March 20, 1962 W. P. VAN DEN BLINK 3,026,406

METHOD OF AND APPARATUS FOR DISPENSING MAGNETIC POWDER

Filed April 8, 1960 2 Sheets-Sheet 1

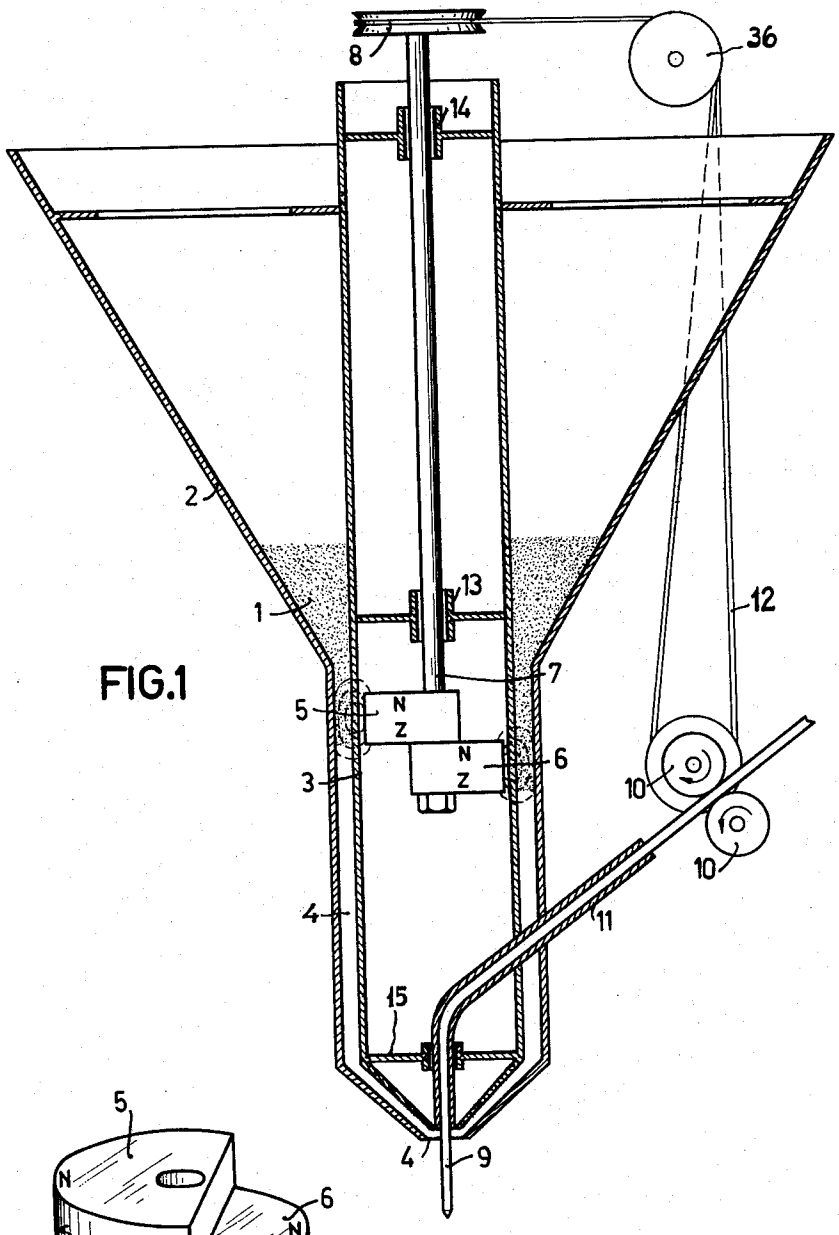


FIG.1

FIG.2

INVENTOR
WILLEM P. VAN DEN BLINK
BY
Frank R. Trifari
AGENT

March 20, 1962 W. P. VAN DEN BLINK 3,026,406

METHOD OF AND APPARATUS FOR DISPENSING MAGNETIC POWDER

Filed April 8, 1960 2 Sheets-Sheet 2

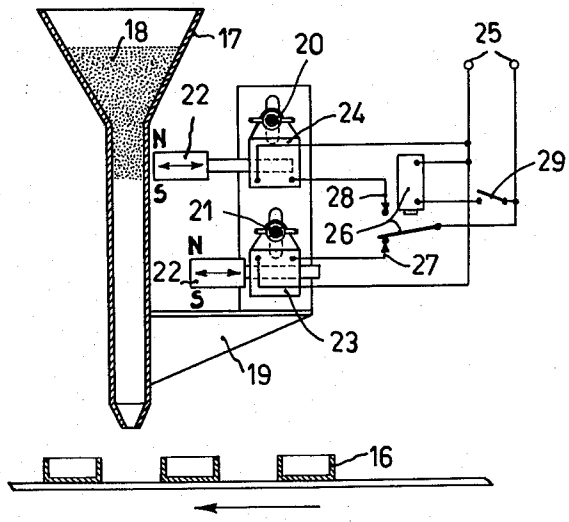


FIG. 3

INVENTOR

WILLEM P. VAN DEN BLINK.

BY

Frank R. [illegible]

AGENT

United States Patent Office 3,026,406 Patented Mar. 20, 1962

3,026,406

METHOD OF AND APPARATUS FOR DISPENSING MAGNETIC POWDER

Willem Pieter van den Blink, Utrecht, Netherlands, assignor to North American Philips Company, Inc., New York, N.Y., a corporation of Delaware

Filed Apr. 8, 1960, Ser. No. 20,863
Claims priority, application Netherlands May 1, 1959
4 Claims. (Cl. 219—130)

My invention relates to a method of and apparatus for dispensing finely-divided magnetic material.

As my invention is particularly advantageous when used in certain types of arc welding, I shall describe the same in this connection. However the invention is not limited thereto, but extends to other fields where it is desirable to dispense magnetic powder in accurate and uniform quantities, for example where magnetic ferrite powder is pressed into members, such as cores or permanent magnet bodies, or where magnetic powder in a moist condition is supplied to a drying oven or the like.

In certain types of automatic arc welding, for instance the type described in U.S. Patents 2,803,740 and 2,820,137, magnetic powder is used in place of, or in addition to, a protective gas and is magnetically held against the electrode wire by means of the magnetic field produced by the welding current passing therethrough. In such welding it is necessary to control accurately the quantity of magnetic powder supplied per unit time, and it has been proposed to accomplish this by means of various mechanical devices which act directly upon the powder.

I have found that such mechanical devices have certain disadvantages. More particularly, there is considerable friction between the magnetic powder and the parts which move in contact therewith, and this not only causes undue wearing of such parts but also causes difficulties in any gears, bearings, etc. which are employed in connection with such parts. In addition it frequently happens that there is irregular packing of the material which causes non-uniformity in the amounts of powder dispensed.

In accordance with my invention I have found that the above difficulties are overcome and accurate and uniform dispensing of magnetic powder is obtained by feeding the powder through a passageway formed by a member of non-magnetic material and periodically applying to axially displaced points within the passageway, magnetic fields which temporarily hold portions of the powder.

In accordance with a specific embodiment of the invention, the dispensing device includes an assembly of a plurality of segment-shaped permanent magnets spaced from each other axially on a shaft and also displaced relatively to each other in a plane perpendicular to the shaft. This assembly is mounted within a tubular member of non-magnetic material surrounded by a second tubular member to form an annular passageway through which the magnetic powder passes and in which the magnetic fields are effective.

I provide means to control the rate at which the magnetic powder is dispensed, and when used in automatic arc welding of the above type this rate is controlled by the speed at which the electrode wire is supplied. In cases where it is desired to dispense certain portions of the powder at spaced time intervals, I may control the amounts of the portions by changing the distance between the points at which the magnetic fields are applied.

In order that my invention may be clearly understood and readily carried into effect, I shall describe the same in more detail in connection with specific apparatus and with reference to the accompanying drawing in which

FIGURE 1 is a sectional side view of a portion of an arc-welding apparatus embodying a dispensing device according to the invention,

FIG. 2 is a perspective view of a portion of FIGURE 1, and

FIG. 3 is a section side view of a dispensing device according to another embodiment of the invention.

The welding apparatus shown in FIGURE 1 comprises a hopper 2 of a non-magnetic material, such as copper, having a conical-shaped upper portion containing a supply of a magnetic powder 1, such as described in the above-mentioned Patent 2,803,740. Hopper 2 has a lower tubular portion with a conical-shaped end forming a narrow annular passageway 4 with a tubular member 3 of non-magnetic material supported near its top by a flange portion of hopper 2. Fixedly supported by a projection 15 of tubular member 3 is a bent tube 11 extending through member 3 and hopper 2. An electrode wire 9, which may be of any of the well-known compositions, is moved through tube 9 in the direction of the arrow by two rollers 10 driven by suitable driving means (not shown).

Magnetic powder 1 flows by gravity into the annular passageway 4 and, in accordance with the invention, is dispensed at the desired rate by means of a dispensing mechanism comprising a shaft 7 rotatably mounted on two bearings 13 and 14 forming part of tubular member 3. Fixedly mounted on the lower end of shaft 7 are two similar-shaped permanent magnets 5 and 6 (see FIG. 2) having magnetic poles at the positions indicated and relatively displaced at an angle, as shown 180°, in a plane perpendicular to the axis of shaft 7. Magnets 5 and 6 are so dimensioned that their peripheral surfaces form only a small clearance with the inner surface of member 3 and produce magnetic fields which extend into annular space 4 as indicated. When shaft 7 is rotated about 180° from the position shown a portion of powder 1, which is being held by the field of magnet 5 will be released by this field, but will be temporarily held by the field of magnet 6. When the shaft is then rotated into the position shown the portion temporarily held by the field of magnet 6 will be released. Thus, the magnetic powder will be continuously dispensed downwardly through annular space 4, and the quantity dispensed within a unit time will depend upon the speed of rotation of shaft 7.

Upon leaving the lower end of annular space 4 powder 1 is attracted to the surface of electrode wire 9 by the magnetic field produced by the flow of welding current therethrough.

In order that the proper amount of magnetic powder will be dispensed, the speed of rotation of the magnets is made dependent upon the speed at which the electrode wire 9 is supplied. For this purpose shaft 7 is provided on its upper end with pulley 8 driven by a belt 12 passing over two idling pulleys 36 and a driving pulley fixedly mounted on the shaft of the upper roller 10. Instead of bringing the electrode wire 9 in at an angle, the construction of the device could, of course, be such that the wire is moved vertically downward and the powder is fed from the side.

The dispensing device illustrated in FIGURE 3 is used to dispense measured quantities of powdered magnetic material in a series of molds 16 carried by a belt in the direction indicated by the arrow. The device comprises a hopper 17 of non-magnetic material containing a supply of magnetic powder 18. Supported from hopper 17 by means of a bracket 19 are two electrically-actuated devices 20 and 21 of similar construction each comprising a permanent magnet 22 supported on the end of a core 23 of a solenoid 24 and spring biased toward hopper 17. Devices 20 and 21 are so supported

on bracket 19 as to be movable with respect to each other and thereby vary the distance between magnets 22 and thus the amount of the powder 18 which is dispensed to each of the molds 16.

The solenoids of devices 20 and 21 are selectively energized from a suitable voltage supply 25 by means of a single-pole double-throw relay 26. For this purpose one terminal of supply 25 is connected to the heel of armature 26 which in the de-energized position shown engages a lower contact 27 connected to one terminal of the solenoid of device 21, and in its energized position engages an upper contact 28 connected to one terminal of the solenoid of device 20. The other terminals of the solenoids of devices 20 and 21 are connected to the other terminal of supply 25. The coil of relay 26 has one terminal connected to one terminal of supply 25, and its other terminal connected through a switch 29 to the other terminal of supply 25.

With the apparatus in the position shown, the powder 18 is held in position by means of magnet 22 of device 20. When switch 29 is closed magnet 22 of the device 20 is moved away from hopper 17, whereas the magnet 22 of device 21 is moved in close proximity to the hopper whereby the powder 18 falls down through the passageway and is held in its lower position. When contact 29 is open the magnets 22 are returned to the position shown whereby the portion of the material 18 in the passageway between the two magnets 22 is deposited in one of the molds 16.

While I have described my invention with reference to specific examples and certain constructions, I do not desire to be limited thereto as obvious modifications will readily present themselves to one skilled in this art.

What is claimed is:

1. A method of dispensing magnetic powder comprising the steps of introducing the powder into a passageway, producing a magnetic field extending into only a portion of the passageway, rotating said field around the passageway, producing a second magnetic field displaced at an angle from said first field and extending through only a portion of the passageway, and rotating said second field in a plane spaced from the plane of rotation of said first field.

2. A device for dispensing magnetic powder comprising two tubular members forming an annular passageway for said powder, a magnet rotatably mounted within the inner member with its magnetic field extending within the passageway, a second magnet secured to said first magnet with its magnetic field extending into the passageway and displaced angularly and axially with respect to the field of the first magnet, and means to rotate said magnets to thereby dispense the powder.

3. An arc-welding apparatus comprising means to supply an electrode wire to an operating point, an inner tubular member and an outer tubular member forming an annular passageway adapted to transport magnetic powder and having an outlet adjacent the electrode wire, a segment-shaped magnet rotatably arranged within said inner member with its magnetic field passing through a portion of the passageway, a second magnet secured to said first magnet with its magnetic field angularly displaced with respect to the field of the first magnet and passing through a portion of the passageway axially displaced from said first portion, and means to rotate said magnets.

4. A device for dispensing magnetic powder comprising means forming an annular passageway for said powder, first magnetic means rotatably-mounted within said first means to produce a magnetic field extending over only a segment of the passageway, second magnetic means rotatably-mounted within said first means to produce a second field extending over only a segment of said passageway and displaced axially and angularly from the first magnetic field, and means to rotate said two magnetic means and fields.

References Cited in the file of this patent

UNITED STATES PATENTS

2,415,376	Strickland	Feb. 4, 1947
2,718,856	Gathercoal	Sept. 27, 1955
2,805,323	Cushman	Sept. 3, 1957
2,820,137	Ghemar et al.	Jan. 14, 1958
2,929,910	Kennedy	Mar. 22, 1960