MECHANIZATION OF MATERIALS HANDLING AND LOADING - UNLOADING OPERATIONS
AS A SOURCE OF IMPROVED LABOUR PRODUCTIVITY

A. B. Chachkhiani

Personnel in materials handling and loading-unloading operations are not engaged in production but merely aid the production process at fibre plants by moving loads of raw materials, intermediate and finished products, packaging, spare parts, etc. In 1972 the average number of workers engaged in materials handling accounted for 6.5% of the total labour force in the man-made fibre industry.

An increase in the labour productivity and a reduction in the materials-handling personnel can be achieved in two ways:

- a reduction in the volume of materials handled by a more efficient organization of the materials flow, and by reducing or eliminating unnecessary reloading operations;
- a comprehensive mechanization of the work of the materials-handling personnel.

For a total man-made fibre output of 583,000 tons in 1970 the total number of handling operations of loads of a ton or more was 27 million, i.e. an average of 44 per ton finished product. Of this total about 10 - 15% was accounted for by external load handling at the arrival and despatch depots of the establishment, up to 50% by the handling of starting materials and intermediate products in the production cycle of the chemical sections, and up to 60% by the handling of fibres and packaging in the spinning and textile sections. These are average figures for the industry and vary with the fibre type product range and organization of the production processes.

External Load Handling at Arrival and Despatch Depots. The storage depots for the raw materials and finished products are sited near the railway siding passing through the territory of the fibre plant. The depots should form units with the production sections in order to minimize the handling distances between the railway truck, depot and production machines and vice versa. The number of handling operations can be reduced by a factor of two or three in this case.

It will be necessary to change from shipping starting materials in sacks to shipping them in large containers or in tank-cars. Labour costs per ton in sack shipments are 0.6 - 1.0 man-hour, in container shipments 0.15 man-hour and in tank-car shipments with pneumatic unloading 0.09 man-hour. Handling costs can be reduced in this manner for cellulose acetate, sulphates, granulated polyamide, polyesters, polypropylene and polyvinyl chloride, lime, magnesite

Fig. 1. Depot for storing polypropylene in granulated form: 1) tank-car with granulate, 2) pneumatic conveyor (PC), 3) electric loader, 4) bridge crane, 5) sack-opener, 6) hopper for unloading the granulate from containers, 7) PC for conveying the granulate to the silos, 8) storage silos, 9) PC for conveying the granulate from the silos to the fibre plant.


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and other friable products. Some types of raw materials will continue to be shipped in liquid form, e.g. caprolactam, dimethylterephthalate, sulphur, etc., at a labour cost of 0.09 man-hour per ton.

The diagram in Fig.1 shows a depot for storing granulated polypropylene at the Balakov Man-Made Fibre Combine. The depot can handle granulate rail-shipped in tank-cars, soft or solid containers, or sacks. The granulate is stored in silos.

Starting materials which cannot be shipped in this manner will have to be handled in small-unit block loads weighing up to 1000 kg. Handling costs will decrease in this case from 0.6 to 0.15 man-hour/ton.

In handling small-unit block loads only minor advantages are gained from using electric trucks with exchangeable load-seizing devices, i.e. labour costs decrease from 0.6 to only 0.4 - 0.55 man-hour/ton.

Finished-product depots are intended for storing bales of staple fibre, cases with staple fibre tow, bolts of cord fabric, and cases with textile packages.

Finished products are stored in stacks and handled with fork-lift trucks or cranes. An extension of the range of exchangeable automatic load-seizing devices would reduce the volume of work connected with handling and slinging the loads so that the personnel concerned could be decreased.

Cases with textile packages can be stored with advantage on rack shelves and handled by stacking cranes in conjunction with packaging machines, remote control of the handling systems, automatically controlled accounting and invoicing systems, etc.

It is, therefore, only by improving the methods of packaging, shipping and handling the materials that it will be possible to reduce the number and raise the labour productivity of the personnel engaged in the external handling of materials.

Internal Materials Handling - the Chemical Section. The handling of starting materials and intermediate products in chemical sections is largely mechanized by means of various mechanical and pneumatic conveyor installations. Over 300 pneumatic conveyor systems for handling loose and fibrous materials are in operation in the industry.

Remote control of handling systems are provided for in design projects and are to some extent already in operation in the industry. Pulp bales etc. are opened manually.

During 1971 - 1972 the State Institute for Planning Man-Made Fibre Establishments produced working drawings for sack-opening machines and for machines which automatically empty sacks of dimethyl terephthalate, caprolactam, granulated polypropylene, etc. To date these machines are in use only at the Kursk Man-Made Fibre Combine. At all other establishments sacks are still opened and emptied by manual work.

Combining the jobs of fork-lift truck driver, machine tender and operator could result in only a small reduction of the personnel of the chemical section.

Internal Materials Handling - the Spinning and Textile Sections. The spinning and textile division of staple fibre production is mechanized by means of electric fork-lift trucks, electric cranes, pneumatic conveyers, etc. The spinning and textile division of textile, technical and cord yarn production is equipped with non-continuous process machines to which the fibre is delivered in packages. There are a large number of technological operations, package handling between the machines and sections is mechanized, and the sections are equipped with overhead or under-the-floor (i.e. dragging) conveyor systems. The doffing and setting-up of the packages on the machines and loading them on and off the trucks and conveyers still await mechanization. All these operations are performed manually, mainly by women, and the volume of the work involved amounts to several million ton-operations per annum.

The larger package weight brings to the fore the problem of developing a mechanized system of threading spinning and textile machines. Non-Soviet concerns have recently started to work on this problem but so far there have been only individual Japanese and West German suggestions for mechanizing the doffing of the packages on certain specially designed textile machines.

The time has come for starting development work on manipulators, i.e. industrial robots which will perform operations like doffing, threading, loading large packages on and off materials-handling machines, etc.
Another task is that of designing mechanized and semi-automatic lines for sorting, wrapping and boxing the packages and for preparing the shipment documents and invoices. These operations are performed in the man-made fibre industry by hand. In 1972 they were carried out by a total of 1541 persons. Of these, 1198 worked by hand, 257 directly on machines and mechanisms, and only 86 persons carried out product-packaging (staple fibre) with the aid of machines and mechanisms. Over the last 15 years attempts have been made at individual establishments to produce automatically controlled lines for this purpose but so far without success, evidently because the bobbins are packaged in paper whereas cellophane is used on automatic sorting and packaging lines developed by non-Soviet fibre producers.

The number of warehouse men increased considerably between 1969 and 1972, i.e. from 838 to 1460, the explanation being the absence of mechanized and automatically controlled stock-keeping systems.

Production rooms, which in some cases occupy a floor space of several hectares, are still tidied by manual labour because the work has not been mechanized. The number of persons engaged on this work rose from 877 in 1969 to 2099 in 1972.