FSTC-HT-23-400-71

ARMY MATERIEL COMMAND

U.S. ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER

BELT CONVEYORS ON AIR CUSHION

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Subject Country: USSR

This document is a rendition of the original foreign text without any analytical or editorial comment.

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1 ORIGINATING ACTIVITY (Corporate author)
Foreign Science and Technology Center
US Army Materiel Command
Department of the Army

2a. REPORT SECURITY CLASSIFICATION
Unclassified

2b. GROUP

3 REPORT TITLE
BELT CONVEYORS ON AIR CUSHION

4 DESCRIPTIVE NOTES (Type of report and inclusive dates)
Translation

5 AUTHOR(S) (First name, middle initial, last name)
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6 REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO OF REFS
29 October 1971	8	N/A

8a CONTRACT OR GRANT NO	9a. ORIGINATOR'S REPORT NUMBER(S)
b. PROJECT NO	FSTC-HT-23- 400-71
c. T702301 2301	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d. Requester P. Agustin, AMXST-GE	ACSI Control Number J-9358

10 DISTRIBUTION STATEMENT
Approved for public release; distribution unlimited.

11 SUPPLEMENTARY NOTES	12 SPONSORING MILITARY ACTIVITY
	US Army Foreign Science and Technology Center

13 ABSTRACT

Analysis of uggested conveyor systems and the designs of apparatus using air cushions has resulted in the development of a classification of possible methods of air support of belts, based on the method of feeding the air beneath the belt. Tests of experimental conveyors with belts moving on air cushion (lubrication) have confirmed their workability and the correctness of the principles upon which they are based.

DD FORM 1 NOV 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

UNCLASSIFIED
Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Cargo Handling Equipment						
Material Handling Equipment						
Conveying Equipment						
Conveyor Transportation System						
Lubricant						
Air						

TECHNICAL TRANSLATION

FSTC-HT-23- 400-71

ENGLISH TITLE: BELT CONVEYORS ON AIR CUSHION

FOREIGN TITLE: LENTOCHNYE KONVETERY NA VOZDYSHNOS POPUSHKE

AUTHOR: P. Onokhov, Yu. Makhover

SOURCE: RECHNOY TRANSPORT, No. 5, 1969

GRAPHICS NOT REPRODUCIBLE

Translated for FSTC by ACSI

NOTICE

UDC 621.8672-72

AIR-CUSHION BELT CONVEYORS

[Article by P. Onokhov, candidate of technical sciences, and engineer Yu. Makhover of the Leningrad Institute for Water Transport; source unidentified, Russian, p 54-55]

The Department of Hoisting and Transport Machines of the Leningrad Institute for Water Transport has been working since 1965 on the creation of a belt conveyor on an air cushion support for dust-free transport of powdered and other bulk cargoes.

The use of the air cushion (lubricant) in belt conveyors allows the transport speed, which is limited by the use of roller supports, to be increased over 6 m/sec and consequently allows a decrease in the weight and size requirements for conveyors per unit of productivity, as well as a decrease in the resistance to belt movement, assuring smooth operation of the power plant. The use of air-cushion conveyors effectively solves the problem of high-productivity dust-free transportation of powdered and light, fine-grain materials.

During 1965-1968, the Leningrad Institute for Water Transport developed the designs for two experimental air-cushion conveyors for powdered cargoes 20 and 60 m in length with a 650 mm-wide belt, constructed and tested them. The Institute is developing a method of calculation, technical-economic studies and research work designed to create optimal conveyor types are being performed.

Figures 1 and 2 show experimental models of belt conveyors designed by the Institute with open covers. One distinguishing feature of foreign suggestions is the method of feeding air beneath the belt from an air chamber,

into which it is pumped by blowers (fans). The air arrives beneath the belt either through perforated chamber covers (FRG patent No. 1081373, English patent No. 1041047), or through a longitudinal channel (FRG patent No. 1166086, 964482, 1179860, French patent No. 13161715, Czech. Patent No. 98670, USSR author's certificate No. 195952). The supply of air to the chamber may be through one or several points through regulating valves or from separate sources. In order to decrease the air flow rate, some systems are equipped with labyrinth seals.

Analysis of suggested conveyor systems and the designs of apparatus using air cushions has resulted in the development of a classification of possible methods of air support of belts, based on the method of feeding the air beneath the belt.

Experimental models of the Water Transport Institute conveyors were subjected to test-stand operation using apatite concentrate with a moisture content of 0.2-2% at belt speeds of up to 5 m/sec with productivities of up to 300 t/hr. The tests have confirmed the correctness of the design decisions made and the possibility of increasing productivity up to 500 t/hr.

During operation of the conveyors, the belt moved quietly, and no cases of local uplift or skewing of the belt were observed. The surface of the belt shows no traces of visible wear. The presence of the air cushion can be confirmed by measuring the power consumption of the belt drive. The parameters of the air used to create the air cushion during the experiments correspond to the calculated parameters.

Figure 2.

Figure 1

Test-stand operation of experimental conveyors confirm the results of laboratory studies of the distribution of pressure in the air cushion, motion of air in the conveyor, influence of curvature and tension on the belt, on the basis of which dependence were produced establishing the relationship between characteristics of the conveyor and fan parameters.

The primary advantage of air cushion conveyors is their ability to operate at speeds greatly exceeding the speeds of roller conveyors, particularly when powdered products are being transported.

A second advantage is the possibility of sealing the path over which transport is performed, which cannot be done for roller conveyors due to the suspension of the belt between supports and difficulties involved with access to these supports, but which is relatively easily done when there are no supports, as in conveyors of the new type.

Location	Purpose of Installation	Approximate Construction Cost Savings, Rubles
Medvezh'yegorod port Second start-up complex	Transport of Apatite Concentrate	180
Cherepovets double super phosphate plant	Reception of Apatite concentrate	35
Wharf in Perm' region	"	68
Wharf at Novo-Il'insk	"	33
Wharf at Engel's	"	30
Volga port	Reception of nepheline concentrate.	34

Sealing of the course is particularly required when operating at high speeds with powdered cargoes (apatite, nepheline, phosphate, etc.). The absence of dust in air support conveyor systems operating at the Institute is an important operational factor.

Technical and economic investigations of the application of these conveyors for powdered cargo have established the effectiveness of their utilization at all productivity rates. In comparison with roller conveyors, the speed of transportation of cargoes on which $v \leq 2$ m/sec, air cushion conveyors (with $v \leq 7$ m/sec) provide a savings of 70% on capital investment and 15% on operational expend tures. Calculations for systems for mechanization of the transport of apatite and nepheline concentrates have shown that when air cushion conveyors are used, a reduction in the cost of construction as shown in the table can be achieved.

When the conveyor is placed on a trestle, capital investments are sharply decreased. For example, for Medvezh'yegorod Port, the effect from the use of these conveyors will provide a savings of 490,000 rubles capital investment for the entire loading unit, plus an operational expense savings of 80,000 rubles.

Thus, belt conveyor systems with air cushion support are technically possible and in many cases economically expedient. Tests of experimental conveyors produced by the Leningrad Institute for Water Transport with belts moving on air cushion (lubrication) have confirmed their workability and the correctness of the principles upon which they are based. Test stand operation of two inclined straight-line conveyors 20 and 60 m long operating at productivities of 300 t/hr with a belt width of 650 mm have shown that these machines can be used to provide dust-free transportation and decrease losses of the material being transported.