

PATENT SPECIFICATION

DRAWINGS ATTACHED

1.195.527

1.195.527



Date of Application and filing Complete Specification: 25 Feb., 1969.

No. 9985/69.

Application made in United States of America (No. 708261) on 26 Feb., 1968.

Complete Specification Published: 17 June, 1970.

Index at acceptance: —B2 L26X; F4 XA2B3

International Classification: —B 05 c 5/00

COMPLETE SPECIFICATION

Improved Tablet Coating Apparatus

We, ELI LILLY AND COMPANY, a Corporation organised and existing under the laws of the State of Indiana, United States of America, of 740 South Alabama Street, City of Indianapolis, State of Indiana, United States of America, 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 following statement:—

This invention concerns a method and apparatus for coating tablets.

Apparatus used in the tablet coating art has generally comprised the use of a stainless steel drum mounted for rotary movement for the purpose of tumbling a bed of tablet in the presence of a coating solution or suspension. Dust problems have been encountered in that the tablets as they tumble form dust which interferes with overall operation. In some instances, dust has formed which requires isolation of the drum from other manufacturing operations. Additionally, the dust precludes film coating of engraved tablets because of the "fill in" problems it creates. Exhaust systems have been provided, and these generally comprise the suspension of an exhaust conduit in the mouth of the drum. Dust is substantially reduced by this arrangement, but the time for coating the tablets is longer than desired inasmuch as the exhaust system does not cause air to flow through the bed of tumbling tablets. Since complete penetration is lacking, some entrapment of the coating material's solvent within the tablet bed occurs, affecting the uniformity of the tablet film. Furthermore, blowback of the coating material into the operator's face is still possible.

Vented drums have been provided in an effort to create circulation through the bed of tablets, but the vents of such a structure become clogged with the coating material. Lengthy shutdown of the apparatus becomes

necessary to unclog the drum's vents, and consequently, the total operating efficiency of the unit is reduced.

Accordingly, the present invention provides a tablet coating apparatus comprising a rotary tumbling drum having an opening adapted for receiving tablets and a coating material rotary driving means coupled to said drum, said drum having a plurality of apertures circumscribing a peripheral area of said drum, a flexible air conduit having a first end in sliding contact with the predetermined portion of said drum over which the bed of tablets tumble, and having a second end coupled to an air exhausting means.

The present invention also provides a method of coating tablets which comprises placing the tablets to be coated in a rotary tumbling drum having a plurality of apertures circumscribing a peripheral area of the drum, continuously rotating the drum, introducing a coating material into the drum and drawing air through a flexible air conduit from a first end of the conduit in sliding contact with the peripheral area of the drum over which the tablets tumble to a second end of the conduit coupled to an air exhausting means.

The apparatus and method of this invention makes more efficient use of the coating material and requires a reduced amount of time for uniformly-coating tablets. The apparatus of this invention has a removable exhaust system and can be quickly cleansed.

Other features of this invention will be apparent upon reading the following description in connection with the drawing, in which:

Figure 1 is a side view of the coating apparatus of this invention.

Figure 2 is a front view of the coating apparatus.

Figure 3 is an enlarged partial front view illustrating the exhaust system in its second position for dis-assembly.

Referring to the drawing, a rotary tumbling drum 11 of a cylindrical configuration in part is provided. Drum 11 may be formed from stainless steel or any other rigid and durable material capable of withstanding repeated use in coating tablets and subsequent necessary cleansing operations. The drum is supported by power transmission means 13 which is coupled to a conventional drive unit 14 for rotary motion. Drum 11 has a wide opening 16 for the introduction and removal of tablets 17 and coating material.

The drum has a plurality of apertures 19 (shown enlarged for clarity) circumscribing a peripheral area 20. Although these apertures are shown in the form of circular holes, they may also be formed by the use of a large mesh screen material or by perforations or other configuration.

Positioned at a lower quadrant of the drum's peripheral apertured area is an exhaust inlet 21. As shown in Figure 2, this inlet has a curved surface 22 which is slightly spaced from the vented peripheral surface 20 of the drum. A number of rollers 25 are positioned on opposite sides of exhaust inlet 21 and are adapted for sliding contact with the drum. For the purposes of this application the term "sliding" includes other forms of relative motion contact including rolling contact. It is essential that the exhaust inlet be positioned adjacent to the leading lower quadrant of the drum where the tablets tumble.

The drum rotates at a relatively slow speed such as 10—30 r.p.m.; and, consequently, the tablets in the drum are not subjected to a significant centrifugal force. Thus, the tablets tend to remain in a pile or bed on the leading lower quadrant of the drum in the direction of rotation which in this particular embodiment is clockwise.

Connected to exhaust inlet 21 is a flexible conduit 27 which in turn has its other end connected to an air exhaust means not illustrated. Exhaust inlet 21 and conduit 27 are mounted for pivotable displacement into a second position shown in Figure 3. In the particular illustrated embodiment, this is accomplished by supporting the exhaust inlet on a pair of pivot arms 29. Arms 29 are pivotably connected to an air cylinder 31 by a connecting link 32. Thus, actuation of the air cylinder extends its piston rod 34 and the exhaust inlet is held in rolling contact with the drum's periphery. When the air cylinder is deactivated, the exhaust inlet and associated linkage assume the position shown in Figure 3. Biasing of the exhaust inlet may be achieved by spring tension, counter weight or other suitable means.

Drum 11 is positioned with the bottom-most portion extending into a cleansing bath 36 which also serves as a dust collector during the coating operation. Thus, after the drum has been used for coating a material it may

be desirable to thoroughly remove all coating material substance from the drum apertures before coating another batch of tablets. Cleansing bath 36 may be filled with a cleansing solvent, subsequent to the deactivation of air cylinder 31 for lowering the exhaust inlet into the position shown in Figure 3. It is desirable to remove the exhaust inlet 21 from the cleansing bath in order to prevent moisture from entering the exhaust system. Inlet 21, once displaced to the position shown in Figure 3, may be easily lifted from pivot arm 29 and set aside. Once this is effected the drum may be rotated in the bath to quickly remove particles lodged in the drum's apertures.

The apparatus of this invention has significantly reduced the amount of time needed for coating tablets. A variety of materials including the following have all shown substantial decrease in coating time: sugar, hydroxypropyl methylcellulose 10, ethylcellulose 7, hydroxypropyl cellulose, cellulose acetate phthalate, polyvinylpyrrolidone, polyethylene glycol 6000, and other polymeric materials.

In one run a 5% solution of methylcellulose was used to coat tablets. The coating solution was introduced into the drum by an airborne type spray system under 25 pounds pressure. Drum speed was 22—24 r.p.m. In the conventional apparatus an exhaust line was associated with the opening of the drum. The amount of time required for satisfactorily coating the tablets with this conventional apparatus was 45 minutes. Apparatus modified according to this invention in which a side exhaust was utilized substantially reduced the amount of time for coating tablets with an identical solution. The time was reduced from 45 minutes to 15 minutes. There was no abrasion of the methylcellulose film on the tablets; and, in fact, it was noted that the apertures in the pan tended to aid in the rolling action of the tablets. It is believed that the coating time required for these tablets was reduced primarily due to the exhaust system which pulled the coating solution and drying air through the bed of tumbling tablets.

In a second experiment a 4% solution of methylcellulose and 1% solution of ethylcellulose in a 50:50 solvent of methylene chloride and isopropanol was used to coat tablets. A spray system using 500 p.s.i. introduced this coating material onto the bed of tablets. Whereas conventional drum coating apparatus required 89 minutes, the apparatus of this invention required only 24 minutes.

The film appearance of the tablets produced by the apparatus of this invention is excellent. External appearance of the coating is exceptionally pleasing. In addition, the uniformity in the thickness of the coating is significantly improved over coatings heretofore produced. Thickness uniformity is

coating
apertures
cleans-
ing
of air
inlet
desir-
m the
ature
t 21,
figure
n 29
drum
move

has
time
of
all
me:
10,
flu-
one,
oly-

ose
ion
rne
re.

on-
as
he
ily
al
li-
ch
ly
ne
s.
e
d
is
r
o
3
1

105

110

115

120

125

130

particularly desirable when the coating includes a therapeutical active ingredient.

Likewise, it was determined that the use of a ladle for introducing the coating solution will produce similar results. In general, the coating time required was reduced fifty percent.

It is apparent that the time required for cleansing the drum is also greatly reduced in view of the novel means for displacing the exhaust system from a cleansing bath enveloping a portion of the drum's periphery. Another benefit of the apparatus of this invention is its ability to "wash down" tablets.

Occasionally tablets are improperly coated and the tablets, instead of being discarded, are basket-dipped in a solvent liquid to gradually wash off the coating. Thus, cleansing bath 36 may be filled with a solvent and the improperly coated tablets are then tumbled in the drum which extends into the cleansing bath. In this manner the tablets are in more uniform and consistent contact with the solution and the coating is quickly removed.

WHAT WE CLAIM IS:—

1. A tablet coating apparatus comprising a rotary tumbling drum having an opening adapted for receiving tablets and a coating material rotary driving means coupled to said drum, said drum having a plurality of apertures circumscribing a peripheral area of said drum, a flexible air conduit having a first end in sliding contact with the predetermined portion of said drum over which the bed of tablets tumble, and having a second end coupled to an air exhausting means.

2. The apparatus of claim 1, in which the axis of said rotary tumbling drum is substantially horizontal.

3. The apparatus of claim 1 or 2, in which the opening of said drum is coaxial with the drum's axis.

4. The apparatus of claim 1, 2 or 3, in which the predetermined portion of said drum is in the leading lower quadrant of said drum.

5. The apparatus of any of claims 1 to 4, in which the lowermost peripheral portion of said drum extends into a reservoir adapted for containing a liquid.

6. The apparatus of claim 5, in which said first end of said conduit is mounted with pivoting means to assume a second

position removed from said drum apertured portion and away from said reservoir.

7. The apparatus of claim 6, including biasing means for biasing said conduit first end against said drum.

8. The apparatus of claim 6 or 7, in which said biasing means is pneumatically actuated.

9. The apparatus of any of claims 1 to 9, in which the sliding contact between said conduit first end and said drum apertured portion comprises rollers on said conduit first end which contact said drum periphery.

10. Tablet coating apparatus constructed and adapted to operate substantially as herein described with particular reference to the specific embodiments illustrated in the accompanying drawing.

11. Coated tablets which have been coated in the apparatus claimed in any one of claims 1 to 10.

12. A method of coating tablets which comprises placing the tablets to be coated in a rotary tumbling drum having a plurality of apertures circumscribing a peripheral area of the drum, continuously rotating the drum, introducing a coating material into the drum and drawing air through a flexible air conduit from a first end of the conduit in sliding contact with the peripheral area of the drum over which the tablets tumble to a second end of the conduit coupled to an air exhausting means.

13. The method of claim 12, in which the drum is rotated about a horizontal axis.

14. The method of claim 12 or 13, in which the first end of the flexible air conduit is in sliding contact with the leading lower quadrant of the peripheral area of the drum.

15. The method of any one of claims 12 to 14, in which the drum is rotated at 10 to 30 revolutions per minute.

16. The method of any one of claims 12 to 15, substantially as herein described with reference to the accompanying drawings.

17. Coated tablets which have been coated by the method of any one of claims 12 to 16.

BOULT, WADE & TENNANT,
111 & 112, Hatton Garden,
London, E.C.1.
Chartered Patent Agents,
Agents for the Applicant(s).

Printed for Her Majesty's Stationery Office, by the Courier Press, Leamington Spa, 1970.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.



particularly desirable when the coating includes a therapeutical active ingredient.

5 Likewise, it was determined that the use of a ladle for introducing the coating solution will produce similar results. In general, the coating time required was reduced fifty percent.

10 It is apparent that the time required for cleansing the drum is also greatly reduced in view of the novel means for displacing the exhaust system from a cleansing bath enveloping a portion of the drum's periphery. Another benefit of the apparatus of this invention is its ability to "wash down" tablets.

15 Occasionally tablets are improperly coated and the tablets, instead of being discarded, are basket-dipped in a solvent liquid to gradually wash off the coating. Thus, cleansing bath 36 may be filled with a solvent and the improperly coated tablets are then tumbled in the drum which extends into the cleansing bath. In this manner the tablets are in more uniform and consistent contact with the solution and the coating is quickly removed.

WHAT WE CLAIM IS:—

30 1. A tablet coating apparatus comprising a rotary tumbling drum having an opening adapted for receiving tablets and a coating material rotary driving means coupled to said drum, said drum having a plurality of apertures circumscribing a peripheral area of said drum, a flexible air conduit having a first end in sliding contact with the predetermined portion of said drum over which the bed of tablets tumble, and having a second end coupled to an air exhausting means.

40 2. The apparatus of claim 1, in which the axis of said rotary tumbling drum is substantially horizontal.

3. The apparatus of claim 1 or 2, in which the opening of said drum is coaxial with the drum's axis.

45 4. The apparatus of claim 1, 2 or 3, in which the predetermined portion of said drum is in the leading lower quadrant of said drum.

50 5. The apparatus of any of claims 1 to 4, in which the lowermost peripheral portion of said drum extends into a reservoir adapted for containing a liquid.

55 6. The apparatus of claim 5, in which said first end of said conduit is mounted with pivoting means to assume a second

position removed from said drum apertured portion and away from said reservoir.

7. The apparatus of claim 6, including biasing means for biasing said conduit first end against said drum.

8. The apparatus of claim 6 or 7, in which said biasing means is pneumatically actuated.

9. The apparatus of any of claims 1 to 9, in which the sliding contact between said conduit first end and said drum apertured portion comprises rollers on said conduit first end which contact said drum periphery.

10. Tablet coating apparatus constructed and adapted to operate substantially as herein described with particular reference to the specific embodiments illustrated in the accompanying drawing.

11. Coated tablets which have been coated in the apparatus claimed in any one of claims 1 to 10.

12. A method of coating tablets which comprises placing the tablets to be coated in a rotary tumbling drum having a plurality of apertures circumscribing a peripheral area of the drum, continuously rotating the drum, introducing a coating material into the drum and drawing air through a flexible air conduit from a first end of the conduit in sliding contact with the peripheral area of the drum over which the tablets tumble to a second end of the conduit coupled to an air exhausting means.

13. The method of claim 12, in which the drum is rotated about a horizontal axis.

14. The method of claim 12 or 13, in which the first end of the flexible air conduit is in sliding contact with the leading lower quadrant of the peripheral area of the drum.

15. The method of any one of claims 12 to 14, in which the drum is rotated at 10 to 30 revolutions per minute.

16. The method of any one of claims 12 to 15, substantially as herein described with reference to the accompanying drawings.

17. Coated tablets which have been coated by the method of any one of claims 12 to 16.

BOULT, WADE & TENNANT,
111 & 112, Hatton Garden,
London, E.C.1.
Chartered Patent Agents,
Agents for the Applicant(s).

Printed for Her Majesty's Stationery Office, by the Courier Press, Leamington Spa, 1970.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.