

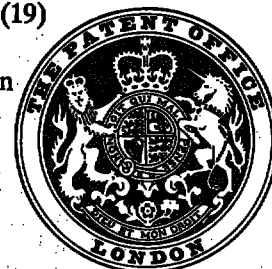
PATENT SPECIFICATION

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(54) APPARATUS FOR THE DOSAGING OF BULK MATERIAL IN A PNEUMATICALLY CONVEYED STREAM

(7 1) W e , A Z O -
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porate, of D-6960 Osterburken, Federal
5 Republic of Germany, do hereby declare
the invention, for which we pray that a
patent may be granted to us, and the
method by which it is to be performed, to be
particularly described in and by the follow-
10 ing statement:-

The invention relates to apparatus for the
dosaging of bulk material in a pneumatically
conveyed stream.

The dosaging of bulk materials, more
15 particularly in powder form, presents con-
siderable difficulties especially when it is
necessary to meter small quantities. On the
one hand the dosaging possibilities are
influenced by the flow behaviour of the bulk
material, and on the other hand such bulk
materials more particularly when under
mechanical stress, for example under static
pressure or the like, tend to cake together.
20 For this reason the dosaging of such bulk
materials in a continuous flow process is
almost impossible. Therefore substantial
use is made of non-continuous processes,
wherein the bulk material is taken in indi-
vidual batches from the supply container by
30 means of rotating devices which have cavi-
ties of specific size, for example cellular
wheel air locks, and supplied to a conveying
conduit, a mixer, a processing machine or
the like.

Cellular wheel air locks cannot be used
35 when dosaging small quantities and where
there are high standards expected as regards
precision. Here, use is frequently made of
apparatus wherein the bottom of the supply
container is formed by a rotating disc which
40 is provided at its upper side with recesses,
grooves or the like. The bulk material fills
these recesses under the action of the
pressure of the column of bulk material
45 resting on the disc. The disc is dimensioned

so that the recesses or grooves after passing
a stripping element, which in the simplest
case is formed of the container wall, pass
outside the container where the bulk mate-
rial contained in the recesses or grooves is
50 taken off. Because of the fixedly preset
volume of the cavities formed by the reces-
ses or grooves, there is a correspondingly
constant dosage volume or, if the bulk
material is of constant density, a constant
55 dosage quantity. Although these dosaging
apparatus give satisfactory results as regards
precision in the case of bulk materials with
poor flowing properties, they have the
disadvantage that they operate non-
60 continuously and cannot be used when it is
desired to have a continuous stream which is
constant as regards volume or quantity.

An object of the present invention is to
construct an apparatus of this general type
in such a manner that continuous and
constant dosaging is possible. A further
object is to allow continuous dosaging in the
conveyed stream of material.

According to the invention there is pro-
70 vided apparatus for the dosaging of bulk
material into a pneumatic conveying conduit
by means of a disc rotating about an axis,
wherein the said disc is situated at least
partly within a column of bulk material in a
supply container whilst a portion of the disc
is situated within the conveying circuit, and
75 the said disc has through holes in which as it
rotates it takes up bulk material and delivers
such material into the conveying circuit after
passing a stripping element, the said disc
being constructed as an apertured disc
80 having a plurality of through holes of width
smaller than that of the conduit, the said
portion of the apertured disc being arranged
as an apertured partition within the
pneumatic conveying conduit between seal-
85 ing rings which respectively abut against the
two faces of the disc and act at the same
time as stripping elements.

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In use of apparatus constructed according to the invention the apertured disc runs within the column of material about a vertical or horizontal axis and takes up in its through holes a volume of bulk material corresponding to the cavity volume of the holes and transports this bulk material into the pneumatic conveying conduit outside the column of bulk material. In that region of the apertured disc which during rotational movement is situated between the sealing rings of the pneumatic conveying conduit, the bulk material is blown out of the through holes and conveyed away by the pneumatic conveying stream. Since owing to the rotational movement of the apertured disc and the uniform arrangement of the through holes the same number of holes always passes the conveying conduit per unit of time, the result is that the conveying stream is charged with a completely constant and uniform amount of material. When the disc enters between the sealing rings of the conveying conduit, these sealing rings act externally as stripping elements so that in fact only the bulk material persisting within the through holes can enter the conveying conduit. By varying the rotational speed the dosage quantity can be adapted to particular requirements.

An apparatus constructed in this way as proposed by the invention is useful in all cases where the bulk material has to be supplied to a consuming apparatus continuously and in a constant quantity. As an example of the use of the apparatus, attention will be drawn simply to pulverised coal firing systems, wherein the coal powder is supplied to the burner pneumatically and the conveying air at the same time acts as combustion air.

According to a preferred constructional form of the invention the apertured disc comprises such through holes only in the region of an external annular portion of the disc, the width of the annular portion being slightly smaller than the diameter of the conveying conduit. This construction makes it in principle possible to use supply containers of any desired size in conjunction with conveying conduits of any desired diameter.

According to a further preferred feature of the invention the conveying conduit is taken through the supply container and parallel to the axis of rotation of the apertured disc at least in the portion into which the apertured disc extends. This constructional form has the advantage that in spite of direct transfer of the bulk material from the supply container into a pneumatic conveying conduit with the interposed rotating apertured disc, any production of dust is substantially completely obviated, since the possible leakage regions between the apertured disc and the con-

veying conduit are situated within the supply container, whereas the conveying conduit itself can be sealed without any difficulty relatively to the supply container, since the connection involved is a static connection.

The diameter of the through holes in the apertured disc is advantageously smaller than the width of the sealing rings of the conveying conduit, so that between the conveying conduit on the one hand and the supply container or column of material on the other hand there is no open connection.

It is also advantageous if the diameter of the through holes of the apertured disc is equal to or larger than the height of the apertured disc. In this way the result is achieved that the through holes are filled in a satisfactory manner by the bulk material.

According to a further preferred feature of the invention the supply container containing the bulk material comprises a fluidising arrangement which loosens up the bulk material in the supply container and keeps it circulating to a certain extent if appropriate. The apertured disc can then be arranged with a spacing above the bottom of the supply container so that it rotates through the moving bulk material. In this case it is advisable if the apertured disc comprises, between its centre and the annular portion comprising the through holes, several large apertures through which the bulk material can pass unhindered, so that the apertured disc only offers substantial resistance to the moving bulk material in the region of the through holes which have small diameters, with the result that the through holes become closed with the bulk material.

If the fluidising arrangement consists of a fan and an air-pervious bottom portion arranged above the supply container bottom which is provided with air inlet opening, according to a preferred form of the invention this fan can be connected at its suction side to the supply container and at its pressure of delivery side to the conveying conduit. When the fan operates, a negative pressure is produced in the supply container and air is thereby drawn in through the inlet openings in the bottom through the air-pervious bottom portion. As a result, the bulk material in the supply container is enriched with air and fluidised. At the same time this fan is used for conveying the dosaged bulk material taken from the supply container, the conveying conduit being connected to the pressure side of the fan. This construction has the advantage that the fluidising side and conveying side of the system form a closed circuit and any particles carried along during fluidisation by the fan pass into the conveying conduit and do not have to be separated by special filter or separating arrangements.

The invention is described hereinafter, by

way of example, with reference to a constructional form shown in the drawings, in which:

Figure 1 shows a diagrammatic overall view of the apparatus, partly in section,

Figure 2 shows an axial section of the dosaging arrangement on a larger scale, and

Figure 3 shows a plan view of the apertured disc.

The apparatus comprises a supply container 1, comprising a conical bottom 2 and a cylindrical portion 3, and a cover 4. The cover 4 has a filling union 5 whilst in the cylindrical portion 3 of the supply container 1 there are arranged a fullness detector 6 and an emptiness detector 7 of known type. The conical bottom 2 comprises two or more air suction unions 8 which are open towards the atmosphere. An air-pervious intermediate bottom portion 9, made of textile fabric or the like, for example, is situated above the conical bottom 2. The supply container 1 can be subjected to a vacuum by means of a fan 10. For this purpose the supply container 1 comprises at its cover 4 a suction discharge union 11 which is connected by way of a suction conduit 12 with the suction side of the fan 10. Arranged in the suction conduit 12 is a throttle valve 13 by means of which the degree of vacuum can be controlled. The bulk material contained in the supply container 1 can thus be fluidised.

Situated within the supply container is a disc 14 which is mounted on a shaft 15 and can be rotated by means of a motor 16. In the illustrated constructional example, the supply container 1 is flange-connected directly to the motor housing 16.

Taken through the supply container 1 is a conveying conduit 17 which is interrupted at the level of the apertured disc 14. The apertured disc is situated for the greater part within the supply container, or in other words within the column of bulk material contained therein, but a smaller portion of the disc passes through the conveying circuit 17. This is shown in more detail in Figure 2.

The conveying conduit 17 opens into the container by way of an inlet union 18 and issues from the container by way of an outlet union 19. The inlet union 18 and outlet union 19 are connected to one another by two elbows 20, 21. Associated with each elbow 20, 21, at the mutually facing ends, is a sealing ring 22, 23 respectively made for example of hard metal. Between the two elbows 20, 21 the conveying conduit is made to extend parallel to the axis 15 of the apertured disc 14. The sealing rings 22, 23 are arranged at a spacing from one another which corresponds to the height (i.e. the thickness) of the apertured disc 14. In order to allow precise alignment of the apertured disc 14 relatively to this gap between the sealing rings 22, 23, there is provided a

tongue-and-groove connection between the apertured disc 14 and shaft 15, which connection can be secured by means of a screw 24.

The apertured disc 14 comprises at its centre a bore 25 for placing on the rotary shaft 15. Situated about the bore 25 are a plurality of through apertures 26 of large size which, as Figure 2 shows particularly, are arranged within the supply container 1 and the column of material situated therein, and through which the bulk material can flow when it is fluidised. In an outer annular portion 27 of the apertured disc 14 there are arranged a plurality of holes 28 of small diameter. The width of this annular portion 27 corresponds approximately to the diameter of the conveying conduit 17 and is situated on such a diameter circle of the apertured disc 14 as to correspond to the spacing of the axis of the parallel portion of the conveying conduit within the supply container from the axis of rotation 15. Thus, when the apertured disc 14 rotates, this annular portion always moves through between the sealing rings 22, 23. The bulk material taken up by the through holes 28 during rotational movement within the supply container 1 is blown out of the holes within the conveying conduit. The diameter of the through holes 28 is advantageously the same as or larger than the height of the apertured disc 14 and smaller than the width of the sealing rings 22, 23 in the region of the sealing surface lying on the apertured disc. The dosage quantity per unit of time is determined on the one hand by the cavity volume of the individual through hole 28, the number of through holes relatively to the cross-section of the conveying conduit, and the rotational speed of the apertured disc 14. Preferably, in order to allow the dosage quantity to be varied, the rotational speed of the apertured disc is adjustable, the driving motor 16 for the apertured disc 14 being regulable for this purpose.

WHAT WE CLAIM IS:-

1. Apparatus for dosaging of bulk material into a pneumatic conveying conduit by means of a disc rotating about an axis, wherein the said disc is situated at least partly within a column of bulk material in a supply container whilst a portion of the disc is situated within the conveying conduit, and the said disc has through holes in which as it rotates it takes up bulk material and delivers such material into the conveying conduit after passing a stripping element, the said disc being constructed as an apertured disc having a plurality of such through holes of width smaller than that of the conduit, the said portion of the apertured disc being arranged as an apertured partition within the pneumatic conveying conduit between sealing rings which respectively abut against



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The apertured disc 14 comprises at its centre a bore 25 for placing on the rotary shaft 15. Situated about the bore 25 are a plurality of through apertures 26 of large size which, as *Figure 2* shows particularly, are arranged within the supply container 1 and the column of material situated therein, and through which the bulk material can flow when it is fluidised. In an outer annular portion 27 of the apertured disc 14 there are arranged a plurality of holes 28 of small diameter. The width of this annular portion 27 corresponds approximately to the diameter of the conveying conduit 17 and is situated on such a diameter circle of the apertured disc 14 as to correspond to the spacing of the axis of the parallel portion of the conveying conduit within the supply container from the axis of rotation 15. Thus, when the apertured disc 14 rotates, this annular portion always moves through between the sealing rings 22, 23. The bulk material taken up by the through holes 28 during rotational movement within the supply container 1 is blown out of the holes within the conveying conduit. The diameter of the through holes 28 is advantageously the same as or larger than the height of the apertured disc 14 and smaller than the width of the sealing rings 22, 23 in the region of the sealing surface lying on the apertured disc. The dosage quantity per unit of time is determined on the one hand by the cavity volume of the individual through hole 28, the number of through holes relatively to the cross-section of the conveying conduit, and the rotational speed of the apertured disc 14. Preferably, in order to allow the dosage quantity to be varied, the rotational speed of the apertured disc is adjustable, the driving motor 16 for the apertured disc 14 being regulable for this purpose.

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1. Apparatus for dosaging of bulk material into a pneumatic conveying conduit by means of a disc rotating about an axis, wherein the said disc is situated at least partly within a column of bulk material in a supply container whilst a portion of the disc is situated within the conveying conduit, and the said disc has through holes in which as it rotates it takes up bulk material and delivers such material into the conveying conduit after passing a stripping element, the said disc being constructed as an apertured disc having a plurality of such through holes of width smaller than that of the conduit, the said portion of the apertured disc being arranged as an apertured partition within the pneumatic conveying conduit between sealing rings which respectively abut against