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3,150,212

PROCESS FOR FORMING HEMISPHERICAL LEAD PELLETS

Filed June 29, 1961

2 Sheets-Sheet 1

FIG. 1

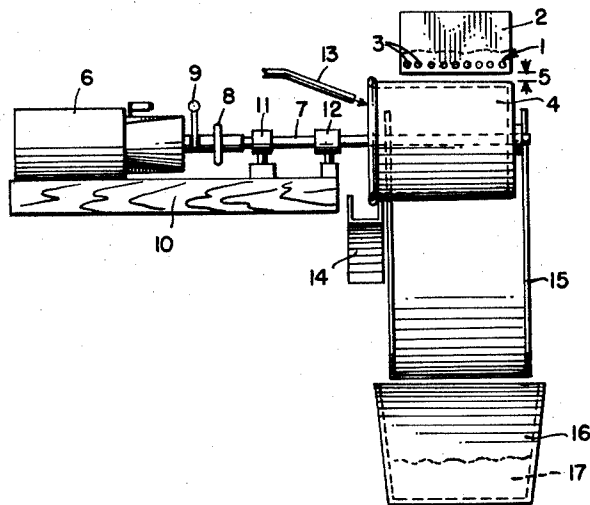
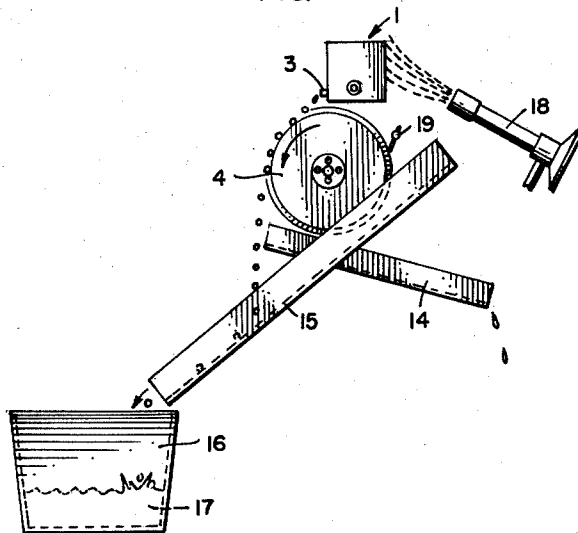


FIG. 2



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FIG. 3

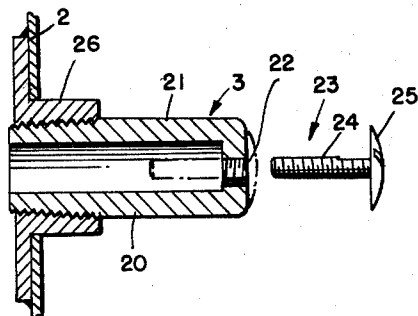


FIG. 4

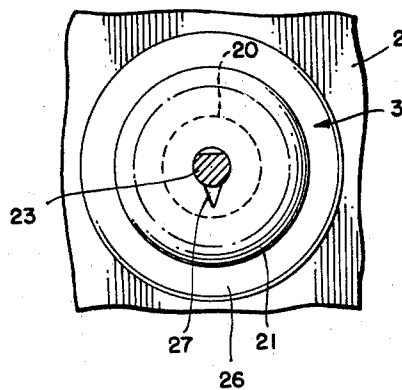


FIG. 5

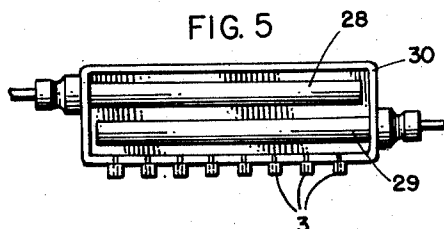
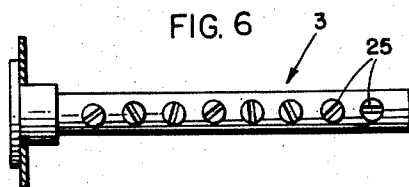


FIG. 6



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3,150,212 PROCESS FOR FORMING HEMISPHERICAL LEAD PELLETS

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2 Claims. (Cl. 264-13)

The present invention relates to a process for forming lead pellets. More particularly, the invention is directed to a process and apparatus for forming lead pellets having smooth surfaces, which pellets are satisfactory for use in most commercial operations.

In the conventional method of forming lead molten beads of lead are dropped from shot towers into quenching tanks. The height of such towers generally is from about 85 to 125 feet. The beads solidify in the air before entering the quenching liquid. Towers of this type were used in order to form pellets having desirable shapes and smooth surfaces. Although such shot towers produce satisfactory pellets, this equipment takes up a considerable amount of space and represents a substantial capital outlay.

The principal object of the present invention is to provide an inexpensive process for forming satisfactory lead pellets.

Other objects will become apparent to those skilled in the art from the following detailed description of the invention.

In general, the invention comprises the discovery that satisfactory pellets can be formed by passing drops of molten lead from a dispensing means through air for a distance of from about $\frac{1}{4}$ " to $\frac{5}{8}$ " onto a moving metal surface. In a preferred embodiment the molten drops of lead pass through air for a distance of from about $\frac{3}{8}$ " to $\frac{1}{2}$ " onto the smooth surface of a revolving metal cylinder. The temperature of the drum surface should be maintained at or below about 150° F., and preferably at or below 125° F., in order to cause the lead drops to solidify properly. It has been found that smooth, uniform, hemispherical lead pellets can be produced by the subject method.

The attached drawing schematically sets forth equipment which can be used to carry out the subject invention.

FIGURE 1 is a side elevation view of a complete pellet-forming device;

FIGURE 2 is an end view of the device of FIG. 1;

FIGURE 3 is a sectional view of a drop dispensing unit;

FIGURE 4 is a front view of a flow control means which is used to regulate the rate at which the lead drops from the dispensing means;

FIGURE 5 is a top view of a heating means which can be used in connection with the subject process to keep the lead in a fluid condition; and

FIGURE 6 is a diagrammatic view of a dispensing pipe containing multiple dispensing units.

In FIG. 1, lead 1 within pot 2 is maintained in a molten condition by means of a suitable heating means. The molten lead passes from pot 2 through dispensing units 3 and onto the surface of cylinder 4. The distance 5 between the exit opening of dispensing units 3 and metal surface 4 can vary from about $\frac{1}{4}$ " to about $\frac{5}{8}$ ". Cylinder 4 is rotated by means of motor 6 through shaft 7. Speed reducer slip clutch 8 and clutch handle 9 are used to control the rate of revolution. Motor 6 is supported by base 10 and shaft 7 is supported by support bearings 11 and 12. Cylinder 4 is cooled by water passing from water nozzle 13 through the cylinder and out trough 14. As the cylinder rotates pellets that have

solidified on the surface of the cylinder fall off onto pellet collecting trough 15 and are passed to collecting bucket 16 and into liquid 17.

FIG. 2 is an end view of the unit which is schematically set forth in FIG. 1. Once again, metal 1 within pot 2 is maintained in a molten condition by a suitable heating means. In the embodiment shown in this figure, the heating means consists of gas burner 18. The lead drops pass from dispensing units 3 onto revolving cylinder 4. As the cylinder rotates the pellets fall into collecting trough 15 and from there pass to collecting bucket 16. In this instance, the bucket can contain a liquid 17 such as hexyl ethyl carbitol which acts as a corrosion inhibiting agent. If the pellets adhere to rotating cylinder 4 they are removed by scraper bar 19. Cooling water which is passed into cylinder 4 is removed by means of trough 14.

FIG. 3 is a cross-sectional view of drop dispensing unit 3. Lead passes through conduit 20 of nipple 21 and out exit opening 22. Opening 22 was tapped for a 10-24 round head screw 23. A V-notch was cut into nipple 21 to provide a means for dispersing lead drops at a desired rate. A portion of threads 24 of screw 23 were filed away to allow the lead drops to pass through the V-notch. When screw head 25 is tight against the end of the nipple, conduit 20 is leakproof. As the screw is loosened the molten lead begins to flow through the recessed portion of the screw thread and escapes around the screw head. This device provides a uniform and easily controlled flow of lead. If desired, the V-notch could be made in the unfilled threads rather than in the nipple. Nipple 21 is removably mounted in sleeve 26 of tank 2.

FIG. 4 is an expanded end view of dispensing unit 3. V-notch 27 has been cut into the end of pipe nipple 21. Screw head 25 covers opening 22 when the screw is tight. As the screw is loosened, the filed portion of threads 24 allow lead to flow around the head and out onto the surface of the metal cylinder at a desired rate.

FIG. 5 is a top view of a suitable heating unit which may be used in the subject process. The unit includes immersion heating elements 28 and 29 which are maintained within casing 30. The heating unit is immersed in the molten lead. Other means of maintaining the lead in a molten condition, of course, could be used in the process. Such additional means would include various burners, heating mantles, etc.

In FIG. 6 a pipe is shown schematically which contains several dispensing units. The passage of lead drops through the outlet openings is controlled by screw heads 25. Using a pipe of this type makes it possible to dispense several drops of lead onto the metal surface of the rotating cylinder at one time.

The following examples are illustrative of certain embodiments of the present invention.

Example I

In this test a dispensing means similar to that set forth in FIGS. 1 and 2 of the drawing was used to produce pellets. The lead drops were passed from the dispensing unit onto the surface of the rotating cylinder which was one-half inch from the outlet openings of the dispensing means. The rotating cylinder was made of smooth stainless steel. The cylinder had a diameter of 8" and was 9½" long. Two 500-watt stainless steel immersion heaters were placed in the casting pot in order to maintain the lead in a molten condition. The casting pot was filled with molten lead and the 8 drip screws were adjusted to provide a drop rate of about five per second. The lead bath temperature in the casting pot was maintained within a range of from about 680° F. to about 740° F. Cooling water was used to control the tempera-

ture of the surface of the cylinder to between about 50° F. and about 125° F. The unit was run for 3½ hours and produced about 200 lbs. of good quality pellets. The rejects were estimated at less than about 1%. The pellets did not stick to the cylinder. Furthermore, no splattering or bouncing of the pellets occurred during the run.

Example II

In this example the distance from the point of lead drop separation to the cooling drum was lowered to ¼". A stream of cooling water was directed into the open end of the drum so as to maintain the temperature of the drum below 125° F. The cooling water carried away the heat which was transferred to the drum by the liquid lead drops. The rotating drum was supported by an 18" long by ⅝" diameter shaft and flange which was bolted to the end of the drum and mounted on bearings. The cylinder rotated about the shaft at a speed of about 6 to 8 revolutions per minute. The rate of revolution was controlled by a ZERO-MAX speed reducer. A production rate of 13.6 lbs. of lead pellets per hour per hole was maintained during a 2¼ hour run with this equipment. The pellets had a smooth surface and a hemispherical shape.

It is important in carrying out the subject process that the distance between the lead drop separation point and the cooling cylinder or drum be from about ¼" to about ⅝". Preferably, this distance is from ⅜" to ½". If the distance is greater than ⅝" splattering occurs causing the formation of irregularly shaped and rough pellets. A fall distance of less than ¼" also provides unsatisfactory results. In order to cause the pellets to solidify properly the surface of the cylinder should be maintained at a temperature at or below about 150° F. and preferably less than 125° F. The broad temperature range which can be employed in the process is from about 35° F. to about 150° F., and preferably from about 50° F. to about 125° F. The surface of the drum or cylinder should be smooth and should be capable of conducting heat away from the pellets. Metals such as stainless steel, iron, nickel, etc., are suitable for this purpose.

The rate at which the drops were passed from the dispensing means onto the metal surface of the cylinder can vary widely. Correspondingly, the rate at which the drum is rotated can also be adjusted within wide limits. It has been found that a drip rate of from about 1 to about 10 per second and a speed of revolution of about 3 to 10 for a cylinder having a diameter of about 8" is satisfactory for most purposes. These details, of course, can be worked out without difficulty by the operator.

Obviously many modifications and variations of the invention as hereinbefore set forth may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. A process for preparing smooth and hemispherically-shaped lead pellets which comprises dripping molten lead from a dispensing means onto a moving metal surface arranged beneath said dispensing means, the distance between the exit opening of said dispensing means and said surface being from about ¼" to about ⅝", the temperature of said moving surface being maintained at from about 35° F. to about 150° F.

2. A process for preparing smooth and hemispherically-shaped lead pellets which comprises dripping molten lead from a dispensing means onto a moving metal surface arranged beneath said dispensing means, the distance between the exit opening of said dispensing means and said surface being from about ⅜" to about ½", the temperature of said moving surface being maintained at from about 50° F. to about 125° F.

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