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Plant Layouts, Collection and Selling of Edible Meat By-Products

F. J. BOWATER
FJB Systems, UK

and

MARK A. CUSTAFSON
US Meat Export Federation, Denver, Colorado, USA

I. INTRODUCTION

Before becoming involved in any aspects of marketing by-products, it is important to define the product and have some understanding of processing techniques together with the economic effects that edible meat by-products have on the viability of meat production and processing as businesses, and thus, their importance.

II. TYPES OF OFFALS

Table 16-1 gives a broad list of offals recovered from large and small stock carcasses and shows a split between edible and inedible categories. Offals can be generally defined as those parts of the carcass which are disassembled on the dressing floor, and which form no part of the carcass when it is finally weighed and transferred to the chillers to undergo cooling. However, when the meat plant is also involved in further processing, any other waste material not used in the process, and which is passed onto the rendering department, can also be classed as an offal. It can be seen from Table 16-1 that most of the other material is removed at the boning stage as trimmings, fat and bones. It will also be observed

TABLE 16–1

BY–PRODUCTS USUALLY RECOVERED FROM CARCASSES AND THEIR POINTS OF REMOVAL

Type	*Removal point*	*Type*	*Removal point*
Liver	Dressing floor	Tallow[a]	Dressing floor and boning room
Tripes	Dressing floor		
Brains	Dressing floor		
Tail	Dressing floor	Lungs	Dressing floor
Tail-end	Dressing floor	Gullets	Dressine floor
Feet	Dressing floor	Gelatin bone[a]	Dressing floor and boning room
Kidney	Dressing floor		
Testicles	Dressing floor		
Heart	Dressing floor	Casings	Dressing floor
Spleens	Dressing floor	Horns/hoof	Dressing floor
Head meat	Dressing floor	Hides/pelts	Dressing floor
Fat	Dressing floor	Tallow[a]	Dressing floor and boning room
Tongues	Dressing floor		
Glands	Dressing floor	Meat and bone-meal[a]	Boning room
Casings	Dressing floor		
Blood[a]	Dressing floor	Blood[a]	Killing area

[a] Utilized for rendering to produce either edible or inedible products as indicated.

that certain fats from the kill floor, together with bones from the boning room, can be turned into edible tallow. Blood specially collected from the kill floor can also be turned into edible products like black pudding and protein supplements. The collection and utilization of blood and blood protein are discussed in greater detail in Chapters 5, 6 and 7.

Offals are also often classified by the industry as green and red, depending on their origin. Although there is not complete agreement on the definition of the terms red and green offals, for this discussion green offals will be defined as those derived from the digestive tract or those being in contact with the feed or grass, hence the term green. Red offals are those that do not come in contact with the contents of the digestive tract, so they are called red in contrast to the green (grass) offals. Using this classification system the tripe and casings would be called green offals, whereas the liver, kidneys, tongue, spleen, glands and heart would be classified as red offals.

III. BACKGROUND

Before the advent of commercial refrigeration, animals were killed in sparsely populated areas to obtain certain edible or inedible offals only, such as skins, wool, tallow and dried meat. The meat and edible offals not utilized were generally thrown away. The advent of reliable refrigeration systems in the latter part of the nineteenth century transformed the meat industry into large commercial plants that slaughtered the livestock that began to be reared in large quantities in the sparsely populated southern hemisphere and midwest of America. The meat was shipped in large quantities to the densely populated northern hemispheres. It was only from that period that edible offals became an important part of the meat industry.

IV. PLANT LAYOUTS

Slaughter plants from which edible by-products are derived are generally either small local plants or large export plants. Each of these types of plant will be discussed. Both types of plant involve essentially the same kind of operations, i.e. slaughtering and disassembly to produce the carcass and the edible and inedible by-products.

Stunning and bleeding of the animal takes place on the slaughter floor, after which the edible and inedible by-products are removed during dressing and evisceration (Table 16-1), and the carcass and its division into wholesale and retail cuts produces fat and bone. These products may be either edible or inedible, depending upon the carefulness of, the operations, thus providing additional usable by-products.

A. Small Plants

Small plants account for the slaughter of only a limited number of animals in each and use more hand labour than is the case in large plants, where each worker usually performs only specific specialized tasks. Thus, the throughput of small plants as arbitrarily defined herein will be those killing less than 100 head of cattle or less than 200 head of hogs or sheep per 8-h shift. However, many small plants slaughter less than 25 cattle

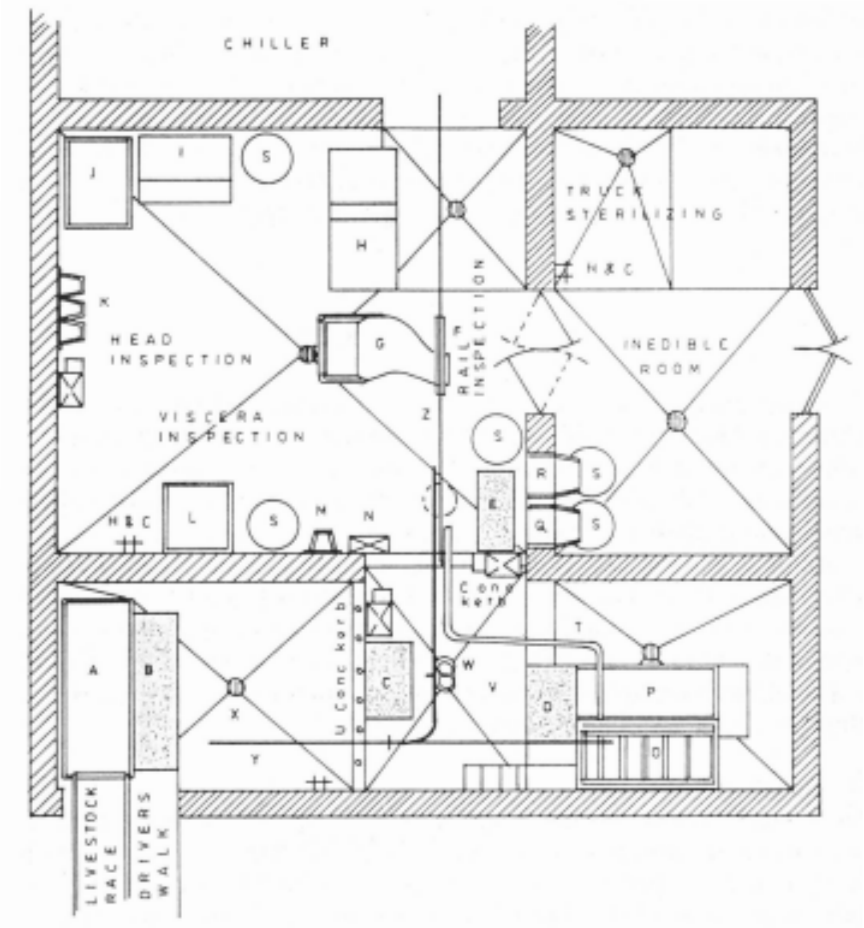

Fig. 16-1. Small slaughter plant layout using a sterilized portable trolley system. Estimated capacity: 5 cattle/h; 5 skinned hogs/h; 10 dehaired hogs/h. Legend for equipment: A, Stunning pen; B, stunner's platform mounted on gate; C, sticker's platform; D, turn-around; E, elevating platform; F, drop rail section; G, viscera truck; H, two-level platform; I, head work-up table; J, offal truck; K, head rack; L, head flush booth; M, horn saw rack; N, saw strerilizer; O, scalding tub for pigs; P, dehairing machine; Q, feet chute: R, udder, pizzle, pig bag chute; S, inedibles drum; T, monorail with budget hoist; U, pipe safety fence; V, bleeding area; W, blood and water drain; X, dry landing area; Y, bleeding rail-height 16'-0"; and Z, dressing rail-height 11'-0"

and 100 hogs or sheep per 8-h day. The low level of throughput makes it virtually impossible for small slaughterers to accumulate enough edible meat byproducts to enter the export market. Thus, the small slaughter plants provide edible offals to the domestic markets and are seldom, if ever, involved in major export activities.

Figure 16-1 shows a small slaughter plant layout with a capacity of 5 head of cattle per hour, utilizing a portable trolley system for evisceration. The same plant can be adapted for hog slaughter and has a capacity of 5 head/hour if skinned, or 10 head/hour if dehaired. The plant utilizes a portable offal truck, which is shown in Fig. 16-2, thus eliminating the

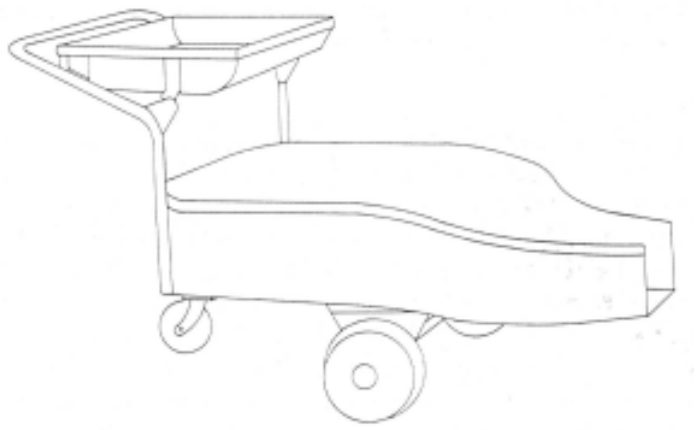

Fig. 16-2. Viscera truck for small plants that can be easily sterilized betweem usage.

more complicated eviscerating system. The viscera are inspected in the truck and then conveyed to the chiller (edible offals). The inedible offals, after cleaning, are usually shipped out direct to a rendering plant. The viscera truck is then sterilized before being used again. Although the plant is small and has a low throughput, it complies to the requirements of both USDA and the EEC. However, it is doubtful if the small plant system described is large enough to invest in high-quality offal processing for export.

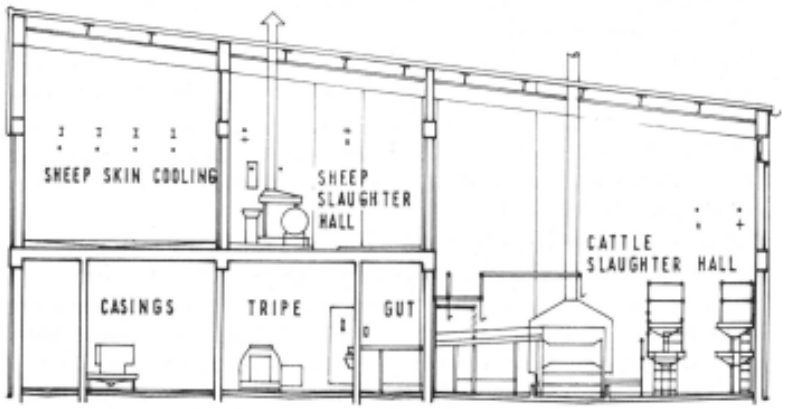

Fig. 16-3. Plant layout for multi-species with spilt-level design showing offal processing area.

B.Large Plants

Figure 16-3 shows a plant layout that is capable of slaughtering and processing the offals from both cattle and sheep. In this layout, sheep are slaughtered on one side of the plant on the top floor, where less headroom is required, and the offals are processed on the ground floor after being conveyed down chutes by gravity. The beef are processed on the other side of the plant at ground floor level but running adjacent to the sheep line. The facility is relatively cheap to build, since the offal processing area and the slaughter floor have a common wall and a light-structured ground floor building is used. The beef offals are then conveyed directly to the offal (ground) room and processed accordingly. The capacity of this type of layout can be small or medium sized, depending upon the length of the building and process chains.

Figure 16-4 shows a typical beef line with a capacity of 350 head of cattle per 8-h shift. By adding a second shift the capacity can be increased to 700 head/day. A similar system for slaughtering of sheep and processing of offals is presented in Fig. 16-5, showing the floor plan and the points at which the offals are removed. Figure 16-6 depicts a floor plan showing separate areas for handling offals from the slaughter operation. In this plan, a specialized area is used for processing green offals (gut, tripe and casings) while a separate area is utilized for the preparation of red offals and head meat trimmings. Still another area is available for the assembly and packaging of edible offals.

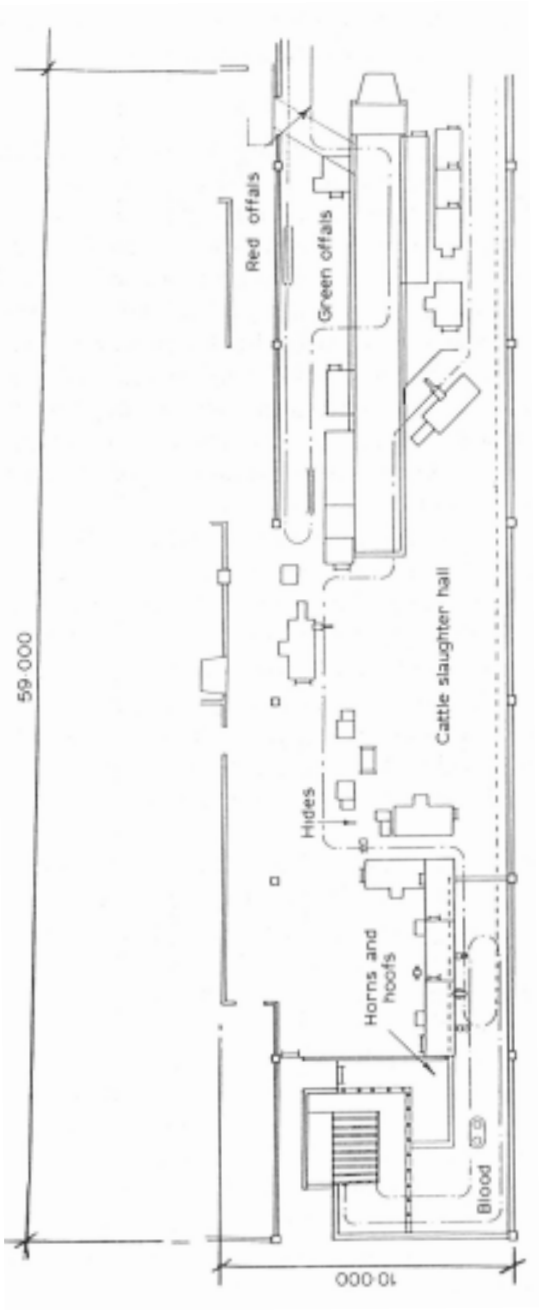

Fig. 16-4. Beef dressing layout showing offal removal points. Capacity: 350 head/8-h shift.

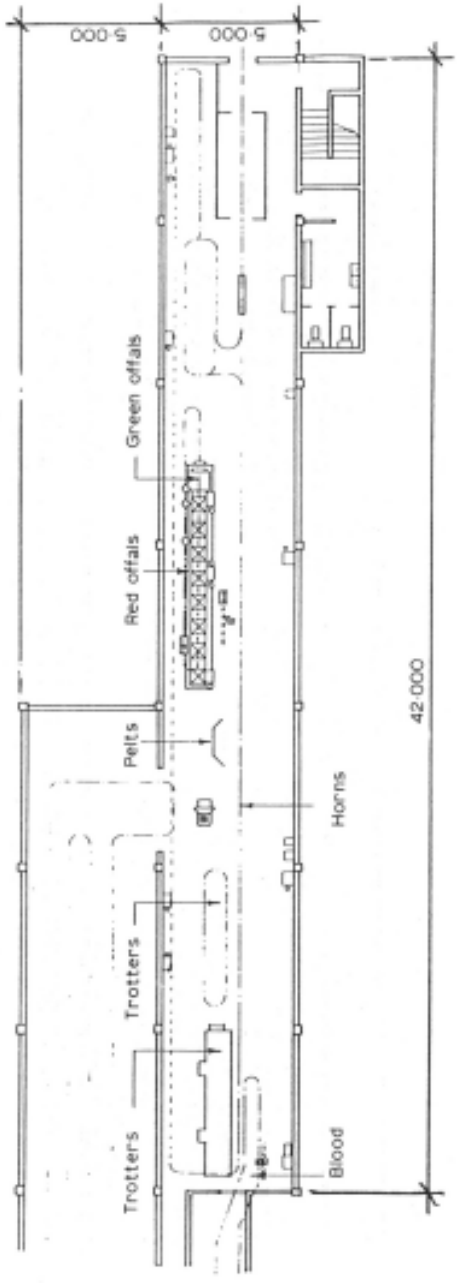

Fig. 16-5. High-speed mutton or lamb slaughter chain showing areas where offals are removed and processed.

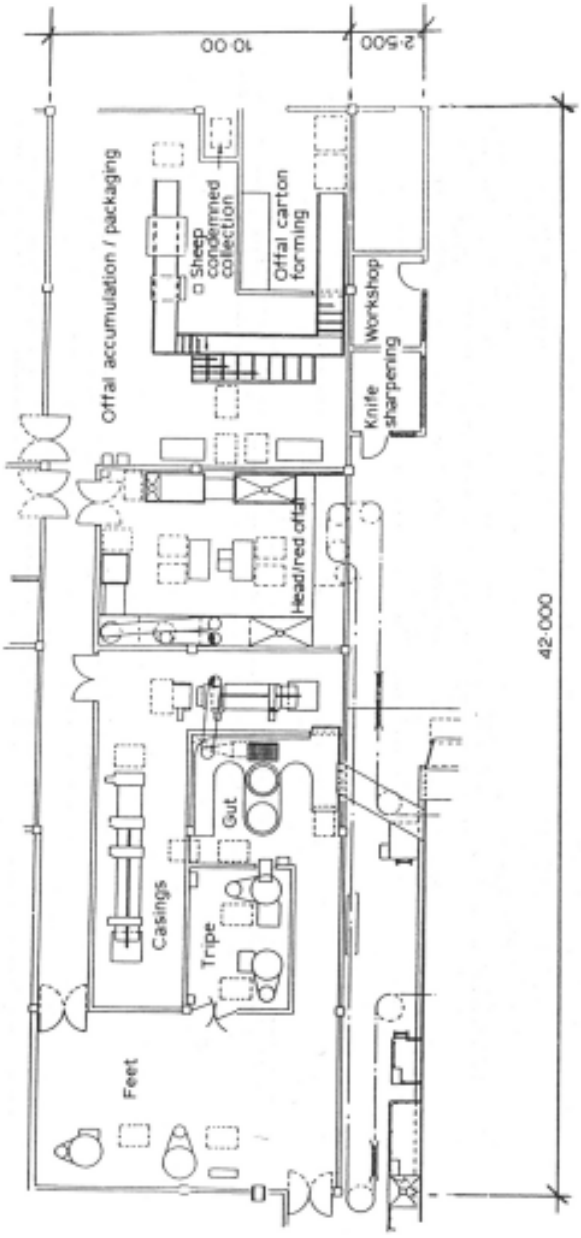

Fig. 16-6. Red and green offal processing plant layout.

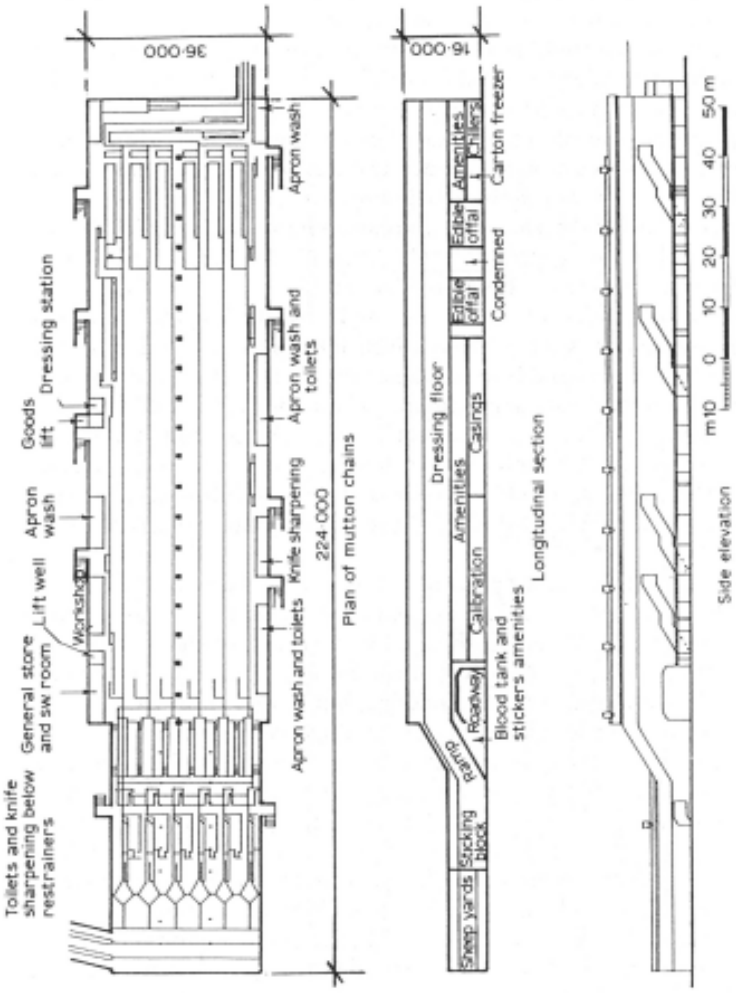

Fig. 16-7. Mutton or lamb slaughter house. (Top) Plan of slaughtering chains; (center) longitudinal cross-section; (bottom) side elevations.

Figure 16-7 shows a layout for the slaughtering of lamb and/or mutton. It shows an overview of the slaughter floor with the plan for six mutton chains. It also presents a longitudinal cross-sectional view, which shows where the offals are processed on the lower level, as well as a side elevation. Plants of this size can accumulate enough edible offals to make the export markets attractive to them.

After bleeding, the hides, pelts, heads, horns and feet are removed while the carcass is passing along the overhead conveyorized rail system.

Evisceration and removal of the red and green offals is the most important and complicated part of offal handling. EEC and USDA requirements specify that the head, edible offals and carcass be identified until the carcass is split and all parts are inspected and passed. The entire process of identity until inspection is completed, is commonly referred to as correlation of the respective parts with the carcass. As mentioned in Chapter 8, the production of edible blood involves a specially designed collection system so that the blood of condemned animals does not get mixed with 'inspected blood'. The determination as to whether the blood is passed as edible is made at this inspection point.

As shown in Fig. 16-4, the red and green offals are placed on a moving conveyor belt upon their removal from the carcass. The green and red offals are then processed in separate areas to avoid contamination.

For plants involved in the business of export, the red offals are conveyed to preparation tables where they are trimmed and re-examined and/or graded by weight and appearance as discussed in Chapter 17. The red offals are then conveyed to the packaging and cartoning area, after which they are frozen or chilled and distributed. The demands for fresh and/or frozen edible by-products are discussed in Chapter 15.

Municipal abattoirs, on the other hand, usually keep the red offals hanging together on special hooks which form part of a trolley system, unless the market demand is for unchilled products. In this case, the offals are conveyed to the sales dispatch area where they are united with their corresponding carcass. If the product is to be chilled, as is the normal practice in municipal abattoirs, the trolleys are placed in specially designed chillers. After chilling, the offals are transferred to a chilled sales dispatch area where they are united with the corresponding carcass

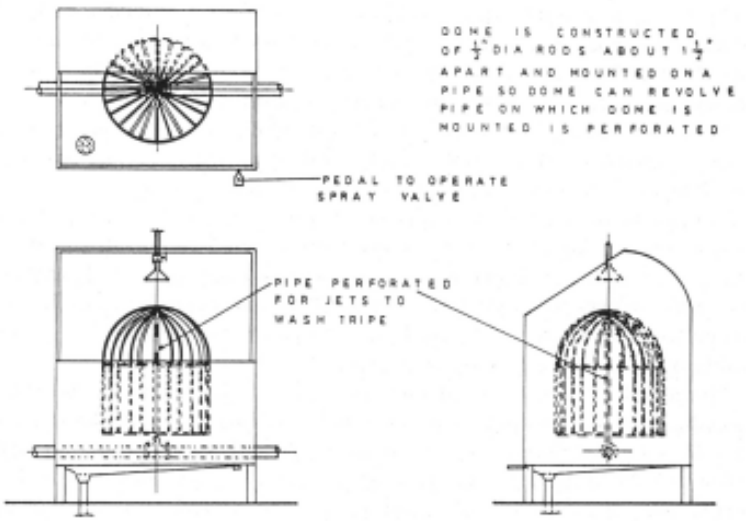

Fig. 16-8. Cattle tripe washing facilities showing some details of construction.

to await collection.

The green offals have a separate processing area. The paunch and gut of each carcass is broken down, the paunch material being blow-conveyed to waste while the beef tripe is usually carefully cleaned on an umbrella system prior to centrifuging, which turns it into an edible product (Fig. 16-8). Sheep and pig tripes are often sent to rendering, but if a market exists they are saved, centrifuged, packed into cartons and frozen.

The intestines are removed from the stomachs and then cleaned by specially designed machinery before being salted and packed for transfer to a casings factory for the production of a variety of finished products. Depending upon market requirements, the casings factory, which could be an adjunct onto the meat works, could produce casings for sausages, sutures (surgical gut required by the medical profession), or tennis and squash strings. The mucosa (the material squeezed out of the gut during cleaning) is used in the pharmaceutical industry to produce heparin for the prevention of blood coagulation. For details on the production of edible casings, see Chapter 11.

Sheep and cattle feet, depending on market conditions, are either sent for rendering or scalded and centrifuged for separate sale. Hides and pelts are usually washed and salted prior to dispatch to a tanning factory. Again, large meat works often have their own tannery. Cattle hides are

used for shoe leather, whereas sheep pelts are used for clothing, etc.

Figure 16-8 shows a design for a cattle tripe washing facility. Although some modern large-scale plants do not utilize this type of tripe washing facility, it is still quite common in export plants in the US and other offal exporting countries.

Figure 16-9 shows a large modern US plant beef slaughter layout for high-speed processing of edible beef offals, which has been approved both by USDA and the EEC. The plant shown in this diagram has a slaughter capacity of 2500 head of cattle per 8-h shift or 5000 head/day in two 8-h shifts. Identification of the edible offals, the head and carcass are maintained even at this rate of processing, although correlation does not take place on the slaughter floor. The plan does not show the coolers and/or freezers. Plants of this capacity have high enough throughput to produce large enough quantities of all edible offals to be highly competitive on the export market. It is interesting to note that a different type washing system is used for tripe, which is then trimmed and scalded before going to packaging.

C. Location of Offal Processing

In designing modern slaughter plants, the location of the offal department has a fundamental effect on the economy of building and efficiency of operation. The conventional approach is to provide a two-story layout, whereby disposal of the offals on the carcass dressing floor above is by gravity and chutes (Fig. 16-7). Gravity chutes for offal transport are not currently in favor because of problems in cleaning and maintaining good sanitation. Furthermore, two-story buildings are expensive. Two alternate solutions are shown in Figs 16-3 and 16-10.

In Fig. 16-3, which was discussed earlier, a single-story building for beef slaughter is relatively low in cost, with offal processing being on the ground level below a small species (sheep or pig) slaughter floor. The offal from the small species is conveyed to offal processing by gravity chutes after correlation inspection is complete. Beef offals can then be conveyed to offal processing on the ground floor. The system works well for one or more small species lines but only accommodates one beef system. Both inspected and passed offals and condemned offals are easily

handled.

Figure 16-10 shows a multi-species plant department layout, including all of the needed facilities, including animal holding (lairage). Offal handling and processing takes place in the abattoir area as shown in the other plant designs. The offal departments are located between dressing lines so that the offals can be easily transferred with either chutes or trucks by designing the evisceration conveyor to run alongside the common wall.

D. By-product Rendering

The by-product rendering plant in a meat works is used for the processing of the edible fats and inedible waste from which dried blood, tallow (both edible and inedible) and animal feed is obtainable. Initially, this process was carried out by cooking the waste products in large vertical vessels by injecting live steam. This system is now superseded by dry-rendering and low-temperature systems. The most commonly used system is the dry-rendering process shown in Fig. 16-1l. Waste material is broken up and then stored in a holding hopper and the material is then conveyed in this case to one of three dry renderers, which consist of steam-heated vessels with rotating agitators. The waste material is broken down and discharged as liquid tallow and solids. The solids are centrifuged and milled for protein feeds.

If the market dictates a substantially higher price for edible tallow, usually the rendering section is divided in two, where the special kill floor fats are broken down together with boning room bones. The tallow produced is kept separate from the inedible process and the solid material then joins a common fertilizer/stock feed inedible department.

A better quality product can be obtained by the use of low-temperature Systems as shown in Fig. 16-12. Production of edible tallow and fat is discussed in greater detail in Chapter 12.

The waste material including bones, etc., is ground down to a fine paste and passed to a conditioning vessel. The fluid is then passed to a horizontal centrifuge, where the solids are removed and then dried for stock feed, while the liquid material passes to vertical centrifuges where water is removed and the final tallow is taken off. Due to the low-temperature process the tallow is of high grade, light color and low in

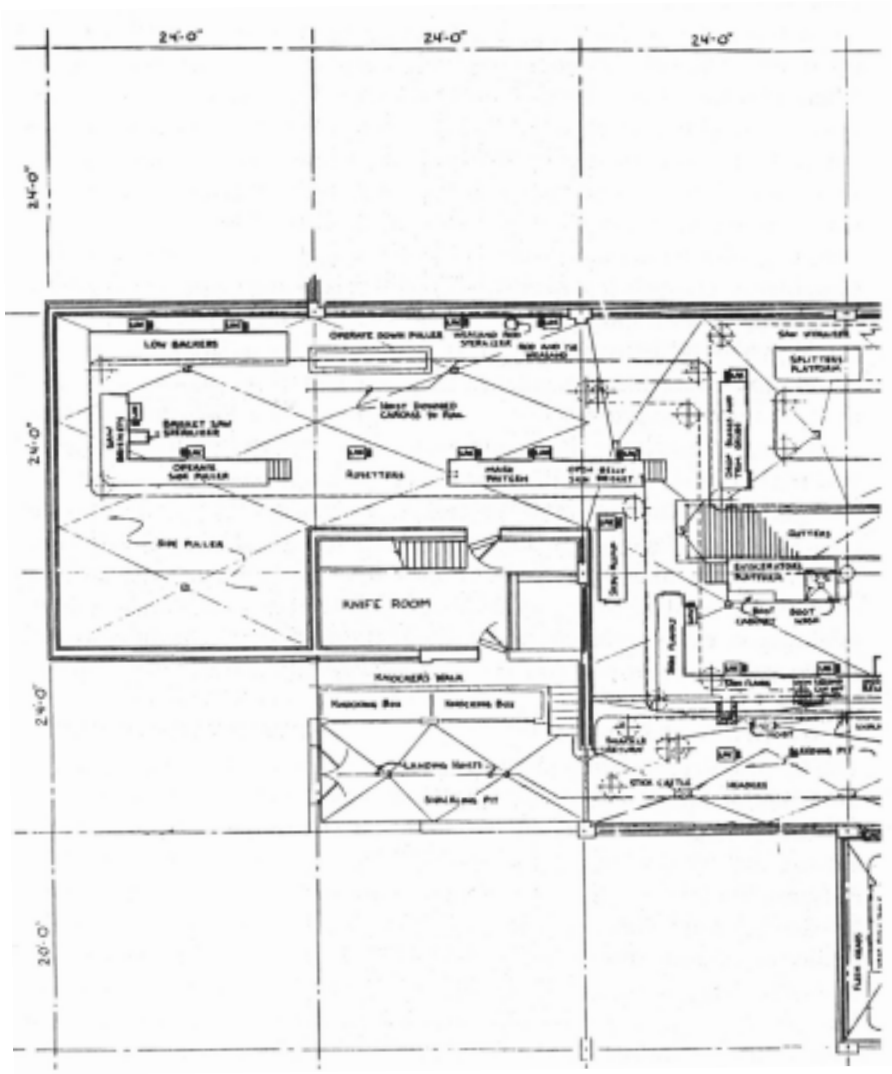

Fig. 16-9a. Large-scale beef slaughter plant showing locations of offal removal and processing. Slaughter capacity of 2500 head/8-h shift.

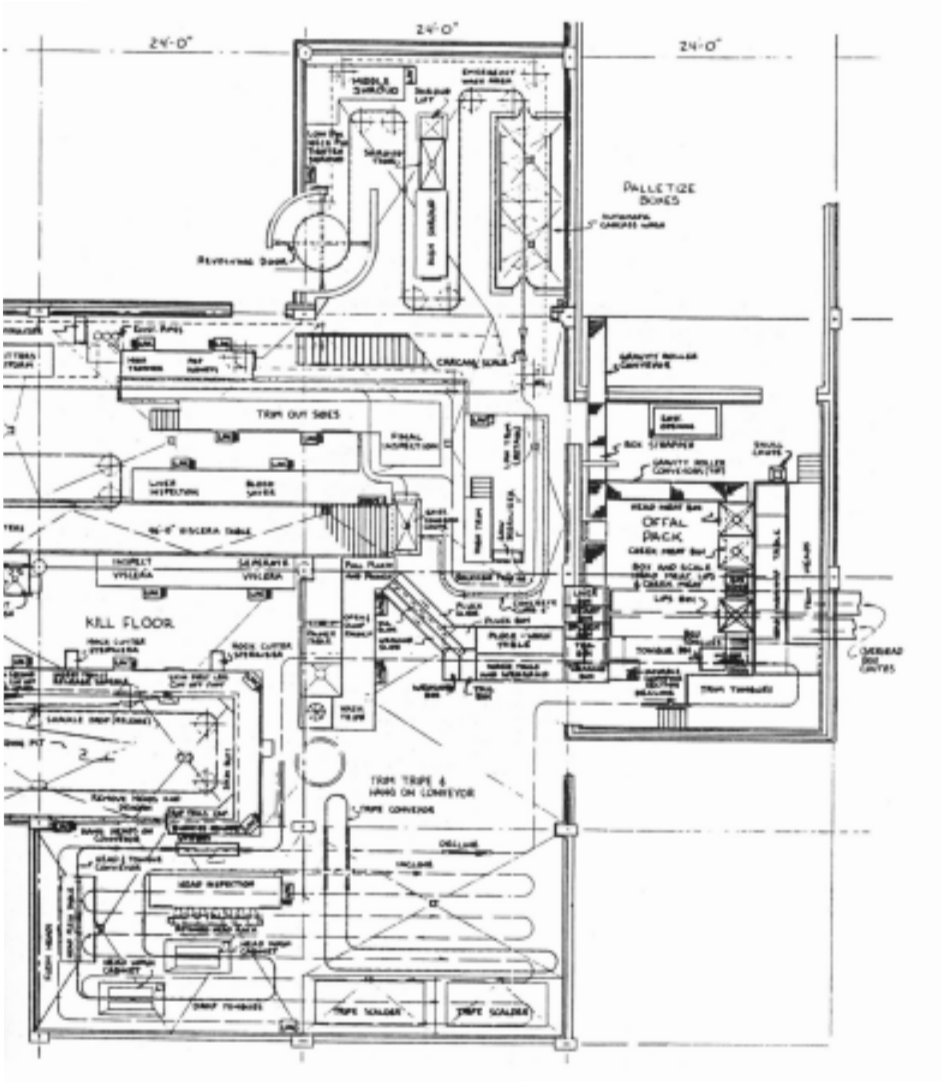

Fig. 16-9b. Large-scale beef slaughter plant showing locations of offal removal and processing. Slaughter capacity of 2500 head/8-h shift.

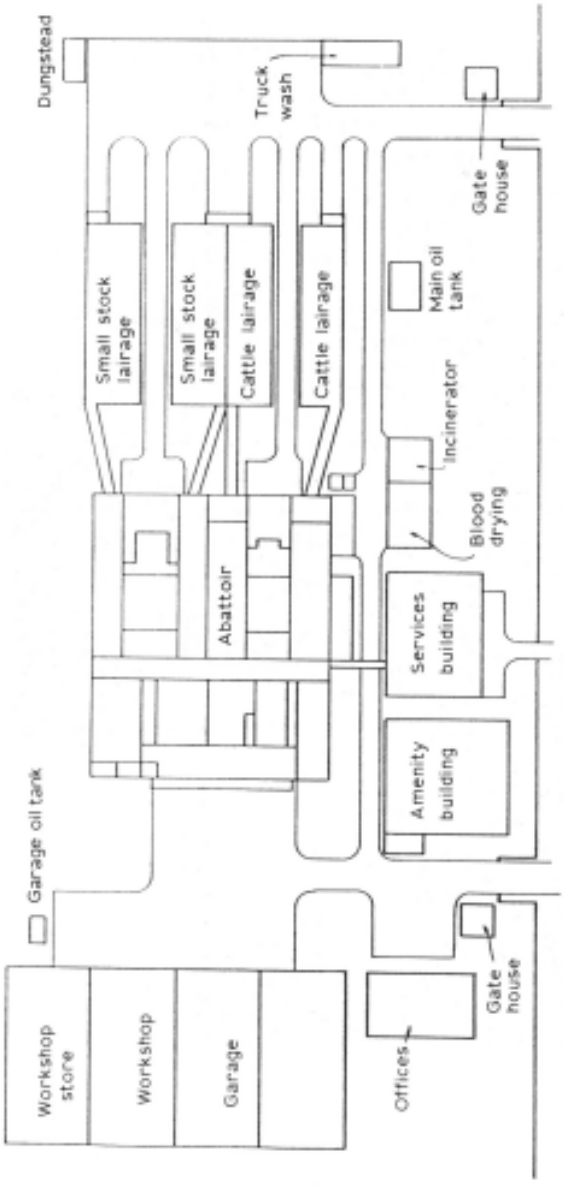

Fig. 16-10. Slaughter plant site layout showing supporting units. Plant is capable of killing cattle or small stock.

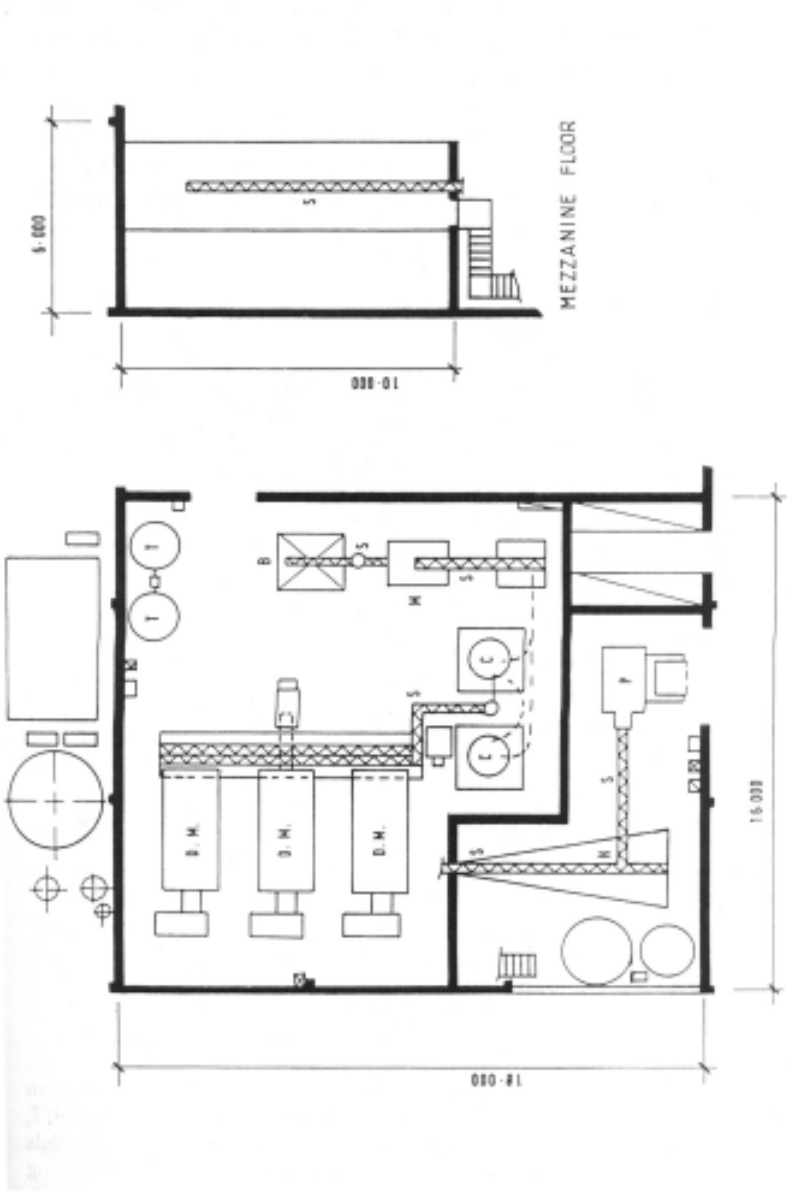

Fig. 16-11. Typical dry rendering batch process showing associated equipment. B, Bagging plant; C, centrifuges; D.M., dry melter; H, hopper; M, mall; P, pre-breakers; S, screw conveyors; T, tallow tanks.

free fatty acids. Yields from the process exceed those of the dry-rendering system, but the initial capital cost is high. However, such high-quality tallow demands a higher price in the edible tallow commodity market.

Many years ago rendering plants were located on the bottom floors of multi-story abattoir buildings. With modern layouts favoring single-story concepts, the rendering plant usually has its own separate building on site which can be built in a light warehouse style, thus minimizing initial building costs.

Also, usually located adjacent to the bleeding operation, is the blood processing operation. The market requires either fresh chilled blood for immediate use in sausages, or dried blood which can be stored for later use. Chilled edible blood is obtained by bleeding each animal separately

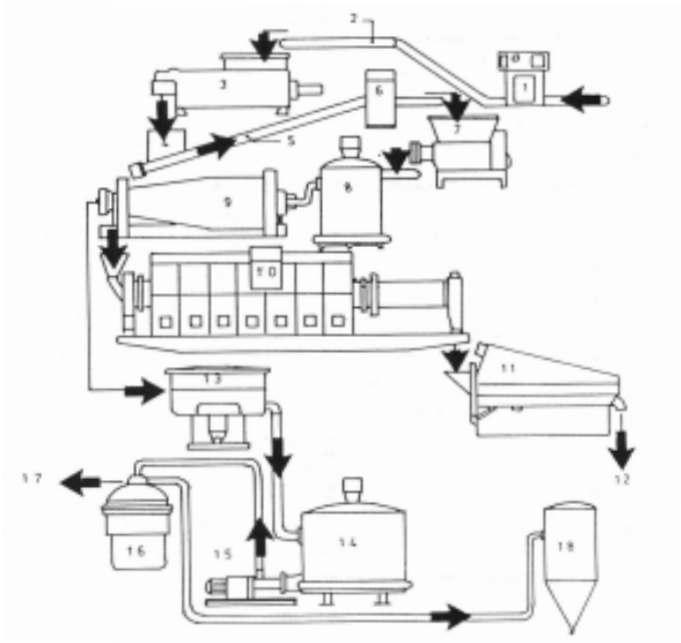

FIG. 16-12 Low-temperature rendering system. 1. Metal detector; 2. inspection conveyor; 3. pre-breaker; 4. flow balancing bin; 5. elevating conveyor; 6. magnet; 7. grinder; 8. conditioning tank; 9. scroll decanter; 10. degreased solids dryer; 11. solids classification system; 12. classified product; 13. liquid screen; 14. liquid conditioning tank; 15. regulating feed pump; 16. polishing centrifuge; 17. polished fat storage; 18. water recycling.

into separate stainless steel drums, using a specially designed sticking knife which drains the blood into the drum. This complicated manual operation is essential to ensure that the blood is suitable for human consumption. By separating each animal's blood, a decision can be made on its suitability following the previously described inspection routine further down the processing line where, through correlation, all parts of the animal are checked for disease. On the basis of inspection finding no problem, the drum containing that specific animal's blood can be taken into the chiller and then used for further processing, or centrifuged to obtain plasma prior to freezing, for storage.

Dried blood can be used for edible or inedible purposes. The blood passes through an in-line coagulator where steam is continually mixed with it and the blood is coagulated, following which the water is drained off. The blood can then be dried either in a steam-heated vessel or centrifuged and dried in a ring dryer. In both cases the aim is to provide a product with a water content of about 8%. Dried blood is normally used for inedible purposes such as fertilizer or livestock feed, but can be used as a protein additive in food products.

V. ECONOMIC CONTRIBUTION OF BY–PRODUCTS

Table 16-2 shows the revenue contribution of a typical European meat business, covering all the normal products produced from a straight beef abattoir operation where no processed products are manufactured. Similar figures are obtainable from other types of livestock. It can be seen that apart from the offal products the main product, the chilled carcass, contributes 85% of the sales revenue.

With the full offal revenue, a gross margin of 12% or about $66.60 (£36)/head was achieved. This means that $66.60 (£36)/head is available to meet the operational costs of the factory and profits. Table 16-3 shows the cost of livestock purchase on the same operation with income from bone-in meat with offal contributions and gross margins. It can be easily calculated from the data in Tables 16-2 and 16-3 that if the management of the business does not consistently ensure efficient offal processing and good market disposal, the business could operate with a negative margin

TABLE 16–2

BEEF OPERATION PRODUCT REVENUE

Product		*Percentage of total revenue*	
Bone-in quarters	Hinds	44.10	
	Fores	40.82	
	Total	84.93	84.93
Edible offals	Liver	1.59	
	Tripes	0.85	
	Brains	0.08	
	Tail	0.14	
	Tail-end	0.02	
	Feet	0.20	
	Kidney	0.15	
	Testicles	0.07	
	Heart	0.19	
	Spleens	0.03	
	Head meat	0.72	
	Fat	0.48	
	Tongues	0.27	
	Glands	0.13	
	Total	4.90	4.90
Inedible offals			
By-products	Casings[a]	0.06	
	Horns/hoof	0.02	
	Hides	8.36	
	Total	8.44	8.44
Rendering	Tallow[a]	0.40	
	Bonemeal[a]	0.50	
	Dry blood[a]	0.83	
	Total	1.73	1.73
Total Offals			15.07
TOTAL			**100%**

[a] can be processed as edible.

TABLE 16–3

BEEF OPERATION GROSS MARGINS/HEAD CATTLE PROCESSED

Product	*Revenue*	
	US$	*£ Sterling*
Bone-in meat	469.90	254.00
Offals	74.00	40.00
Rendering material	9.25	5.00
Total revenue	553.15	299.00/head
Cost of livestock	486.55	263.00/head
Gross Margin	US$66.60[a]	£36.00/head

[a] 12.04% of total revenue.

of $l6.60 (£9)/head. Similar figures are applicable with sheep or pigs, where it should be possible to obtain a gross margin of 15%. The optimization of offal revenue is, therefore, of the utmost importance to achieve profitability.

VI. SELLING OF BY–PRODUCTS

Although the marketing of edible meat by-products is discussed in Chapter 17, some special considerations in selling these products are discussed here. Offal processing and successful selling of these products determines the viability of a meat works business. None of this is possible without hygienic and scientific disassembly of the carcass on the dressing floor. Nor would it be possible without careful consideration of the initial design of the offal section layout and machinery, and their location in relation to the other parts of the factory. The revenue contribution to the business from offals represents 15% or total revenue and without this contribution no modern meat works could survive.

A. Red Offals

In order to make the best return on the edible by-products, and as shown above without a good return a modern meat works cannot make money,

it is important to have a sales operation conversant with world meat prices and markets, and to sell to those world markets which provide the best return. One of the important requirements in preparing a product to meet this requirement is product specification and packaging.

In general terms, for red offals, if the product is to be exported, then well prepared packaging is necessary and the product must be frozen. The following discussion gives a broad outline of red offal markets and requirements.

(i) Australia and New Zealand

Both of these countries have specialized in the volume production of livestock and volume processing of meat products. Both countries also have a very small internal population and, consequently, this high volume trade is directed to export. Bearing this in mind, offal production is processed and packed for the export market.

Red offals, therefore, when received from the dressing floor, are carefully trimmed to specification and they are then wrapped prior to being placed in 60-lb (27.2 kg) cartons and then frozen. The exception to this is livers, which are usually packed in their own plastic containers, in order to retain the liver shape, and the plastic containers are then in turn packed into similar 60 lb (27.2 kg) cartons.

The processing of heads is also carried out in a sophisticated manner. Head meat is taken off and used for follow-on processes. The heads are split and brains and tongues are removed and specially trimmed and packaged into 60 lb (27.2 lb) cartons for export.

Generally speaking, the small local market requirements are met in exactly the same way. Butchers shops are supplied with hygienically trimmed and packed red offals, with little differentiation between the products they receive and those for the export market.

As the majority of offals are exported, it is important for the meat slaughter plant sales office to dispose of these products to the best market, i.e. those countries offering the highest price. At the present time and over the last few years the best market has been the EEC countries, and this is one of the reasons why Australian meat works have had to maintain EEC standards. Most of their products go to the USA and, therefore, except for the offal market, they would have no requirements from a

hygiene or veterinary point of view, other than those for the USDA.

(ii) USA

The large operations in the USA process and pack their red offal products in a similar manner to those utilized in Australia and New Zealand. The local standards are high, and the markets within the USA are geographically far apart. Consequently, the products are again packed into 60 lb (27.2 kg) cartons, frozen and then transported by road container to the markets within the USA which will provide the best return.

Large amounts of variety meats are exported to Europe which, as previously mentioned, provides the best world market for offals (see Chapter 17). Problems have recently been experienced as to whether the European veterinary authorities accept many of the US operations as being in compliance with EEC requirements. However, such decisions are frequently political, rather than based on scientific evidence.

(iii) Argentina, Brazil, Kenya, Zimbabwe and Botswana

The above-mentioned countries are, again, involved with high-volume meat processing operations, having breeding and livestock fattening operations to service export markets. As a consequence, the export products are, once again, processed and packed in a similar manner to that described for Australia and New Zealand. Nevertheless, there is a specific difference in the operation of meat packing plants in these areas, in so far as the local market will not take the highly processed red offals. In some of these countries the local market is large, but as explained with Australia and New Zealand, their internal population is small. Australia has only 13 million people and New Zealand has a population of 3.5 million. In Brazil the local population totals some 160 million, and Argentina has over 30 million inhabitants. The latter local markets are, therefore, large and important.

To service the local market and provide the edible meat by-products required for local consumption, export operations are a distinct division from local needs. Offals going to the local market will not normally be trimmed to specification and packed, but rather they will be passed direct to a chiller unwrapped. Wherever possible they will be held as offal sets

comprising the head complete, the liver, the tail, the heart, the spleen and the kidneys. Chilling will normally take place on trolleys or on special trays, which will be placed in the cold room. Disposal to the local market will then be carried out by the butchers bringing their own vans to the meat works and manhandling the offal sets into their vans. This is a totally different approach from export, in that the heads are taken whole by the butcher and are not broken down into tongues, brains, cheek meat, etc., by the meat works.

(iv) Western Europe

Western Europe processes and distributes Fed offals along similar lines to those described for the local operation in Argentina and Brazil. Neither the private operations in Europe nor the municipal systems usually provide facilities for trimming and packaging of red offals. The offal sets are held in chillers and then taken away by the local butchers.

The above is a general view. However, there is a percentage of export trade operating within Europe and under these circumstances trimming and packaging takes place prior to freezing and transport by road.

(v) Middle East and Turkey

The markets in these countries are not sophisticated, particularly with municipal meat works, which are in the majority. Much is left to the imagination with respect to hygiene and processing methods.

Many of the municipal abattoirs in these countries are old, and have been designed by engineers totally untrained in efficient methods of meat processing. The general rule is that individual butchers purchase stock from local farms or imported stock, which they obtain through markets, and they bring their stock to the municipal meat works. In some instances, the slaughterhouse allows the local butchers to kill their own livestock and carry out their own processing. The treatment of red offals is, therefore, generally most unhygienic and, once the animal is killed and the parts taken off the carcass, the offals are taken away by the individual butchers in their own transport.

There are, however, certain exceptions. In Turkey, the government is attempting to privatize and bring incentives to the private sector. Thus, private companies are moving into the meat industry and taking some

of the business from the municipal meat works and the state-controlled operations. These few companies, also operating in Middle Eastern countries, are attempting to bring in hygienic practices for the treatment of red offals.

B. Casings

In the large meat processing operations, which exist in countries such as Australia, New Zealand, Zimbabwe, Botswana, Kenya, the USA and several South American countries, casings treatment is fairly sophisticated. Because of the volume of product passing through the works, it pays the companies to treat these offals with care and they are involved in producing Special products scientifically packed for export.

After the casings are stripped and cleaned, they are usually salted and held under refrigeration until required for the next operation. The products, which can be produced from these salted casings, cover special graded casings for use in the production of sausages, frozen specially prepared casings for sutures that are used in the medical profession, and other products which can be produced are strings for tennis and squash racquets. Therefore, these large meat processing works normally have a grading operation which results in packs of casings being produced covering diameter and length which are then salted and passed on to sausage factories for use in the production of sausages. Depending on the market, the operation could well have a sutures production unit and these products, after being packed in cartons, may be frozen, usually for export. Again, a large processing works in the countries listed above could well have their own tennis and squash racquet string factory. This is a sophisticated operation, which ultimately provides packs of strings sold for export to the main tennis and squash racquet companies. For further information on the production of edible casings, see Chapter 11.

With respect to smaller meat operations, particularly those in Europe, it is general for the meat works to strip the casings and clean them and then simply to salt them down and hold them in drums, which are kept under chilled refrigeration conditions, before they are sold to further processors. These further processing companies collect from the smaller abattoirs and produce the previously mentioned products, such as graded casings for sausages, sutures for the medical profession and strings for

tennis and squash racquets. It is not economic to have a complete casings processing factory attached to a smaller meat plant.

Turning to the municipal abattoirs in Europe and the Middle East, where the municipality does not actually own the product, it is usual for the municipality to bring in outside traders who sometimes use the slaughter plant facilities for cleaning and salting prior to selling elsewhere. Alternatively, they take the green casings and sell them direct to centralized processing factories.

C. Rendering Material

In the larger meat works associated with export, in countries such as Australia, New Zealand, South America, Southern Africa and the USA, it is usual for each slaughter plant to have its own rendering department located on the same site. Depending upon the market prices, the rendering department would have facilities to produce edible and inedible tallows, dried blood and meat-meal. All these products are commodities which are traded on the world market and, consequently, prices are quoted in the financial press.

The meat and bone-meal, which is the dried solids from the process, are usually milled down to a fine particle size and then bagged in 440 lb (200 kg) bags. Prior to this operation the marketing people have determined whether they are going to obtain a larger revenue by adding dried blood to the meal to raise its protein content. In general terms, the soft material recovered from the kill floor operation results in a higher protein value than bone material received from the boning room. Therefore, the decision as to whether dried blood should be added to the product depends very much upon the type of operation and the quantity of boning taking place. Plants with large boning operations usually add dried blood to their product in order to raise the protein value.

Turning now to tallow, as previously explained, the plant can be divided into two parts, allowing edible tallow to be produced, and this plant would only receive high-quality edible fats from the kill floor and bones from the boning room. Commodity prices are dependent upon the quality of the product which, in turn, depends upon the free fatty acid content of the tallow and its color. Rendering material, which has

not been processed rapidly following processing on the kill floor, has a tendency to have a high free fatty acid content and a dark color. In addition, these two factors depend upon the type of rendering plant chosen by the meat works. For more information on edible tallow, see Chapter 12.

The large meat slaughtering operations normally make use of all blood produced in the process. The blood is coagulated and then dried, and is bagged in 440 lb (200 kg) sacks. One of the market requirements is that dried blood should not have a water content of over 8% and provided this requirement is maintained, quoted commodity prices should be attainable.

In small plants, particularly in Europe, and also in most municipal plants, no rendering department is attached to the meat works. In these cases the wet product is sold to central rendering plant operators who collect from a number of small abattoirs. Because there is a considerable time lag from collection at the abattoir and processing in the centralized plant, the volume of free fatty acids in the final product is high, and the tallow is generally of a lower quality than would be produced in a large meat works. The product is generally inedible, as it is not economical to collect edible and inedible materials separately from each different small plant. In these smaller meat plants the collection of blood is uneconomic and is normally lost.

VII. SUMMARY

Slaughter plants can be classified as large or small on the basis of volume. Large plants usually incorporate sound methods of preparation, packaging and freezing, and are thus able to enter the export business whereas lower-quality processing usually dictates that small plants sell to the domestic market. A number of plant layouts are shown with brief descriptions of the processing of red and green offals. The economics and importance of the reclaiming and marketing of by-products is emphasized together with the importance of hygienic collection and inspection. Finally, consideration is given to the collection systems used and the selling of meat by-products on different world markets.