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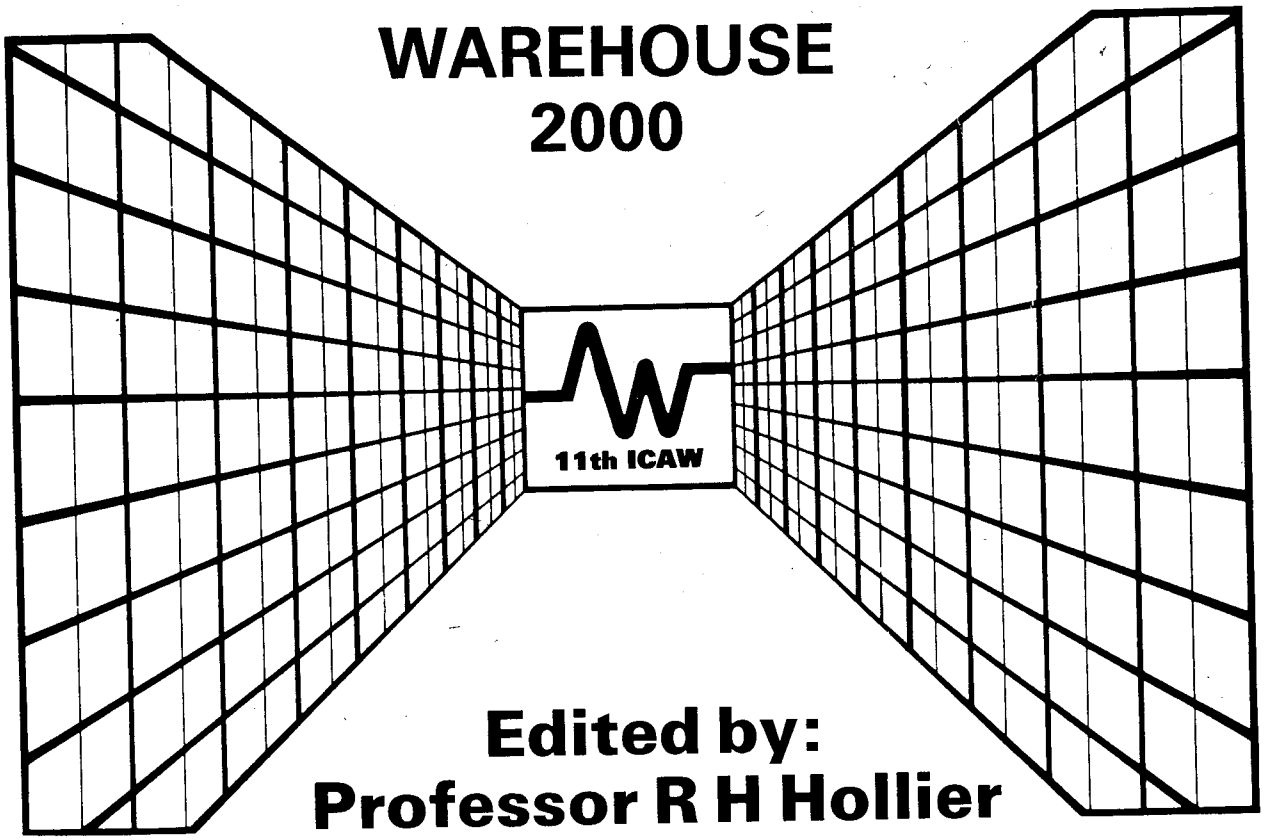

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Order picking system for extreme throughput rates - specialised picking technologies forming a universal system

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ABSTRACT

West German distributors of pharmaceuticals have been trend-setters in logistics. especially in order picking technology since the early 70s. For years they have been realizing JIT picking out of more than 70 000 SKUs within 45 - 60 min. after order acceptance. Today they increase productivity and efficiency by applying special picking technologies in each seperate area of their distribution centers which are connected by automated conveyor lines forming a universal computerized system where the human picker works beside robots and automated picking plants.
Other branches of trade and industry start adopting such systems. Besides this, new combinations of sorter and warehouse technology create goods-to-man-systems of a new type for similar high throughputs. The first system of that new type will start working in 1991.

STATE OF THE ART

Since the early 70s, German distributors of pharmaceuticals have developed order picking systems which are based on a computerized conveyor system and picking bins with fixed coding.

These systems are capable of handling up to 1500 bins per hour, each bin assigned to a defined customer order. Out of more than 70 000 SKUs, "just-in-time" picking of goods is performed manually and, in part, automatically (up to 50 % of total picks). Here, JIT means that 3 to 5 times a day customer orders are received and bins filled with goods are transported by vans to customers' retail shops which, in urban areas, are supplied 3 to 5 times per day exactly at the time agreed between customer and distributor.

In the distribution center, orders have to be completed within 30 to 45 minutes even in peak hours, otherwise JIT requirements cannot be met.

In the meantime, other branches of trade and industry have at least partially adopted this unique order picking technology.

ACTUAL TRENDS IN INTERNAL LOGISTICS

* Volume of stock is reduced to save interest.
* Decentralized warehouses are centralized to allow for automation.
* Continued differentiation of products for an improved market penetration results in an increasing number of SKUs.
* Suppliers have to deliver their products JIT as we also have to manufacture and deliver at shorter intervals.

* As a consequence, our workshops are reorganized as FMS using all the advantages of CIM thus achieving competitiveness even with lot size "1"

* Finally, German economy enjoys real growth, i.e. more units per hour enter and leave our warehouses and workshops.

Considering all these trends, the average stock volume per SKU decreases. Total throughput increase results in progressively growing turnover rates.

As we intend to limit the increase in handling costs we have to consider the influence of the trends mentioned on the right choice of warehouse and picking technologies.

EFFECTS ON CONVEYING TECHNOLOGY

Units to be conveyed are, in fact, getting smaller as to their volumes and lighter in weight.

We normally transport pallet-size units between separate enterprises, thus the percentage of socalled mixed pallets (i.e. containing more than one type of article) will increase.
As to intrafactory transports, it might be that we will no longer keep to identical storage and transport units from an economical point of view.

Where units have to be stored and retrieved containing one type of article only and have to be transferred to picking places, to price labelling stations and working stations in workshops, etc., roller and belt conveyors gain ground again. As far as a high number of transfer cycles are to be performed in a limited area, this technology is superior to AGVs and monorail.

In cases where transports have to cover long distances between A and B and where tranport times do not play a significant role, it may be more efficient to arrange larger transport units (palletizing) and make use of AGVs and monorail instead which, additionally, would have an energy-saving effect! Depending on the throughput required, this will also lead to a growing number of automated palletizing/depalletizing systems and/or robots for that type of application.

Futhermore, functions which are still being performed manually will be carried out automatically to a growing extent.

To give you just one example, it should be recognized that JIT can only be realized on condition that the goods supplied to our goods receiving areas are of the qualities and quantities required.

To secure the advantages of JIT our suppliers must become reliable partners as regards unobjectionable quality of their products. Any quality checks of ingoing goods would interrupt the material flow and deteriorate the advantages of JIT. Therefore, we should inform our partners, on a long term basis, about the requirements of production and, on a short term basis, about the actual goods requirements to keep the delivery date defined. Any control of incoming goods which might be necessary could be performed automatically, e.g. by laser scanners reading bar codes.

PRODUCTIVITY OF ORDER PICKING

Automation is a must since all the trends mentioned would reduce the efficiency of order picking! As long as the major part of picking jobs is performed manually, walking of pickers normally is part of the picking process. More frequent picking due to smaller lot sizes, etc., involves more picking lists, more orders (without more turnover in money) and particularly more walking. All these trends affect pickers' productivity!

Here is another example: when picking of small parts is performed, walking times amount to approx. 20 - 30 %. If the turnover rate of a system is increased from 8 to 12 per year and the frequency of deliveries is increased identically, this could result in additional 10 per cent labour requirements.

Even if we consider that with an increase in the turnover rate warehouse areas and, consequently, walking distances could be reduced, there would still be additional 5 per cent staff requirements.

An increase in the turnover rate achieved by centralization of warehouses (e.g. of 3 warehouses of identical structures and a turnover rate of 8 p.a.) would result in three times the average distance a fork lift has to travel when transferring a pallet from the truck to a warehouse location!

NOVEL MATERIAL FLOW STRUCTURES

Apart from the question whether additonally necessary personnel would impede each other in case the structures which have proved so far would be maintained and provided you would succeed in obtaining personnel of the quality and quantity required, you must take care that the considerable economies which, no doubt, result from reduction of stock (tied-up capital) and from centralization (overheads) are not unnecessarily wasted by additional personnel cost.

Even if that loss in productivity reflects global trends only which are to be checked on the basis of planning figures and optimal layout variants for any individual case, it is obvious that organizational structures and techniques which have proved for years must be doubted!

For places where manual work must be continued in the foreseeable future, it should be considered whether a separation of reserve stock from the articles available for direct order picking would put the necessary manual movements again down to an acceptable amount. In this connection, extra expenditure for any re-storing necessary should usually be taken into consideration, unless flow racks can be used which would ensure automatic performance.

Of course, checks can be made as to whether goods-to-man systems in combination with automated storage techniques could completely eliminate any ways to simultaneously achieve additional economies in labour requirements. Two aspects are to be considered in this conjunction: usually, articles are picked for a definite order with the aid of bins, trays or pallets, etc. which are transferred to the storage location defined to accept the articles desired (preferably according to computer-aided paperless instruction!). Multiple picking of articles from one storage location is possible to the extent ensured by the availability of sufficient and suitable order picking aids within the picker's reach or by the possibility of transferring the storage means over a conveyor system to a number of suitable picking places. This would involve complex organizational structures and comparatively more comprehensive conveying techniques which incorporate accumulating, branching and intersecting.

Mention should be made of the fact that the efficieny of such systems depends on the capacity of the system delivering and discharging the order-picking aids and on that of the corresponding conveyor system handling the storage units. With an increasing frequency of picking (at a decreasing quantity picked for a specific order) any reserve capacity originally available is being utilized. The original coordination of picking (goods from the storage units) with the procedure providing the next storage unit is not possible any longer - this type of picking technique, too, will be more and more uneconomic.

ARTICLE-RELATED ORDER PICKING IS OF GROWING IMPORTANCE

The conclusion which suggests itself is the replacement of order-related (single-stage) picking by article-oriented two-stage picking. This would be an optimal solution as regards the way portion of manual picking. In the case of a computer-aided goods-to-man system, interdependencies between the individual picking places which involve waiting queues as to storage units and order picking aids would disappear in no time. The utilization rate of the "storage machine" could easily be maximized.

What is the reason that this technique has not gained acceptance so far?

As to our conveying techniques, the capacity limits are reached considerably earlier if, for example, instead of one bin for each order one bin for each line of the order is conveyed - even if this bin is of a smaller size (Note: bin size to suit the maximum dimensions of the part to be picked, i.e. bases are hardly reduced due to lower quantities conveyed each bin). Furthermore, individual picks must be put together according to customer and/or order (possibly in a certain order, e.g. heavy parts before light parts or in product groups) and must be combined to a consignment for dispatch. Any gains realized at the first stage will come to nothing, if manual handling is applied at the second picking stage.

FUTURE-ORIENTED SOLUTIONS

Automation of the 2nd stage by means of sorter technology is a solution which comes up to future requirements. The sorter should be capable of accepting the articles picked (article-oriented picking) at the picking place (goods-to-man!) without any additional mechanical aids.

Compared to conventional continuous conveyor design with order picking aids, efficieny is definitely increased by factor 10 (max.).

The individual components of the sorter, for example, aim at the packing place which is temporarily allocated to a specific order.

In conjunction with parallel order picking, such type of sorter naturally also could accept articles which partly have been picked to the order-related mode from technologically different areas (goods-to-man systems), normally however order picking aids included.

Such an intensification by integration of manual picking areas inclusive of way portions or automatic picking machines or robots for correspondingly suitable articles results in an additional increase in overall system efficiency.

Should this not be sufficient to meet the requirements of the near future, we could shift to 3-stage picking. The goal of the 1st stage would then be the automatic discharge from the sorter into a bin. The 2nd stage would be characterized by the order-related combination of such bins from different sorters.

This efficiency-increasing idea could of course be developed to still better results...

Finally, I would like to point out that the technologically practicable solutions I have described should also be practicable from the economical point of view. In view of an ever-growing economy, we can get control of the development of costs in the foreseeable future by substituting capital cost for personnel expense.

In the event of a decline in employment, the relatively high share of fixed costs could have unfavourable consequences due to the high degree of automation achieved.

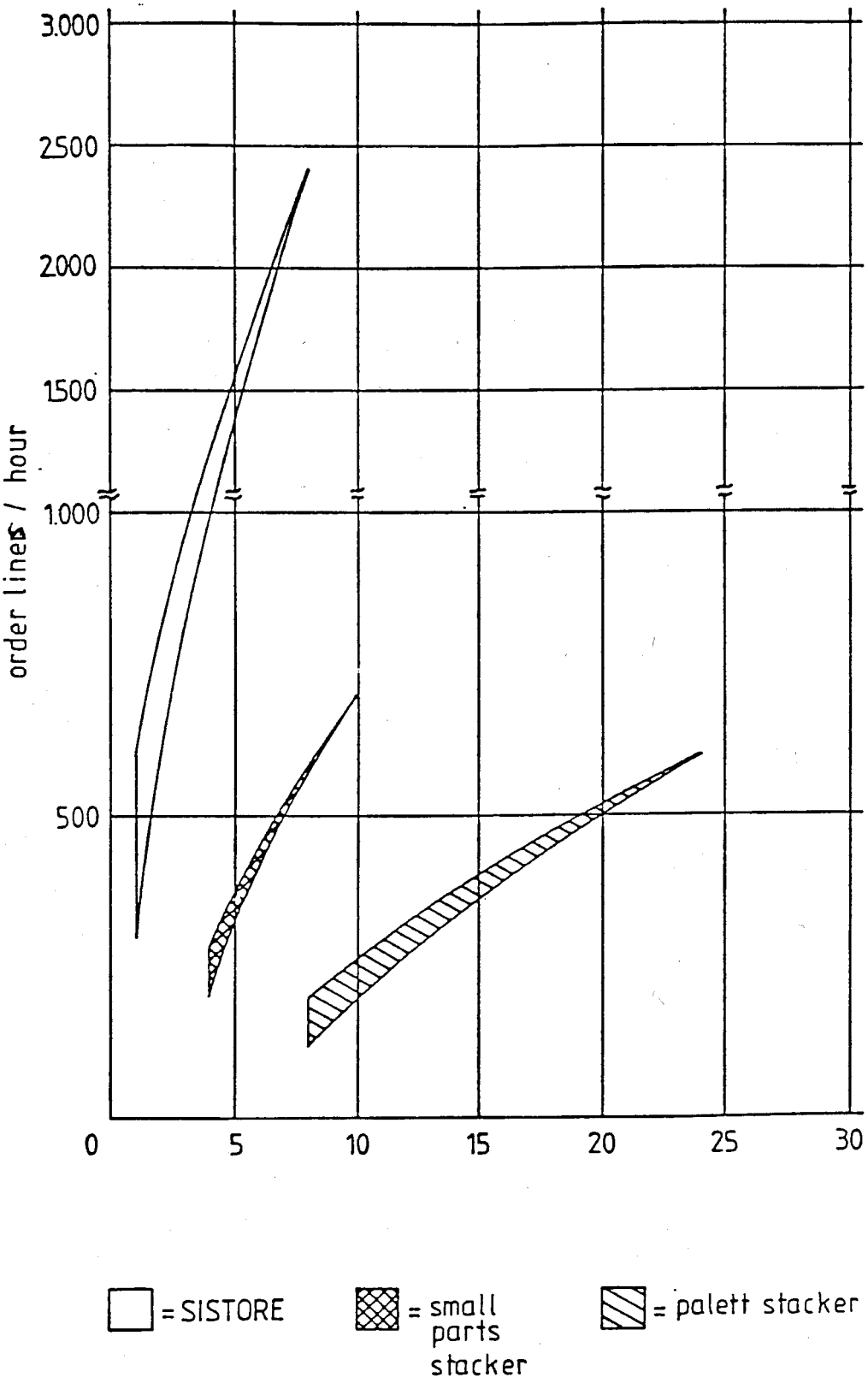
Anyway, planning of conveying and storage systems is of great importance in the light of an ever growing employment of capital. Any overdimensioning could reduce the gain in productivity and, in an extreme case, due to seeming unproductivity jeopardize a project which would secure a company's competitiveness.

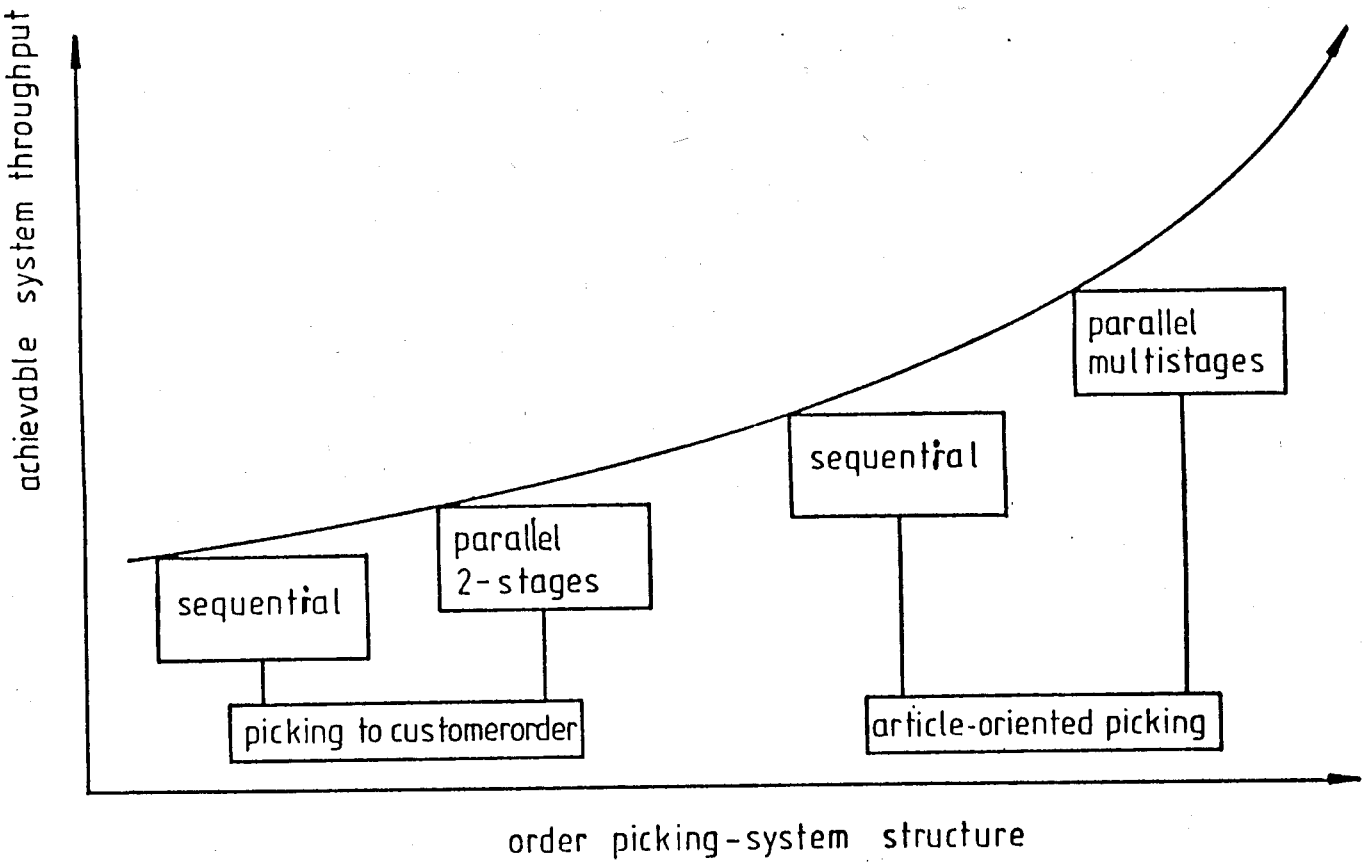
Any underdimensioning can be fatal, if the capacity to compete obviously decreases due to a serious decline of logistical service.

Relevant systems must of course be controllable and tailored to suit specific requirements which will require excellently qualified personnel to operate and maintain the system.

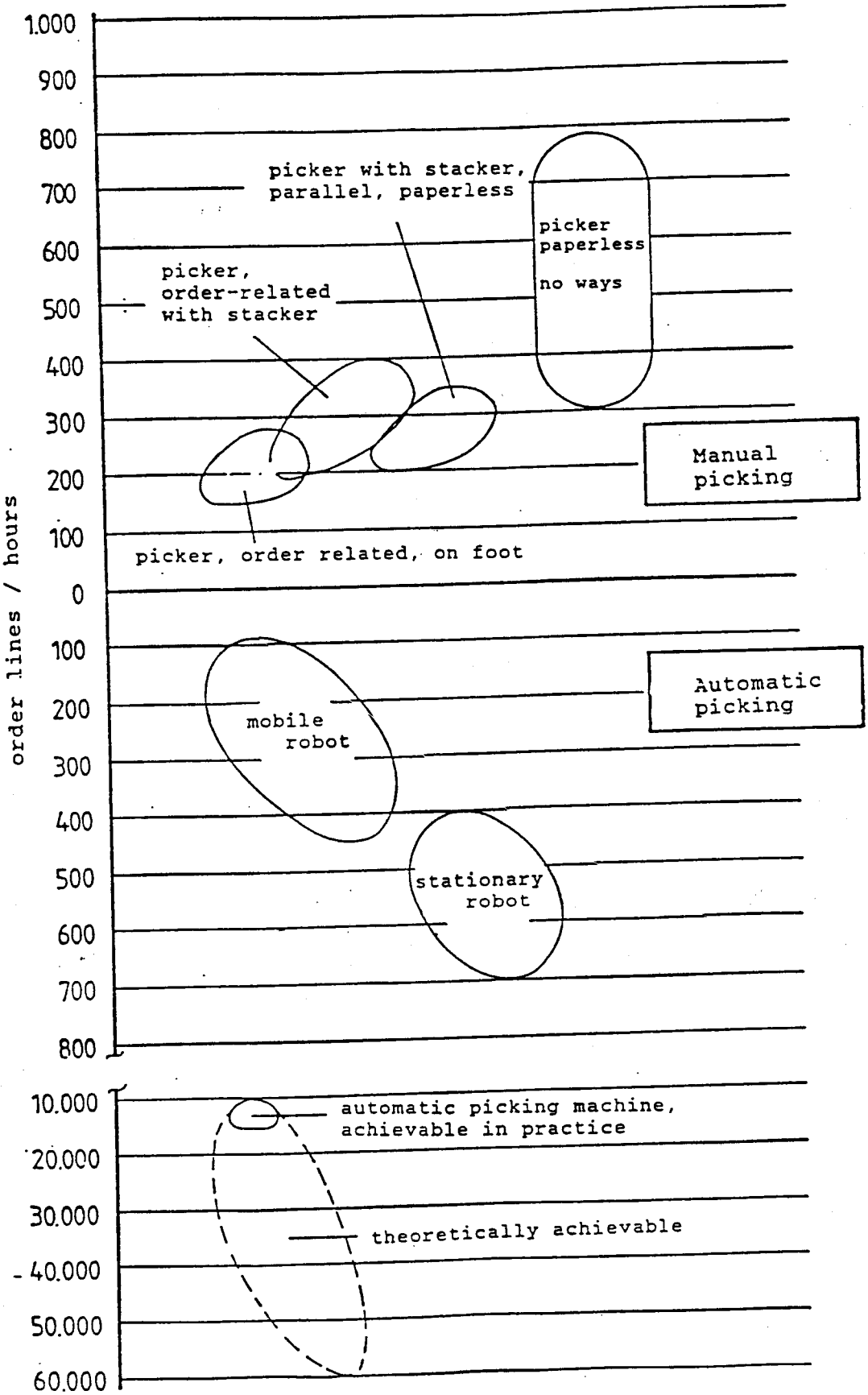
Future conveying systems will be characterized by new capacity categories, by an increasing use of multi-stage picking techniques employing sorters as well as by the employment of less personnel at considerably higher qualifications.

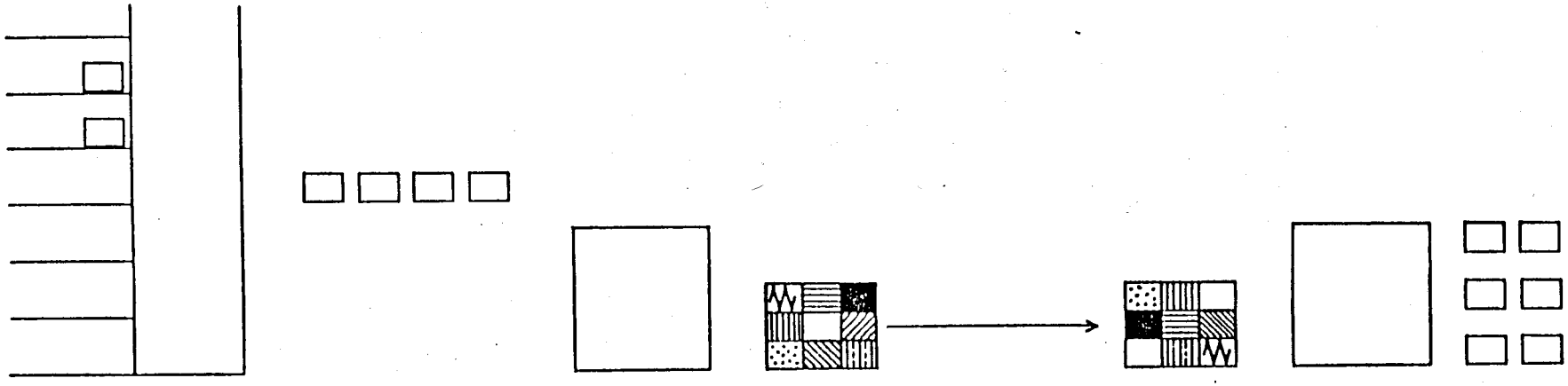
Capacity limits of automated goods - to - man systems on the basis of static availability of articles and order - related picking




achievable system throughput
sequential
parallel
2-stages
sequential
parallel
multistages
picking to customerorder
article-oriented picking
order picking-system structure

Efficiency comparison of different order picking techniques by example of pharmaceuticals and cosmetics





buffer storage - one type of article per unit

bin conveyor system for high transfer rates

palett station

larger units, i.e. differen SKUs per one unit, for long distance transport, where larger transport times are permitted

depalettization

local distribution of small units

The goal of a high efficiency at high system capacity leads to "mixed" conveying systems (storage unit = transport unit)

BIOGRAPHICAL

Dr.-Ing. Wolf-Michael Scheid

24 April 1945	born in Limburg (betwenn Cologne and Francfort)
1951 - 1964	Schooling
1964 - 1965	Apprenticeship as industrial salesman
1965 - 1971	Industrial Engineering Studies at Berlin Technical University
1971	Scientific assistant at Berlin Technical University, specializing in cybernetics and lecturing on electronic data processing
1971 - 1975	Project engineer and project manager for planning and implementation of complex materials handling plants at DEMAG Systemtechnik, Hagen
1975 - 1978	Lecturer, Handling and Storage Technology, Dortmund University, under Prof. Jünemann
9 Feb. 1979	Degree, Dr. Ing., Mechanical Engineering Department, Dortmund University
1979 - 1991	SIEMAG TRANSPLAN GMBH, Leichlingen and Netphen, various responsibilities, since January 1988 member of the board of directors, in charge of conveyor systems department (and until 1990: automated warehouse department), inventor of the SISTORE warehouse system, i.e. a system for extreme high throughputs
1 May 1991	IMB Logistic Systems GmbH, Berlin-Falkensee and Düsseldorf, Managing Director

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	German Society for Logistics, DGfL
	Federal Association for Logistics, BVL