® D + S, Corgon, Coxogen, KRYSAL®, forming Gas, welding Argon W, welding Argon S
For instrumentation:
Argon-Methane (proportional counting gas), Argon-Hydrogen for spectrometry, Helium-Butane (quenching gas), Neon-Helium, calibration gases, synthetic Air
For the lighting industry:
Lamp Argon, lamp Krypton, purge gas, custom mixtures, radioactive mixtures
For the semiconductor industry:
Doping gases
For the automobile industry:
Nitrogen-Hexane (fume control)
For advertising purposes:
Balloon gas.

Custom Mixtures:
Binary mixtures and multi-component mixtures of pure and extremely pure gases accurately mixed and carefully analyzed with analysis certificate
with radioactive components, if desired.

Gases and Gas Mixtures for Medical Applications
Carbogen, medical grade Oxygen, Oxygen mixtures with Helium, Carbon Dioxide, Nitrogen, in various compositions.

Hydrocarbons
Alkanes, Alkenes, Alkines, Alkadienes of various degrees of purity, from the following groups:
C 1 Methane, C 2 Ethane, Ethylene, Acetylene, C 3 Propane, Propylene, Propadiene, C 4 n and i Butane, n and i Butene 1 and 2, Iso-Butadiene (1,2) and (1,3), C 5 n and i Pentane.

Fuel Gases
Acetylene, Natural Gas, gas mixtures for torch adjustment, Propane according to DIN 51 622 Carbide.

Processes and accessories
Fittings for extremely pure gases,
Gas mixers for non-combustible and combustible gases,
Mercury for the lighting industry,
OXISORB® gas purification systems
CRYOGEN®-Trans liquid nitrogen refrigeration systems,
CRYOGEN®-Rapid liquid nitrogen flash-freezing installations
Liquid nitrogen deflashing machines for deflashing of rubber and plastic formed parts
Vessels for cryobiology and freezing, vessels for low-boiling liquefied gases, steel cylinders for industrial gases
Ozonators for water and sewage treatment
Oxygen lances, oil/oxygen burners, gas/oxygen burners, sulphur/oxygen burners, with instruments
Sparging devices for liquid foods.

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