UNITED STATES TARIFF COMMISSION

COBALT

Report to the Congress on Investigation No. 332 - 42 Under Section 332 of the Tariff Act of 1930 Made Pursuant to Senate Resolution 206, 87th Congress, Adopted September 23, 1961



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UNITED STATES TARIFF COMMISSION

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Introduction

This report is made pursuant to Senate Resolution 206, 87th Congress, adopted September 23, 1961, which directed the Tariff Commission to conduct an investigation of conditions in the cobalt industry. A copy of the Senate resolution is included in appendix A of this report.

The U.S. Tariff Commission instituted such an investigation on October 5, 1961, under the authority of section 332 of the Tariff Act of 1930, as amended (19 U.S.C. 1332), and ordered a public hearing in connection therewith to be held May 15, 1962. Public notice of the investigation and of the public hearing was given by posting a copy of the notice at the offices of the U.S. Tariff Commission in Washington, D.C., and in New York, N.Y., and by publishing the notices in the <u>Federal Register</u> (26 F.R. 9610) on October 11, 1961, and in <u>Treasury</u> Decisions, October 12, 1961.

The Commission convened on May 15, 1962, for the purpose of holding the public hearing. No interested party appeared and requested to be heard.

Information for this report was obtained from the Commission's files, from other Government agencies, from fieldwork by members of the Commission's staff, and from questionnaires.

Description and Uses

Cobalt, a silvery white metal with a bluish tinge, is a widely diffused component of the earth's crust; it occurs in small quantities in many ores of copper, nickel, iron, silver, manganese, lead, zinc, and pyrites. The important types of cobalt minerals found in these ores are the sulfides (carrollite and linnaeite), arsenides (smaltite, safflorite, skutterudite, and cobaltite), and oxides (asbolite, heterogenite, sphaerocobaltite, and erythrite). However, these minerals are seldom found in sufficient concentration to justify mining the ore for cobalt alone. Practically all of the world's production is obtained as a byproduct or coproduct in the smelting and refining of copper, nickel, iron, and lead ores. World production of cobalt is thus largely governed by the demand for other metals, mostly copper and nickel.

Metallic cobalt, generally containing 98 to 99.6 percent cobalt, is marketed in the form of granules, rondelles, powder, briquets, and electrolytic cathodes (sheared or broken); cobalt fines containing about 96 percent cobalt are also marketed for use in the production of cobalt salts and industrial catalysts.

Cobalt metal is used as an alloying element primarily because of its ability to withstand high temperatures and its magnetic properties. High-temperature alloys, or superalloys, with a cobalt content of from 9 to 68 percent and varying amounts of other metallic elements, such as nickel, chromium, molybdenum, or tungsten, maintain strength and resist wear and corrosion at high operating temperatures; these alloys are used in parts of jet aircraft engines (such as turbosupercharger

buckets, nozzle vanes, and tail cones) and in other high-temperature applications. Permanent-magnet alloys with a cobalt content of 5 to 52 percent and varying proportions of aluminum, nickel, iron, and sometimes other elements, are widely used in such applications as components of loudspeakers, telephones, television receivers, motors, meters, relays, and many other articles.

In high-speed tool steels, the addition of from 3 to 13 percent of cobalt and various percentages of chromium, vanadium, tungsten, or molybdenum imparts hot-hardness and wear resistance, which allows cutting tools to be used at high speeds and for deep cuts even at elevated temperatures. Cobalt in other steel provides high-yield strength at elevated temperatures, which is essential for parts of aircraft and missiles, and for other applications. Cobalt powder is the most widely used binder for cemented carbides, especially tungsten carbides. which are extremely hard materials and resistant to wear at relatively high temperatures. Cemented carbides are used for cutting tools, drawing dies, rock-drill bits, and sand-blast nozzles, as matrix for mounting diamonds in special cutting tools, for armor-piercing projectiles, and in similar applications. Cobalt in hard alloys, mostly carbides, is also used in hard-facing, whereby the alloy is deposited on a softer metal base by a welding process. This process is used to hard-face parts subjected to abrasion, such as ballmill liners, hammers of crushing equipment, engine valves, and valve seats. Cobalt is also a constituent of many specialty alloys, such as metal-to-glass seals, dental alloys, and springs.

Cobalt oxide, containing 70 to 76 percent cobalt, is marketed in the form of a black or grey powder. It is used as a coloring agent to impart various shades of blue to glass and glazes in pottery, as a whitening agent, and as a bonding agent to promote the adherence of ground coat enamel to metal. Cobalt salts, containing 20 to 62 percent cobalt, are used in animal feed, as catalysts, and in electroplating. Organic salts of cobalt, usually containing 2 to 9 percent cobalt, are used as driers in paints, varnishes, and printing inks.

Information on the trend of consumption of cobalt in the United States, total and by principal uses, is presented in the section on U.S. consumption.

U.S. Customs Treatment

Cobalt and cobalt ore are specially provided for in paragraph 1652 of the Tariff Act of 1930. Cobalt compounds are dutiable at various rates under paragraph 29. Alloys containing cobalt are classifiable for duty purposes under many tariff paragraphs depending upon their composition; they are subject to too many rates of duty to enumerate. The duty-free status of cobalt metal and cobalt ore has been bound, and the duties on cobalt compounds have been reduced, pursuant to concessions granted by the United States in trade agreements from time to time (table 1 in appendix B). The most recent concessions on cobalt products were those made in the 1960-61 negotiations under the General Agreement on Tariffs and Trade (GATT). The concessions provide for two-stage rate reductions on some cobalt compounds; the first reduction became effective on July 1, 1962, and the second reduction is to become effective on July 1, 1963.

The following tabulation shows, for the principal cobalt products, the rates of duty that were originally provided in the Tariff Act of 1930, the rates that were in effect during 1961, and for the cobalt compounds the rates that became effective on July 1, 1962, and those that are to become effective on July 1, 1963, as well as the average ad valorem equivalents of the specific rates of duty in effect during 1961 based on the value of imports in that year:

| | Tariff Act of 1930 | | | | | |
|---|-----------------------|--|--------------------------|--|--------------------------------|--|
| | : : (cents) | Par. 29 (cents per pound or percent ad valorem) | | | | |
| Item | Cobalt oxide | Cobalt sulfate | Cobalt lino- leate | : Cobalt : salts and : compounds, : not spe- :cially pro- : vided for | Cobalt and cobalt ore | |
| Rate originally pro- vided in the Tariff Act of 1930. | 20¢ | 10¢ | 10¢ | 30% | Free. | |
| GATT rate in effect during 1961. | 4¢ | 2.5¢ | 5¢ | 15% | Free. | |
| GATT rate negotiated in: 1960-61; effective July 1, 1962 July 1, 1963 | 2.7¢ 1.5¢ | 2¢ 1.5¢ | | 13.5% 12% | | |
| Average ad valorem equivalent of the 1961 specific rate based on imports in 1961. | 4.1% : : : : | 6.9% : : | <u>1</u> / | | | |

1/ No imports in recent years.

The duty-free status of imports of cobalt metal and cobalt ore, and the reduced rates of duty on cobalt compounds, classifiable under paragraph 1652 or paragraph 29, of the Tariff Act of 1930, will be continued in the Tariff Schedules of the United States, the adoption of which is provided for in Public Law 87-456, approved May 24, 1962. It is anticipated that these schedules will become effective January 1, 1963. The pertinent item numbers in the schedules are as follows: Cobalt ore, 601.18; cobalt metal and waste and scrap, 632.20; cobalt alloys, unwrought, 632.84; and cobalt compounds, 418.60, 418.62, 418.68, 426.24, 426.26, and 490.40. U.S. Government Purchase and Assistance Programs

The economic position of the cobalt industry in the United States and in other free-world countries has been greatly affected in the period since World War II by U.S. Government purchases of cobalt, and of nickel and copper with which cobalt is often associated in the ores. U.S. Government purchases or acquisitions of cobalt have been made under three basic legislative authorizations: The Strategic and Critical Materials Stock Piling Act (60 Stat. 596), approved July 23, 1946, the Defense Production Act of 1950 (64 Stat. 798), and section 303 of the Agricultural Trade Development and Assistance Act of 1954 (68 Stat. 459). Government stockpile

The Senate Armed Services Subcommittee on the National Stockpile reported on March 23, 1962, that the total quantity of cobalt in Government inventories as of December 31, 1961, was 97 million pounds. The quantities in the three different stockpiles in relation to the stockpile objectives were as follows (in thousands of pounds):

> Basic objective----- 6,900 Maximum objective----- 19,000 Government inventories: Strategic stockpile----- 76,974 Defense Production Act inventory----- 18,997 Commodity Credit Corporation and supplemental stockpile----- <u>1,077</u> Total----- <u>97,048</u> Surplus in inventories over maximum objective----- 78,048

The market value of the surplus shown above is \$117,072,000 (based on the price of \$1.50 per pound, which has been in effect since March 1, 1960).

Of the total quantity of cobalt in Government stockpiles at the end of 1961, 79 percent was in the strategic stockpile and 20 percent was in the Defense Production Act inventory; the remaining 1 percent was held by the Commodity Credit Corporation or was in the supplemental stockpile, representing cobalt acquired under the barter program in exchange for surplus agricultural commodities.

The following data supplied by the Office of Emergency Planning indicates the rates of growth of the Government inventories since the end of 1948:

| Year | Total U.S. Government inventories, end of year | Additions to inventories during year |
|-------|---|--|
| | 1,000 pounds | : 1,000 pounds |
| 1948 | 7,234 | <u>1</u> / |
| 1949 | 10,555 | 3.321 |
| 1950: | 14,353 | 3,798 |
| 1951 | 16,611 | 2,258 |
| 1952: | 20,327 | : 3,716 |
| 1953: | 30,618 | 10,291 |
| 1954: | 42,656 | 12,038 |
| 1955: | 53,510 | 10,854 |
| 1956: | 62,157 | 8,647 |
| 1957: | 72,033 | : 9,876 |
| 1958 | 82,774 | 10,741 |
| 1959 | 90,914 | 8,140 |
| 1960 | 97,022 | 6,108 |
| 1961 | 97,048 | 26 |
| : | | 2 |

1/ Not available.

Government inventories were accumulated most rapidly during the period 1953-58--at the rate of 8.6 to 12.0 million pounds per year. U.S. market prices during this period were at their highest level--from \$2.00 to \$2.60

per pound (table 4). Cobalt additions to Government inventories declined rapidly after 1958; they amounted to only 26,000 pounds in 1961. It is estimated that more than four-fifths, or about 79 million pounds, of the 97 million pounds of cobalt in Government inventories at the end of 1961 was obtained from foreign sources, and the remainder was obtained from domestic sources. During 1946-61, about one-third of all imports of cobalt and about three-fifths of the domestic mine production were acguired for the Government stockpiles.

Cobalt acquisitions under the Defense Production Act totaled about 27 million pounds during the period 1950-61. 1/ The average purchase price amounted to about \$2.08 per pound. 2/ Approximately 34 percent of the total quantity was purchased from domestic sources at an average cost per pound of \$2.38, approximately 66 percent from foreign sources at an average cost per pound of \$1.92. 2/ All contracts for the purchase of cobalt by the Defense Production Administration have expired except one held by Freeport Nickel Co., which is due to expire June 30, 1965. However, owing to the nationalization of the company's mines in Cuba, there has been no production by this concern since August 1960.

Government assistance for exploration and related development

In addition to purchasing cobalt from foreign and domestic producers, the U.S. Government initiated two programs for exploration and related development of domestic cobalt-bearing mines. The first program was con-

1/ The General Services Administration reports that of this total, 6.2 million pounds did not meet specifications and an additional 2 million pounds was disposed of. Those quantities are not included in the data shown in the tabulation on p. 7.

2/ Calculated from the <u>Report</u> on <u>Borrowing Authority</u> prepared by General Services Administration for the Executive Office of the President, Office of Emergency Planning, Dec. 31, 1961.

ducted under authority of the Defense Production Act of 1950 and was administered by the Defense Minerals Exploration Administration (DMEA) from the inception of the program in 1951 until its termination on June 30, 1958. From April 1951 until March 1953, the Government offered to finance 90 percent of exploration costs. In March 1953 the Government assistance offer was reduced to 75 percent of costs.

The second program was conducted under authority of Public Law 85-701 (72 Stat. 700), effective September 21, 1958, by the Office of Minerals Exploration (OME), which was to administer DMEA contracts and to continue the program of assistance in the exploration for domestic mineral deposits. OME was authorized to pay 50 percent of such exploration costs.

In both IMEA and OME applications and contracts, cobalt was only one of the minerals involved. These applications and contracts included the exploration and development of copper-cobalt, nickel-cobalt, lead-zincnickel-cobalt, and other cobalt-containing mines. To be eligible for such government aid it was necessary for a person or concern to have what the Government regarded as "sufficient interest" in a cobalt-containing property. Exploration contracts covered only outlays for reasonable delineation and sampling of the ore; they did not provide funds for actual mining or preparation for mining. The money contributed by the Government was to be repayable through a royalty on all production from property involved, ordinarily for a period of 10 years or until the Government's contribution was repaid, whichever occurred first. Any debt that was not paid within the period specified by contract was to be

canceled. As of January 19, 1962, all contracts pertaining to cobalt exploration had been terminated and there were no cancellations.

Of the 15 contracts executed under DMEA and OME, 5 resulted in the discovery of cobalt-bearing materials, but none of these discoveries are operable under present market conditions.

U.S. Industry 1/

Although the United States is the largest consumer of cobalt in the free world, cobalt produced by domestic mines has never been an important factor in supplying domestic requirements. It is estimated that in 1962 U.S. mine production will supply about 5 percent of domestic consumption and reused scrap another 2 to 4 percent. Because of lack of commercial ore reserves no major increase in domestic mine production is anticipated in the foreseeable future. Recovery of cobalt from scrap in the United States has never been large during periods when ample new cobalt supplies were available. Owing to difficulties in segregating and efficiently using cobalt-bearing scrap, no substantial quantities of cobalt are obtained or expected from this source.

Before 1940 U.S. mine production of cobalt was sporadic and insignificant. In that year U.S. mine production amounted to 134,000 pounds; by 1945 it had increased to 1,100,000 pounds. This increase resulted from the recovery of cobalt from pyrites associated with the iron ore mined at Cornwall, Pa., and larger production of cobalt from a lead mine at Fredericktown, Mo. During 1946-51, U.S. mine production ranged from 518,000 to 902,000 pounds per year; it increased substantially thereafter

1/ All information in this section was obtained from published sources or was authorized for publication by the companies involved.

reaching a record high of 4,844,000 pounds in 1958. This increase came as a result of Government assistance granted under the Defense Production Act of 1950 which brought about larger production at the mines in Pennsylvania and Missouri and the opening of a new and larger cobaltproducing mine in Idaho. After the expiration of Government contracts production decreased; the Cobalt Information Center $\frac{1}{}$ estimated that production in 1961 was about 1,100,000 pounds, all from the iron mines in Pennsylvania and from "cleanup" operations at Fredericktown, Mo.

Minor amounts of cobalt are also present in residues recovered from the electrolytic refining of zinc at Kellogg, Idaho. These residues are stockpiled at the mine. No cobalt metal products have ever been recovered from this source.

Operations of the individual companies which were engaged in the production of primary cobalt in recent years are discussed below. Bethlehem Steel Corp.

Bethlehem Steel Corp. has been a regular producer of cobalt since 1940 and is at present the sole surviving domestic mine producer. The company produces cobalt-containing iron ore (magnetite) from two mines in eastern Pennsylvania. The Cornwall mine, nearing exhaustion, produces iron ore largely by openpit mining. The ore as mined contains 35.0 percent iron, 1.4 percent sulfur, 0.3 percent copper, and 0.025 percent

1/ The Cobalt Information Center is the executive organization of the Cobalt Development Institute, a trade association formed in 1957 by the leading free-world producers of cobalt to develop the cobalt market. The organization sponsors research and dissemination of information with a view to extending the present uses of cobalt and to finding new applications. The main office of the Cobalt Information Center is in Brussels, Belgium; branch offices are located in Columbus, Ohio; Dusseldorf, Germany; and London, England.

cobalt. During 1960 the company began production at the Grace mine, an underground operation. Ore from the Grace mine averages 40.0 percent iron, 1.2 percent sulfur, 0.4 percent copper, and 0.012 percent cobalt. At both mines the cobalt is contained in pyrites, which must be removed before the ore can be processed at the company's steel plant. The magnetite is separated from the ore magnetically at the mines. Pyrite tailings are concentrated by flotation at company mills at Lebanon and Cornwall, Pa. The flotation concentrate is then shipped to the company's Sparrows Point, Md. steel plant for roasting in Fluo-Solid reactors. Here sulfuric acid is produced from the sulfur contained in the pyrite, and cobalt and copper minerals are converted to soluble sulfates. The cinder produced by roasting is a fine red powder and averages about 1 percent cobalt. $\frac{1}{2}$ The cinder is shipped by rail to The Pyrites Co., Inc., Wilmington, Del. (a subsidiary of Rio Tinto Co., Ltd.), where the cobalt and copper are recovered by a leaching process on a toll basis. The leached cinder is returned to the Sparrows Point plant for recovery of the iron content. At the plant of The Pyrites Co., Inc., cobalt metal, oxide, and hydrate are produced from the cobalt solution, and these products are sold by Bethlehem Steel Corp. to the trade. It is estimated by Bethlehem Steel Corp. that the process employed by the company results in the extraction of about 70 to 80 percent of the cobalt contained in the ore.

^{1/} When the Cornwall ore body is mined out, cinder will be produced only from the Grace mine and will have an average cobalt content of about 0.7 percent.

No employees engaged in mining and processing iron ore can be properly allocated to cobalt production, since the ore is mined for its iron content and the pyrite is extracted regardless of its cobalt content. The Pyrites Co., Inc., employs 30 to 35 men in its cobalt recovery operations.

National Lead Co.

In 1942 the National Lead Co. purchased a lead mine at Fredericktown, Mo. This mine (having a complex lead, copper, nickel, cobalt ore) had been in operation for years, but owing to the complexity of the metallurgical problems encountered in treating the ore, no cobalt was recovered before July 1944. The ore as mined contained 2.5 to 2.75 percent lead, 0.5 to 0.75 percent copper, 0.25 percent nickel, and 0.25 percent cobalt. In producing a 78 to 80 percent lead concentrate the flotation mill made a 27 to 30 percent copper concentrate and a product containing 7.5 percent each of nickel and cobalt. The lead concentrate was shipped to a lead smelter at Herculaneum, Mo., and the copper concentrate, to a smelter at El Paso, Tex. The mine was closed from July 1946 until late in 1949. Before 1955 most of the cobalt-bearing material was stockpiled at the mine, although some concentrate was shipped to The Pyrites Co., Inc.

In 1956 National Lead Co. began production of cobalt metal powder in a new refinery at Fredericktown, Mo. This refinery, financed by the U.S. Government, $\frac{1}{}$ was placed in operation before all metallurgical

^{1/} The original contract (D-12095) between the Government and National Lead Co., effective Oct. 11, 1951, provided for an advance of \$7,500,000 by the Government for construction of a plant (refinery) to produce cobalt, nickel, and copper metal from the concentrates. Effective Dec. 1, 1956 a new contract (DMP-131) provided for the acquisition of the refinery by the Government, cancellation of the \$7,500,000 advance, and leaseback of the refinery to National Lead Co.

tests were completed; maximum annual production of about 1 million pounds of cobalt was not attained until 1958. To keep the refinery in operation at an efficient level, it was necessary during the entire period to supplement the then current supply of concentrate with previously accumulated stocks.

The Government ceased its purchases of cobalt from this source on January 1, 1960, but the mining operation was continued until January 31, 1961. The company continued operating the refinery until May 1961, when it was closed. From January 1960 until May 1961 the output of the refinery was sold to private industry in the United States. The company estimates that known ore reserves are practically depleted. The closing of the mine and refinery resulted in the release of about 400 employees--200 from the mine and 200 from the refinery. All mining and milling equipment is being salvaged by the company and the Government has sold the refinery and other equipment to salvage dealers. No future cobalt production is expected from this source.

Under its contract the Government purchased 2,885,789 pounds of cobalt powder from National Lead Co. at a cost of \$7,520,000. After the closing of the refinery 3,300 tons of concentrate--containing 15 percent cobalt and nickel combined--was sold to the Canadian firm of Sherritt Gordon Mines, Ltd.

Calera Mining Co.

Calera Mining Co., a wholly owned subsidiary of the Howe Sound Co., operated the Blackbird Mine at Cobalt, Idaho and a cobalt smelter and refinery at Garfield, Utah. The run-of-mine ore averages about 1.5

percent copper and 0.7 percent cobalt. This was one of very few ore bodies mined where cobalt was the metal of chief value. Mining of cobalt ore in the Blackbird district has been difficult because of wide variations in the form of the ore body and complications caused by faulting. These conditions also interfere with accurate estimates of the ore reserves. A large portion of the production came from the open pit operations and from cut and fill stopes in the underground section of the mine.

Production of concentrates began in June 1951, at a flotation plant originally designed to treat 600 tons of ore per day. Late in 1950 the Government requested an expansion of milling capacity to 1,000 tons per day, sufficient to produce concentrates from which about 3 million pounds of cobalt would be recovered annually. This expansion was completed late in 1952. The flotation plant produced a cobalt concentrate containing about 17.5 percent cobalt and a copper concentrate. The copper concentrate was shipped to a custom smelter, and the cobalt concentrate, to the company's refinery at Garfield, Utah.

Production in the cobalt refinery began in March 1953, and maximum production was reached in 1958. Until late in 1957 the refinery recovered cobalt by leaching the concentrate with sulfuric acid, adding ammonia, and precipitating the metal with hydrogen in vertical autoclaves. After the precipitate was melted in an electric furnace, the cobalt was poured into water, producing granules containing 95.5 percent cobalt and 4 percent nickel. Late in 1957 the method of refining was changed to electrolysis, eliminating the hydrogen-reduction and electric-furnace steps used previously. The resulting granules contained about 97.7 percent cobalt and 2 percent nickel.

The entire output at this operation--6,380,302 pounds of cobalt, valued at \$14,528,000--was produced under Government contract and went into the stockpile. With the expiration of the Government purchase contract, mining operations ceased in June 1959 and the refinery was closed in September 1959.

At the time of its maximum production, the Calera Mining Co. employed approximately 900 persons--600 at the mine and 300 at the refinery. The Garfield cobalt refinery was sold in April 1960 and converted into a vanadium oxide plant. The company sold its mining plant to a salvage dealer, and the sales contract provided that it be held on a standby basis for 2 years before being salvaged.

The company reported developed and proven ore reserves of 386,888 tons containing 0.35 percent cobalt and 1.74 percent copper on January 1, 1960. In view of the sale of plant and equipment, it is not expected that production from this source will be resumed.

The parent company, Howe Sound Co., reported an investment of approximately \$15,000,000 in the Calera subsidiary. In its annual report for 1959 Howe Sound Co. reported a loss of \$6,524,322 on abandonment of the mine and refinery, after assigning an estimated salvage value of \$462,000 to these properties. The write-down of the properties resulted in a saving of \$1,665,000 on income taxes. The net result was a loss after taxes of \$4,859,322 which reduced the 1959 earnings, after income taxes, of Howe Sound Co. from \$6,631,739 to \$1,772,417.

African Metals Corp.

Before 1957, approximately 2 million pounds of cobalt metal and oxide was produced annually at the Niagara Falls, N. Y., refinery of the African Metals Corp., a sales subsidiary of Union Miniere du Haut-Katanga. All production was from a cobalt-copper alloy (white alloy) imported from the Belgian Congo operation of Union Miniere. In 1957 the Niagara Falls refinery was abandoned because the process and equipment used there had become obsolete. Since the closing of the refinery, all Katanga cobalt production has been refined in the Republic of the Congo or Belgium, but African Metals Corp. is still Union Miniere's sales subsidiary in the United States (see Republic of the Congo in the section on free-world production).

Freeport Nickel Co.

In 1958-60, Freeport Nickel Co. (a wholly owned subsidiary of Freeport Sulphur Co.) erected a nickel-cobalt refinery at Port Nickel, La., to treat the nickel-cobalt concentrates from the company's mines located at Moa Bay, Cuba. The plant was designed to produce approximately 50 million pounds of nickel and 4.4 million pounds of cobalt annually. The plant operated for a short period in 1960, but with the nationalization of the company mines in Cuba the refinery was closed in August 1960. It is now being maintained on a standby basis.

The annual report of Freeport Sulphur Co. (and its consolidated subsidiaries) for the year 1960 stated that the investment in Freeport Nickel Co. was written down to a nominal value of \$1. The remainder of

the Freeport Sulphur investment in Freeport Nickel, \$18,030,000, was charged to earnings retained in the business (surplus account) by the parent company.

As long as the government of Cuba follows present policies, it seems unlikely that this plant will operate (see pp. 33-34 for discussion on production in Cuba).

U.S. Consumption

The United States is the world's largest consumer of cobalt. During 1956-61 it accounted for about 38 percent of total free-world consumption (estimated at almost 24 million pounds per year, mostly from data supplied by the Cobalt Information Center). Annual U.S. consumption of cobalt in all forms averaged 5.3 million pounds in 1946-50, increased to an average of 9.7 million pounds in 1951-55 (reflecting increased consumption during the Korean conflict), and declined to an average of 9.1 million pounds in 1956-61 (table 2). $\underline{1}/$

Average annual U.S. consumption in 1956-61 was 74 percent larger than that in 1946-50. Most of the increase occurred in the two principal uses of cobalt--in high-temperature alloys and in permanent-magnet alloys. The consumption of cobalt in high-temperature alloys (also known as superalloys), plus small quantities for cutting and wear-resisting alloys, for which separate data are not available for the earlier period, increased from about 1.2 million pounds per year during 1946-50 to approximately 2.7 million pounds per year in 1956-61, or by 119 percent. Annual consumption in permanent-magnet alloys rose from 1.6 million pounds in 1946-50 to 2.6 million pounds in 1956-61, or by 66 percent.

The consumption of cobalt in most other uses, although smaller than in the uses named above, has also been substantially larger in recent years than in the late 1940's. Annual consumption of cobalt was larger

^{1/} The term "U.S. consumption" as used in this report refers to the quantity of cobalt in all forms put into process by industrial consumers, as reported by them to the U.S. Bureau of Mines. Data on consumption by forms are shown in table 3.

during 1956-61 than during 1946-50 in cemented carbides (by 205 percent), in hard-facing rods and materials (311 percent), in high-speed and other steels (32 percent), in salts and driers (22 percent), and in miscellaneous metallic and nonmetallic uses (289 percent). However, annual consumption of cobalt in ground-coat frit declined 9 percent from 1946-50 to 1956-61 and that of cobalt in pigments remained virtually unchanged.

Of the total quantity of cobalt in all forms consumed in the United States in 1961, about 78 percent was used for alloying metallic products and the remaining 22 percent entered in nonmetallic uses--half of this in salts and driers, and the other half in the manufacture of ground-coat frit, pigments, and miscellaneous chemical products. More than half of all the cobalt consumption was accounted for by permanent-magnet alloys and high-temperature alloys.

Distribution of the consumption of cobalt by uses in 1961 was as follows:

| Use | 1961 |
|-----------------------------------|------------|
| | Percent of |
| | |
| Metallic: | : |
| High-speed steel | 2.3 |
| Other steel | 6.1 |
| Permanent-magnet alloys | : 25.6 |
| Cutting and wear-resisting alloys | : 2.7 |
| High-temperature alloys | : 24.5 |
| Hard-facing rods and materials | : 5.7 |
| Cemented carbides | 3.1 |
| Other | . 8.4 |
| Total metallic | 78.4 |
| Nonmetallic. | - |
| Ground-coat frit | |
| Salts and driers | 2.2 |
| Pigments | |
| Other | · 23 |
| Total nonmetallic | <u> </u> |
| | |

In addition to consumption by uses the Bureau of Mines also reports consumption by forms (such as metal, oxide, etc.) in industry; these statistics are shown in table 3.

Continued growth of cobalt consumption in the near future appears certain in view of the increasing need for this metal, especially for high-temperature and permanent-magnet alloys. Increased use of cobalt is being stimulated by the lowered cobalt price coupled with improved quality of cobalt products and growing knowledge of their properties and their uses. Adequate free-world supplies to meet consumption requirements in the foreseeable future seem assured in view of the presently known large ore reserves, expanded production facilities, and improved production techniques. However, the United States will probably continue to depend primarily upon imports for its supplies, principally because of the limited domestic ore reserves.

Marketing Practices and Prices

The domestic cobalt-mining industry has never been an important factor in the domestic open market for cobalt. At present the sole domestic mine producer supplies about 5 percent of the domestic requirements. Under these circumstances, imports of cobalt metal and cobalt oxide are of chief significance.

Only 10 concerns imported metal or oxide at any time during the period 1957-61: ⁴ concerns sold the cobalt metal or oxide imported by them to domestic processors, and the remaining 6 imported one or both of these products for use in their own plants.

Consumers place rigid specifications on the purity and form of metal they purchase. The national stockpile specification for cobalt metal, issued on October 26, 1957, provided for a minimum cobalt content of 97 percent. Since these specifications were established, improved technology has resulted in the production of metal averaging from 99.25 to 99.60 percent cobalt or from 99.55 to 99.95 percent cobalt plus nickel with a nickel content of between 0.08 and 0.45 percent. In general, the quantity of impurities present in the metal has been reduced to less than one-tenth of that tolerated by the original stockpile specification.

The four importers that import cobalt for sale in the United States are either subsidiaries or exclusive representatives of the world's major producers. In 1961 sales by the four concerns accounted for about 85 percent of the total sales of cobalt and cobalt products in the United States.

African Metals Corp. is the predominant supplier of cobalt metal in the U.S. market and, therefore, the major factor in influencing the U.S. market price. All of the cobalt metal sold by this concern in the United States originates in ores mined by Union Miniere du Haut-Katanga in Katanga Province of the Republic of the Congo; some of the metal sold is produced in Katanga and some of it is refined in Belgium from crude cobalt alloy produced in Katanga. The sales agent for all cobalt metal produced from ores mined by Union Miniere (more than half of the freeworld output) is Societe Generale des Minerais; African Metals Corp. is the U.S. sales agent for Societe Generale. It is understood that refined cobalt metal produced by Union Miniere in Katanga and by its subsidiary in Belgium, Societe Generale Metallurgique de Hoboken, is sold at the same price f.o.b. all major world ports, including those in the United States.

The second largest U.S. supplier of cobalt is Phillips Brothers, importers of cobalt metal from the Federal Republic of Germany (West Germany). Sales by this firm are made ex-dock or c.i.f. port of entry in the United States and prices are based on <u>Engineering and Mining</u> Journal quotations.

All sales of cobalt metal, beginning February 1, 1957, by the International Nickel Co. have been made at \$2.00 per pound f.o.b. Port Colborne, Ontario. Since February 1, 1959, this metal has been sold at a premium over the price of other cobalt entering the U.S. market; it is understood that it is sold in limited quantities for uses where this cobalt, because of its particular composition, is advantageous.

Cobalt marketed by Ugines Industries from French refineries is priced on the basis of <u>American Metal Market</u> quotations ex-dock or warehouse in the United States.

Table 4 lists the <u>E & MJ Metal and Mineral Markets</u> commercial price quotations for cobalt metal and oxide. These prices do not include the higher prices paid by the U.S. Government for cobalt under stockpile contracts which are discussed under the chapter on U.S. Government purchase and assistance programs. Neither do listed quotations reflect International Nickel Co. sales in this country at \$2.00 per pound of cobalt metal since February 1, 1959.

Cobalt has undergone less violent price fluctuations than most metals. On January 1, 1946, cobalt metal was quoted at \$1.50 per pound in 500-pound drums f.o.b. U.S. port of entry. This was the maximum price fixed by the Office of Price Administration (OPA) during World War II. OPA price controls on cobalt were removed on June 12, 1946, and were not restored during the Korean emergency. After June 30, 1947, the quoted price increased steadily, to a high of \$2.60 per pound effective November 1, 1953, and remained at that level until late in 1956. On December 1, 1956, the quoted price dropped to \$2.35 per pound and it has declined steadily since, reaching \$1.50 per pound on March 1, 1960, since which date the price has remained unchanged. $\frac{1}{}$ The decrease in price since December 1, 1956, has resulted from increased world production and technological progress which has reduced production costs, as well as from efforts by the major free-world producers to stimulate consumption of cobalt.

The price of cobalt oxide in 250-pound kegs varies directly with the price of cobalt metal.

1/ During the period in which the price has been \$1.50 per pound for cobalt in 500-pound drums the quoted price for that in 100-pound lots has been \$1.52 per pound and for that in less than 100-pound lots, \$1.57.

Foreign Trade

U.S. imports

U.S. imports of cobalt increased rapidly in the postwar period from 3.2 million pounds in 1946 to a record peak of 21.3 million pounds in 1959. <u>1</u>/ Imports dropped thereafter to 10.6 million pounds in 1961 (table 5). Imports were unusually large during 1952-60, averaging 16.7 million pounds per year. The large imports during this period are attributable partly to increased U.S. consumption of cobalt, but principally to purchases by the U.S. Government of foreign cobalt for its stockpile. With the cancellation or termination of U.S. Government stockpile contracts, imports in 1961 declined to the lowest volume since 1951.

<u>Composition</u>.--Cobalt metal has accounted for more than 80 percent of the total imports of cobalt in nearly all postwar years and, since 1956 for more than 90 percent of total annual imports (table 5). Imports of scrap, reported in combination with the metal, are known to be small.

Imports of ore, concentrates, and white alloy averaged slightly more than 2 million pounds annually in the period 1948-56. Almost all the imports under this classification consisted of crude white alloy, and were destined for conversion to refined cobalt metal and oxide at the African Metals Corp. refinery at Niagara Falls, N. Y. The capacity of the refinery to treat raw materials governed the volume of imports. When the refinery was closed in 1957, imports of white alloy ceased.

1/ Throughout this report data on imports represent imports for consumption, that is, direct entries for consumption plus withdrawals for consumption from customs bonded warehouses. Imports of cobalt compounds did not rise significantly in the period 1946-61, and except in 1946 never exceeded 10 percent of total cobalt imports. More than 90 percent of the cobalt compounds imported consisted of cobalt oxide.

<u>Principal sources</u>.--In the period 1946-56, the Belgian Congo (now Republic of the Congo) and Canada were the sources of all U.S. imports of primary cobalt except the minor quantities obtained from the Federal Republic of Germany (West Germany) (table 6). Imports from the Belgian Congo plus imports of Congo-mined material refined in Belgium accounted for 92 percent of total imports in that period. Imports of metal from Canada plus Canadian material refined in Norway were equivalent to 6 percent of the total. The Belgian Congo and Canada remained the principal sources of imports in the period 1957-61, but combined imports from those countries declined to about 85 percent of the total imported in that period.

Practically all of the cobalt oxide imported has come from Belgium, where it is produced from cobalt mined in the Republic of the Congo; minor quantities of cobalt oxide are imported from Canada.

U.S. Exports

The United States exports small quantities of cobalt raw materials described in the official statistics as "ore, concentrates, metal, and scrap" (table 7). The available statistics on quantity are in terms of gross weight and therefore do not indicate the cobalt content. Since 1953, the value of U.S. exports has ranged from \$0.5 million to \$1.9 million per year, compared with the annual foreign value of imports during the same period of \$14.9 million to \$44.3 million.

Annual exports of cobalt raw materials have been several times larger beginning in 1954 than they were during 1946-53. The larger exports during 1954-61 reflect principally exports of cobalt-bearing scrap, mostly to West Germany and in 1961 to Japan.

Cobalt and cobalt alloys in both crude and semifabricated forms, and cobalt compounds, require a validated export license for export to any destination except Canada. Export controls are administered by the U.S. Department of Commerce pursuant to section 2 of the Export Control Act of 1949, as amended.

Free-World Production 1/

Annual average free-world production of cobalt from mines was about 12 million pounds in 1946-50; it increased to an average of nearly 25 million pounds in 1951-55 and to more than 32 million pounds in 1956-61 (table 8). Much of the expansion in free-world production was financed by purchases and loans under the U.S. Government stockpiling procurement program. World production reached a record high in 1959, but has declined since then because domestic producers, with one exception, ceased operations when the U.S. stockpiling program expired. World mine production of cobalt will probably continue to reflect principally the production of copper, nickel, and pyrite, since the ores of these minerals are the major sources of cobalt. To a considerable extent, however, cobalt production can be adapted to fluctuations in the market for cobalt by selective mining of ores, especially in Katanga and Northern Rhodesia, where the cobalt-to-copper ratio in ores varies widely.

The Republic of the Congo (in earlier years the Belgian Congo) accounted for more than half (about 60 percent) of the free-world production of cobalt in the past 10 years. The Federation of Rhodesia and Nyasaland accounted for 9 percent; Canada, 10 percent; the United States, 9 percent; Morocco, 7 percent; and all other free-world countries, about 5 percent.

Production of cobalt in the principal foreign producing countries of the free world are discussed below.

^{1/} Very little information is available concerning cobalt production in Communist-dominated areas.

Republic of the Congo

In 1961 the Republic of the Congo accounted for about 57 percent of the free-world production of cobalt. The Union Miniere du Haut-Katanga, the world's largest producer, is the only company mining cobalt in the Republic of the Congo. All of its cobalt is produced in conjunction with the treatement of copper ore. Most of the ore comes from the Musonoi and Kamoto open pit mines; these are located near Kolwezi in what is called the Western Group of Mines of the Union Miniere concession, 205 miles northwest of Elisabethville, capital of the Katanga Province, and 50 miles north of the Rhodesian border. A railroad connects Katanga to the seaport of Lobito on the Atlantic coast of Angola (Portuguese West Africa), some 1100 miles from Kolwezi.

Ores mined and the resulting smelter products are processed in Katanga, except that white alloy (a crude alloy containing 42 percent cobalt and 15 percent copper) is shipped to Olen, Belgium, for processing. The outcome of present political readjustments taking place in Africa may have a pronounced effect on the future availability of cobalt from this important source. Production of cobalt in Katanga in 1961 (18,518,000 pounds) was not reduced from that in 1960 (18,126,000 pounds), despite the armed clashes associated with the attempt by Katanga to become independent of the rest of the Republic of the Congo.

Data concerning ore reserves at the Katanga mines are not available, but it is estimated by the industry that production at the present rate can continue for at least 50 years.

Federation of Rhodesia and Nyasaland

In 1961 the Federation of Rhodesia and Nyasaland, the second largest producer of cobalt, accounted for 11 percent of the free-world total. Cobalt produced there is a coproduct of copper.

Rhokana Corp., Ltd., a subsidiary of Rhodesian Anglo American, Ltd., operates the Nkana and Mindola copper mines in the northern part of Rhodesia. Cobalt has long been an important coproduct obtained in the recovery of copper from the ores of these mines. The company reports copper ore reserves at the two mines to be 120 million tons averaging 3.07 percent copper and 0.15 percent cobalt. Production by the mines of the Rhokana Corp., Ltd. is refined at Nkana.

Chibuluma Mines, Ltd., a subsidiary of Rhodesian Selection Trust, Ltd., is mining a copper-cobalt ore at the Chibuluma mine, located at Kalulushi, in the northern part of the Federation near the Congolese border. Copper ore reserves are estimated at 10 million tons containing 4.59 percent copper and 0.15 percent cobalt. Cobaltiferous matte is produced at the company's Ndola smelter and shipped to Belgium for refining.

Rhodesian Selection Trust, Ltd. is now developing the Baluba mine-a future source of copper and cobalt. Ore reserves at the Baluba mine on June 30, 1961, were estimated at 112 million tons containing 2.41 percent copper and 0.16 percent cobalt.

Morocco

The only company engaged in cobalt production in Morocco is the Societe Minière de Bou-Azzer et du Graara, Casablanca, which accounted for about 9 percent of the free-world total in 1961. The mine and concentrator are located south of the Atlas Mountains near Bou-Azzer. Moroccan cobalt ore occurs in vein-type deposits as arsenides of cobalt, and averages about 1.2 percent cobalt. The ore also contains recoverable nickel and gold.

Concentrate from the company plant averages about 11 to 12 percent cobalt; about 70 percent of the output is shipped to France for refining and the remainder to Belgium for treatment.

British East Africa

Estimated annual production of cobalt in Uganda protectorate of British East Africa is about 1.5 million pounds. At present cobaltbearing concentrates are stockpiled. Ore reserves are estimated at 15 million tons assaying 2 percent copper and 0.16 percent cobalt. Canada

Canadian production of cobalt totaled 3.2 million pounds in 1961--10 percent of the free-world production. More than 95 percent of the production was a byproduct of the mining and treatment of copper-nickel ores in the mining districts of Sudbury (Ontario) and Lynn Lake (Manitoba). Other cobalt producers were the silver mines of the Cobalt and Gowganda districts in Ontario.

In the Sudbury district there are two cobalt producers, International Nickel Co., Ltd., and Falconbridge Nickel Mines, Ltd. International Nickel Co. accounts for about 65 percent of total Canadian cobalt production, which is obtained in connection with the production of nickel. The company reports ore reserves of 265 million tons containing 8 million tons of copper and nickel. The cobalt content of the reserves is estimated at 0.06 percent, or about 300 million pounds of cobalt.

Falconbridge Nickel Mines, Ltd., accounts for about 20 percent of total cobalt production in Canada. Cobalt production at this mine is a byproduct of the mining and treatment of nickel-copper ores. It is reported that ore reserves on January 1, 1959, at the Falconbridge Mines amounted to about 44 million tons containing 1.45 percent nickel, 0.81 percent copper, and 0.05 percent, or 44 million pounds, of cobalt.

Sherritt Gordon Mines, Ltd., is the only cobalt producer in the Lynn Lake district, in northern Manitoba. It accounts for about 10 percent of total Canadian cobalt production. The cobalt is a byproduct obtained in the mining and treatment of nickel-copper ores. The company also operates a cobalt metal-powder rolling mill for the production of metal strip, rod, and wire. Estimated ore reserves on January 1, 1959, of Sherritt Gordon Mines, Ltd., totaled 15 million tons averaging 0.9 percent nickel and 0.48 percent copper. Actual cobalt content of the reserve ore is not known but, based on recent production statistics, the recoverable cobalt content of the ore appears to be 0.01 percent. Therefore, an estimated 3 million pounds of recoverable cobalt is contained in the ore reserves.

The aggregate output of several small mines located in the Cobalt and Gowganda districts of Canada amounted to about 175,525 pounds of cobalt in 1960, or about 5 percent of total Canadian production. No estimates of the ore reserves in this area are available.

Cuba

In the period 1952-57 the Moa Bay Mining Co., a wholly owned subsidiary of Freeport Sulphur Co., developed 50 million tons of lateritic ore averaging 1.36 percent nickel, 0.13 percent cobalt, and 46.0 percent iron

at its mine in Oriente Province, Cuba. Construction was started on the mining and concentrating plants at Moa Bay in 1957. At the same time, the Freeport Nickel Co., also a wholly owned subsidiary of Freeport Sulphur Co., began construction of a plant at Port Nickel, La. (U.S.A.), for the treatment of nickel-cobalt concentrate $\underline{1}/$ from the Moa Bay mine. Actual production began at Moa Bay in November 1959, and at Port Nickel early in 1960.

Ore reserves at Moa Bay were estimated to be sufficient for 40 to 50 years of operation. However, Cuban Government restrictions and prohibitive taxation forced the suspension of operations at the Moa Bay nickel-cobalt plant on April 1, 1960. In August 1960 the Cuban facilities were seized by the Cuban Government and, as a direct result of the closing of the mine, the refinery at Port Nickel, La., ceased operations in 1960. The refinery is now being maintained on a standby basis.

Before closing, the Freeport Nickel Co. produced cobalt metal from the Cuban concentrate at its refinery at Port Nickel and sold 307,840 pounds of cobalt to the U.S. Government under its defense production contract.

The investment by Freeport Sulphur Co. for the combined operations at Moa Bay and Port Nickel amounted to about \$100 million, of which approximately \$61.5 million was for the Cuban operation.

1/ The material, a mixture of nickel-cobalt sulfides, was produced from ore by a chemical process; as such it is not regarded as a "concentrate" in customs practice. However, it is often referred to as a "concentrate" in the trade.

Europe

Primary cobalt of European origin is derived from pyrite residue. Pyrite from Cyprus, Finland, Sweden, Spain, and other countries is roasted to produce sulfuric acid. The residue from the sulfuric acid plants is sent to West Germany, where it is treated to recover the copper, zinc, and cobalt content. Data on the amount of cobalt produced in Europe are not available, but production there is known to be small.

Free-World Reserves

Cobalt occurs in many parts of the world, the principal known reserves being located in North America and Africa. Exclusive of the Sino-Soviet bloc, estimated major mine reserves of cobalt content contained in ore are shown in the following tabulation:

| Country | Cobalt content | | |
|--|---|-----------------------------------|--|
| country | Quantity | Grade | |
| | 1,000 pounds | Percent | |
| North America, total Cuba Canada United States | 1,402,000 744,000 386,000 272,000 | 0.07-0.12 0.08-5.0 0.05-0.7 | |
| Africa, total Republic of the Congo Federation of Rhodesia and Nyasaland Morocco | 2,294,000 1,500,000 766,000 28,000 | 0.2-8.0 0.07-3.0 0.75-1.25 | |
| Oceania: New Caledonia | 880,000 4,576,000 | 0.05 | |

Source: Cobalt, A Materials Survey, U.S. Bureau of Mines, 1962.

The Cobalt Information Center reports that the U.S.S.R. is the sole producer of cobalt in the Sino-Soviet bloc countries. The reserves of cobalt in that country appear to be large and to consist of cobalt-bearing ores including nickel-cobalt, manganese-cobalt, and other complex ores.

In addition to the above reserves of cobalt, the Cobalt Information Center reports that possible future sources of cobalt are--

The nickel-cobalt deposits on the island of Waigeo, Netherlands New Guinea.

The manganese ore bodies in the State of Minas Gerais, Brazil.

The marine, mineral reserves recently reported to exist in large quantities in the Pacific Ocean and to show relatively high cobalt content.

Foreign Rates of Duty

Rates of duty currently imposed on imports of cobalt and cobalt products by the principal foreign consuming countries are shown in table 9.

European Economic Community

The European Economic Community (EEC), established by the Treaty of Rome (signed on March 25, 1957), is presently comprised of France, West Germany, Italy, Belgium, the Netherlands, and Luxembourg. $\underline{1}/$ These countries, as a group, account for a large part of the free-world consumption of cobalt. The Treaty of Rome provides for the gradual elimination of trade barriers between the member countries, and the

1/ Most of the former overseas colonies of the EEC countries are also associated with the EEC.

gradual adoption of a common external tariff on imports from other countries. These objectives are to be achieved on or about January 1, 1970. Imports of cobalt ore, concentrates, metal, waste, and scrap would then enter the EEC countries free of duty; cobalt shapes and forms would be dutiable at 7 percent ad valorem; and cobalt oxide and hydroxide would be dutiable at 10 percent.

Initial steps toward the common external tariff have been taken. Adaptation to the common external tariff necessitates lowering tariffs on cobalt metal, waste, and scrap by France and Italy, lowering tariffs on worked metal shapes and forms and on cobalt oxide and hydroxide by France, and raising the tariffs on these articles by the other EEC countries. The rates of duty currently imposed on imports of cobalt and cobalt products by the EEC member countries are discussed below.

France.--Ore and concentrates are duty free, regardless of source. Metal, waste, and scrap are currently dutiable at 6.0 percent ad valorem when imported from a member of the European Economic Community; when imported from nonmembers, metal, waste, and scrap are dutiable at 7.2 percent ad valorem. Metal forms imported from EEC countries are dutiable at 7.5 percent ad valorem; those originating elsewhere are dutiable at 10.6 percent. Duties on oxides and hydroxides are 15.0 percent ad valorem for imports from EEC countries and 20.4 percent for these from all other sources.

An additional import (stamp) tax of 2 percent of the amount of the duty is also levied on the dutiable cobalt products specified above.

<u>West Germany</u>.--Cobalt ore, concentrates, metal, waste, and scrap are duty free. Metal shapes and forms are duty free from EEC countries and currently dutiable at 1.7 percent ad valorem from other sources. Oxides and hydroxides are duty free from EEC countries and dutiable at 2.4 percent ad valorem from all other sources.

Italy.--Cobalt ore and concentrates are duty free from all sources. Metal, waste, and scrap are currently duty free when imported from EEC countries and dutiable at 2.1 percent ad valorem when imported from other sources. Cobalt shapes and forms from EEC countries are dutiable at 3.0 percent ad valorem and those originating elsewhere, at 6.0 percent. Oxides and hydroxides are dutiable at 2.0 percent ad valorem when of EEC origin and at 5.2 percent when originating outside the EEC. An import tax of 2.5 percent of the duty-paid and sales-tax paid value is also applicable for oxides and hydroxides.

Benelux.--The Benelux countries--Belgium, the Netherlands, and Luxembourg--constitute a customs union; hence the rates of duty applicable to imports of cobalt and cobalt products are the saem for all three countries. Cobalt ore, concentrates, metal, waste, and scrap are free of duty regardless of origin. Metal shapes and forms are currently free of duty when imported from EEC countries but dutiable at 1.7 percent ad valorem when originating elsewhere. Cobalt oxides and hydroxides from EEC countries are free of duty; originating from other sources, they are dutiable at 2.4 percent.

United Kingdom and Japan

Cobalt ore, concentrates, metal, waste, and scrap enter the United Kingdom free of duty regardless of source. Metal shapes and forms are currently duty free when imported from Commonwealth countries; they are dutiable at 6 percent ad valorem when imported from member countries of the European Free Trade Area (EFTA) and at 10 percent when imported from other sources. Cobalt oxide enters free of duty from Commonwealth countries; it is dutiable at 12 percent ad valorem when imported from a member of EFTA and at 20 percent when imported from any other source.

Japan does not levy any import duties on cobalt or cobalt products.

APPENDIX A

SENATE RESOLUTION 206

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87TH CONGRESS 1st Session

V

S. RES. 206

[Report No. 1103]

IN THE SENATE OF THE UNITED STATES

SEPTEMBER 11, 1961

Mr. DIRKSEN (for himself, Mr. MANSFIELD, Mr. COOPER, Mr. MORTON, Mr. AL-LOTT, and Mr. DWORSHAK) submitted the following resolution; which was referred to the Committee on Finance

> SEFTEMBER 21, 1961 Reported by Mr. Byrn of Virginia, with amendments

SEPTEMBER 23, 1961 Considered, amended, and agreed to; preamble agreed to

RESOLUTION

- Whereas, pursuant to a resolution of the Senate Committee on Finance, dated August 14, 1954, the United States Tariff Commission made an investigation under section 332 of the Tariff Act of 1930, of the domestic fluorspar industry and submitted a report of the results thereof to the said committee on June 6, 1955, and the Senate of the United States subsequently on August 21, 1959, by S. Res. 163, directed the United States Tariff Commission to bring up to date said report and to submit its findings not later than February 21, 1960; and
- Whereas, pursuant to a resolution of the United States Senate adopted August 21, 1959, the United States Tariff Commission was directed to make a supplemental investigation of conditions in the lead and zinc industry and to bring up to date its report on lead and zinc [°]which had previously been made on April 19, 1954; and

- Whereas, pursuant to a resolution of the Senate Committee on Finance, dated March 17, 1958, the United States Tariff Commission made an investigation under section 332 of the Tariff Act of 1930, of the domestic mercury (quicksilver) industry and submitted a report of the results thereof to the said committee on December 1, 1958; and
- Whereas the industries producing manganese, cobalt, and beryllium are becoming more and more distressed and such distress could have an effect on our national security: Now, therefore, be it

Resolved, That the United States Tariff Commission is
 hereby directed, pursuant to section 332 of the Tariff Act
 of 1930, to make further studies and bring up to date the
 reports on lead, zinc, mercury, and fluorspar and to report
 to the Congress on or before May 15, 1962, and to conduct
 investigations of conditions in the industries producing
 manganese, cobalt, and beryllium and report to Congress
 not later than August 31, 1962.

9 The supplemental reports and new reports shall include a summary of the facts obtained in the investigation, in-10 11 cluding a description of the domestic industry, domestic 12production, foreign production, imports, consumption, chan-13 nels and methods of distribution, United States exports, and other factors affecting the competition between domestic 14 15 and imported products. In the course of the investigations. the Commission shall hold hearings, giving adequate oppor-16

tunity to interested parties to appear and be heard, except
 that in the case of lead, zinc, mercury, and fluorspar where
 reports are being brought up to date, the matter of further
 hearings shall be left to the discretion of the Tariff Commis sion.

APPENDIX B

STATISTICAL TABLES

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| Tariff designation | Rate | Effective date and trade agreement |
|-------------------------------------|---|---|
| Par. 1652: Cobalt and cobalt ore | : Free : Free 1/ | : : : June 18, 1930; Tariff Act of 1930. : Jan. 1. 1936 and Jan. 1. 1939: Canada. |
| Par. 29: Cobalt oxide | : Free 1/ : : 20¢ per 1b.3/ : 10¢ per 1b. : 10¢ per 1b. 1/ | : Jan. 1, 1948; GATT. 2/ : : June 18, 1930; Tariff Act of 1930. : Jan. 1, 1936 and Jan. 1, 1939; Canada. : Jan. 1, 1948; GATT. |
| | : 5¢ per lb. : 4-3/4¢ per lb. : 4-1/2¢ per lb. : 4¢ per lb. : 2.7¢ per lb. : 1-1/2¢ per lb. | : June 6, 1951; GATT. : June 30, 1956; GATT. : June 30, 1957; GATT. : June 30, 1958; GATT. : July 1, 1962; EEC. 4/ : July 1, 1963; EEC. 4/ |
| Cobalt sulfate | : 10¢ per 1b. <u>3</u> / : 5¢ per 1b. : 5¢ per 1b. <u>1</u> / : 2-1/2¢ per 1b. : 2¢ per 1b. : 1-1/2¢ per 1b. | : June 18, 1930; Tariff Act of 1930. : May 1, 1935; Belgium. : Jan. 1, 1948; GATT. : June 6, 1951; GATT. : July 1, 1962; EEC. 4/ : July 1, 1963; EEC. 4/ |
| Cobalt linoleate 5/ | : : 10¢ per 1b.3/ : 10¢ per 1b.1/ : 5¢ per 1b. | : : June 18, 1930; Tariff Act of 1930. : Jan. 1, 1948; GATT. : June 6, 1951; GATT. |
| Cobalt salts and compounds, n.s.p.f | : 30% ad val. <u>3</u> / 15% ad val. 13-1/2% ad val. 12% ad val. | : June 18, 1930; Tariff Act of 1930. Sept. 10, 1955; GATT. July 1, 1962; UK. 6/ July 1, 1963; UK. <u>6</u> / |

Table 1.--Cobalt and cobalt ore, and cobalt compounds: U.S. rates of duty under the Tariff Act of 1930, 1930 to 1962

1/ Bound.

2/ General Agreement on Tariffs and Trade. 3/ Currently applicable to the products of Communist-dominated nations or areas designated by the President pursuant to sec. 5 of the Trade Agreements Extension Act of 1951 (includes Cuba, Public Lew 87-45).

 $\frac{1}{2}$ / European Economic Community; bilateral agreements made during the 1960-61 negotiations at Geneva. $\frac{5}{2}$ / Subject also to $2\frac{1}{4}\phi$ per lb. Internal Revenue Code (I.R.C.) tax if imported from non-Communistdominated nations or areas, and $4\frac{1}{2}\phi$ per lb. I.R.C. tax if imported from Communist-dominated nations or areas. See I.R.C. sec. 4571(1).

6/ Bilateral agreements made during the 1960-61 negotiations at Geneva.

| ages 19 46-50 | |
|---------------------------|-----------------------------|
| avera | |
| U.S. consumption by uses, | and 1951-55, annual 1956-61 |
| Table 2Cobalt: | |

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| | 1961 1/ | 220 584 584 2584 257 2550 2550 2598 804 804 | 526 1,040 314 | 2,072 | 9,596 |
|--------------|------------------------|--|--|--------------------|--------------|
| | 1960 1/ | 2, 387 2, 387 2, 387 2, 263 4447 320 6, 825 | 465 1,172 190 278 | 2,105 | 8,930 |
| | 1959 | 214 2,979 2,423 404 339 654 7,771 | 1,131 200 254 | 2,128 | 9,899 |
| | 1958 | 2,340 2,340 161 2,193 361 148 252 2,543 5,643 | 457 1,030 251 161 | 1,899 | 7,542 |
| ontent) | 1957 | 237 2,927 2,927 264 264 264 249 237 7,279 | 474 1,011 205 188 | 1,878 | 9,157 |
| cobalt co | 1956 | 259 2,788 2,788 2,788 2,709 2,53 3,612 7,701 7,701 | 525 989 232 115 | 1,861 | 9,562 |
| of pounds, (| Average : 1951-55 : | 227 124 2,199 4,560 528 348 348 328 8,213 | : 124 884 1421 763 | 1,505 | 9,718 |
| iousands o | Average 1946-50 : | 251 1,583 1,583 1,226 117 88 124 | 57 57 57 | 1,691 | 5,253 |
| (In th | Use | Metallic: High-speed steel | Nonmetallic: Ground-coat frit Salts and driers (estimated) Pigments: Other | Total nonmetallic: | Grand total: |

 $\frac{1}{2}$ / Freliminary. $\frac{2}{2}$ / Includes in some years small quantities of soft magnetic alloys.

Source: U.S. Bureau of Mines.

Table 3.--Cobalt: U.S. consumption by forms, averages 1946-50 and 1951-55, annual 1956-61

| Period | Metal | Oxide | Purchased scrap | Salts and driers | Total |
|---------------------|---------|------------|--------------------|------------------------|------------------|
| | : | ; 1 | | | |
| Average: 1946-50 | : 3,572 | 745 | 35 | ⁸ 73 | <u>1</u> / 5,253 |
| 1951-55 | 7,187 | 624 | 1,021 | 884 | <u>2</u> / 9,718 |
| Annual: 1956 | 7,321 | 857 | 395 | 989 | 9,562 |
| 1957 | 7,028 | 755 | 363 | 1,011 | 9,157 |
| 1958 | : 5,403 | 754 | 355 | 1,030 | 7,542 |
| 1959 | 7,630 | 877 | 261 | 1,131 | 9,899 |
| 1960 <u>3</u> / | : 6,761 | : : 757 | 240 | : 1,172 | 8,930 |
| 1961 <u>3</u> / | : 7,478 | 900 · | 178 | : 1,040 : | 9,596 |

(In thousands of pounds, cobalt content)

1/ Includes 25,000 pounds of cobalt-nickel compound and about 2,000 pounds of ore and alloy.

 $\frac{2}{3}$ / Includes about 2,000 pounds of ore and alloy. 3/ Preliminary.

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Source: Compiled from official statistics of the U.S. Bureau of Mines.

| Period | Cobalt metal, f.o.b. Niagara Falls or New York, N.Y. <u>1</u> / | : Cobalt oxide (ceramic : grade, gross weight) : east of : Mississippi River <u>2</u> / |
|------------------------------|---|--|
| Jan. 1, 1946-June 30, 1947 | \$1.50 | : \$1.16 |
| July 1, 1947-Mar. 31, 1949: | 1.65 | $1.27\frac{1}{2}$ |
| Apr. 1, 1949-Dec. 31, 1950 | 1.80 | 1.38 |
| Jan. 1, 1951-Sept. 30, 1951- | 2.10 | 1.60 |
| Oct. 1, 1951-Oct. 31, 1953: | 2.40 | <u>3</u> / 1.82 |
| Nov. 1, 1953-Nov. 30, 1956 | 2.60 | 1.96 |
| Dec. 1, 1956-Jan. 31, 1957 | 2.35 | 1.78 |
| Feb. 1, 1957-Jan. 31, 1959 | 2.00 | 1.52 |
| Feb. 1, 1959-Feb. 29, 1960 | 1.75 | 1.33 |
| Mar. 1, 1960-Aug. 1, 1962: | 1.50 | 1.15 |

Table 4.--Cobalt: U.S. prices per pound of cobalt metal and cobalt oxide, Jan. 1, 1946-Aug. 1, 1962

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1/ 500 pound drums f.o.b. carrier. 2/ 250 pound kegs, f.o.b. shipping point, freight allowed. 3/ Priced at \$1.76 per pound from Nov. 1, 1951, to Jan. 10, 1952.

Source: E&MJ Metal and Mineral Markets.

| • | Primary products | | | Compounds | | | | |
|---|---------------------------------------|--|---|---|------------------------------------|-----------------------------------|--------------------------------|--|
| Year | Ore, concentrates, and white alloy | : Metal : and : scrap | Total | Oxide <u>1</u> / | Sulfate 2/ | Compounds, n.s.p.f. <u>3</u> / | Total | Total, all products |
| | | | Quantit | ty (1,000 pc | unds, cobalt | content) | | |
| : 1946: 1947: | 513 499 2 550 | : 1,936 : 7,684 | 2,449 8,183 7,834 | : 774 : 587 : | - | : 4/ : : 4/ : : 4/ : | 774 587 558 | 3,223 8,770 8,302 |
| 1940 | 1,711 | 5,588 | 7,299 | 259 | · · · | <u><u> </u></u> | 259 | 7,558 |
| 1950: 1951: 1952: 1953: | 1,850 1,795 2,868 2,464 | 6,706 8,406 12,021 14,443 | 8,556 10,201 14,889 16,907 | 675 : 314 : 279 : 439 : | 4/ <u>4</u> / 3 57 | $\frac{1}{4/2}$ | 676 314 282 496 | 9,232 10,515 15,171 17,403 |
| 1954: 1955: 1956: 1957: | 2,370 2,501 2,019 832 | : 14,228 : 15,535 : 12,974 : 16,173 | 16,598 18,036 14,993 17,005 | 310 773 596 466 | 72 67 79 76 | 2 : 10 : 5 : 1 : | 384 850 680 543 | : 16,982 : 18,886 : 15,673 : 17,548 |
| 1958 1959 1960 <u>5</u> / 1961 <u>5</u> / | - - - - | : 14,537 : 20,087 : 10,801 : 10,036 | : 14,537 : 20,087 : 10,801 : 10,036 | : 602 : 1,121 : 1,051 : 490 | 34 53 43 33 | : 19 : : 6 : : 6 : : 6 : | 655 1,180 1,100 524 | : 15,192 : 21,267 : 11,901 : 10,560 |
| | | | Fo | reign value | (1,000 dolla | urs) | | |
| 1946 1947 1948 1949 | 491 464 2,523 2,011 | : 2,749 8,439 7,744 9,000 | : 3,240 : 8,903 : 10,267 : 11,011 | : 1,450 : 813 : 813 : 813 : 384 | | : 1 : : 2 : : 5 : : 1 : | 1,451 815 818 385 | : 4,691 : 9,718 : 11,085 : 11,396 |
| 1950 1951 1952 1953 | 2,240 2,707 5,668 4,951 | : 10,952 : 16,585 : 27,304 : 33,225 | : 13,192 : 19,292 : 32,972 : 38,176 | : 1,039 : 604 : 621 : 980 | 1 2 11 172 | 5 2 6/ 1 | 1,045 608 632 1,153 | 14,237 19,900 33,604 39,329 |
| 1954 1955 1956 1957 | 5,576 5,760 3,737 1,320 | : 35,391 : 38,585 : 32,910 : 32,433 | 40,967 44,345 36,647 33,753 | 723 1,792 1,413 853 | 200 197 221 177 | : 11 : 52 : 25 : 2 2 ; | 934 2,041 1,659 1,032 | 41,901 46,386 38,306 34,785 |
| 1958 1959 1960 <u>5</u> / 1961 <u>5</u> / | • • - • - • - • - | : 28,664 : 35,926 : 17,093 : 14,867 | : 28,664 : 35,926 : 17,093 : 14,867 | i,116 i,856 i,520 i,663 | : 78 : 111 : 83 : 56 : | : 68 : 23 : 21 : 3 | 1,262 1,990 1,624 722 | 29,926 37,916 18,717 15,589 |
| <pre>1/ Estimated 72 percent cobalt. 2/ Estimated 21 percent cobalt. 3/ Estimated 25 percent cobalt. 4/ Less than 500 pounds. 5/ Preliminary. 6/ Less than \$500.</pre> | | | | | | | | |

Table 5.--Cobalt: U.S. imports for consumption by kinds, 1946-61

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Source: Compiled from official statistics of the U.S. Department of Commerce.

Note .-- No imports of linoleate were recorded.

| Table 6Cobalt ore, concentrate, white alloy, metal, and scrap: by principal sources, 1946-61 | V.S. | imports | for consumption, |
|---|------|---------|------------------|
|---|------|---------|------------------|

| Year | Belgian Congo <u>1</u> / | Belgium | : Canada : | : Federation of : Rhodesia and : Nyasaland 2/ | West Germany | : Norway | : : France | All other | : : Total |
|-----------------|---|---------|---------------|---|-----------------|-------------|---------------|-------------------|------------------|
| | Quantity (1,000 pounds, cobalt content) | | | | | | · · | | |
| 1946 | 690 | 1 685 | 1 74 | 1 | 1 | | : • | 8 | 1 |
| 1947 | 5,248 | 2,726 | : 78 | | | - | | | : 2,449 |
| 1948 | : 5,239 | 1,725 | : 870 | - | 1 - | | | <u>3</u> / 131 | : 8,183 |
| 1949 | ; 5,096 | 2,181 | : 12 | • | : - : | - | : - | 10 | 1,034 |
| 1950 | 5,782 | 2,755 | : 19 | | 1 | 8 | 8, | 3 | : |
| 1951 | : 6,973 : | 2,998 | : 219 | | - | - | · - | 1 | : 8,556 |
| 1052 | : 10,971 : | 3,539 | : 362 | t s | | - | · · | · 4 | 10,201 |
| 1993 | : 11,754 : | 3,567 | 1 788 | t – t | 590 : | 208 | - | · | : 16,907 |
| 1954 | 11,582 | 2,515 | 1,223 | ; - · | 018 | 300 | | 1 | : |
| 1054 | : 12,665 : | 3,164 | : 1,347 | · - : | 607 : | 250 | , ≥, | 38 | : 16,598 |
| 1957 | : 11,436 : | 1,361 | : 1,282 | : - : | 498 : | 407 | 9 | | 10,036 |
| | · 9,390 ! | 1,43(| 2,246 | 530 | 856 : | 762 | 41 | 4/ 1,737 | : 17,005 |
| 1958 | 8,812 : | 2,355 | 1,065 | 818 | 712 | - 737 | 1 | | 1 |
| 1959 | : 11,887 ; | 4,477 | 540 | 983 | 1.377 | 746 | 27 | 11 | 14,537 |
| 1960 5/ | 4,736 : | 3,276 | 525 | 340 : | 1,103 ; | 717 : | 104 | 61 9 | 20,087 |
| 1/01 2/ | 4,009 : | 1,802 | 896 | 200 ; | 1,394 : | 547 : | 295 | <u>ب</u> ع | 10,001 |
| | Foreign value (1,000 dollars) | | | | | | | | |
| 1946 | 800 | 0.0%0 | | : | · · · · | : | | | |
| 1947 | 4.675 | 2,300 : | 60 50 | - : | - : | - : | - : | | 3.240 |
| 1948 | 6,958 | 2.661 | 59 : 647 : | | - : | - : | - : | 3/ 202 | 8,903 |
| 1949 | 7,388 : | 3,595 : | 9; | | - : | | - : | | 10,266 |
| 1050 | : | : | : | : | | | ~ ; | 19 : | 11,011 |
| 1951 | 8,492 : | 4,684 1 | 16 : | · · | - : | | - : | | 13,102 |
| 1952 | 24,343 | 7 006 | 362 : | - : | - : | - : | 23 : | 3 : | 19,292 |
| 1953 | 26.465 | 8.248 | 1.603 | - | - : | - : | ; ∠- : | 2: | 32,972 |
| | : | : | ., | | т, зы . | 499 : | · · · · | | 38,176 |
| 1954 | 28,609 : | 6,256 : | 2,995 : | | 2.168 : | 847 : | · · · | | 10 077 |
| 1955 | 31,171 : | 7,873 : | 3,106 : | - : | 1,515 : | 650 : | 10 : | 90 : | 40,967 LL 315 |
| 1957 | 18 101 1 | 3,500 : | 2,806 : | - : | 1,217 : | 1,033 : | 32 ; | | 36.647 |
| | 10,404 | 2,009 : | 4,277 : | 1,117 | 1,671 : | 1,539 : | 108 : | ½/ 3,768 : | 33,753 |
| 1958 | 17,468 : | 4,742 : | 1,963 : | 1,626 | 1.346 | 1.447 • | 71 | | 08 (() |
| 1959: | 21,046 : | 8,329 : | 982 : | 1,784 | 2.316 | 1.309 | 156 • | 7 : | 20,664 |
| 1900 //: | 7,364 : | 5,293 : | 916 : | 564 : | 1,623 : | 1,139 : | 191 | 4: | 37,920 |
| 1701 <u>/</u> / | 7,177 : | 2,684 : | 1,422 : | 294 : | 2,001 : | 814 : | 457 : | 18 : | 14,867 |

1/ Became Republic of the Congo on June 30, 1960.
2/ Beginning July 1, 1954, includes Northern Rhodesia, Southern Rhodesia and Nyasaland. Data for periods prior to this date are for Northern Rhodesia only.
3/ Includes 129 thousand pounds, valued at 198 thousand dollars from Japan.
4/ Includes 1,733 thousand pounds valued at 3,766 thousand dollars from the United Kingdom.
5/ Preliminary.
6/ Less than 500 pounds.

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Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 7.--Cobalt ore, concentrate, metal and scrap: U.S. exports of domestic merchandise, by principal markets, 1946-61

| Year | Canada | : United | Netherlands | : West | Italy | Sweden | France | Japan | Australia | : All | Total |
|--|---------------------------------------|--------------------------------------|-------------------------|--|-----------------------------|-------------------------------|----------------------------|---|-----------------------|---|--|
| | Quantity (1,000 pounds, gross weight) | | | | | | | | | | |
| 1946 1947 1948 1949 | 1/ 1/ 148 | ; <u>1</u> / ; <u>1</u> / ; 70 | | : : - : - : - | : 13 : - : - : 16 | : - : - : - : - | : l : - : - : - | : - : - : - | - - - - 1 | : 3 : 1 : 2 : <u>1</u> / | 17 135 165 |
| 1950 1951 1952 1953 | 27 5 25 | : - : 30 : 140 | | 116 - - 197 | : 15 : 2 : - : 2 | 1/2 1/2 | | - - 1/ | 1/ 1/ 1/ | : 1 :2/2,506 : 1 ⁴ | 159 10 2,536 378 |
| 1954 1955 1956 1957 | 245 10 299 53 | 959 1,726 643 219 | 108 302 140 10 | : 1,732 : 1,715 : 1,712 : 1,712 | · 2 · 1 · 2 · 5 | <u>1</u> / 38 102 85 | : 1 : 1 : 15 : 2 | <u>1</u> / 10 | 5 4 24 1 | : 9 : 19 : 78 : 21 | 3,061 3,816 3,025 1,069 |
| 1958 1959 1960 4/ 1961 4/ | 5 11 25 180 | 238 142 417 160 | 27 134 173 81 | 1,243 313 780 245 | : 3 : 63 : 99 : 84 | 1 1 7 23 | 2 1 10 86 | <u>1</u> / 18 208 1,025 | 1/ 1/ 1/ 44 | : <u>3</u> / 227 : 12 : 79 : 147 | : 1,758 : 695 : 1,798 : 2,075 |
| | Value (1,000 dollars) | | | | | | | | | | |
| 1946 1947 1948 1949 | 2/ 63 15 | 5/ 118 | | : - : - : - | 20 - - - - | | : 5 : - : - | : - : - : - | - - 4 | 22 22 36 | : 28 : 2 : 184 : 56 |
| 1950 1951 1952 1953 | 3 9 - 57 | - 3 - 39 | - - 3 5 | 44 - 36 | 27 4 - | - 7 3 6 | - - - 3 - 7 | · - · · · · · · · · · · · · · · · · · · | - 1 4 13 | 8 43 2/363 138 | 82 64 379 320 |
| 1954 1955 1956 1957 | 50 52 124 181 | 185 341 195 88 | 18 100 103 11 | 633 485 1,052 371 | 22 11 32 41 | 3 25 62 48 | 30 22 43 34 | : 1 : - : 4 : - | 4 22 20 18 | : 173 : 120 : 185 : 155 | 1,119 1,178 1,820 947 |
| 1958 1959 1960 4/ 1961 <u>4</u> / | 38 65 68 776 | 77 76 270 167 | 14 56 69 31 | 326 100 266 116 | 34 43 214 148 | 9 12 19 47 | 31 22 37 75 | : 6 : 18 : 115 : 300 | 13 14 22 19 | <u>3</u> / 554 137 233 202 | : 1,102 : 543 : 1,313 : 1,881 |

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1/ Less than 500 pounds. 2/ Includes 2,502 thousand pounds, valued at 303 thousand dollars to Belgium. 3/ Includes 216 thousand pounds, valued at 428 thousand dollars to Belgium. 4/ Preliminary. 5/ Less than \$500.

Source: Compiled from official statistics of the U.S. Department of Commerce.

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Table 8.--Cobalt: Mine production of major free-world cobalt-producing countries and estimated free-world total, 1946-61

| | | | | | ······································ | ۵۵ ۵۰ |
|------|-----------------------------|--|---------|---------|--|--|
| | | Africa | | North A | America | |
| Year | Belgian Congo <u>l</u> / | Federation of Rhodesia and Nyasaland | Morocco | Canada | United States | Free-world total (estimate) <u>2</u> / |
| 1946 | 4,740 | 1,218 | 440 | 76 | 518 | 7,600 |
| 1947 | 7,854 | 926 | 816 | 578 | 646 | 11,500 |
| 1948 | 9,528 | 810 | 612 | 1,546 | 688 | 13,600 |
| 1949 | 9,706 | 886 | 460 | 620 | 522 | 13,000 |
| 1950 | 11,390 | 1,478 | 926 | 584 | 810 | 15,800 |
| 1951 | 12,600 | 1,494 | 1,500 | 952 | 902 | 18,600 |
| 1952 | 15,060 | 1,290 | 2,204 | 1,422 | 1,364 | 21,800 |
| 1953 | 18,250 | 1,492 | 1,322 | 1,602 | 1,258 | 25,000 |
| 1954 | 18,980 | 2,528 | 1,622 | 2,252 | 1,996 | 28,800 |
| 1955 | 18,886 | 1,742 : | 1,668 | 3,318 | 2,610 | 29,400 |
| 1956 | 20,038 | 2,410 : | 1,420 | 3,516 | 3,596 | 31,800 |
| 1957 | 17,890 | 3,166 : | 1,000 | 3,922 | 4,144 | 31,800 |
| 1958 | 14,332 : | 3,584 : | 2,042 | 2,710 | 4,844 | 29,200 |
| 1959 | 18,588 : | 4,540 : | 2,660 | 3,150 | 2,994 | 34,600 |
| 1960 | 18,126 : | 4,072 : | 2,802 | 3,568 | <u>3</u> /1,570 | 33,600 |
| 1961 | 18,518 : | 3,402 : | 2,844 | 3,236 | <u>3</u> /1,100 | 32,200 |

/Quantity (1,000 pounds of contained cobalt)/

1/ Became Republic of the Congo on June 30, 1960.

 $\overline{2}$ / Includes small quantities produced principally in Europe, Australia, and New Caledonia.

3/ Estimated by Cobalt Information Center.

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Source: Compiled from official statistics of the U.S. Bureau of Mines, except as noted.

Table 9.--Cobalt: Rates of duty applicable to imports into principal foreign consuming countries, July 1, 1962

| (In perce | nt ad valore | m) |
|---|--|---|
| T 1 | General | : Preferențial |
| Item and country : | rate | : rate <u></u> |
| Ore and concentrate: France | rate Free Free Free Free Free Free Free Fr | : rate = : Free (EEC). 1/ : Free (EEC). : Free (EEC). : Free (EEC). : Free (EEC). : Free (EFTA; C). 2/ : - : - : 6.0 (EEC). 4/ : Free(EEC). : Free (EEC). : Free (EEC). |
| Belgium and Luxembourg Netherlands United Kingdom Japan EEC Common external tariff 2/: Metal, worked, shapes and forms: France West Germany West Germany Italy | Free Free Free Free 10.6 4/ 1.7 6.0 1.7 1.7 10.0 | : Free (EEC). : Free (EFTA; C). : - : - : 7.5 (EEC). 4/ : Free (EEC). : 3.0 (EEC). : Free (EEC). : Free (EEC). : 6.0 (EFTA). : Free (C). |
| Japan EEC Common external tariff 2/: Oxide and hydroxide: France | Free 7.0 20.4 4/ 2.4 5.2 5/ 2.4 2.4 20.0 6/ Free 10.0 | : - : - : 15.0 (EEC). 4/ : Free (EEC). : 2.0 (EEC). 5/ : Free (EEC). : Free (EEC). : 12.0 (EFTA). 6/ : Free (C). : - |

1/ European Economic Community (EEC).

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 $\overline{2}$ / European Free Trade Area (EFTA), British Commonwealth (C).

 $\frac{3}{4}$ Proposed to apply on or about Jan. 1, 1970. $\frac{1}{4}$ An import (stamp) tax of 2 percent of the amount of the duty only is also applicable.

5/ An import tax of 2.5 percent of the duty-paid and sales-tax-paid value is also applicable.

6/ Applies to cobalt oxide. Rates for the hydroxide are as follows: General, 33-1/3 percent; EFTA, 20.0 percent; Commonwealth, free.

Source: U.S. Department of Commerce.