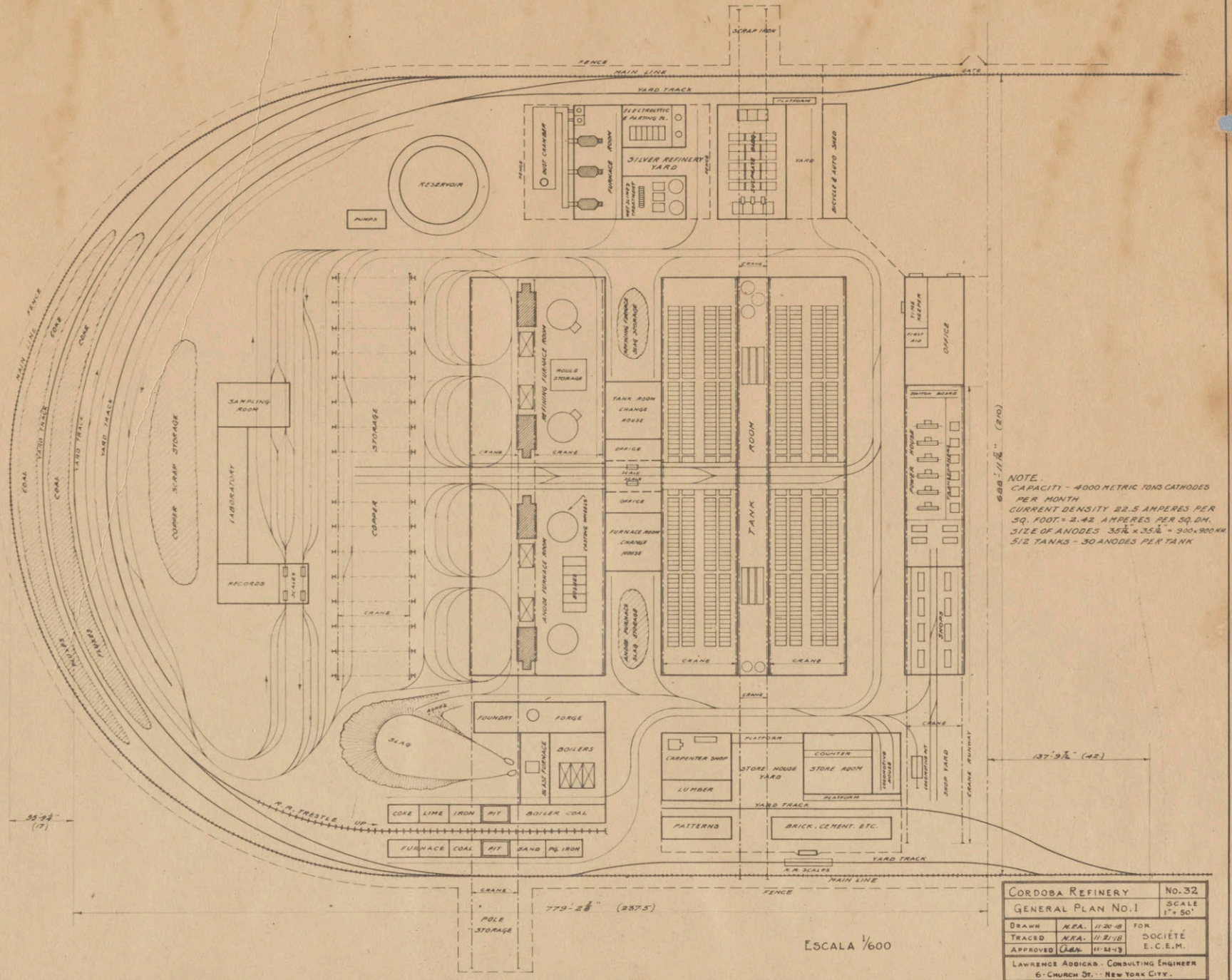
Bismuth Sales Reports

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|---|---|---|---|
| CORDOBA REFINERY | | | No. 32 |
| GENERAL PLAN No. 1 | | | SCALE 1" = 50' |
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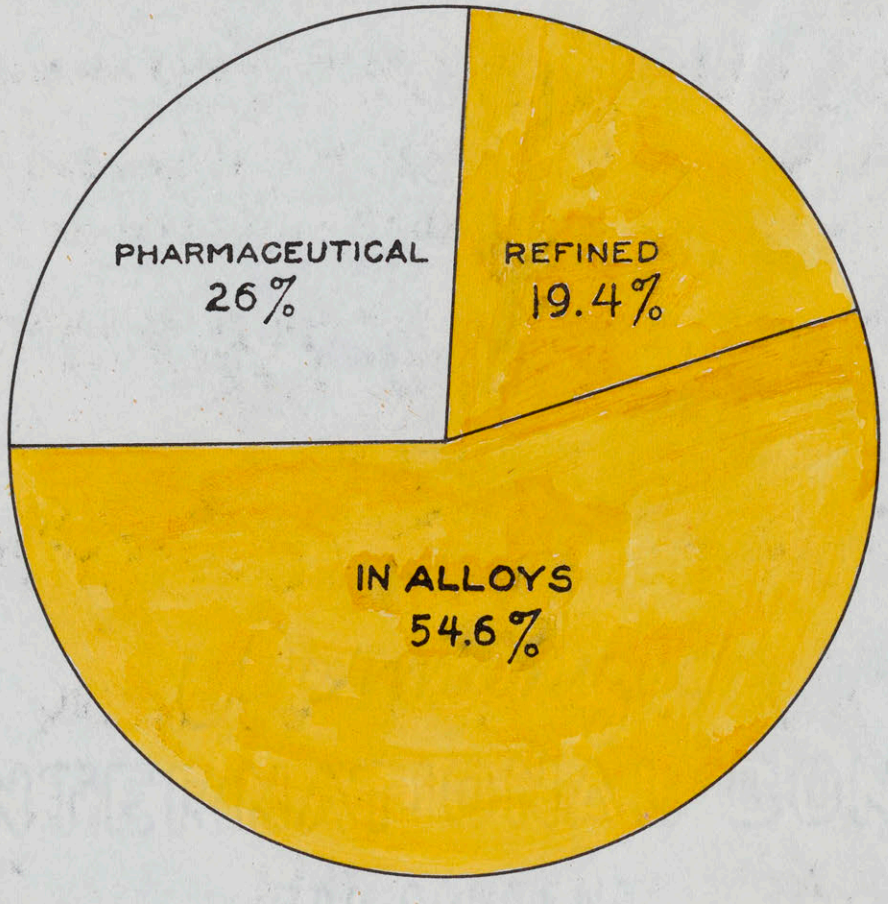
| TRACED | N.F.A. | 11-21-18 | |
| APPROVED | [illegible] | 11-24-18 | |

LAWRENCE ADDICKS - CONSULTING ENGINEER
6 - CHURCH ST. - NEW YORK CITY -

# Bismuth Sales Report
1941




1941

BISMUTH SALES

○ PHARMACEUTICAL

● METALLURGICAL

## GENERAL

Sales of bismuth to customers located in the United States and Canada made by the Corporation are divided into two general classifications.

1. Pharmaceutical - Bismuth used in the manufacture of bismuth salts.

Sales in this group were made to two customers, namely, The J. T. Baker Chemical Company and Merck & Co.

2. Non Pharmaceutical - Bismuth for metallurgical purposes.

Sales in this group are divided into two classes: (a) Refined bismuth, (b) Bismuth in alloys.

The principal customer of refined bismuth is the Belmont Smelting & Refining Works, Inc., whose use for bismuth is in the manufacture of certain alloys and for resale.

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The following table shows the total quantity of bismuth sold by the Corporation in the United States and Canada during 1941 classified into their respective groups as mentioned above.

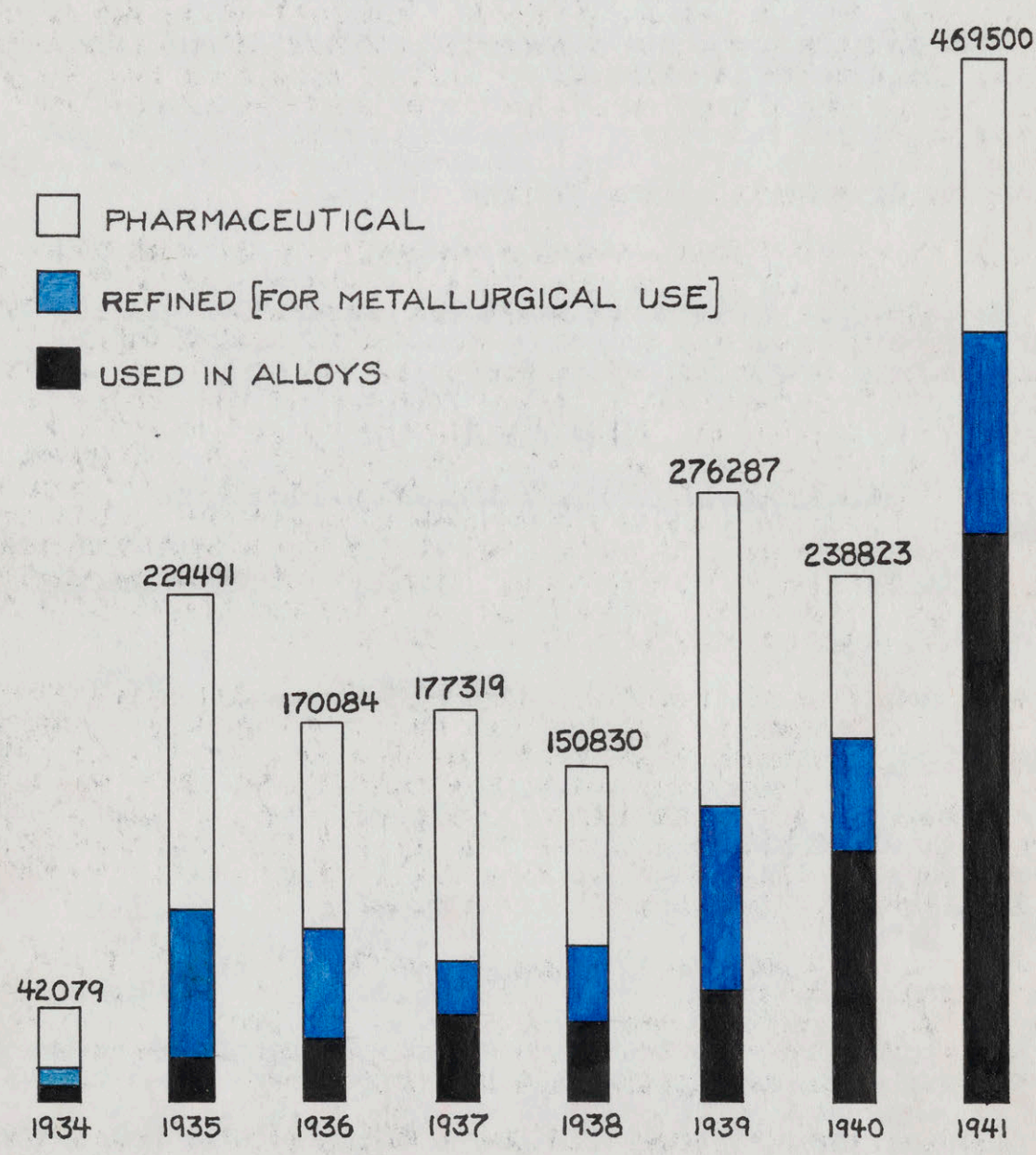
TABLE NO. 1

BISMUTH SALES UNITED STATES AND CANADA 1941

| | POUNDS SOLD | PERCENT TOTAL SALES |
|---|---|---|
| PHARMACEUTICAL | | |
| Merck & Co. | 18,029 | 3.8 |
| J. T. Baker | 104,338 | 22.2 |
| Total | 122,367 | 26.0 |
| METALLURGICAL | | |
| Refined | 91,071 | 19.4 |
| (Belmont 87,225) | | |
| (Others 3,846) | | |
| In Alloys | 256,062 | 54.6 |
| Total | 347,133 | 74.0 |
| Total Bismuth Sold | 469,500 | 100.0 |

A graphical representation of the above figures is presented on the opposite page. Metallurgical bismuth represented 74% of 1941 sales as compared with 69% in 1940 and 49% in 1939. Bismuth in alloys represented 55% of 1941 sales as compared with 48% in 1940 and 19% in 1939.

The following pages of this report are devoted to the sale of bismuth for metallurgical purposes.




BISMUTH SALES IN POUNDS
(UNITED STATES & CANADA)

# SALES POLICY

## Refined Bismuth Sales

As in past years, the greater part of the sales of refined bismuth for metallurgical purposes were made to the Belmont Smelting & Refining Works. The policy of the Corporation to divert as many sales as possible for refined bismuth through Belmont has been retained. In spite of this, a small amount of refined bismuth has been sold direct to customers by the Corporation

## Alloy Sales

The increase in the sales of alloys can be attributed to several factors. 1. Increased number of representatives and distributors. 2. Increased publicity through magazine advertising and articles written for publication on various applications. 3. Increased use of the alloys in the production of defense and war equipment.

1. Representatives and Distributors

During the year 1941, a change was made in our West Coast Agent. At the expiration of our contract with the Jamison Steel Corp., San Francisco, July 1st, a new agreement was consumated with the Castaloy Die Fixture & Engineering Company, Los Angeles, California. The latter company is a branch of a company by the same name in Detroit, Michigan, which is the manufacturing division of the Curtis Industrial Designing Engineers, agent for our alloys in the State of Michigan. A noticeable increase in the sales of our alloys on the West Coast was effected by the change, mainly because of their experience in handling our alloys for various applications in the automotive plants in the Detroit area. The use of Cerrobend fixtures and templates developed and patented by them for the rapid production of more accurate dies in the automobile industry was responsible for most of the sales of Cerrobend during 1941.

The same kind of fixture as constructed for the automotive industry was introduced by the Castaloy Co. to the aircraft companies in the form of assembly jigs and fixtures to serve a useful purpose in the assembly of airplane parts more rapidly and with more accuracy than heretofore. It is estimated that greater quantities of our alloys will be used in the aircraft industry than were used in the automotive companies. Reprints of articles relative to the fixtures just mentioned are included with this report.

While on the subject of agencies, another point of interest is the addition of the Metal Goods Corporation to our list of distributors, whose six offices and warehouses in St. Louis, Mo.; Kansas City, Mo.; Tulsa, Okla.; New Orleans, La.; Dallas and Houston, Texas respectively cover the middle West and Southwest.

Negotiations are nearly completed with the Jackson Associates to act as our agent in Massachusetts, Connecticut and Rhode Island with offices and warehouses in Boston, Mass. and Ansonia, Conn.

**Representatives ● Distributors**

| | |
|---|---|
| **New York, N. Y.** | Belmont S. & R. Works, Inc.<br>330 Belmont Ave., Brooklyn, N. Y. |
| **Philadelphia, Penna.** | Machine & Tool Designing Co.<br>1011 Chestnut Street |
| **Cleveland, Ohio** | Die Supply Company<br>1390 East 30th Street |
| **Detroit, Michigan** | Curtis Industrial Designing Engrs.<br>227 Iron Street |
| **Chicago, Ill.** | Sterling Products Co., Inc.<br>121 North Jefferson Street |
| **Moline, Ill.** | Sterling Products Co., Inc.<br>1524 Third Avenue |
| **Milwaukee, Wis.** | Harry C. Kettelson, Inc.<br>329 North Milwaukee Street |
| **St. Louis, Missouri** | Metal Goods Corporation<br>5239 Brown Avenue |
| **Kansas City, Missouri** | Metal Goods Corporation<br>1701 Baltimore Avenue |
| **Tulsa, Oklahoma** | Metal Goods Corporation<br>517 National Mutual Bldg. |
| **New Orleans, La.** | Metal Goods Corporation<br>413 Canal Bldg. |
| **Dallas, Texas** | Metal Goods Corporation<br>2102 Bryan Street |
| **Houston, Texas** | Metal Goods Corporation<br>16 Drennan Street |
| **Los Angeles, Calif.** | Castaloy Die Fixture & Eng. Co.<br>1855 Industrial Street |
| **Canada** | Dominion Merchants Ltd.<br>180 Vallee Street<br>Montreal |

The only area of any consequence then remaining to be covered by an agent is the western half of Ohio. Arrangements may be made during 1942 to have this territory covered by our Detroit representative.

A list of representatives and distributors as of December, 1941, is shown on the opposite page.

2. Publicity and Advertising

Numerous articles relative to the interesting uses of our alloys were published during the year in several leading trade magazines, which include Aviation, Iron Age, Modern Industrial Press, Tool and Die Journal and Western Machinery and Steel World.

Lectures with the aid of slides were given by Mr. Trethaway before the members of various chapters of the American Society of Tool Engineers in the following cities: Moline, Illinois, Racine, Wisconsin, Philadelphia, Baltimore, York, Pennsylvania and Milwaukee.

The display of applications of our alloys and distribution of literature at our booth created considerable interest at the Machine and Tool Progress Exhibition, held in Detroit, March 25th to 29th inclusive. The exhibition was sponsored by the American Society of Tool Engineers and was well attended by its members and guests from all parts of the United States.

Magazine advertising was increased over that of previous years in order to include a wider coverage of personnel in industries in which our alloys may be used to advantage. The inquiries and orders received through this medium have materially increased our sales during the year. The schedule below lists the trade publications and the insertions which appeared in them during the year 1941.

CERRO DE PASCO ADVERTISING PROGRAM FOR 1941

| PUBLICATION | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mach.Tool Mag. | 1/2 | - | 1 | - | 1/2 | - | 1/2 | - | 1/2 | - | 1 | - |
| Modern Mach Mag | 1/2 | 1/2 | 1/2 | 1 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1 | 1/2 | 1/2 |
| Tool Die Mag. | - | 1/2 | - | 1 | - | 1/2 | - | 1/2 | - | 1 | - | 1/2 |
| Elect. Mfg. | 1/4 | - | 1/4 | - | 1/4 | - | 1/4 | - | 1/4 | 1/4 | - | - |
| Ind.Equip.News | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 | - |
| New Equip.Mag. | - | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 |
| Mod.Ind.Press | - | 1/6 | - | 1/6 | - | 1/6 | - | 1/6 | - | 1/6 | - | 1/6 |
| Product Eng. | 1/4 | - | 1/4 | - | 1/4 | - | 1/4 | - | 1/4 | - | 1/4 | - |
| Tool Eng. | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 |
| Iron Age | 1/3 | - | - | - | 1/3 | - | - | - | 1/3 | - | - | - |
| Mill & Factory | 1/3 | - | 1/3 | - | - | - | - | - | 1/3 | - | - | - |
| Foundry | - | 1/4 | - | - | - | 1/4 | - | - | - | 1/4 | - | - |
| Metals-Alloys | 1/3 | - | - | - | 1/3 | - | - | - | - | 1/3 | - | - |

* The above fractions represent parts of a page.

3. Use of Alloys in War Equipment

Bismuth alloys are being used as an important part in speeding up the production of war materiel.

Cerrobend as a filler for tube bending operations; assembly jigs and welding fixtures; short run forming dies; and fusible plugs for safety devices.

Cerromatrix for anchoring parts in stamping dies and machinery; split jaw chucks for holding irregular parts while being machined; and other special applications.

Cerrobase for metal patterns; proof casting of metal core boxes; and as a base metal to make low melting solders such as are used in certain types of ammunition. The Aluminum Company purchased approximately 60,000 lbs. of Cerrobase during the year for use in making free cutting aluminum.

#3333-1 alloy is used in the Curtis shell lathe to locate and hold cast iron and bronze bearings accurately in place in the cored holes of the machine; 74,000 lbs. of the alloy were used for this purpose during 1941. Greater quantities of the metal may be required during 1942, if the program is increased to make more of the lathes.

Cerrosafe, with its minimum shrinkage and expansion properties, is used advantageously for holding airplane propellers accurately in position during machining and grinding operations.

## SALES

The following table shows the sales of alloys with the corresponding bismuth content of each for the year 1941.

### TABLE NO. 2

### ALLOY SALES FOR YEAR 1941

| ALLOY | LBS. ALLOY | LBS. Bi CONTENT |
|---|---|---|
| Cerromatrix | 58,550 | 29,094 |
| Cerrobend | 222,634 | 111,317 |
| Cerrobase | 126,312 | 70,103 |
| Cerrodent | 1,760 | 668 |
| Cerrosafe | 16,462 | 6,996 |
| #3333-1 | 74,081 | 24,691 |
| #5600-1 | 2,706 | 1,515 |
| Special | 21,831 | 11,678 |
| Total | 524,316 | 256,062 |

There is a substantial increase in the sales of the individual alloys during 1941 over those of any previous year. Charts will be found at the conclusion of this report showing the comparison of

sales of our standard alloys for the years of 1934 to 1941 inclusive.

Cerrobend continues to occupy first place in alloy sales, due chiefly to its use in the aircraft industry for assembly jigs and fixtures as mentioned previously.

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## SALES BILLED & EXPENSES

The total value of alloy sales billed for the year 1941 was $312,530.39 as compared with $137,364.33 for 1940. The expenses incurred, exclusive of bismuth and Cerrobase, were as follows:

TABLE NO. 3

| | Total in Dollars | Cents per pound Alloy | Cents per pound Bi Content |
|---|---|---|---|
| Manufacturing Cost | $14,418.70 | .0275 | .0563 |
| Tin purchased (Belmont) | 4,632.82 | .009 | .0181 |
| Tin purchased (Metal Reserve) | 30,096.21 | .0574 | .1175 |
| Cadmium | 21,902.46 | .0418 | .0855 |
| Lead purchased (Belmont) | 347.50 | .0007 | .0014 |
| Antimony (C de P) | 125.21 | .0002 | .0005 |
| Dies,Molds etc. | 386.30 | .0007 | .0015 |
| Salaries & Commissions | 9,642.41 | .0184 | .0377 |
| Advertising,Printing,etc. | 9,306.93 | .0178 | .0363 |
| Traveling Expense | 1,738.66 | .0033 | .0068 |
| Boxing,Cartage,Postage,etc. | 6,338.93 | .012 | .0248 |
| Storage, Insurance | 3,163.00 | .006 | .0124 |
| Rent (Walker & Whyte Inc.) | 200.00 | .0004 | .0008 |
| Miscellaneous | 359.39 | .0007 | .0014 |
| Total | $102,658.52 | .1958 | .4009 |

The above expenses include all costs with the exception of the cost of Cerrobase and bismuth withdrawn from stock used in the manufacture of the alloys. The purchases of tin and cadmium were necessarily high due to the fact that Cerrobend, which contains these two metals, constituted a large proportion of the total alloy sales.

TABLE NO. 4

| | Total Dollars | Cents per pound alloy | Cents per pound Bi Content |
|---|---|---|---|
| Gross Value Alloy Sales Billed | $312,530.39 | 59.60 | 122.1 |
| Expenses from Table #3 | 102,658.52 | 19.6 | 40.1 |
| Sales less N.Y. Expense | $209,871.87 | 40.0 | 82.0 |

The above table shows the gross value of alloy sales billed in 1941 less such expenses as apply exclusively to the sale and

manufacture of alloys. These figures do not include the cost of Cerrobase or bismuth and are presented to show that approximately $210,000.00 or 82 cents per pound of bismuth content was realized after paying all charges incidental to selling bismuth in this form These figures compare with about $88,000.00 or 77.3 cents per pound of bismuth realized in 1940 and $32,000.00 or 62.7 cents in 1939.

To make up the alloys sold during the year, Cerrobase and bismuth were supplied by the Corporation as follows:

| | |
|---|---|
| 371,983 @ 22.226¢ | $82,676.94 |
| 49,744 @ 40.2¢ | 19,997.09 |
| | $102,674.03 |

Viewed from the standpoint of alloy sales alone, the indicated net profit would be shown as follows:

TABLE NO. 5

| | Total Dollars | Cents per pound Alloy | Cents per pound Bi Content |
|---|---|---|---|
| Sales less N. Y. Expense (Table #4) | $209,871.87 | 40.02 | 82.0 |
| Cost of Cerrobase & bismuth as shown above | 102,674.03 | 19.58 | 40.1 |
| Indicated net profit | $107,197.84 | 20.45 | 41.9 |

Inasmuch as the sales of alloys are so closely connected with the sales of refined bismuth for metallurgical purposes, it is only fair to combine all sales of bismuth used for non-pharmaceutical purposes to present a true picture. When the sales of refined bismuth to Belmont and others for metallurgical uses are added to alloy sales by the Corporation, the indicated net profit is shown below.

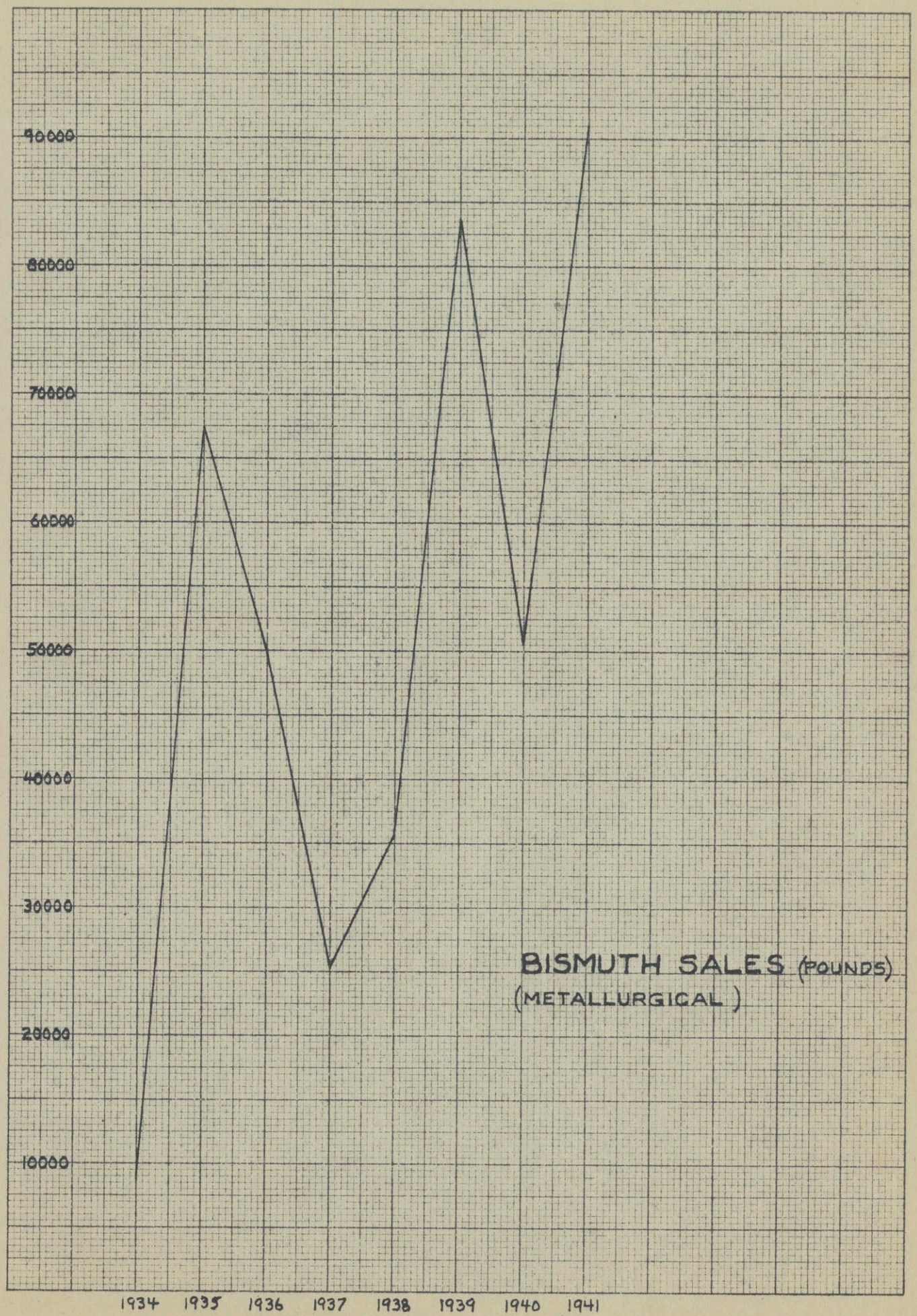
TABLE NO. 6

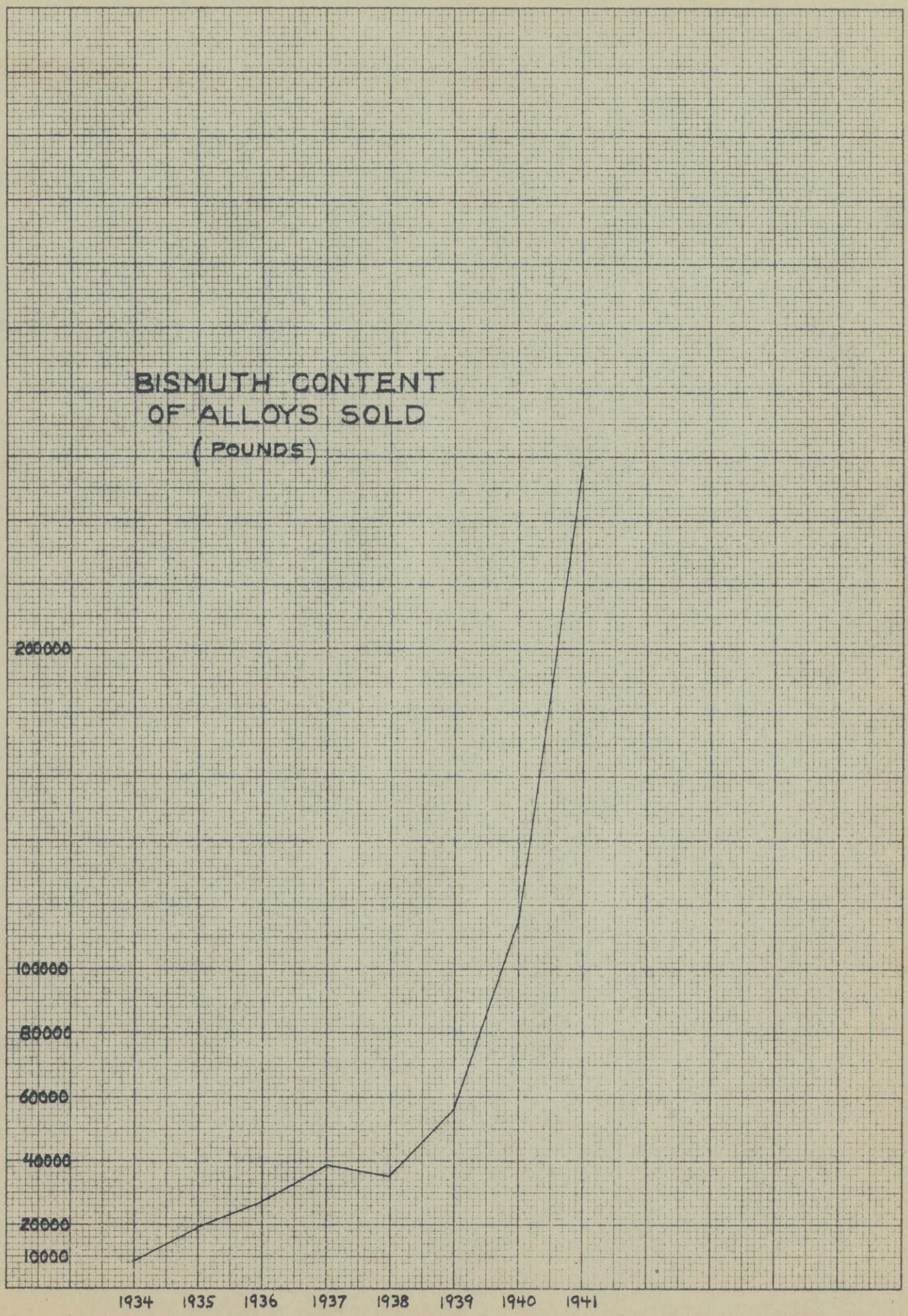
| | Total Dollars | Cents per pound Alloy | Cents per pound Bi Content |
|---|---|---|---|
| Gross Value Alloy Sales | $312,530.39 | 59.6 | 122.1 |
| " " Bismuth sold Belmont | 84,499.27 | | 96.9 |
| " " " others (Met.) | 4,522.02 | | 117.6 |
| Total | $401,551.68 | | 115.7 |
| Sales Expense Alloy Sales | $102,658.52 | 19.6 | 40.1 |
| Cost of Bismuth Content Alloy | 102,674.03 | 19.6 | 40.1 |
| Cost refined Bismuth sold | 36,610.54 | | 40.2 |
| Total | $241,943.09 | | 69.7 |
| | $159,608.59 | | 46.0 |

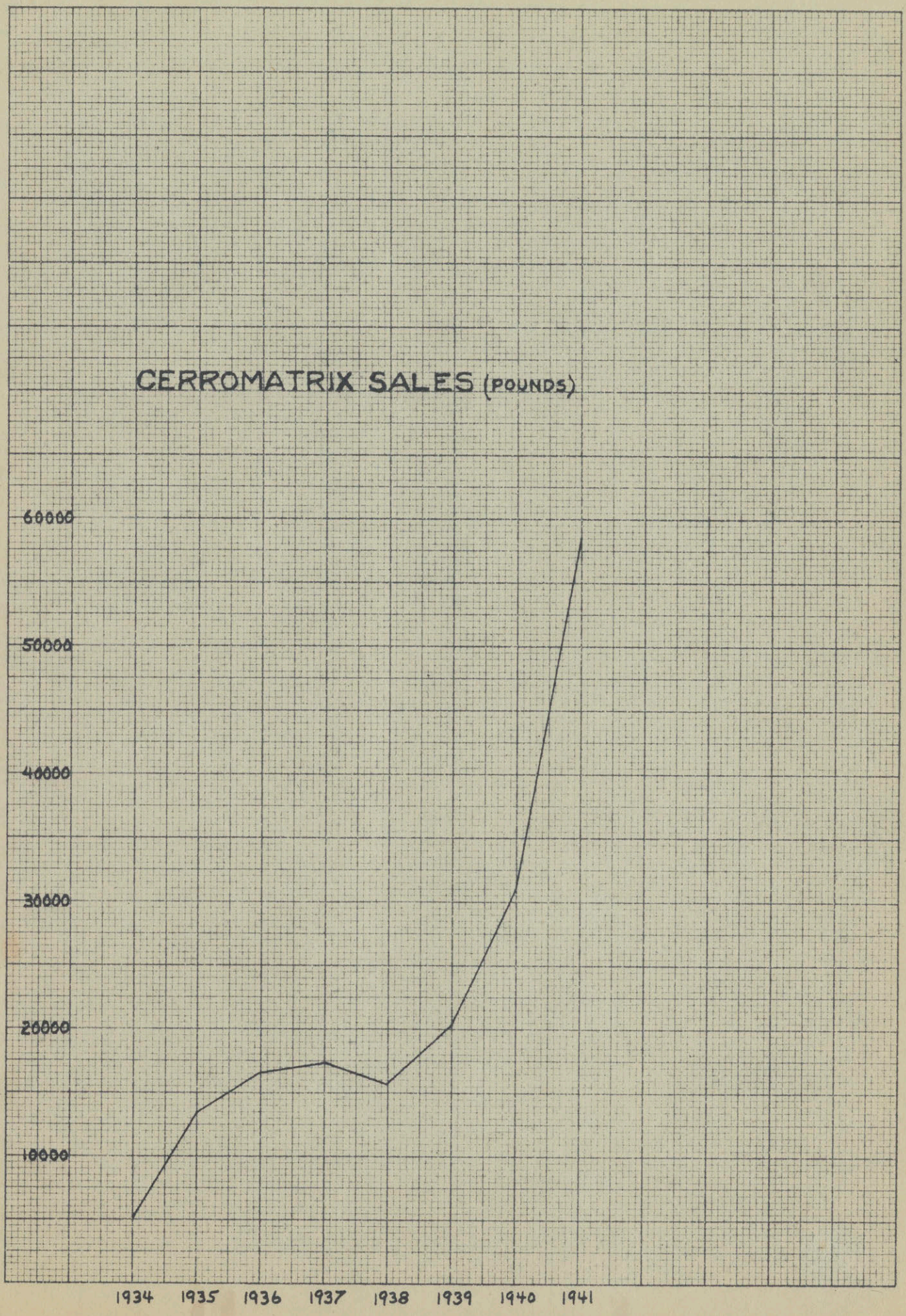
## FUTURE PROSPECTS

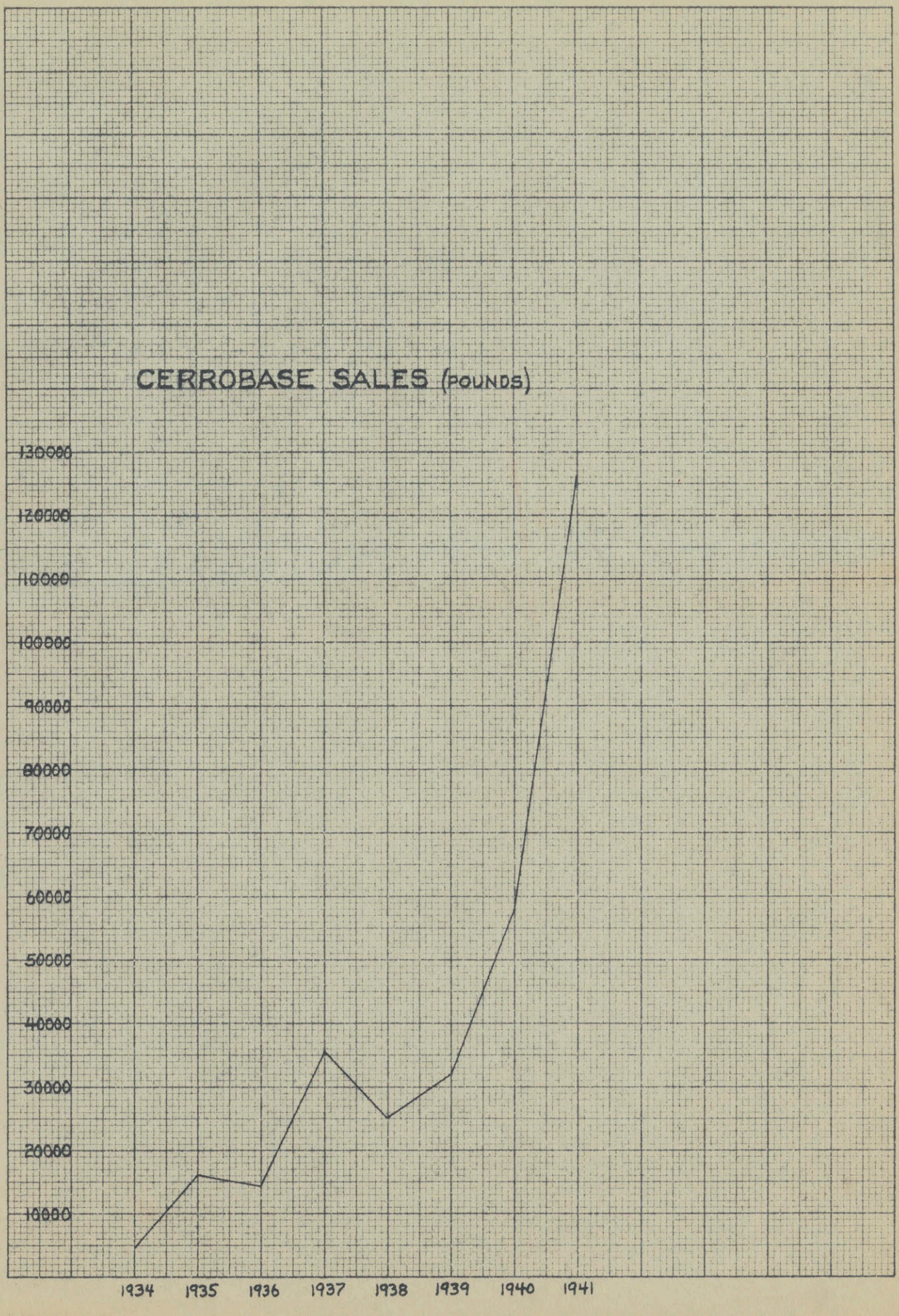
Unless there is a drastic curtailment of tin and cadmium for use in the alloys during the coming year, it is quite possible the sales of alloys and bismuth for metallurgical purposes may exceed those of any previous year. The unique properties of our standard alloys are being used to advantage by an increasing number of customers in the United States and Canada. Any decrease in sales to the automotive industry, because of the discontinuance of automobile production will be more than offset by the increase in sales to the aircraft companies and others producing war equipment in their effort to speed up mass production.

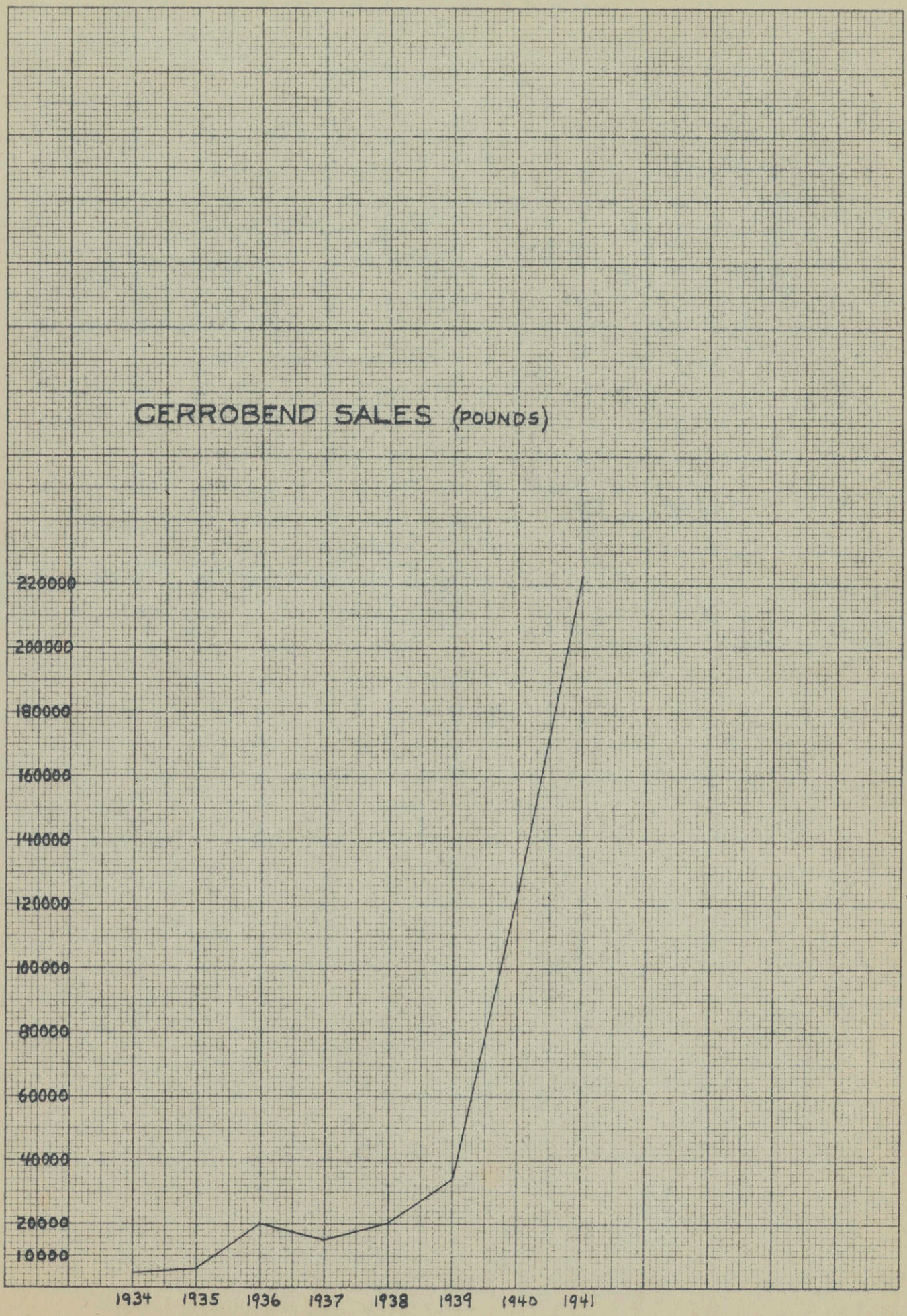
Several new applications of our alloys, now in the experimental stage, show promise of becoming a standard method of procedure by many companies during and following our present emergency.











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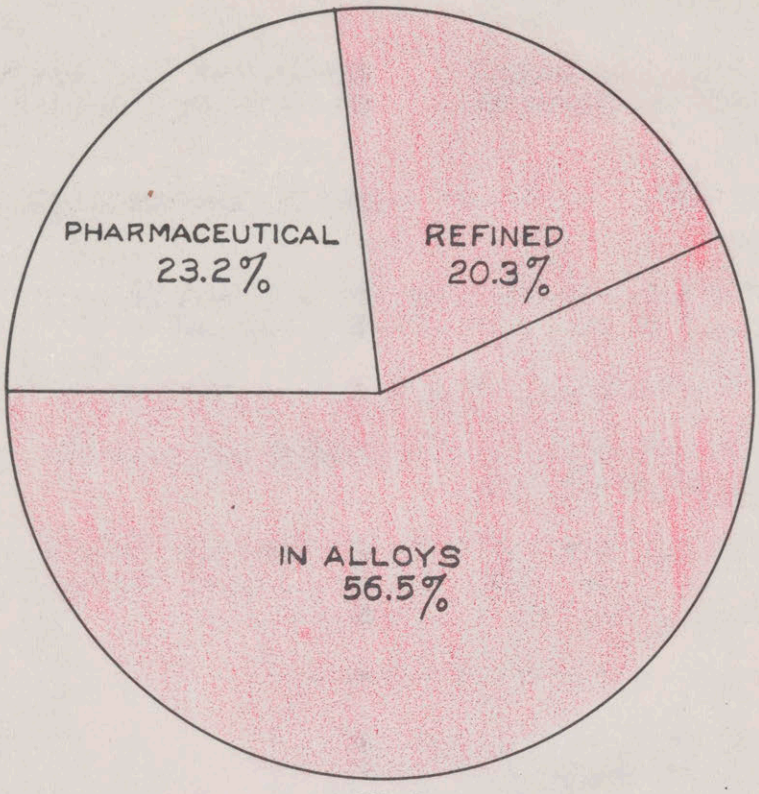
# Bismuth Sales Report
1942.

U.S. and Canada

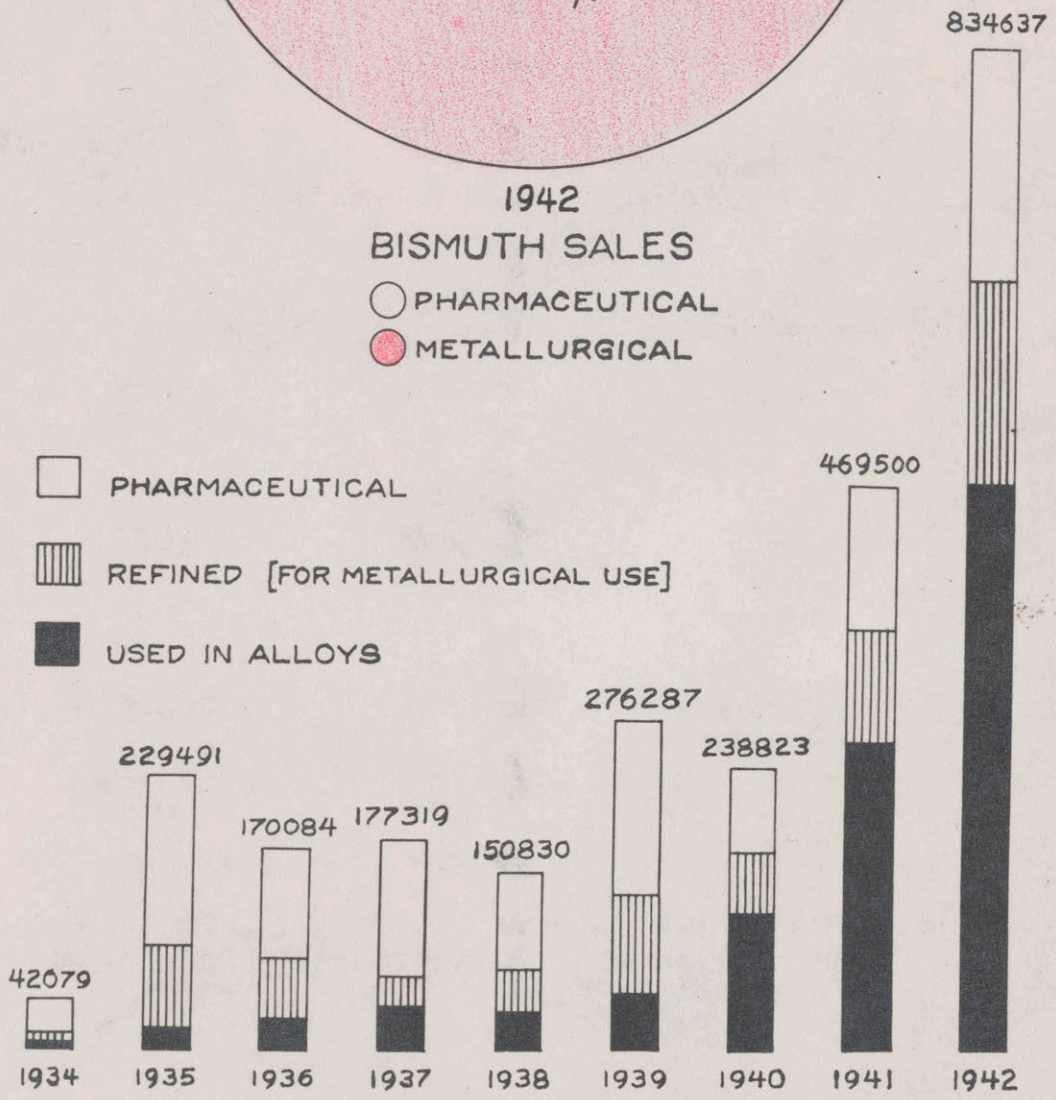



1942

BISMUTH SALES

PHARMACEUTICAL

METALLURGICAL




BISMUTH SALES IN POUNDS

UNITED STATES & CANADA

## GENERAL

Sales of bismuth to customers located in the United States and Canada made by the Corporation are divided into two general classifications.

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Sales in this group were made to two customers, namely, The J. T. Baker Chemical Company and Merck & Company.

2. Non Pharmaceutical - Bismuth for metallurgical purposes.

Sales in this group are divided into two classes: (a) Refined bismuth, (b) Bismuth in alloys.

The principal customer of refined bismuth is the Belmont Smelting & Refining Works, Inc., whose use for bismuth is in the manufacture of certain alloys and for resale.

The following table shows the total quantity of bismuth sold by the Corporation in the United States and Canada during 1942 classified into their respective groups as mentioned above.

### TABLE NO. 1

### BISMUTH SALES UNITED STATES AND CANADA 1942

| | POUNDS SOLD | PERCENT TOTAL SALES |
|---|---|---|
| PHARMACEUTICAL | | |
| Merck & Co. | 28,497 | |
| J. T. Baker | 165,727 | |
| Total | 194,224 | 23.2% |
| METALLURGICAL | | |
| Refined | | |
| (Belmont 153,533 lbs) | 170,054 | 20.3% |
| (Others 16,521 lbs) | | |
| In Alloys | 470,359 | 56.5% |
| Total | 640,413 | 76.8% |
| Total Bismuth Sold | 834,637 | 100.0% |

A graphical representation of the above figures is presented on the opposite page. Metallurgical bismuth represented 76.8% of 1942 sales (1941 - 74%; 1940 - 69%; 1939 - 49%). Bismuth in alloys represented 56.5% of 1942 sales (1941 - 55%; 1940 - 48%; 1939 - 19%).

The following pages of this report are devoted to the sale of bismuth for metallurgical purposes only.

# Representatives • Distributors

| | | |
|---|---|---|
| Brooklyn, N. Y. | Belmont Smelting & Refining Wks., Inc.<br>330 Belmont Ave. | Tel.—Dickens 2-4900 |
| Boston, Mass. | Jackson Associates<br>80 Boylston St. | Tel.—Hancock 1046 |
| Ansonia, Conn. | Jackson Associates<br>88 Main St. | Tel.—Ansonia 1422W |
| Philadelphia, Pa. | Castaloy Metal Sales Co.<br>123 South Broad St. | Tel.—Pennypacker 2116 |
| Cleveland, Ohio | Die Supply Co.<br>4747 Hough Ave. | Tel.—Express 1133 |
| Detroit, Mich. | Castaloy Metal Sales Co.<br>197 S. Waterman St. | Tel.—Vinewood 2-6800 |
| Chicago, Ill. | Sterling Products Co., Inc.<br>121 N. Jefferson St. | Tel.—State 1126 |
| Moline, Ill. | Sterling Products Co., Inc.<br>1524 Third St. | Tel.—Moline 1024 |
| Milwaukee, Wis. | Harry C. Kettelson, Inc.<br>515 East Buffalo St. | Tel.—Broadway 4882 |
| Minneapolis, Minn. | Northern Machinery & Supply Co.<br>Lumber Exchange Bldg. | Tel.—Atlantic 6281 |
| St. Louis, Mo. | Metal Goods Corporation<br>5239 Brown Avenue | Tel.—Goodfellow 1234 |
| Kansas City, Mo. | Metal Goods Corporation<br>1701 Baltimore | Tel.—Victor 9028 |
| New Orleans, La. | Metal Goods Corporation<br>413 Canal Bldg. | Tel.—Raymond 9498 |
| Dallas, Texas | Metal Goods Corporation<br>Texas Bank Bldg. | Tel.—Central 6466 |
| Houston, Texas | Metal Goods Corporation<br>16 Drennan St. | Tel.—Preston 5221 |
| Los Angeles, Calif. | Castaloy Metal Sales Co.<br>3035 Treadwell St. | Tel.—Cleveland 6-28808 |
| Canada | Dominion Merchants Ltd., Montreal | |

# CLEARTYPE

Trade Mark Registered

## COUNTY-PRINCIPAL CITIES MAP OF THE UNITED STATES

Scale of Miles

0 100 200 300

MAP NO. 762

# SALES POLICY

## Refined Bismuth Sales

As in past years, the greater part of the sales of refined bismuth for metallurgical applications were to the Belmont Smelting & Refining Works. The policy of the Corporation to divert as many sales as possible for refined bismuth through Belmont has been retained. However, a small amount of refined bismuth was sold direct to customers by the Corporation.

## Alloy Sales

The increase in the sales of alloys is largely due to the demand stimulated by the accelerated war program. Publicity through the medium of magazine advertising and articles written for publication on various applications, and supplemented by the efforts of our representatives and distributors have increased the number of new customers.

### Representatives and Distributors

During the year 1942, arrangements were made with several established sales companies to cover certain newly assigned territories. The territory previously assigned to the Castaloy Corp. was extended to include sections of Indiana, Ohio, Pennsylvania, Maryland, Delaware and New York. Sections of the first two named states were combined with Michigan and are serviced from their Detroit office. Sections of the last four named states are serviced from their new office in Philadelphia. The Machine & Tool Designing Company, Philadelphia, who formerly acted as our agent in the latter territory relinquished the territory at our request upon the termination of their contract. The change was motivated by the increased activity of the Castaloy Company in that particular area.

An arrangement was made with Jackson Associates to act as our agent in Massachusetts, Connecticut and Rhode Island with offices and warehouses in Boston, Mass. and Ansonia, Conn.

The Northern Machinery & Supply Company, Minneapolis, Minn. was also added to our list of distributors to cover Minnesota.

A map on the opposite page shows the respective territories and the locations of our representatives and distributors as indicated on the list.

### Publicity and Advertising

Numerous articles publicizing the applications of our alloys were published during the year in many of the leading trade magazines.

The amount of paid advertising in trade publications was approximately the same as in 1941. The schedule below lists the publications and the insertions which appeared in them during the year 1942.

| PUBLICATION | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mach. Tool Mag. | 1 | - | 1/2 | - | 1/2 | - | 1/2 | - | 1/2 | - | 1 | - |
| Modern Mach Mag. | 1 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1 | 1/2 | 1/2 |
| Tool Die Mag. | 1 | 1/2 | - | 1/2 | - | - | - | 1/2 | 1/2 | 1/2 | - | 1/2 |
| Elect. Mfg. | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 |
| Ind.Equip News | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 | - |
| New Equip Mag. | - | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 |
| Mod. Ind. Press | 1/8 | - | 1/8 | - | 1/8 | - | 1/8 | - | 1/8 | - | 1/8 | - |
| Product Eng. | 1/4 | - | 1/4 | - | 1/4 | - | 1/4 | - | 1/4 | - | 1/4 | - |
| Tool Eng. | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 |
| Mill & Factory | 1/3 | - | 1/3 | - | 1/3 | - | 1/3 | - | 1/3 | - | 1/3 | - |
| Foundry | 1/4 | - | - | - | 1/4 | - | - | - | - | - | 1/4 | - |
| Metals-Alloys | 1/3 | - | 1/3 | - | 1/3 | - | 1/3 | - | 1/3 | - | 1/3 | - |
| Western Machinery & Steel World | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 |

Note: The above fractions represent parts of a page.

Use of Alloys in War Equipment

Cerrobend as a filler for tube bending; aircraft assembly, drill and welding fixtures; and fusible plugs for safety devices.

Cerromatrix for anchoring parts in stamping dies and machinery; split jaw chucks for holding irregular parts while being machined; for locating and supporting contact points on airplane assembly jigs (Page 33, Figure 78, Cerromatrix Manual); and other special applications.

Cerrobase in the process of electroforming copper (Kollsman Pitot Static Tubes for airplanes) and iron products (U. S. Rubber iron molds and other essential war products); for manufacturing free cutting aluminum alloys; (Aluminum Company purchased approximately 38,000 lbs during the year). Liquid seal for nitriding furnaces (Westinghouse).

Cerrosafe for holding airplane propellers accurately in position during machining and grinding operations; aircraft assembly fixtures; master patterns; proof-castings of molds, gun chambers and forging dies, etc.

#3333-1 alloy is used in the Curtis shell lathe to locate and hold cast iron and bronze bearings accurately in place in the cored holes of the machine. The anticipated increase in the use of this alloy during 1942 did not materialize, because of other arrangements made by the Ordnance Dept. to import lathes from Canada on a Lend/Lease basis.

#5600-1 alloy as a low temperature solder filler between parts on certain type of shells. This application may be discontinued in favor of other methods in order to conserve bismuth.

#9500-1 alloy for mounting small Alnico permanent magnet rotors on steel shafts used in small generators and motors for controlling various airplane mechanisms.

A considerable quantity of special alloy is used for fusible plugs on temperature controlled safety valves, which are standard equipment on oxygen tanks for altitude flying, etc.

## ALLOY SALES FOR YEAR 1942.

The following table shows the sales of alloys with the corresponding bismuth content of each for the year 1942.

TABLE NO. 2

| ALLOY | LBS. ALLOY | LBS. Bi CONTENT |
|---|---|---|
| Cerromatrix | 121,566 | 58,352 |
| Cerrobend | 448,499 | 224,249 |
| Cerrobase | 177,988 | 98,783 |
| Cerrodent | 1,057 | 403 |
| Cerrosafe | 72,759 | 30,923 |
| #3333-1 | 37,065 | 12,354 |
| #5600-1 | 39,881 | 22,333 |
| #9500-1 | 11,297 | 10,732 |
| Special | 26,501 | 18,230 |
| Total | 936,613 | 470,359 |

Sales of alloys for 1942 show a substantial increase over those of any previous year. Charts will be found at the conclusion of this report showing the comparison of sales of our standard alloys for the years 1934 to 1942 inclusive.

Cerrobend continues to occupy first place in alloy sales, due chiefly to its use in the aircraft industry for assembly jigs and fixtures.

## SALES BILLED & EXPENSES

The total value of alloy sales billed for the year 1942 was $574,105.32 as compared with $312,530.39 for 1941 and $137,364.53 for 1940. The expenses incurred, exclusive of bismuth and Cerrobase, were as follows:

TABLE NO. 3

| | Total Dollars | Cents/lb. Alloy | Cents/lb. Bi Content |
|---|---|---|---|
| Manufacturing Cost | $17,907.34 | .0191 | .0381 |
| Tin Purchased | 54,134.81 | .0578 | .1151 |
| Cadmium Purchased | 49,990.50 | .0534 | .1063 |
| Lead Purchased | 9,027.51 | .0096 | .0192 |
| Antimony Purchased | 1,393.59 | .0015 | .003 |
| Dies, Molds, Etc. | 337.03 | .0004 | .0007 |
| Salaries & Commissions | 9,735.12 | .0104 | .0207 |
| Advertising, Printing, Etc. | 8,891.41 | .0095 | .0189 |
| Traveling Expense | 133.15 | .0001 | .0002 |
| Boxing, Cartage, Postage, Etc. | 6,839.47 | .0073 | .0145 |
| Storing, Insurance | 2,224.33 | .0024 | .0047 |
| Rent (Walker & Whyte, Inc.) | 200.00 | .0002 | .0004 |
| Misc. (Includes Calif. Tax) | 1,097.63 | .0012 | .0023 |
| Total | $161,909.89 | .1729 | .3443 |

The above expenses include all costs with the exception of the cost of Cerrobase and bismuth withdrawn from stock used in the manufacture of the alloys. The purchases of tin and cadmium were necessarily high due to the fact that Cerrobend, which contains these two metals, constituted a large proportion of the total alloy sales.

TABLE NO. 4

| | Total Dollars | Cents/lb. Alloy | Cents/lb. Bi Content |
|---|---|---|---|
| Gross Value Alloy Sales Billed | $574,105.32 | 61.29 | 122.1 |
| Expenses from Table #3 | 161,909.89 | 17.29 | 34.4 |
| Sales less N.Y. Expenses | $412,195.43 | 44.00 | 87.7 |

The above table shows the gross value of alloy sales billed in 1942 less such expenses as apply exclusively to the sale and manufacture of alloys. These figures do not include the cost of Cerrobase or bismuth and are presented to show that approximately $412,000.00 or 87.7 cents per pound of bismuth content was realized after paying all charges incidental to selling bismuth in this form. These figures compare with about $210,000.00 or 82 cents per pound of bismuth realized in 1941, $88,000.00 or 77.3 cents per pound in 1940 and $32,000.00 or 62.7 cents in 1939.

To make up the alloys sold during the year, Cerrobase and bismuth were supplied by the Corporation as follows:

| | | | |
|---|---|---|---|
| Cerrobase | 311,341# | @ 24.997¢ | $ 77,824.35 |
| Bismuth | 239,389# | @ 49.4 ¢ | 118,258.17 |
| | | | 196,082.52 |

Due to an increased tariff rate imposed on bismuth/lead alloys the first part of 1942, we were obliged to discontinue the importation of Cerrobase. This accounts for the greater percentage of pure bismuth used and lead purchased than in previous years for the manufacture of the alloys.

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Viewed from the standpoint of alloy sales alone, the indicated net profit would be shown as follows:

TABLE NO. 5

| | Total Dollars | Cents/lb. Alloy | Cents/lb. Bi Content |
|---|---|---|---|
| Sales less N.Y. Expense (Table #4) | $412,195.43 | 44.0 | 87.7 |
| Cost of Cerrobase & Bismuth as shown above | 196,082.52 | 20.9 | 41.7 |
| Indicated Net Profit | $216,112.91 | 23.1 | 46.0 |

Inasmuch as the sales of alloys are so closely connected with the sales of refined bismuth for metallurgical purposes, it may be assumed that all sales of bismuth used for non-pharmaceutical applications may be combined with the bismuth contained in alloys sold for the purpose of indicating a net profit as shown below in Table No. 6.

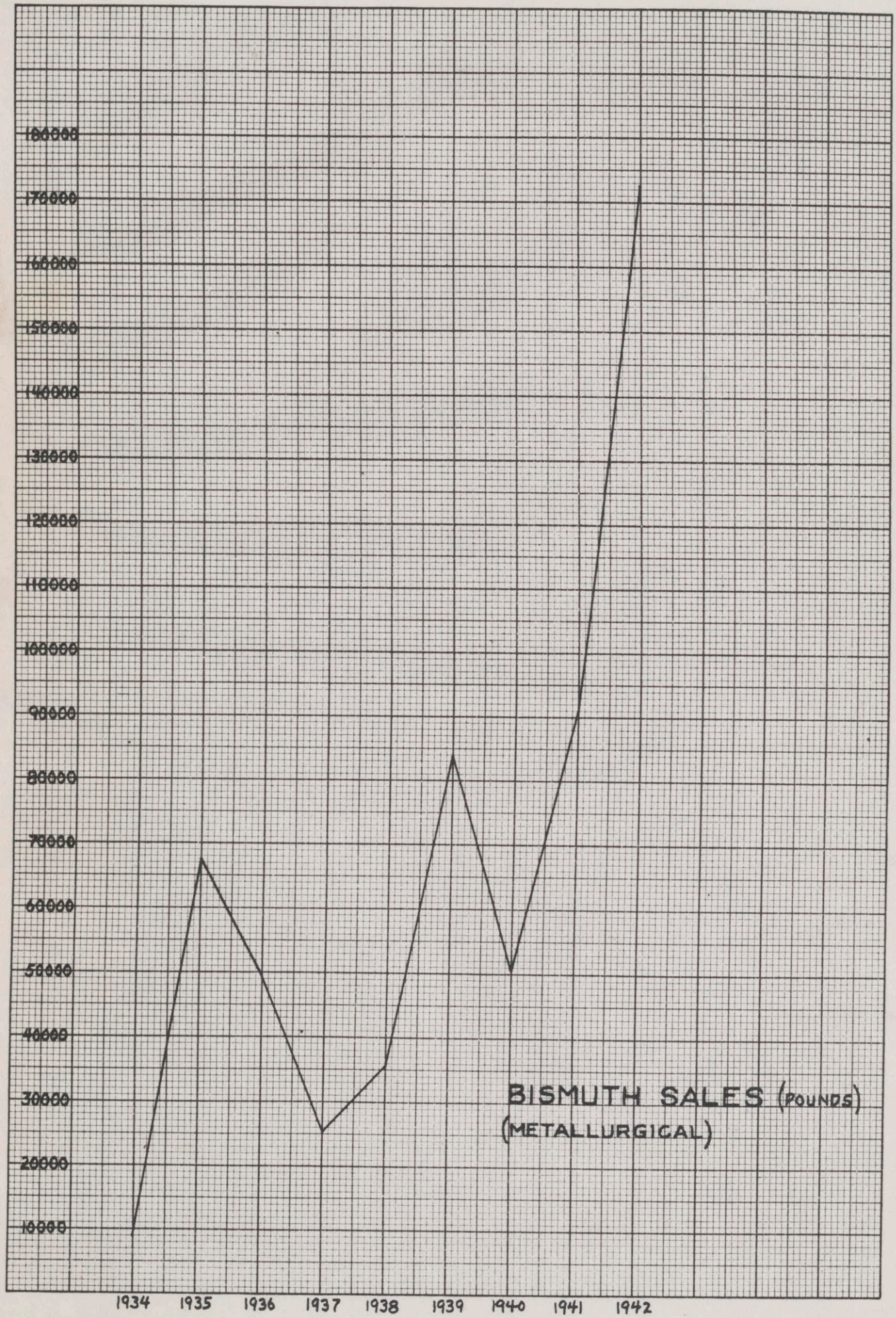
TABLE NO. 6

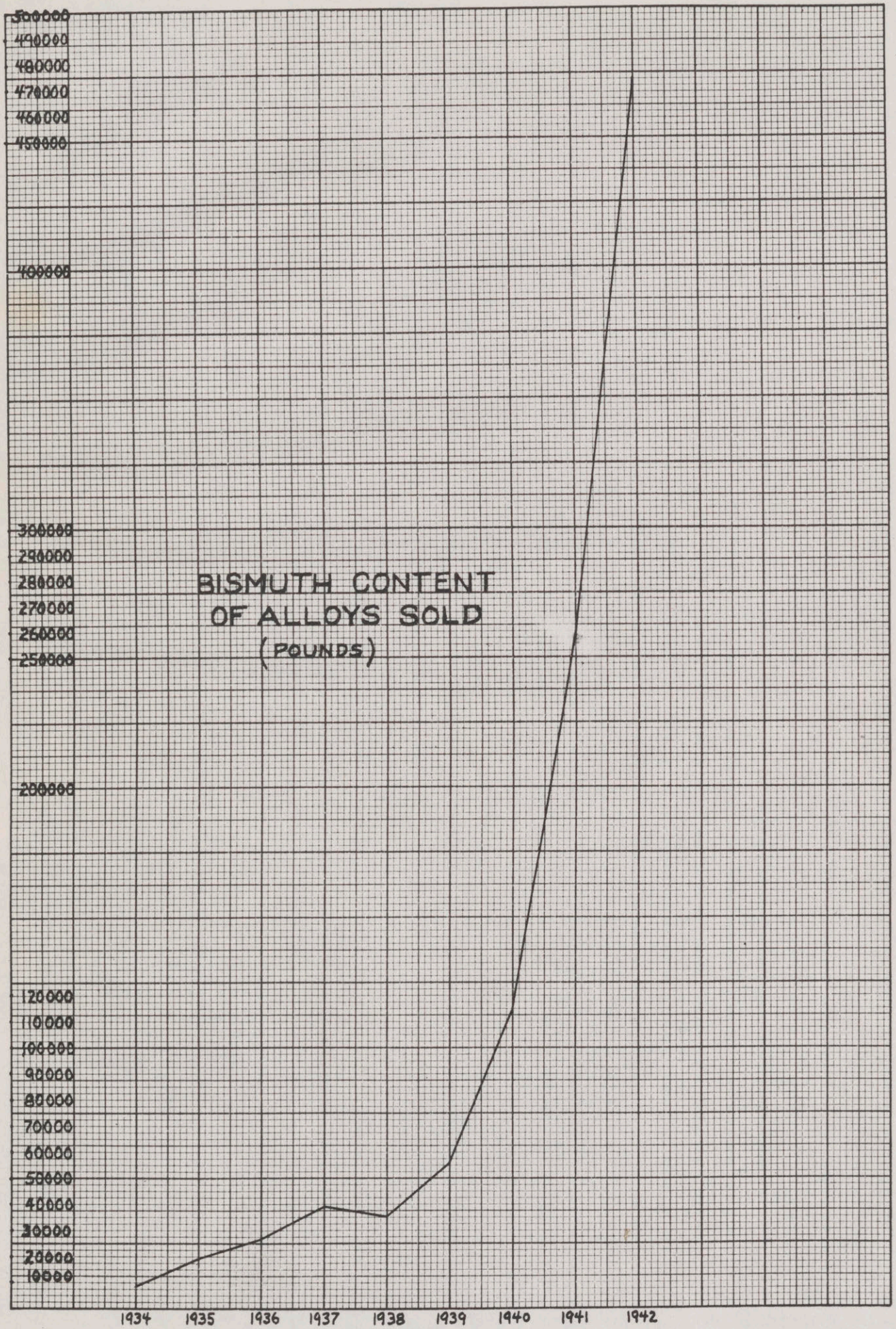
| | Total Dollars | Cents/lb. Bi Content |
|---|---|---|
| Gross Value Alloy Sales | $574,105.32 | 122.1 |
| " " Bismuth sold Belmont | 148,735.16 | 96.9 |
| " " " others (Met.) | 19,778.84 | 119.7 |
| Total | $742,619.32 | 115.9 |
| Expense Alloy Sales | $161,909.89 | 34.4 |
| Cost of Bismuth Content Alloy | 196,082.52 | 41.7 |
| Cost of refined Bismuth Sold | 84,007.66 | 49.4 |
| Total | $442,000.07 | 69.0 |
| | $300,619.25 | 46.9 |

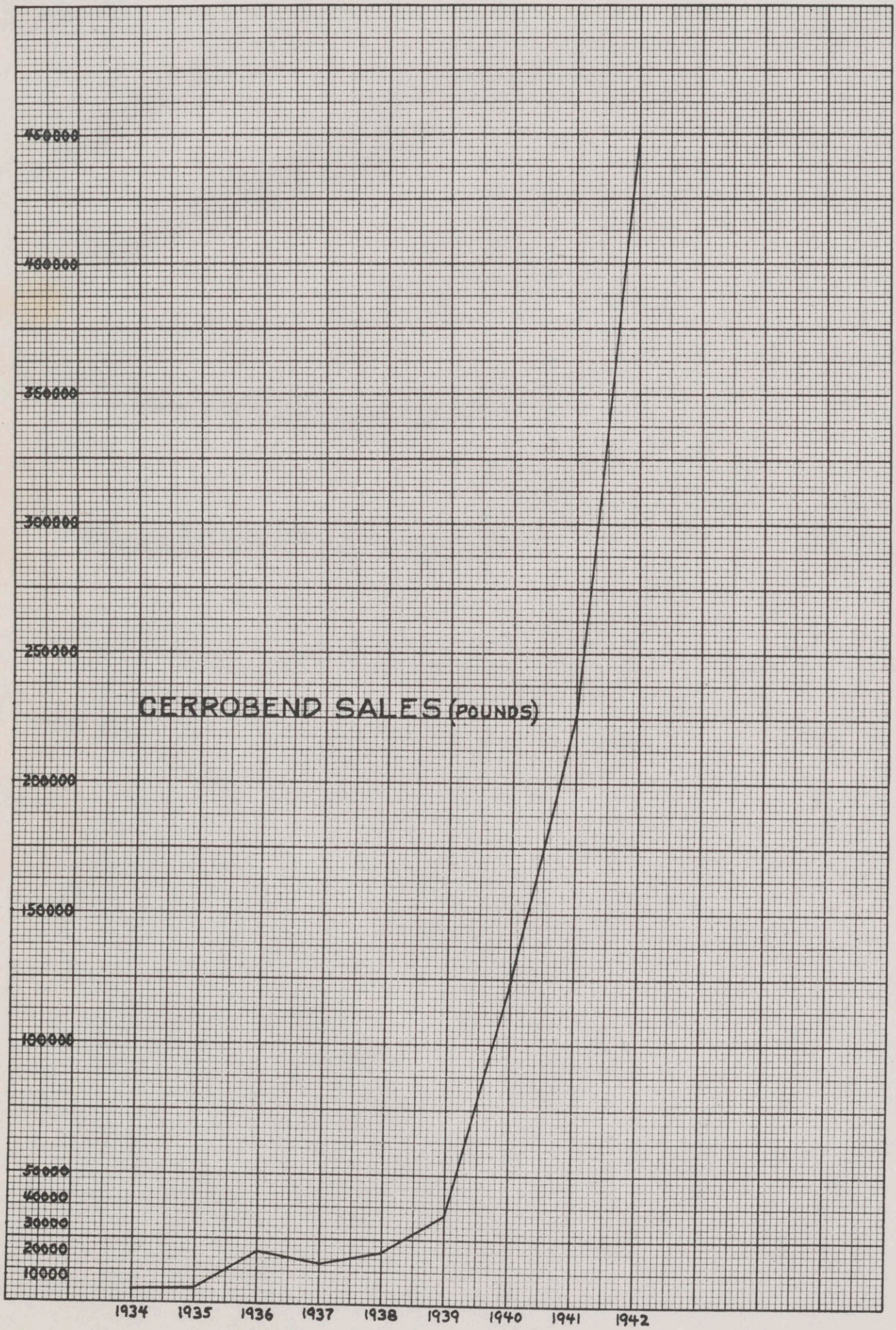
## FUTURE PROSPECTS

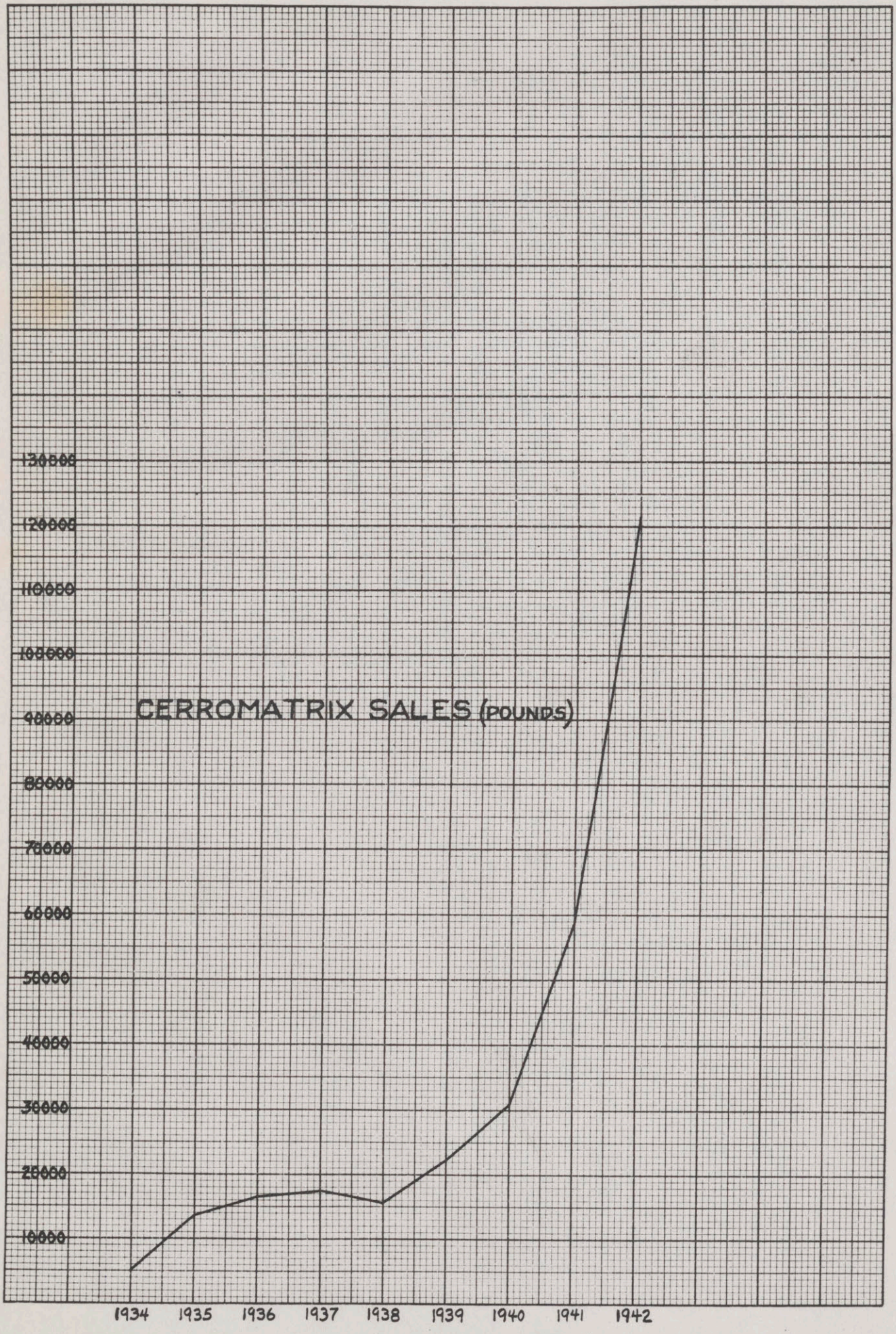
The accelerated war program now in force indicates that our total sales of bismuth for 1943 may equal our production for the same period. Government regulations may have an effect on the distribution of bismuth for pharmaceutical and metallurgical applications. It is hoped that the War Production Board will allocate a sufficient quantity of bismuth for the manufacture of alloys, so that we may maintain ample stocks to satisfy the requirements of those companies, who will use the alloys in the production of war materiel.

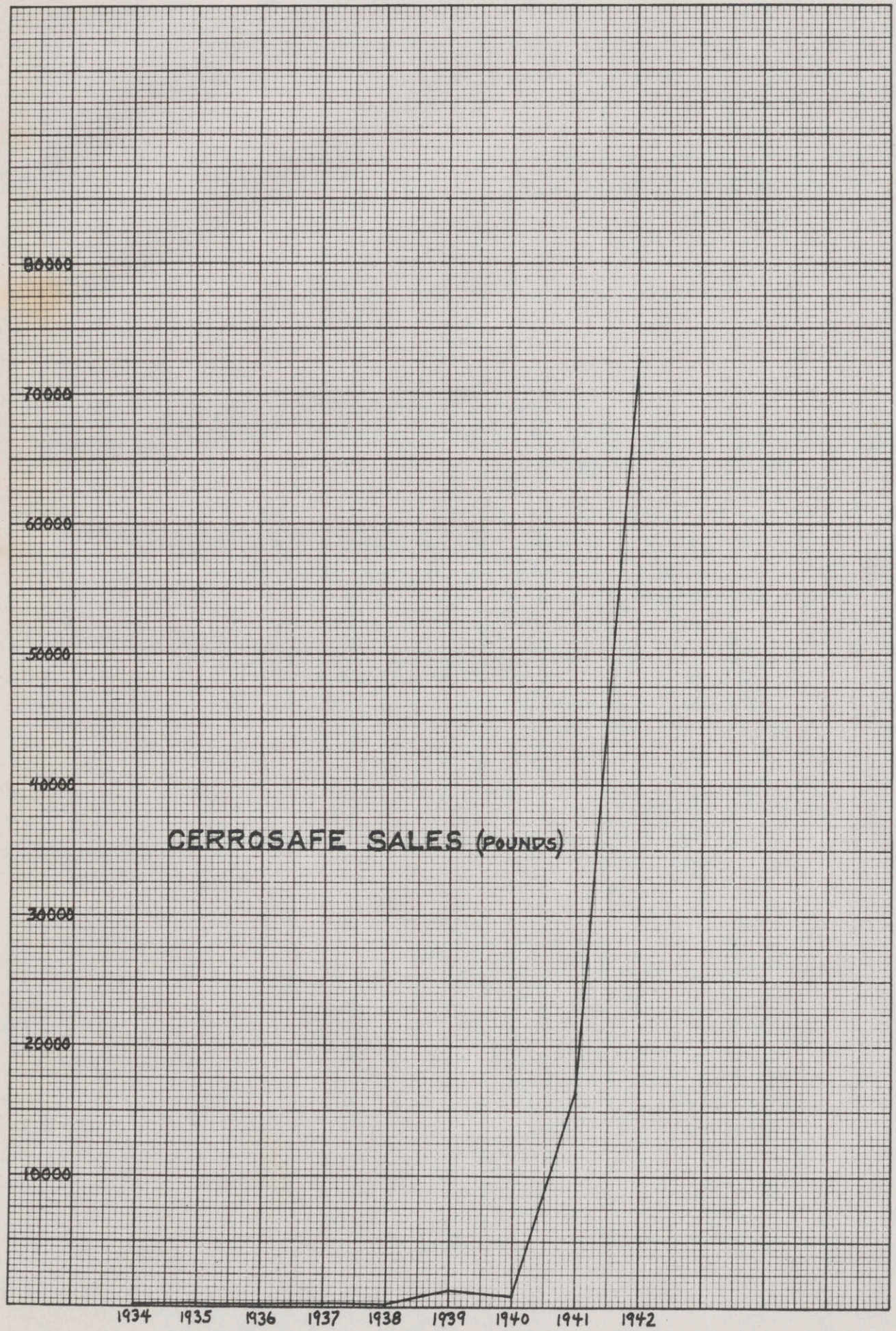
Every effort is being made by the Corporation to conserve bismuth to conform with government regulations. In line with this policy, we are advocating the use of Cerrosafe as a substitute for Cerrobend and Cerrobase wherever applicable.

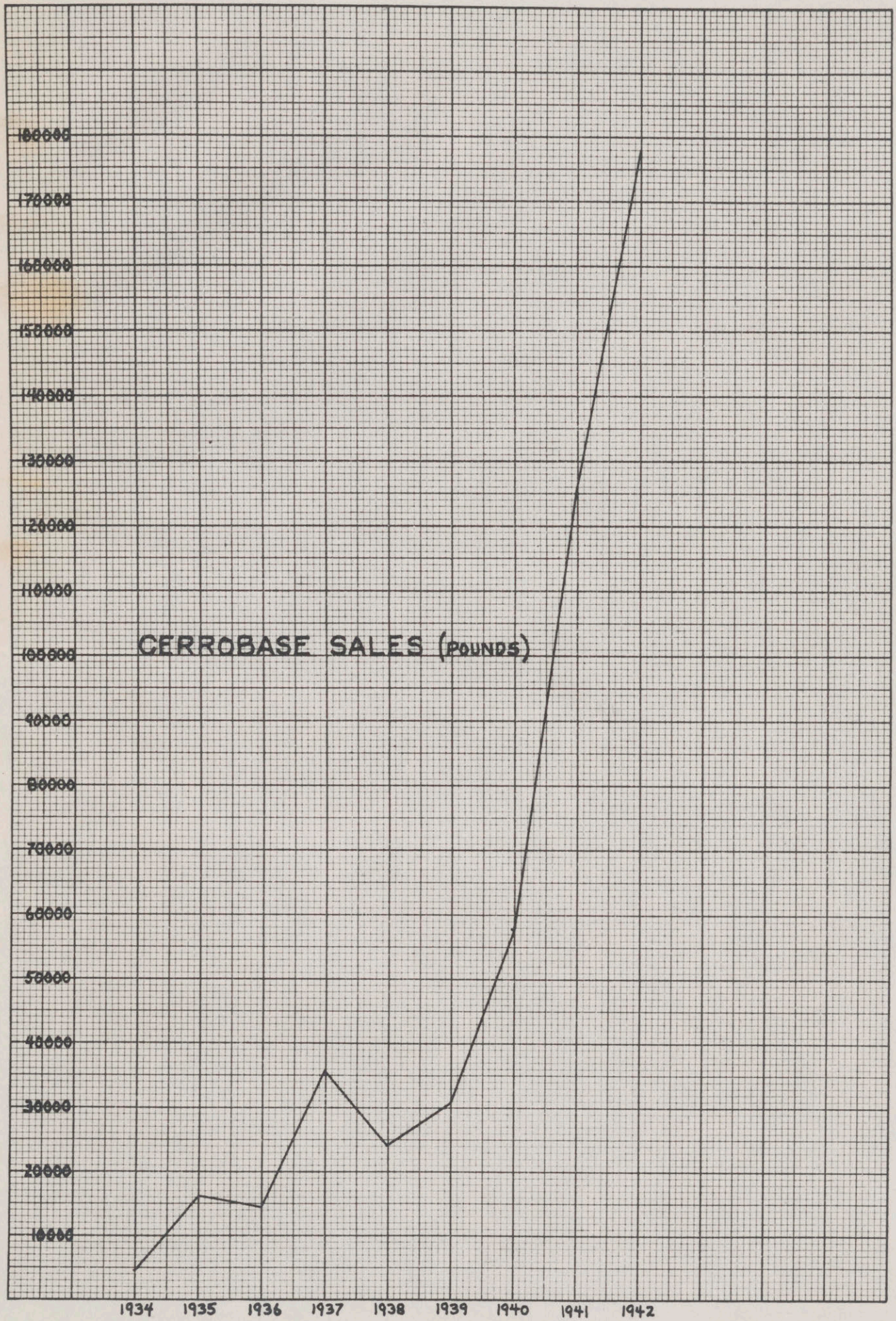








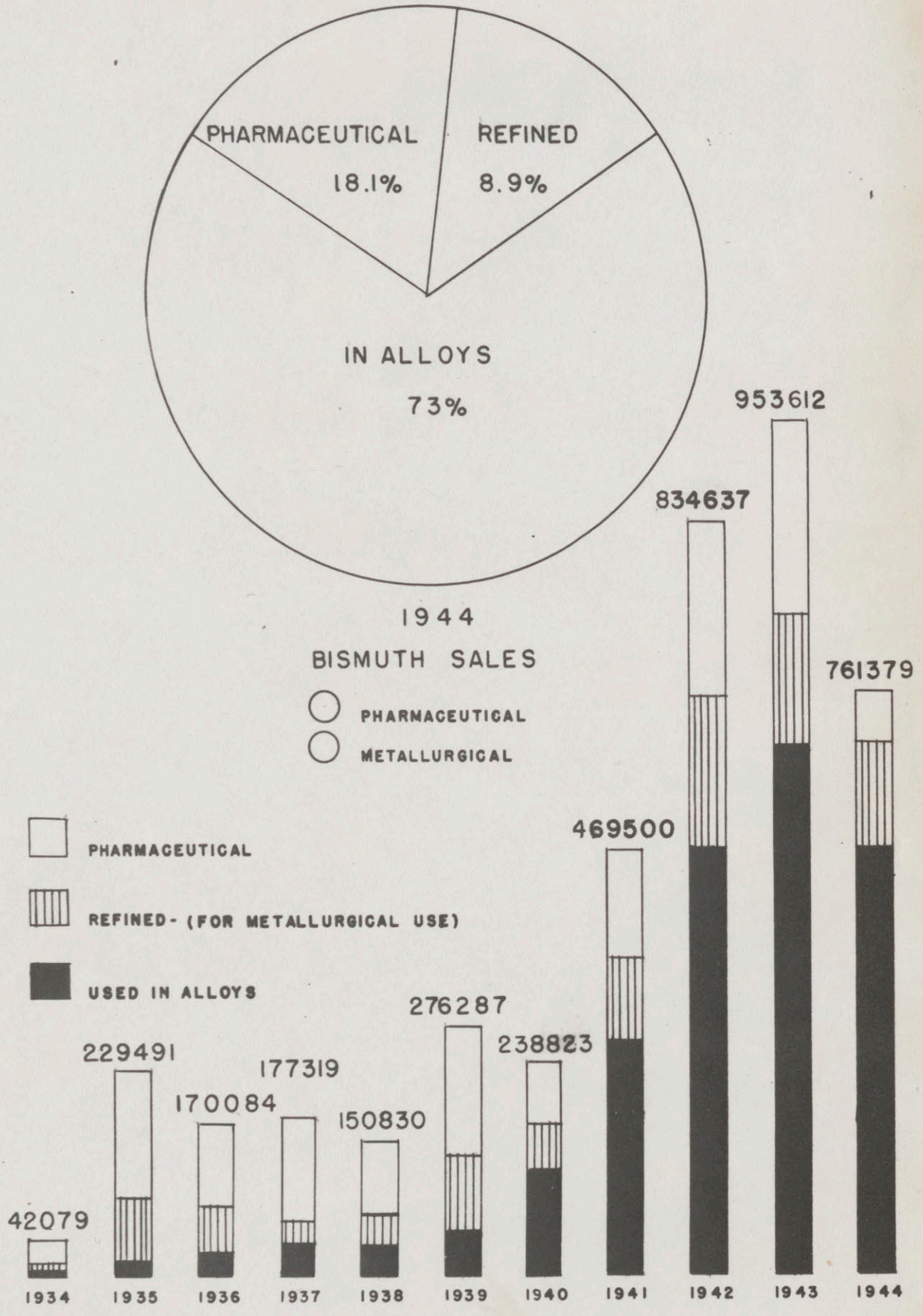




Bismuth Sales Report

1944

U.S. & Canada.




BISMUTH SALES IN POUNDS

UNITED STATES & CANADA

## GENERAL

Sales of bismuth to customers located in the United States and Canada are divided into two general classifications.

1. Pharmaceutical - Bismuth used in the manufacture of bismuth salts.

Sales in this group were made to one customer, namely, J. T. Baker Chemical Company. A marked decline in sales to this customer is accounted for by War Production Board reduction of allocation of our bismuth for pharmaceutical purposes.

2. Non-pharmaceutical - Bismuth for metallurgical purposes.

Sales in this group are divided into two classes: (a) Refined bismuth, (b) Bismuth in alloys.

The principal customer for refined bismuth was the Belmont Smelting and Refining Works, Inc., Brooklyn, N. Y., whose use for bismuth was in the manufacture of special alloys and for resale.

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The following table shows the total quantity of bismuth sold by the Corporation in the United States and Canada during 1944 classified into their respective groups as mentioned above.

### TABLE NO. 1

### BISMUTH SALES UNITED STATES AND CANADA 1944

| | POUNDS SOLD | PERCENT TOTAL SALES |
|---|---|---|
| PHARMACEUTICAL | | |
| J. T. Baker Co. | 137,848 | 18.1% |
| METALLURGICAL | | |
| Refined<br>(Belmont 60,000)<br>(Others 8,128) | 68,128 | 8.9% |
| In Alloys | 555,403 | 73.0% |
| Total Bismuth Sold | 761,379 | 100.0% |

A graphical representation of the above figures appears on the opposite page. Metallurgical bismuth represented 81.9% of 1944 sales (1943 - 77.2%, 1942 - 76.8%, 1941 - 74%, 1940 - 60%, 1939 - 49%). Bismuth in alloys represented 73% of 1944 sales (1943 - 61.9%, 1942 - 56.5%, 1941 - 55%, 1940 - 58%, 1939 - 19%).

The following pages of this report are devoted to the sale of bismuth for metallurgical purposes only.

## Refined Bismuth Sales

The major part of sales of refined bismuth for metallurgical purposes were to the Belmont Smelting and Refining Works in continuance of the Corporation's policy of diverting refined bismuth sales through this firm. However, small quantities of refined bismuth were sold directly to customers by the Corporation.

## Alloy Sales

The decline in bismuth sales from the high figure reached in 1943 was a direct result of lower bismuth production. Production during 1944 was about 171,000 pounds less than in 1943. During the entire year bismuth was under allocation by the War Production Board. The importance of the use of alloys in the war effort was recognized by this agency resulting in reduced allocation, hence our sales to the pharmaceutical trade.

Through the efforts of our distributors and representatives and publicity of magazine advertising there has been an increase in customers.

## Representatives and Distributors

Brooklyn, N. Y. - Belmont Smelting & Refining Works
Boston, Mass. - Jackson Associates
Ansonia, Conn. - Jackson Associates
Philadelphia, Pa. - Castaloy Metal Sales Company
Cleveland, Ohio - Die Supply Company
Detroit, Mich. - Castaloy Metal Sales Company
Chicago, Ill. - Sterling Products Company, Inc.
Moline, Ill. - Sterling Products Company, Inc.
Milwaukee, Wis. - Harry C. Kettelson, Inc.
Minneapolis, Minn. - Northern Machinery & Supply Company
St. Louis, Mo. - Metal Goods Corporation
Kansas City, Mo. - Metal Goods Corporation
Tulsa, Okla. - Metal Goods Corporation
New Orleans, La. - Metal Goods Corporation
Dallas, Texas - Metal Goods Corporation
Houston, Texas - Metal Goods Corporation
Los Angeles, Calif. - Castaloy Metal Sales Company
Montreal, Canada - Dominion Merchants Ltd.
Honolulu, Hawaii - The H. S. Gray Company

There were no changes made in the agencies or their respective territories in 1944.

Castaloy Metal Sales Company and their manufacturing division, Castaloy Corporation, merit praise for their continued outstanding work in the promotion of uses for our standard alloys in the aircraft industry.

A comparison of sales to and through our respective agencies during 1944 of standard alloys, is as follows:

## ALLOY SALES TO AND THROUGH DISTRIBUTORS

| | Pounds or Alloy | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | #5000-6 | BASE | BEND | DENT | MATRIX | SAFE | TRU | TOTAL |
| Belmont Smelting & Refining Wks. | | 27500 | 42500 | | 24000 | 3850 | 350 | 98200 |
| Castaloy Metal Sales Company | 10741 | 23026 | 171814 | | 215229 | 60247 | 1499 | 482556 |
| *C de P Direct Sales | | 198023 | 21963 | 63 | 9677 | 219 | 3994 | 233939 |
| Die Supply Company | | 500 | 19000 | | 7025 | 1900 | 195 | 28620 |
| Dominion Merchants | | 450 | 7845 | | 2200 | 900 | | 11395 |
| H. S. Gray Company | | | 4018 | | | | | 4018 |
| Jackson Associates | | 3088 | 11884 | | 6390 | 2426 | 500 | 24288 |
| H. C. Kettelson, Inc. | | 6650 | 2410 | | 900 | | | 9960 |
| Metal Goods Corporation | | 3725 | 48750 | | 72750 | 1500 | | 126725 |
| Northern Machinery & Supply Co. | | 185 | 130 | | 1305 | 700 | | 2320 |
| Sterling Products Co., Inc. | | 3300 | 8042 | | 10600 | 1300 | 200 | 23442 |
| | 10741 | 266447 | 338356 | 63 | 350076 | 73042 | 6738 | 1045463 |

*Shipped from New York by the Corporation to open territory

#5000-6 substitute for Cerrobend permitted by WPB for jigs and fixtures.
Added to "Standard Alloys" for duration.

## Publicity and Advertising

Because of limitations imposed by the War Production Board on the uses of the alloys practically no articles were written for publication.

The amount of paid advertising in trade publications was the same as in 1943. The following schedule lists the publications and advertising space allotments for each month.

| PUBLICATION | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mach. Tool Mag. | 1/2 | - | 1/2 | - | 1/2 | - | 1/2 | - | 1/2 | - | 1/2 | - |
| Modern Mach. Mag | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 |
| Tool Die Jour. | 1/2 | 1/2 | - | 1/2 | - | 1/2 | - | 1/2 | 1/2 | 1/2 | - | 1/2 |
| Electric Mfg. | 1/4 | - | 1/4 | - | 1/4 | - | 1/4 | - | 1/4 | - | 1/4 | - |
| Ind. Equip. News | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 | - |
| New Equip. Digest | - | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 | - | 1/9 |
| Mod. Ind. Press | 1/6 | - | 1/6 | - | 1/6 | - | 1/6 | - | 1/6 | - | 1/6 | - |
| Prod. Eng. | 1/4 | - | 1/4 | - | 1/4 | - | 1/4 | - | 1/4 | - | 1/4 | - |
| Prod. Eng. & Mgt. | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 |
| Mill & Factory | 1/3 | - | 1/3 | - | 1/3 | - | 1/3 | - | 1/3 | - | 1/3 | - |
| Metals & Alloys | 1/3 | - | - | 1/3 | - | 1/3 | - | 1/3 | - | 1/3 | - | 1/3 |
| Aero Digest | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 | 1/2 |

Note: The above fractions represent parts of a page.

## Use of Alloys in War Equipment

Cerrobend as a filler for tube bending, fusible plugs for safety devices.

Cerromatrix for anchoring parts in stamping dies and machinery; split jaw chucks for holding irregular parts while being machined; locating and supporting contact points on airplane assembly jigs (Page 33, Figure 78, Cerromatrix Manual); short run forming dies; and other special applications.

Cerrobase as fusible cores in the electroforming process for making intricate shapes with irregular cavities; fusible inserts in complicated sand cores; master alloy in free cutting aluminum; heat transfer medium in autoclaves; liquid seal in nitriding furnaces; bending filler for large diameter tubes, fusible cores in hollow molded plastics and secret war uses.

Cerrosafe limited by War Production Board to use in inspection gauges and proof-casting of molds, gun chambers, forging dies, etc.

#5000-6 (6.5% Cadmium) as substitute for Cerrobend in making aircraft assembly jigs and fixtures.

Special alloys for safety devices; holding shell lathe bearings and small alnico rotors onto shafts in motors used in airplanes for operating control equipment.

## ALLOY SALES FOR YEAR 1944

The following table shows the sales of alloys with the corresponding bismuth content of each for the year 1944.

TABLE NO. 2

| ALLOY | LBS. ALLOY | LBS. Bi CONTENT |
|---|---|---|
| Cerrobase | 266,447 | 147,878 |
| Cerrobend | 338,356 | 169,178 |
| Cerrodent | 63 | 24 |
| Cerromatrix | 350,076 | 168,036 |
| Cerrosafe | 73,042 | 31,043 |
| Cerrotru | 6,738 | 3,908 |
| Specials: | | |
| C de P 3333-1 | 902 | 301 |
| *C de P 5000-6 | 12,324 | 6,162 |
| C de P 5600-1 | 20,214 | 11,319 |
| C de P 9500-1 | 4,107 | 3,902 |
| Others | 26,369 | 13,652 |
| Total | 1,098,638 | 555,403 |

*10,741 pounds of C de P 5000-6, bismuth content 5,370 pounds, were sold as Standard Alloy.

Charts will be found at the conclusion of this report showing the comparison of sales of our standard alloys for the years 1934 to 1944 inclusive.

## SALES INVOICED & EXPENSES

The total value of Alloy sales invoiced for the year 1944 was $628,463.02 as compared with $699,249.77 for 1943, $574,105.32 for 1942, $312,530.39 for 1941 and $137,364.33 for 1940.

### TABLE NO. 3

### BISMUTH ALLOY EXPENSE 1944

| Item | Total Dollars | Cents/lb. Alloy | Cents/lb. Bi Content |
|---|---|---|---|
| 1. Manufacturing Cost | $24,713.96 | .0224 | .0445 |
| 2. Tin Purchased | 61,175.22 | .0557 | .1101 |
| 3. Cadmium Purchased | 33,104.70 | .0301 | .0596 |
| 4. Cadmium Acquisitioned | 3,854.61 | .0035 | .0069 |
| 5. Lead Purchases | 23,372.69 | .0213 | .0421 |
| 6. Antimony | 5,381.42 | .0049 | .0097 |
| 7. Dies, Molds, etc. | 180.00 | .0002 | .0003 |
| 8. Salaries & Commisions | 2,741.35 | .0025 | .0049 |
| 9. Advertising & Printing, etc. | 10,504.70 | .0096 | .0189 |
| 10. Traveling Expense | 252.42 | .0003 | .0005 |
| 11. Boxing, Cartage, Postage, etc. | 9,797.60 | .0089 | .0176 |
| 12. Storage, Insurance | 449.39 | .0004 | .0008 |
| 13. Rent (Walker & Whyte Inc.) | 200.00 | .0002 | .0004 |
| 14. Alloys Purch. for resale | 1,478.98 | .0013 | .0027 |
| 15. Miscellaneous | 1,861.17 | .0017 | .0034 |
| Total | $179,068.21 | .1630 | .3224 |

The above expenses include all costs with the exception of bismuth withdrawn from stock used in the manufacture of the alloys.

Increases in unit costs of items shown above are explained as follows:

Items 5 and 6. Lead and Antimony purchases increased due to increased sales of Cerromatrix and Cerrobase.

Item 9. Printing cost increased due to reprinting of literature to replace consumed stocks and the printing of special literature for distribution by Castaloy Metal Sales Company at the Southern California Exposition, Los Angeles, California. Advertising in trade journals totalled $6043.50.

Items showing decreases are responsible for a net decrease in unit cost per pound of bismuth as follows:

Item 1. Manufacturing costs reflected a decrease due to production of large quantities of Cerrobase to Aluminum Company of America and others put up in eight pound and fifty pound ingots.

Items 2, 3 and 4. Tin and Cadmium costs decreased because of reduced Cerrobend sales.

Item 11. Fewer shipments due to decreased sales plus reason under Item 1.

In summation, the total unit cost per pound of bismuth content was reduced from $.4734 in 1943 to $.3222 in 1944, a net decrease of $.1510.

TABLE NO. 4

| | Total Dollars | Cents/lb. Alloy | Cents/lb. Bi Content |
|---|---|---|---|
| Gross Value Alloy Sales Billed | $628,463.02 | 57.20 | 113.15 |
| Expenses from Table #3 | 179,068.21 | 16.30 | 32.24 |
| Sales Less N. Y. Expense | $449,394.81 | 40.90 | 80.91 |

The above table shows the gross value of alloy sales billed in 1944 less such expenses as apply exclusively to the sale and manufacture of alloys. These figures do not include the cost of bismuth and are presented to show that approximately $449,395.00 or 80.91 cents per pound of bismuth content was realized after paying all charges incidental to selling bismuth in this form.

To produce the alloys sold during the year, bismuth was supplied by the Corporation.

555,403 lbs. @ 41.527¢ $230,640.79

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Viewed from the standpoint of alloy sales above, the indicated net profit would be shown as follows:

TABLE NO. 5

| | Total Dollars | Cents/lb. Alloy | Cents/lb. Bi Content |
|---|---|---|---|
| Sales less N. Y. Expense (Table #4) | $449,394.81 | 40.90 | 80.91 |
| Cost of Bismuth | 230,640.79 | 20.99 | 41.53 |
| Indicated net profit | $218,754.02 | 19.91 | 39.38 |

Inasmuch as the sales of alloys are so closily connected with the sale of refined bismuth for metallurgical purposes, it may be assumed that all sales of bismuth for non-pharmaceutical applications may be combined with the bismuth contained in alloys sold, for the purpose of indicating a net profit as shown below in Table No. 6.

TABLE NO. 6

| | Total Dollars | Cents/lb. Bi Content |
|---|---|---|
| Gross Value Alloy Sales | $628,463.02 | 113.15 |
| " " Bismuth sold Belmont | 58,125.00 | 96.9 |
| " " " Others (Met.) | 8,018.59 | 98.7 |
| Total | $694,606.61 | 111.40 |
| Expense Alloy Sales | $179,068.21 | 32.24 |
| Cost of Bismuth Content Alloys | 230,640.79 | 41.53 |
| Cost of Refined Bismuth Sold | 30,461.12 | 44.71 |
| Total | $440,170.12 | 70.59 |
| Indicated Net Profit | $254,436.49 | 40.81 |

## FUTURE PROSPECTS

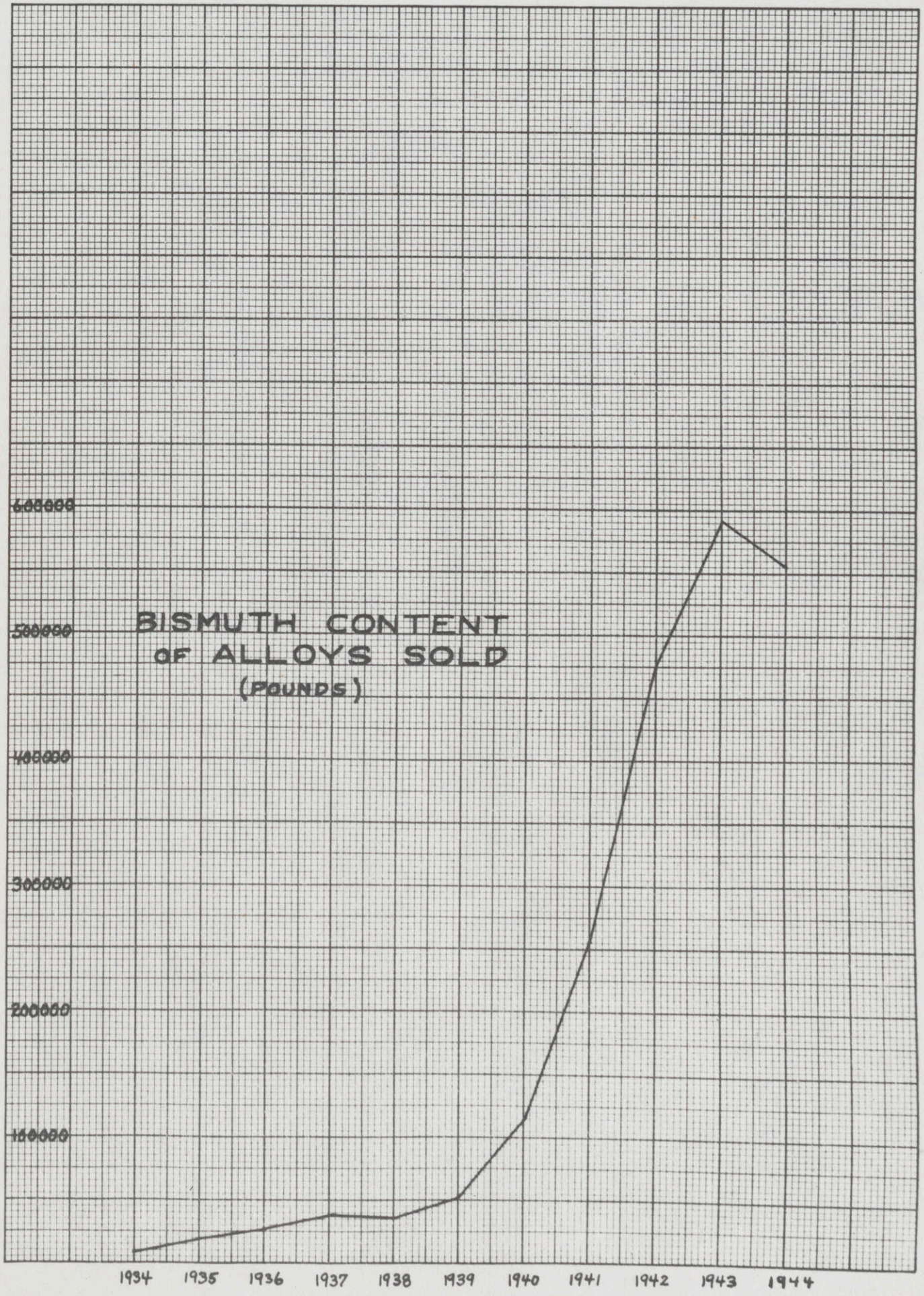
It is expected that cessation of hostilities will release for public use a number of applications of the bismuth alloys which have been permitted only for essential war work. Also several applications of the alloys were not permitted during the war because of the shortage of certain components such as cadmium and tin.

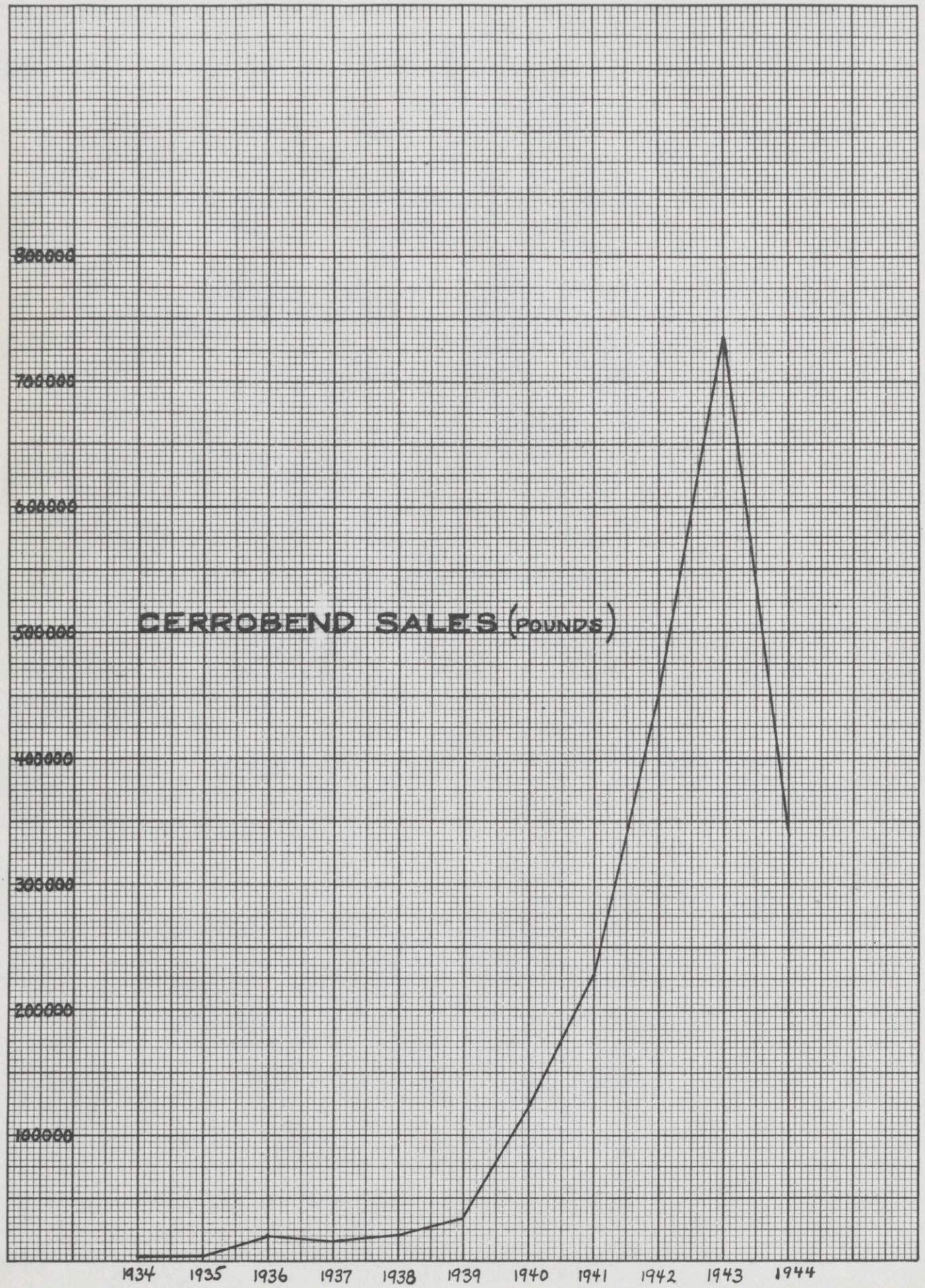
Short run forming dies used in forming shapes of sheet metal are made of Cerrobend. This use was prohibited because of the shortage of cadmium contained in this alloy. It is anticipated that the automotive industry as well as the aircraft manufacturers will make use of large quantities of Cerrobend for this purpose when restrictions are removed from Cadmium.

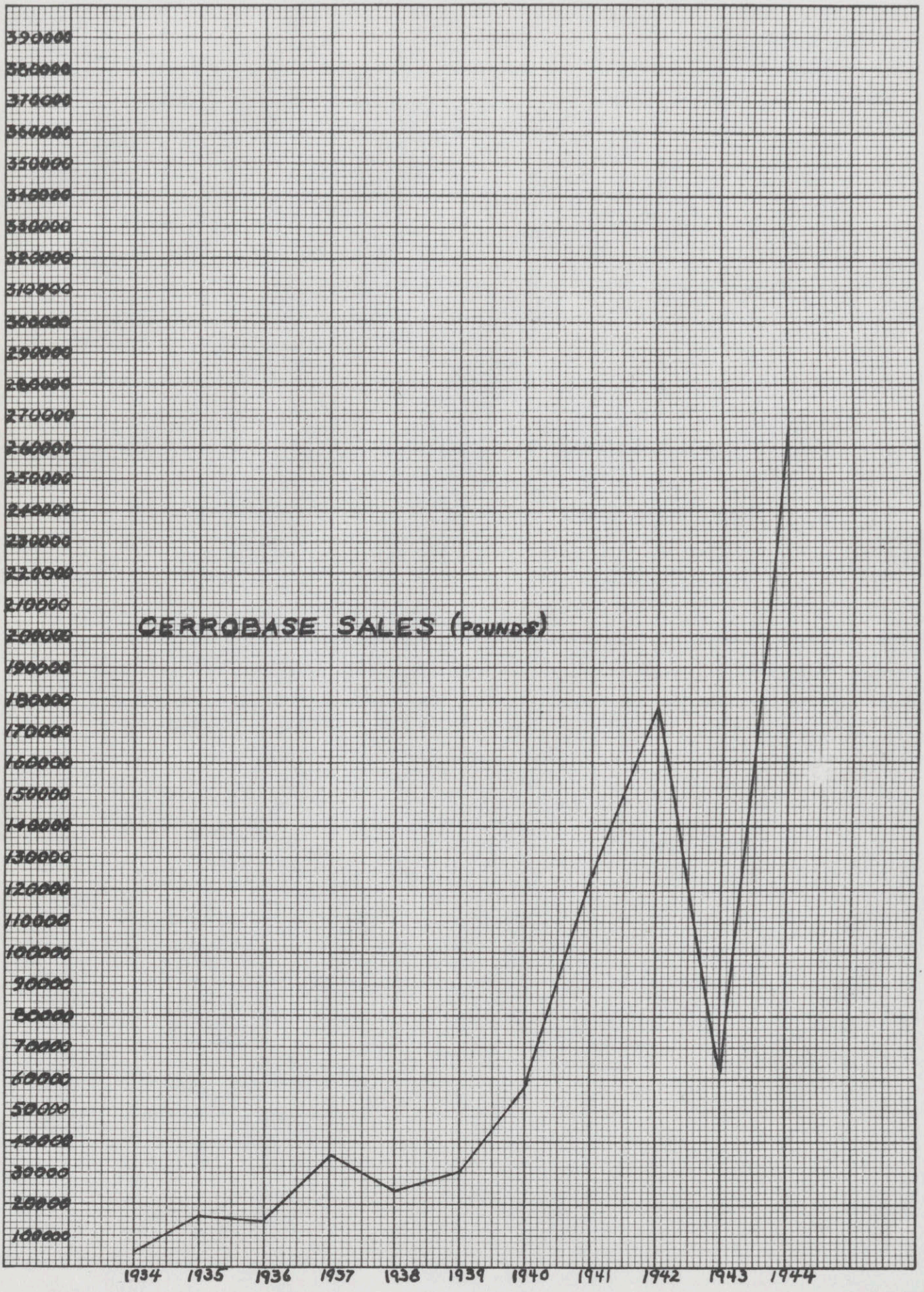
Development of metal spraying equipment accomplished during the war will stimulate the use of one or more of the alloys for protective coating of wood patterns and core boxes to prevent warpage and resist wear. This is a use prohibited by war restrictions.

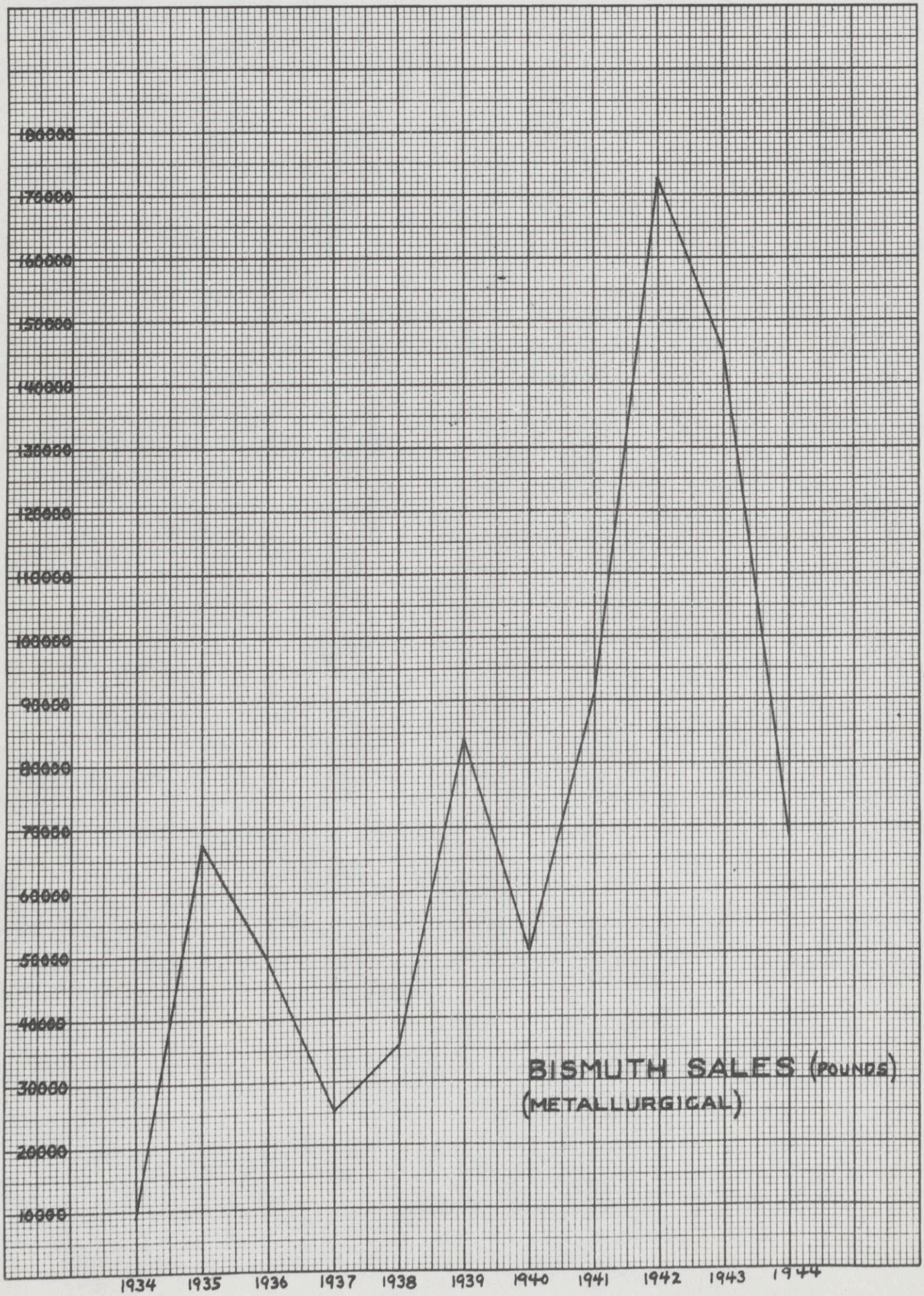
Electroforming; a process for the production of intricate shapes by electrodeposition of metal on Cerrobase and then melting away the alloy leaving a finished article otherwise impossible to produce has received great impetus during the war. This method of manufacture should become popular in post war methods and account for a fair volume of alloy.

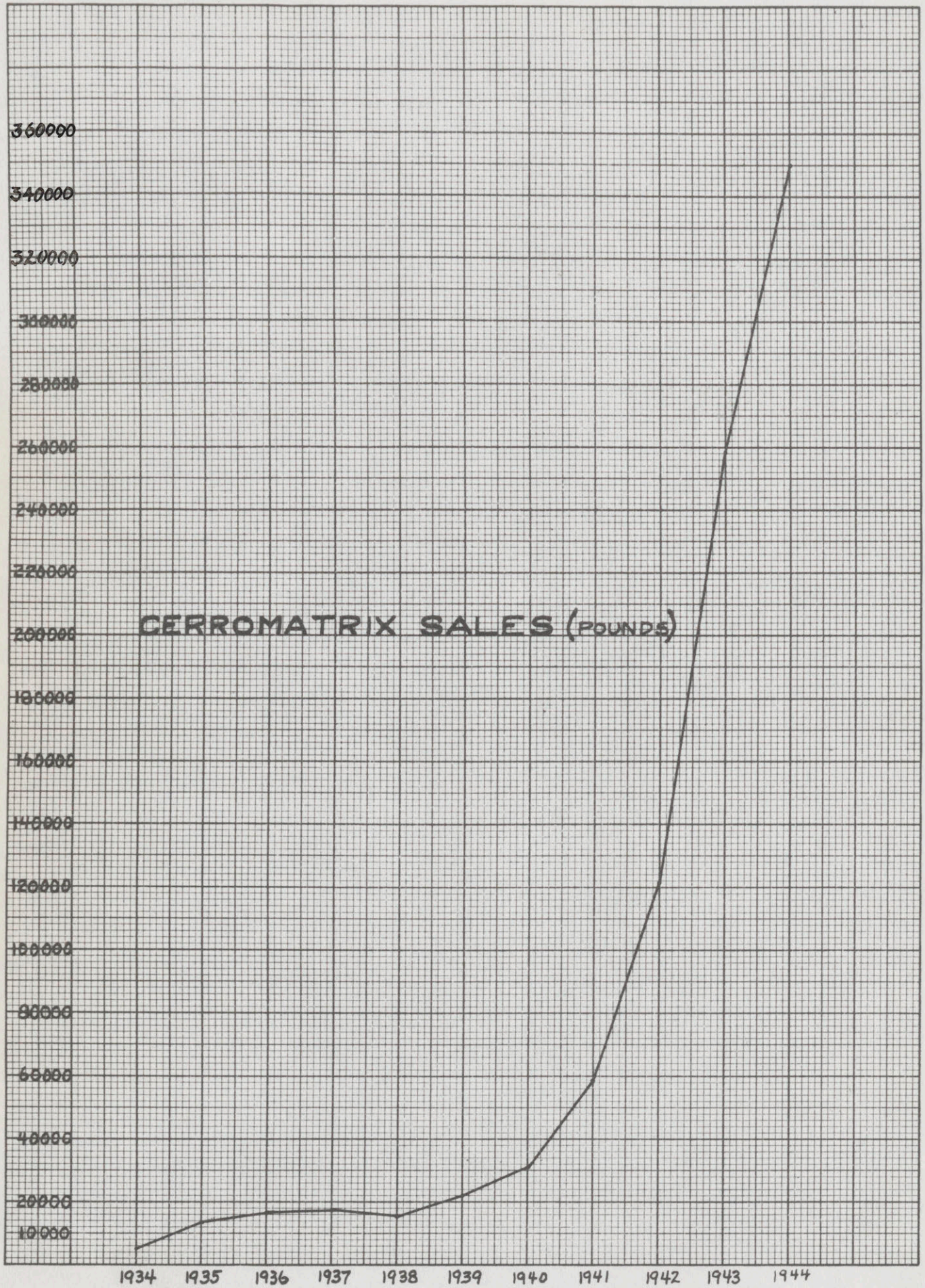
In general it can be said that reconversion to peace time manufacturing will, in all probability, consume our total output of bismuth at its present rate of production.

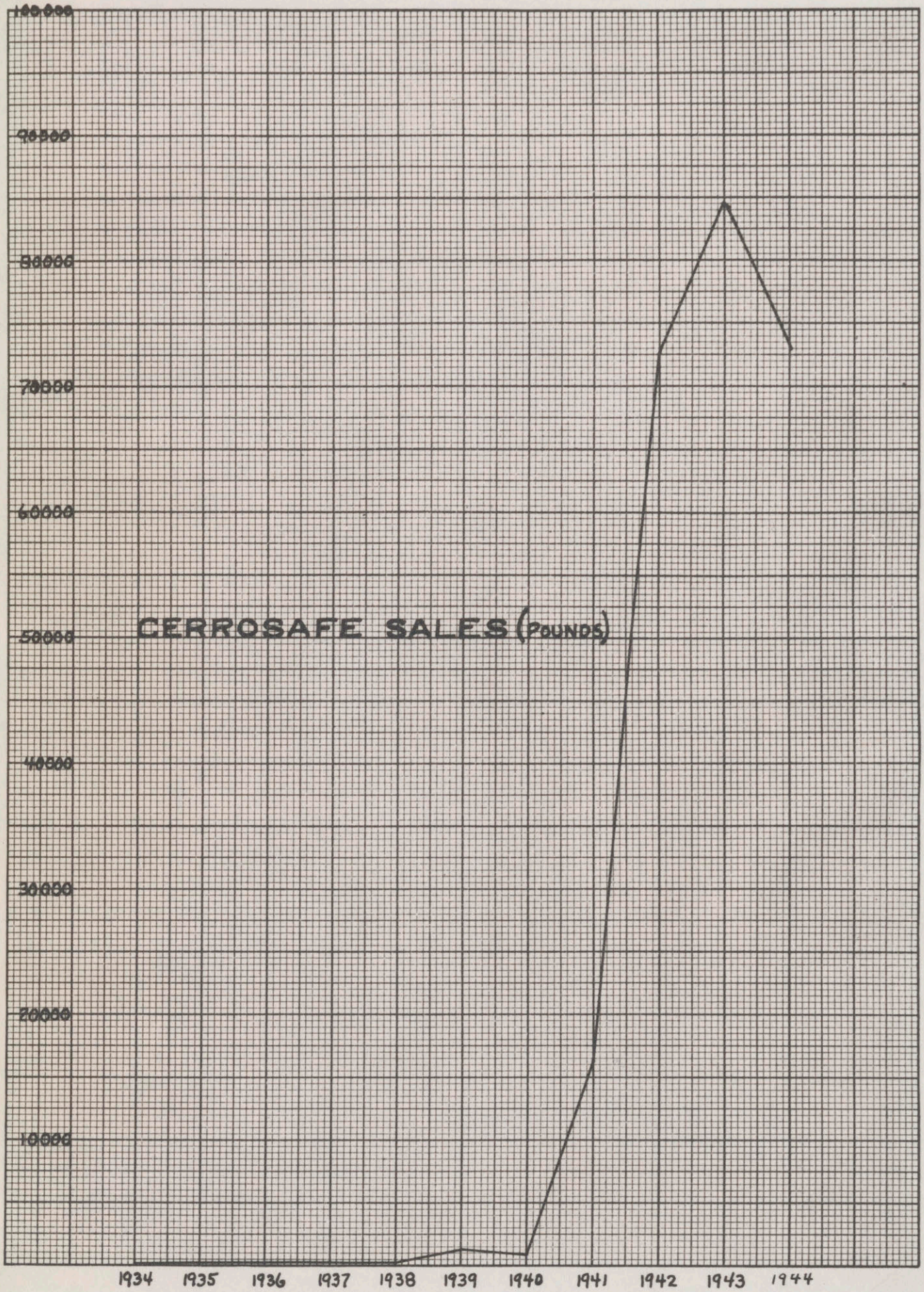


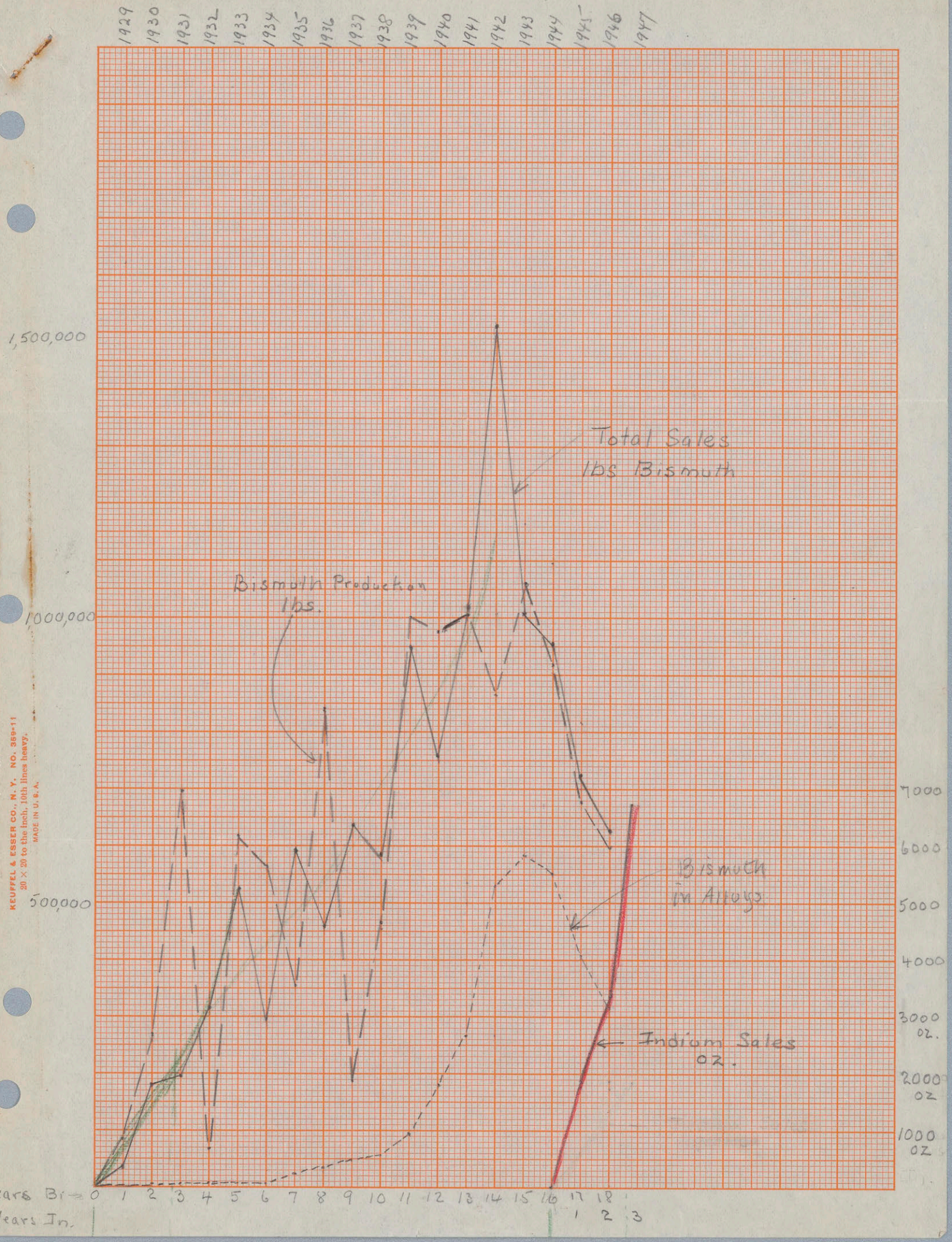








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Years In. 1 2 3
KEUFFEL & ESSER CO., N.Y. NO. 359-11
20 × 20 to the inch, 10th lines heavy.
MADE IN U.S.A.

CERRO DE PASCO COPPER CORPORATION

40 WALL STREET, NEW YORK 5, N. Y.

October 7, 1947

Mr. Lawrence Addicks
Bel Air, Maryland

Dear Mr. Addicks:

The attached curves were plotted from data available, without digging too deeply into the records. The sales exceed production by about 200,000 lbs. in 18 years, a part of which can be accounted for in alloys purchased and resold.

Yours truly,

CERRO DE PASCO COPPER CORPORATION

W. C. Smith

WCS:RL

Enclosure

# MOLD MAKING

# WITH

# CERRO-ALLOYS

CERRO DE PASCO COPPER CORPORATION
40 WALL STREET, NEW YORK 5, N. Y.

CERRO DE PASCO COPPER CORPORATION

40 WALL STREET, NEW YORK 5, N. Y.

# MOLD MAKING WITH CERRO-ALLOYS

Ease of handling Cerro-Alloys (Low Temperature Melting Metals) makes them ideal for rapid and accurate production of individual or multiple cavity molds without need of highly skilled labor or expensive machinery. Minute detail is perfectly reproduced in Cerro Alloy molds and high lustre surface finishes require no polishing. Low production cost, combined with 90 to 95% salvageability of used metal when molds are discarded commend this method of mold making for the serious consideration of every fabricator of plastics.

## ALLOY TO BE USED IN MOLD MAKING

Several Cerro Alloys are suited to the purpose, but the setting or curing temperatures of the plastic to be used will govern the choice. Three Cerro Alloys commonly used are listed:

| Alloy | Melting Temperature |
|---|---|
| Cerrobend | 158° F |
| Cerrobase | 255° F |
| Cerrotru | 281° F |

Cerrotru is most frequently used for molds because of its higher melting temperature, greater hardness and dimensional accuracy.

High lustre finish of molds, equalling the surface finish of the master model is important. To obtain this type of finish when using Cerro Alloys, it is essential that quick cooling of the alloy at the pattern surface take place. Frequently it will be desirable to make molds from patterns made of materials of poor heat conductivity, such as: soap, wood, wax, ceramic, plastics, etc., as well as metal and therefore consideration will be given first to a method of mold production that will work with patterns of good and poor conductivity.

## SPRAYED MOLDS

Spraying a Cerro Alloy on a pattern is advantageous because the metal is deposited in a relatively cool state and does not warp or set up strains in the pattern. The pattern is bombarded with globules of metal in the plastic state that flatten

out as they strike the surface and thus cool rapidly. Extremely small in size, the particles get down into all crevices, completely filling them, reproducing faithfully all surface detail. Over 5000 lines per inch can be reproduced. Because quick cooling of large masses of molten metal is not necessary the sprayed method may be considered the most useful way to make molds.

Equipment and materials required:

1. Cerro Alloy (Cerrotru)
2. Electrically heated spray gun, low temperature type. Two manufacturers with whose equipment we are familiar are:

W. M. Fiore
135 Liberty Street
New York, New York

K & F Metal Spray Industries
11204 Charlevoix
Detroit, Michigan

3. Source of compressed air for spray gun, 40 - 80 pounds pressure - consumption 4 - 6 cubic feet per minute.

4. Plaster, wax or modelling clay.

5. Separating medium. In many cases graphite in finely powdered form will suffice to facilitate separation of the mold from the model, but mold release fluids such as produced by Dow-Corning Corporation, are preferred because no deposit will remain on the mold to blemish plastic castings.

6. Melting pot and ladle.

A. Making a Single Cavity, Open Face Mold

1. Secure pattern to a mold board preferably of metal.
2. Apply parting medium to pattern and mold board, removing any excess.
3. If desirable to fix outside dimensions and shape of mold, place a suitable frame around mold board.
4. Have spray gun full of molten Cerro Alloy and spray surface of mold board and pattern in same manner as if spray painting. Attention must be paid to aiming gun so as to get into all corners and crevices of pattern. After a thickness of 1/16" to 1/8" has been uniformly deposited over model surface by fine spray, more rapid building up should be done with a coarse spray. If cooling of mold is required, a suitable loop of copper tubing may be placed over initial layer and embedded in the mold by continuing to spray until completely covered. Rapid filling can be done by careful pouring from a ladle. In case plaster is to be used for mold backing to conserve weight, a protective sealing coat of lacquer should be applied to sprayed surface. This is to prevent chemical action of the plaster upon the sprayed metal.



5. The pattern is now removed from mold and it is ready for service.

Sheet plastics of certain types can be readily formed by vacuum or air pressure. Molds for this purpose are made by spraying a Cerro Alloy as outlined above. Shells should be built up to a thickness of 1/4" or heavier. The required number of shells are nested on a plate having all sides surrounded by a wall of wood or angle iron. This is to retain a suitable filler of plaster which is poured over and around the shells after they have been given a protective coat of lacquer. The base plate, usually of steel, has openings conforming in dimension and shape to the openings of the shells. It serves to take the draw of the plastic sheet, acts as a hold down pad and attachment bolts for fastening to press ram are attached to it.

Provision for cooling molds is made by looping copper tubing around each shell and bringing ends for inlet and outlet through angle iron wall and connected to water supply and drain.

Vents are drilled in each shell through plaster and mold is ready to mount in press.

This method of sheet plastic forming requires the press platen to be heated and this can be readily accomplished with steam or electric heaters.

C A U T I O N : All spray work must be done under thorough ventilation. A simply constructed dust catcher consists of a table having an air tight compartment beneath. The table top forms the top of the compartment. Cut hole in side of compartment for inlet connection of suction fan. Cut square or oblong opening in table top and cover with metal grill or heavy wire mesh. Exhaust of suction fan discharges into large cloth bag to recover dust for salvage. A hood should be constructed on table top and working opening made small as practical to assure dust removal.

Compartment below table should be fitted with drop bottom or removable drawer for clean out.

B. Multiple Cavity, Open Face Mold

1. Follow steps 1 through 4 as A, above.
2. Apply parting medium to sprayed mold cavity and flat surfaces.
3. Spray into this cavity to cover surfaces 1/16" thick.
4. Fill remainder of cavity with plaster or dental stone.
5. Before plaster sets place one or more tapped inserts in it and level off.

6. When plaster has set and hardened remove from mold. This will now be a metal faced duplicate pattern and as many as needed can be produced in this way.

7. Duplicate patterns are mounted on board using the tapped inserts to secure to board with bolts through holes in the board.

8. Repeat steps 1-5 (A) as for single cavity molds to make final multiple cavity mold.

C. Two Piece or Closed Molds

1. With split patterns proceed same as for open face mold, invert drag of flask, place other half of pattern in position.

2. Apply separator.

3. Place cope of flask in position and repeat all steps. Plaster backing of cope and drag can be done after spraying of both halves is complete. Lacquer sprayed shell before pouring plaster.

4. Pouring gates, sprues and vents may be placed wherever convenient.

D. Molds Made of Cast Cerro Alloys

When the pattern to be reproduced is made of a good thermal conductor such as brass, steel, aluminum, etc., and provision for quick chilling through the pattern can be made, direct casting instead of spraying, may be practical. Each type of mold as described above is easily produced by simple casting.

Preheating of the model is necessary. Exact temperature in each case will have to be determined experimentally. 200°F should be a good starting point. Pour the Cerro Alloy as near its melting point as possible to avoid necessity of excess heat removal.

When pouring move ladle about to avoid hot spots.

Immediate and thorough quenching, from pattern face, through the pattern, should be provided. Large patterns should be designed to have cold water circulating rapidly through them. The quicker the quench the better the working surface will be.

MOLD TREATMENT BEFORE CASTING PLASTICS

In general, it will be necessary to use some form of parting medium before casting plastics in Cerro Alloy molds, particularly those made by spraying. Sprayed alloy is somewhat porous and will require impregnation with a material suitable for the plastic being used. A light tin or copper plating of working surfaces improves release. Some of the elastomeric plastics can be cast directly in Cerrotru molds with no parting medium. At this time we are not in a position to furnish a list of casting resins with the corresponding parting media to be used. It is suggested



that the manufacturer of your material be consulted concerning the best medium to use with his product in Cerro-Alloy molds.

At a later date it is expected that more specific information on separating materials will be made available.

E. Permanent Molds Made By Electrodeposition

When permanent molds are required and time and cost of manufacture must be considered, multiple cavity molds can be economically made by electrodeposition or electroforming.

Electroformed molds of complicated shapes with undercuts or back draft can be produced with internal surface finish equal to that of the model.

Mold materials in common use are iron, nickel and copper.

A duplicate model is made of Cerrobase. This Cerrobase model is then plated with the desired metal until the required thickness of metal has been deposited. Cerrobase is melted out of the cavity. The mold shell is backed with suitable backing metal, such as Kirksite or by metallizing with a high temperature metal spray gun and machined to suitable size and shape for mounting in press.

C. L. Duncan, 1 Depot Plaza, White Plains, New York, W. M. Fiore, 135 Liberty Street, New York City, U. S. Rubber Company, Detroit and others are equipped to produce electroformed molds.

# DISTRIBUTORS

ANSONIA, CONNECTICUT
L. Heres De Wyk & Company, 89 Main Street

BOSTON, MASSACHUSETTS
Robert P. Waller, 80 Boylston Street

CHICAGO, ILLINOIS
Sterling Products Company, Inc., 121 N. Jefferson Street

CLEVELAND, OHIO
Die Supply Company, 5349 St. Clair Avenue

DALLAS, TEXAS
Metal Goods Corporation, 6211 Cedar Springs Boulevard

DAYTON, OHIO
Die Supply Company, 1110 Hampshire Road

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HOUSTON, TEXAS
Metal Goods Corporation, 16 Drennan Street

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LOS ANGELES, CALIFORNIA
Composite Die Supply Company, 1855 Industrial Street

MILWAUKEE, WISCONSIN
Williams-Collins, Inc., 2409 West State Street

MINNEAPOLIS, MINNESOTA
Northern Machinery & Supply Company, Lumber Exchange Building

MOLINE, ILLINOIS
Sterling Products Company, Inc., 1524 Third Street

NEW ORLEANS, LOUISIANA
Metal Goods Corporation, 432 Julia Street

NEW YORK, NEW YORK
Belmont Smelting & Refining Works, Cerro-Alloy Div., 37 Wall St.

PHILADELPHIA, PENNSYLVANIA
Jackson-Walter Company, 210 North 13th Street

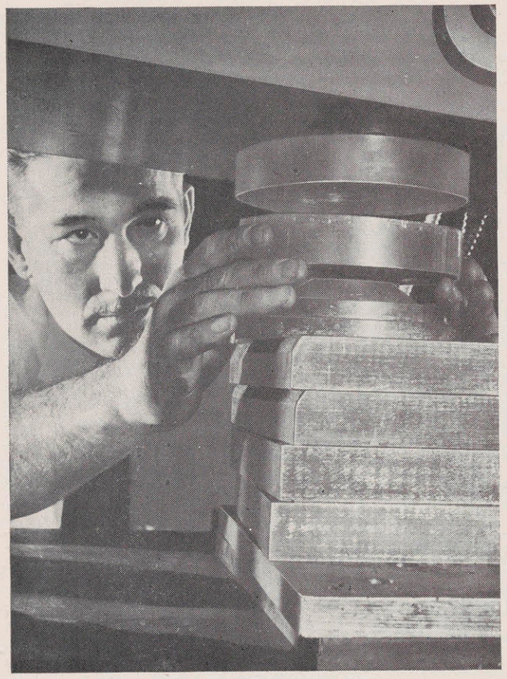
ST. LOUIS, MISSOURI
Metal Goods Corporation, 5239 Brown Avenue

TULSA, OKLAHOMA
Metal Goods Corporation, 19 E. Cameron

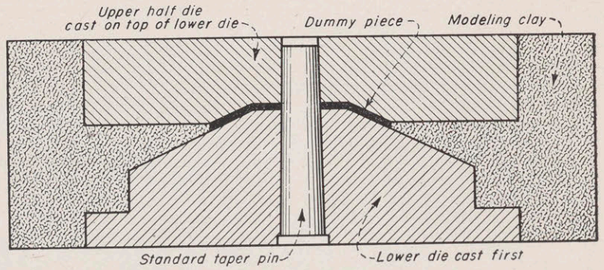
# Frozen Dies Form Experimental Parts

By CHESTER S. RICKER

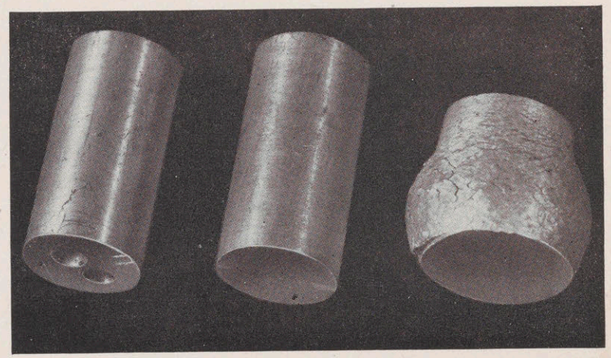
*Reprinted from* AMERICAN MACHINIST
*Issue of Dec. 4, 1947*



Economy of time and labor are outstanding in Wood's metal dies for short run production




How aluminum dummy and plasticine clay are used when pouring the upper half of the die



Test specimens of Cerrobend. Left, before load test; center, after 5650-lb. load at —320 F.; right, after 5650-lb. load without cooling

# Frozen Dies Form Experimental Parts

**Tripling the strength of Wood's metal dies**

**by freezing in liquid nitrogen**

**makes them suitable for forming thin sheet metal parts**

BY CHESTER S. RICKER
DETROIT EDITOR

TEMPORARY DIES for either experimental or very short runs usually pose a difficult problem in choice of material for minimum cost and ease of working. Fred Klemach, stress analysis engineer, Ford Motor Co., Dearborn, reasoned that Wood's metal would be ideal for the purpose if some way could be found to harden it. This material, an alloy of bismuth, tin, cadmium and lead, melts readily in hot water, is very easy to cast in any kind of mold, plaster, clay, wood, metal, or even cardboard, is very easy to work, and can be reclaimed after use by melting in boiling water.

Freezing the metal seemed to offer a solution to the hardness problem, and experiments showed that freezing in liquid nitrogen would more than triple the yield point. In the chilled condition, dies were found capable of forming SAE 1020 sheet steel up to 0.040 in. thick. Very satisfactory experimental parts of intricate design can thus be made in small quantities, five or ten at a time, and if more are needed the dies can be chilled again for additional runs.

These dies have effected considerable savings in time and money. Small steel dies for experimental parts usually take six or more weeks to produce, and after they are finished, even a small change in design generally means a complete loss of the dies and the high-priced labor that has gone into them. Wood's metal dies, however, can be made from a sample wood or clay model and finished pieces produced from them in one or two days. If there is a change in design the dies can be melted and recast with the expenditure of only hours instead of weeks.

Both male and female dies are made from the same alloy. The bottom die is made in a plaster mold taken from a turned wood pattern. This is placed in a hydraulic press and covered with a sheet of aluminum of the size and thickness of the material to be formed. A heavy rubber pad is then pressed down to form the sheet to conformity with the die. This sheet acts as a spacer and also as a mask, its high conductivity preventing the new hot top die metal from melting that in the bottom die.

Before the upper die is poured, plasticine modeling clay is built up over the lower die to protect it and also to reduce the amount of alloy required in the top die. The two halves are secured in proper relation to one another by taper pins cast into the lower die. After casting, and before the two halves are separated, the top and bottom are carefully faced off to assure perfectly parallel bearing surfaces.

After separating, the halves are examined for flaws, and any blow holes or scratches repaired with a soldering iron and a piece of the alloy. Even minor changes in the die can sometimes be made by this means and the surface smoothed up with a scraper.

Chilling is effected by dipping the dies for a few minutes in liquid nitrogen, which is inexpensive and easily obtained. Sheets of asbestos are used above and below the dies in the press to prevent too-rapid conduction to the platens. Asbestos gloves are used in handling the dies to prevent severe burns from the minus 320 F. temperature.

Compression tests of 1-in. dia., 2-in. long samples show that the alloy begins plastic deformation at about 7500 psi., but the same test piece after chilling will stand about 25,000 psi. or better. There is no deformation when chilled, the ultimate stress and yield point being the same. The Brinell hardness test shows less than one-fourth the ball impression on the chilled piece as compared with one at normal temperature.

The material acutally used by Ford is Cerrobend, but other metals in the same category could be used. Table 1 shows the constitution and physical properties of some of these materials. It should be noted that Cerrobend expands 0.001 in. per in. during solidification and grows rapidly for 1 hr. afterwards. The growth continues at decreasing rates for 1000 hr. The total expansion is about 0.008 in. per inch.

**PROPERTIES OF CERRO ALLOYS**

| Name | Bi | Sn | Cd | Sb | Pb | Melting Temp., °F. | Freezing Range, °F. | Wt. per cu. in., lb. | % Elong. in 2 in. | Tensile Strenght | Bhn. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cerrobend | 50 | 13.3 | 10 | — | 26.7 | 158 | 158-158 | 0.339 | 200 | 5990 | 9.2 |
| Cerrosafe | 42.5 | 11.3 | 8.5 | — | 37.7 | — | 194-158 | 0.341 | 220 | 5400 | 9.2 |
| Cerromatrix | 48 | | — | 9 | 28.5 | — | 440-218 | 0.343 | 1 | 13,000 | 19.0 |
| Cerrobase | 55.5 | — | — | — | 44.5 | 255 | 255-255 | 0.371 | 60-70 | 6400 | 10.2 |
| Cerrotru | 58 | 42 | — | — | — | 281 | 281-281 | 0.315 | — | 8000 | 22.0 |

## CERRO ALLOY DISTRIBUTORS

ANSONIA, CONNECTICUT, L. Heres De Wyk & Co., 89 Main St.
BOSTON, MASSACHUSETTS, Robt. P. Waller, 80 Boylston St.
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DALLAS, TEXAS, Metal Goods Corp., 6211 Cedar Springs Blvd.
DAYTON, OHIO, Die Supply Company, 1110 Hampshire Rd.
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TULSA, OKLAHOMA, Metal Goods Corp., 19 E. Cameron
TORONTO, CANADA, The Canada Metal Co. L'd., 721 Eastern Ave.
LONDON, W.C.2, ENGLAND, Mining & Chemical Prods. Ltd., Mansfield House, 376, Strand



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