RI 8886

Bureau of Mines Report of Investigations/1984

New Bag Nozzle To Reduce Dust From Fluidized Air Bag Machines

By Andrew B. Cecala, Jon C. Volkwein,
and Edward D. Thimons

UNITED STATES DEPARTMENT OF THE INTERIOR

Report of Investigations 8886

New Bag Nozzle To Reduce Dust From Fluidized Air Bag Machines

By Andrew B. Cecala, Jon C. Volkwein,
and Edward D. Thimons

UNITED STATES DEPARTMENT OF THE INTERIOR
William P. Clark, Secretary

BUREAU OF MINES
Robert C. Horton, Director

Library of Congress Cataloging in Publication Data:

Cecala, Andrew B

New bag nozzle to reduce dust from fluidized air bag machines.

(Report of investigations ; 8886)

Includes bibliographical references.

Supt. of Docs. no.: I 28.23:8886.

1. Mineral industries–Dust control. 2. Bagging–Equipment and supplies. 3. Nozzles. 4. Bagging–Dust control. I. Volkwein, J. C. (Jon C.). II. Thimons, Edward D. III. Title. IV. Series: Report of investigations (United States. Bureau of Mines) ; 8886.

TN23.U43 [TH7697.M56] 622s [660.2'8] 84-600090

CONTENTS

ILLUSTRATIONS

TABLES

UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

ft^3/min	cubic foot per minute	min	minute
lb	pound	pct	percent
mg/m^3	milligram per cubic meter	s	second

NEW BAG NOZZLE TO REDUCE DUST FROM FLUIDIZED AIR BAG MACHINES

By Andrew B. Cecala,[1] Jon C. Volkwein,[2] and Edward D. Thimons[3]

ABSTRACT

A new prototype bag nozzle system has been designed under a Bureau of Mines contract to reduce dust generated during the bagging operation on fluidized air baggers. A field analysis of the new system has shown that the bag operator's dust exposure was reduced 83 pct. The amount of blowback was reduced 89 pct, which corresponds to a significant product savings. The new prototype system has been operating for a substantial period of time with no major problems.

[1]Mining engineer.
[2]Physical scientist.
[3]Supervisory physical scientist.
Pittsburgh Research Center, Bureau of Mines, Pittsburgh, PA.

INTRODUCTION

Many different types of mineral products are packaged into 50- or 100-lb bags. In many cases, these bags are filled by fluidized air bagging machines, which offer a fast and effective way to package mineral products into paper bags. However, a substantial amount of dust is generated during the fill cycle.[4] The dust generated results from a few specific causes. One is a "rooster tail" of product from the fill nozzle and bag valve as the bag is discharged from the fill station. Another cause is blowback of product as the bag is filling, which results in the accumulation of dust on the outside of the bag. Also, as the bag falls from the fill station and hits the conveyor belt, a blast of product is blown out from the bag valve because the bag is under pressure as it leaves the fill station. This, combined with the blowback, contaminates the outside of the bag, resulting in a dust problem for workers loading the bag onto a pallet.

A new system has been designed under Bureau of Mines contract H0318013 by Foster-Miller, Inc., to eliminate these major dust sources (fig. 1). The new system is composed of an improved bag clamp designed to reduce the amount of product blowback during bag filling. The clamp reduces blowback because it has direct contact with approximately 80 pct of the nozzle. An air exhaust system incorporated around the fill nozzle exhausts the excess pressure from the bag when it has finished filling. The inner nozzle is the normal fill nozzle, around which is another nozzle used as the exhaust nozzle. The exhaust system is powered by an eductor, which uses a venturi effect to exhaust the bag at approximately 50 ft^3/min. The exhaust exits to a bucket elevator, which recycles the exhausted product. A pinch valve is used to open and close the exhaust system to the bag.

There are four steps to the new system.

Step 1.--The operator places the bag on the fill nozzle and activates the start button. The bag clamp closes, the product valve opens, and the bag fills normally with no changes. (Fill time variable dependent on product mesh size; no increase in fill time with new system.)

Step 2.--The bag is slightly overfilled, the product valve closes, the bag clamp remains closed, and the pinch valve opens allowing the bag to be exhausted (5 s).

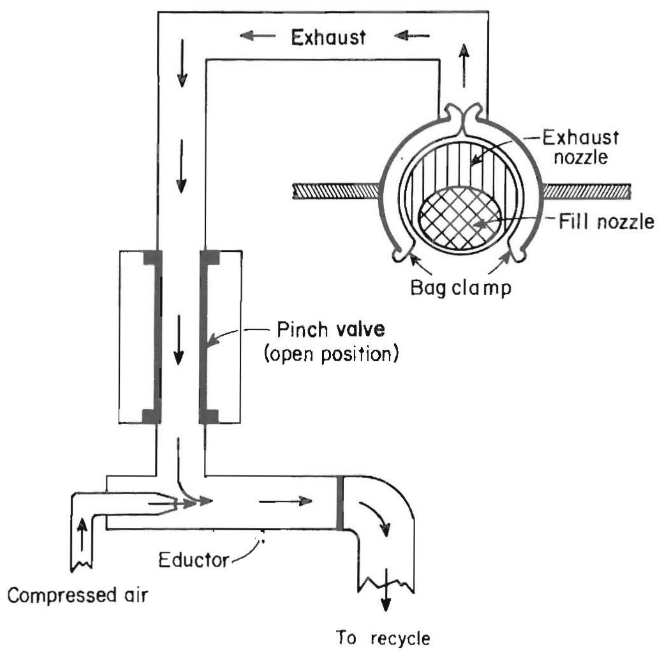

FIGURE 1. - New bag nozzle system.

[4]National Industrial Sand Association. Guidance and Solutions to Reducing Respirable Dust Levels in the Bagging of Wholegrain Silica Products. Silver Spring, MD, 1977, 35 pp.

Volkwein, J. C. Dust Control in Bagging Operations. Proc. Industrial Hygiene for Mining and Tunneling (Symp., Denver, CO, Nov. 6-7, 1978). Am. Conf. of Governmental Ind. Hygienists Inc., 1979, pp. 51-57.

Step 3.--The bag clamp opens, and the bag begins to fall away from the fill nozzle. The exhaust system, which is still operating, cleans the bag valve as the bag falls away (2 s).

Step 4.--The pinch valve closes, turning off the exhaust system. A new bag can be placed on the fill nozzle and the cycle repeated.

TESTING

A field evaluation was performed on the new system during the second week of a 2-week test on a four-station fluidized air bagger at a minerals-processing plant. During the first week, the conventional system was tested to determine the amount of dust generated. Over the weekend, the new system was installed, which took approximately 30 worker-hours. During the second week, the same test was performed using the new system.

Five real-time aerosol monitors (RAM) were placed at various locations throughout the bag-loading and transport operation as follows:

Location 1 was in the exhaust duct of the exhaust ventilation system for the four-station bag area that goes to a baghouse collector. It gave a direct indication of the amount of blowback.

Location 2 was at the transfer point between the bag machine discharge belt, and the belt to the loading dock to measure the amount of dust on the outside of the bag and belt.

Location 3 was at the area of intake air into the bag room. It gave an indication of dust from the belt and the loading dock area and was used as a baseline for bag room measurements.

Location 4 was on the lapel of bag operator to give a direct indication of dust exposure at the operator position.

Location 5 was in the back of the bag room to indicate the dust level throughout the bag room.

Dust from each product mesh size was measured separately. Table 1 gives the results obtained for the operator location for the first week with the conventional system as compared with the second week with the new bag nozzle system. As the product size is reduced (finer product), the dust generated during bagging increases; the new prototype system is more effective. The dust levels with the finer mesh sizes are not lower; in fact, dust levels are very close for all the mesh sizes with the new system. The increase in percent reductions with the finer product sizes is due to the increased dust levels during the first week of testing (conventional system). Table 2 shows the dust reductions obtained for the 325-mesh product size, the finest (dustiest) product bagged at this operation.

TABLE 1. - Dust exposure at operator position

Product size, mesh	Conventional system, mg/m^3	New system, mg/m^3	Reduction, pct
120.......	0.27	0.14	48
180.......	.49	.09	82
325.......	.42	.07	83

TABLE 2. - Dust analysis for 325-mesh product

Measuring location	Conventional system, mg/m^3	New system, mg/m^3	Reduction, pct
Exhaust...	>200.00	21.87	89
Transfer..	.33	.13	61
Intake....	.29	.06	79
Operator..	.42	.07	83
Background	.32	.07	78

Figure 2 shows a portion of the RAM measurement at the operator position for the first and second weeks. The

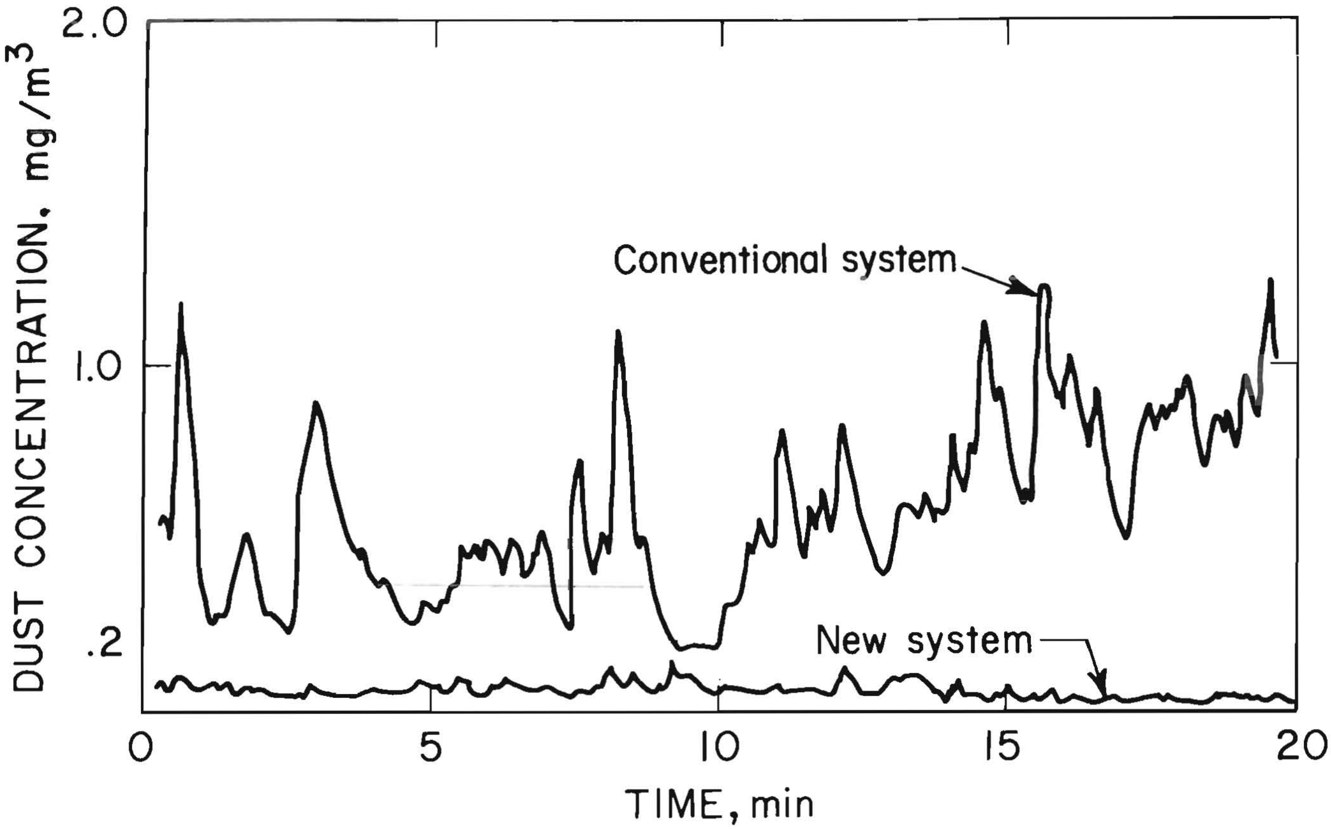

FIGURE 2. - Operator exposure using conventional system and new system. Monitor located on operator's lapel.

threshold limit value (TLV) for this operator ranges from 0.17 to 0.20 mg/m^3, and peak dust exposure levels remained under this TLV value.

Because of the increased time involved to exhaust the bag, the production rates for both weeks of testing were monitored. The effect on productivity with the new system is presented in table 3. The new system has increased the time approximately 1.5 s per bag over that of the conventional system. The increase was attributed to the time the operator waited after loading nozzle 4 until he could begin loading nozzle 1. Normal truck loading time with the conventional system was approximately 45 min; with the new system, it increased to approximately 58 min. The time increase had no significant effect on productivity at this mill.

TABLE 3. - Increase in production time using new system

Product size, mesh	Per bag, s	Per truck (480 bags), min
120............	1.4	11.2
180............	1.7	13.3
325............	1.5	12.2
Average...	1.5	12.2

The problem dust areas on fluidized air baggers have been significantly corrected by this new prototype bag nozzle system. The rooster tail has been eliminated because the exhaust system is cleaning out the bag valve and fill nozzle. Figure 3 shows a bag coming off the bag machine with the conventional system and figure 4 shows the same occurrence with the new system. The blowback has been significantly reduced because of the new bag clamp, which has direct contact with

FIGURE 3. - "Rooster tail" effect using conventional system.

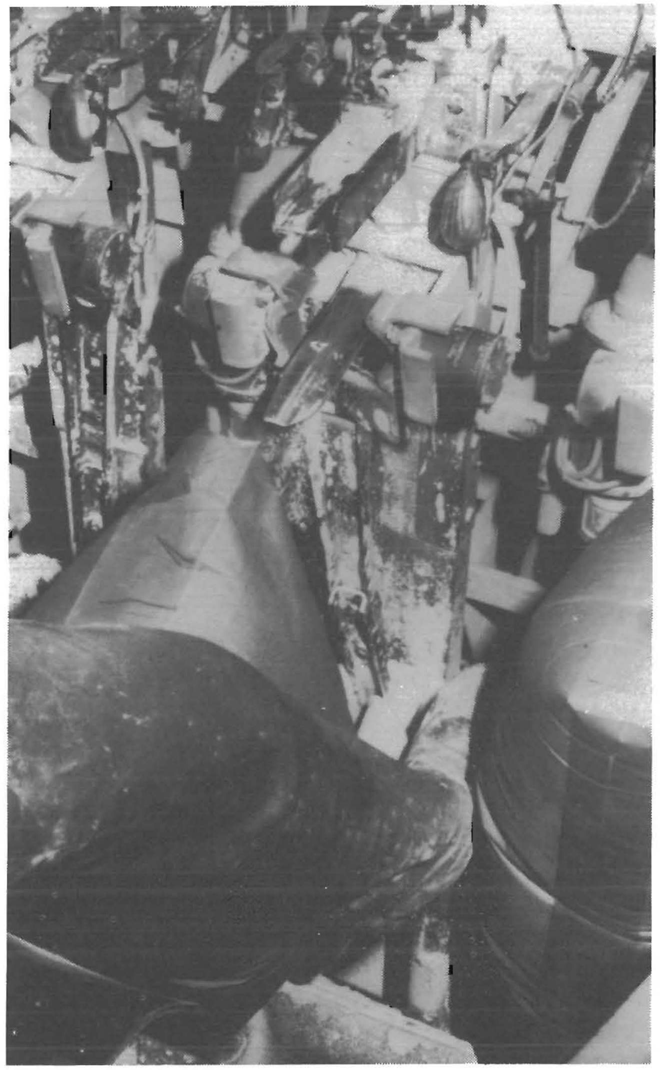

FIGURE 4. - Elimination of "rooster tail" effect using new system.

approximately 80 pct of the bag nozzle. The blast of product when the bag hits the conveyor is reduced because the bag is not pressurized as it falls from the fill station. Because of the foregoing, and the reduced amount of blowback, the bags are much cleaner on the outside as they travel on the conveyor belts to the loading dock.

CONCLUSIONS

The new bag nozzle system was very effective at reducing dust levels during the bagging operation at a minerals-processing plant. For the finest (dustiest) product bagged at this operation, an 83-pct reduction was recorded at the operator position. An 89-pct reduction was recorded for blowback during bag filling, which is also an indication of the amount of product savings. The new system requires little maintenance and has had no major problem in the 8 months since installation.

☆U.S. GPO: 1984-705-020/5026

INT.-BU.OF MINES,PGH.,PA. 27560