DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INTRODUCTION</strong></td>
<td>4</td>
</tr>
<tr>
<td>Equipment</td>
<td>4</td>
</tr>
<tr>
<td>Raw Material</td>
<td>4</td>
</tr>
<tr>
<td><strong>PREPARATION LABORATORY - ROOM 232</strong></td>
<td>4</td>
</tr>
<tr>
<td>Preparation of Raw Material</td>
<td>6</td>
</tr>
<tr>
<td>Hammer Mill</td>
<td>6</td>
</tr>
<tr>
<td>Maintenance of Hammer Mill</td>
<td>8</td>
</tr>
<tr>
<td>Powder Separation</td>
<td>8</td>
</tr>
<tr>
<td>Ball Mill - 140 Mesh Product</td>
<td>9</td>
</tr>
<tr>
<td>Ball Mill - 200 Mesh Product</td>
<td>9</td>
</tr>
<tr>
<td>Maintenance of Ball Mill</td>
<td>9</td>
</tr>
<tr>
<td>Powder Separation - Hammer Mill</td>
<td>9</td>
</tr>
<tr>
<td>Powder Separation - Ball Mill - 140 Mesh Product</td>
<td>10</td>
</tr>
<tr>
<td>Powder Separation - Ball Mill - 200 Mesh Product</td>
<td>12</td>
</tr>
<tr>
<td>Powder Separation - Ball Mill - Special Product</td>
<td>12</td>
</tr>
<tr>
<td>Maintenance of Shaker</td>
<td>12</td>
</tr>
<tr>
<td>Waste</td>
<td>12</td>
</tr>
<tr>
<td>Product</td>
<td>12</td>
</tr>
<tr>
<td><strong>SAFETY</strong></td>
<td>13</td>
</tr>
</tbody>
</table>
INTRODUCTION

The purpose of this manual is to describe preparation of bismuth powder for use in process operations.

Bismuth powder is to be prepared in Room 232 of "T" Building where all necessary apparatus is installed.

Equipment

The following equipment is installed in Room 232:


1 - Ball Mill, manufactured by Paul O. Abbe, Inc., Little Falls, New Jersey, Serial No. 46680, U. S. A. No. 7344, fitted with three porcelain jars 8 1/2 inches in diameter by 8 1/2 inches high.

1 - Sieve Shaker, "Ro-Tap", manufactured by W. S. Tyler Company, Cleveland, Ohio, Serial No. 6280, U. S. A. No. 7410.

1 - Timer, manufactured by Walser Automatic Timer Company, New York, New York, Sieves 8 inches in diameter by 2 inches deep, with U. S. Bureau of Standards Screens, Bottles, Flasks, Tools, Containers, Balances, Weights, Repair Parts, etc.

Raw Material

Bismuth to be used for preparation of powder is purchased in bars having the dimensions shown in Figure 1. These bars weigh approximately 6 pounds each and are generally packed in wood boxes containing 28 bars, weighing about 170 pounds net.

When a shipment of bars is received, the boxes are stored in Room 15 and the proper records made on stock cards in Room 272. Boxes are withdrawn from Room 15 as required. A withdrawal slip is made for each withdrawal, and these slips are given to the Group Leader in Room 272 where proper entries are made on stock records. Boxes are then transported to Room 232 for processing, using a hand truck, or other suitable conveyance.

PREPARATION LABORATORY - ROOM 232

Room 232, Preparation Laboratory, should be locked at all times when not in use. The key may be obtained from Group Leader in Room 272.
A hood is installed over the bench supporting the ball mill and siever shaker. This hood is connected to the plant ventilation system and air should flow through this hood at all times. Before starting any operations in this room determine if the ventilation system is functioning properly; if not, notify Group Leader in Room 272.

When operations in this room have been completed and at the close of each day, all apparatus must be cleaned, dusted, and returned to the proper place. The floor must be swept, all dust removed and placed in suitable trash containers on the loading dock.

**Important - Wear respirator at all times when dust is present.**

Suitable respirators are provided and stored in the bench cabinet. When clean respirators are required notify Group Leader in Room 272.

**Preparation of Raw Material**

When received from the stock room, boxes of bismuth should be opened carefully, all nails extracted and the box top preserved so that the box may be kept closed until the contents have been used.

Bismuth bars purchased for this use are of specially manufactured, high purity material and should not be handled unnecessarily or exposed to contamination of other materials. Do not open more than one box at any time and do not bring the bars in contact with any metallic substances, such as bench tops, containers, etc.

After opening, one bar is removed, the box covered, and the bar placed in a plastic "smash box", flat side up. A sharp blow with a hammer at the "neck" or groove in the bar will cause a break at this point, forming four truncated pyramids of metal weighing about 1.5 pounds each. This material is the hammer mill feed.

**Hammer Mill**

The hammer mill, illustrated in Figure 2, is direct-connected to a 5 horse-power motor and installed on the east side of the room.

**Wear a respirator at all times when operating this equipment.**

**Tighten door links, GC-54-21, both top and bottom.**

Plug motor leads into receptacle on south wall under mill support. This is a three-pronged plug and can be inserted into the receptacle in only one position.
Close and fasten powder receptacle under mill.

Start mill by pressing "Start" button on motor started located at north end of mill support.

Be certain mill has attained full speed before feeding slug to hopper.

Feed one slug to hopper and wait until this slug has been completely ground before adding another slug. Generally a slug is ground in 45 seconds or less. Should longer be required, stop the mill and investigate.

During grinding, the operator should stand near the motor starter in order that the mill may be stopped promptly if choking should occur.

Feed about 12 slugs in succession.

Stop the mill by pushing the "Stop" button on the motor starter.

Open discharge door on bottom of mill and collect product in powder receiving box.

**Maintenance of Hammer Mill**

Repairs to this equipment will be made by Maintenance Department. Group Leader will issue work orders for such repairs as may be required.

The hammer mill is provided with roller bearings lubricated by means of grease cups on each bearing. The motor is provided with sealed bearings requiring lubrication at five year intervals. Lubrication of this equipment is the responsibility of Maintenance Department and requires no work order.

**Powder Separation**

Transfer ground product to a suitable air-tight glass container.

Separate the product as described in section: "Powder Separation Hammer Mill." Combine 20 and 100 mesh for feed to Ball Mill; bottle 140 mesh and 200 mesh separately; discard through 200 mesh as waste.

**Ball Mill - 140 Mesh Product**

The ball mill is located on a bench on the west side of the room and is driven by a belt-connected motor mounted on the mill base.
Wear a respirator when operating this equipment if dust is present.

Balls for this mill are prepared from bismuth slugs by crushing slugs to 3/4 inch to 1/2 inch size. Slugs may be readily crushed with a hammer, using the plastic "smash-box" described above.

Weight 4.0 kg. of bismuth balls and place in porcelain jar.

Weight 2.0 kg. of feed (material retained on 100 mesh as described above) and add to porcelain jar containing balls.

Close jar, tighten lid clamp and place jar on mill.

Start mill by means of switch on side of mill.

Grind for 15 minutes.

Stop mill and empty jar into plastic box with perforated bottom, separating powder and balls.

Return balls to jar and place powder in suitable receptacle.

Recharge jar with feed material and repeat operation.

Separate powder as described below.

This mill has a capacity of three jars and by proper arrangement of work, two jars can be grinding while one jar is being recharged.

**Ball Mill - 200 Mesh Product**

For preparing 200 mesh product, operations are exactly the same as for 140 mesh product except the ball and feed loading. Use a ball load of 4.5 kg. and a feed load of 2.5 kg.

**Maintenance of Ball Mill**

Oil cups are provided on each roll bearing and a grease-gun fitting is provided on the drive shaft. The motor bearings are waste-packed and require a few drops of machine oil yearly. Lubrication of this equipment is a responsibility of the Maintenance Department and does not require a work order.

**Powder Separation - Hammer Mill**

Powder is separated into desired fractions by means of sieves in a
"Ro-Tap" shaker mounted on the bench adjacent the ball mill. This shaker is shown in Figure 3.

Arrange sieves in the following order, from bottom up: receiver, 200 mesh, 140 mesh, 100 mesh, 20 mesh top.

Set sieve stack on support plate L-163 and adjust plate support so that the top of the screen stack is in contact with and held by screen cover L-45. Tighten clamp screws in support plate L-90 to hold the stack in this position.

Remove stack and place 1000 grams of material in the upper sieve.

Replace top and set stack in shaker.

Lower hammer L-42 and upper carrying plate latch L-139.

Turn timer pointer more than five divisions to the right and then left to five. The shaker motor will start and operate for a period of five minutes, stopping automatically.

Remove stack; combine the material on sieves 20 and 100; place in container for ball mill feed.

Bottle material on 140 mesh and 200 mesh sieves as product.

Transfer material in receiver to waste container.

Repeat operations until all material has been separated.

**Powder Separation - Ball Mill - 140 Mesh Product**

Prepare shaker as described above.

Arrange sieves in the following order, from bottom up; receiver 140, 100, 20 top.

Adjust shaker as described.

Separate 1000 grams as described.

Combine the material on sieves 20 and 100, return to ball mill feed.

Bottle material on 140 mesh as product.

Discard receiver material to waste.
Powder Separation - Ball Mill - 200 Mesh Product

Separate as described above except use the following sieves; receiver, 200, 140, 100, 20 top.

Combine the material on sieves 20, 100, and 140; return to ball mill feed.

Bottle material on 200 mesh as product.

Discard receiver material to waste.

Powder Separation - Ball Mill - Special Product

Special grades of powder are sometimes required for various purposes. Sieves of the desired numbers may be inserted in the stack during normal operation and these special requirements filled during routine separations.

Maintenance of Shaker

The gear housing of the shaker is filled with a light oil and there should be a minimum of 2 3/4 inches of oil in the housing at all times. This housing should be drained and refilled yearly. Grease-gun fittings are provided on the shaking mechanism. A few drops of oil should be applied to push rod L-122 where it passes through bearing L-57. The motor bearings are waste packed and require a few drops of oil yearly. Lubrication of this equipment is a responsibility of Maintenance Department and does not require a work order.

Waste

All bismuth waste is to be preserved in suitable containers of such a character that the material will not be contaminated by other materials. At regular intervals this waste is to be transferred to wood boxes of about 150 pounds net weight. The Group Leader will make arrangements for shipment of this material.

Product

Transfer product to 4 ounces amber-colored screw-cap bottles, 500 grams in each bottle, place cap on bottle tightly and seal with scotch tape. Label each bottle with the grade of powder contained therein.
SAFETY

Wear a respirator at all times when dust is present.

Wear eye goggles at all times when breaking or crushing bars.

Keep fingers away from rotating apparatus. Do not attempt to adjust any equipment when this equipment is in operation.

Keep gear and belt guards closed at all times during operation.

In case of accident to personnel or equipment notify Group Leader immediately.

Notify Group Leader of any repairs to equipment which may be necessary or of any unsafe conditions in this area.