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Processing Texas Broilers

TEXAS AGRICULTURAL EXPERIMENT STATION

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Summary and Conclusions

This bulletin reports some of the methods used to assemble and process Texas broilers and the equipment and labor used in the ten plants studied. Some of the factors responsible for variations in productivity are analyzed.

The method of purchasing broilers f.o.b. the processing plant with a 1 cent a pound price differential over the farm price eliminates many of the problems that exist when birds are purchased on the basis of farm weights. Such a system places the responsibility for delivery of the birds on the hauler and producer.

Although loading broilers during the day on trucks with built-on cages may be more productive than catching birds at night and and hauling them in wooden cages, processing practices and other factors rule out such a practice.

No great differences in labor requirements exist in the three methods used to receive live broilers that are to be slaughtered immediately. However, when birds are held and fed for short periods less labor is required to haul and hold them in wooden crates than to transfer and hold them in batteries.

The speed of the dressing and eviscerating line generally sets the pace for the entire processing operation. Removing pinfeathers from the carcasses accounts for the greatest portion of labor used in the dressing operation.

Some of the reasons for variation in labor efficiency are: more pinners than necessary, manual operation of supposedly automatic pickers, reversing the carcass more than necessary, not running the line as fast as the workers could handle the birds, variation in quality of different lots of birds, too low a scalding temperature or too short an immersion period in the scalder, poor agitation of the water, improper adjustment of pickers, birds varying in size or too few pickers. Some factors which processors reported might influence feather removal were the breeds and crosses of chickens processed, the moisture content of the body tissues and whether the birds were tired at the time of slaughter.

The following operating methods offer possibilities for increasing output rates:

(1) More carcasses can be eviscerated by pulling the crop and giblets loose than by cutting them. (2) More giblets can be wrapped in parchment paper than in paper bags. (3) Opening the bags by an air blowing machine increased productivity. (4) More giblets can be inserted in the body cavity, per man-hour, when carcasses are suspended on shackles rather than being on tables.

The fastest method of cutting up broiler carcasses is to cut off the wings while the carcass is suspended on the line and then cut up the remainder of the carcasses with a band saw.

Cover Picture

A modern poultry processing plant can process 24,000 chickens in an 8-hour day. Five chickens can now be processed with the same amount of labor it formerly took to process one.

Processing Texas Broilers

G. J. MOUNTNEY AND F. A. GARDNER*

BROILER PRODUCTION IN THE UNITED STATES increased more than 212 percent during 1945-55. Production in Texas increased 475 percent during this period. The sale of broilers added $58,928,000 to the Texas farm income in 1955.

Rapid changes in poultry processing methods after the second World War have created many problems for processors and caused wide variations in output, methods, equipment and labor requirements among the plants.

The phenomenal growth of the broiler industry encouraged processors to increase plant facilities. The development of new equipment has made old machinery and buildings obsolete. While new machinery reduced labor requirements, hourly wage rates increased. Consumers demanded more marketing services and better poultry. Some plants had to be remodeled to meet the sanitation standards of the United States Department of Agriculture and Texas state and local ordinances. At the same time high building and equipment costs made it impractical for processors to discard machinery and remodel buildings every few years.

To keep operating costs at a minimum and to justify remodeling or building new plants, processors have had to insure a steady volume of broilers for their plants. This steady supply has been achieved by integration with one or more of the following: feed companies, financing agencies, haulers and producers. Some operators even grow their own broilers to augment the supply for their processing plants. Also, modern assembly methods have made it possible to haul broilers long distances without any loss in quality. Several broiler assembly patterns have developed.

Object of the Study

The objectives of this study were (1) to determine the methods used to procure Texas broilers, (2) to determine the efficiency of labor utilization in ten Texas broiler processing plants, as measured by the number of broilers processed per man-hour and (3) to determine the factors within the operations of these plants responsible for the differences in productivity per man-hour.

Method of Procedure

Ten broiler-processing plants located in the main broiler-producing areas of Texas were selected for this study on the basis of location, type of operation and the number of broilers processed per hour. The duties of each worker, his position in the plant and the speed of the line were recorded and were rechecked on each subsequent visit.

The overall processing operation was classified into four main sections:

Receiving included the period from the time the poultry was unloaded at the receiving platform until the birds were hung in the shackles. Feeding operations were included in this section.

Dressing included catching, hanging, killing, picking, pinning and other similar jobs but it did not include the point where the body cavity was opened or the shanks cut off.

Eviscerating included removing the viscera, head, neck and shanks and cleaning of the giblets. All jobs through insertion of the carcass in the chill vat for cooling were included in this section.

Packing included packaging and packing for shipment up to the time the carcasses were ready for storage or loaded for delivery. This section was subdivided into the following three operations: icepack; whole, cut-up; and parts, cut-up.

Each operation was subdivided into individual jobs. The duties of each worker determined his job classification. If a worker was assigned more than one job the percent of his time spent in each job was recorded. The number of workers used in each job are listed as man equivalents.

Productivity or the number of broilers processed per man-hour has been used as the unit of labor efficiency. This unit combines the speed of the line and the number of workers, which permits a comparison of two or more operations, even though they differ in size.

Six of the ten plants were under the supervision of the U. S. Department of Agriculture inspection services. Government inspectors were not included in the labor required for processing, but graders were included. It should be empha-

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sized that although some of the practices described in this bulletin may be desirable, the quality of workmanship may have been below that required by the USDA inspection service. It was not possible in this phase of the study to evaluate the quality of the finished product from each of the plants.

This basically is a descriptive study which indicates possible variations in efficiency for different handling methods. It was not possible at this time to conduct a detailed time and motion study which could be analyzed statistically.

Purchasing

There are three general methods of procuring broilers in Texas. Of the ten plants studied, two plants were supplied from flocks owned by the processing plant, another had a working agreement with the local feed dealer in which the processor controlled and purchased the dealer's entire supply, and the remaining plants, although they bid on the open market, usually purchased most of their broilers from a selected group of 10 to 15 haulers or feed dealers.

Four plants did some of their hauling, but usually processors depended on independent haulers or the feed company that financed the birds to deliver the broilers to the plant. Feed dealers usually acted as the clearing house for arrangements for selling and delivering the birds to the processor. The dealer's service man usually was present when the birds were loaded; he arranged for a catching crew; saw that the birds were handled properly and prevented the catchers from damaging equipment in the house. Few processors dealt directly with broiler growers.

Truckers received ½ to 2 cents a pound for hauling broilers. The price depended on the area and the distance hauled. Processors who did their hauling estimated their hauling costs at one-fourth to one-half cent per pound. Birds were purchased as far away as 175 miles from the plant, although 50 miles was the average distance. Buyers generally agreed to pay up to [illegible] percent for any loss in weight of the load of broilers; the hauler was expected to pay for any loss over that figure.

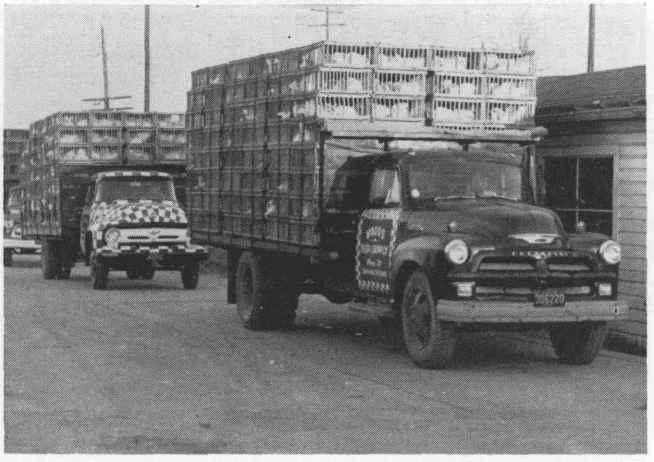


Figure 1. Bulk weighing of broilers is used almost exclusively in Texas. Here trucks are being weighed after loading at the farm.

Some processors paid for broilers on a delivered-to-the-plant basis. The paying price was determined by the weight of the birds when they were received at the plant. This eliminated the problems of who should take the shrink, how much the hauler should be paid and the responsibility for the birds during assembly. To compensate for hauling charges and loss in weight during transit, the paying price on such transactions was generally 1 cent a pound over the on-the-farm market price.

Bulk weighing of broilers is used almost exclusively in Texas, Figure 1. The truck loaded with empty crates is weighed at the public scale nearest the farm. After the birds are loaded, the truck is reweighed. With bulk weighing, only one or two cross rows of crates must be removed from the truck to load broilers.

Bulk weighing practices varied considerably. When loads were sold on the basis of a 4 percent maximum shrinkage during hauling, the loaded trucks were weighed at both the public scales nearest to the farm and at the public scales nearest the plant or at the plant. When the flocks were owned by the processing plant or the load was purchased on a delivered-to-the-plant quotation, the load was weighed at the plant only.

Birds usually were caught at night because they were easier to catch, struggled less, settled down in the coops faster and the weather was cooler. The loading schedule was arranged so that the birds arrived at the plant just before the morning work began.

Birds to be loaded were caught by a catching crew of four or five men who were paid a total of 8 to 10 dollars to catch 3,000 chickens. Before a house of birds was caught, all feeders, waterers and other equipment were moved to one corner of the house and the lights turned out or dimmed so the birds did not become excited. Two men caught broilers, four in each hand, Figure 4. Then the birds were handed to two other men in the catching crew who carried them to the truck outside the house; there the truck driver and a helper placed them in the coops and arranged them on the truck, Figure 5. The truck driver was responsible for seeing that the birds were properly crated and loaded and that they arrived at the plants on schedule and in good condition.

The labor required to catch and load a truck of broilers is shown in Table 1. The birds loaded by hauler A came from several small broiler houses on the same farm. To obtain a full truckload of broilers it was necessary for the truck and catching crew to move from one house to another. The moving reduced the overall efficiency of the catching and loading. Hauler E was able to handle 576 birds per hour because cages were built on the truck. All haulers except E loaded broilers at night.

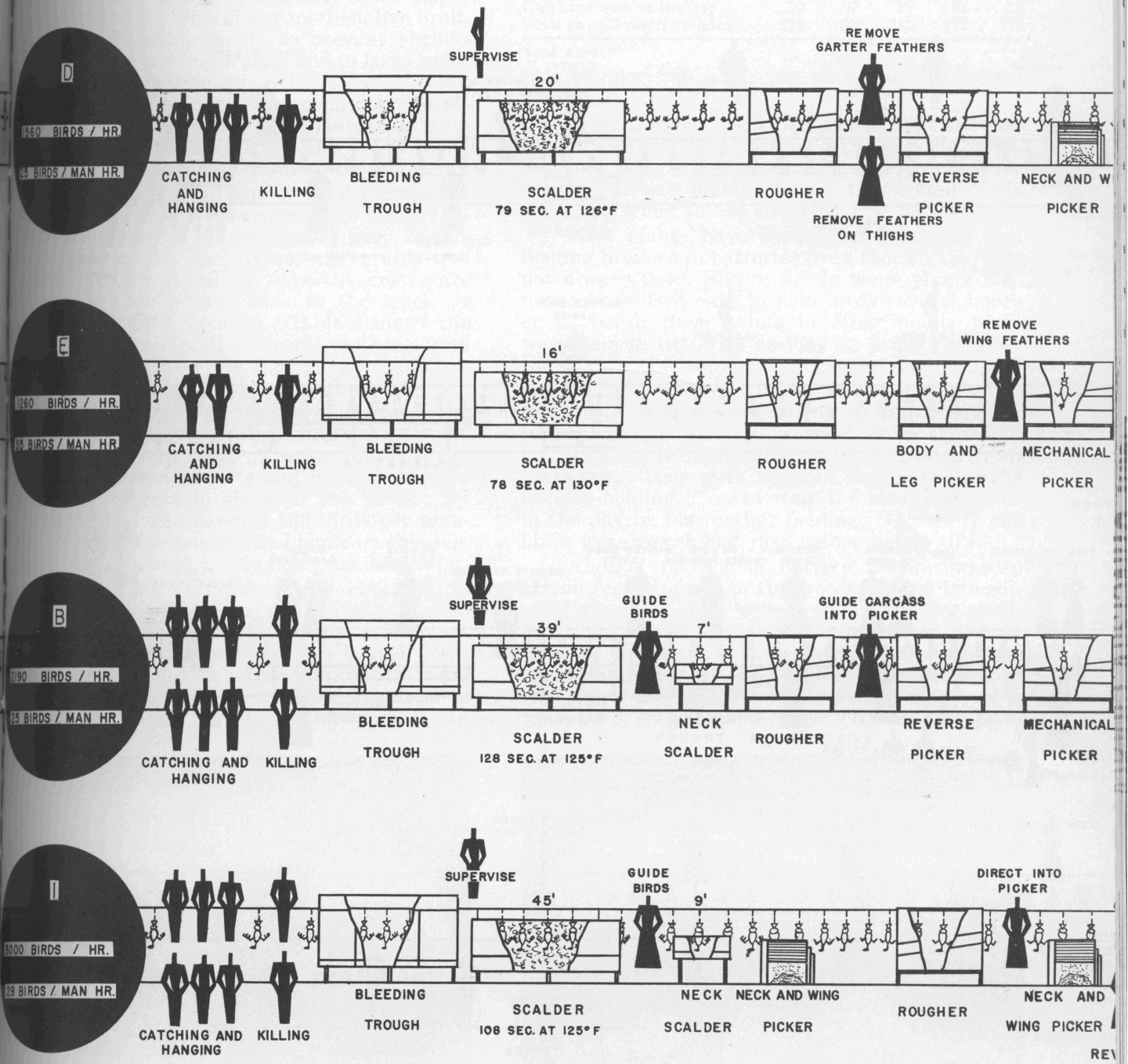
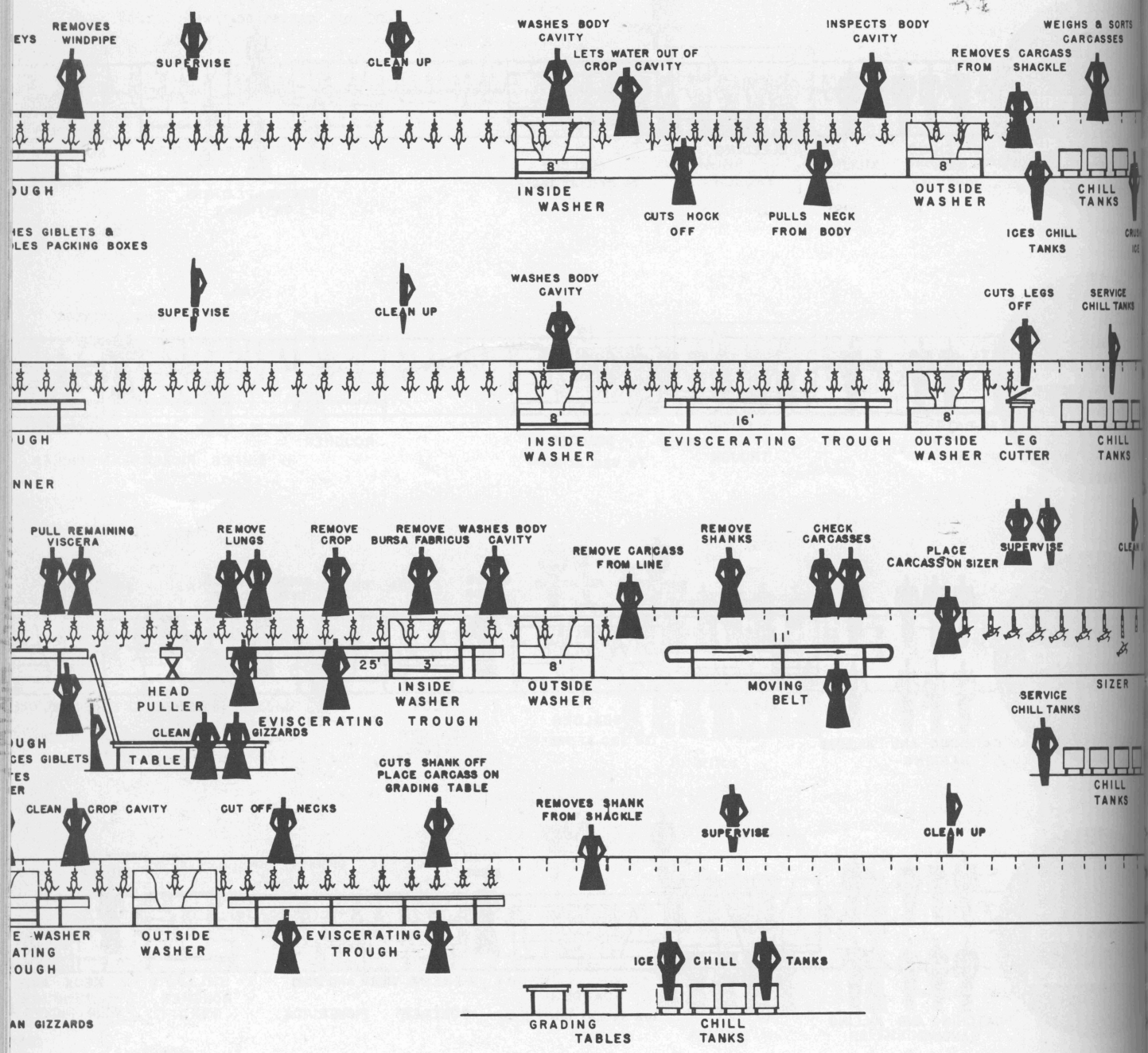
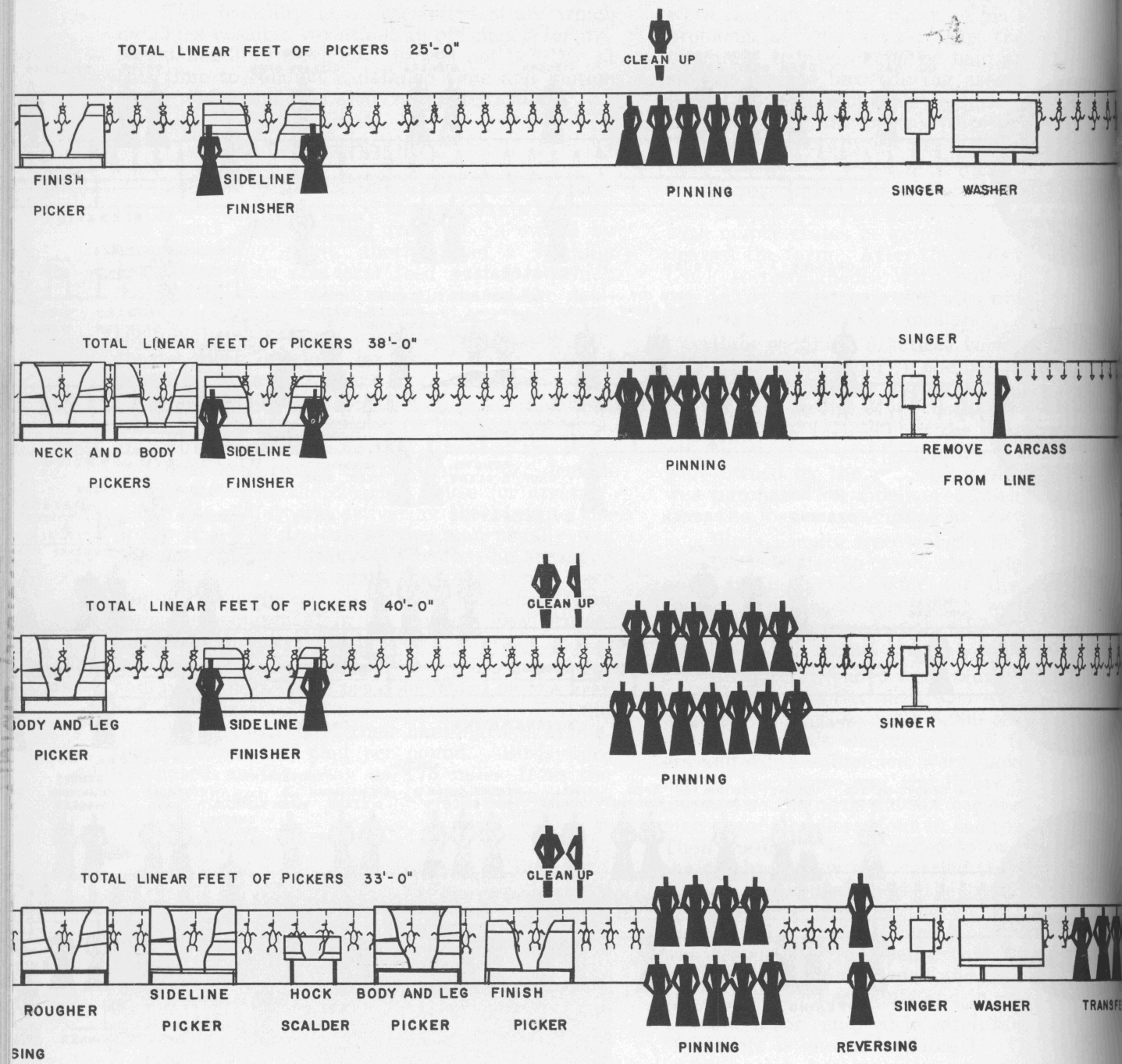


Figure 2. Poultry dressing time study and job description, selected plants.


REMOVES WINDPIPE
SUPERVISE
CLEAN UP
WASHES BODY CAVITY
LETS WATER OUT OF CROP CAVITY
INSPECTS BODY CAVITY
REMOVES CARCASS FROM SHACKLE
WEIGHS & SORTS CARCASSES
8'
INSIDE WASHER
CUTS HOCK OFF
PULLS NECK FROM BODY
OUTSIDE WASHER
CHILL TANKS
ICES CHILL TANKS
SUPERVISE
CLEAN UP
WASHES BODY CAVITY
CUTS LEGS OFF
SERVICE CHILL TANKS
8'
16'
8'
INSIDE WASHER
EVISCERATING TROUGH
OUTSIDE WASHER
LEG CUTTER
CHILL TANKS
PULL REMAINING VISCERA
REMOVE LUNGS
REMOVE CROP
REMOVE BURSA FABRICUS
WASHES BODY CAVITY
REMOVE CARCASS FROM LINE
REMOVE SHANKS
CHECK CARCASSES
PLACE CARCASS ON SIZER
SUPERVISE
11'
25'
3'
8'
HEAD PULLER
INSIDE WASHER
OUTSIDE WASHER
MOVING BELT
SIZER
CLEAN
GIZZARDS
EVISCERATING TROUGH
TABLE
SERVICE CHILL TANKS
CHILL TANKS
CUTS SHANK OFF PLACE CARCASS ON GRADING TABLE
CLEAN
CROP CAVITY
CUT OFF
NECKS
REMOVES SHANK FROM SHACKLE
SUPERVISE
CLEAN UP
OUTSIDE WASHER
EVISCERATING TROUGH
ICE
CHILL
TANKS
GRADING TABLES
CHILL TANKS


TOTAL LINEAR FEET OF PICKERS 25'-0"
CLEAN UP
FINISH PICKER
SIDELINE FINISHER
PINNING
SINGER
WASHER
TOTAL LINEAR FEET OF PICKERS 38'-0"
SINGER
NECK AND BODY PICKERS
SIDELINE FINISHER
PINNING
REMOVE CARCASS FROM LINE
TOTAL LINEAR FEET OF PICKERS 40'-0"
CLEAN UP
ODY AND LEG PICKER
SIDELINE FINISHER
PINNING
SINGER
TOTAL LINEAR FEET OF PICKERS 33'-0"
CLEAN UP
ROUGHER
SIDELINE PICKER
HOCK SCALDER
BODY AND LEG PICKER
FINISH PICKER
PINNING
REVERSING
SINGER
WASHER
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SING

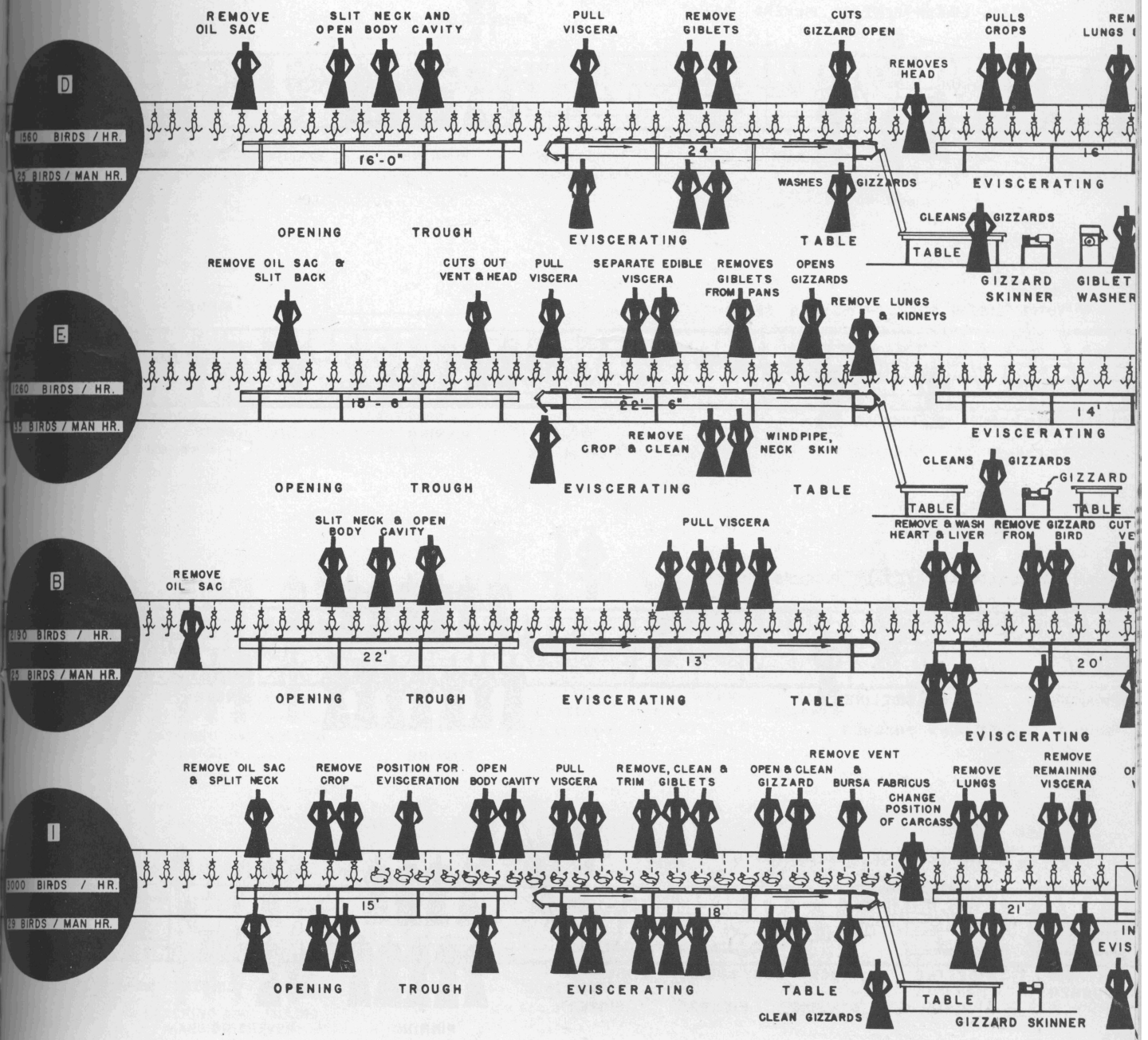

Figure 3. Poultry eviscerating time study and job description, selected plants.

Plant Receiving Operations

The two general methods used for receiving broilers in Texas processing plants are: (1) to unload and slaughter the birds immediately, commonly called "tail gating" and (2) to hold them for as long as 2 days in batteries. Most plants use both methods. With either method, live broilers must be handled quickly to prevent shrinkage, carefully to prevent bruises and in large units to reduce labor requirements. The time at which birds are slaughtered usually depends on the inventory of birds on hand at the plant, plant conditions, orders for dressed birds and the physical condition of the birds on arrival at the plant.

When birds are tail gated, loaded crates of broilers are moved off the trucks onto roller conveyors and pushed to the processing line. Several men remove the birds from the crates and shackle them for slaughter. As the crates are emptied, they are pushed back to the truck on roller conveyors and reloaded. Table 2 shows the relative efficiencies of the several methods used to handle broilers from the time they are unloaded from the trucks until they are shackled.

Two methods of removing broilers from the crate and shackling them were observed. At one plant two men were used. The first worker removed birds from the crate and handed them to the second worker who shackled the birds. By this method two men handled 333 birds per man-hour. When one person worked alone on this job, productivity increased to 424 birds per man-hour.

Several other variations were observed in plants in which birds were tail gated. In one plant the birds were hauled from farm to plant on trucks with built-in cages. The loaded truck drove alongside the dock where the broilers were removed and shackled. The labor required to load and unload the crates was eliminated. In this manner 365 birds per man-hour were handled.

TABLE 1. LABOR REQUIRED TO CATCH AND LOAD ONE TRUCK OF BROILERS

Item	Hauler				
	A	B	C	D	E
Number of broilers handled	2720	4100	3086	2918	1200
Number of men catching	5	5	5	4	5
Number of men crating	2	2	2	2	2
Catching time (minutes)	70	97	77	57	18
Birds caught per man-hour	333	363	343	512	576

Several plants were laid out so that the distances between the unloading docks and the dressing lines were too great for the use of roller conveyors. These plants hauled the crated birds from the truck to the dressing line on dollies.

Most plants have facilities for holding and feeding broilers in batteries even though they are not always used, Figure 6. In some plants batteries were used only to hold birds several hours or to weigh them, while in other plants birds were held in batteries as long as 3 days so they could gain the weight lost during hauling and to improve the quality of the carcasses.

Birds to be held more than a few hours before slaughter were transferred from crates to batteries immediately after being unloaded from the truck. They were weighed and moved to the battery-holding area to wait for slaughter later in the day or for further feeding. Generally the birds were reweighed just before being killed.

Another method of battery feeding was to attach feed troughs to the wooden coops immediately after the birds were brought into the plant. By using wooden crates the broilers could be bulk weighed on the truck immediately after they were loaded at the farm. When the birds arrived at the plant, the crates were unloaded, eight at a time, on a special hand truck with no additional

Figure 4. Two men carrying four broilers in each hand from the house to the truck. All catching is done at night.

Figure 5. The broilers are carried from the house and then handed to two men on the truck who put them in crates.

weighing, and moved from the truck to the holding area, Figure 7. Feed troughs were fastened on the crates within a few minutes after the chickens arrived at the plant. Because individual birds were not handled, there was less chance of the birds becoming injured or fatigued.

Both tail gating and battery holding have advantages and limitations. With tail gating, immediate slaughter reduces handling of the birds and crates and eliminates crate storage. Shrinkage is reduced because the chickens are handled rapidly. Birds are weighed only at the time of purchase. With the battery system, they must be weighed a second time just before slaughter to determine the weight gained or lost during the feeding period.

Some processors are of the opinion that holding and feeding birds in batteries for short periods before slaughter reduces shrinkage and improves the quality of the carcass by putting moisture back into the tissues. An inventory of live birds in batteries at the plant insures a large enough supply of birds for continual and uniform operation of the plant in case a scheduled truckload of birds is late or fails to arrive. With the battery method, broilers can be unloaded at night with less disturbance than during the day and the weather is cooler. When birds are tail gated they often must be held on the truck or loading dock without feed or water until they can be shackled, which may cause considerable shrink.

More labor and handling are necessary when batteries are used. Extra handling increases the chances of birds becoming bruised and, because they are held for several days, of the bruises darkening before the birds can be slaughtered. Operating capital is encumbered for several days while the birds are fed and there is always the danger of the birds going "off feed" and losing weight.

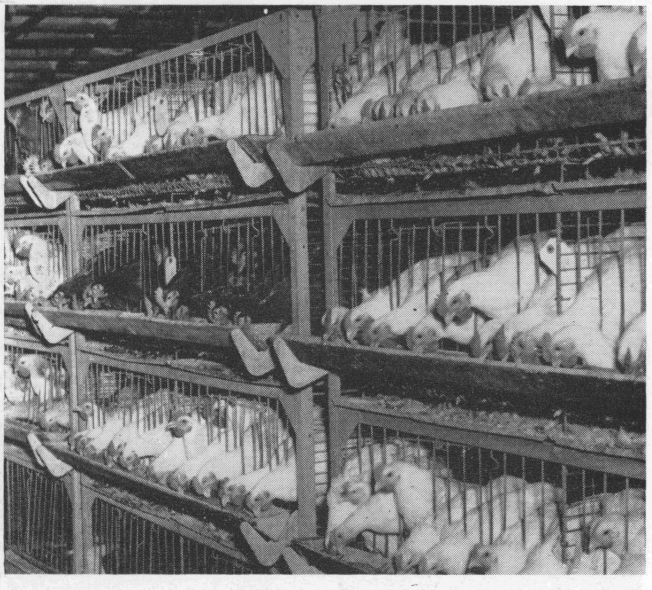

Figure 6. Most plants have facilities for holding and feeding broilers in batteries even though they are not always used. Here birds are being fed before slaughter.

TABLE 2. LABOR USED AT THE PLANT TO RECEI BROILERS BY VARIOUS METHODS[1]

Method of receiving, handling and delivering to the dressing line	Man equivalents required	Birds handled per hour	Birds handle per man-hou
Crated birds moved on a roller conveyor to the dressing line	7.0-9.0	2331-2968	333-42
Birds removed from cages built on the truck and shackled	6.0	2190	365
Crated birds moved on dollies to the dressing line	4.2	1500	357
Birds held and fed in batteries before being moved to the dressing line	16.0	2640	165
Birds held and fed in wooden crates before being moved to the dressing line	6.7	1562	233
Birds held but not fed in batteries before being moved to the dressing line	11.3	2633	233

[1]Includes unloading, reloading crates and shackling birds bu does not include weighing, cleaning or supervision.

Dressing Procedure

Broiler processing plants in Texas usuall operate within two ranges, 1,200 to 1,800 or 2,10 to 3,000 birds per hour. The speed at which th line operates sets the pace for the entire process ing operation. Labor requirements for the var ious plant operations are shown in Table 3. I general, plants processing more than 2,100 birds per hour are more efficient in labor utilization than plants operating at slower speeds. The labor and equipment used in typical Texas dressing operations are illustrated in Figure 2.

Processors have the problem as to the best method to use in killing birds. Four plants used electric stunners before bleeding the birds, the remaining plants only severed the jugular vein. Grease on the rollers of the overhead conveyors and failure of the birds to remain in contact with the electric plate often prevented all birds from being stunned. Instead, they were still struggling when they reached the killer.

All plants which operated at speeds of 2,100 birds per hour or faster used a neck scalder and two plants also used a hock scalder, Figure 8. Variations in labor efficiency were caused pri-

TABLE 3. LINE SPEED, MAN-HOURS REQUIRED TO DRESS, EVISCERATE AND ICEPACK 1,000 BROILERS, AND BROILERS PROCESSED PER MAN-HOUR IN 10 TEXAS PLANTS

Line speed per hour	Man-hours				Broilers per man-hour
	Dressing	Eviscerating	Icepacking	Total	
1,260	11.9	12.6	4.1	28.6	34.9
1,500	12.3	14.8	9.5	36.6	27.3
1,560	11.0	20.0	9.1	40.0	25.0
1,800	7.4	16.5	6.6	30.4	32.9
2,190	12.6	18.1	9.8	40.5	24.7
2,640	10.1	18.4	6.9	35.3	28.3
2,640	8.1	18.4	8.5	35.0	28.6
2,880	9.8	17.1	8.1	35.0	28.6
2,970	8.8	20.3	9.6	38.7	25.8
3,000	10.1	16.5	7.8	34.5	29.0

marily by using more pinners than necessary, manual operation of supposedly automatic pickers, reversing the carcass too many times and possibly running the line too slow.

Removing pinfeathers from carcasses accounted for 30 to 37 percent of the labor used in the dressing operation. Poorly feathered birds were processed by using extra labor and pinning the carcasses by hand or by letting the birds go into a lower grade. Too low a scalding temperature, too short an immersion time in the scalding vat, or poor agitation of the water also made it difficult for pickers to remove the feathers. Some of the plants operated efficiently without manually operated pickers which indicates that such picking machinery might be eliminated in other plants. Improper adjustment of pickers, birds varying in size or too few picking machines also increased the work required to remove pinfeathers from the carcasses. Processors reported that the breeds and crosses of broiler chickens processed, the moisture content of the body tissues and whether the birds were tired at the time of slaughter also might influence feather removal.

Most plants had guide bars on the machines to save labor, but in several plants workers had to guide carcasses into scalders or pickers. Reversing the carcass too many times and running the line at slow speeds also caused unnecessary labor costs.

In plants operating at speeds above 2,100 birds per hour, one man supervised the dressing operation; in plants operating below this speed the supervisors divided their time between the dressing and eviscerating operations.

Four plants had separate dressing and eviscerating lines; the other plants used the same conveyor for both operations. Plants with separate lines required one to three workers to change carcasses from one line to the other.

Eviscerating Procedure

Carcasses to be eviscerated came from the dressing line hanging by the feet. Usually they were eviscerated as follows: the oil sac was removed, the neck slit, the crop removed, the body cavity opened, the viscera removed, the giblets cleaned, the carcass washed, graded and thrown into the chill tank. The labor and equipment used in typical evisceration operations are shown in Figure 3.

Generally viscera were removed through a slit in the abdomen. In one plant, Plant E, the carcasses were slit down the back and giblets removed through this opening. The latter method made it easier to remove the viscera and inspect the body cavity, but had other disadvantages such as appearance and ease of packaging. Although some methods may be more efficient than others, the quality of the product also must be considered.

Several methods of removing viscera were observed. In plants where the crop was pulled

Figure 7. One way to reduce labor in handling live birds is to use wooden coops for batteries. Birds are being unloaded for feeding prior to slaughter. Wooden feed troughs will be attached to the crates.

loose from the carcass, 520 to 750 crops were removed per man-hour; in plants where crops were cut loose, 480 to 730 were removed per man-hour.

It was possible to tear the heart and liver from 700 to 900 broilers per man-hour, but only 440 to 780 could be cut loose. One worker could remove the lungs from 660 to 1,200 birds per hour with a Lynn lung remover or from 1,260 birds with a vacuum lung remover, Figure 9.

Automatic head pullers were used to remove the head in five plants, the heads were cut or pulled off by hand in four plants and in the plant where carcasses were slit down the back the heads were pulled off by picking machines. With the latter method of evisceration, it was not necessary to leave the heads on during the eviscera-

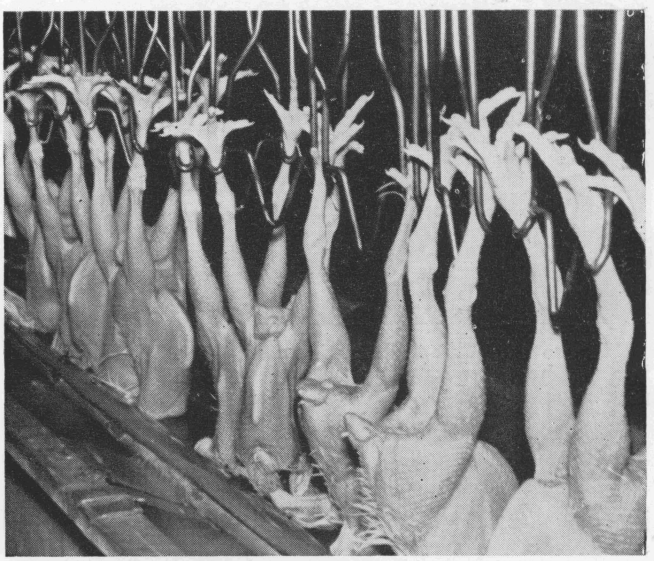

Figure 8. All plants in this study which operated at speeds of 2,100 birds per hour or faster used a neck scalder.

Figure 9. Lungs can be removed from 660 to 1,200 birds per hour with a Lynn lung remover.

tion process because the carcasses were not held in the shackles by the head at any time.

Shanks were removed from the carcass at any convenient point on the line. Generally, the individual removing the shanks also performed some other task. In two plants the shanks were removed when the carcass was transferred from the dressing to the eviscerating line.

Figure 10. Three plants inserted the wrapped giblets into the body cavity of the carcass while it was still suspended on the shackle.

In five plants the shanks were cut off with a power saw, and in the remaining plants with pruning shears. When the shanks were cut with pruning shears, 1,320 to 3,120 broilers per man-hour could be handled, when cut with a power saw 1,500 to 4,400.

Packing and Packaging

Processed Texas broilers are delivered to the consumer whole and icepacked, cut-up with the whole carcass placed in a container, or as individual parts such as breasts, thighs or wings. All plants sold broilers whole and icepacked, three plants sold whole-cut-up broilers and four plants produced a parts-cut-up package.

Whole broilers, surrounded by crushed ice, were delivered in wooden paper-lined boxes. One plant used re-usable aluminum boxes which eliminated the job of box assembly and simplified the closing and sealing of the boxes. By using aluminum boxes one worker was able to icepack 245 broilers per man-hour as compared with 102 to 152 when the wooden boxes were used.

Three variations were observed in the methods used to wrap giblets. In four plants giblets were wrapped in paper bags which were opened by an air-blowing machine. By this method 490 to 628 giblets were wrapped per man-hour. When the bags were opened by hand, only 288 to 383 giblets could be handled. When giblets were wrapped in parchment paper, 449 to 701 sets per man-hour could be handled.

Three plants inserted the wrapped giblets into the body cavity of the carcass while it was still suspended on the shackle, Figure 10. By this method 1,220 to 2,880 sets of giblets were packed. When the packing was done on a table after the carcasses were removed from the chill vat, 764 to 1,440 sets of giblets were packed per man-hour. In one plant, where broilers were packed in aluminum boxes, 40 sets of giblets were wrapped in one package and packed with the broilers.

Labor required to cut up carcasses was 115, 260 and 33 birds per man-hour, respectively. In the first plant the drumsticks, thighs and wings were cut off with a knife while the carcass was still on the drain line. In the third plant only the wings were removed with a knife; the rest of the carcass was removed with a band saw.

Acknowledgment

The authors wish to acknowledge the cooperation of the processing plants in which these studies were made.