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Design of Mixing Device for High Mixing Degree Powder Metallurgy

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Abstract: A high mixing degree powder metallurgy mixing device has been designed, belonging to the field of metal smelting technology. The device includes a bottom bucket and a mixing bucket. A collection box and a fixed plate are installed on the inner wall of the bottom bucket by sliding. The lower surface of the mixing bucket is equipped with a discharge component and a vibration mixing function. In this design scheme, a discharge component is installed. When the mixing drum moves to a certain position, one side of the baffle will be blocked by the fixed plate. At this time, the baffle will rotate under the action of the installation plate and the rotating shaft, causing the sealing plug to lose its blocking effect on the discharge pipe. At this time, the powder will fall into the collection box through the discharge pipe. When the weight of the mixing drum decreases, the telescopic spring will move the mixing drum up through the lifting rod. At this time, the connecting spring will pull one side of the baffle upwards, and then seal the discharge pipe through the sealing plug, achieving automatic discharge of the device, improving the efficiency of discharge, and reducing the labor intensity of the operator.

Keywords: Powder Metallurgy; Mixing Equipment; Mixing Degree; Vibration Stirring; Scheme Design

1. Introduction

Powder metallurgy is a process technology that uses metal powder or metal powder as raw material to produce various products such as metal materials through forming and sintering. Powder metallurgy technology has significant energy-saving, material saving, and excellent performance characteristics, and is suitable for large-scale production. In recent years, it has been widely researched and applied [1-5]. Reference [6] reports that the improvement of magnetic properties is closely related to the regulation of microstructure and the quality of the powder. High-quality powder can be prepared by high pressure aerosolization. Reference [7] reports that Copper-40mass%zinc (Cu-40Zn) brass alloy powder containing 1.0 mass% Cr was prepared by the water atomization. Reference [8] describes a method and equipment that solve these problems by subjecting the powder charge to vibro-aereational mixing. In the process of powder metallurgy, different types of powders need to be mixed, but the current mixing device cannot achieve automatic discharge and requires manual discharge. In addition, there will be some clumped powder clusters during the mixing process. If they are not crushed, it will affect the effectiveness of powder mixing and thus affect the quality of metallurgical products. Therefore, a high mixing degree powder metallurgy mixing device has been designed.

2. Scheme design of mixing device

In order to overcome the shortcomings of existing technology, the following technical solution for the mixing device has been designed: the main components of the mixing device include a bottom bucket and a mixing bucket. A collection box is installed on the inner wall of the bottom bucket, a fixed plate is fixedly installed on the inner wall of the bottom bucket, a discharge component is installed on the lower surface of the mixing bucket, and a vibration mixing component is installed on the inner wall of the mixing bucket.

The outer surface of the discharge pipe in the discharge component is installed with a mounting plate by rotating the shaft, and a baffle is fixedly installed on the lower surface of the mounting plate. The upper surface of the baffle is fixedly installed with a sealing plug and a connecting spring. The sealing plug extends to the inside of the discharge pipe, and one end of the connecting spring is fixedly connected to the lower surface of the mixing drum. The electric telescopic rod in the vibration mixing component is fixedly connected to the upper surface of the mixing drum. One end of the electric telescopic rod extends into the interior of the mixing drum, and one end of the electric telescopic rod is fixedly installed with a filter screen. The lower surface of the filter screen is fixedly installed with a threaded rod, threaded sleeve, and rotating column. One end of the rotating column is rotatably connected to the inner wall of the bottom surface of the mixing drum, and a mixing rod is fixedly installed on the outer surface of the rotating column. The inner wall of the bottom bucket is equipped with a travel groove

and a telescopic spring. One end of the telescopic spring is fixedly installed with a lifting rod, and the upper surface of the lifting rod is fixedly connected to the lower surface of the mixing bucket. The upper surface of the mixing bucket is fixedly installed with a first feeding port and a second feeding port.

3. Specific instructions for using the mixing device

As shown in Figures 1, 2, and 3, when the device is in use, as the powder increases, the weight of the mixing bucket (3) also increases. When the mixing bucket (3) moves to a certain position, one side of the baffle (72) will be blocked by the fixed plate 8. At this time, the baffle 72 will rotate under the action of the installation plate 75 and the shaft, causing the sealing plug 73 to lose its blocking effect on the discharge pipe 71. At this time, the powder will fall into the collection box 2 through the discharge pipe 71. When the weight of the mixing bucket 3 decreases, the telescopic spring 9 will move the mixing bucket 3 upward through the lifting rod 10. At this time, the connecting spring 74 will pull one side of the baffle 72 upward, and then seal the discharge pipe 71 through the sealing plug 73. The sentence is:. Pour two different powders into the mixing bucket 3 through the first feeding port 4 and the second feeding port 5 respectively. Firstly, the powder will fall onto the filter screen 62. The fine powder particles will pass through the filter screen 62 and fall into the mixing bucket 3, while the larger or already agglomerated powder particles will stay on the upper surface of the filter screen 62. Then, the electric telescopic rod 61 drives the filter screen 62 to vibrate up and down, shattering the agglomerated powder on the filter screen 62 and causing it to fall down. When the filter screen 62 moves up and down, it also drives the threaded rod 63 to move up and down. At this time, the threaded rod 63 will cause the threaded sleeve 64 to drive the rotating column 65 to rotate through the thread, thereby causing the stirring rod 66 to rotate back and forth, stirring the powder in the stirring bucket 3.

Working principle: Two different powders are poured into the mixing drum 3 through the first feeding port 4 and the second feeding port 5, respectively. Firstly, the powder will fall onto the filter screen 62, and the fine powder particles will fall into the mixing drum 3 through the filter screen 62. The larger or already agglomerated powder particles will stay on the upper surface of the filter screen 62, and then the electric telescopic rod 61 will drive the filter screen 62 to vibrate up and down, crushing the agglomerated powder on the filter screen 62, and causing the agglomerated powder to fall down. When the filter screen 62 moves up and down, it will also drive the threaded rod 63 to move up and down. At this time, the threaded rod 63 will cause the threaded sleeve 64 to drive the rotating column 65 to rotate through the thread, thereby causing the stirring rod 66 to rotate back and forth. Stir the powder in mixing bucket 3, and as the powder increases, the weight of mixing bucket 3 will also increase, When the mixing bucket 3 moves to a certain position, one side of the baffle 72 will be blocked by the fixed plate 8. At this time, the baffle 72 will rotate under the action of the installation plate 75 and the rotating shaft, causing the sealing plug 73 to lose its blocking effect on the discharge pipe 71. At this time, the powder will fall into the collection box 2 through the discharge pipe 71. When the weight of the mixing bucket 3 decreases, the telescopic spring 9 will move the mixing bucket 3 up through the lifting rod 10. At this time, the connecting spring 74 will pull one side of the baffle 72 upward, and then seal the discharge pipe 71 through the sealing plug 73.

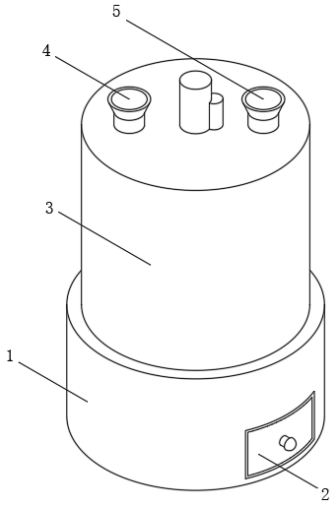

Figure 1. Schematic diagram of the three-dimensional structure of the mixing device for powder metallurgy

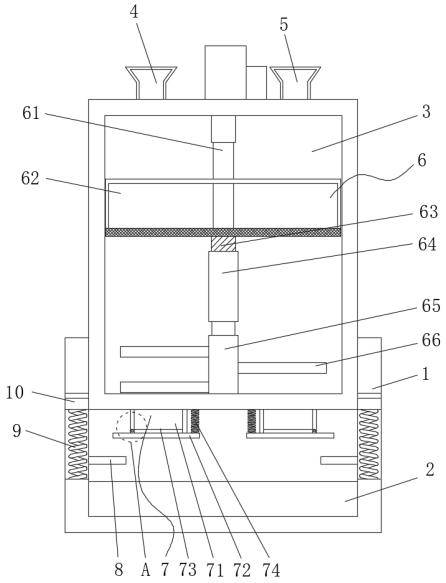

Figure 2. Schematic diagram of the internal structure of the mixing device for powder metallurgy

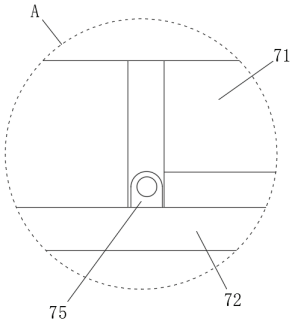

Figure 3. An enlarged schematic diagram of the structure at point A in the powder metallurgy mixing device

Legend description:

1. Bottom bucket; 2. Collection box; 3. Mixing bucket; 4. First feed inlet; 5. Second feed inlet; 6. Vibration mixing component; 61. Electric telescopic rod; 62. Filter screen; 63. Threaded rod; 64. Threaded sleeve; 65. Rotating column; 66. Mixing rod; 7. Discharge components; 71. Discharge pipe; 72. Barrier; 73. Sealing plug; 74. Connect the spring; 75. Installation board; 8. Fixed plate; 9. Telescopic spring; 10. Lift rod.

4. Summary

(1) In this mixing device, a discharge component is installed. When the mixing drum moves to a certain position, one side of the baffle will be blocked by the fixed plate. At this time, the baffle will rotate under the action of the installation plate and the rotating shaft, causing the sealing plug to lose its blocking effect on the discharge pipe. At this time, the powder will fall into the collection box through the discharge pipe. When the weight of the mixing drum decreases, the telescopic spring will move the mixing drum up through the lifting rod. At this time, the connecting spring will pull up one side of the baffle, and then seal the discharge pipe through the sealing plug, achieving automatic discharge of the device, improving the efficiency of discharge, and reducing the labor intensity of the operator.

(2) In this mixing device, a vibration stirring component is installed, which drives the filter screen to vibrate up and down through an electric telescopic rod. The agglomerated powder on the filter screen is crushed, causing the agglomerated powder to fall down. When the filter screen moves up and down, it also drives the threaded rod to move up and down. At this time, the threaded rod drives the rotating column to rotate through the threaded sleeve, causing the stirring rod to rotate back and forth, stirring the powder in the mixing bucket. During the process of falling after filtration, mixing can also be carried out to avoid layering. Moreover, rotating the stirring rod back and forth can improve the uniformity of powder mixing.

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