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SMALL PARTS ORDERPICKING

1980 AUTOMATED MATERIAL HANDLING STORAGE SYSTEMS CONFERENCE

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Small parts order picking has evolved from a completely manual operation into a variety of semi-automatic and even fully automatic systems. The choices facing a production or plant manager are somewhat bewildering. Manual systems have been refined to include online communication with a central computer to direct the picking of parts. Semi-automatic systems provide a choice of moving the orderpicker to the parts or moving the parts to the orderpicker.

Factors that must be considered in the selection of a small parts orderpicking system include: 1) number and size of the different parts, 2) available space, 3) degree of control required and 4) throughput rate. These factors often dominate the consideration of the type of small parts system is often more dependent upon how the parts move into and away from the storage area rather than on the type of system. Consideration must be given to how parts are received and introduced into the system and ultimately how the picked parts are assembled for delivery into subsequent phases of the operation. Are the parts picked for a production operation or are they picked for delivery out of the facility as is common in a distribution center?

Not to be overlooked in the considerations is the optimum placement of parts so that an orderpicker may easily reach them. The optimum work height for the average worker is approximately 31". Within 18" of this is the most productive range of reach. Outside of this the worker must stretch or bend to a degree that becomes uncomfortable and fatiguing over a normal workday.

Before we discuss the variety of systems that are available, let us first define the terms listed as the keypoints for consideration.

The number and size of the parts will have an important impact on the type of system you choose. This will affect the type of storage you will select to hold the parts and whether any type of mechanization or control is used. Some systems contain a relatively small number of different



parts. For example, a tool crib may supply 5,000 different parts to the product area. Replenishment parts are received in boxes of 10 to 100 while issues are in unit quantities. However, a distribution facility such as the Defense Logistic Agency may have up to 750,000 different part numbers ranging in size from washers to fifty pound pails of paint.

Consideration must also be given as to how parts are picked. In unit quantities or lots? Are parts handled individually or are they combined to make a kit or consolidated order? Likewise how is the supply replenished? If replenishment loads are on pallets or on large cases while picks are in units or small quantities, we would like to select a system which would accept a pallet or large load and would allow an orderpicker to select the individual quantities as required.

The available space will also significantly affect the choices that you have for selecting the type of system. Some types of systems may be eliminated because of the floor space or the clear height of the storage area. Office height areas can be effectively equipped with a variety of storage devices including carousels, bins, shelving, drawers and flow rack. Higher areas above 15 feet may effectively be used with orderpicking vehicles, SR machines (both manrider and automatic) and automatic loading carousels. The available space must not only include the stoppage media but also the delivery system for moving material into and out of the storage area. Included in the available space must be consideration for the variety of different types of workstations. These range from the P and D stations found at the end of mini S/R machines to sophisticated material delivery systems for a highly integrated orderpicking vehicle, mini S/R machine or automatic loading carousel system.

The degree of control is important for a variety of reasons. Control not only means the physical control of material while it is in storage but also the accountability control, which is achieved through effective inventory management. We might select different types of control systems where security is important as opposed to a combined storage and open stock area. Where the number of parts and/or locations becomes large both mechanization control and inventory control is mandatory.

Throughput measures of the number of picks required to meet production needs and the activity required replenishing the storage area. Many systems are capable of extremely high output over short periods of time. However to be effective these systems must be replenished in a manner consistent with the demand.

We typically define throughput as the total number of transactions on a per hour basis. These may be defined as the number of picks, the number of stows or replenishments and the number of ancillary functions which must be performed. The ancillary functions include audits, inventory count, part number changes, location consolidations or removal of excess stock. Each is important to the overall operation of the system.

Now that the major considerations have been identified, let us examine the various types of small parts handling equipment. Small parts handling systems fall into three basic types and are dependent upon how the material is to be handled. The fully automated type system will achieve the pick without any interaction by an operator. The other two alternatives depend on the movement of the parts or the operator. While the fully automated system is totally dependent upon a higher level of control, the other two types of systems can range from a totally manual



operation to a near automatic operation where the orderpicker is directed to retrieve specific parts from a specific location. With these systems a variety of storage systems can be used to optimize system efficiency.

Fully Automated System

A fully automated system is effective where there is an extremely high throughput of a relatively small number of SKU's. The unit stored and the unit of issue must be the same. The SI Handling's Itematic is a dispenser type system, which offers an interesting alternative for small parts handling. It is not unlike the large AS/RS systems where a pallets or unit loads are delivered to consolidation stations.

Items for each order are picked at one time for delivery to a packing station. The capacity of the system at Zahn Drug is approximately 1600 orders per day with 53 pieces per order. This works out to a rate of approximately 850 items per hour for each of the 12 machines in the system. The 12 machines contain a total of approximately 8,000 items, which are typical of those found at the corner drug store. Material is delivered to a packing station via a conveyor including a shipping document. The loading of the system is loading; items may be delivered from the manufacturer in specially configured cartons or manually loaded into the system. The unit load SR machine with a delivery conveyor is an analogous cousin on a large item basis to the automatic system.

The advantages of this type of system are a very high throughput with a relatively low floor space requirement. However, the system deals with consistently packaged goods such as drugs or retail automotive parts and must be manually replenished from the rear.

Move the order picker to the parts

Where the operator is moved to the parts, a variety of methods are available. With each of these, a variety of storage aids including fixed bin, flow rack, shelving and drawers may be mixed to achieve the most efficient storage density for the material to be stored. Combinations of these different types of storage media can provide an optimum utilization of the storage capacity of the area. The three alternatives available in this approach are manual where the operator walks up and down the aisles picking or replenishing the parts, an orderpicking vehicle or stock selector and a rail guided manrider.

With each of these, alternative methods of control are available. This control can be manual with the orderpicker using a pre-printed pick list to direct him to the locations listed in sequential order. Auto positioning moves the operator to the correct location where he performs the tasks listed on a preprinted list. A fully interactive system, which automatically directs a vehicle to the correct location, will instruct the operator via a display to perform a particular operation. He may also attach a printed form to the picked parts produced by the onboard printer.

Manual systems have been traditionally the mainstay of small parts orderpicking. In these systems, the orderpicker must walk up and down the aisles selecting the different items as directed by a pick list which is either manually or computer generated. As items are picked, they may be placed into containers and packed or placed on a conveyor for delivery to a packing station. Manual systems with computer-generated pick lists that route the orderpicker through



the storage area are capable of between five and twenty picks per hour. This is highly dependent upon how fast the orderpicker moves along the aisles and how long it takes him to package the order.

Through the addition of an interactive display, the rate may be increased by a factor of two to three depending on what is done with the material after it has been picked. In this type of system the orderpicker is directed to move to specific locations along the aisle and told what to do at each location. The problem of visually sorting the list for the next location is eliminated.

A unique system of indicators and feedback at each binface by Dimension, Inc. can increase the pick rate to as high as 600 items per hour. With this system, the operator looks for an indicator light and then picks the number of items shown on a display in front of each bin. When the operation is complete, he pushes a button to clear the display the records in the central controller are automatically updated. As the operator clears a zone, the central controller may re-program each location for a subsequent picking operation. In this system, flow rack, which is replenished from the rear, is used to furnish material to the picker.

By providing a means of moving the orderpickers to location, travel time can be substantially improved. Operator utilization is improved because of the speed and reduction of the fatigue resulting from wading long aisles. The orderpicking vehicle and the manrider S/R machine provide the alternatives. The selection of one will depend upon the number of SKU's and the volume required. Clear height available will also help determine which device is most effective. Orderpickers can operate up to 30 feet with 20-25 feet being most typical. Manrider S/R machines can go above 50 feet.

With computer-generated pick lists, the operator may manually control his position both horizontally and vertically within the aisle to the appropriate location. With this type of system, a pick rate of 10-25 picks per hour may be expected. The functions which the operator must perform once he has picked the material will affect the throughput rate. Because the operator controls the speed and direction of travel, he can pace the throughput rate. He will only do as much work as he feels he should regardless of the supervisory controls.

To improve the throughput, the vehicles, both manrider S/R and orderpicker, may be controlled to provided automatic horizontal and vertical positioning. A sequence of locations can be entered into the vehicle controls. The work (both picks and stows) are displayed sequentially as the vehicle automatically moves to each new location. Once the vehicle is positioned at the proper location, the operator performs the required picking operation. In this mode of operation, the operator may continue working while the vehicle is moving to the next location significantly improving the number of transactions that he can perform.

By mounting an interactive display onboard, the manrider S/R machine or orderpicking vehicle, throughput may be substantially increased and control significantly improved. In the most automated systems, communication is mounted between the vehicle and a central control processor either through the wire communications the floor or through a radio or optical data link. A fully interactive console provides the operator with a display that will give him instructions and requires an interaction activity to confirm that the operation is complete. One of



the significant advantages of this type system is that activities may be given to the operator in a real-time or in a batch mode depending on this particular mode of operation.

In the system at Robins Air Force Base in Warner Robins, Georgia, the vehicles are in communication with a central control processor which not only directs the routing of the vehicles throughout the warehouse but also provides the operator with instructions on activities at each location. The operator may be instructed to pick a quantity of a particular part or to put away material that was placed in the attached module in receiving.

In this particular system, parts are placed in plastic bags with an issue routing document. As the vehicle moves past the takeaway conveyor at the end of the aisle, the operator offloads material for destination to the issue area. In the issue area material is consolidated by shipment and directed to the appropriate shipping area. In this type system, throughput rates between 40-60 transactions per hour per vehicle are achievable. The total number of system transactions will depend upon the total number of vehicles in service. Vehicles may be put in service as the demand requires. Each of the vehicles may be routed anywhere in the 300,000 square foot facility to service the 200,000 part numbers.

The manrider S/R machines have the same capability as the orderpicking vehicle system. However, since the machines are typically captive to an aisle, all aisles must be operated in order to gain full access to all parts. Because this type of system can go considerable higher than the orderpicking vehicle, this may not be a problem where the number of parts is limited to 20-30,000 parts. The throughput for the manrider S/R systems may be significantly improved by placing a takeaway conveyor within the shelving structure. As parts are picked, they are placed on the conveyor with a label indicating the destination. Parts can then be delivered to a consolidation or sortation station for delivery out of the system. An additional advantage of the manrider S/R machines is that high-speed travel is permitted at all levels.

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Carousels provide the alternative of bringing parts to the work area where an operator may be directed via a pick list or by an interactive display. The carousel systems may be manually operated by an operator using a foot switch; in a semi-automatic mode where the operator enters the sequential series of locations into a controller or may expand to a semi-automatic mode where the carousel is positioned automatically and the operator is directed via a CRT to pick the deS/Red materials.

Move the parts to the orderpicker

One way travel time may be minimized is to move the parts to the operator. Through careful system planning, the operator will seldom be affected by the travel time of the parts. His work may be paced by the functions to be performed and not by the time between operations.

The alternative of bringing the parts to the man can be achieved with carousel mini S/R machines and automatic loading carousels. With each of these systems, a dedicated workstation provides



the base of operation. Whether the activity is manually directed or driven by a computer, the operator need go no further than the delivery station to either pick or put away material. Because the workstation is fixed, it can be made as efficient as required for the particular operation. Counting scales, packing materials and transportation devices may be placed conveniently for the operator.

When two or three carousels are operated by one orderpicker, each carousel may be driven independently to position containers in such a way that the operator never waits for a location. Through the use of automatic controls, rates of 50-60 picks per hour are realistic. Storage density is improved over standard shelving because the carousel units may be placed close together eliminating the wide aisles necessary for the movement of operators with truck sort carts. Operator efficiency and accuracy can be assured through the use of light bars to indicate the appropriate container and an interactive CRT.

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Delivery of material to or from the workstation can be achieved through relatively simple conveying mechanisms extending across the face of the workstations.

With each of the systems discussed, the operator was required to extract material from a storage location. In the last type of system, the parts are moved to an operator in containers. Containers may be configured to hold one or several SKU's depending upon the individual part size. A variety of workstation arrangements permit selecting an operating configuration to satisfy the real operator needs.

The mini *S/R* machine provides an automated means of storing a retrieving container. There are a variety of configurations of workstations which may be used to achieve different throughput rates. The most common is a pair of pickup and delivery stations at one end of the aisle. In this configuration, containers are delivered to the P and D stations as a result of a key entry by the operator. When the containers are delivered to the P and D stations, materials are picked or put away in the appropriate bins as determined by a pick list.

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With the mini *S/R* machine and a single P and D station at the end of the aisle, throughput rates of up to 50 transactions per hour are possible. This rate is dependent upon the length and height of the system which may be as high as 40 feet and as long as 150 feet. A typical container is 24" x 40" x 6"H. These containers are stored in defined locations throughout the system. Computer control of locations is frequently used even when the location selector is manual. In a manual system, pick lists are provided to the operator who may key in the locations defined by the pick lists. The system then proceeds to deliver the appropriate container to him. Automation can be achieved in the mini *S/R* system through the use of conveyor systems and workstations combined with a computer control system. Unique containers and parts are automatically delivered to each workstation. Some of the advantages of the mini *S/R* machine are that it is fully automated. We can typically achieve inventory reduction through accountability and control. Personnel production is reliable because operations are directed by the system rather than the operator directing the operation.

Since transaction times are often limited by the capacity of the operator performing the operations, a number of mini *S/R* machines and conveying equipment can be combined to significantly improve the system throughput. Using computer controls and a combination of mini *S/R* machines, conveyor and workstations, we can achieve a transaction throughput of approximately 250 transactions per hour.

CONTROL

The type of system you choose will depend upon the number and size of the parts, the space available, the degree of control and the throughput you require. For most, it is not difficult to count and size the parts. The available space will be determined by whether it is a new or existing facility and the throughput will be a function of your production goals. If the results of your current operations were perfect, you would not now be looking for ways to improve your understanding of material handling systems techniques. The different types of mechanization can

improve operator efficiency, but the mechanization alone often won't solve the problem. To solve the complete problem of small parts orderpicking, the degree of control must be determined.

A few of the many questions which must be answered to determine how much control or automation you should have are as follows:

- How much control do you now have?
- Do you really know where every part is and how many there are?
- How often do you have to do an inventory count?
- Are the actual counts close to the record quantities?
- What type of work force do you have?
- Is it union/non-union; skilled/semi-skilled; seasonal/steady?
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Control does not necessarily mean large additional computer rooms with multi-processors and megabytes of memory. Many small computer systems are available which can interface - with your existing computerized inventory system, the mechanization and the operators to achieve a satisfactory level of control.

The primary benefits of control are: increased visibility of worker performance, available material and location of material. Controls can reduce the impact of slow or inaccurate workers by allowing supervisors to take corrective action quickly.

How much can you afford? Several companies today are using an annual rate of \$30,000 per stockroom employee to justify controlled systems. Reductions of 30% to 40% of the current work force is achievable. This comes from improved efficiency at both the worker and supervisory levels.

If you don't have any kind of control now, don't expect to be able to move to a fully automated inventory control system in one step. Your best approach is to install a system capable of expansion to make the transition easier.

CONCLUSION

We have considered small parts orderpicking from manual to semi-automatic and even fully automatic systems. While it is economically impossible at this time to eliminate the operator, we have examined ways of making the job of orderpicking faster and more accurate. Computerized pick lists represent a major step forward in manual systems. Through the addition of controls, operator efficiency can be improved by a factor of 20. Moving the operator to the parts, allows better utilization of resources in large facilities. The space efficiency is good and transaction throughput rates of 60 to 80 per hour are achievable. Moving the parts to the operator provides a flexible means of adapting the work force to the workload. By configuring work stations to meet the needs of the operator, accuracy and speed may be improved.

The degree of control must be compatible with your current operations. Significant improvements in inventory utilization can be achieved by knowing what is available for issue. Controls also provide the means to supervise employees, thereby improving accuracy and speed. By utilizing effective mechanization control, parts may be tracked throughout the receiving, storage, issue and delivery phases of the operation. The result is an opportunity for you to significantly improve your small parts order picking operation.

