GETTING THE MOST OUT OF DAIRY EQUIPMENT

CARL W. HALL
Department of Agricultural Engineering
Michigan State College, East Lansing, Michigan

To hold the cost of products sold at a competitive level in face of rising prices, it is necessary that production costs be held to a minimum. The first major field of reduction of production costs is in labor costs. In order to get the most out of dairy equipment labor must be properly used. When the time requirements of a job are reduced by improving the method, the worker must be gainfully employed at some other assignment. There are beneficial changes which provide leisure, add to the comfort of the worker, and reduce the hazards of his work. Changes in plant equipment arrangement may be made even though they are not justified on a purely economical analysis.

The paper presents principles, with applications, which can be followed in each plant to improve the work method and decrease time requirements.

Today when labor costs are greater than ever before, it is important to investigate the possibilities of saving part of the cost of operation. With the high labor costs which exist, the first major field of reduction of production costs is in labor costs. It is also important to point out that if you are to save time by improving the method, the worker must be gainfully employed at some other assignment.

There are beneficial changes which provide leisure and add to the comfort of the worker and reduce the hazards of his work. Changes in plant equipment arrangement are often necessary even though not justified from a purely economical analysis. One of the popular items in the jargon of manufacturing concerns is "labor saving" but perhaps we should use the words "labor serving" instead because in many cases improvements can be made which would lighten the worker's job and help him to become more contented with his task.

What can the dairy plant operator do to meet these increased costs? To make preliminary savings, you do not need detailed time and motion studies to locate bottlenecks in the operation. The principles involved in making time standards and an analysis of work simplification can be applied.

The following items should be investigated with the idea of improving the work method and decreasing the time requirements. In making equipment adjustments in the plant, all of us, including the workmen, resist change.

1. Relieve hands of work that can be done with the feet. An example of this type of motion economy can be found at the weigh can where the hands are normally used for filling. For closing or opening the valve in the weigh can, a foot-operated valve would relieve the hands for more valuable work. Another example is the control at the bottle filler which permits the cases of bottles to go into the refrigerated storage. This control should be foot-operated.

2. Eliminate reaching. Several items of equipment have controls which are often located so that the worker has to step or walk to reach them from his work position. The valve at the can washer should be easily accessible by the man dumping the milk. If the valves are not close to the dumping point, it might be possible to place an extension from the valves to the worker, so that it is not necessary for the worker to move in order to open and close the valves. See Figure 1.

3. Tools and materials should be within easy reach of the operator. At the can washer, the dumper should have the hammer or pipe for loosening the lids within easy reach. The pencil for recording the weights of the milk should be located where easily and quickly accessible. The water valve should be close to the point of use.

4. Pre-position tools. Not only should the tools and materials be within easy reach, but they should be pre-positioned so that by one grasp of the fingers, the tool is held in a position so that it may be used at the job. There is a right and a wrong way, for example, for nicking up a pencil. The pencil should be pre-positioned so that it is not necessary for the operator to turn it in his hand before he is ready to write. If the preceding motion is carried out properly, additional work is not required to pre-position a tool properly.

5. Motions should be balanced and both hands should work simultaneously. The most obvious application of this practice is at the bottle filler and bottle washer. Both hands should work simultaneously.

6. The hands should not be used as a holding device. Equipment which is being washed should be held by jigs or fixtures so that the hands are relieved of the job of holding and can be used for more important tasks.
7. Use a drop delivery. Cartons, washing powders, etc., could easily be dropped into the processing or adjoining room by means of a chute from a storage above, thus eliminating considerable work as far as handling is concerned.

8. Can we combine operations? The HTST pasteurizer is an example of a piece of equipment which accomplishes heating, pasteurizing, and cooling in one unit. Investigate the possibility of combining hammers, wrenches, screwdrivers, etc., where used at approximately the same time into one tool.

9. Can we eliminate operations? Question the necessity of each step followed in carrying out an operation. Milk can be separated without the customary heating. When hooding milk bottles, select a hood so that capping is eliminated. In the washing operation, eliminate excessive rinsing.

10. Can we change the sequence of operations? If one piece of equipment is slowing an operation, it might be possible to carry out the process at another time. The clarifier will often not take the milk as rapidly as it can be dumped in the receiving room. Clarifying after storage might be a solution.

11. Can we simplify operations? By properly applying all the principles listed, the operations will be simplified.

As a worker in the plant, you must obtain the approval of management before most changes are made. Improving the operations in any part of the plant where the worker is actually idled while being envied by his co-workers may result in unsatisfactory labor relations. In such a case, changes should be planned, but not carried out until an appropriate time.

In conventional analysis, if the man is not kept busy at his job, the implication is that he is not doing his share. Some of the evils of time study could be eliminated if the lack of work by the employee is attributed to the machine which he is attending. The fault then lies with the engineer for improperly designing and arranging the equipment.

It is important to point out that equipment should be designed and arranged to permit utilization of labor, not to expedite labor. It is usually necessary to balance the cost of equipment by labor saving. On the basis of recent tests, the total cost of operation of many dairy plants could be reduced 5 percent to 8 percent by adopting more efficient plant operations.

Using the above principles, a detailed time and motion study was made of each operation in the plant. Based on this study a method was proposed for selecting the proper size of equipment for various sizes of dairy plants. The material which follows is a summary of the results of the research work along that line.

1. In the receiving room, it is possible to reduce the time for weighing from 0.13 to 0.095 minute with a print-weigh device on a conventional scale. At 1952 prices with labor at $1.75 per hour, 4.8 years would be required for a 40,000-lb per day dairy to pay for the added cost of a print-weigh device.

2. It was found that the reasons for delays to the dumper were caused by:

(a) Conveyor improperly designed. The cans should be dumped at right angles to the incoming conveyor at the weigh can position. See Figure 2. It was found that there was a large variation in the length of the incoming and outgoing can conveyor in the receiving room. A chart was worked out on the basis of the time studies which illustrates the proper length of conveyor for the receiving room in order to dump and weigh the milk in the shortest possible time. It was found that in a few plants it would be more desirable to have a long incoming conveyor instead of a long outgoing conveyor.

(b) Weigh can too small. A small weigh can requires additional weighing time for large producers. A chart was developed to balance the added cost of a larger weigh can to the labor saving through the use of a larger weigh can. This information was based on a time study from which were evolved standard times for the dumping and weighing operations. From this chart it is possible to select a size of weigh can on the basis of the number of cans dumped. It was also found that the time the dumper allowed the weigh can to drain was far greater than necessary. A self-closing valve would permit a saving on the average of 0.02 minute for each weighing.

(c) Can washer. The can washer was often found to be either too small or too large. A can washer which was too large did not benefit the dairy in spite of the fact that the workmen were not held up at their job, but did require an additional investment for equipment and additional space for placing the equipment. A can washer which is too small does not permit the most efficient utilization of the labor because the dumper can empty the cans faster than the can washer operates. It was found that a 10-can per minute washer for a one-man receiving room was the most efficient size to utilize the
man's time. The major loss of time at the can washer was caused by the lids jamming in the lid rack at the top of the washer. The rotary can washer should be used for plants of 10,000 pounds per day capacity or less (1952). It was formerly recommended that a rotary can washer be used for 20,000 pounds per day or less, but that is an incorrect recommendation based on today's labor charge.

(3) Processing room.
(a) Clarifier
The clarifier is usually too small to process the milk as fast as it is dumped at the weigh can. Some plant managers have overcome this small capacity by running the pump which feeds the clarifier at a speed above the rated capacity. This results in some decrease in efficiency of clarifying but increases the utilization of labor in the receiving area. The major loss from an economical standpoint to using a clarifier which is too small does not come from the loss of time at the dumping area but actually results from a loss of milk at the weigh can because the dumper does not wait for the milk to be clarified before he dumps in the next can into the receiving tank.

(b) Storage tank.
A study showed that the 84-inch diameter storage tank required less cleaning time than the 96-inch diameter tank of the same capacity. However, the tank with the smaller diameter requires more space in the plant. The saving in labor with the 84-inch diameter tank must be balanced against the additional building space required in comparison to the 96-inch diameter tank. The time saving amounted to about 5 minutes per day for cleaning. Based on the time study results of 1952 the 84-inch diameter storage tank would be more economical for the dairy plant in sizes up to and including 4000 gallons. At present, the largest tank of 84-inch diameter has a capacity of 3000 gallons. It should also be pointed out that it may not be necessary to change the design of the equipment, in this case, to utilize the labor more efficiently. Improved work methods might be carried out so that the cleaning requirements for the tanks of the two diameters would be the same. In one plant five people were delayed a total of seven hours during the day because of insufficient storage for the raw milk.

(c) Cleaning
One of the major methods of time saving with cleaning equipment can be made by using parts racks, so that the equipment as it is washed on the rack is also positioned for the assembly, usually the following day. The major cause of excessive time requirements in cleaning dairy equipment is due to excessive rinsing. This would often amount to 50 percent of the total labor requirement for the cleaning operation. A water valve on the end of a hose would probably decrease the water requirements and also decrease the labor requirements in that it would not be necessary for the workman to go back to the mixing valve in order to turn the water on and off. The importance of the proper method of carrying out one operation and its relation on another operation is often overlooked. A water hose crossing an alley may not cause the cleaning operation to take much longer than it ordinarily would but would require excessive time for those operations which require the alley for moving materials. Possibly an extra cabinet for storage of cleaning agents would save considerable time.

Check List for Receiving Room

1. Dumping
Cans should not pinch during dumping.
Water on the floor should drain away from the operator.
To secure a rapid dumping rate, the trucker should loosen the can lids; two truckers may work together in unloading the cans and loosening lids.
If the trucker does not loosen the lids, the person doing the dumping should loosen several lids at a time, not just one.
An automatic can lid loosener should be used for receiving at rates faster than 7 cans per minute.
Cans should be permitted to drain before going into the can washer; an extension should be provided on the can washer to catch the drippings from the cans.
2. Weigh Can, Scales, Weighing, Sampling
A self-closing valve on the weigh can should be given consideration. There is justification for a self-closing valve on the weigh can, particularly for a multiple man-operation.
An air-operated valve should be used to lighten the work of the weigher.
The correct size of scales and weigh can should be selected according to the size of dairy and the size of the producers.
Scales installed in a dairy should have a capacity of either 750 or 1000 pounds.
A permanent table should be placed near the sampling position for recording weights.
A foot-operated weigh can valve control should receive consideration.
The receiving tank need not be more than three times as large as the weigh can; a receiving tank twice as large as the weigh can is usually sufficient.
There is little justification for a 1000-pound weigh can unless the plant has a capacity of 60,000...
The use of a print-weigh device on the scales should be considered to speed up the receiving operation.

The dial of the scales should be positioned so that it is easy to read. A permanent place should be provided for the weigh sheets where they can be kept in order.

In a two-man operation, the weigher should be able to see cans numbers easily without the dumper rotating the can.

Dumper should be able to see receiving tank so that he can avoid running it over.

Make sure that there are no obstacles to encounter when obtaining the sample.

Man dumping the cans should be able to see if cans are removed from the can washer.

Sample bottles should be easy to obtain, clearly marked, and fitted with a lid which is easy to manipulate.

Both hands should be used simultaneously when sampling.

3. Can Washer

A can washer should operate as rapidly as worker's normal dumping speed.

The water and steam valves should be within easy reach of the operator.

The can washer should be checked regularly to see if lids are feeding through properly.

The speed of the receiving operation may be affected by direction in which the lids are taken into the washer. The cap (flat side) of the lid may be fed into the can washer to the right or left.

The lid rack from the can washer should be extended so that it is within easy reach of the dumper.

The safety devices on the can washer should be checked periodically to prevent breakage in case of an obstruction.

4. Conveyor

The connections between the gravity conveyor and roller conveyor should be carefully designed and periodically inspected to prevent lodging of the cans.

The possibility of including a cross-over between conveyor looms to facilitate handling small truck loads should be investigated.

The incoming conveyor should be level with or slightly higher than the bed of the truck.

The outgoing conveyor should be close to the incoming conveyor, but there should be sufficient area for one truck to be unloading and one truck to be loading at the same time. In large operations, the possibility of having two incoming conveyors so that the trucks could unload simultaneously should be investigated.

Conveyors should not "box in" the workmen.

Conveyors should be arranged so that a short reject line is required.

The incoming and outgoing conveyor lengths should be selected so that the dumping will not be delayed.

Conveyors should be lubricated regularly.

The pinching of the cans at the dump can be eliminated by dumping at right angles to the conveyor.

If the dumper must remove the lids, the incoming conveyor should be arranged so that he can easily travel around it.

There should be a conveyor control for the truck driver near the unloading platform.

Minimize cost of conveyor system by utilizing a single chain whenever possible.

If conveyor goes to the outside of the building, a method of locking the can washer must be provided. The doors should be easy to open and close.

Conveyor should be placed about 30 to 32 inches above the floor.

5. General receiving room

A truck door should be provided which can be either opened or closed by both the can and the truck to eliminate need for the trucker to get in and out of the truck at the loading and unloading platform.

The handling of two grades of milk should be considered when designing the receiving room.

A wash basin should be in the receiving room for the dumper.

The washing of ten-gallon cans from processing room which may have been used in other operations should be considered.

The total and unit costs of the operation should be used as a guide to equipment selection.

The receiving operations should be balanced with the processing operations.

The trucks bringing in the milk from the farms should not interfere with the milk route loading and return positions.

The receiving room should be planned so that it can be easily adapted to bulk handling.

If a storage tank is placed in the receiving room, a door should be provided with adequate size to move the tank through.

Adequate ventilation should be provided—a minimum of 300 cubic feet per minute of air movement for each can per minute capacity of the washer.

Window should be placed by the unloading platform so that the trucker can see into the receiving room.

The receiving room should be well-lighted—natural and artificial light.

SUMMARY

The use of time and motion study methods can improve the operations in practically every part of the dairy plant. In order for the saving in time to benefit the plant, the worker must be utilized in a productive operation during the time salvaged from the work improvement. Evaluate each operation in the entire plant on the basis of the time and motion principles presented. Everyone resists change. We must try to:

1. Combine operations.
2. Eliminate operations.
3. Simplify operations.
4. Change the sequence of operations.
5. Place tools close to work.

Often by following one or more of these items we can get the most out of dairy equipment.

REFERENCES


