This invention relates to spray drying equipment and more particularly to equipment usable in connection with the collection of the material as it is spray dried.

The primary objective of this invention is to provide efficient means for the collection of a sterile spray dried material in an efficient manner, and to set forth means for effecting the transfer of the sterile material under sterile conditions to a shipping unit which is capable of maintaining the required condition of sterility in the product or material.

The invention will be more fully understood by reference to the following detailed description and accompanying drawings wherein:

Figure 1 illustrates schematically a conventional spray drying system;

Figure 2 is a view partially in section of an arrangement of a collection means embodying the precepts of this invention;

Figure 3 illustrates the packaged condition of the sterile material;

Figure 4 illustrates a step in the removal of the collection means from the system; and

Figure 5 is a perspective view, with portions cut away, to illustrate the structural arrangement of the collection means.

Referring to the drawings there is indicated at 1 in Figure 1 a spray drying from which dried material 3 is blown through a first conduit 5 to a receiver 7. Since the drier 1 operates at conditions of elevated temperature the air passing with the material 3 through conduit 5 is heated to a considerable degree and must be exhausted from the equipment; consequently a blower 9 in a second conduit 11 is normally provided for withdrawal of the hot air to the atmosphere from the otherwise closed system.

Blower 9 in its operation however, together with the effect of the air rushing through the conduits past receiver 7, creates a suction pressure in this receiver; since the materials which have been spray dried are normally fluffy, light materials, a large quantity of the product is drawn through conduit 11 and lost.

While it is possible to prevent a complete loss of material by collecting the same at the exit of conduit 11 this is unsatisfactory where the product is required to be sterile as complete reprocessing is necessary then to obtain the desired condition.

Accordingly, the structure of Figure 2 is provided to increase the efficiency of the process described above. Thus in Figure 2 there is shown at 10 (see Figure 1 also) a third conduit extending downwardly from the outlet of conduit 10, the remainder of the equipment except for receiver 7 being the same as described hereinbefore.

As shown in Figure 2 receiver 7 is replaced by a collector unit having an inner, sterilized, air permeable bag 13 secured to conduit 10 at 15 by twine or any suitable tying means capable of forming an air tight seal between the throat 17 of the bag and the conduit portion. This bag is also provided at 19 with a second tying means (Figure 4) which may be integral therewith but which when the apparatus is functioning is free as depicted in Figure 2.

Positioned outside of bag 13 is a casing consisting of a shell or a pouch, 21, which may be of heavy rubber, metal or other air-impermeable material; this casing 21 when of resilient material is provided with stays as at 23, 25, 27 and it is only necessary that sufficient support be present to prevent rupture or collapse under vacuum conditions.

Casing or pouch 21 has a neck 29 of resilient material provided with securing means 31 which may be a twine or other similarly resilient device for providing intimate engagement with throat 17 of the inner bag 13. Casing or pouch 21 is also provided at 33 with a flexible protuberance or a protuberance having a sealing means which engages over conduit means 35 connected to suction pump 37. Protuberance 33 it will be noted is secured to conduit means 35 by clamp 39.

It will thus be noted that bag 13 is effectively a barrier positioned in a flow of air containing the spray dried material and that by establishing a differential pressure across this air permeable barrier, air may be caused to pass therethrough to the spacing between the pouch and bag while the dried material is deposited in the bag. The air passing through is of course promptly disposed of by pump 37 and the effect of blower 9 is overcome.

It is to be noted that all operations of the apparatus of invention are carried out under sterile room conditions. Thus when the product of spray drying is a fluid material like dextran the room and apparatus are first rendered sterile; thereafter care is exercised to insure that no portion of the apparatus which contacts the dextran may be contaminated.

In the operation of the apparatus with the air and, for example, fluffy dextran flowing through line 10, blower 9 (Figure 1) is operated to withdraw the hot air. However suction pump 37 is now also operated to cause a low pressure in the pouch 21; this occasions air to move through the permeable walls of the bag 13 and this flow overcomes the hereinafore noted combined effect of blower 9 and the air flow past bag 13.

The drop in the pressure in pouch 21 need only be slight to occasion a considerable air flow from the interior bag and to prevent completely the passage of the dried dextran through conduit 14 to the atmosphere. This is quite unexpected since it might normally be expected that the dextran would flow along with the hot air being evacuated to the atmosphere through the smaller conduits 10 and 11.

When sufficient dextran has been collected in bag 13 suction pump 37 is shut off, the seal broken at 31, and pouch or casing 21 is removed; cord or twine 19 is then tied about the cloth or paper bag 13 to securely seal the same and since no differential pressure is now applied to the bag walls the same will not leak a substantial amount of air in the reverse direction.

However the bag 13 should itself be removed as promptly as possible from conduit 10 and placed as indicated in Figure 3 in an outer sterilized bag 5 for shipping.

With the apparatus of invention substantially no loss of material occurs and the operation is rendered much more facile over those units employing glass and metal receivers.

Since sterility of the product is an essential factor means are provided in conduit 10 for testing periodically. Thus line 43 having valve 45 terminates in a sample collector 47 which is ribbed as at 49. In the operation of this portion of the apparatus valve 45 may be opened to permit the product to enter collector 47 in an amount sufficient for test purposes; thereafter valve 45 is closed and the sample collector removed from the unit (Figure 5).

Where necessary an outer shell or pouch may be also...
provided over collector 47 and the collector subject to a differential pressure. However normally the material flow will be such that collection of the required sample may be achieved by simply opening valve 45 during normal operation.

It is to be noted that for convenience in handling when assembling the unit that pouch 21 is preferably made of a flexible material and stays 23, 25, 27 are suitably provided to prevent collapse thereof; the flexible feature is of assistance in obtaining the airtight seals at opposing ends of the pouch and it is merely required that the walls have a sufficient thickness to resist rupture. However metal walls or walls of heavy plastic may also be employed if arranged to permit the required pressure drop and such shells should be provided with rubber or other flexible seals to permit the required sealing. In fact any suitable airtight casing may be employed and the same should be readily removable over the inner air-permeable bag 13.

This application is related to co-pending application of Frank E. Bonner, Serial No. 322,315 filed November 24, 1952, and assigned to the same assignee as the present invention.

It will be understood that while this invention has been described with particular reference to operations concerning sterile materials it is susceptible to modification in order to adopt it to different usages and conditions and accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. A spray drying system having a first conduit through which hot air and spray dried material pass, a second conduit communicable with the first conduit for the exhausting of heated air to the atmosphere, and a third conduit communicable with the first and second conduits and through which the spray dried material may be passed, a collection unit secured over said third conduit for receipt of spray dried material, said collection unit comprising, an inner air-permeable bag, an outer pouch of flexible material having supporting stays, said pouch defining a spacing with said air-permeable bag, and means associated with said pouch operable to reduce the pressure in said spacing to an extent sufficient to cause dried material to flow to said air permeable bag.

2. A spray drying system having a first conduit through which hot air and spray dried material pass, a second conduit communicable with the first conduit for the exhausting of heated air to the atmosphere, and a third conduit communicable with the first and second conduits and through which the spray dried material may be passed, a collection unit secured over said third conduit for receipt of said spray dried material, said collection unit comprising, an inner air-permeable bag, an outer pouch of flexible material having supporting stays, said pouch defining a spacing with said air-permeable bag, and means associated with said pouch operable to reduce the pressure in said spacing to an extent sufficient to cause dried material to flow to said air permeable bag.

3. In a spray drier system in which the flow of spray dried material is subjected to a vacuum pressure for the elimination of heated air, a vacuum pump, a collection unit for the dried material comprising a conduit, an inner air-permeable bag, an outer casing of a flexible material having supporting stays, said casing defining a spacing with said permeable bag, and means for removably securing superposed ends of each said bag and casing in an airtight relation with the said conduit to permit the atmospheric pressure in said spacing to be reduced below that in said bag, means to reduce the pressure in said spacing below that in said bag and said conduit, the vacuum pump also being connected to the conduit and operable to exhaust air therefrom while said collection unit is filling.

4. A process of collecting hot spray dried material in a sterile state comprising the steps of securing an air permeable bag in a position to receive a flowing air stream containing the sterile material, securing an outer pouch over said bag to form a spacing therebetween, and evacuating air from said spacing to an extent sufficient to cause some air to flow thereto from said bag and to cause said material to be retained by said bag while the remainder of said air of said flowing stream is exhausted to the atmosphere in a direction other than through said spacing.

5. A process for collecting hot spray dried material in a sterile state comprising the steps of establishing a flowing stream of hot air and the hot air dried material, securing an air permeable bag in a position to intercept at least a portion of the contents of the flowing stream, establishing a first pressure on the outer side of said bag sufficient to cause the spray dried material to be drawn therein and some of the hot air to be drawn therethrough, and subjecting the flowing stream of air and air spray dried material to a second pressure lower than that of said stream and sufficient to draw some of the air therefrom.

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