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METHOD OF PRODUCING PRESSINGS TO FORM PERMANENT MAGNETS

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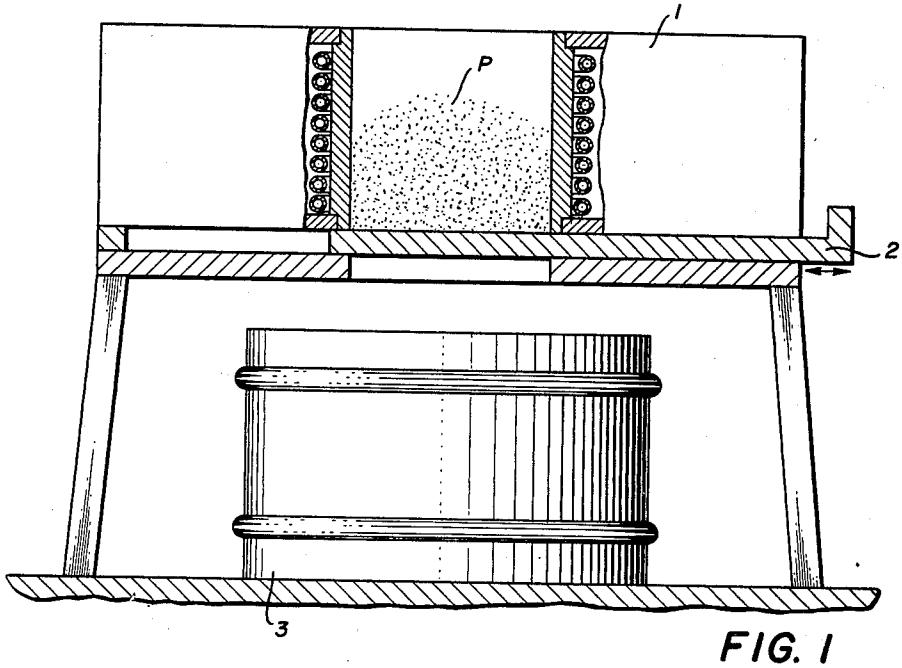


FIG. 1

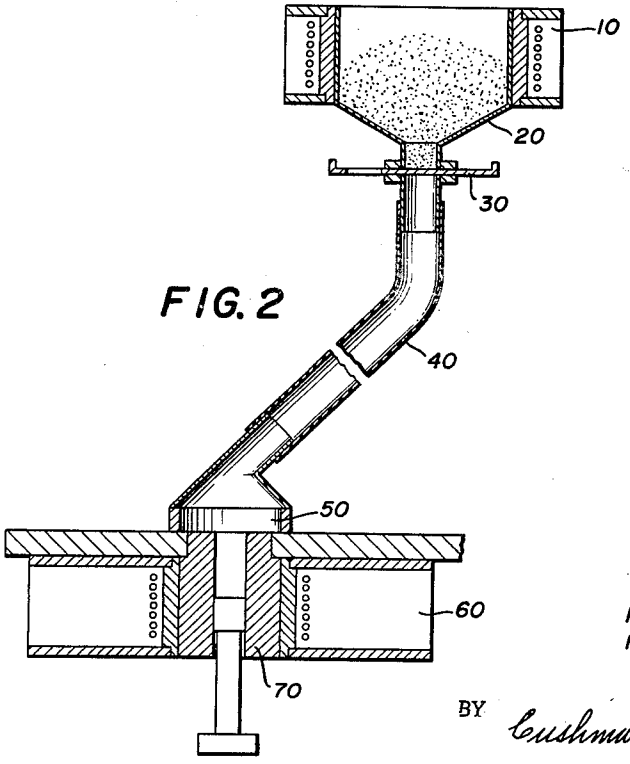


FIG. 2

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METHOD OF PRODUCING PRESSINGS TO FORM PERMANENT MAGNETS

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5 Claims. (Cl. 264—24)

As known, difficulties arise in the production of pressings for permanent magnets, especially if the magnet material is one based on barium ferrite. These are due to the extremely fine grain of the powder. The fineness of the powder prevents it from flowing, facilitates arching and in any event hinders it from entering the cavity of the die without manual help.

In order to overcome this drawback such powders have been submitted to a previous process of granulation. However, this step also has disadvantages, firstly because it introduces an additional operation, and secondly because trouble arises if the granulated powder is to be used for the production of anisotropic permanent magnets and compacted in a directional magnetic field. A granulated product of such a kind contains magnets oriented in random directions and the individual granule is practically not affected by the directional magnetic field. Another known method is to press the powder when wet. Wet processing is both complicated and tedious. Moreover, special steps must be taken to deal with the volatile wetting agent.

It would therefore be very desirable if a method could be devised which permitted the powder to be fully automatically processed by pressing without wetting or granulating the same. One step in this direction has been proposed of introducing the powder into the cavity of the die through a feeder and of energising an electrical coil which surrounds the die cavity for the purpose of sucking the powder magnetically into the same. This method has been successful in practice. However, from time to time the feeder (a filling shoe or box) requires recharging by hand by the operator attending the press, because the powder will not of its own accord flow from a major storage container.

In order to perform the operation of refilling the feeder by automatic means the present invention proposes to magnetise the powder before charging it into the devices which feed it to the press and into the die. Surprisingly it has been found that by magnetising the powder it becomes flowable. Although it tends to cling lightly together, it does not form pronounced lumps and, although to the touch it feels like damp sand, it flows from the hopper of the press into the feeder and thence into the die cavity in a manner which is nearly ideal.

The fact that the powder can be made to flow in this way may also be utilised on other occasions when it is desired to convey the powder from one place to another.

The method can be carried out by apparatus as shown in the accompanying drawings in which:

FIGURE 1 is a sectional elevation of one embodiment; and

FIGURE 2 is a sectional elevation of another embodiment.

Referring to FIGURE 1, for magnetising the powder, the latter is conveniently introduced into the interior of a fairly large diameter air-cored coil 1 (field strength about 1500 gauss), the bottom of the coil being closed by a sliding trap 2 during the process of magnetisation. The coil need be energised for only a short period at the end of which the magnetised powder charge can be drained by opening the trap 2 to permit the powder to flow into a storage container 3, or the like, for subsequent feeding into the hopper of the press.

Alternatively, see FIGURE 2, a storage container 20 affixed to the press in a more elevated position may itself be surrounded by a magnetising coil 10 which is briefly energised to generate a field whenever a fresh charge is filled into the container. When the slide 30 is opened, the powder, which is rendered flowable by magnetisation, is released to fall through the pipe 40 to the conventional filling shoe 50 and in conventional manner with the shoe brought over the cavity of the die 70, the magnetised powder is magnetically sucked into the cavity by energising the coil 60.

What we claim is:

1. A method of producing pressings to form permanent magnets from ferromagnetic powders of such fineness as to be non-flowable which comprises the step of trapping the powder and magnetising the powder by the brief application of a field thereto while so trapped so that the particles cling lightly together and thereafter releasing the magnetised powder to flow solely by gravity into the cavity of a die and pressing it.

2. A method as in claim 1 wherein the trapped and magnetized powder is based on barium ferrite.

3. A method of causing ferromagnetic powders, that are of such fineness as to be practically non-flowable by gravity, to flow invariably when released to the influence of gravity, including the step of magnetizing such a fine powder by the brief application of a field thereto while it is trapped in a container from which it can be downwardly released until its particles cling lightly together sufficiently for the magnetized powder to flow spontaneously under its own weight when released from said container.

4. A method of transferring a ferromagnetic powder, of such fineness as to be practically non-flowable by gravity, from one point downward to another point including magnetizing the powder by the brief application of a field thereto while releasably held at said one point to impart to it the property of spontaneously flowing under the influence of its own weight to said another point when released from said one point.

5. A method as in claim 4 wherein said powder includes barium ferrite.

References Cited by the Examiner

UNITED STATES PATENTS

2,742,185	4/57	Landry.
2,959,823	11/60	Schwabe et al.
2,984,866	5/61	Schwabe.
2,984,871	5/61	Venerus.

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