A study of the methods and equipment employed in the harvesting, grading, and packing of the Massachusetts apples

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A Study of the Methods and Equipment Employed in the Harvesting, Grading and Packing of the Massachusetts Apples

BY

CHINGHSI HIRAM LOWE
A Study of the Methods and Equipment Employed

In the

Harvesting, Grading, and Packing

of the

Massachusetts Apples.

by

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Thesis submitted for the degree of M.Agr.

Department of Pomology

Massachusetts Agricultural College,

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Introduction

Apple growing is one of the leading industries of rural Massachusetts. The soil and climate of the State are among the best known for producing apples of fine flavor and texture, so that the quality of the fruit grown under proper orchard management is far superior to the average grown in many States. The market for apples within the State is sufficiently large to take care of all the present production as soon as it is properly harvested, graded, and packed. There are also extensive markets in the neighboring States within easy shipping distance. In addition, there is usually a good demand in the countries of Western Europe which can be readily reached by trans-Atlantic steamship lines from Boston and other New England ports. In times past, the watch-word of the fruit grower has been "Production." Consequently, through the concentration of mind and effort of the growers on the problems of production, the orchard practice of Massachusetts has gone through stages of immense improvement and the general level has been rapidly raised. But this increase in production of higher quality apples has not been generally accompanied by a corresponding improvement in the methods of handling.

The competition of an increasingly large amount of carefully prepared boxed apples from the Northwest has made the markets in Massachu-
setts and the Eastern States more exacting. It has also emphasized the need of better methods of preparing the fruit for the market.

The purpose of this paper is to present a careful study of the fundamental principles involved and the existing methods employed in the harvesting, grading, and packing of Massachusetts apples with discussions on the necessary and possible improvements.

A large part of the material presented herein is the result of a thorough and careful review of the existing literature on these subjects, supplemented by information secured through questionnaires sent out to various county agents and through the writer's own personal experience and observations.
Harvesting is one of the most important operations in profitable apple production. Proper grading and packing begin only with the proper harvesting of the fruit. Improved methods of harvesting, therefore, should precede any advance in grading and packing of apples.

Too little thought is often given to this phase. Apples may be excellently grown, but unless they are carefully harvested will not command the highest market price. It is a generally admitted fact that the methods employed in harvesting the crop have just as much influence on the final returns from sales as the methods employed in producing it. The harvesting of the crop is of vital importance — it is the climax of years of labor on the grower's part — yet just here many growers fail. The importance of proper harvesting methods, therefore, can not be over emphasized.

There are two necessary considerations to be borne in mind when harvesting the apple crop; first, the proper time to pick, and second, the proper methods and equipment employed in the picking.

The Proper Time To Pick

The proper time to pick has a marked influence upon the keeping quality, color, size, and flavor of the fruit. In making inspections of apples on the markets, during the course of the investigations conducted by members of the Federal Bureau of Markets, a large amount of fruit reaching the markets each season has been found to be greatly impaired in quality by being picked at the wrong stage of maturity, either too early or too late. Personal observations of the writer on apples sold in the
community markets in the vicinity of Northampton, Holyoke, and Springfield, Massachusetts, also show that a larger part of the apples sold in these markets has been picked at the wrong stage of maturity, especially with the earlier varieties, which have been picked rather too early. This mistake is caused both by a misunderstanding on the part of many growers as to when the fruit should be picked, and by the failure to interpret correctly under field conditions the factors determining the proper stage of maturity.

Well informed growers are often careless in the observance of the proper picking time. The growers may be inclined to pick too soon in order to take advantage of the high prices offered for certain varieties during the earlier season. Watching the market and disposing of the crop regardless of the ripened condition seem to be the practice of these growers. There may be likewise a tendency on the part of some other growers to delay the picking of their crop beyond the proper stage of maturity in order that they may become larger in size and take on a better color.

Apples picked too soon lack color, which in many varieties is essential to their ready sale, eating quality, and size. Apples harvested in an immature condition are also inclined to scald in storage and in extreme cases may shrivel — and exception must be made in case of summer apples, as they are not intended for storage. On the other hand, if allowed to become over-ripe on trees, they will get mellow or soft after picking, and have a short season of consumption, as the length of time they will keep in storage is reduced greatly.

It is hard to know just when an apple has reached the stage when, if picked, it will keep the longest and still retain the highest quality for culinary and dessert purposes. Varietal characteristics, seasonal variations, the soil, its moisture content, the stock, the exposure, cultural practices, and other factors affect the maturity of apples, and it is
difficult to lay down any fixed rules to determine the proper stage for
harvesting. The time for harvesting will further vary with the kinds of
markets the grower is catering to, the distance the fruit has to be shipped,
and the storage and labor facilities.

There are, however, indications of maturity, such as the color of
the fruit, color of the seeds, and the ease with which the stem separates
from the spur. These indications will enable any grower with some practice
to recognize the proper stage.

The amount of red color is usually the basis for judging the
time of picking red and striped varieties; in a majority of cases normally
colored fruit of such varieties is ready to harvest if it has attained the
proper size and separates readily from the spur. Fruit is not ready to be
picked when it clings to the spur so tightly that the stem is pulled out
or the spur broken. This of course, varies somewhat with the varieties and
the manner the fruit is picked by the picker. Red color, however, is not
always a reliable index, as the amount of color varies with the season, the
size of the crop - the load, the age and vigor of the tree, foliage, soil
conditions and other factors. For example, in years when bright days and
cool nights come early in the season, the fruit will color up before reaching full size and maturity; while on the other hand in seasons of warm
cloudy weather, the crop may become overripe without acquiring the normal
amount of color. Frequently a crop of poorly colored fruit is allowed to
hang so long in an attempt to secure good color that it is harvested in an
over ripe condition. Whether or not the color develops normally, a reliable
index is the ground color, which, when the fruit is ready for picking,
should be turning from a clear green, indicating immaturity, to a whitish
or greenish yellow. With yellow, green, and russet varieties, color can
not be used to determine maturity. Such varieties are generally ready to
pick when they have attained the proper size and the stems separate readily
from the spur.

It is generally believed that the only reliable test of ripeness
for any apple is by the color of the seeds. When picked just as the seeds
have turned a light brown and before they have become dark around the edges,
there will be found not only flavor, but best keeping quality. But this
is not a reliable test or index of maturity, as it is very common to find
colored seeds in immature fruit. It is certain, however, that the fruit is
not ready to be picked before the seeds turn brown.

Horticultural Commissioner W. H. Volck of California, states:
"Growers can approximately determine the maturity of apples by the iodine
test for starch. When the core areas show general reduction in starch and
small portions of these areas do not stain blue (when stained with a dilute
iodine solution), the variety is ready to begin harvesting. This is
especially true if the fruit is intended for distant shipment or storage.
Fruit intended for immediate use may remain on the trees two or three weeks
longer. Growers may also learn to use the hydrometer in making the juice
tests. Bellflowers and other early apples will test about 12% total solids
in the juice, and Newtons and other late varieties, about 13% when
sufficiently mature to begin picking". What Commissioner Volck has re-
commended to the Western growers may be worth while for the growers in
Massachusetts to try.

The proper time for picking depends a good deal on the variety
itself and of its habit of holding on the tree. The grower, therefore, must
study each variety carefully to get the best results in storage and in
market. Apples may be divided, according to their condition at maturity,
into several different classes. Among apples that drop when they are ripe,
we may mention the CrimEa, Golden, Wagoner, Wealthy, and Wine-sap. Others that drop before they are ripe are such varieties as the Gravenstein, McIntosh, and Snow. Many varieties that hang too long on the tree develop the core-rot, and we find that Jonathan, Gravenstein, Delicious, and Ortley come under this class. Others, if they hang too long get mellow or soft after picking, and have a short season of consumption. In this class, there are such varieties as the Jonathan, King, and Baldwin. Some varieties such as the Early Harvest, Duchess, Red Astrachan and Jonathan are troubled with cracking at the calyx. On the other hand, there are varieties like the Northern Spy and Ben Davis that may hang after maturity before picking.

As a rule, the sooner after maturity the summer and early autumn varieties are picked, the better and more profitable they are in the market to the growers. The summer varieties drop badly as a rule. When the earlier varieties are intended for shipment, they should be picked quite green, but should have some degree of coloring, and should not be soft. Winter apples should not be picked until fully grown, but should be secured before freezing weather takes place.

The distance fruit is to be shipped also governs the time for picking. With earlier varieties that are to be marketed locally, the fruit can be picked a little later than when it has to be shipped for distant market. If one is fortunate to have a personal market, delivering the fruit to the consumer directly, then one may hope to retain this market only by delivering the products in the very best desert condition. Those who intend to ship their apples for long distance, will have to pick earlier.

If the apples are to be placed in ordinary storage they should be picked earlier than if they are to be put into cold storage. One must not, however, pick apples too green as they are more liable to scald in storage.
Experience during the past few years has proved that apples must be picked several days earlier than they have been in order to obtain satisfactory results from storage.

It is not advisable, under certain circumstances, to pick all the fruit at one picking. Experience has taught the growers that if the smaller apples are allowed to remain on trees they will materially increase in color and size. This is especially true with many earlier varieties which do not ripen evenly, and it is a common practice amongst some growers to mulch the ground under the trees quite heavily with straw (usually 2" to 3" deep) and to allow the apples to drop rather than pick them, thus giving them a chance to ripen fully. Such varieties as Gravenstein, Williams, Duchess etc., when treated this way become very beautifully colored and are splendid for immediate consumption. The cost of picking is also somewhat less, but for long distance shipping this could not be practiced. It is also customary to thin out the largest apples of later varieties as soon as they become large enough to meet the demands of the market.

Most growers in all sections, however, remove all of the fruit from the trees at one picking. Some growers make two or more pickups during the season, especially when the fruit is not uniformly of good color, but is otherwise of high quality. The advisability, however, of making more than one picking depends upon the extent to which the size and color of the fruit are affected by the load. The apples on the outside of the tree, especially the larger and better colored specimens, are removed by the first picking to permit the limbs to lift and expose the uncolored fruit to the sun. This thinning also tends to bring about an increase in size of the fruit remaining on the trees. With early varieties this holds true, and it will even hold with as late varieties as Gravenstein and McIntosh. Better fruit could be secured through this method of treatment and it is quite surprising how the
smaller apples which are left on the trees will color up and increase in size. This is especially important with McIntosh and Wealthy, which tend to drop before they are fully ripe, yet it is even worth while trying with varieties which hold on the trees well. In the course of a week or ten days the second picking is usually removed. In a very few instances more than two pickings are made. Two pickings are more costly than one due to the additional time required to pick the fruit in this way, though the increase in the market value of the crop often justifies this practice. But if the crop is of low quality because of various blemishes, the value of the fruit is not sufficient to warrant the extra cost of more than one picking.

Some of the most commonly grown varieties in Massachusetts are arranged below in order of their approximate time for harvesting:

<table>
<thead>
<tr>
<th>August</th>
<th>September</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow Transparent</td>
<td>Gravenstein</td>
<td>King</td>
</tr>
<tr>
<td>Red Astrachan</td>
<td>Wealthy</td>
<td>Delicious</td>
</tr>
<tr>
<td>Williams</td>
<td>McIntosh</td>
<td>R. I. Greening</td>
</tr>
<tr>
<td>Duchess</td>
<td></td>
<td>Wagener</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Baldwin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Northern Spy</td>
</tr>
</tbody>
</table>

Proper Methods and Equipment Employed

Carefulness and the utilization of proper methods in picking are of prime importance. Carelessness as well as improper methods employed in picking the fruit have a material effect not only on the fruit itself and its sale, but also on the trees in the orchard and the successive crop. Therefore, the use of the very best methods and every possible care in picking the crop in the orchard is essential.
Government fruit experts have found by actual observations in the field, that a large percentage of fruit lost during storage and shipping could be directly traced to poor methods used and carelessness in picking the crop. Small breaks in the skin such as caused by sharp finger nails, punctures from fruit spurs, and stems pulled off, offer ideal resting places for blue molds and other micro-organisms. When a foothold is once obtained by them, the fruit is quickly destroyed. During shipment the whole pack is liable to become slack on account of just this, and a slack pack will not carry any distance without the fruit being badly bruised. The result being a dead loss to the shipper. Fruit pickers seldom realize how much the normal season of a fruit is shortened by bruises due to careless and indifferent handling. The life of an apple depends very much on the care used in picking it.

The time was when apples used to be shaken off the tree. In reality, there are still some careless small growers at present who are addicted to this sort of handling. When the fruit is shaken from the tree and thrown carelessly into a hard bottomed, rough-sided basket, dumped into a wagon box, or transported in sacks like potatoes, the keeping season is shortened and the percentage of loss on stored fruit is very great. Such fruit will not ship, keep, or sell, and fit only for immediate home consumption. However such apples are still sometimes offered in the market. They would undoubtedly bring little to those who attempt to market them and often times interfere seriously with the sale of good hand-picked apples. Apples should never be shaken from the tree, as not one in ten thus gathered fail to receive some injury.

Apples, in order to be marketable and destined to compete with not only the properly handled native ones but also those shipped in from out of State, must be carefully handpicked. In picking apples handle them as
carefully as eggs. Employ pickers who can pick with two hands. Unfortunately expert apple pickers could not always be hired. Growers are usually obliged to put up with ordinary day laborers and mill hands and to make up in the carefulness of his own or a competent foreman's supervision the lack of experience on the part of the pickers.

Nature has supplied a small joint at which the stem of the apple may be easily separated from the spur. This is marked by a collection of wrinkles on the spur. If the apple is grasped and pulled away from the tree, the joint may break correctly, but the chances are that the stem will either be torn out of the apple or the spur torn off the tree. When a stem is pulled out it breaks the skin, thus allows micro-organisms to enter the apple, resulting in rot or disease in an otherwise sound apple, thus, losses which are often times attributed to commission men are often the fault of the careless pickers. This is an absolutely unnecessary loss if due care is exercised. Under the present California law, all stemless apples, except Gravensteins, go in the lower grades. Such law would undoubtedly benefit the apple industry in Massachusetts, if adopted as a State law here. Each broken spur means that several apples are deducted from the next three or four years' crops, since the fruit is borne on the same spur year after year. After the spur is once destroyed it is practically impossible to replace it on the old strong wood which is best able mechanically to bear a heavy load of fruit. Some varieties lose their spurs very readily even when reasonable care is exercised by the pickers, but growers should insist that these spurs be removed from the fruit before it is placed in the picking receptacle even if the speed of the work is reduced, as the spur pulled off with the fruit may cause punctures.

The correct manner to separate the stem from the spur during picking is to place the thumb beside the joint between the stem and the spur and then the fruit is bent towards the thumb with a quick motion. The joint
will usually break rapidly. The ease with which an apple may be picked depends very largely upon the variety and the stage of maturity. After a little practice, a picker could usually learn how to do it. But once mastered, the picker will have less opportunity in pulling off stems or tearing off spurs. However, it requires skill to perform so simple a thing. This is a point frequently over-looked by careless pickers. Satisfactory results are seldom obtained unless the work of each picker is inspected from time to time by the grower or a competent foreman.

Care should also be taken to see the pickers have their finger nails clipped short, and that the individual fruits are not pinched by fingers in removing them from the spurs. Growers in the West often require the pickers to wear cotton gloves when picking delicate varieties. This is, however, not an over-cautious measure. Here again a Ben Davis will withstand more careless handling than will such varieties as Yellow Transparent and McIntosh.

Pickers should also be cautioned not to climb into the tree while picking, especially young trees, as broken branches, bruised limbs and rubbing off of fruit spurs are bound to result from such a procedure. Wounds and bruises upon limbs constitute ideal condition under which canker and other diseases start and flourish, while rubbing off of fruit spurs may seriously injure the prospect for future crops. In one instance, a grower counted 43 fruit spurs on the ground under one tree in which pickers had been climbing. It is generally necessary, however, to gather part of the fruit in the center of dense and tall tree by climbing, and where this is done, much injury to the tree may be prevented if the pickers wear rubber-soled shoes or leather shoes without heels instead of heavy heeled shoes which are more likely to split the crotches and peel the bark off. Children (young boys) are often employed to do the climbing as they are lighter and could do the work with least amount of injury to the tree. Therefore, one of the first
lessons a grower or foreman must give a picker is to caution him not, under any circumstances, to bruise or puncture the skin of the fruit, rub off fruit spurs, or injure the tree in any way. A picker can soon train himself to handle the fruit gently, if he takes the slightest interest in the work.

Suitable receptacles for picking are important. The receptacles selected for picking should prevent all bruising as far as possible and should give ease in handling. The half-bushel round sided and small flat bottomed oak-splint picking basket with a swinging bail of wire or wooden handle is used extensively by growers in Massachusetts and other Eastern apple growing sections. The swinging bail allows the basket to be lowered into the barrel or other field receptacles and the content poured out with the least danger of bruising the fruit. The rigid sides of these baskets protect the fruit from pressure, and in harvesting tender varieties this feature is essential. The oak-splint half-bushel basket is smooth and rigid and most growers prefer it to the elm-splint ones and find it most satisfactory and desirable to pick into. Pickers have a tendency, when using picking baskets, to place them in a crotch of a tree or to hook them over a limb, and then toss the fruit into them from a distance of several feet, causing severe bruising and broken skin. If the baskets are padded or lined with canvas or burlap-sack the fruit will be protected to a considerable degree from such injury. It should be lined especially for picking tender varieties. The baskets should first be oiled, thus making them more durable; they should then be lined with canvas or burlap. A stout bent iron "S" shaped hook, or a heavy wire bent in the form of the letter "S" with the upper part large enough to put over limbs and the lower part to fit the handle of the basket, is very useful. Baskets fitted with these hooks enable the pickers to move them frequently where ladder work is being done and to use both hands for picking. In some instances where fine fruit is
handled and when the picking is being done in a large tree, a strap or rope is attached to the hook and the basket filled with fruit is lowered to the ground, where it is emptied by an assistant, thus making it unnecessary for pickers to climb up and down the tree for every basketful. The rough woven type of picking baskets should never be employed for picking. The costs of these baskets are just as much as the splint baskets.

There are many other kinds of picking receptacles besides the half-bushel baskets. There are the galvanized buckets and bags of various types. Hamper baskets serving as picking utensils are rarely used by growers in Massachusetts but are encountered in the Delaware and New Jersey apple sections where they are used extensively. Galvanized iron buckets are more of a Western affair and are used very much by the growers there. Some of them are 10" x 10" buckets, while others are buckets with flaring mouths. Besides being a perfect rigid affair with no tendency to allow the fruit to squeeze down along the edges of the receptacle as it would in any flexible one, the galvanized metal bucket when used without padding claims the additional advantage that the foreman can readily detect workers doing careless work by the sound of the fruit as it is dropped into the bucket. These buckets, like the half-bushel picking baskets are provided with hooks for hanging in the tree or on the ladder. One thing of importance when buying the buckets is to see that they are not too large that will not go down inside of the field receptacles. These buckets could also be padded or lined for picking delicate varieties.

Of picking bags, great diversity prevails. They vary widely in design and in the material used in making them. In the Potomac Valley region and in Virginia many growers are employing a home-made sack of burlap which holds about $\frac{1}{2}$ of a bushel. These sacks can be made easily and quickly from a burlap bag with little expense, but because such bags must be
inverted to be emptied, which usually increases the amount of bruising, they are generally more undesirable than the drop bottom type. They may be used without appreciable injury to the crop if the fruit is generally of low quality, or of a variety not easily bruised such as the Ben Davis. The drop-bottom canvas bags, holding about half a bushel, are equipped with straps that fasten them securely in front of the body and hold them in place as the picker is working from the ladder. The bag consists of a canvas tube held open at the top by a wire frame. The bottom of the sack may be closed by folding up the tube and attaching it to a ring or hook, as the case may be, on the front of the bag. These bags allow the pickers to have the full use of both hands at all times. When a picker gets it full and is ready to empty it, the bottom is unfastened and the apples roll into the field receptacle. For this reason they can be used to advantage where speed is the chief consideration. Another type of canvas bag has the opening in front, but hangs under the picker's arms. This construction enables the picker to descend from the ladder without bumping the fruit into the ladder. Then there are the aprons, blouses, and tin buckets with drop bottoms of canvas.

The chief objection to the use of these bags is the greater chance of bruising the fruit, when the picker walks about, or presses the bag against the ladder or branches. When bottomless bags are employed, the pickers frequently will allow the fruit to shoot into the field receptacles when emptying the bags, thus causing immense bruising. Another disadvantage of the bags and aprons etc., is that the picker will have to carry the fruit with him at all times, where as the baskets and the buckets can be hung on the ladders or branches of the tree while being filled. With careful pickers they may work very well, but even then it is hard to avoid bruising as the operator moves about in picking. The bruises may possibly not show when the fruit is emptied into the field receptacle and they may not even show when packed, but they would certainly
Fig. 1. — Picking receptacles:
No. 1. "Portland" drop-bottom picking bag.
No. 2. "Rapid Underwood" drop-bottom picking bag.
No. 3. Burlap-lined ½ bushel picking basket, provided with the "S" shaped hook.

Fig. 2. — Picking ladders:
No. 1. The three legged step ladder.
No. 2. The pointed orchard-type of ladder.
show when reaching the market.

Picking bags are used quite extensively in the West. It is largely a means of labor saving there. But there are also growers in Massachusetts who use bags exclusively as picking receptacles. Those who employ them think they are quite satisfactory, but a great many admit that they may damage the apples if not properly handled. When used by the growers themselves, the danger of bruising is less, but that the hired pickers might damage the fruit more or less. It is evident that all these picking receptacles have uses to which they are particularly adapted and one can not be recommended to the exclusion of the other. The successful use of any particular picking utensils, after all, is largely a matter of management and two different kinds can often be used to advantage – the baskets are especially convenient for gathering fruit near the ground, while bags can be used to advantage only when the pickers maintain an upright position.

Growers will soon find out that it costs money to step on a ladder and all that can be reasonably done by pruning to start the head of the tree low and keep it low is a paying investment. However, a dwarf tree can never be made by any amount of pruning, and ladders of some kind soon become a necessity in an orchard. When the trees are young and small, most of the fruits can be easily reached from the ground, but as they increase in age and size it is necessary to have aid in reaching the fruits. Climbing about among branches of a tree is always to be avoided whenever possible.

The principal point to look for in a good picking ladder is one that will stand firm; nothing can be more detrimental to the tree and to the good handling of the fruit than a ladder that is always threatening to fall over. While a strong and steady ladder is desired, it must at the same time be light. The ladder should be of such weight that the picker can handle it rapidly without undue exertion – especially on uneven ground. Have as little bulk as possible, as bulky ladders are hard to handle and may cause serious
damage to the fruit spurs and small branches of the tree. The ladders should be made of straight grained, light lumber and well seasoned. All ladders should be housed when not in use, otherwise they begin to decay very rapidly and weak ladders are dangerous things to work with.

As a general rule, there is not enough consideration given to the selection of ladders best adapted to the particular requirements of the orchard. There are a large number of ladders on the market that can be used for picking. The styles of ladders used will depend, however, directly on the height of the tree. There are several different types of ladders for picking are in common use. The ordinary straight ladder is still being used in some sections, but it is being rapidly displaced by the improved types. The chief disadvantage of the straight ladder is the top-heavy tendency which makes it difficult to set it securely against the smaller branches without breaking them or knocking off the fruit. For old apple trees the best ladder to use is the common orchard type of ladder, where the two side rails come together in a point at the top. This construction gives a better distribution of the weight and makes it correspondingly easy to handle. This painted ladder is light and can be placed against a limb or fork that would not support a common straight ladder. For picking the top of high trees, extension ladders are sometimes used, but they are more cumbersome and difficult to manage than the light long pointed-top orchard type of ladder. Even the use of such extension ladders is preferable to having the pickers climb the trees.

Step ladders of various kinds are especially satisfactory in harvesting fruit from small trees, or from lower limbs of large trees. The most desirable type is wide and flaring at the bottom, narrow at the top, and supported with but one prop. It enables the operator to establish it firmly on the ground much more quickly than the four-legged type. It is easily set up securely on uneven grounds. It is used extensively by growers in Franklin and Berkshire counties whose orchards are situated on steep side hills. The
wide spread of the legs at the bottom of the steps make it especially stable. As this type of ladder could be set up without leaning against the tree as do the long orchard type of ladders the danger of knocking off the fruit is also avoided.

Picking poles or other patented fruit pickers are sometimes used to pluck some of the very highest apples growing in the center of tall trees, but they are uncommon among commercial growers. One such pole has a wire basket mounted on the end; the top of the basket is open to permit the entrance of the apple; the stem and spur working down between the wire fingers on the side and the operator twisting the pole to the right or left to sever the stem from the spur. The apple must then be removed from the wire basket. Another pole which operates in the same way has a wire basket with half of the top open at one side. Still another picking pole severs the stem and permits the fruit to drop down through a cloth tube to the operator or a basket on the ground or attached to the handle. The chief objections to these kinds of picking poles are that the chance of bruising is greater and are slow to work with, thus increasing the cost of picking. Up to present time the patent pickers have not been so perfected as not to bruise the apples, or they are deficient in other ways. Patent pickers may be used occasionally for stray and scattered apples.

Apple picking machines are also rare things in commercial orchards. They are usually some kinds of mechanical compromise between shaking fruit off the tree and picking by hand. A typical apple picking machine consists of a considerable spread of canvas stretched on a frame and mounted on a wheelbarrow. The canvas is arranged somewhat in form of a broad flaring funnel. Apples are shaken onto this canvas and roll toward the center where there is sometimes a hole through which they pass into a basket. The only proper way to pick is of course by hand, but certain exceptions are made for apples intended for cider, canning and drying where the picking machines may be used.
The question of field receptacles for the picked apples now arises. If possible these field receptacles should not be the same packages which are to be sent to the market, as these packages will get soiled in their trips from store house to the orchard and back again and a dirty package always detract from the sale of the fruit. The field receptacles to be used will depend upon what is available or easily obtainable, upon whether the apples are to be sold shortly after being harvested, or are to be stored, and upon the sort of container they are to be marketed in. There are several different types of field receptacles in use in Massachusetts. Growers in Eastern section have been marketing almost entirely in the Boston Box for Farm Produce which holds 1 1/5 bushels. They have also used this box as a field and storage container. These growers have also adopted a smaller box which contains 12.47 cubic inches more than a U. S. Standard bushel by cubical content within tolerance of the law. This box stores well when empty, can be used over and over again, stacks well in storage and on trucks, and when full is not too heavy to be handled easily. Risers (dimensions: 5/8" x 5/8" x 18" for the old Boston Bushel Box, or 5/8" x 5/8" x 17 1/2" for the newly adopted box) are nailed on top ends of the boxes to prevent bruising of fruit when piled one over the other and also provides for good ventilation in storage. Growers in the central and western parts of the State are rapidly adopting this package as a field and storage receptacle; peach baskets are used by few growers, who market their apples in them, as field receptacles, especially for the earlier varieties which are to be sold immediately. Bushel hampers are also used by some, both for field and storage receptacles. Orange, grape fruit and cracker boxes are used by several of the large progressive growers. These can be secured at a little cost and furnish excellent ventilation. Second hand barrels are used extensively in the western part of the State for field and storage receptacles. When bushel boxes are used for field receptacles, it is sometimes best to stamp the name of the
orchard on the name of the grower on one end so there will be less danger of their straying away. Time will be saved if pickers are at all times provided with an abundance of field receptacles to receive the picked apples. The grower or foreman should see that these are distributed to the proper joints in advance of the crew.

The proper method of emptying the picking receptacle should be impressed repeatedly upon the pickers' mind. In emptying either baskets or bags, care should be exercised to avoid dropping the fruit. For example, if baskets are emptied into field boxes, the baskets should be lowered to the bottom and inverted gently, or the field box should be tipped so that the apples roll directly from the basket down the side. With barrels, the basket should be lowered into the barrel and tipped gently over to let the apples gradually roll out. In either case, use hand to check the too violent rolling of the apples. Drop bottom bags are so constructed that the fruit can be emptied without bruising, if the bottom of the bag rests on the bottom of the field receptacle when it is opened.

Where the crop is graded and packed over tables that are moved from place to place in the orchard, the fruit is usually carried in the picking receptacle to the packing table. It is a common practice for pickers to carry the fruit, but in so far as possible this should be avoided as it is both expensive and inefficient. Certain members of the crew should be assigned to the task of carrying the filled baskets to the table and furnishing the pickers with empty picking receptacles. These men carry at least two full baskets of fruit from the tree to the table, whereas the picker makes the trip with one. If picking bags are used in picking, the fruit is carried to the tables in field boxes which when full are too heavy to be handled by women or boys. The carriers also save much time for the pickers who are working on ladders or in the trees by taking the full baskets which are lowered by measure of a rope and attaching empty ones. This is unnecessary for the pickers to climb down to empty his baskets.
Where the packing is done at a central packing house or at one permanent location in the orchard or to be stored in common storage, the fruit is delivered to those places in the field containers. Various practices prevail with regard to the immediate disposal of apples when they are taken from the trees. Sometimes they are even placed in piles on ground near the trees. But this is a poor practice. Some growers put them into barrels or boxes without grading and left in the orchard; some put them ungraded into barrels or boxes and carried to temporary storages; and some immediately grade, pack, and send to storage. When apples are destined to be stored in commercial cold storage, which is customary with growers whose orchards are near to city cold storages, they are usually immediately graded, packed and sent there. With the majority of the growers, apples, as soon as picked, are hauled either to temporary storage place or to permanent storages in field receptacles and grading, packing are done afterwards under cover. With earlier varieties, for growers who pack them, the grading and packing work is usually done right in the orchards.

Apples, as soon as they are transferred to the field receptacles, ought to be placed in shady portions of the orchard when not hauled away immediately. It is a bad practice to expose the fruit to hot sun for any length of time as the ripening process is invariably hastened. Apples destined to common storage ought to be hauled away immediately as soon as picked. The very best results in long-keeping qualities are secured when apples are taken directly from trees to a cool place and then kept in storage where the ripening process is partially checked. To keep apples in a cool place as soon as picked is especially important if they are to be shipped for long distances and particularly when exported. If the weather is cool and somewhat dull at picking time, this precaution is not so essential as in autumn that is dry, bright and warm.
The ideal time for picking is on a cool and dry day, but this can not always be had, and the best has to be made out of the situation. The picked fruit should of course be transferred to a cool place as soon as possible. Picking should be avoided after a heavy rain or during rainy weather. It is a poor practice to pile picked fruit in the field, especially where the menace from crickets is great.

The organization and distribution of labor is always a problem of orchard management. In picking it is usually advisable to divide the pickers into crews, giving to some of the women and boys, in case they are employed, the job of picking from the lower branches which they can reach from the ground or from short step ladders. The fruit on the upper branches could be picked by another crew working on taller ladders. Some growers even divide the picking gang into three groups, one for the ground work, another using short step ladders, and the third picking from tree tops. The work of the crew should start at one side of the orchard, taking a certain number of rows of trees, and proceed steadily through these rows to the other side of the orchard. Then another definite set of rows should be picked. If more than one picking is to be given, or if the varieties are mixed in the orchard, slight modifications of this method may be necessary. For greatest efficiency there should be but one head, or foreman, who has the full command of the pickers. Where picking crew is large, it will be best to use several field foremen. The best of help will get careless if left to themselves and the fruit is liable to suffer. It is a great advantage to the grower if he can have regular men, or men who have worked on the place long enough to take an interest in the work, and put one or two of them with the pickers. It is desirable not to have too many men in one gang. It is often desirable, when apples drop badly, to send a few pickers ahead of the main picking gang to clean up the windfalls and also to have pickers trailing the picking gang to
gather up apples dropped and knocked off. However, these apples should be kept separate from the hand picked ones.

The labor situation around apple producing areas in Massachusetts is as a whole not so acute, but in some sections labor facilities are quite inadequate during harvesting time. The growers usually depend upon home labor or local supply, and little outside labor is brought in during harvesting time. Boys are often employed in some sections as pickers during picking seasons. Growers near to manufacturing sections often solve their labor problem during harvesting time through the hiring of local unemployed mill workers. Some growers resort to Sunday picking when mill help is available. During labor shortage, some large growers have been forced to employ women and girls, mainly of foreign extraction, to help harvest the crop. Farmerettes have in the majority of cases proved to be very satisfactory and many growers that have used them prefer to continue employing them as long as they are available.

It is a general practice amongst the majority of growers to pay the pickers on a straight day wage basis, but there are occasionally growers who pay on the basis of the amount of apples picked. With the latter system, the speed of the work is undoubtedly increased. This system may be used advantageously when there is a labor shortage, or when the quality of the fruit is low, or dropping is heavy, or any other circumstances demanding the quick removal of the crop. The pickers generally make better wages by this plan, and any tendency toward carelessness can be avoided by strict supervision. If the grower is not able to superintend the picking, the damage resulting from carelessness may more than offset the advantage of the increased amount picked. It is possible to check accurately on the work done by each picker by requiring that a check bearing an identifying number be placed in each basket box, or barrel picked. But, with a few exceptions, the only proper way is to pay by the day and not by pieces. When a grower wants good work done he can
get it only by absolutely owning the picker's time. The prevailing wages paid to pickers by growers in Massachusetts vary, but they range all the way from $2.50 to $4.50 per day. It is pretty hard to secure the exact data on wages paid to pickers when piece work is done. The average price paid by growers who are employing pickers on the piece-work plan is about twenty cents per barrel, and this is of course very variable.

In hauling the picked apples from the orchard, some suitable wagon or truck is necessary. Orchard wagons should be low for ease in loading and unloading; should also be easy riding; and preferably should have low broad wheels so arranged that they will cut under and permit a short turn. A low wagon also prevents rubbing against branches in orchards where trees are trained low. Bolster spring can be supplied to the wagon so that there will be no unnecessary jolting of the fruit in hauling. Auto-trucks are often employed by large progressive growers and are found satisfactory. Large market express wagons are used in Eastern Massachusetts for hauling apples to the packing shed or storage.
The grading of the fruit is extremely important viewed from every angle. There is hardly anything which affects the price secured more than this. To growers, who are producing apples that will satisfy the consumers' needs it is economically desirable not only to raise the right variety and quality of apples, but to so arrange or classify the resulting products that the buyers may easily recognize them as the articles for which they are in search. To the consumers, grading facilitates selecting and purchasing and enables other savings in consequence of which demand is increased. To the middlemen, it lessens the volume of waste product to be handled and thereby reduces marketing costs. Finally, the grower is benefited because increased demand gives him a larger market which, combined with the lower costs of marketing on the part of the middlemen, rewards him with better prices or in larger sales, either of which means greater returns from the same orchard.

In buying ungraded products, the consumer is obliged not only to accept many inferior commodities, representing waste, but he must himself perform the grading service. In general, it may be said, therefore, that the service of grading benefits the consumers by enabling them to obtain just what they want more easily and economically than is the case when products come to them ungraded.

The service of grading economizes space throughout the marketing system. Particularly is this the case with transporting and storing. *The United States Bureau of Markets found, for example, during a period of three

* U. S. D. A. Bul. 302, pp. 10-11
months, between Sept. 15 and Dec. 5, 1914, that the receipts of apples at Chicago, contained over 15 percent of apples so inferior in quality that they could not have been sold at all were it not for being mixed with other apples of better grades which the consumers wanted. These 410 car-loads of apples out of 2200 car-loads represented not only a waste to themselves, but they seriously depressed the prices obtained for the good apples mixed with them. Grading in this case would have saved the cost of buying barrels for 160 car-loads of apples, of packing this large quantity of fruit, of loading 410 cars with barreled and bulk apples, and of paying freights there on to the market. Furthermore, these inferior apples could probably have been disposed of profitably either as livestock feed or for cider-making purposes at the point of shipment rather than have become a total loss on the distant terminal market. The cost of handling and of paying freight rate upon inferior products unavoidably constitutes a cause for wider middleman margins than would otherwise be necessary. Either the grower or the consumer or both must bear the burden of extra costs caused by the failure to grade the products at the point where this service could be rendered most economically. Failure to grade products makes necessary wider margins than otherwise would suffice and unavoidably places the premium on low grade products, thus penalizing those who attempt to produce high quality.

Grading also enables the middleman to select and arrange or classify the products that they will be constantly in demand. Continuity of business operations made possible by stabilized demand, gives enviable opportunities for securing adequate financing at minimum rates.

In the absence of grading producers of high quality do not obtain the real value of their products for the reason that neither they nor the buyers know the true value. The grower who grades his products thereby gains a knowledge of the quality of his goods and is better able to bargain for a price
in keeping with the true grade and value.

Ungraded products always cost more to market than do products that are graded. Grading renders sale by sample and sale by description possible which are more economical than sale by bulk. The method of sale depends upon grading; if products are poorly graded, they have to be sold in bulk, i.e., the buyer has to inspect the whole mass of the commodity offered for sale before he can know what he is buying; if the products are divided into uniform grades, sale by sample and in some cases sale by description are possible, thus facilitating the marketing process. In association selling, uniform grades make possible the mixing of different lots of same grade in central packing house and the issuance of warehouse receipts to represent these apples - instruments that not only serve as collateral for loans, but also make possible an early exchange from hand to hand.

Aside from these considerations, careful grading of apples as to size, shape, color etc., is of great importance in packing. Well and uniformly graded apples pack more easily in containers - especially in boxes. It is a conservative statement to say that uniformly graded apples of a certain size, shape, and color pack more easily and look better in a barrel or box than a mixture of ungraded apples of all sizes, shapes and colors.

In the past, the grading of apples was not considered an absolute necessity, but as apple raising has rapidly been developed from a side-issue on the farm to an important industry by itself, strict and uniform grading has become imperative. Competition with the well and uniformly graded boxed apples from the Pacific Northwest has become keener and the consumers as a whole are more discriminating, that in order to sell apples at remunerative prices, the local growers must practice strict and conscientious grading.

Good grading of apples automatically enforces itself in sections that are at great distance from the large markets, as for example in the Pacific
Northwest and in the interwoven mountain States, for there only the highest quality stock, well and uniformly graded can possibly return a net profit to the producers after deducting the high transportation charges in addition to the cost of production and handling. The location of the orchard districts of Massachusetts within easy reach of some of the best markets in the country, naturally affords opportunities not only for the sale of the best but all grades of apples. Primarily because of this fundamental fact there is a tendency to slight the grading of apples and it is not uncommon for one to find about as many variations of the so-called grade as there are growers, ranging in each case from the excellent to very poor and sometimes even fraudulent. However, it is not too late to improve these conditions and the enactment of the State grading law is a step to the right direction. Already Massachusetts grown apples have a reputation of their own and Massachusetts Baldwins that are carefully and uniformly graded and packed in open barrels now are selling as high as well packed Western Delicious and Stayman of equal grade in Springfield and other local markets. There is no reason why the Massachusetts growers can not equal the Western growers on uniformity of size and grade and then put the flavor, texture and keeping quality of the Massachusetts grown apples against the color and finish of the Western apples.

**LEGISLATION**

The service of sorting apples into grades of uniform kind, quality, size, shape, and color is known as grading. Standardization establishes the permanency of these grades; that is, it means that the given grade shall contain the same uniform kind, quality, size, shape and color of apples each day, week, month or year. Standardization furnishes a common denominator by which sellers and buyers may trade in a particular commodity in language which means the same thing to both of them. As long as each individual grower has his own idea of what is meant by a "Fancy", a "No. 1", or a "No. 2" apple, such a common denominator is of
course impossible. Apple grading legislation has furnished this standard for the apple industry.

Because all commodities in general trade are handled to a much better advantage in a large way if standardized and such standardization can not be generally obtained in food products except by some compulsory standard defined by law and some one with authorized power to enforce such standardization, apple grading legislation has been made necessary. The apple trade of Massachusetts is fast becoming one of the large items of her agricultural income. The keen competition with the Western boxed apple trade makes the enactment of a State apple grading law a necessity. Western boxed apples are standardized to such a degree that, opened top, side or bottom, what is shown represents the entire contents of the package, but such can not be said about the average barreled apples.

In 1915 a State apple grading and packing law was passed on the initiative of practically all (the Massachusetts Fruit Growers' Association in particular) that were interested in the production and distribution of apples in the State of Massachusetts and in other New England States. It was an attempt to get a universal law established all over the New England States, and New York State, and in the winter of 1915 three of the New England States passed this law. New Hampshire passed a State grading and packing law of a similar nature in 1917. New York has almost identically the same law, and Maine has an apple grading law which grades its apples into "First", "Second", and "unclassified," instead of "Fancy", "A", "B", and "ungraded." The different State grading and packing laws passed by the New England States are practically the same in nature, as the New England States are very much alike in the production of their apples.

The Massachusetts State grading and packing law fixes a standard for barrels which is the same as the United States Standard as provided in the "Sulzer Bill", and a standard for box uniform with standards of the principal apple growing States; it defines a closed package; it establishes three standard grades
and provides that all apples sold in closed packages not conforming to these three grades or, if conforming, but not branded in accordance therewith shall be deemed ungraded and so marked; it requires every closed package of apples packed and repacked within the State to be marked in a conspicuous place with certain information as to its contents; it specifies that closed packages containing apples packed or repacked without the State to be sold within the State, as of a Massachusetts Standard grade, shall not be falsely marked; it authorizes the secretary of the State Board of Agriculture to make and publish rules and regulations for carrying out the provisions of the act; it empowers the said secretary and inspectors to enter any building or other places where apples are packed, stored, sold or offered or exposed for sale and to open any closed package, and, upon tendering the market price to take samples therefrom. There is also a penalty attached to the law for offences.

The requirements for the three standard grades as provided by this law are as follows:

"Standard Fancy Grade," shall consist of apples of one variety, which are well matured but not over-ripe specimens, handpicked, above medium in amount of color for the variety, normal in shape, good and reasonably uniform in size, sound in condition, free from diseases, fungus, and insect injury, bruises, and any other defects except such as are necessarily caused in the operation of packing. A tolerance of three percent below the foregoing specifications on any one defect, or on a combination of defects is allowed on apples of this grade.

"Standard A Grade," shall consist of apples of one variety which are well matured but not over-ripe specimens, medium in the amount of color for the variety, normal in shape, sound in condition, practically free from diseases, insect and fungus injury, bruises and other defects except as are necessarily caused in the operation of packing. A tolerance of 5 percent below the foregoing
specifications on any one defect, or a combination of defects is allowed on apples of this grade.

"Standard B Grade," shall consist of apples of one variety, which are well matured but not overripe specimens, practically free from diseases, insect and fungus injury or any other defect that materially injures the appearance or useful quality of the apples. A tolerance of 10 per cent below the foregoing specifications on any one defect, or on a combination of defects is allowed on apples of this grade.

"Ungraded," apples not conforming to the foregoing specifications, or if conforming, are not branded in accordance therewith, shall be classed as ungraded and so branded."

The color requirements provided in this law for standard "Fancy" and Standard "A" grades refer to the amount and not to the shade. The proportions of the surfaces to be colored for the different varieties fixed by the regulation of this law are as follows:

"Standard Fancy Grade," the color of apples shall cover at least 75 percent of the surface in the case of red varieties, such as Baldwin, Tompkins, King, Escoge Spitzenburg, Jonathan, McIntosh, Ben Davis, Sutton, Alexander, Wealthy, Fameuse, and the like; at least 60 percent in the case of varieties having slightly less red color than the above, such as Hubbardston, Gravenstein, Northern Spy, Rome, Oldenburg, Wagoner, and the like; and at least 10 percent in the case of varieties having still less red color, such as Maiden Blush, Winter Banana, and the like. Yellow or green varieties, such as Rhode Island Greening, Grimes Golden, Yellow Newton, and the like, must have the characteristic green or yellow color of the variety; the presence or absence of a blush need not be considered.

"Standard A Grade;" The color of the apples shall cover at least 35 percent of the surface in the case of red varieties, such as Baldwin, Tompkins, King, Escoge Spitzenburg, Jonathan, McIntosh, Ben Davis, Sutton, Alexander
Wealthy, Fameuse, and the like; at least 20 percent in the case of varieties having slightly less red color than the above, such as Hubbardston, Gravenstein, Northern Spy, Rome, Oldenburg, Wagener and the like; and at least 5 percent in the case of varieties having still less red color, such as Maiden Blush, Winter Banana, and the like. In the case of yellow or green varieties, the presence or absence need not be considered. The presence or absence of color in the case of the "Standard B Grade" apples is not considered.

There are no size requirements for "Standard A," "Standard B," and "Ungraded," except that the minimum sizes of the above grades be stated on the packages. The minimum sizes when measured at right angles to the stem and blossom end for the different varieties in the "Fancy Grade" are fixed by regulation in the law as follows:

First Group: Diameter, 2\(\frac{1}{4}\) inches; Fameuse (Snow), Golden Russet, Red Canada, Roxbury Russet, Williams, Yellow Transparent.

Second Group: Diameter, 2\(\frac{3}{4}\) inches; Baldwin, Ben Davis, Hubbardston, McIntosh, Oldenburg, Palmer Greening, Red Astraehan, Sutton, Wagener, Wealthy, Yellow Belleflower.

Third Group: Diameter, 3 inches; Fall Pippin, Gravenstein, King, Northern Spy, Rhode Island Greening, Rolfe, Rome Beauty.

Fourth Group: Diameter, 3\(\frac{1}{2}\) inches; Twenty Ounce, Wolfe River.

There has been some objection on the part of some growers and dealers to the term "Ungraded" as provided in the law. The objection to the term "Ungraded" being this: some growers do not grade their apples at all and mark them "Ungraded," so they are in reality "orchard run" - there are some good apples and some very poor apples in them. Other growers take out their "Fancy" and "A" grades and perhaps even all the three standard grades, than the culls which are left are marked "Ungraded". Therefore, the person who is packing "Orchard run" comes into competition with the man who is packing culls, both under the same mark. To make this point clear, it is not uncommon for growers
in New York State to mark "Orchard Run" after the mark for "Unclassified". "Unclassified" is the term used in Maine grading law. The specification for "Unclassified" apples in the Wisconsin grading law is that, if the package contains more than 10 percent of badly deformed fruit from insect injury or fungus disease they must be labeled "Cull".

Another point in the State grading law that has been debated upon is that the size for "Fancy" Baldwins, which is now 2\(\frac{1}{2}\) inches minimum size, should be reduced to 2\(\frac{3}{4}\) inches; and there seems to be a difference of opinion on this. The opinions of a number of growers and dealers all over the State on it seem to be divided. There has been a feeling that a Baldwin apple which is strictly "Fancy" as to color, shape, and varietal characteristics, but which is only 2\(\frac{1}{2}\) inches in size should be admitted to the "Fancy" grade. On the other hand, some people feel that size is an important qualification in the term "Fancy" and there should be no change in the law concerning this point.

The standard grades, as defined in legal language in the bill, are sometimes found to be hard to comprehend. A simple way has been devised to interpret these various grades so to make them easier to understand and to remember and is given as follows:

"Standard Fancy Grade" the sort of an apple which the far west ships to the Eastern markets in the standard bushel apple box, a highly colored, blemishless apple.

"Standard A Grade" a good looking apple with one third color. Before the State grading law was passed, it was the custom of the trade to grade apples as "Number One's" and "Number Two's". This "A" grade apple about conforms to a good old "Number One" apple, except that the former is a little higher in color. The old "Number One" grade would take a great many apples from the center of the tree which, while sound and of good size, do not have enough color for the "A" grade. There should further not be enough blemishes to injure the appearance of the apple.
"Standard B Grade". Similar to the old "Number Two". The "B" grade is the useful grade, a sound, fairly clean apple with no color requirement. The apple of this grade does not have to be particularly good looking; but defects which seriously injure the usefulness will put it in the ungraded class.

These grades as provided in the State grading law make an assortment that would satisfy the demand of the market, and if strictly followed, would go far towards fixing the supremacy of the Massachusetts apples. It has been recognized in New York City during the past few years that Massachusetts "Standard A Grade" usually stands for good apples, and some of the best grade Baldwins on the New York City market have been Massachusetts Baldwins.

To facilitate grading in accordance with the requirements of the State grading law, the State Department of Agriculture has published a circular containing the grading law in detail and also the provisions and regulations. The Department has also published a number of posters giving the various grades and their requirements which could be conveniently posted in the packing houses or sheds so that a grader who is grading according to the standard grades could look up the requirements occasionally whenever in doubt.

The grading law as it stands now is by no means perfect and will stand further improvements. Such terms as "Practically free" "Should be", "Fairly represent", "Materially injure", etc., are too indefinite and make the prosecution of violations difficult. The law requires that the face or shown surface must be a fair representation of the contents, but this is rather insufficient to cover this important point concerning facing, with a result that over-facing is sometimes carried too far in some cases. This should be made to read: "The face or shown surface must be a true representation of the contents of the package." This should also be made to cover not only closed packages but also open packages, as over-facing is too often practiced on apples sold in open packages. In fact, members of the Massachusetts Fruit Growers Association, in their last annual meeting in Worcester, have passed a resolution that the
present grading law concerning facing should be extended by the legislature body to cover faced-open packages. Uniformity of grade in a pack - "U.C.Top,U.C.All" - sells Western box apples, cold Hales' Georgia peaches, and will sell Massachusetts apples. The Canadian Fruit Marks Act requires that the face should truly represent the pack. The Delaware law has gone further and required that the face shall be truly representative of the size, color and quality of the apples in the package. The Maine law states that the pack should be uniform throughout except in barrels, the facing should be made up of apples of uniform size, color, and shape and the apples used in facing should be a part of the grade in the package and should not be taken from a higher grade.

In the inspection work, State inspectors usually cover the Boston markets almost daily and the Springfield and Worcester markets about once in a week. At Boston the inspectors keep in touch with the export trade and inspect the apples on the dock. The inspectors are provided with blanks on which to make reports - these blanks show the owner, packer, number of packages and other necessary facts and whether the lot is correctly or incorrectly marked. Inspection work is also done at the principal shipping stations in the State and also on application. The principal part of the inspection work at the shipping points has been in the big apple growing section in this State, in Franklin county. As far as shipping goes in Franklin county, it extends from about Greenfield to Charlemont on the Fitchburg Road and there has been a wide distribution of the Franklin county apples over the Northeastern part of the United States. With cold storage apples they are inspected when moved to cold storage, and with incorrectly marked apples the owner is notified to mark them. With correctly marked apples, a certificate of inspection is sent to the owner which practically gives him a clearance card to sell the apples.

The beneficial effects of the State grading law on the Massachusetts apple industry can be easily seen and are summarized as follows:

First, since it authoritatively defines grader, it will tend towards
producing more uniformity in grades and better quality.

Second, it will in effect guarantee to the purchaser the grade to be as marked and described on the package, and as a direct result of this, it will encourage the sale of all grades under their respective names.

Third, since it establishes standards for grades, apples graded in accordance with such standards will naturally be in a greater demand, as it is a well known fact that the demand is steadier for established grades than unstandardized ones.

Fourth, it will greatly facilitate market quotations; for, unless the quotations stand for very definite qualities of goods, they can not be used as trading bases.

Finally, such a law tends toward higher and more uniform prices since it prevents fraudulent competition of the poorer with the better grade to the weakening of the price and the discouragement of the better.

A 06 the law has just passed, the effect of this law on prices has been found to be negligible. The only effect the law had at the beginning was that more apples than ever were packed in open packages by growers who seemed to be a little afraid of the law. Practically was this felt by growers in the Eastern section of the State where, in the past two years, a great many growers have used open boxes, as they found that in trying to grade their apples to come up to the Massachusetts Standards and put them in closed packages, such a wide variation in opinion as to what an "A" or "B" grade ought to be like in order to please both the growers themselves and at the same time the inspectors has arisen; and the fault that has been found with apples in cold storages by the inspectors for being marked not according to the Standard have rather discouraged many producers, so that the open boxes of apples have been put on the market without any marks on them whatever. It is not a much a question of the individual grower paying more attention to his pack as it would be to have the chance to hire some one to look after the grading end of the work whose
opinion as to grades would be unquestioned. During the last few years this law has begun to have an effect on the apple prices to the extent that the graded apples according to the Standard move rather freely compared with the unstandardized ones. It has been found that the apple grading law is bringing about this result in some cases; namely, that buyers are beginning to specify Massachusetts Standard grades when they are buying apples. The reason being that the buyers know that if the apples do not come up to the specifications that they can call in the State inspection service as an umpire.

It is, however, unwise to pack in open boxes or marketing all apples as ungraded in order to avoid the grading law. In some sections where the crop is so poor in quality that perhaps this is necessary as it is a practical question whether the grower has enough clean stock to make it pay to grade the apples, but if a man has a reasonable proportion of clean stock, he is certainly making a mistake to put "A", "B" and culls altogether and mark them as "Ungraded," as his ungraded apples are coming into competition with the "Ungraded" apples of a man who has already taken out his "A" and "B's". In other words, " Orchard Run", a large proportion of which is too good for "Ungraded", is coming into competition with culls.

It was with the appreciation that standards must be created and maintained in order that the demand for apples might increase with the production that the International Apple Shippers Association drafted the first standardization measure regarding the grading and packing of apples. Gradually, various Horticultural Societies gave their support, and in 1912 the apple grading law, popularly known as the "Sulzer Bill", was passed for the interstate and foreign commerce. This law is not mandatory; it does not compel honesty, nor can it compel intelligence. The "Sulzer Bill" is educational in nature. It defines three standard grades differing from each other only in size and provides a penalty for misbranding. It provides and defines the capacity of a standard barrel, and states that when the standard grade is packed in the standard barrel,
the grower may then use certain United States brands to designate the three
grades of his apples.

The main purposes of this bill are to establish universal standards for
grades for the marketing of apples in interstate and foreign commerce; to give
confidence to the purchasers; to increase the demand for apples; to raise the
price because of the increased demand; and to stimulate the exporting of apples
to foreign countries. In order to avoid the jurisdiction of the Massachusetts
Act, apples packed in this State must be intended for shipment in interstate
and foreign commerce, and packed and branded in accordance with the "Sulzer Bill".
In other words, apples graded and packed according to the National Act could
only be sold in other States and foreign countries instead of in this State
where they are packed.

The United States Bureau of Markets and Crop Estimates maintains a
fruit product inspection service, one of the offices of which is located in
Boston. This service provides a means whereby shippers or receivers interested
may have upon application a full accurate and disinterested report of the
condition of their inter-state shipments upon arrival at market.

GRADING OPERATIONS

The actual grading of the fruit is an important piece of work. It is
not a mechanical operation, but work that requires quick judgement, a keen eye
and considerable experience. One never grades apples accurately until certain
standard is at first visualized and then established in the mind, and the
grader must also have had experience in the selection of specimen apples for
each grade conforming to the standard. A grader must have such a correct and
sharp mental picture of the requirements for each grade that he will know at
once, when he sees an apple on the sorting table, where it belongs. Having
established in his own mind the grades that are to be made, the grower or the
The supervisor must exercise special care to maintain these standards. He is in danger himself of drifting away from them. The line between the different grades cannot be defined in so many words. The graders must be carefully and persistently instructed in this matter, both by words and example, and their work should be frequently examined and criticized. Carelessness on the part of the employees in grading spoils many a pack that is meant to be the best.

Uniformity in grading should be the keynote. Uniformity in size, shape, and color will not only make an attractive pack, but it also makes packing easier, especially in boxes. All the specimens should grade up to a uniform standard of size, shape, color, and quality; and any fruit so perfect in itself would not be considered to be of high grade if placed amongst fruits either much larger or very much smaller. It might not be out of place to say that much uniformity in size, color, shape etc., can be attained and much expense and time saved in sorting and sizing if more growers would practice thinning early in the season. The man who starts the grading should finish the work, in order to maintain a uniform grade of apples. Frequent shifting of graders is sure to prove unsatisfactory.

Grading is essentially a classification of the apples according to size, color, shape, quality, and blemishes. In grading two or less distinct operations are involved, viz., sorting and sizing.

Sorting: From the very nature of the work, sorting for color, shape, quality and blemishes of any kind must be done by hand, either at the time of picking in the orchard, or in the packing house or shed. Each apple is carefully inspected by the grader and rated as "Fancy", "A", "B", or "Ungraded", according to the grading law used as a standard. A good deal of the grading also depends upon the common sense of the grader. The grader should have the limitations of the different grades with regards to the requirements for shape, color, quality and blemishes explained to him very definitely; his work must be carefully supervised and frequently checked.
The following points should be established in the mind of the grader in sorting:

1. **Perfectness** of shape, which will vary with the varieties handled. The shape should be typical of the variety and should be uniform.

2. **Color** varies also with the varieties handled. The color of apples in each grade should be uniform. The amount of color for each grade is determined by the law or rule followed as a standard.

3. **Quality** — the quality of the apples in each grade should be uniform.

4. **Blemishes** — the limitations of which are determined by the requirements for each grade provided in the grading law or rule followed. The indentification of the insect and fungus injuries as well as bruises enables the sorter in blemish sorting to sort more intelligently.

Carefulness in sorting saves the packer's time and trouble in making the final selection. Upon the sorter, in large measure depends the quality of the output.

**Sizing:** Sizing to maintain a uniformity in sizes is quite an essential feature in grading. It is very important that the apples in a package be uniform in size, it facilitates the packing operations. Sizing could be done either by hand by the grader while sorting for color, shape, quality and blemishes, or at the time of packing, or separate into various sizes by other workers before reaching the packing table. Sizing with the aid of mechanical sizers of various makes is not uncommon with larger growers in recent times. In most instances where hand sizing is done, it is found convenient to have a sizing board on hand, for consultation when in doubt. The sizes of the holes in the sizing board are commonly in variations of one quarters of an inch, such as 2 inches,
2 3/4 inches, 2 3/8 inches, 3 inches, and so forth. But when closer sizing is desired, as in box packing, boards with sizes of hole vary in one eighth of an inch, such as 2 3/4 inches, 2 3/8 inches, 2 1/2 inches, 2 5/8 inches, 2 3/4 inches, and so forth are found to be convenient. But usually when closer sizing is desired as in box packing, packers usually split the differences by hand without the aid of closer sizing boards, when apples are brought to the packing tables in variations of one quarter of an inch. Beginners will find that sizing boards are helpful, while skilled graders seldom have to refer to sizing boards in sizing.

**METHODS AND EQUIPMENTS**

As a rule, the fruit can be best graded and packed in a packing house or shed, as the best work can be done when the best facilities are offered. In Massachusetts, grading and packing operations are very generally conducted under cover, though some growers grade and pack their apples right in the orchards and send the packed apples directly to city cold storages. In some cases early apples are generally graded and packed directly after picking in the orchard. The prevailing temperature during harvesting season in the fall favors common storage and the grading and packing can be extended over a considerable length of time. With later varieties, the common practice is to pick the fruits and place them in barrels, boxes or other field containers which are stored temporarily in sheds and other out buildings and to grade and pack later. If the fruit is to be held for any length of time it should be placed under proper conditions of storage, otherwise, it should be graded and packed as soon as possible and removed to storage. Some of the growers have the fruit graded over before storing in common storages so that each grade could be piled together to facilitate packing later on and the space otherwise would have been occupied by inferior grades or culls could be saved for the better ones.
It is the practice of many growers to grade as they pack, or perhaps more accurately pack as they grade. That is, as the fruit is graded it is placed directly in the container in which it is to be packed. If there is very little grading to do, or if a large percentage of the fruit will fall into one grade, this may be the best plan; but if there is a considerable amount of each of three or four grades, time will be lost by attempting to combine the two operations. In fact, if the apples, as they come from most of the orchards, are to be graded and packed strictly according to the State grading law, separation of the two operations will be found quite necessary.

Sorting tables of some kind are found to be indispensable in grading. When grading is done in the orchard, a movable table should be provided. There are many different types of sorting or grading tables in use. Two types of grading tables are commonly used for barrel packing either in the orchard or in the packing house or shed. These are the apron table and the canvas or burlap table. The apron table or a variation of this type is very commonly used. Frequently tables similar to this could be equipped with wheels so that they can be moved easily about the orchard. The convenient dimensions for such an apron table, or and delivery table, are: length, 7 feet; width, at back, 3½ feet; height at front, 32 inches; height at back, 36 inches; height of the side boards 6 inches. The bed of the table which is sometimes slatted for the dirt and leaves to fall through, is inclined so that the fruit as it is graded rolls to the lower end, where, upon the opening of a stop or trap, it is lowered by means of an apron into the barrel. The slatted bottom is not a good practical construction as the bottom is easily weakened and more-over the slats bruise the fruit more or less. The end of the table where the packing is done tapers down to an opening approximately one foot in width. A fifty or seventy-five bushel hopper or bin into which the fruit is emptied in first is sometimes attached to the apron table. The arrangement has the advantage of furnishing a continuous supply to the grading table. However, unless the bin is kept nearly full, the
fruit is almost certain to be bruised in rolling down the necessarily steep incline to the bottom. The weight of the fruit in the bin also makes it difficult to regulate the feeding and the apples often rush by the graders faster than they can be graded properly. The usual method, where two grades are packed, is to remove the culls and the second grade fruit into baskets or barrels and to allow the first grade to run over the table. When one of the two grades is graded out, the graders should always remove the grade which constitutes the smaller proportion of the fruit, in order to reduce the amount of handling to a minimum, and to allow the grade constituting the larger part to be run over the apron into the barrel. It is a mistake to run the first grade over the end of the table when this would necessitate the handling of the larger proportion of the apples. The man who packs the barrel is usually responsible for the maintenance of the grade. He has charge of the crew at his table and in addition to checking up the work, he supplements the grading by going over the fruit as it passes into the barrel. This type of table allows rapid work to be done, but it is not altogether satisfactory, as the fruit frequently crowds past the grader in a way which encourages carelessness. The actual grading takes place as the fruit is being pushed or rolled along to the delivery end of the table which is frequently kept so full that it can not be thoroughly inspected. Only with very careful management can the different grades be maintained by the rise of this table, especially, if the fruit is not uniform in size, shape, color, and quality.

The canvas or burlap grading table is made of canvas or burlap stretched over a rectangular frame. It is not constructed for running the fruit over an apron into the barrel as does the apron on end delivery table. The apples must be graded by hand into baskets. The advantage of this table is that all the apples are subjected to careful inspection as they are removed by the grader. Although, as a rule, this is a slower process than that of handling the fruit over an apron table, the grader with some practice soon becomes skillful and
and able to handle the fruit very rapidly. When as much as half of the fruit must be removed from the apron table in the process of grading, the same work could be done as rapidly and more accurately over the canvas or burlap top table. Care must be exercised with the use of either type of table if the best result is to be obtained. In case of the apron-end delivery table, the fruit is often bruised by crowding it along with the picking baskets, when the work is done in the orchard, as they are being emptied on the table. With the canvas or burlap topped tables, the graders should be cautioned about throwing the apples into the baskets into which the fruit is being graded. Injury from this source may be avoided to a considerable extent by padding the baskets.

The canvas or burlap topped table just described in connection with grading for barrel packing can also be used in case of grading for box packing.

The box packing table which is shown in Fig. 3 is also used sometimes for grading if the fruit is not graded before reaching the table. The dimensions for such a table are: 3 x 4 feet, made of 6 x 1 inch boards with 8 x 4 inch joists as posts. A stout canvas is stretched across the top of the boards. An old piece of rubber hose may be nailed along the top of the boards over the canvas to protect the apples from bruising. Shelves for holding the apple boxes are made at a slant on opposite corners of the table. Extra shelves may also be made under the table for the holding of wrapping papers and other packing accessories, thus saving a lot of the packer's time by having everything convenient. As the apples are placed upon the table they are generally graded for size, shape, color and quality. Sizing is often times done by the aid of a mechanical sizer before the apples reaching the table for bluish and color sorting.

A convenient grading table arranged for grading apples either for barrel or box packing when the crop handled is small, is shown in Fig. 4. ABCD represents a table 2 3/4 to 3 feet high. E shows where the grader stands. Opposite the grader on the table is placed the box or basket of ungraded fruit. To the side of and behind this are placed baskets or other containers to receive the
Fig. 3. — A box grading and packing table.

Fig. 4. — A convenient grading table arranged for handling a small crop. ABCD represents the table, and E the position of the grader.
different grades. As these are filled they may be set away and other empty ones are put in their places.

**MECHANICAL SIZERS**

Recently larger growers, co-operative associations have begun to employ machine sizers. Information secured on this shows that there are over one hundred such machines in use in the State at present and the use of them is increasing. Reports received from the manufacturers and dealers of machine sizers show that they are increasing at the rate of about thirty each year. They are to be considered when different sizes are to be made in the same grade. The enactment of the State grading law to regulate grades and packages will necessarily demand more attention to the size in the pack, and the use of mechanical sizers is a good means for complying with the grading law cheaply. Growers who have been trying to grade apples by hand have found it fairly expensive and it will pay any larger growers or any group of growers who have enough apples to send to the markets, to use machines for sizing. The use of the machine enables the grower to give more attention to the sorting for color, shape, defects etc., as the graders are not concerned with the size classification.

Prior to 1911 there were no mechanical deciduous fruit sizers, because the problem of check to check measuring by machinery had not been solved. After many years of experimenting, fairly satisfactory machine sizers for deciduous fruits have at last been produced. Now one finds many types of mechanical sizers on the market, from a simple portable one to a complicated and heavier type, driven either by hand or motor power.

Mechanical sizers are often erroneously called "Grading Machines". It must be remembered that the machine is simply a sizing apparatus, and the actual sorting for color and defects has to be done by hand either before or after the apples are sized by the machine. The most common types of mechanical sizers
employed by growers in this State are the Pease and Gifford, which are shown in Figs. 5 and 6 respectively. Brief descriptions of these are given below:

**Pease**—This sizer can be used to size not only apples, but also peaches and pears. It makes two, three and four sizes. It can be cranked by hand or driven with a 1/8 horse-power motor. The fruit is placed first in a hopper which is inclined toward an endless belt of wooden cups or packets. As the belt of cups travels upward each cup takes up an apple and carries it over the sizer. These cups open at various intervals to different sizes, and the fruit drops gently into canvas chutes or conveyors. This sizer can be adjusted to make four sizes ranging from 1 1/4 inches to 3 1/2 inches. A simple set-screw at the point where the fruit drops from the cups into the canvas chutes can be raised or lowered instantly to the desired sizes. The points at which these thumb screws are to be lowered or raised are indicated by graduation or size marks. The hopper is low, so that one man can easily fill it either out of the barrels or boxes. The cups travel upward and so pick up the fruit from the lower or feeding hopper. The feeding from the hopper into the cups is automatic. This machine can be moved around in the orchard. The chutes and feeding table can be taken apart from the main body. The cost of the machine is about $400. This machine sizer sizes accurately but in somewhat rough on the fruit. The capacity of this machine is about 400 to 450 bushels per day. The efficiency of this machine is about 87 percent.

**Gifford**—This sizer is equipped with an endless horizontal belt which is inclined in such a way that the fruit rolls toward the lower edge where it comes in contact with a revolving roller. This roller is set at a height of 2 1/4 inches above the belt at one end and 3 inches above the opposite end. This arrangement will provide for three sizes, 2 1/4 inches to 2 1/2 inches, 2 3/4 inches to 3 inches, and 3 inches and larger, the largest size being carried over the end of the belt. However, the roller is adjustable and may be set at various heights, depending upon the sizes desired. There are also models which provide...
Fig. 5. — The "Pence's Perfect" mechanical sizer.

Fig. 6. — The "Gifford" mechanical sizer.
for more than three sizes. The capacity and efficiency of this machine is about the same as the Pease. This type of sizer is best for round apples, as the flat ones do not roll well. Bruising is easier with this machine and it also catches apples if not well managed. The machine is light and portable and can be used in the orchard. The price for this machine is about $125. This type of machine can be either cranked by hand or driven by motor power.

The speed of these machines needs to be regulated very carefully, as the accuracy and care with which the apples are handled are largely dependent upon the speed of the belts and chains. Practically all sizing machines when run too rapidly are inaccurate and cause an excessive amount of bruising. When the conveyor belt delivers the fruit very rapidly to the sizer a congestion may result from the inability of the sizing device to size all the fruit delivered on it. When it is desirable to increase the output of the machine, the fruit should be supplied in an uninterrupted flow rather than by increasing beyond normal the number of revolutions of the drive wheel.

There are many other types of mechanical sizers on the market which are less commonly used by growers in this State. The choice of the machine will have to be made by the grower, based on a consideration of the size of the orchard, the equipment already on hand, the accuracy required, and the number of sizes desired. There are a number of points that growers should keep in mind in making this choice:

1. The machine must have a capacity proportionate to the size of the orchard so that the operation can be conducted economically. In choosing between two machines, one which has a large capacity but is only moderately accurate and the other which has a small capacity but is very accurate, such as those used in connection with box packing, the former is preferable in most cases where apples are graded for barreling.
Fig. 7. - The "Pease's Perfect" sizer inside of a packing-house.
(2). Simplicity of design and freedom from too numerous adjustments are features very much desired.

(3). An investigation should be made to see that there are no arrangements or devices that will unduly bruise the fruit. If the apples are bounced along on metal or unpadded parts, or if the construction in any way necessitates crowding or congestion, there is danger of injury, and such a machine will not be suited to tender varieties.

(4). The durability of the machine is a matter of great importance. If such a machine is not substantial, it will soon go to pieces when subjected to the rough handling that is usually given to such equipment.

A survey of the existing conditions amongst the growers in Massachusetts concerning the question of grading has been attempted by the writer through a circular letter or questionnaire which has been sent out to eleven county agents, and ten replies have been received. Two of the questions on the questionnaire are of interest:

(1). How extensive is the practice of grading amongst the growers in your county? Do they follow the Massachusetts Standard grades?

(2). Do growers who cater to local trade and sell their apples in open packages grade their apples at all?

The answers to the above questions given by the ten county agents representing the different counties are tabulated below:

<table>
<thead>
<tr>
<th>County</th>
<th>Question No. 1</th>
<th>Question No. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barnstable</td>
<td>Very little grading done. The grades are &quot;1st&quot; and &quot;2nd's&quot; and not standard grades, where grading is practiced.</td>
<td></td>
</tr>
<tr>
<td>County</td>
<td>Question No. 1</td>
<td>Question No. 2</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Bristol</td>
<td>Most apples are sold &quot;Jumble Pack&quot;. Very few growers follow any standard.</td>
<td>Yes, most of them have &quot;let's&quot; and &quot;End's&quot;.</td>
</tr>
<tr>
<td>Essex</td>
<td>Very little grading done.</td>
<td>Yes.</td>
</tr>
<tr>
<td>Franklin</td>
<td>A small part of the crop is graded, much of it is shipped ungraded, although the best growers usually grade.</td>
<td>Yes, and they are now developing a very good demand for local apples.</td>
</tr>
<tr>
<td>Hampden</td>
<td>75 percent of the growers practice grading but very few growers follow the standard grades. They market in open packages.</td>
<td>Grade fairly well when sold in open packages.</td>
</tr>
<tr>
<td>Hampshire</td>
<td>Bulk of the apples sold ungraded.</td>
<td>No regular grading.</td>
</tr>
<tr>
<td>Middlesex</td>
<td>Most growers make two or three grades. These grades do not correspond with the standard grades in the apple grading law. They are mostly sold in open packages. They tendency among most growers is to overface, especially the &quot;3rd&quot; grade.</td>
<td>Tendency, when supplying the local trade is to grade better than when selling in wholesale market.</td>
</tr>
<tr>
<td>Norfolk</td>
<td>A very few growers grade.</td>
<td>Growers who cater to local trade make two grades.</td>
</tr>
<tr>
<td>Plymouth</td>
<td>Very little grading practiced.</td>
<td>Some.</td>
</tr>
<tr>
<td>Worcester</td>
<td>&quot;let's&quot; and &quot;End's&quot; are mostly sold together.</td>
<td>Yes.</td>
</tr>
</tbody>
</table>
PACKING

The fast growing commercial importance of the apple crop in Massachusetts demands the packing phase of the industry be given intelligent study. Wonderful strides have been made in the methods employed by the average growers in the management of their orchards, but only recently have the growers begun to give more time and attention to the packing of their fruits for market. While the more progressive growers are putting up really good packs, there are still too many poorly packed apples being offered for sale on the market.

Better packing methods are needed especially for the higher grades of apples. It is often true that the best Massachusetts apples are not any better packed than the poorest, but since the average consumer buys the fruit more on its appearance than because of its quality, the growers suffer a corresponding loss of whatever they have gained through the improvement of the orchard practice to secure better quality apples. Nothing is more discouraging than the loss of legitimate profit, or a major portion of it, on a crop of fruit that has been produced at a considerable expense, because unattractively presented to the market.

The grower may criticize the consumers' taste in doing so, but it is to this taste they must sell and gradually they are learning to consult it. It has often been said that the package sells the fruit, but more correctly, it should be the package together with packing that sell the fruit, or at least largely influence its sale.

The consumers have seen the neatly packed Northwestern boxed apples and somehow they have come to associate the straight, even rows and uniform layers with high quality; and almost unconsciously, they associate less attractive packing with slip-shod methods of culture and careless handling, perhaps often unjustly, but the fact remains nevertheless. Uniformity of quality, color, and size together with attractive packing and neatness of package are assets to better
advertising, and a satisfied customer is the best known advertising medium.

It is well known that the quality and flavor of Massachusetts apples are far superior to those raised under conditions of irrigation, but unfortunately this fact is not always appreciated because of improper packing. Many retailers and consumers who confess a preference for the quality and flavor of Massachusetts grown apples are yet habitual buyers of apples grown and shipped outside of the State because they are offered to them in a manner which appeals to them.

A lesson can well be taken from the Northwestern growers, not that all the apples should be packed in boxes but that fruits of good and uniform quality should be attractively packed in any package, whether barrel, box or other kinds of containers. Many instances can be given of good profits made from good packing compared with poor packing, but nearly every one has seen illustrations of this in the markets.

The packing problems of a grower who is disposing of his products locally direct to special or personal markets are few and comparatively simple. But when larger growers who are catering to distant and open markets, the problems multiply and become intensely complicated. Packages that will stand rough handling and shipment must be used. They must be neat, reasonable in cost, and attractively packed, for where the grower is unknown to the buyer both he and his wares are invariably judged by the appearance of the latter. In the keen competition of the open market, the well packed barrel and box always sell at the top of the market while carelessly packed fruit of better quality will bring only an indifferent price. To be sure that clothes do not make the man, but they do make an impression on strangers.

The apple grading and packing law has done and is doing much to give the Massachusetts apples a reputation of not only in the local markets but also in those outside of the State, as during the last few years Massachusetts apples have been sold as far west as Cleveland and Detroit in considerable quantities.

The strong tendency for apples to be grown more skillfully combining with better packing methods will go far towards fixing the supremacy of Massachusetts
Before going into a discussion of the equipment for and methods of packing, it is best to consider the packages employed as packages will determine to a large extent the equipment and methods. In general, packages are mainly of two types, non-returnable or "gift" packages, such as the standard apple boxes, peach baskets, hampers, cartons etc., and the returnable packages, such as the standard boxes for farm produce. As for gift packages, the grower bears the expenses; it is his aim to use a package which is at the same time strong, light, attractive and cheap. The increasing cost of lumber is making this a more and more serious problem. The principle functions of a package are: to furnish a convenient means of handling the product; to furnish protection from physical injury to the contents; to render safe from pilfering; to furnish a measure of the contents; to furnish ventilation to the goods; to furnish a means whereby the goods carry marks of identification, shipping directions, indices of quality, compliance with the laws, and advertisement; and to insure cleanliness of the contents. The size and kind of packages will of course depend more or less upon the kinds of markets catered to, the variety, the ease of handling, the convenience of retailers and consumers, and the shipping distance.

In the choice of an ideal package, it is often best for the grower to have the following points in mind. An ideal package should be relatively cheaper in cost; shipped well "knocked down", causing the minimum amount of bruising to the contents, easy to pack the fruit in; fitting or packing well in wagon, truck, or car; attractive in appearance, easily carried by the consumer and conveniently handled by the retailer; useful after being emptied; safe from stealing; carrying advertising well; and rebate, or possible to be used again.

There are many kinds of packages now employed for apples in Massachusetts. Notably among these are the standard apple barrel and the standard box for farm
produce. The standard apple box which is similar to the Northwestern apple box is used to a very limited extent in this State. The following is a brief discussion of these various kinds of packages now employed with reference to their uses and limitations.

The barrel is an old and well recognized package. From almost the beginning of the apple industry, the barrel has been the standard apple container and it possesses many valuable features. It costs less, and is easily obtained, more adapted to rough usage in transit than any other container, safe from pilfering, and useful when empty. A barrel can be easily and quickly packed, and the apples in it can be handled at a less cost than in boxes. It can further be handled by rolling more easily than any other packages of its size.

On the other hand, it has many disadvantages also. Chief among these are that it contains a larger amount of fruit than most families can buy at once, and it does not stack to advantage either in storage or in shipping. Fruit packed in it are more easily bruised due to the amount of pressure that has to be exerted to secure a firm pack. It is, furthermore, not adapted for handling fancy apples of tender-skinned varieties, like Gravensteins, McIntosh and Northern Spy.

The barrel, in spite of its many undesirable features, is still the most profitable container for the main commercial trade. The barrel is at present used for the larger share of the crop of the Western part of the State both for storing and marketing apples in. The greater bulk of Massachusetts apples are at present packed in barrels for the main commercial trade and it promises to be a standard container especially for the Massachusetts leading variety, the Baldwin, for many years to come.

Certain trade will require first class fruit in barrels and must be catered to. It is an excellent package for use in the exporting trade, especially to England, where people are more accustomed to Eastern apples in barrels; and the apples must be put into a container that the market demands and it is never wise to force on a market, containers which it is not accustomed to.
The barrel is especially adapted to the wholesale trade of average grades. Its cheapness, strength and ease of packing recommend it highly to the growers who must handle large quantities of medium grades of apples or who must depend upon inexperienced men for his packers. For the marketing of the greater bulk of the Massachusetts apples the barrel presents advantages that make it indispensable. The barrel, therefore, still maintains a permanent position as a package for apples in this State.

The old Boston Produce box, which is eighteen inches in length, eighteen inches in width, and eight inches in depth, inside measurements, has long been used for the marketing of apples by growers in the vicinity of Boston who are within trucking distance of their markets. Its place has been taken by the new standard farm produce box, which is seventeen and half inches in length, seventeen and half inches in width and seven and one sixteenth inches in depth - inside measurements. It was legalized as a wholesale package by State legislative measure in the winter of 1931. This produce box of these dimensions is also a legalized container for vegetables and fruits in Rhode Island.

This standard produce box possesses a few valuable features as a package for apples. It is easy to pack apples in and a strong and convenient package to handle. It enables the apples packed in it to present a large show surface. Since it does not require much pressing, there is less bruising due to packing commonly found in barreled apples. The box itself is comparatively cheaper in cost and is at present a credit package, which means that the grower obtains a portion of his original package investment back from the purchaser. It is also the practice in some sections, where the market is local, to get the empty boxes back and sell to the vegetable growers. These used-boxes can also be used over and over again for the lower grades. They also make excellent receptacles for field and storage purposes.

The standard produce box, being a more rigid affair, has hardly any "give" to it. Tightness, therefore, can not be very easily secured, and it is
not at present a very desirable package for long distance shipping. Furthermore, it does not possess good space for advertisement on its sides as does the standard apple box.

For local markets, the standard produce box is largely in use among growers in the Eastern part of the State. Its growth in popularity is making the barrel a less and less used package in the Eastern part of the State. The automobile truck has had a very great effect in making this standard produce box very popular. Boston especially has a preference for this box as an apple container. A great many more apples are coming into Boston in this package every year from as far as fifty miles. There are also many apples in this standard produce box handled in Worcester, Brockton and Taunton markets.

This standard produce box has become extremely popular with growers in Middlesex, Essex, Worcester, Norfolk, Barnstable and Bristol Counties. But, due to the fact that firm pack is hard to secure with this standard produce box, there has not been very many apples shipped in it for distant markets. There are however, some growers, in the Eastern section who have been using it as a package to ship apples into Liverpool, England. Notably among these growers is Mr. John Hardy, who has been shipping on the average of about a thousand boxes yearly to England.

Commissionmen who have handled the produce boxes for the export trade, seem to think unfavorably of them. The reasons they give are that the apples in this box could not be handled well in transit and the steamship companies require it to be wired to avoid breakage which adds a cost of five cents per box, thus increasing the cost of handling. Furthermore, the commission men claim that the English people have a prejudice against the produce box as an apple container and it is known as a "crate" instead of box there; and they are more accustomed to Eastern apples in the barrels. In off years, it is said, that the produce boxed apples will sell. But in spite of its disadvantages for long distance shipment, it is the opinion of many growers that it will surely increase in popularity as a package for apples especially for local trade in Massachusetts.
It is only within the last two decades that the "Western box," as a container for apples, has been coming to the front as an important competitor to the barrel. The standard Western box is a legalized apple box in Massachusetts, since the enactment of the State apple grading and packing law in 1915.

This standard apple box possesses several valuable features which cannot be overlooked. Chief among these are: 1. the fancy fruit can be displayed to advantage in it and is more accessible to inspection; it is flexible in construction and the top and bottom boards are made to bend rather than the fruit in it, therefore, there is less bruising of especially the tender varieties, like Gravenstein, McIntosh and Northern Spy; in larger containers, there is a greater amount of shrinkage in transit which results in a slack pack with corresponding bruising to the fruit, and to overcome this result of shrinkage, the box permits a heaped bushel and as the contents shrink in transit, the top and bottom boards of the box conform to the decreasing amount, so that the arrangement of apples within it is not disturbed and the pack remains firm; it packs well in wagon, truck or car and stacks well in limited space; its size makes it more convenient for many customers, thus a grower can get his brand directly to the consumer; it carries advertisement well and is a more attractive package; and finally, it has a good reputation as an apple container and is favorably known in all first class trade.

In spite of all its valuable features, it is not generally used in Massachusetts. The reason for this being that it fits only the highest grade of tender varieties for dessert trade; the cost of package, packing and handling; is comparatively high; it requires skilled packer to pack which is hard to obtain; and being a gift package, there is no rebate. Furthermore, it is the opinion of many growers of high quality apples that Massachusetts grown apples have a reputation of their own and deserve a distinctive package to mark them from the out-of-State grown apples. The present produce box might prove to be the future candidate as it can stand further possible improvements to make it
fit for such a mission.

The Pomology Department of the Massachusetts Agricultural College recommends that only Massachusetts Standard Fancy Grade apples of high quality varieties be packed in this standard apple box. A possible exception might be made in the case of perfectly high quality apples of full color but which are not large enough to go in the Standard Fancy Grade.

High quality varieties grown for a home market trade may be packed in the standard apple box with good financial results, particularly when the fruit is fancy and unusually good and uniform. This is evident as lower grades and varieties that are primarily cooking apples will not pay for the grower to go into the expense of careful grading, wrapping and packing in the standard apple boxes, and the consumers can not pay a fancy price for them.

There are a few individual growers in Massachusetts who are growing strict high grade fruit of extremely high quality varieties and packing it with great uniformity and care and who because of these and well directed advertising are building up a fine reputation for their apples in the standard apple boxes, and find an unlimited market for them. Notably, among these growers are a few in Franklin county who have developed a good local market for their boxed McIntosh and Northern Spy.

Growers in Massachusetts should spare no effort to maintain the high standard of quality in attempting to use the standard apple box, for high quality is the thing which the standard apple box has always stood for. The fruit should be grown under a well-planned orchard practice. In addition to this, the grading and packing have to be properly done and the whole package has to be made attractive, without these qualifications the standard apple box can not be profitable in any market. The success of the Northwestern growers in using the standard apple box could be attributed to: first, care is taken to produce and pack nothing but the highest quality fruit; second, because they have employed trained packers to pack in a systematic and uniform manner; and finally, because not only is the packing done by persons trained in this work, but it is supervised by
the association through which most of the Northwestern fruit is marketed.

The use of the standard apple box has been objected to in some cases by commission men and fruit dealers. Sometimes it was due to the fact that the apples packed in it were not up to the standard of high quality or packing was not properly done, but it has not always been on account of these that they have based their objections and discouragements toward the use of the standard apple box on the growers part. In some cases it has been found that the Commission men and fruit dealers have bought apples packed in barrels and repacked them in the standard apple boxes, thereby making quite a profit for themselves.

Growers in the vicinity of Springfield, Massachusetts, have been using the fourteen-quart peach basket as a container for apples. This has proven to be a fine package as it contains a convenient quantity of apples for a family to purchase and consume are lost from deterioration starts. It has filled the long felt want for a smaller package. But it has many defects, such as being a poor package for hauling to market and stacking in the retail market or retail store. It has been the opinion of many growers that the standard half-bushel farm produce box legalized by the state law, which is 12 3/8 inches in length, 12 3/8 inches in width and 7 1/16 inches in depth — inside measurements — will be destined to replace the fourteen-quart peach basket and become popular with growers of high grade apples who are catering to the roadside stands, fruit stores, and retail-store trade. It is hoped that in the future, when it is extensively used, it may in time become also a credit package like the standard bushel produce box.

The four-quart, wire bale baskets are also coming into common use for fruit stand and roadside stand trades for the earlier varieties. Corrugated paper packages, which are ideal for special and personal trade, are used by a few growers, but not to any extent commercially. Their use will likely be developed in the future for specialized markets. The cost of these corrugated paper packages is rather high at present. The stave bushel basket and the
bushel hamper are attractive packages, but these are used to a greater extent in other sections outside of Massachusetts.

A new cardboard box, holding a bushel of apples, has made its initial appearance in Massachusetts last year and it is known as the "Fibo-pack" box. It is not used to any extent by growers in Massachusetts, although John Connor's retail fruit store in Boston has handled a number of them recently. This box has a flaring mouth or top and the cover is clamped down on each side by means of copper wire clamps. But its non too rigid sides cause the contents to be easily bruised during handling. Apples cannot be packed in it to advantage either, due to its construction.

Packing Equipment and Materials and The Methods of Packing

Barrel - The apple barrel employed at present is a standardized barrel both by the Federal and State legislation. The dimensions and capacity of the standard barrel as defined by the Massachusetts law correspond to those specified by the Federal law. The specifications of the Standard barrel as provided in the Federal and State laws are: length of the staves, twenty-eight and half inches; diameter of heads, seventeen and one eighth inches; distance between the heads, twenty six inches; circumference of the bulge, sixty-four inches, outside measurement; and the thickness of staves should not be greater than four sixteenths of an inch. Any barrel of a different form having a capacity of seven thousand and fifty cubic inches could be used as a standard barrel.

The apple barrels are made from various kinds of woods, the more common ones being elm, white gum, maple and birch. Oak makes a rather heavy barrel and is too expensive for common use. Hickory used to be employed for barrel material, but it is too expensive to be used at present. Poplar has the advantage of being light, but the wood is brittle and likely to give trouble during heading. Pine, hemlock, and spruce are sometimes employed, but they are rather unsatisfactory as harder woods are to be preferred, since they are stronger. Elm, Maple and birch
are very satisfactory.

The heads of the barrel are usually made from the same material as the staves and come in two to four pieces. If the separate pieces are held together by means of staples, they are much more convenient to handle than if loose. Rim hoops, sawed rather than split, are desirable for use. Split hoops are claimed to be stronger, but sawed hoops are certainly more neat in appearance. Iron hoops are not as common in Massachusetts as in the other New England States. Wire quarter hoops have been used by growers in the western part of the State, but their use is diminishing. It is claimed that wire quarter hoops fit more tightly and do not break as easily as the wooden hoops. However, if the wire hoops are broken or become untwisted at the joint, it is almost impossible to repair them without special equipment.

Two grades of barrels are commonly made. The main difference between these two grades lie in the kind of wood used and the workmanship. The first grade of barrels are made from better woods and more care is exercised in the selection of the hoops than in the second grade stock. The heads of the first grade barrels are usually made from two or three pieces while those of the second grade are frequently composed of four pieces. Barrels of the first grade are probably more economical on the whole, as those of the second grade frequently break and cause extensive loss in handling.

Barrels are usually coopered with six hoops, but eight hoops can be used to advantage for long distance shipping—four quarter-hoops are used instead of the usual two. The double middle-hoops insure greater strength, as the usual two quarter-hoops are often broken in handling and a barrel without quarter hoops is very likely to be badly sprung. Furthermore, barrels fitted with double quarter-hoops are more solidly stacked on the bilge as they are prevented to a certain extent from rocking.

The barrel, when not ordered "knocked down", is generally delivered to the grower with both heads and all the hoops in place, but with none secured by nails. This permits storing it indefinitely without the danger of warping. Barrels in
this State are usually in good supply, but some of them are rather inferior in quality. Most of the supply has come from the local mills, with the exception of a few cases of New York barrels shipped in at times. The present cost of barrels ranges from sixty-five to seventy-five cents per barrel.

Some growers buy the materials in shocks and cooper the barrels up themselves. But the larger number of growers obtain their barrels from the manufacturers already made up. To avoid possible difficulty of obtaining barrels, it is always desirable to order them in advance of the time when they are needed.

When large quantities of apples are to be handled in barrels, the best method of buying the barrels is to secure them "knocked down" in shocks, that is, staves, heads and hoops separate in car lots. With a serviceable cooper outfit and any out-building can be readily fitted for barrel making. A package storage room above a packing and storage house can also be fitted for this purpose. Skilled workers can be employed, but ordinary farm help can also be easily trained for this purpose with a few instructions so that they can work at barrel making during winter months or other times when work is slack on the farm. The advantages of barrel making at home are that the stock can be bought early in the season and is easily stored and the price therefore is usually cheaper than when an order has to be placed in a hurry. The chance of being left without a stock of packages is also minimized.

The use of clean and bright packages for packing apples in can not be too strongly emphasized, especially with the higher grades of apples. It is not advisable to use second-hand barrels even for local market, and it is absolutely impossible to make a profit on apples shipped to distant markets in second-hand barrels. A second-hand barrel can never be made as clean as new ones. Apples in general market when packed in second-hand barrels are often sold at a reduced rate, notwithstanding the quality of the fruit. If second-hand barrels must be used, they should be carefully cleaned and used only for the lower grades.
New barrels should always be used for the best and second best grades.

Serviceable and adequate equipment and materials are indispensable for good packing. In barrel packing, a packing or grading table is an essential piece of fixture whether the packing is done in the orchard or under cover. The canvas or burlap-topped table as described under grading is by far the better table for use. Another table of a similar type which is three feet wide and six feet long and six inches deep with six inch boards around will be found convenient. The sides and bottom of this table should be padded or the latter made of canvas or burlap to lessen the danger of bruising the apples. A table of this size can be mounted upon two carpenter’s "saw horses" instead of having rigid stationary legs. The tray part of this table can be hung up on the wall when not in use. To save the time of the packer, it is better to have the fruit graded before packing starts. Swing-bail, half-bushel picking baskets, as described under picking, should be provided for lowering into the barrels during filling.

There are many different makers of barrel presses on the market, but mainly of two types: the screw press and the lever press. The type of the press used to head the barrel is a matter of considerable importance since there are two principles of construction involved, one of which is outstandingly superior to the other. The pressure in one case is applied by means of a screw and in the other by means of a lever. The screw press, shown in Fig. 8, although probably slower in operation than the lever press, is safer to use, as it enables the packer to head a barrel with the minimum amount of bruising. This is quite evident because the pressure is exerted as a steady force which adjusts the head by degrees, and the severe shock that usually accompanies the use of the lever is avoided. Where the lever type of press is used it is not uncommon to see the header jump on the lever and bring the head into place with a crash, thus causing severe bruises and skin breaks of the apples in the top-layer.

There are two different styles of screw press, the circle follower and the bar follower as shown in Fig. 8. The former consists of a circular iron ring,
Fig. 6. – Barrel packing equipment:

No. 1. Screw-press with circle follower
No. 2. Screw-press with bar follower
No. 3. "Stemmer" (small thinning shears)
No. 4. "False head", or padded follower
No. 5. A good type of hatchet for use in either barrel or box packing
No. 6. Hard-wood hoop follower
No. 7. Corrugated, card-board pastor head.
fourteen inches in diameter, with two arched crossed iron bars; and the latter consists mainly of a horizontal wooden bar that fits against the head of the barrel. The circle follower is an improvement over the old bar style follower, as the former puts the pressure exactly where it is needed, around the outer portion of the head next to the chime. The circle follower is therefore a better one to use than the bar follower as it touches the entire circumference of the head thus insuring its going down more evenly than the bar. Often times, in using the bar follower, the center of the head, immediately beneath the horizontal bar is forced half of an inch below the level of the croze in order to get the edges of the head down into the croze; and the center often springs back when the pressure is removed, but it has needlessly bruised a great many apples on the surface layer.

An attachment to the screw press, which has been recently introduced, consists of a platform on which the barrel rests when it is headed, but this would be inconvenient for work in the orchard. When not equipped with such a platform, the press hooks onto the bottom of the barrel by means of iron strips with hooked ends that extend down each side of the barrel. It has been claimed that this arrangement is undesirable as it is likely to break the bottom hoops as the head is pulled into place, especially if the barrels are old or damp, thus materially weakening the barrel for subsequent handling.

A "stemmer" which is usually a side-cutting wire nipper is necessary for clipping off a portion of the stems from the apples, especially the long-stemmed varieties, of the face layer to avoid skin punctures of these apples as the long stems, when not clipped short, often bend over and pressed by the head of the barrel into the flesh of these apples. Furthermore, when the stems are clipped short, the apples in the face layer will stay more stationary and rest more evenly upon the face end, wobbling and buckling of apples in the face layer are therefore avoided. When fancy face circle is employed, the chance of puncturing this circle by the stems of apples in the face layer is also minimized.
Stemming is sometimes omitted in strictly commercial work, however, when careful work is desired, this is indispensable. A pair of small thinning shears, as shown in Fig. 8, will serve the purpose of a stemmer when the side-cutting wire nipper is not available. Stemming should not be attempted with ordinary knife as it is almost impossible to avoid cutting the skin of the apple with the point of the knife and this injury would be as great as any that could be made by the stem itself.

To facilitate tailing, a heavy, round piece of board, thickly padded on the underside, slightly smaller than the barrel head, with or without a handle on top, is universally employed and favored by growers in barrel packing. It is known as the "false-head", or "padded-follower". It is employed when the barrel is nearly full for pressing the apples down during racking to secure a level surface on which to lay the "tail" or last layer of the barrel. It is fitted into the head of the loosely filled barrel, and being held in place during the racking operation, it causes the apples to settle with an even surface. This "false-head" is applied to the full barrel if the "jumble tailing" is used; but when the barrel is "ring tailied", it is applied before the barrel is quite full.

A good barrel hatchet should not be dispensed with for rapid and satisfactory work. A serviceable one is shown in Fig. 8. Light cooper's hatchets or shingling hatchets are commonly employed and are quite satisfactory. Care should be taken to select a hatchet with a notch cut in the throat for nail pulling with the upper surface bevelled so as to go easily under the head of a nail that is already about one eighth of an inch or less out.

A small two inch thick hardwood block, as shown in Fig. 8, known as "hoop-follower" or cooper's "driver" is sometimes employed to distribute the force of blows and save the hoops when being driven with a hatchet. It is easier on the hoops and with careless packers it is perhaps absolutely necessary that a driver should be used. With care, however, much rapid work can be done by using the flat side of the hatchet in driving the hoops down into place.
Racking plank of at least two inches thick for solidity, by twelve to fourteen feet wide, and by eight feet long is especially necessary to rack barrels on when packing is done in the orchard or on soft grounds. It will enable better racking and also prevent the face end of the clean barrel from being badly fouled with soil. It ought to be used especially for apples packed in the orchard intended for long distance shipment or export, as a firm pack is nowher more needed than in these occasions.

Good stencils, ink and brush are needed for satisfactory stencilling work. Nothing detracts more from and otherwise good packing than imperfect or slovenly stencil work. The requisites for good stencilling work are good stencil ink and a fairly stiff round stencil brush. The ink should be thin enough to work freely into the fibre, but not so thin as to run under the stencil even in the direction of the fibre of the wood.

Liners, which are strips of pliable wood, are usually made of the same material as the hoops. Elm and gum-wood liners are most commonly employed. The usual dimensions are six inches long and three-eighths of an inch in width. They usually come in bundles. Liners, when used, tend to prevent the heads from springing out of the crosset when the pack is submitted to a severe strain. The use of liners can not be too strongly recommended. They add greatly to the strength of the heads and do not detract from the appearance when made of proper material and properly placed. The use of liners is especially important in packing apples for the export trade and long distance shipment, where rough handling is expected, though it is a good plan to use them in all barrel packing. The liners should be kept thoroughly damp while being used to avoid breaking and splitting when bent to the curve of the heads and nailed.

Nails are another item that is essential in barrel packing work. Five-penny, smooth nails are heavy enough for nailing through the hoops and the heads. Three-and-a-half-penny nails are also commonly employed for this purpose, but five-
Fig. 9. – Head of a barrel with liners properly placed. A, A represent the two liners.

Fig. 10. – The face of a packed barrel, showing the fancy lace circle.
penny ones are better, for nailing the head-liners, the ordinary small hoop
nails are found satisfactory, as heavier nails often cause the splitting of the
liners.

Corrugated, circular, card board heads and pads, just large enough to
fit into the head of the barrel, are used by practically all growers in packing
to reduce the amount of bruising of the two end layers of apples caused by
pressing the head into place. The use of these paper heads or pads are especially
desirable for higher grades of apples. When these heads or pads are employed, the
apples on the ends are kept cleaner and brighter and also add to the attractiveness
of the package. It gives the purchaser the impression that greater care has
been used in the packing. The value of this confidence won can hardly be
estimated in dollars and cents, but without doubt, it has its influence upon the
price and promptness of sale. Two pads are generally used, one is placed under
the face layer and the other over the tail layer; if but one is used, it may be
placed on either end, but it will serve the purpose best if placed over the tail
end, especially when the barrel is jump-tailed and exposed to the rough and
frequently uneven pieces of the head which cut and bruise the fruit when pressure
is applied.

The plain paper cap is similar to the corrugated pad, except
that it is not corrugated. The paper cap may also be printed for advertising
purposes and is designed as an additional protection. Excelsior cushions are
excelsior stuffed pads, but they are seldom used as they are more expensive and
have no particular advantage over the corrugated pads in ordinary packing opera-
tions.

The excelsior cushions are ordinarily one inch to one and a half inches
in thickness. The manufacturers claim that these cushions will not only prevent
bruising and keep the fruit bright and clean, but will also partially obliterate the
unevenness of a poor tail layer, as these cushions are only used on the tail ends
and keep firm by expanding, should the fruits tend to shrink. In spite of this,
barrels packed with such cushions in usually become slack when shipped to any
great distance or stored for any length of time. If, however, a delicate and easily bruised variety is being packed for show purposes, such cushions may be used to advantage.

Fancy lace circle or collar is sometimes employed when the quality of the apples packed warrants its use. It will undoubtedly increase the attractiveness of the face layer. Its purpose is mainly ornamental. While the use of fancy lace circle may be practical for the higher grades of fruit, it does not often pay with the average grades.

The preparation of the barrel for packing is one of the essential parts in the packing operations. Successful packing is more or less dependent upon the manner the barrel is prepared. The barrel should be carefully examined and properly prepared before attempting the actual packing.

New barrels, as they are received from the cooper, are seldom nailed. The heads and hoops are all in place and the latter are more or less driven down. The poorer head, if there is a difference between the two heads, should be used for the face end as it will not bear as much pressing as does a good, strong head. The face head is usually nailed with six five-penny nails, evenly spaced, by driving the nails through the first or end hoop at an angle of about forty-five degrees. Nails driven horizontally into the ends of the pieces making up the head frequently split the wood and do not hold as securely as when driven in a slanting downward direction through the first hoop. Six five-penny nails, well placed, will hold the three or four piece heads in place with the help of the two strip-liners. The use of more nails is a waste and a source of annoyance and loss of time to the man who has to open the barrel—especially when sometimes as many as twelve or fifteen nails are employed.

After the head is nailed in place, the two strip-liners are tacked over the ends of the pieces making up the head at opposite sides to prevent it from breaking out of the croze. Care should always be taken to see that the liners run at right angles to the grain of the head, and it is necessary that the liners support the end of each piece that makes up the head as shown in Fig.?
Linens should never be omitted. Four to five small hoop nails evenly spaced are enough to hold each linen in place. The nail points, if projecting on the outside, should be clinched to avoid injury to the handler's hands.

The quarter hoops, after being driven down firmly, are usually nailed with four three-centy nails to each hoop, driven in a slenting downward direction at opposite sides of the barrel. All the exposed nail points inside of the barrel should always be clinched smooth as they are apt to injure the apples seriously in the process of racking and pressing. Too frequently one or two nail points are left unclinched because the packer is in a hurry, and becomes one of the minor causes of the general complaint of the purchaser.

When stencilling work is done after packing, it has been found convenient to mark with a pencil the necessary remarks near the chime on the face end to avoid confusion when stencilling is done later — especially when packing is done in the orchard.

Facing is important in barrel packing. To quite an appreciable extent the price that the barrel brings depends upon the appearance of the face-layer. This face, probably more than anything else, has led to the all too common practice of selecting the choicest fruit for facing and filling up the middle of the barrel with an entirely different grade. Experienced buyers are not greatly misled about the contents of the package by the face layer, but still it has its influence. The advantages of honest and proper facing are two fold. First, it legitimately increases the attractiveness of the pack and draws the attention of the prospective buyers more readily than if there were no order of arrangement; second, by carefully placing the apples evenly over the surface of the end and reinforced by "spotters" in the second layer, each apple in the bottom shares an equal amount of the pressure of the head and the amount of bruising is thus reduced to a minimum, which will occur if apples were carelessly jumbled at the face end of the barrel.

The chief objections to the practice of facing is that of over-facing
by employing only those apples of superior size, color and quality in the face layer to defraud and mislead the buyers. But due to the fact that the trade expects and customarily demands an attractive pack the better colored apples of uniform size and quality may be placed in the face layer, but the general quality and size of these facers should conform to the grade of the remainder in the barrel. In other words, the face layer should consist of apples fairly representative of the contents in the barrel as required by the State grading and packing law. Dishonest facing is usually detected and destroys the confidence of the buyers, while honest facing gives the buyer confidence in the whole pack and facilitates inspection.

The most important point in facing is that the apples in the face layer should be well arranged. This really counts more than trying to place in the face layer, only the best apples in the barrel. The facers should be taken out from the general run of the grade to be packed, but should be fairly uniform in size and color, as apples uniform in size and color make a much more attractive face than those lacking in uniformity. Since to over-face is prohibited by the State grading and packing law and an undesirable practice, it is a good business policy and justifiable to arrange the facers truly representative of the grade in the pack in as attractive a manner as possible.

Prior to facing, the barrel with the head of the face and nailed is turned over and the two upper hoops of the tail end are loosened and the head of the tail end is taken out. A corrugated paper head or pad is put into the bottom of the barrel with the corrugated side down. Printed paper cap and base circle when used are placed on top of the corrugated pad. The barrel is now placed on a racking plank if packing is done in the orchard.

Apples in the face layer are always placed with the stem ends down in concentric rings as this not only adds to the attractiveness of the shown surface, but also affords a broader bearing surface against the face end of the barrels and thus tends to lessen bruising.

The number of apples in each ring, the number of rings, and the number
of apples in the center depends upon the sizes and shapes of apples employed. As a general rule, when the apples of the face layer are uniform in size and shape, there should be six apples less in each of the succeeding rings starting from the outermost ring. This arrangement is known as the "regular" face. There are four regular faces that can be employed, in accordance with the different sizes of apples used, which contain 12, 16, 18, and 18 apples respectively followed by 6, 9, 10, and 18 in the second ring and 1, 3, 4, and 6 in the third ring or center. In all these four regular faces, the outer ring may contain one more apple than those given above, namely, 13, 16, 17 and 19 respectively, without detracting from the general appearance of the face and at the same time may facilitate the work of facing. It is desirable that these regular faces be used when possible as they add to the appearance of the pack.

Apples in the face layer should fit tightly. Lack of firmness is one of the most common faults with the face layer. It seriously detracts from the appearance of the pack. Difficulty is often experienced in getting a firm face layer but this is readily overcome often times by taking advantage of the fact that apples are scarcely symmetrical in their transverse diameters. Thus, apples can be made to fit tightly in the face layer by turning one or more apples so that their longer diameters are in line with the ring. On the other hand, it is often possible to wedge the apples in too tightly and when this is done, one or two apples are apt to "buckle" during the process of racking.

Practically all growers, in barrel packing, use the "single face," consisting of one face layer; but occasionally growers use the "double face," especially for their extra fancy apples and exhibition barrels by arranging another layer of apples in concentric rings as in the first layer. In the double face, the second layer is sometimes arranged in concentric rings with apples packed on their cheeks. In strict commercial work this is of course impractical. Practically all growers in commercial packing use the single face.

When the barrel is single faced, a better plan is to place the apples
in the second layer on their cheeks, with the colored cheeks downward, if the
variety used is colored, filling the cavities of the preceding layer. Apples
thus placed in the second layer are known as "Spotters", and will show through the
cavities formed between apples of the first layer, and thus add to the appearance
of the face layer when the packed barrel is reversed and the head is taken out.
These "spotters" also keep the apples of the face layer in place when the remainder
of the stock is poured into the barrel. The double face has no advantage over
the single face and only tends to create a false impression of the rest of the
contents and also represents a waste of time.

Apples selected for the face layer should have their stems clipped short
with a stemmer or small thinning shears and should be lowered into the bottom of
the barrel and poured out gently by tipping the basket. To drop the apples in
carelessly results in bruising.

After the barrel is faced, the filling process commences. Two methods of
filling the barrel are commonly employed as they make it possible to lower the
fruit into the barrel with a minimum amount of bruising. Filling is usually
accomplished by the aid of a canvas or burlap apron attached to the end-delivery
table or packing bin of a mechanical sizer, but a better method is by the use of
the swing-bail, half-bushel basket which can be lowered carefully in the barrel
and gently emptied.

Where the end-delivery inclined table is used or where a sizing machine
is employed, the apron attachment is often employed, but where the fruit is
emptied from field containers onto canvas or burlap-topped table and is graded
directly into half-bushel baskets, it is emptied directly from these baskets into
the barrel. Either method could be satisfactorily employed if the packer
employs a reasonable amount of care.

Apples should never be made to face, during the process of filling, even
a few inches into the barrel, especially with the more delicate varieties, slight
bruises, caused by dropping the apples at a distance of even a few inches into
the barrel, may not be immediately perceptible; but, nevertheless, the tissue has
been injured and, in the course of a few days, the injured area will show and often gives start to decay which will eventually result in a slack pack and severe bruising.

A barrel, in addition to being carefully filled, must be tightly packed so that shrinkage and handling in transit or storage will not cause a slack pack. Racking must be thoroughly done to insure a tight pack. Racking consists of rocking a barrel back and forth in a sharp, jerky manner to cause a forced settling of the apples in the barrel. A racking plank should always be used to insure thorough racking when packing is done in the orchard. Its use is especially insisted upon when apples are packed in barrels in the orchard for export. Export brokers, whom the writer has had a chance to interview on this subject have all voiced their opinion that successfully packed barrels for export trade are those that have been racked on more solid foundation than the soft ground in the orchard.

Racking should be done only after about a bushel of apples has been poured in upon the face layer. To defer the process of racking until a bushel of apples has been placed on the face layer is to insure that there is sufficient weight upon the face apples so that racking will not jar them out of their positions.

To insure a tight pack, racking must be repeated after each half-bushel basket full of apples is emptied into the barrel until it is nearly full. To facilitate the process of tailing the barrel, the padded false head is generally employed. In the final racking with the aid of this false head, much success can be attained by a long heavy stroke from side to side, the operator bearing firmly upon the false head with his forearms, until the fruit is well settled in place and a level surface obtained.

Under no circumstance should a grower or packer omit the process of racking and resort to overfilling as a means of securing a tight pack. Many barrels, filled so full as to bruise or even split the apples at the time of
heading, turned out later to be slack. Pressing an overfilled barrel causes severe bruising all through the pack, but does not result in a thorough settling of the fruit. By thorough racking combined with light but sufficient pressing even such delicate varieties as McIntosh, Northern Spy and Gravenstein could be successfully packed in barrels, stored and reach the final destination tight and in perfect condition.

Before pressing the head into place, it is important to have a level end layer so that the pressure will be distributed equally over the entire surface and not confined to a few projected spots. This process is commonly known as "tailing off", and it is said to be ninety percent of the art of good barrel packing, and a supreme test of the packer's skill.

Tailing is usually done in one of the two ways; either by roughly leveling off the high places or by arranging all the apples exposed at the tail end of the barrel into concentric rings similar to that of the face layer. The former practice is commonly known as "jumble tailing", and the latter as "ring tailing". Jumble tailing should not be used with the better grades and delicate varieties, as the chance of bruising is more than when ring tailing is used.

The ring tailing is used to increase the attractiveness of especially better grades, and it also enables the grower to make a tight pack without injury from the pressure of the head. The apples, in the end layer, in ring tailing, are either placed with the stem ends up or on their checks, but many growers use the latter arrangement, especially when the final racking has lowered the pack a little more than desired.

The height of the end layer varies according to the varieties packed, the thoroughness of racking and the distance to be shipped. Opinion on this varies in different localities and with different packers. Varieties like Russet and Ben Davis will generally stand more pressure than tender varieties like Gravenstein, McIntosh and Northern Spy. In general, the height of the end layer above the chime of the barrel, varies from half an inch to one and half inches, as far as could be ascertained in commercial packing. However, when racking is
thoroughly done, a height of half an inch above the chime of the barrel is sufficient even for export. Over-pressing is almost unavoidable when the end layer projects too far above the chime of the barrel, and more slack barrels have resulted from over-pressing than from any other cause. Only with thorough racking could over-pressing be avoided.

To prevent the end layer from bruising, another corrugated head or pad is generally placed with the smooth side down between the head and the end layer. In pressing the head into the croze, the first hoop is usually removed and allowed to hang against the screw of the press and the second hoop is loosened.

To assist the head in going down, a few well directed light blows or taps with the hatchet on the cover edges, as they start to pinch against the inside of the staves, is considered indispensable. Heavy pounding, as in sometimes done by careless packer, is unnecessary and causes bruising of apples in the tail layer.

As soon as the head is forced into the croze, the second hoop is tightened and the first hoop replaced. Wetting the hoops is sometimes necessary to avoid their slipping back. The first hoop, head, and the strip liners are nailed in a similar manner as discussed under the preparation of the barrel for packing.

Amount of barrels that could be packed by a packer depends upon: the skill of the packer; whether the fruit is well graded or not before brought to the packer; and the size of apples to be packed. A good barrel packer can usually pack on the average of fifteen to twenty barrels a day; if the fruit is well graded and of medium size, the average should be nearer to twenty barrels a day. Many do considerably less than this because they attempt to grade as they pack. For rapid packing in either barrel or box, fruit should always be well graded beforehand to save the packer's time.

In stencilling work, the necessary statements, as required by the State grading and packing law, are usually marked on the head of the face end of the
barrel. The order of the statements, as demanded by the law on closed packages, is as follows: name of State in which the apples were grown; legal designation of the grade; the minimum size of apples in the package; quantity of contents expressed in terms of volume or weight in pounds; the true name of the variety; and the name and address of the packer or repacker.

The grade of apples contained in the barrel should be indicated by the term "Standard" for the three standard grades but when the apples packed are meant to be marketed as ungraded, the term "Standard" should not be used. State inspectors, in the earlier days when the grading and packing law was just passed, have had considerable trouble with growers who have used the term "Standard" in marking their ungraded apples.

Since there are no size requirements with the exception of the "Standard" Fancy grade, the minimum sizes of apples of the other grades in a barrel should always be given. The weight in pounds of apples in a barrel varies with the size and variety of apples contained; it has been found convenient to use the term "One Standard Barrel" to designate the volume. The true name of the variety packed should be given, that is, the name by which the variety is known on the market. When the variety packed is not known the expression "Variety unknown" should be used. A correctly marked head of the barrel is shown in Fig. 11.

The law further requires that only block letters and figures of a size not less than thirty-six point Gothic or half an inch in height be used. There is the least possible work in stencilling the head of the barrel, a consideration that must not be overlooked where a quantity of barrels are handled.

Barrels packed in the orchard, when not shipped away immediately, should be brought under cover. A packed barrel that is exposed to more than the slightest shower, or to alternate sunshine and shower, is almost certain to go slack in a comparatively short time. In addition, it loses the fresh appearance of a package that has been protected as it should be. If growers are provided either with common or cold storage, it is advisable that as soon as the barrels are packed,
Fig. 11. — A correctly stencilled barrel head, bearing the required statements in the right order as demanded by the State grading and packing law on closed packages.
whether in the packing house or in orchard, that they should be stored at once in the coolest possible place above freezing point.

Packed barrels, if held in storage for any length of time, should be placed on their sides. This method of stacking prevents the fruit in a barrel from bearing the weight of other barrels, as the package itself bears the weight, and prevents apples in the package from becoming slack. Barrels are also stacked on their sides in a car in transit. The most popular and perhaps the most satisfactory method of stacking in a car in transit is known as the "Alternating straight" stack, and could also be used in storage with a little modification.

This method of stacking in a car is started by placing two rows of three barrels each, end to end, across the car which leaves a space of about half the length of a barrel at the end of the rows. The second layer is then started by placing a row of three barrels on top of the first two rows but starting from the opposite side of the car and covering the open space between the ends of the rows below and the side of the car. The remainder of the car is loaded in the same way, alternate layers being started from opposite sides of the car. This forms long channels along the walls, lengthwise of the car, which serve as flues for the circulation of air to keep the fruit in the barrels cool. An additional advantage is derived from this method, as the bulge of one barrel does not rest directly upon the bulge of another, but rests in the hollow space over the ends of four barrels.

The Standard Apple Box — This box, which is used by the Northwestern growers in shipping their apples in, is a standard box for apples in Massachusetts by the State law. The dimensions and capacity of this standard apple box as specified by the law are: eighteen inches in length, eleven and half inches in width and ten and half inches in depth, inside measurements, without distention of its parts; and shall have a capacity of not less than 8,173$^{\frac{1}{4}}$ cubic inches.

It has been found that, when the box is properly packed and given a bulge of three fourth of an inch on both top and bottom as desired, these bulges
equal approximately an extra half inch in depth of the box without distortion of its parts, and its capacity is increased by approximately 104 cubic inches, or about five percent, giving a total capacity of 2,177 cubic inches. Since the United States bushel contains 3,150.42 cubic inches, a properly packed standard apple box, with three fourth inch bulge on top and bottom, contains about 1.06 bushels. A box of different dimensions, or of a different capacity is not a standard box, but could be used for packing apples of the standard grade for sale and distribution.

Good box material should be strong, straight grained, with grain running crosswise, free from knots and should not impart odor to the fruit. Spruce is usually considered to be the best material for box making, and is generally used in the Northwest. In Massachusetts and other New England States, native White Pine is commonly employed, but it has been found that the top and bottom boards when made of this material are too easily broken.

The dimensions of the ends, sides, tops and bottoms, and cleats are more or less standardized through usage and cannot be changed to any extent. The dimensions of these parts are: 2 end pieces each, 2" x 10" x 11 3/4"; 2 side pieces each, 3/8" x 15 1/2" x 19 1/2"; 2 top and bottom pieces each 1 1/4" or 3/16" x 15 1/2" x 19 1/2"; 4 cleats each, 3/8" x 3/4" x 11". It is necessary that the top and bottom boards be made of thin material in order to accommodate the bulge; while the sides should be sufficiently strong to prevent any chance of a side bulge, which is an undesirable feature in a box pack.

The sides, however, should not be heavy, as unnecessary weight detracts from the general utility of the box and adds to the cost of material.

The boxes are usually bought "knocked down" in shocks, the tops, bottoms, ends, sides and cleats being bundled separately. This has been found to be a most satisfactory method of purchasing and the box materials can be put together during rainy weather before the season opens. It is not a difficult nor a long process to nail them together in the packing house, shed, or other outbuildings, and they occupy so much less room, that it is considered to be the
preferable way to order than already nailed up by the manufacturer. The price per box in the shooks ranges from twenty-seven and half cents to thirty-five cents, f. o. b.

The side when it comes in two pieces, should be tongued and grooved, and the end when not of a single piece, should come joined with iron cleats to insure solidity. The top and bottom boards usually come in separate pieces, that is, two separate pieces for the top and two for the bottom — the separate pieces making them more elastic. There are two separate cleats, which are sometimes made of gum wood, for the top boards and two for the bottom boards, at each end. Cleats are necessary on every box, and the values of cleats are three fold; namely, to strengthen the top and bottom pieces which are apt, otherwise, to split and break when nailed; to protect to some extent the bulge on top and bottom when the box is packed, pressed, and nailed, as the bulge has a tendency to push the thin boards over the nail heads; and finally, to enable dealers to open the box for display or inspection without injury to the cover. The new style top and bottom covers come in single piece with cleats glued on the two separate boards that make up the top and bottom cover. These new style covers are well liked by those who have used them.

Whatever wood is used for box material, the parts that make up the box should be well finished on at least one side, and sometimes box could be secured from the manufacturer with both sides smooth.

A box maker with proper equipment can work very rapidly, making 400 to 500 boxes a day. Many professional box makers in the Northwest can make 700 or more per day. To attain this speed, it is necessary to have a box-form or box nailing bench as shown in Fig. 12, to hold the ends in position while the sides and bottoms are being nailed on. A suitable hatchet, like the one discussed in barrel packing, is essential for efficient and satisfactory work.

In using the box-form or nailing bench, one side should be nailed to the two ends first; then the bottom, followed by the remaining side. The box is
It is very essential that the boxes, securely made up to carry the fruit well in shipping by freight or express where rough handling is expected. The best nails for this purpose are the six-penny cement-coated or rosin-d box nails. They hold much better than the smooth or corrugated nails. Reports of mechanical tests made by the United States Testing Machine, at Watertown Arsenal, Watertown, Massachusetts, on June 30, 1902, and August 5, to 16, 1903, have shown that six-penny sized, cement-coated nails give one half to two thirds more adhesive resistance power in pounds than the common smooth nails of the same size. These cement-coated or rosin-d box nails can be bought by the kegs at prices ranging from four dollars to eight dollars per keg, according to the size of the kegs.

The number of nails required to the box is usually thirty-two. Four nails are used at each end of the side of the box, with the nail at each end half an inch from the edge. When the side comes in two pieces, tongued and ground, a nail should be driven close to each side of the joint—six nails are used when the side comes in three pieces. In nailing the bottom four nails are employed at each end and driven through the cleat and the bottom boards into the end. Should the cleats show a tendency to split, it is a common practice to wet them. When boxes are made of good lumber and properly nailed with cement-coated nails, the growers need not hesitate to ship them by freight, and wiring them for export can also be dispensed with.

For rapid and efficient work in packing, a box packing table is an essential and necessary piece of packing equipment. A most convenient one which is easily made is shown in Fig. 3, which is the same table described under grading for box packing. This table is more shallow and holds fewer apples than the canvas or burlap-topped table for barrel packing. In using this box-packing table, it is desirable, in order to secure the best results, that the apples to be packed, be graded for color, blemishes and size, with or without the aid of a
Fig. 12. - Box-making bench, or box-form.

Fig. 13. - "Horse-Head Clutch" type box press.

Fig. 14. - Bail type box press.
mechanical sizer before going to the table. With trained box packer, apples can be brought to the table ungraded, and the packer grades as he packs; but, however, it would be better to have the apples sorted for color and blemishes beforehand and leave the sizing to be done by the packer, as even the best packer is apt to include fruit that is lacking in color or having other defects in the "Fancy" or "A" grade box.

With regards to sizing, an experienced packer can size as he packs with surprising accuracy. The eye can be trained to pick out readily the various sizes only through long practice. It has been often said that those with long experience in barrel packing seldom make good box packers, since it is difficult for them to adjust themselves to the closer grading and a consideration of each separate fruit.

Two packers can pack to good advantage at one of these box tables which is provided with two slanting box rests, especially when the apples have been sorted for color and blemishes, but not sized, or roughly sized, before brought to the table. One may pack a certain size while the other is packing some other size, thus keeping the table fairly well cleaned off.

In order to nail on the cover on the packed box, a box press is indispensable. There are many types of Western box presses. But the two most common types which have given satisfaction, are the "Horse shoe clutch" type and the bails type which are shown in Fig. 13 and Fig. 14, respectively. Many other types of box presses are, however, equally efficient and convenient. The essential points of construction of any box press being; to rest the box on the ends so that when the top is nailed down the bottom is free to bulge; and also to catch and press down the top pieces from the ends so that a minimum amount of bruising will result.

The use of box lining papers is certainly to be recommended. Lining papers not only keep dust and dirt out of the box after it has been packed and nailed, but also add much to the attractiveness of the boxed fruit. Lining paper is made commonly from unprinted newspaper stock, commonly known as "White news".
This paper can be purchased of any wholesale paper dealer. It is light, white, clean and reasonable in cost. The convenient size is eighteen inches by twenty-four inches.

The box is lined on the bottom sides and top with two sheets of lining paper. No lining paper is placed at the ends. These two sheets of lining paper are placed so that they overlap about an inch in the bottom of the box and cover the two sides with enough left to fold over a little beyond the center when the box is packed. To prevent the papers, along the lower edge of the box where the sides meet the bottom, from tearing when the bulge is forced out of the bottom, each sheet of the lining paper is creased five or six inches from the end.

A double crease is sometimes made by first folding the end of the paper over the required five or six inches and crease, and then folding this doubled strip over three eighth or one half of an inch in the same way and crease again. Either of these methods is satisfactory. The creases lie across the corners of the box and provides for apple slack. Packing one hundred boxes will need approximately seven and half to eight pounds of lining paper.

Layer boards are flexible paper card boards which were formerly employed between each layer of apples in a box. With the advent of the diagonal pack as a sole commercial pack, more solid pack can be put up with these layer boards left out between layers. The general practice at present is to place one sheet on the bottom and another on top inside of the lining papers. Layer boards thus placed prevents the top and bottom boards from chafing the apples while the box is being nailed and during storage and shipment. The lining papers together with these two layer boards afford a dust-proof package.

The convenient size of this layer board is eleven by eighteen inches. The material should be of a flexible and absorbent nature and of medium weight. Colored manila tag-boards are commonly used for this purpose. Approximately, sixteen pounds of layer boards are needed for the packing of one hundred boxes.

The use of wrapping paper for individual apple in box packing possesses many valuable features which can not be overlooked. Apples that are wrapped add
greatly to the character of the pack. Wrapped apples can be more easily and firmly packed than the wrapped apples. In addition, a box of wrapped apples conveys an impression of greater carefulness in packing. Wrappers further serve as cushions between apples and protect the apples against bruising and discoloration that may result from rough handling in transportation. Wrappers have also been found to retard shrivelling and add to the value of the fruit by preserving its attractiveness and appearance.

Investigations conducted by Lason of New Hampshire State Agricultural College experiment station in 1902; Powell and Fulton of the Bureau of Plant Industry, U. S. D. A., in 1903; and Eastace and Beach of the Iowa State Agricultural College experiment station in 1909 have shown that the keeping quality of the apple is affected by the use of the wrappers. It has been found by these investigators that the wrapper may influence the keeping quality of the fruit in several different ways. It extends the life of the fruit beyond its normal period by retarding the ripening process. The influence of the wrapper in this regard is apparent, especially at the end of the normal season of the naked fruit when the flesh begins to grow mealy from over-ripeness. At this time the wrapped apples may be firm and remain in prime condition for several weeks or even months. The wrapper is especially useful in extending the season of early winter varieties, or in making the long keeping varieties available for use over a still longer period of time.

The wrapper may also be useful in preventing the transfer of rot from one apple to another. If the fungus is capable of growing in the storage temperature, it is not likely that the wrapper retards its growth; but when the spores develop, they are confined within the wrapper and their dissemination is difficult or impossible.

Wrapping paper should be light but strong; it may be either white or light-colored, but it must be absorbent on one side and glazed on the other. The absorbent side is placed next to the apple to absorb any moisture given off by the fruit; and the glazed surface on the outside prevents the entrance of moisture...
Light manila paper as well as thin tissue paper are commonly employed for this purpose.

The wrapping papers come in different sizes. The common sizes are nine inches by nine inches, ten inches by ten inches, and eleven inches by eleven inches. The ten inches by ten inches size is suitable for medium and larger apples, and the nine inches by nine inches size for smaller apples. A supply of all the three sizes should be kept on hand for convenience. Some growers have their brands or trade names printed upon the wrappers for advertising purposes. Approximately, fifty pounds of wrappers are needed for packing one hundred boxes.

Wrappers are usually placed with the glazed sides up in a hod, which is generally made of galvanized sheet iron. The construction of the hod and its position on the box are shown in Fig. 15. The hod is sometimes made of wood. To facilitate the picking up of the wrappers, half of an apple is often mounted on the edge of the upper side of the hod to wet the middle finger of the packer's left hand. A rubber stole is sometimes worn on the middle finger of the left hand to facilitate the picking up of the wrappers, in place of the piece of apple on the hod.

To wrap an apple attractively and rapidly requires practice. In wrapping an apple, a sheet of wrapping paper is picked up with the left hand, and at the same time with the right hand an apple is picked up from the packing table. The apple is fairly tossed into the center of the paper on its side, if it is a side pack, or on its end with calyx end to the palm, if it is an end pack. With the right hand the packer draws in the corners of the paper, and then with a slight rolling motion completes the wrapping. In so doing, the wrapped apple is left in the left hand in the proper position to be packed in the box. The methods of wrapping vary with different pickers, but the main points sought for are speed and a neat and attractive appearance when wrapped.

Three systems or styles of pack have been used and until recently advocated in the Western box packing districts. These are known as the "off-set", "straight" and "diagonal" styles of pack. At present the diagonal style is
Fig. 15. — Showing the construction of the hod and its position on a box.

Fig. 16. — The various styles of packs: No. 1, the Off-set; No. 2, the "Straight"; No. 3, the "30°" diagonal; No. 4, the "2-3" diagonal.
practically the only one employed in commercial packing. The off-set style has been discarded as apples packed in this way are apt to work loose in the pack; and besides, apples packed this way present too many empty spaces along the sides on the face of the package to the critical buyer.

The diagonal style of pack is preferable to the straight style of pack, as the former permits a wider variation in the size of the apples. In the straight style of pack, the apples must be more classily sized and uniform in order to fit exactly. The diagonal style of pack also permits of more or less pressing without bruising, as the apple in the diagonal pack rests in the center of the space formed between two or four apples in the layer below. In the straight pack, each apple is placed directly over the other; thus, when the top is pressed and the cover is nailed on, a certain amount of bruising is sure to happen even with only a slight pressure. However, with a few sizes of apples, straight pack is necessary.

Under the diagonal style of pack, there are mainly two kinds which are most commonly employed in commercial work; namely, the "3-8" and the "3-3" diagonal style of packs. These two kinds of diagonal packs take care of all sizes commonly used in the standard apple box packing. The "3-3" diagonal style includes all apples which are larger than five across the end of the box. In other words, when four apples of the same size fit side by side across the end of the box, or four apples fit loosely and the fifth one will not go in, the style of pack is "3-3" diagonal. Five layers of apples are needed to fill the box when this style is employed.

The "3-8" diagonal style includes all apples larger than four across the end of the box up to and including three fitting loosely across the end of the box. In other words, when three apples of the same size fit loosely across the end of the box, side by side, and the fourth one will not fit in, the style of pack is "3-8" diagonal. Four layers of apples are needed to fill the box when this style is employed. The "3-8" diagonal style of pack takes care of medium and small apples, and the "3-3" diagonal is for medium and large apples.
The straight pack is used when three apples of the same size or five apples of the same size fit tightly side by side across the end of the box. The "straight 3" pack is for very large apples which are rarely common in commercial packing work. The "straight 5" consists of apples too small to justify packing in the standard apple box, except in case of highly colored variety of very good quality.

In the past, it has been considered necessary to pack certain sizes of apples on ends. But it has been found, however, that practically all sizes can be packed on the cheek and that packing all sizes one way makes the operation much easier, especially for the beginner.

The following table of commercial box packs is adopted from the department of Pomology, Massachusetts Agricultural College. It gives the number of apples in the box, size of the apples, the style of pack, number of the apples in the row, number of layers in depth, number of apples in the layers and the position of apples in the box.

Table of Commercial Box Packs. (On next page).

The sizes of apples given in table, indicates in a general way the transverse or cheek-to-cheek diameters of the apples for the various packs. This of course, will vary with different varieties of apples. For instance, the diameter of a flat apple will be much greater than that of a long slender apple that will pack the same number per box. The number of apples in a box vary sometimes also with the varieties due to their difference in shapes and thickness. The 113 size apple in the "3-3" diagonal pack is the size that will pack a "straight 4" tier, but it is usually advisable to avoid a straight pack when possible.

Massachusetts growers when using the standard apple box should aim to pack nothing smaller than 163 size apple to the box; and by far the large proportion of box packing should be of sizes which run 165 or less to the box.
<table>
<thead>
<tr>
<th>Apples per box</th>
<th>Size of</th>
<th>Style of</th>
<th>No. of apples</th>
<th>No. of</th>
<th>Apples in layers</th>
<th>Position of apples</th>
</tr>
</thead>
<tbody>
<tr>
<td>230</td>
<td>2 3/8&quot;</td>
<td>3-2 Dmg.</td>
<td>8-8</td>
<td>5</td>
<td>40-40-40-40-40</td>
<td>on cheek</td>
</tr>
<tr>
<td>180</td>
<td>2 5/8&quot;</td>
<td>3-2 Dmg.</td>
<td>8-8</td>
<td>5</td>
<td>32-32-32-32-32</td>
<td>on cheek</td>
</tr>
<tr>
<td>175</td>
<td>2 5/8&quot;</td>
<td>3-2 Dmg.</td>
<td>8-8</td>
<td>5</td>
<td>35-35-35-35-35</td>
<td>on cheek</td>
</tr>
<tr>
<td>163</td>
<td>2 5/8&quot;</td>
<td>3-2 Dmg.</td>
<td>8-8</td>
<td>5</td>
<td>32-32-32-32-32</td>
<td>on cheek</td>
</tr>
<tr>
<td>150</td>
<td>2 5/8&quot;</td>
<td>3-2 Dmg.</td>
<td>8-8</td>
<td>5</td>
<td>30-30-30-30-30</td>
<td>on cheek</td>
</tr>
<tr>
<td>180</td>
<td>2 5/8&quot;</td>
<td>3-2 Dmg.</td>
<td>8-8</td>
<td>5</td>
<td>28-28-28-28-28</td>
<td>on check</td>
</tr>
<tr>
<td>125</td>
<td>2 5/8&quot;</td>
<td>3-2 Dmg.</td>
<td>8-8</td>
<td>5</td>
<td>25-25-25-25-25</td>
<td>on check</td>
</tr>
<tr>
<td>113</td>
<td>2 5/8&quot;</td>
<td>3-2 Dmg.</td>
<td>8-8</td>
<td>5</td>
<td>23-23-23-23-23</td>
<td>on check</td>
</tr>
<tr>
<td>112</td>
<td>2 5/8&quot;</td>
<td>3-2 Dmg.</td>
<td>8-8</td>
<td>5</td>
<td>20-20-20-20-20</td>
<td>on check</td>
</tr>
<tr>
<td>104</td>
<td>2 5/8&quot;</td>
<td>3-2 Dmg.</td>
<td>8-8</td>
<td>5</td>
<td>20-20-20-20-20</td>
<td>on check</td>
</tr>
<tr>
<td>90</td>
<td>2 5/8&quot;</td>
<td>3-2 Dmg.</td>
<td>8-8</td>
<td>5</td>
<td>18-18-18-18-18</td>
<td>on check</td>
</tr>
<tr>
<td>84</td>
<td>2 5/8&quot;</td>
<td>3-2 Dmg.</td>
<td>8-8</td>
<td>5</td>
<td>15-15-15-15-15</td>
<td>on check</td>
</tr>
<tr>
<td>50</td>
<td>2 5/8&quot;</td>
<td>3-2 Dmg.</td>
<td>8-8</td>
<td>5</td>
<td>14-14-14-14-14</td>
<td>on check</td>
</tr>
<tr>
<td>48</td>
<td>2 5/8&quot;</td>
<td>3-2 Dmg.</td>
<td>8-8</td>
<td>5</td>
<td>12-12-12-12-12</td>
<td>on check</td>
</tr>
<tr>
<td>63</td>
<td>Straight 3</td>
<td>7-7</td>
<td>3</td>
<td>21-21-21-21-21</td>
<td>on check</td>
<td></td>
</tr>
</tbody>
</table>
A well packed box should always have a bulge, or "swell", of three fourths of an inch upon both top and bottom. As the box is packed before the cover is nailed on, this bulge will be about one-and-half inches in the middle of the top layer, but when the cover is nailed on, the top and bottom of the box spring out thus making both the top and bottom bulge equal.

This bulge or "swell" is, as the "tailing off" in barrel packing, a crucial point. A box packed without the proper amount of bulge compares more or less closely to a slack packed barrel. In both cases, the fruit becomes slack and rattles about, often becoming badly bruised. The bulge not only holds the fruit firm when the cover is nailed on, but the spring of the top and bottom boards will keep it firm as it shrinks, at least up to the point where the top and bottom boards become practically parallel.

In a straight pack, less bulge is required as the apples thus packed do not settle into the crevices as is the case with the diagonal pack. In the straight pack, smaller apples may be used for the ends of the box and thus the proper bulge is obtained. It may become necessary when flat apples are packed on their cheeks to turn the rows at the ends flat in order to attain the desired bulge while keeping the ends low at the same time.

In the diagonal pack, the spaces left at each end of the layers help to give the proper bulge in the middle of the pack. By packing the center more closely, the space left between the apples is lessened and the next layer cannot be pressed in as deep in the center and thus the middle space is built up. The ends being packed looser, the spaces are more open and the apples at the ends can be pressed down lower so the ends are not raised as high. Apples that are a little larger or thicker are often selected for the middle part of each layer, and this will also tend to give the proper amount of bulge in the center.

To avoid the bruising of apples at the ends of the box during pressing and nailing the pack should be but little in excess of the height of the box at the ends. In the diagonal pack, the apples at each end of the box should come
Fig. 17. - The proper bulge before nailing: No. 1, shows not enough bulge; No. 2, shows the proper amount of bulge; No. 3, shows too much bulge.

Fig. 18. - The proper bulge after nailing: No. 1, not enough bulge; No. 2, the right amount of bulge on each side; No. 3, too much bulge.
one fourth to three eighth of an inch above the level of the box. In the straight pack a little less is sufficient as it does not stand as much pressing as does the diagonal pack. If the ends are much higher than this, the fruit will be bruised when the cover is pressed and nailed on. Means of securing the proper center bulge by regulating the height of the ends as discussed in the paragraph above could be employed to secure the proper height of the ends. It is generally not difficult to come out even at the ends in box packing as the height of the box is planned for this, and further the selection of the right style of pack and in placing the apples in the layers afterwards will all tend to make the ends come out at the proper height.

Firmness of the fruit in the pack is also of importance in box packing. Each layer should be packed so that every single fruit in it is firm and tight, but sufficient pressure to dent or bruise the fruit should not be used when forcing it into place. Apples are almost certain to shrink a little in storage and still more during shipment, and unless very firmly packed, they are bruised against each other and resulting in a slack pack when the final destination is reached and unable to command the highest price. Advantages should be taken of the variation in diameter and length of the different apples to "key" each apple tightly in place.

Evenness of each layer of apples in a box, especially the top layer, is a very desirable feature, as evenness not only prevents some apples from receiving an undue amount of pressure and others from not being held in place when the cover is bent down over the top by the press, but adds greatly to the attractiveness of the pack. The smooth, even surface of a good pack at once suggests uniform grading and inspires confidence in the thoroughness and care in packing. Probably more than any other one factor, unless it be that of alignment, the average purchaser judges the quality of the packing and value of the package by the evenness of its surface.

Another factor that distinguishes good box packing is the good alignment which refers to the straight, neat rows across the box, rows running parallel with
Fig. 19. — A correctly stencilled box end, bearing the required statements in the right order as demanded by the State grading and packing law on closed packages.
the sides and ends of the box in case of the straight packs, and diagonally in case of the diagonal packs. There is a neatness and finish about a box with perfectly straight rows that gives the purchaser the impression of careful packing. Curved or irregular rows are common occurrences especially with the diagonal packs. Often by the turning of an apple quarter or half way round and leaving it in the same place will straighten out a curved or irregular row and enable the apples touching it to fall into line. A little attention on the part of the packer will correct this.

Stencilling is generally done after the cover is pressed down and nailed in the same manner as the bottom with the aid of a box press. The box is usually stencilled on one end with the required statements demanded by the State law as given under stencilling for barrel. In stencilling the box, the quantity of the contents is commonly expressed either in terms of numerical counts or in measure, such as; the actual number of apples or "One standard bushel". A correctly stencilled box is shown in Fig. 19.

Boxed apples in storage or shipment should always be stacked on their sides, or on ends as is sometimes done, but never on the bulge of the tops and bottoms as they could not be piled to advantage in this manner and the fruit will surely become bruised badly.

The Standard Box for Farm Produce — The dimensions of this produce box as defined by the State law are: 17 5/8 inches in length, 17 5/8 inches in width, and 7 1/16 inches in depth, inside measurements. The capacity of this box should not be less than 2150.42 cubic inches, or one Standard bushel. However, a box of these dimensions has been found to contain 2153.83 cubic inches, and holds 22.47 cubic inches more than the Federal Standard bushel of 2150.42 cubic inches.

The law further requires that when this produce box is made of wood, the ends should not be less than five-eighth of an inch in thickness and the sides and bottom three-eighth of an inch in thickness. Each box must also be marked on at one outer side, usually on the side or end, in bold, uncondensed capital
letters of not less than one inch in height, the words: "Standard Box Farm
Produce".

The best box material is either pine or spruce. Chestnut is sometimes
used and is a few cents cheaper than boxes made of pine or spruce, but it is not
as clean and white in appearance and soon hardens thus developing a tendency to
split. Boxes could be obtained from a number of reliable box factories in the
State at a cost ranging from twenty cents to thirty-two cents per box. The boxes
should be properly nailed with the six-penny cement-coated box nails, and a nail
should be driven close to each side of a joint. Usually it is the best way to
secure the supply of boxes with only the four sides nailed up, having the bottoms,
slates and risers come separately.

Slats are usually 1½ inches wide, ½ inches in thickness and 19 inches
long. On closed packages, four slats are commonly employed on a box, but five
slats are considered better, when the box is to be shipped for any longer distance.
Two slats are ordinarily used, when the packed box is marketed as an open package,
to hold the card-board cap in place, one on each side of the box about one inch
in from the side. A square of paper card-board or corrugated board cut to the
inside dimensions of the box is generally placed over the top layer of apples
under the slats to prevent bruising and to keep the dust from the fruit. When
packed apples are piled without covers either in storage or when trucked open to
the market, it has been the practice of some growers to employ two long slats,
with a short piece of riser at each end, between each layers of boxes to protect
the apples at the top of each box from bruising and at the same time to hold the
boxes securely.

When the surface of the pack is level with the top of the box, the
box does not present a full appearance. Further, jostling in transit may settle
the pack and leaves the box slack when the final destination is reached. The use
of risers upon the heavy ends of the box under the slates, makes it possible to
pack the apples somewhat above the top of the box and thus presents a full
appearance. The use of the risers will also render piling of the boxes without
the danger of bruising the apples. The sizes of the bins have been varied, but five-eighth of an inch thick, five-eighth of an inch wide and seventeen and half inches long are the standardized dimensions and are well established by custom.

It is essential that the apples packed in the produce boxes, that are to be shipped far, be firmly held in place to prevent bruising. This can be best done with the aid of a box press. As most of the box presses on the market are built for the Western or standard apple box, there are not many box presses available for the standard produce box.

Mr. Houghton of Harvard, Massachusetts, who is now dead, has invented a produce box press which is shown in Fig. 20. The original pattern has been improved upon by Mr. Calkins of the same place, and some of the improved type were manufactured and sold. There has been no more manufactured at present as this improved type has transgressed the pattern right of the Western box press of the bail type.

Last year, however, the Meadow Brook Farm Inc., at Sterling Junction, Massachusetts, had put on the market a new nailing press designed primarily for the Standard produce box, but could be adjusted for use on the standard apple box and other fruit boxes. Being a new product, its merits and defects have not yet been thoroughly tested out, although the manufacturer has claimed many desirable and valuable features in its favor. A picture of which is shown in Fig. 22.

The use of this press is limited at present as the price is rather prohibitive for the average growers. The manufacturer, however has realized this difficulty and has manufactured a more simple one recently and the price is reduced within easy reach of the average growers who are using the standard produce box as a market container. The cost of the original press is forty dollars.

Western box press of the bail type, however, could be adjusted to fit the standard produce box by shortening the bail arms as shown in Fig. 23. A crude but effective press has been employed by some growers for pressing the produce box during nailing. It consists of a wooden beam or slat which is hinged to a post.
Fig. 21. — The improved "Houghton" press for produce box, showing the position of a packed produce box during pressing.
Fig. 22. - The "Meadowbrook" box press for produce box. Detachable roller tables are provided on each side of the press to enable rapid work during pressing and nailing.

Fig. 23. - Western box press of the bail type adjusted to fit the produce box by shortening the bail arms.
Box to be nailed is put on a nailing bench under this press and the beam or slat is pressed down on the cover during nailing. It takes a man and a boy to operate it, but with a little practice it can be operated quite rapidly.

There has been up to the present time no standardized system of packing the produce box. The so-called "Jumble" pack is the usual pack employed, and the larger part of the Massachusetts apples marketed in this produce box are jumbled into the box without any attempt at arrangement and with a little more grading than is demanded by the State grading law. Low grades of apples can probably be handled best in this manner, but for the better grades a more attractive and better pack must be used to secure the full benefit for the crop produced. There are, however, a few growers of better grade of apples, who are using layer packing in the produce boxes.

The faced "Jumble" pack is an advance over the "Jumble" pack and represents a step to the right direction. This system of pack was developed in the Eastern section of the State. A box, without the top and bottom, is set up and the slatted cover is then nailed in place, and the box is turned over and packed from the bottom up like a barrel. A plain or corrugated card board is first laid on the slatted cover, and a layer of apples is arranged on it. When the box has been packed and turned over later, this layer is shown as the face. The apples in this face layer are usually packed closely in rows with either the stem ends up or the cheeks down, although the latter arrangement will present a more attractive appearance. Care is usually taken to select a size so that a certain number of apples will just fill a row, and give the same number of rows. A more attractive face layer can be made by using one of the methods explained later under layer packing in the produce box. To keep this face layer level, the apples must be made to fit tightly in at least one direction. The larger cracks in the face layer are covered by placing apples with the red cheeks down, in the second layer, over them. The remainder of the apples are carefully jumbled in to fill the box. As the box is being filled, it may be slightly racked, which tends to settle the apples down.
into the empty spaces.

The top of the box is leveled off as well as possible by placing some apples on their cheeks and some on their stem ends up, and the bottom boards of the box is nailed on under light pressure. For marketing in the nearby markets as an open package, the slatted cover may be lightly nailed on first until the packing is done when it maybe removed without disturbing the face layer.

A packing board is commonly employed, instead of the slatted cover, by growers in faced "Jumble" packing. It is made somewhat larger than the box and is padded with a piece of heavy felt, out of a size, 17 1/2 inches by 7 1/2 inches, so that it just fits into the box to protect the apples in the face layer from bruising. The apples in the face layer are placed upon this felt and the rest of the operation is the same as discussed above.

Apples packed in this way are mainly used for nearby markets and are shipped in open packages; therefore, the bottom is ordinarily put on with only such pressure as can be exerted by bearing down on the bottom with elbows. After the bottom nailed on, the box packed together with the packing board, is reversed and the latter is removed. Two slats are sometimes nailed on the box to hold the card board in place if the latter is used.

The growers who have used the faced "Jumble" system, report that it does not require much additional time than using the plain "Jumble" pack and that the package will generally sell for twenty-five to fifty cents more which pays them well for their time put on it. However, the faced "Jumble" pack is only suited to "A" grade apples and not for the better grades.

A system of layer packing the produce box has been developed by Mr. W. E. Piper of Hudson, Massachusetts, which is an improvement yet over the faced "Jumble" packs. Apples in this system are made to fit horizontally by turning one or more rows as shown in Fig. 25. The apples are adjusted to the height of the box by placing one or more layers with the stem ends up. Apples in the top layer should rest with their cheeks up when possible to present a better appearance.
Fig. 24. - A "Jumble" packed produce box.

Fig. 25. - The "Piper" method of layer packing the produce box. Apples are made to fit horizontally by turning the one or more rows.
These layers of the most common sized apples, for instance, 8½ inch apples, will fill the box and come to the top of the risers when each apple in the layers is placed on the cheek. When over 2½ inches for instance, 2 5/8 inches or a little larger, apples of the bottom layer are placed stem ends up. For apples still larger, two layers have to be placed stems up. This system of adjustment fails, however, when the apples packed are so large that three layers, stems up, more than fill the box, which is common with most varieties above the three inch size.

Flatter apples such as the Gravenstein, probably can be packed to advantage with this system. The greater the difference between cheek-to-check and stem-to-calyx diameters, the easier it is to use this system in adjusting the pack by turning rows or layers. Round apples, without much difference in the two diameters, are not so easily packed with this system.

The size of apples for this system of pack should not vary more than one eighth of an inch in a box. Closer sizing is therefore necessary when this system is employed.

The Western style of layer packing has been tried with success by Mr. C.H. Gould of the Department of Pomology at Massachusetts Agricultural College, for packing the standard produce box. This is recommended for use only with apples of "A" grade or better. Higher grades of apples packed with this method present a more attractive appearance than the methods given above.

Layer packing of the Western style is primarily a diagonal type of pack, although a straight could be used with the smaller sizes of apples. Various styles of the diagonal type of pack could be used according to the sizes of apples. For 2½ inch and 2¾ inch apples, a straight pack is used; for 2⅛ inch apples, a "4-3" diagonal pack is used; and for 3 inch apples the "3-3" diagonal pack is used.

Apples sized into minimum sizes of 2½, 2¾, 2⅛, and 3 inches may be layer packed in one of the three styles given above. The "4-3" and "3-3" diagonal packs will be more commonly used in layer packing the produce box, as they embrace
Fig. 26. - The "Piper" method of layer packing the produce box. Apples are adjusted to the height of the box by placing one or more layers with stem-ends up.

Fig. 27. - The Western styles of layer packing the produce box: No. 1, the start of the "4-3" diagonal pack; No. 2, the first layer of the "3-3" diagonal pack.
the most common size of apples packed in box. The terms "4-3", "3-3" etc., refer to the manner in which the apples are arranged in each layer in the box.

To determine which of the above styles of pack is used, the following rules should be used as a guide:

**Rule 1.** Six apples of the size to be packed are placed along the heavier end of the box in a horizontal row and if these fit loosely and a seventh one will not fit in, the "4-3" diagonal pack is used.

**Rule 2.** Five apples of the size to be packed are placed along the heavier end of the box in a similar manner as explained in Rule 1, and if these fit loosely and the sixth one will not fit in, the "3-3" diagonal pack is used.

**Rule 3** If any number of apples placed along the heavier end of the box in a horizontal row fit tightly, a straight pack is used.

Apples in any of the above packs should be placed on their cheeks, but occasionally the size and shape of certain apples necessitate the placing of apples in one or two layers on their ends. To determine whether this procedure is necessary, three apples are placed on their cheeks, one above the other, in one corner of the box. When the top-most apple is from one half to one inch above the level of the top of the box, the apples could be safely packed diagonally on their cheeks in each layer as the top will be somewhat lower, due to the fact that the apples in the second and third layer fitting into the pockets formed by apples beneath. But when the top-most apple is more than one inch above the top of the box, the bottom layer or even the second layer maybe better placed on their ends and face off with a layer on cheeks. This procedure is rarely employed except when very large or very small apples are used in the packing.

An essential point in this layer packing is that apples in each layer should be tightly packed and there should be no loose apples in any layer. A slack pack detracts from the general appearance of a pack and the danger of bruising is great during handling. Advantages should be taken of the variation in diameter and length of the different apples to "key" each apple tightly in
Fig. 28. - The "4-3" diagonal pack, showing the last two layers with apples packed on ends to secure the proper height of the face layer.

Fig. 29. - Packed produce box with the cover raised to show the corrugated cardboard pad and the fruit in the face layer.
Fig. 30. – A convenient portable packing-stand made by inverting a produce box and nail on three stationary legs.
Fig. 31. - A properly packed produce box with cover nailed, showing the correctly stencilled end.

Fig. 32. - A properly packed produce box with the cover raised to show the face layer. The words, "Standard Box Farm Produce", are correctly stencilled on the side of the box as required by the State law.
Fig. 33. - Showing on the right two packed produce boxes wired for export; and on the left, a produce box nailing-bench.
place in each layer. To present a good appearance, the box must be packed full and well faced. When red varieties are used, the red cheeks of the face apples should be turned upward to add attractiveness to the pack.

The pack must further be regular in a well layer-packed box. When the pack is started, for instance, with a "4-3" diagonal pack, the same style should be continued in each succeeding layer. When apples are placed in the bottom layer on their cheeks, each succeeding layer should be the same, except made with apples either too large or too small which necessitate the placing of one or two layers on ends. The alignment of apples in rows should be reasonably straight.

For convenience in layer packing, a packing stand of some kind is necessary even when a few boxes are to be packed. A rigid, built-in stand is most satisfactory where many apples are handled. The height of the stand should be adjusted to suit the packer and the slope of the stand should be sufficient to keep the apples from rolling out of position. A good portable stand can be easily made by inverting a produce box and nailing on three legs of sufficient height to bring it within easy reach of the packer as shown in Fig. 30. This stand could be easily placed beside a grading or packing table or sizer bin containing the sized apples.

The box, in layer packing should have the permanent bottom nailed on before packing. After being packed, a card-board either plain or corrugated is placed over the top layer. The necessary required statements as demanded by the State law on closed packages can either be stencilled on the top of the card board or on the side or end of the box. If the two risers are not already nailed on the heavy ends of the box before packing, a false cover, consisting of four or five slats nailed on two pieces of risers at the end, can be used conveniently during packing to measure the height of the top layer.

Other Types of Packages — The packing of containers like the fourteen-quart peach baskets, bushel hampers, stave bushel baskets etc., have not been so
well reduced to a system. If it is largely a question of securing a smooth and attractive face on the package that shall fairly represent the contents and still be attractive to the purchaser.

With the fourteen-quart peach baskets, growers who are using them, generally jumble the apples in with no attempt of arrangement, although a few growers face off the top layer by arranging the apples in concentric circles with generally the red cheeks up as is done in "tailing off" a barrel. A red netting is sometimes placed over the top of the basket. Red netting is employed as apples do not show to advantage through pink or other colored nettings. Red screen cloth is also used for this purpose.

When a grower is catering to a special market, the fourteen-quart peach basket can be packed in the following manner for shipments: two baskets are "telescoped" together to strengthen it for shipment. Lining papers, either of the special heavy basket liner or ordinary box lining paper, are placed along the inner sides of the basket in a cone fashion. Apples are wrapped in tissue papers and placed in concentric rings, as the facing of a barrel, with the stem ends up. Each layer of apples should be tight to prevent bruising. When the basket is filled, an excelsior cap or just plain excelsior is placed over the top layer. Burlap out to the right length and width is wrapped over the basket and sewn up tightly.

Growers who are using the removable bottom bushel hampers generally pack them as a barrel. The bottom is taken out, and then the cover is fastened to the top of the hamper. A fifteen-inch corrugated cap is placed on top of the wooden cover. The face layer is then arranged as in barrel packing. The rest of the apples is carefully jumbled in the bottom is nailed on.

A survey of the existing condition in Massachusetts with regards to packing is a large and comprehensive subject. Conditions vary not only between localities, but often within one locality as well. To summarize and generalize the existing packing conditions in Massachusetts would be an impossibility. There are, however, three types of growers in every locality; namely, the grower whose
fruit is his main crop and income and who takes care of his orchard and packs his fruit in a systematic manner; the grower whose fruit is a side issue and who takes care of his orchard and packs his fruit in the best manner he knows how; and the grower whose fruit is a side issue and who takes no care of his orchard and packs his fruit in no systematic way.

A study has been attempted by the writer in determining the number of growers in each county that are practicing packing, but accurate data on this could not be secured. In general, Norfolk, Middlesex, Worcester, and Franklin Counties stand out prominently as the counties in which a larger percentage of the growers practice systematic packing than growers in the remaining counties. In Norfolk and Middlesex counties, there are approximately 90% of the growers who pack their apples. The prevailing type of containers employed by the growers in these counties is the standard produce box. In Worcester County, there are approximately 75% of the growers who practice packing and the standard produce boxes are also generally used as market containers. In Franklin county, 75% of the growers who have any commercial orchards pack their apples. The prevailing type of containers being the standard apple barrel. Standard apple boxes are occasionally used there mainly for McIntosh and Northern Spy apples.

Co-operative packing has been practiced by a few growers. Co-operative Associations in the State. Notably, among these, are the Ashfield Farmers' Co-operative Exchange, the Associated Growers of Sterling Apples, and the Williamsburg Fruit Growers' Association.

In the Ashfield Farmers' Co-operative Exchange, each member picks his own fruit and the Association sends a mechanical sizer and packers to each orchard to do the grading and packing. Each grower pays for the grading and packing of his own apples. The standard apple barrel is used as the marketing package.

With the Associated Growers of Sterling Apples, the manager did all the packing in 1931. A charge of five cents was made on each box packed. Two hundred
boxes a day was the rate of packing. Each member pays for the picking and packing of his fruit. The standard produce box is employed. The association has also adopted an attractive label to go with each packed box. The members of this association realize the benefit of a good and honest pack.

The Williamsburg Fruit Growers' Association was formed in 1916 with the purpose of enabling the members to find a better and more profitable market for their apples by the process of good and honest grading and packing. A seal has been adopted by the association to be put on every barrel packed. The association has two mechanical sizing machines and two packing crews. The members of the association are required to pick their own apples and then to notify the manager when they are ready for grading and packing. The packing crews and sizing machines are sent to the farms of all the members in West Chesterfield and Worthington and apples are shipped from Huntington to these towns to be graded and packed. Apples are also packed at the farm in Williamsburg, but all other members must carry their fruit to the association's packing house which is located in the center of Williamsburg. Each member pays for the grading and packing of his own apples. The standard apple barrels are the containers employed. Recent information secured shows that the association is not functioning at present due to the lack of higher grade apples produced.
Fig. 34. — A convenient wheel-truck for handling produce boxes inside of packing house. It can accommodate from 24-30 boxes. It is 4 ft. and 10 inches long, 3 ft. and 3 inches wide. (courtesy of Mr. A.M. Hulet, S. Amherst, Mass.)

Fig. 35. — Showing the construction of the bottom of the wheel-truck and the arrangement of wheels. (courtesy of Mr. A.M. Hulet, S. Amherst, Mass.)
Fig. 36. — A packing-house built as an adjunct to a common storage. It accommodates 3 packing tables and 6 packers. (Courtesy of Mr. A. H. Hulst, S. Amherst, Mass.)

Fig. 37. — Floor plan of a combined packing and storage house.  
No. 1. The packing room  
No. 2. The common storage room (After Cole, M.A.C. Extension leaflet No. 3.)
SUMMARY

Harvesting is an important operation in profitable apple production.

The proper time for harvesting has marked influence upon the keeping quality, color, size, and flavor of the fruit. It varies with the kinds of markets the grower is catering to, the distance fruit is to be shipped, the storage and labor facilities, and the variety itself.

Ground color is a more reliable index to maturity than the red color with the colored varieties. Proper size and ease with which the stem separates from the spur are the reliable indices to maturity with yellow, green and russet varieties.

Successive pickings are profitable with varieties that ripen unevenly, especially the earlier varieties.

Carefulness and the utilization of proper methods in harvesting are of primary importance. Carelessness and improper methods employed in harvesting have a material effect not only on the fruit itself and its sale, but on the trees and the succeeding crops as well.

Suitable receptacles for picking are important. The receptacles selected for picking should prevent all bruising as far as possible and should give ease in handling.

In harvesting the fruit from the trees that can not be easily reached from the ground, suitable ladders should be provided -- climbing about among branches is always to be avoided.

Picking poles and other patented pickers are not in use among commercial growers.

Field receptacles should not be the same packages which are to be sent to the market, as soiled packages always detract from the sale of the fruit.

Fruit as soon as picked should be moved immediately to a cool covered place, or placed in shady portion of the orchard when not hauled away immediately.

The ideal time for picking is on a cool and dry day.

A low, spring wagon is most desirable for use in orchard hauling work. For rapid hauling, auto trucks are frequently employed.
GRADING

Grading is both necessary and desirable. It benefits both the purchaser and the producer and facilitates the marketing system.

Careful grading as to size, shape, and color facilitates the packing operations.

The enactment of state grading and packing law establishes a permanent standard for grades and furnishes a common denominator by which sellers and buyers may trade in a particular commodity in a language which means the same thing to both of them.

To pack all the apples as ungraded in order to avoid the grading law is not advisable, except under exceptional circumstance, and proves detrimental to the producer.

Uniformity in size, shape, color and quality is the keynote to successful grading.

To grade and pack the apples strictly according to the grading and packing law necessitates the separation of these two operations.

Mechanical sizers are necessary where any quantity of apples is to be sized and rapid work in sizing desired. Peace and Gifford mechanical sizers are the most common ones employed by larger growers in this State.

PACKING

Better packing methods are necessary and desirable and are especially needed for the higher grade of apples.

Packages selected should be based upon the consideration of the cost, attractiveness, convenience to consumers, ease of packing, the markets catered to, and the variety of apples.

Standard apple barrels, standard farm produce box and 14-quart peach basket are the most prevalent kinds of containers employed for apples in Massachusetts. The use of the standard apple box is very limited in this State.

Hard wood barrels with sawed elm hoops are the most desirable.

The use of second-hand barrels should be avoided as they detract from the sales.

For satisfactory racking when packing is done in the orchard or on soft grounds, a racking plank should be used.

Liners either of elm or gum wood to strengthen the head, especially for export or long distance shipping should not be dispensed with.

Apples selected for the face layer should fairly represent the contents of the barrel. They should also be uniform in size, shape and color. They should be well and tightly arranged.
"Ring tailing" should be used especially with the better grades of
delicate varieties.

Height of the tail layer should not be over one-and-half inch above the
chime of the barrel. When packing is thorough a height of 6 to
sufficient even for export.

Packed barrels if held in storage for any length of time, or loaded in
car for shipment should be placed on their sides.

Box material should be strong, straight grained with grain running
crosswise free from knots and should not impart odor to the fruit.
Native white is generally used in New England. Spruce is the best.

For rapid work in box making, a box form is indispensable.

Wrapping paper for individual apples adds to the character of the pack;
makes packing easier and pack tighter; serves as a cushion between
apples to minimize bruising in handling, and prevents the spreading of
rot.

The diagonal pack is practically the only system employed at present in
commercial box packing. It permits a wider variation in the size of
apples in a box and allows more or less pressing without bruising.

The "3-3" and the "2-3" represent the two most commonly employed styles in
the diagonal pack and they embrace all the sizes commonly used in box
packing.

Straight 3 and straight 5 packs are for very large and very small apples
which are less commonly met with in commercial box packing.

Well-packed box should have a bulge of 1/4 of an inch upon both top and
bottom. A proper amount of bulge holds the fruit in a packed box firmly
and prevents slack and bruising.

A straight pack requires less bulge as apples thus packed do not settle
into crevices as in the diagonal pack.

The pack should be but a little in excess of the height of the box at
ends to prevent the apples at the ends from bruising.

Firmness of fruit in the pack is of importance in box packing. Unless
firmly packed shrinkage in storage and transit will cause a slack pack.

Evenness of each layer of apples in a box prevents damaging from pressing
and adds greatly to the attractiveness of the pack.

Good alignment of the rows of apples in a box imparts neatness and finish
to the packed box and attracts the purchaser.
Boxed apples in storage or transit should always be placed on their sides or ends but never on bulge.

The best material for the legalized produce box is either pine or spruce; chestnut makes poor box.

Risers when used facilitates packing and imparts a full appearance to the packed box.

"Jumble" pack is only suited for lower grades of apples. "Faced jumble" pack is suited for "A" grade or lower, while layer pack is suited only for "Fancy" and higher grades.

The "4-3" and "3-3" diagonal packs are more commonly used in layer packing the produce box, as they embrace all sizes commonly used in commercial packing.

In layer packing there should be no loose apple in each layer, a slack pack detracts from the general appearance of the pack and causes bruising.

The pack should be regular in a well layer-packed box. The alignment of apples in rows should be reasonably straight.

The methods of packing containers other than barrel, standard apple box and standard produce box have not been reduced to a system. It is largely a question of securing a smooth and attractive face on the package.

Norfolk, Middlesex, Worcester and Franklin Counties stand out prominently as the counties in which a larger percentage of growers practice systematic packing.

Co-operative packing has been done by the Ashfield Farmers' Co-operative Exchange, the Associated Growers' of Sterling Apples, and the Williamsburg Fruit Growers' Association.
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