

The Manufacture of Cork Insulating Board
from Douglas Fir Bark Through the
Organization of a
Cooperative
by
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Permanized
OLD RELIABLE BOND

PERMANENT

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INTRODUCTION

The purpose of this thesis is to show that it is possible to produce cork insulation board profitably from Douglas Fir bark.

Another purpose is to show the lumber industry that they, themselves, can produce this first rank goods here in the State of Oregon. If this industry is allowed to leave the state and move to the location of the present cork board industry, we will have allowed another first rank industry^{to} slip away from us. Looking at this problem from a purely economical standpoint, it is better by far to keep the industry here on the west coast. If it is allowed to leave the Douglas Fir region, we will be required to send the cork or bark to the east coast where it will be make into cork insulation board, then it will come westward again where we will be compelled to pay a goodly sum to buy the cork back again.

In this thesis, I would like to suggest a possible means whereby the lumber industry, itself, will profit by this new product. In the logging industry where we have very little money to throw away, I would like to suggest the organization of a cooperative, wherein each saw mill shall invest a certain amount of money in a processing mill and then will send their bark to this mill. At the same time the bark problem, which has been a worry to the industry for years, will be cleared up.

This industry is now in its embryonic stage. Little

work has been done in this field. The work which has been done up to the present time was done by Glenn Voorhies, Assistant Professor of the Wood Products department and Leo Friedman, Assistant Professor of the Chemistry department, both at Oregon State College. Some work is also being done at the University of Washington by Dr. Fredrick Wangaard of the College of Forestry faculty, and Professor Bror L. Grondal, director of the entire research program. Washington University is working under a grant from the Washington State Planning Board, and Oregon State is working with the \$25,000 allotment given by the Oregon Legislature.

I have taken an arbitrary district in which I was able to find enough mills within a fifteen mile radius for the supply of bark. I have chosen Creswell, south of Eugene, solely on the assumption that I would be able to secure bark from the districts around Eugene and Cottage Grove. These mills have been studied and the amount of bark has been determined. I will only use the mills that are connected by, or accessible to railroads.

CHAPTER I

OUR PRESENT PROBLEM

At the present time, after the entry of the United States into the Great War, we have come to realize more fully the great importance of having the raw materials which we use for war, produced right here on our own soil. We have come to realize that one of the "critical materials," which was listed by the Army and Navy Munitions Board, is the common everyday cork.

Cork is used by every engine that turns in helping this nation win the war. Yet we find that all the cork that is consumed by the United States comes from the countries bordering on the Mediterranean Sea. Because of the shipping threat of the Axis powers, this supply is virtually cut off, therefore, the problem which is facing us at present is, "Where can we find another source of supply of cork?" or "Where can we find another substitute for cork?"

THREE POSSIBLE SOLUTIONS

We could: -

1. Continue our present policy of bringing shiploads of cork from the Mediterranean Sea. This would mean many valuable ships lost because of Axis bombs and torpedoes. This would also demand a large protective fleet which could be effectively used somewhere else.
2. Raise our own cork. It was thought up to the present time that cork could not be raised other than in

its native land. We find, however, in the American Forests Magazine¹ an article by Ruth Ringle which tells of some cork which is being raised in California. It will produce as good cork as in its native land. There is at present, a large number of cork trees being planted but they will take a great number of years to produce enough to supply the great demand in the United States.

3. With a little thought we will see that the two methods so far brought out would not be satisfactory. The only alternative is to produce cork from some other product or tree which will have the same qualities and requirements of natural cork. With research which has been carried out in the past year, we find that there is a large quantity of cork in Douglas Fir bark. This comprises 50% of the bulk of the bark. The independent granules are relatively small, being 1/16 or 1/8 inch in maximum size. Because of the large amount of Douglas Fir bark which is wasted or burned as fuel, we could very easily convert this bark to cork and we would have a more complete utilization in our sawmills and it would remove one of the problems which has been confronting us ever since we began cutting Douglas Fir for lumber.

¹Ringle, Ruth, "Cork Oak-Naturalized American," American Forests Magazine. Vol. 48, No. 4. Page 161 /, April, 1942.

CHAPTER II

THE BACKGROUND OF CORK*

To get a better idea of what kind of a material we are dealing with, I have inserted this chapter in the thesis. Many people are ignorant of the source of cork, the qualities of cork, and the possibilities of cork.

IN ANCIENT HISTORY

Cork has been used as far back as 2500 B. C. It is one of the oldest materials that has been used by man. The use of cork has been mentioned by such historians and scholars as Theophrastus in his botany work; Pliny, the Roman historian, mentioned stoppers, floats, and shoes being made of cork; Horace, in Ode III spoke of stoppers; Cato in his work De Re Rustica; and Plutarch mentioned it as a life preserver. There are other accounts which show how cork has been used far back in history.

IN THE PRESENT TIME

There were several reports stating that Cork Oak would not grow anywhere except along the border of the Mediterranean Sea. Even as late as March 1930, Dun's International Review told how the attempts to raise Cork Oak in the United States were unsuccessful, but apparently he did not investigate the places where these trees were

*Most of the data in this chapter was obtained from

Faubel, Arthur L., Cork and the American Cork Industry, Rahway, N. J., Quinn and Boden Co., Inc., 1938.

planted, for we read in Ruth Ringle's article "Cork Oak--Naturalized American"¹ how John Benson saw these trees--planted years before--and how he planted seventy trees in 1878 on his Napa Valley Ranch in California. We also have a grove of 400 trees planted by the University of California on the Forestry station in Butte County in 1904. And now we read in the Oregon Journal² how the State of California is making a scientific, systematic, and state-wide drive to make California the greatest cork-producing region in the world. In 1943 they are planting 1,000,000 trees and then an additional 1,000,000 trees for the next seven years. A cork tree can be stripped only once in eight years. They will have to wait twenty years to get their first crop, which will be too late for the present demand.

When cork industries started in the United States about 1840 to 1845, the only products they manufactured were stoppers and a few novelties, such as floats and buoys. The industry continued with these same products until about 1890 when they realized that the insulating qualities of cork could be developed. At this time, a German firm produced "impregnated" cork board. They used granulated cork and a binder. This product they used for insulating purposes. In 1892, John T. Smith, an

¹Ringle, Ruth, "Cork Oak-Naturalized American," American Forests Magazine Vol. 48, No. 4. Page 161 7.
April, 1942.

²Oregon Journal, Sunday, April 26, 1942. News Section A5, Col. 3.

American, produced an insulation board of cork without a binder. He utilized the resins which were already in the cork. From this time on the insulation board has surpassed the original product, stoppers.

THE STRUCTURE OF CORK

Cork has a unique structure which differs from all other wood cells in that it has fourteen sides--it is tetrakaidecahedral. In most trees the bark is somewhat fibrous, but in cork we find millions of honeycomb cells. Each cell has imprisoned a small bit of air. The cells are so sealed that this air cannot escape even under great pressures. There are 200,000,000 of these cells in a cubic inch. Half the volume of cork is air, which accounts for its lightness and resiliency.

THE PHYSICAL PROPERTIES OF CORK

The most important of the physical properties of cork are as follows:

1. Buoyancy. The specific gravity of cork is .25 and it is one of the lightest of solid substances. As above stated, this is due to the imprisoned air in each cell.

2. Compressibility. This quality is again attributed to the cork's unique structure. When the cork is under pressure, the air that is in the cell is compressed and very little escapes. When this pressure is released the cork will take its former shape. When the cork is under pressure there will be only slight lateral flow, or

in other words, the cork will not spread appreciably which is a quality which is desired.

3. Resilience. Because pressure does not break down the cells, the air which is compressed under pressure will tend to spring the cork back to its former shape even after a long period of time.

4. Resistance to Moisture and Liquid Penetration. Because of the structure of the cells, there is no taking on of moisture even when the cork is boiled in the liquid.

5. Frictional Qualities. Cork is highly frictional material. Its coefficient of friction is much greater than other materials which are used for friction. The cell structure along a cut will form suction cups which will work even if coated with grease or oil.

6. Low Thermal Conductivity. Because of the dead air spaces in the cells, we have what is next to a vacuum as an efficient non-conductor. The insulation industry, therefore, uses cork as the standard material throughout the world.

7. Ability to Absorb Vibration. The cork tends to cushion and absorb the sound which strikes against it. When an object is placed on top of it and is vibrating, very little vibration is transmitted through the cork because most of it is air which acts like a cushion.

8. Stability. Cork is one material which will hold its qualities long after other materials have worn out. There are very few things which will have any effect on

cork. Temperature changes, humidities, and other atmospheric conditions have a very slight effect on the cork. This is another good reason why cork makes a good insulator.³

DOUGLAS FIR CORK IN RELATION TO CORK OAK

Up to this period, I have discussed the cork which is obtained from Cork Oak. We also have another cork which is found in Douglas fir bark. The cell structure is different from the cork tree cells, the same as any two species of wood, in cell structure. The cell walls of the Douglas Fir cork are thinner walled. We do not find the total bark made up of cork as in the Oak, but there is 50% which can be used in the cork products. The number of products which can be made from the Douglas Fir cork is limitless. Therefore, I will deal only with the insulation board. There is no reason why the cork in Douglas Fir cannot be used for everything that the cork in Cork Oak is used. In Cork Oak we have what is called natural cork cut out of the bark in its finished state. This natural cork has many defects which really make it a worse product than the composition cork.

³Faubel, Arthur L., Cork and the American Cork Industry, Rahway, N. J., Quinn and Boden Co., Inc., 1938.

CHAPTER III

THE MANUFACTURING PROCESS

The processes in manufacturing Douglas Fir cork board are very similar to processes that are used in the Cork Oak insulation board, in fact, many of the processes are the same and must go through the same type of machines. The only place where the two industries will differ is where the Douglas Fir bark must be separated into cork and other bark materials. The methods of removing the bark from the tree and logs differ also.

DEBARKING PROCESSES

There are three possible ways to debark logs. They are: debark by hand; debark slabs after log has been sawed; and debark with hydraulic jets. Other systems which are in practice are the barking drums and knives. These last two processes injure the best lumber in the log. Another objection to these last two methods is the fact that they can't handle the large logs of Douglas Fir.

DEBARKING BY HAND

Because of the size of the logs which have to be debarked, it may take quite a long period of time to have this done economically, for one could not afford to spend too much money removing the bark. This process, with the manhandling that must be done to the logs, would require several men to operate.

DEBARKING FROM SLABS

This process has proven satisfactory. With this

process the slabs pass under a hydraulic jet which is exerting great pressure. The force of the water forces the bark from the slab. The slab travels on rollers which runs each slab under the jet. It has the same principle as a planer in a sawmill--each piece pushes the preceding one forward through the machine.

DEBARKING THE LOG

In Everett, Washington, the Weyerhaeuser Timber Company is constructing a debarking device which will remove the bark by means of hydraulic pressure. This process is quite similar to the process that is used for slabs. It is a new process in the lumber industry and it will make its debut in the Everett Mill in the very near future.

In this process there is a tremendous pressure behind the water as it is forced through a series of jets having the force to rip the bark from the log.

By debarking before the log goes through the sawmill all of the small stones imbedded in the bark, that may dull the head saw, are also removed. One will also be able to see all the defects a lot better and as a result the sawyer will be able to cut for higher quality.

STORAGE OF BARK

AT THE SAWMILL

Many of the mills will not produce a carload of bark each day, therefore it will be necessary to store the bark until a car load is on hand. This is quite necessary so the company will not be required to pay the demurrage for

keeping the railroad car too long. The demurrage rate is three dollars per day. The best plan to cope with this situation would be to construct a hopper from which the boxcar could be loaded.

AT THE CORK BOARD MILL

When the carloads of bark arrive at the cork board plant they will be dumped into bins which can be located below the level of the railroad tracks. Another way to solve this problem would be to construct a shed with a conveyor passing along the ridge just below the roof. With the use of this conveyor, one will be able to fill the shed from the unloading cars.

There should be another conveyor along the bottom of these sheds to carry the bark into the mill as it is needed.

HOGGING AND HAMMERING

From the bin, the bark is carried by means of an endless conveyor, into a hog which will break the large pieces of bark into smaller granules. Going directly from the hog, the material will be carried to the hammer mill where the granules are hammered so that the cork is completely separated from the other bark materials.

DRYING THE BARK

We do not know whether or not it is necessary to dry the material. It might be possible to have the cork wet when it is being made into corkboard, for in all the experiments that have been tried up to the present, they

have dried their bark. This will need further research and if it will work, it will eliminate one of the processes which will make the finished product that much cheaper or the profits so much higher.

It is feared, however, that the small dust particles of the other bark materials will cling to the cork and will thus find its way into the cork board, although we do not know if this will harm the finished product or not.

The most rapid way to dry this material would be to have a rotating dryer, with a conveyor to carry the material to the top of the machine. As the material passes down through the machine by the force of gravity, it will be dried with the gases from the stack, that are passing up through the dryer.

THE SEPERATION OF CORK FROM OTHER BARK MATERIAL

To seperate the cork from the other bark materials we can use several processes.

SCREENING

This may be the most expensive process, but if we wish to manufacture more than one grade of cork board, we could use this method to get different sizes of cork granules.

To screen the cork, we would use the same type of process as they use in the coal industry while screening the coal in the breakers.

The different meshes that would be used are as follows:

50 mesh will give powder, but it is useable
30 mesh - - - - - good
20 mesh - - - - - excellent
15 mesh and up - some possibilities.

CYCLONE

If we want to use the cyclone method, we must install a blower system. This is by far the cheapest process if only one grade of cork board is desired.

The cork and other bark materials are blown to the cyclone at a certain rate of speed. Upon reaching the cyclone, the expansion of the chamber will retard the speed of the air passing through this section of the blower system. The larger pieces of cork, which no longer can be carried by the air, settle to the bottom of the cyclone where they pass off to a storage bin. The rest of the bark material will then proceed along the blower pipe and will be discharged at a desired spot. This cyclone principle is based on Stokes Law.

I want to mention in passing, that the other bark materials which are separated from the cork may find use in many other products. It is already ground up into powder and ready to be processed, however, since we are dealing strictly with cork we will pass by this by-product. Further research would be required to find uses for this product.

MIXING AND PLASTICISING

When the cork board is ready to be made, the cork is

drawn from the storage bin by conveyor. It is poured into a mixer, which may be of various types. The main principle is to get the cork thoroughly mixed with the resins. There are many resins which might be used. It all depends on what the finished product will be used for.

MOLDS

After the mixture is plasticized, it is placed in molds. These molds are made of metal and can be constructed of any size or shape desired. They have movable top and bottom plates used to press the mixture in and to facilitate removal.

ROD MOLDS

The rod molds vary from a few inches to two or three feet in length. By a certain process, rods can be made of indefinite length.

Tube Molding Process

In this process, the mixture is placed in a hopper and forced into hollow metal tubes by plungers. When the tube is filled, it is placed in an oven and is baked for a period of 20 to 30 minutes at a temperature of 200° F. to 250° F. The inside diameter of the metal tube determines the diameter of the finished rod. After the baking, the rods are removed from the oven and forced out of the tubes. They are then stored for seasoning. This seasoning period will last from several days to several weeks.

Most of the products that are made from these rods

are used in the manufacture of liner discs. These are used in bottle caps. However, there are various other uses that are too numerous to mention.

Extrusion Process

In this process, the mixture is placed in a hopper and forced through a metal tube. The extrusion machine has a battery of metal tubes, each of which has a baking unit or element surrounding a section of the tube. A small amount of mixture is fed into the machine with a plunger, packed, and slowly pushed through the tube about one or two inches a minute. While it passes through the baking area, it is baked at a temperature of 250° F. to 300° F. As it emerges from the end of the tube, the rod is periodically cut off. The rods can be further baked in an oven although this may not be necessary.

BLOCK MOLDS

As in the rod process, the mixture is placed in a hopper and is poured into metal molds. The shape and size of the metal mold decides the shape and size of the finished article. Both the top and the bottom plates are removeable and adjustable. It is by this means that the mold is filled with the mixture and the finished article is removed. The filled mold goes into an oven which has a temperature of 200° F. to 250° F. and stays in for eight or ten hours. The molds are then removed and the blocks taken out and stored for seasoning.³

³Faubel, Arthur L., Cork and the American Cork Industry, Rahway, N. J., Quinn and Boden Co., Inc., 1938.

OVENS

In the discussion on molds we spoke about the temperatures of the oven and the length of time that the material must remain in the oven. This length of time is due to the insulation qualities of the cork. The thicker the article the longer it will take the heat to get into the center of the board. The ovens are quite similar to the ones used in plywood.

CHAPTER IV

ORGANIZATION OF THE COOPERATIVE

Essential principles in Cooperative Marketing.

1. An organization must furnish a definite service needed by producer.
2. An organization must have a sufficient volume of business to enable it to operate effectively and economically.
3. An organization must have a loyal membership.
4. An organization must have good management.⁴

With these qualities in mind, we look into the various problems that will confront this industry. There will not be enough bark produced in each mill to warrant the building of a cork mill at each mill site; it seems feasible, therefore, to have a cooperative. Another way to handle this problem would be to sell the bark to some outsider. To allow money to return to the sawmill owners, it seems best to have a cooperative by which they would receive the profits from their products. By having a cooperative, greater efficiency will be developed, which will result in a higher net return to the producer. This will also allow a lower price to the consumer.

MEMBERS

In the organization of a cooperative there should be some agreement by which they would specify the number of

⁴Gatlin, George, Cooperatives, Oregon State Agricultural College, Extension Service, Extension Bulletin # 429, Oct., 1930.

members that they will take into the organization. The main item to consider in this point is the location or centralization of the members. In the set-up, I have included thirty one members, none of which is more than fifteen miles from the central location, namely Creswell, Oregon. There is another consideration that should be remembered when starting a cooperative. That is the potential business that will be secured by the members. One need not worry about this point for most of the mills have a steady supply of lumber output.

SALES

An important point to consider in starting a new kind of industry is the ability to get the product into the hands of the consumer. At the present time, while we are at war, all the cork insulating board which could be produced would find its way into war production needs, and by the time the war was over, the business would be well established. Most of the flaws in the organization would be ironed out and everything would be running smoothly.

BY-LAWS

The by-laws of the organization should be written by all the members or by a committee appointed for this purpose, the committee members being appointed by the members of the organization.

The by-laws should include such measures which fix the time, place, and manner of holding regular and calling

special meetings of members. They should prescribe the number, qualifications and duties of the officers, and how they should be elected, how long they should remain in office, and how their compensation is to be determined.

Other points to consider are: the dismissal and admission of members with the qualifications and conditions which would be attached; the number of member and directors which will constitute a quorum; the executive committee should be considered and its authority should be defined; the directors authority in handling money should be stated.

There are many other items which should be mentioned in the by-laws. All items should be made as general as possible and there should be provision made for amending any of the by-laws.

DIRECTORS

The powers under which a director works are varied and many. Two of the ones he works under are the powers which are imposed by the Federal, State and local governments. The other is the powers which are imposed by the statutes which are laid down by the organization itself. The first directors of an association are usually named in the Articles and generally are the incorporators. It is not necessary that the directors be members, in fact, it would be a good policy to secure a director who had previously been employed in the cork industry, for he would know many of the problems which would confront the

newly organized cooperative.

The directors of a cooperative must supervise and control five major functions, viz.,

1. Acquisition of possession of members' product either as buyer or agent;
2. Establishment of pools;
3. Borrowing;
4. Selling the product;
5. Distribution of proceeds.⁵

This shows that the directors have a great responsibility to make sure that they choose the salesmen with a reasonable amount of judgment, keep the salaries within reasonable limits, create some financial reserves, have some satisfactory procedure in paying the members for their work, and many other duties.

MANAGEMENT COMMITTEE

This is sometimes called the executive committee. It is appointed or elected by the directors. This committee is used to carry on the ministerial duties and with this supervision the management will be able to work closer to the production end of the business. This committee may have power to make many decisions which may arise during the daily work of the organization. If, however, an im-

⁵ Hanna, John, The Law of Cooperative Marketing Associations, The Ronald Press Co., N. Y., Page 202. 1931.

portant question or decision confronts the committee it should be passed on to the directors for their decision. The duties of the management should be quite specific and should be ratified from time to time. If the directors meet regularly once a month, the management committee should meet once a week or perhaps once every other week. The manager consults this committee about opening new lines or new departments, also about the hiring of help etc.⁶

Minutes should be kept for all the meetings of this committee and then they should be read at the directors' meeting. Another important duty for the management committee is to prepare matters for the directors' meeting so that decisions can be reached easily without a lot of wasted time.

BUILDING COMMITTEE

The building committee, which is appointed by the directors, is to function only during the time there is building to be done. If possible, this committee should consist of members who know something about carpentry or building in general.

MINUTES OF MEETINGS

One of the first tasks that should be undertaken is the formulation of definite regulations and system for

⁶Alanne, U. S., Mannual of Co-operative Directors, Co-operative Publishing Association, Superior, Wisc., 1938. Page 83/.

the preservation, filing, binding, preparing, and indexing the minutes of the various committees. This is very important because there might be a desire to know just when the directors have passed on or are supposed to have done a certain work. If the minutes were not organized so they could be referred to at a minutes notice, great damage may occur to the industry.

Documents which have been approved by the directors should be so described and filed in order that they may be found on a minutes notice.

The minutes should be bound from time to time into convenient volumes and a good index system provided for each volume.

OFFICERS AND EMPLOYEES

Officers should be elected by the directors and frequently they must be from among the directors. This need not be the rule, however. Some officers might be neither directors or members. If officers are directors they should not be allowed to vote on the question of their compensation.

The duties of the officers are stated in the statutes or by-laws of the organization. The employees are the people who are entitled to compensation for work done. Officers and employees can be removed by the directors if there has been no signed contract. If a contract has been signed for a certain period of time and the directors remove an officer they might find themselves with a damage

suit on their hands.

MEETINGS OF MEMBERS

There should be some provision made which will state that the members will have an annual meeting and special meetings should be held whenever necessary--as called by the directors or by a certain proportion of the members. Sufficient notice should be given for the meetings, with these regulations stated in the by-laws. The members who attend a regular called meeting will constitute a quorum for that meeting unless otherwise stated in the by-laws, which might state that a certain number would have to be present to take a vote.

CHAPTER V

FINANCING THE COOPERATIVE

Three types of finances are required to meet expenses. They are those expenses one must meet before the organization starts producing, the money that is needed to meet fixed assets, and the working capital or operating capital. Another might be mentioned, namely, the reserve.

The expenses that are required before the organization starts production include the costs of postage, transportation and legal fees. Fixed or capital assets require finances to cover the investment in the plant building and equipment. Operating or working capital is needed to meet current expenses such as wages, salaries, educational activities, transportation, legal charges, insurance, rent, advertising, research, processing, etc.

SOURCES OF COOPERATIVE CAPITAL

Because of the situation that faces us at the present time, it is my belief that the organization that desires to set up a cork plant could receive financial assistance from the United States government. With most of the supply of cork shut off it is necessary for someone to start another product that can take its place.

Another source of capital is from the members who can purchase stocks and pay fees. Loans can be secured from private individuals, preferably members, local banks, or other large banks in the region. Some loans can be

secured at large money centers also, if necessary.⁵

⁵Hanna, John, The Law of Cooperative Marketing Associations,
The Ronald Press Co., N. Y., 1931. Page 202 *ff.*

CHAPTER VI

MAKING AN ESTIMATE ON THE INDUSTRY

Because of the lack of information it is foolish for me to make an estimate of the cost of the finished product, the amount of profit and risk that should be applied, and all the milling costs.

The only way a person could make a satisfactory estimate would be to have worked in the field beforehand. Because the cork industry is identical to the corkboard industry it would be a good plan to have someone in this field make an appraisal. The only difference between the two industries being the source from which they get their raw material. This being the case, the products being the same, the difference in the cost of the product or the amount of profit secured will be determined by the difference between the cost of the product up to the time it reaches the cork mill.

The Cork Oak costs will be the cost of the raw material in the Mediterranean region and the cost of the shipping and other transportation costs to where the bark enters the mill.

The Douglas Fir bark costs would include the debarking of the logs and the transportation costs.

Therefore, as stated before, the difference in cost would make a difference in the price of the finished product or the amount of profit made, all other things being equal.

I have figured the cost of transportation which is needed to supply the cork mill each day. I was not able to secure the necessary information on the debarking of logs with hydraulic pressure nor was I able to get the costs of Cork Oak.

I have estimated the amount of cork that will be produced in the 31 mills that I have arbitrarily choosen. (See Figure 1.)

I estimated the cost of construction of the mill by the footage method. From the Copeland Retail Lumber Yard I secured an estimate of the price per footage, which amounted to \$2.50. There being a total of 3375 sq. ft. in the building, the cost would be approximately \$8,437.50.

In actually figuring out the many cost that are required to start the industry, it would be necessary to have an expert estimator figure out costs etc. of all phases of the industry.

CHAPTER VII

CONCLUSION

In my opinion, the Cork Board from Douglas Fir bark is very practical, especially now when we need everything working toward war production. There are many possibilities in this field and perhaps even in the by-products. Although there hasn't been any research done with the by-products, we will have it in a workable form where it will require little processing.

With a cooperative established we will be enlarging the field of forest products and it will help us secure a higher maximum utilization in the Douglas Fir industry and at the same time remove a problem that has bothered the industry for some time--the problem of the disposal of bark.

BIBLIOGRAPHY

Ringle, Ruth, "Cork Oak-Naturalized American," American Forests Magazine, Vol. 48, No. 4. April, 1942.

Oregon Journal, Sunday, April 26, 1942. News Section.

Faubel, Arthur L., Cork and the American Cork Industry, Rahway, N. J., Quin and Boden Co., Inc., 1938.

Gatlin, George, Cooperatives, Oregon State Agricultural College Extension Service, Extension Bulletin #429, Oct., 1930.

Hanna, John, The Law of Cooperative Marketing Associations, The Ronald Press Co., N. Y., 1931.

Allane, U. S., Manual of Co-operative Directors, Co-operative Publishing Association, Superior, Wisc., 1938.

University of Washington Bulletin, News Letter, General Series No. 690, April 18, 1942.

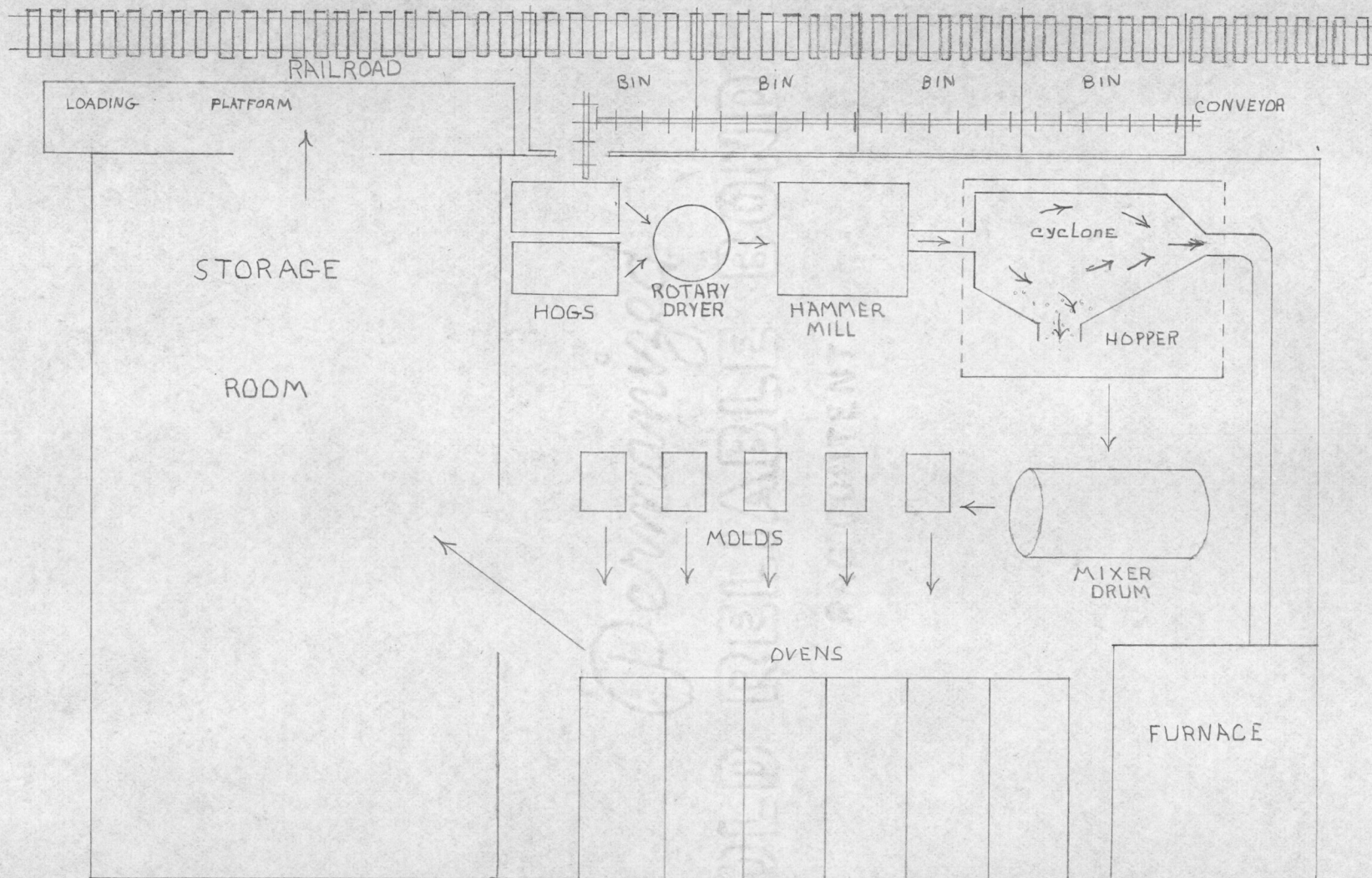
CHART SHOWING TRANSPORTATION COSTS
AND AMOUNT OF PRODUCTION

Name of sawmill	M bd.ft. / day	# cu.ft. bark from mill	# units going to mill	trans. /unit	cost/ day for trans.
Hyland	20	400	2.	1.05	2.10
King and Langacher	20	400	2.	1.05	2.10
Langacher, Fred	20	400	2.	1.05	2.10
Monroe Lumber Co.	20	400	2.	1.05	2.10
Walters Dushong	25	500	2.5	1.05	2.63
West Side Lumber Co.	25	500	2.5	1.05	2.63
Triple H. Lumber Co.	20	400	2.	1.05	2.10
Owen Lumber Co.	15	300	1.5	1.05	1.58
Pettybone	20	400	2.	1.05	2.10
Olson, J. O.	30	600	3.	1.05	3.15
Danebo Mill Co.	65	1300	6.5	1.05	6.83
Giusting Bros.	100	2000	10.	1.05	10.50
Cone Lumber Co.	40	800	4.	1.00	4.00
Booth kelly	150	3000	15.	1.00	15.00
Rosboro Lumber Co.	100	2000	10.	1.00	10.00
Currier Mill	40	800	4.	1.00	4.00
Delta Lumber Co.	25	500	2.5	1.00	2.50
Pacific Mill Co.	40	800	4.	.95	3.80
Creswell Mill Co.	30	600	3.	.95	2.85
Chamberlain, M.	6	120	.6	.95	.57
Douglas, Ed	5	100	.5	.95	.48
Saginaw Lumber Co.	40	800	4.	1.00	4.00
Walker Mill Co.	10	200	1.	.95	.95
Durabl Fir Lumber Co.	65	1300	6.5	1.10	7.15
Walden Lumber Co.	40	800	4.	1.00	4.00
Chambers	100	2000	10.	1.00	10.00
Woodard Lumber Co.	100	2000	10.	1.00	10.00
Cottage Grove Lbr.Co.	30	600	3.	1.00	3.00
Lyle Davis	15	300	1.5	1.00	1.50
S. and S. Lumber Co.	6	120	.6	1.05	.63
Harris, H. H.	20	400	2.	1.05	2.10
	1242	24840	124.2		126.45

200 cu. ft. in a unit
16 units in RR car
7.76 cars or 8 cars available every
day

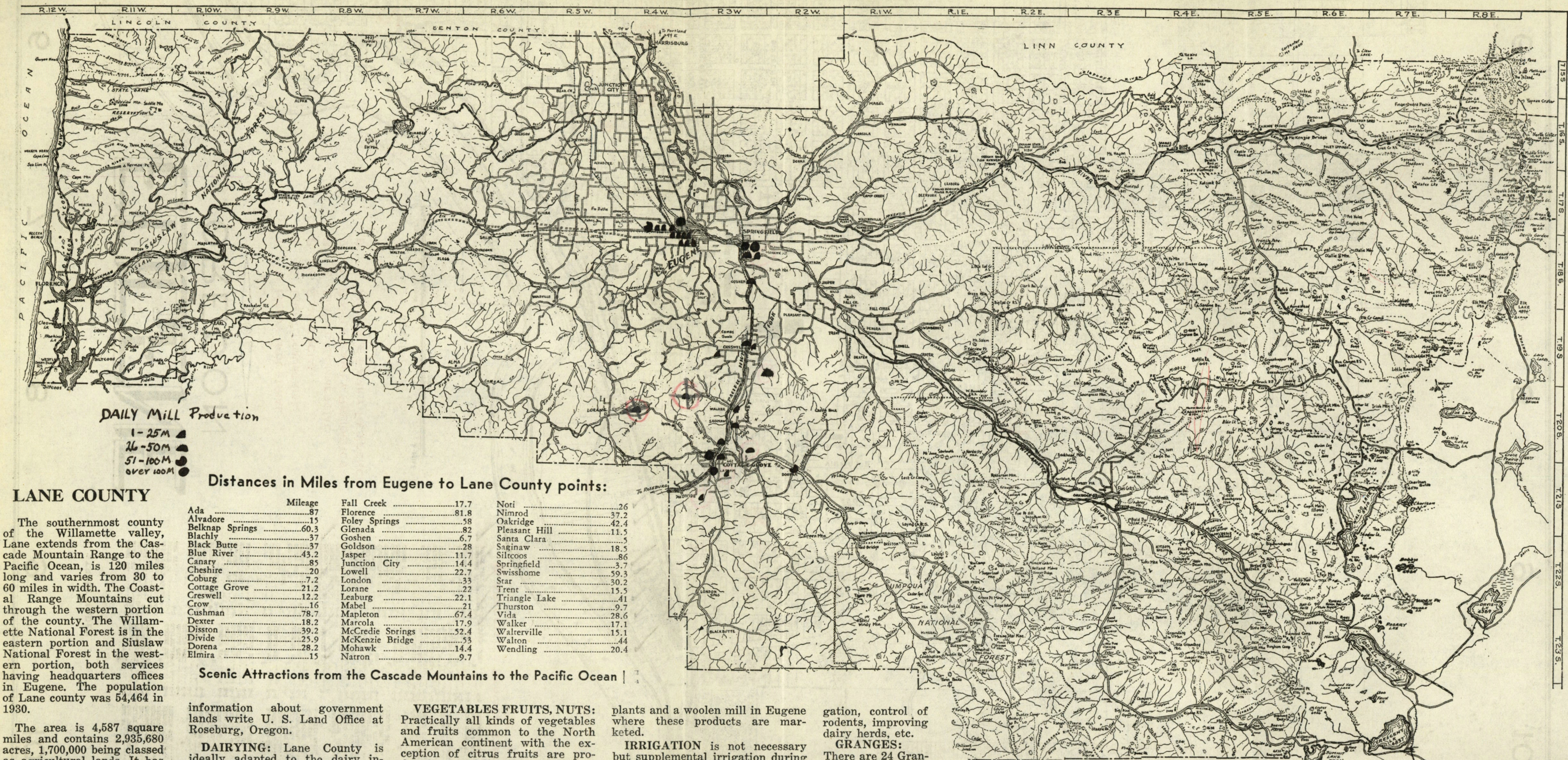
Figure 1.

Figure 2.



SCALE 1"=10'

FLOOR PLAN OF CORK MILL.



LANE COUNTY

The southernmost county of the Willamette valley, Lane extends from the Cascade Mountain Range to the Pacific Ocean, is 120 miles long and varies from 30 to 60 miles in width. The Coastal Range Mountains cut through the western portion of the county. The Willamette National Forest is in the eastern portion and Siuslaw National Forest in the western portion, both services having headquarters offices in Eugene. The population of Lane county was 54,464 in 1930.

The area is 4,587 square miles and contains 2,935,680 acres, 1,700,000 being classed as agricultural lands. It has a commission form of government with all offices in the County Court House at Eugene. County and state tax rate is 23 mills.

SOIL AND LAND VALUES: depend upon location, soil, improvements, etc. but range as follows: Cut-over lands \$5 to \$15 per acre; foothill, \$20 to \$60; Valley \$50 to \$150 and River bottom, orchard and nut lands, \$150 to \$1000 per acre. All government homestead lands were closed to entry by the President in 1935. For other

Distances in Miles from Eugene to Lane County points:	
Ada	87
Alvadore	15
Belknap Springs	60.3
Blachly	37
Black Butte	37
Blue River	43.2
Canary	85
Cheshire	20
Coburg	7.2
Cottage Grove	21.2
Creswell	12.2
Crow	16
Cushman	78.7
Dexter	18.2
Disston	39.2
Divide	25.9
Dorena	28.2
Elmira	15
Fall Creek	17.7
Florence	81.8
Foley Springs	58
Glenada	82
Goshen	6.7
Goldson	28
Jasper	11.7
Junction City	14.4
Lowell	22.7
London	33
Lorane	22
Leaburg	22.1
Mabel	21
Mapleton	67.4
Marcola	17.9
McCredie Springs	52.4
McKenzie Bridge	53
Mohawk	14.4
Natron	9.7
Noti	26
Nimrod	37.2
Oakridge	42.4
Pleasant Hill	11.5
Santa Clara	5
Saginaw	18.5
Siltcoos	86
Springfield	3.7
Swisshome	59.3
Star	30.2
Trent	15.5
Triangle Lake	41
Thurston	9.7
Vida	28.6
Walker	17.1
Walterville	15.1
Walton	44
Wendling	20.4

Scenic Attractions from the Cascade Mountains to the Pacific Ocean |

information about government lands write U. S. Land Office at Roseburg, Oregon.

DAIRYING: Lane County is ideally adapted to the dairy industry. Dairy herds are comprised of pure bred stock consisting mainly of Jerseys, Holsteins, Guernseys. There are 6 creameries and 2 cheese factories in Lane County together with many dairies that sell milk wholesale and retail.

POULTRY RAISING: Chickens and Turkeys are raised on a large scale; cooperatives and egg packing plants ship poultry products to all parts of the world. Ducks and Geese are raised successfully. White Leghorns, Barred Plymouth Rocks are principal kinds of chickens, while Narraganset, Bronze and Red Turkeys are the leaders.

VEGETABLES FRUITS, NUTS: Practically all kinds of vegetables and fruits common to the North American continent with the exception of citrus fruits are produced successfully. The filbert and walnut industry is growing rapidly. U. S. Department of Commerce reports that the Willamette valley is the only natural filbert growing country in the world. Many of the fruits and vegetables are canned and packed by the Eugene Fruit Growers Association in Eugene, and shipped to all parts of the world.

GRAINS: Corn, Wheat, Clover, Vetch, Maize, Rye and many other grains for seed and feed purposes are grown most successfully.

LIVESTOCK: Cattle, Sheep, Hogs are raised for commercial purposes. There are meat packing

plants and a woolen mill in Eugene where these products are marketed.

IRRIGATION is not necessary but supplemental irrigation during July and August has proven profitable since reported increases in produce have been 300% also gives a higher quality product. Irrigation projects are being carried out by pumping from ground, diverting streams and springs.

As this is a country of diversified agriculture where we can raise almost anything it is advisable for each farmer to specialize in one major product and grow other crops for own consumption. Our County Agricultural Agent maintains an office in the Public Market in Eugene where he assists the farmers with their problems of crop rotation, culling poultry, irri-

gation, control of rodents, improving dairy herds, etc.

GRANGES: There are 24 Granges in Lane county all affiliated with the Lane County Pomona Grange, which are very active in carrying out projects for improvement of rural districts.

4-H CLUB WORK is carried on extensively in Lane County for the training of the future farmers and homemakers. Many honors and awards have been won by Lane County club members. Some in the form of trips to Chicago, scholarships, etc. 341 clubs have been organized in Lane County.

LUMBERING constitutes one of Lane County's largest resources and normally provides over two-

thirds of the county's payroll. There are over 75 mills in operation employing around 5,000 persons. There are 60 billion feet of merchantable timber.

MINING: In the Bohemia mining district, 35 miles east of Cottage Grove and the Blue River Mining district, 45 miles east of Eugene, are to be found valuable and rich mineral deposits containing gold, silver, lead, mercury, zinc, copper, antimony, sulphur, and a few other minerals.

RECREATION: Lane County answers the sportsmen's most

cherished dream. Deer, Pheasant and Duck are in abundance in their season. Cougar, Bear, Raccoons may be bagged by those desiring this kind of game. Salmon, Trout, Steelhead, Bass and many other kinds of fish are caught in the many lakes and streams which never dry up.

HIGHWAYS AND TRANSPORTATION: Five paved highways serve practically all sections of county; other communities being served by good macadam market roads maintained by county. 3 main rail lines and 5 branch lines serve the county. The Siuslaw River is now spanned by a drawbridge at Florence.

CITIES IN COUNTY: Larger cities and towns in Lane County outside of Eugene are Cottage Grove, Oakridge, Westfir, Springfield, Junction City, Florence, Mapleton and Creswell.