EXPERIENCIES OF

STUART McLAIN

Volume 3

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WARNING

Let the Reader beware! This is a "brag" story - only the good parts are included! The Reader should balance these against the bad things that happened and which are obviously omitted.

PERSONAL HISTORY OF STUART McLAIN

Written in 1978

Introduction

In 1975 I wrote a report or history entitled, "Experiencies of Stuart McLain." That report covered the subjects:

Aberdeen Proving Ground
Nuclear Development
Corporations through 1974

Thus, the first report covered my experiencies in the Army, particularly those at Aberdeen Proving Ground during World War II and the "Atomic Energy Commission work beginning in 1948 along with a review of my Consulting and Industrial Experience" up to 1974.

This History includes a "McLain Family History" with emphasis on my knowledge of it. This History thus supplements the "Experiencies" report in that it covers the History of the McLain and the Robert Denman Families to the extent that Winifred and I can recollect and readily find data. It is personal in nature and is being written for use of the Family only. Winifred suggested that we include some details of how our Parents and we lived when we were young. Then our friend, Irene Backus, suggested that we include as many details as possible about how our parents and we lived in our early lives.

It should be noted that there was considerable intermarriage between the various Families who were related to the McLains. This has caused confusion in writing as many details overlap and there are unanswered questions about the various relationships. I haven't checked any official records as it would take years to do so. I can only hope that other members of thevarious Families referred to will carry the History further. Help has been received from many persons already and I trust additional assistance will be received as it is needed to complete the stories of those related to the McLain Family.

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~~A few years~~ After writing ~~the "Experiencies of Stuart McLain"~~ pages 1 through 710 I started writing some of my other Experiencis. This was done at the suggestion of Douglas McLain. So the two Stories are not in sequence. The first two Volumes were dated January 1975. This is being written in 1978. It covers my the story of my College Education from 1925 until 1933, and my ~~History as a boy, and~~ in Industry that is not covered in the first report.

Combine with page 710 & Judge where as

College Education

I entered the University of Michigan in September 1925. When I graduated from High School in June 1925, I did not know whether I could raise enough money to enter the University in September. I seriously considered a five year course in which I would work half time and go to school half time at the Detroit YMCA. They simply fostered and arranged the program and the courses were given at various points and the students worked half time at various industrial plants.

During the early part of the Summer of 1925, I worked at home helping my Father on the farm. Later I worked at the Gravel Washing Plant south of Tecumseh. As a result, I was able to save enough money along with what my parents could help me to enter the University in September. But I could not pay my tuition for the whole year and had to sign a note for the second semester's tuition.

By about the first of September I was able to go to the Superintendent of Schools in Tecumseh, Mr.Laidlaw, and ask him to send a recommendation to the College of Engineering of the University requesting that I be allowed to enter. Perry Hayden, who lived in Tecumseh and had been a University of Michigan student and worked on the Michigan Daily, had been able to get me a job delivering the Daily. This promised me a job that would pay a good part of the daily expenses for food and a room. Actually for over three years, it paid for my room and about half of my meals. Without this job, I could not have entered the University. He was most helpful. Mr. Laidlaw apparently sent the recommendation and necessary papers to the University very promptly. But I never received notice of Admittance or Refusal. Nevertheless, I went to Ann Arbor prepared to enter the Engineering College. When I got there, I went to the Enginnering Registration Desk and asked if I had been admitted. The Secretary looked in the Card File and pulled out a card that stated that I was admitted with no deficiencies. So, I entered the Engineering College of the University of Michigan as a Chemical Engineering student.

Then, I went to the Michigan Daily Office. Due to Perry Hayton's efforts, I had a job delivering the Paper six days a week for which I got enough to pay my Board but not my room or tuition. I got from $7 to $10 per week which was enough at that time to pay for my meals. I had saved enough to pay tuition but I had

to buy my books, instruments, etc. I had an old set of drawing instruments that Leigh McIain had used. They needed some repair but one of the Drawing Professors stated he could repair them - which he did that evening for $0.50. Apparently, it took him only about five minutes. I had to rely at first on my folks to help with room rent etc, but it was only a few weeks until I had enough work to make all my expenses. A few weeks after school started, I got a job as janitor of an Apartment building which paid me several dollars per week; so I became financially sound except that from time to time I had to borrow or my parents sent me some. Actually, during the First Semester, I saved the tuition for the Second Semester. Nevertheless, my parents kept sending me some each month; so I had all that I really needed.

When it came to Registration, I was asked if I wanted to take Military Training; and I said I did. The Officer on duty was a Captain Bricker whom I knew later at Aberdeen Proving Ground.

So I registered at the University of Michigan College of Engineering in Chemical Engineering to carry some 19 Credit Hours with the prospects of earning most of my living. With the necessity to get up at 0430 each morning and to deliver some 400 Michigan Dailies, things were a bit rough. After I got my route learned, things went well. I had to deliver the papers every morning except Monday. One later Semester I carried 22 Credit hours.

I got a room at the Swenkmeyer home. They had lived in Ridgwey, Michigan. Their son, Merle, was also in the Engineering College and their older son, Carl, was an Architect in Detroit. There was also another student roomer but I have forgotten his name. The Wilsons, who are mentioned several years in the future, lived next door.

It seems that I was very lucky in respect to Instructors the First Semester. I remember a couple of them. For English I, I had a Professor Egly, who was an excellent instructor in respect to theme writing. He was kind enough to use one of my book reviews, Willa Cather's book on the Western Plains - but I have forgotton the name - for an example. It was actually posted on the Bulletin Board for a Semester.

For Drawing I, I had a Professor from MIT on leave from there; his idea of teaching Drawing was to sit on a stool in the center of the room and tell stories about how the work we were doing could be used in design. He had been a heavy artillery design

engineer during World War I; so he spent hours telling us about stresses, design problems, metal failures of Artillery Guns and Gun Carriages, etc. It was an excellent education in materials. This background may have led to some of my quick decisions at Aberdeen Proving Ground during World War II as similar problems came up in both Wars. His Lectures or stories tied in our work with practical applications. He was one of the few MIT people that I have met that I was honored to know - too many are overly conceited.

The Drawing work itself was very easy even though it was time consuming. To me it was a necessity and it is one of the courses that I have used almost daily since. One look at a drawing and I can visualize the article in three dimensions. The techniques are simple but practice is required. Every Engineering student should be required to take at least one Engineering Drawing course to teach him to visualize how things are designed and constructed - even things like automobile engines. It is too bad that Engineering Colleges are removing all the practical aspects of Engineering and leaving only the theoretical work. A balance appears to be desirable.

The Second Semester I had Descriptive Geometry. This course was designed to teach visualization in three dimensions but to me it was a bore. I did only what was required. I think I got a C in the course. But I had an excellent Instructor. The third course in Drawing in my Sophomore Year was a design course and I got an A I think. Anyway I did only what I had to do as I had too many Laboratory Courses.

For Mathematics, or Analytical Geometry I had a young Professor who had a considerable accent, I believe Polish, but he was an excellent teacher. During the second Semester with more Analytical Geometry, I had a man that could talk good English but who was one of the World's worst teachers. I had several of them.

During the Second Semester I had General Chemistry. The Professor that gave the Lectures, I think, was another of the World's worst Lecturers. I think he did not go into the Subject as far as we did in High School and he was most uninteresting to listen to. I think I slept through most of his Lectures. Further the Laboratory work was very uninteresting and elementary. Actually, we went further in Classroom and Laboratory under Mr. Earl McNeil

in High School than we did in the College Course. I believed that my Quiz Instructor knew less Chemistry than I did. I never understood why I had to take the Course.

I also took a Course in Chemical Engineering Materials. Professor Jack Brier gave the Lectures which were interesting. The other courses I have forgotten.

The Summer after my Freshman Year I spent at home. For the first couple of months of vacation I helped my Father on the Farm following the procedures we followed during my High School Years. So I worked on the Farm during June and July and the rest of the Summer I worked at the "Gravel Pit" or the gravel washing plant of the Tecumseh Gravel Company some two miles South of Tecumseh, Michigan. I also bought an automobile which I sold in the Fall when I went back to the University in September.

During the Summer I saved most of the money I needed for tuition and books. Later my parents helped some and they kept sending me some money each month. I still lived at Schwenkmeyers and delivered papers. I did little else except on Saturdays, I worked some at the Arcade Cafeteria as a "Bus Boy" picking up used dishes. The Lady who ran the Cafeteria (her Husband was the Boss and served the roasts) was the cashier and Bus Boy Boss. She would call me whenever they needed extra help. Since she helped me a lot, I always dropped what I was doing and helped out. This was mostly on Saturday evenings after Football Games and Sunday Dinners. This went on through my Junior Year and some in my Senior Year. It was most helpful to me.

The Sophomore Year was noteworthy for the Qualitative and Quantitative Analysis Courses in Chemistry. I also took Physics two Semesters, one Semester in Drawing, Chemical Engineering Materials and one Semester of Stress Analysis, etc. I remember the two Chemistry Professors very well.

Professor Carney lectured in Qualitative Analysis. While the subject would appear to be dry, he gave the most interesting Lectures that I had in the University. He went into the theory of chemical reactions, how the different chemicals acted, their manufacture, and their usefulness. All as background for Qualitative Analysis! As an example, years later at the University of Arkansas,

when I was teaching Chemical Engineering, Professor Lyman Porter, the Analytical Chemistry Professor, became ill just before a class in Qualitative Analysis. Since no one else was available, I was asked by Professor Hale, Head of Chemistry Department, to meet his Class and dismiss it.

But when I met the Class, I asked what they were discussing. I found that I was able to present Professor Carney's Lecture almost in its entirety on that subject. This was a surprize to the students as Professor Porter never went beyond a review of the Laboratory procedures. Later, one of the girls in the Class asked the Department Head why I couldn't give all the lectures. But I give all the credit to Professor Carney. He and the Drawing I Professor were the two most interesting people to me outside of the Chemical Engineering Professors, Baker, Brown, and Brier, that I had in the University. I should also include Professor Colby of Physics in the same interesting group.

The Laboratory work in Qualitative Analysis was tedious and uninteresting. What I learned, I have forgotten. But I probably have remembered the Chart of the Elements as a result of the Course and the Course was of more value than several others that I had in the University.

Professor Willard who lectured in Quantitative Analysis was said to be Internationally known for his Research in Analytical Chemistry, but to me at least, he should have been known Internationally as one of the World's worst lecturers to students. I remember nothing about his classes except they were extremely boring and I slept through most of his lectures. I believe I could have done better myself - I would have at least done some reading and preparation before I faced the Class. He appeared to consider himself above us to the point that it was beneath his dignity to prepare an outline and a lecture before meeting the Class. He did point out some of the errors that we might make in the Laboratory work but he failed completely to tie the Course work into the total picture of the use of Analytical Chemistry in the World's work. His lectures were just the opposite of those of Professor Carney. I got a C in the course. The Laboratory work was extremely tiresome as such great care had to be taken in sample weighing, separations, washings, drying of precipitates, etc. Lecture demonstrations followed by sample Laboratory work by the Students would have been worth while but all the work we had to do was excessive. And yet a full Laboratory Course of various experiments would have been of great value to us.

In Calculus the first semester I had the Department Head whose name I have forgotten. He, too, was a very poor Instructor. Since then, I have had to teach Calculus at times but I believe that I did a better job than my First Semester Instructor. He was just the opposite of my Freshman Mathematics Instructor who made the subject interesting. The second semester Calculus Instructor was excellent.

It is too bad that all students aren't required to rate all their University Instructors and Professors by secret ballot at the end of each Semester. These ratings should be based on what the Instrutors appear to know of the subject; the presentation; notes distributed to the Students; attitudes not only on what they know but what they are able to impart to the students, examinations, etc.

Mathematics is so logical that any fool that understands the subject should be able to teach it well. It may be difficult to make it interesting but at least two of my Professors did so.

I also had a course in stress analyis which was well taught both semesters. The courses were made interesting and useful by presentation of examples and discussion. I also had a full year of Physics. One of the Instructors was poor and one good but the Professor who lectured both semesters was excellent.

The Summer after my Sophomore Year I again worked at home for my Father for several weeks. This helped during hay harvest, wheat cutting, oat cutting, corn cultivating, etc. I also helped my Father and carpenters rebuild a barn for the cattle and storage of grain and hay. I painted part of it but did not finish until Christmas vacation. As I remember it, I did no work at the Gravel Washing Plant.

During the Junior Year I began the Chemical Engineering Processes Courses. Professor George Grainger Brown gave the Lectures in Fuels. The Course covered the theory of combustion, combustion calculations, materials of furnace construction, and a bit of Furnace Design. There was also a Laboratory with the Course which covered Gas Analysis, Heating Values of oil and coal, etc. The work was interesting and Brown was an excellent lecturer. The course led to my working in the field and presenting the same course several times. The problems and Laboratory were easy and interesting.

I had another course in Stress Analysis of which I remember nothing. It was quite simple, but well taught.

The Chemistry Courses were two Semesters of Organic Chemcistry and one Semester of Physical Chemistry. The Physical Chemistry Course was taught by the worst instructor that I ever had the pleasure of knowing. So much for him. But the course was important and I have had to study it since.

The Organic Chemistry Course ran for two Semesters. The Lecturer was Professor Moses Gomberg. While he was Internationally known, he talked in a monotone - nevertheless he was extremely interesting. He went into the Chemistry of the various groups of Organic Compounds, mentioned their relationships, the history of their discovery, their uses, etc. I believe that I could have taught Organic Chemistry the next year - at least I could have repeated most of what he had presented. The Laboratory work was boring and I think not at all well planned for Chemical Engineers as the Professional Chemistry Students tobk the same course but even for them the Course should have had a better designed Laboratory course. I believe that the Medical Students were not taking the long course in Organic Chemistry and yet they of all people should understand the extremely complex Chemistry of the human body more than any other group or profession. Funny decisions are made by University Faculties! Why Doctors of Medicine need to know less Organic Chemistry than Chemical Engineers has always been a mystery to me.

The stress analysis and similar courses were interesting but I have forgotten them. I have also forgotten what we did in Military Training.

During the Junior Year I took the basic Courses in Chemical Engineering Unit Operations such as Fluid Flow, Heat Transfer, Distillation, etc. These Courses were taught by Professor Baker. He was not a dynamic lecturer but he did go into details and make the courses interesting. I have taught these courses several times and I was able, I think, to make them more interesting than Baker did.

By the middle of the Junior Year I was making some money in work for the University and was so busy that I gave up my Paper Route. I also began to run behind financially and had to borrow money to stay in the University.

During the Second Semester of the Junior Year the University had received a Contract from the Michigan Gas Association to carry our tests on use of bituminous coal from different sources - coal from different mines varies considerably in composition and in coking properties and in the way it acts during use in the manufacture of Water Gas. The University hired Professor Elmer Pettyjohn to be the Director of the Project. He hired David Fox, Chalmers Kirkbride, and me as part time assistants. Both Fox and Kirkbride were Fraternity Brothers of mine as we were members of Alpha Chi Sigma, the National Chemical Fraternity. Pettyjohn and Fox had both worked for the Peoples Gas Company in Chicago on Water Gas Plants; so Kirkbride and I were the novices; but both of us had had University Courses in Gas Technology.

The "tests" as finally run consisted of the collection of operating data such as temperatures, gas flow rates, various samples, and other data for twelve hours of running time on a Water Gas Plant at Port Huron, Michigan, using different coals. Block coal in carload lots of carefully graded sizes, 3 x 4 inch only, I believe, was obtained from different mines in Kentucky, Virginia, etc. The tests for twelve hours continuous operation were run using only that coal as fuel. The Plant was fueled with the test fuel for at least twelve hours before the tests were run.

The following procedures were followed in making the tests., Samples of the coal were taken while the car load quantities of coal used in a test were being unloaded; the coal would be used for twelve hours before the tests; a 12 hour test or "run" would be made during which detailed test data on temperatures, gas analyses, gas production, etc would be taken; and calculations would be made on the efficiency of the operation. An elaborate system of continuous analysis of the various gas flows through the Plant was used. All tests followed the same procedures and operating procedures were as nearly as possible the same. After all the data were available Pettyjohn would make a series of calculations to indicate the optimum coal for Water Gas Production.

Since Fox owned a car, he would take Kirkbride and me and we would drive to Port Huron on Friday afternoon. Since I had a class, I would get out at 3:30 and we would arrive at Port Huron about 1800. After dinner we would go to the Plant and set equipment up for the tests and get back to the StClair Inn, where we stayed, at about 2200. Pettyjohn stayed there also.

The manufacture of coal gas and of coke-oven gas has been described in the preceding chapter.

Water Gas [4]

Water gas is made by passing steam into a bed of incandescent coke; the temperature of such a fire is 1400° C. (2552° F.). Between the temperatures of 1400° and 1000° C. (1832° F.), the reaction $H_2O + C = CO + H_2$ takes place. As it proceeds, there is a fall in the temperature of the fire; the incoming steam must be heated. The reaction itself is endothermic, and heat is lost by radiation. With coke at a temperature below 1000° C., the steam reacts to form carbon dioxide, which is not desired, for carbon dioxide has no calorific value.

$$2H_2O + C = CO_2 + 2H_2.$$

Hence the steam is stopped before the low temperature is reached, and the fire is brought back to its normal high temperature, 1400° C., by an air blast. Coke is consumed during the blast period, so that it could not be expected that all of it would be represented by carbon monoxide. Usually, between 50 and 60 per cent is transformed into the lower oxide; the rest burns to carbon dioxide which escapes through a stack. There always are a few colder spots present, so that the second reaction takes place to some extent.

For many purposes, water gas is used as such; for sale in municipalities, it is usually enriched with oil gas, produced in a separate vessel forming part of the system. The gas-making period lasts 4 minutes; the air-blast or revivifying period, 2 minutes; the complete cycle is therefore 6 minutes. In order to fully use the hottest coke, the steam period is divided in two, and the steam sent in from below for one half, from above during the other half. Simultaneously with the change of direction of the steam, one of two gas valves open, so that the gas formed is led off in either case through a wide flue to the oil-gas vessel. After the steam has been on 3 minutes, the apparatus is purged for 1 minute, and then only is the air blast turned on. The operations and their duration are then: 1½ minutes for "up-steam," 1½ minutes for "down-steam", 1 minute for purge, and 2 minutes for air blast.

The complete generating apparatus consists of 3 vessels; the generator, the carburator, and the superheater. All are steel vessels, cylindrical, of somewhat differing heights and diameters, as indicated in the accompanying figure (Fig. 99); the generator is 10 feet in diameter and 15 feet high. The coke fire is in the generator; the coke charge is shoveled in through an opening in its top, level with the working floor. The steam for the up-blow enters below the fire through a perforated circular distributor; the gas made passes out through the upper valve in the 42-inch flue to the carburator. For the down-blow, the steam enters above, and the gas passes out through the lower valve which lies in the

[4] Also called blue gas, because it burns with a blue flame.

same vertical plane as the upper; a flue leads the gas to the upper horizontal flue, so that this gas enters the carburator in the same place as the up-blow gas. The valves are slot valves, and being exactly in one plane, are operated by one rod; the three-way steam cock is connected with levers to this rod, so that a single motion (small compressed air cylinder) makes all the changes simultaneously. The generator and flues are brick-lined.

The carburator is filled with a checkerwork of bricks; during the air blast, the products of combustion stream through and raise its heat. During the steam period, the made gas, at high heat itself, enters near

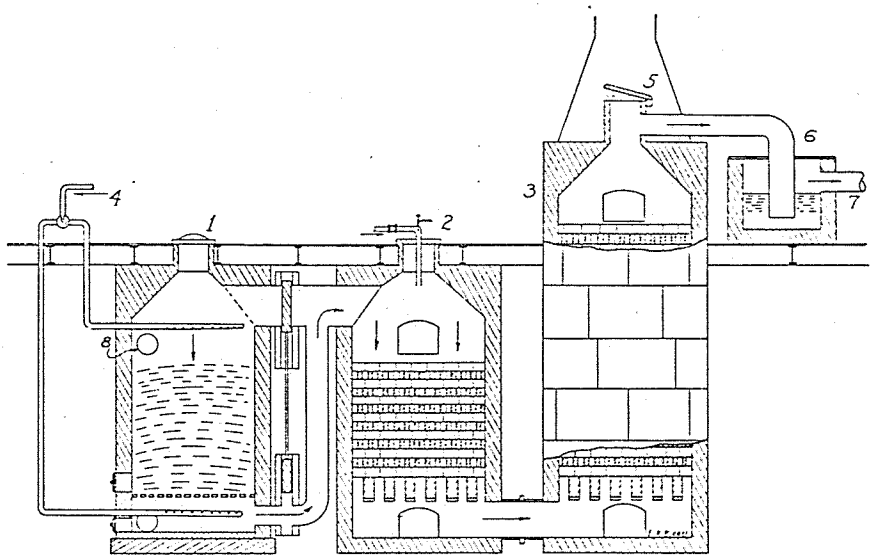


Figure 99.—Cross-section through a water-gas plant. 1, generator; 2, carburator; 3, superheater; 4, steam inlet set for down-blow; the path of the gases is shown by arrows; valve 5 being closed, they pass through water box 6 to conduit 7 which leads to the purifying apparatus. 8 is the inlet for the blast during the revivifying period.

the top and passes downward, while an atomizer delivers oil at the top of the carburator. The current of gas carries the mist of oil against the hot checkerwork; the greater part is reduced to molecular fragments which at normal temperature form gases; at the same time, a certain amount of tar is produced. From the base of the carburator the gases pass to the superheater, in which they stream upward, to be delivered to the flue leading to the purifying apparatus. The superheater is also filled with bricks, and provides space and heat to carry the oil-cracking and the thorough mixing of the gases as far as possible. The path of the gases is indicated in the general illustration.

The three minutes of steam blow are followed by one minute of purge, during which steam enters at the top of the carburator and sweeps

out the good gas which remains in the carburator and in the superheater. At the end of four minutes, the blast is turned on, to bring the fire back to incandescence; the products of combustion, after passing through generator and superheater, escape through a stack just above the latter, through a valve in the flue leading to the purifying apparatus. Each time the valve opens, the waste gas catches fire with an explosion-like noise. Safety of operation is insured by interlocking devices, which permit the opening and closing of the several valves only in the proper order.

For the generator of the dimensions given, coke of the egg size is introduced in 820-pound lots; the production is about at the rate of 1000 cubic feet of straight water gas to each 40 pounds of coke consumed (total). To enrich this gas, varying amounts of fuel oil or special gas-oil fraction are used, for instance 3½ gallons per 1000 cubic feet of water gas; in the set described, this would require 20 gallons per cycle. The temperature in the carburator lies between 1200 and 1300° F. (650° and 704° C.), and is measured by means of pyrometers.[5]

In an oil-gas plant, a generator and superheater are used, and the heat is furnished by an oil burner; otherwise the operation is similar to the one just described.

The Purification of Carburetted Water Gas. The flue leading away from the superheater dips in the water of the wash-box, where the small amount of tar is deposited; the gas then passes to the cooler, a nest of pipes laid in running water. From here it is pulled by exhausters and pushed into the purifying boxes containing the same lime-iron oxide coated shavings which are used for coke-oven gas.[6] From the purifying boxes, the gas passes to the holders, ready for delivery. Metering and testing are performed by the continuous, recording Thomas meter and Thomas calorimeter already described (Chapter 14).

A water-gas plant is compact; it may be started at short notice, and when shut down for a given period is readily maintained in good condition. When part of a system supplying municipalities, it is usually shut down in the summer months, when the demand is light enough to be supplied by coke-oven gas or coal gas; it is placed in operation in the winter months.

Producer Gas

The modern producer is a steel vessel of moderate size, as for example 10 feet in diameter and 12 feet in height, brick lined, in which any low-grade fuel may be partly burned, while steam in addition to air is sent into the fire. The operation is continuous; the fuel (for instance, low-grade coal) is dropped into the producer at a constant rate. A mixture of air and steam is served all the time. The made gas passes out continuously, and the ashes are removed constantly by a sweeper in

[5] Chapter 46.

[6] For "liquid purification" *see* previous chapter.

the water seal at the base. Such a producer is shown in Figure 100; it carries a water-cooled, rotating arm which levels the charge and prevents the formation of holes. The shell is stationary. The reactions are essentially the same as those which take place in a water-gas plant, but in producer gas, there is contained all the nitrogen entering with the air for combustion, hence its total combustible constituents are low, and its heat value per unit volume also. Numerous forms of producers are on the market; in some of these, the shell rotates.

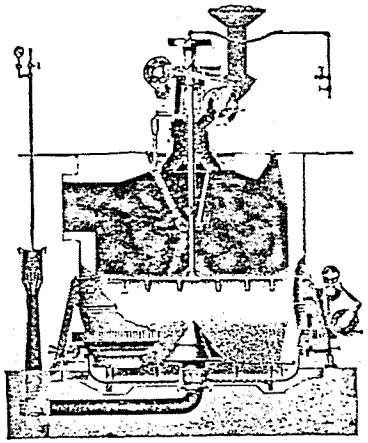


Figure 100.—The Chapman Gas Producer with stationary shell. (Courtesy of the Cooper-Bessemer Corporation, Mt. Vernon, Ohio.)

The capacity of a producer 10 feet in diameter and 12 feet high with automatic operation, is 3000 to 4000 pounds of coal per hour. The air-steam mixture is forced in by means of the steam which is applied to an air injector (see illustration); the composition of this mixture is approximately 7 volumes air and 1 of steam. The amount of steam used per pound of coal gasified lies between 0.3 and 0.5 pound, sometimes a little lower, 0.25; the amount depends upon the clinkering properties of the coal used. The volume of gas varies with the grade of coal. The following figures will serve as guides: 1 pound of bituminous coal yields 60 cubic feet; semi-bituminous. 30 cubic feet, and lignite, 28 cubic feet.

Natural Gas

Natural gas is found in regions which also have coal or oil, although the wells may be many miles away. Many gas wells do not yield oil, but an oil well almost always produces gas and oil: the gas is then known as casinghead gas. The gas from wells which yield no oil is usually rich in methane and contains some ethane and higher hydrocarbons; its composition remains fairly steady over long periods. The gas obtained with oil (petroleum) is at first methane essentially, but gradually becomes richer in the higher hydrocarbons, and poorer in methane; such gas when

On Saturdays we would get up early, at 0430, and be at the Plant so we could start the 12 hour test at 0600. After the test at 1800 we would go back to the St.Clair Inn for dinner and the evening. On Sunday morning we would go back to the Plant and run the necessary analyses, straighten up our equipment, and after dinner at the Inn, drive back to Ann Arbor. Some fun! But it paid well and I learned many things, one of which was "How not to do it!"

At first I was a novice in Water Gas Technology but I soon learned enough that I lost faith in Pettyjohn as did Fox and Kirkbride. Fox was a much better Engineer. But Pettyjohn was a "Jolly good Fellow" and we got along in fine shape. He went out of his way to be good to me. Mrs. Pettyjohn was an angel.

A "Water Gas Plant" is a complex piece of equipment as shown on the following pages which were taken from, "Industrial Chemistry," E. R. Riegel, Reinhold, 1937, pages 268-270.

The Port Huron Water Gas Plant consisted of two water gas generators, a gas purification system, a gas holder, etc. It was located directly across the road from the Port Huron Power Plant of the Detroit Edison Company about three miles South of Port Huron. Steam for the Gas Plant was furnished by the Power Plant. The Plant was new and in excellent condition. I believe it was one of the last Manufactured Gas Plants built by Semet-Solvay Company.

During my Junior and Senior years at Ann Arbor we made about 20 trips to Port Huron for the tests. We always stayed at the St. Clair Inn in St. Clair. This was on the St. Clair River about six miles south of the Plant.

During the Summer between my Junior and Senior Years, I had to take a six weeks Military Active Duty tour as a part of my Military work leading to a Commission in Ordnance. So I had to go to Aberdeen Proving Ground for six weeks. During my Freshman and Sophomore and Junior Years I had taken Military Training in Ordnance. Captain Bricker was the Officer that I had the most contact with. He was a good Instructor but he lacked imagination and a sence of humor.

There were two other University of Michigan students ordered to Aberdeen at the same time. One was Mortenson and one was Ravenscroft. I remember Mortenson as on the Health examination, he was asked if he had any broken bones at any time. He surprized the

Medic when he replied, "Broke my neck once." He had recovered but, when you watched closely, you could see that he moved his neck slowly. Ravenscroft was from Chicago and had enough money to have a new car; so we drove to Aberdeen together. He was also a Fraternity brother and we were good friends.

Anyway we drove to Aberdeen together.

The experience at Aberdeen was of interest as there were about 40 of us in the group. We were all Engineers between the Junior and Senior Years. I think that most of us were from Massachusetts Institute of Technology, Cornell, and Michigan. We were all Engineers between the Junior and Senior Years and I think all Chemical or Mechanical Engineers. We were housed in two old barracks and ate at a regular mess hall. There were three Regular Army Officers, one from each University including Captain Bricker from Michigan. I was in the Company captained by the Officer from Cornell with whom I got along in fine shape. I liked him better than I did Captain Bricker.

The "Training" consisted of up at 0630, 15 minutes of exercise from 0715 to 0730, breakfast, classes from 0900 to 1200, lunch, and classes from 1300 to 1500 with a Formation at 1800 followed by dinner. The exercise, like all exercise, was a necessary bore. Food was excellent. The classes were taught by Aberdeen people and were mostly a bore as they were too elementary for us. Nonetheless, by asking questions, and reading all the Texts, we did get quite a bit out of the work. The Instructors on the whole were knowledgeable but had no idea how to make a boring subject interesting. They were mainly Aberdeen Civilian Employees. By dint of reading all the books and information that I could get, I obtained a really good idea of Ordnance design, manufacturing, and maintenance problems. I didn't realize that I would have to direct Development Development Firing Tests on all types of Ordnance and approve the recommended changes in design which I subsequently did in World War II.

Two Officers asked me to their homes for visits. Later, I thought that we lived in each of the two homes that I visited.

We had "Student Officers" under the three Regular Army Officers. So, I ended up Captain of one of the Companies for a week as we changed officers each week. Ravenscroft was my Sergeant. And as usual under such circumstances, I got razzed.

One of the most enjoyable parts of the training was that from 1500 to 1800 we were off duty. Most of this time was spent as far as I was conserned in swimming. There were a number of Officers children and some members of a Family from just off the Post and several of us that went swimming every afternoon. One of the girls that was only 12 I think was the best swimmer. One of the students was a Life Guard examiner; so several took life saving tests.

One of the most interesting things about the whole training was the opportunity to visit the Museum of Ordnance. The Museum covered about five acres. Most of the equipment was from World War I. There was also a whole series of "dumps" in which World War I weapons and ammunition had just been stored in the open by stacking on boards laid on the ground. The guns were recognizable but the ammunition was in bad shape. Some of this ammunition entered into my work in World War II.

Nevertheless, most of the American, German, and French weapons were available for inspection. Actually, some of the French weapons were fired by us or for us in Demonstrations. We received excellent instruction in some things but not in recoil mechanisms as these were only described to us. Much later at Rock Island Arsenal I learned quite a bit about Recoil Mechanisms.

After the duty at Aberdeen I returned home and worked at the Gravel Washing Plant. Then, at the end of September I returned to the University as a Senior.

My Senior Year was quite enjoyable as I was an Assistant in the Fuels Laboratory. So I had an University Office; a key to the Chemical Engineering Building; and most important I did a lot of Fuel Analyses for Professor George Grainger Brown. He was doing considerable consulting and thus obtained many samples of fuels for "referee" or third party testing that were referred to the University. These he sublet to me at good rates andadded 20% or so for overhead and I suppose doubled the rates.

Professor Brier taught the course in Chemical Engineering Organic Processes. This was a descriptive course of organic chemical plants and operations. It was a very well taught course with no particular engineering. I suspect that Brier could not have included much beyond what was in the texts.

I have forgotten my other courses.

At the beginning of my Senior Year I accidentally met Winifred Denman on an Ypsilanti-Ann Arbor bus. We had known each other from High School days. As a result of this meeting, we began to go together. She had returned to Ann Arbor as a Student Nurse.

In June 1929 I received a Bachelor of Science Degree in Chemical Engineering.

During the Summer of 1929 I worked at Pontiac, Michigan, for Consumers Power Company in the Gas Works. I reported to Pontiac the day I graduated. When waiting for my bus to go to Detroit from Ann Arbor, I watched the Graduation Parade which included Winifred and Helen Wilson. Helen was one of the Wilson Girls that lived next to the Schwenkmeyers where I had been living all four years; so I knew Helen well. Carl Schwenkmeyer had been going with Helen's sister Kathryn and later married her. Helen and Winifred were very close friends and still visit and correspond with one another.

I took a bus to Detroit and an Interurban Car to Pontiac. When I got to Pontiac, I reported to the Gas Plant. After introductionsetc. the Chemist and Bookkeeper took me in charge to get me a room. They looked in the "Room for Rent" ads and spotted a likely area. So we drove to the house listed and I rented the room. I spent the rest of the day getting settled. The room was very small but clean. Immediately the People that owned the house "adopted me." I usually got up late after the man of the house had left for work. So I had breakfast with the Landlady and sometimes we danced for a half hour or so to phonograph music. The room was about a half mile from the Gas Plant so it was easy to walk to work.

On reporting to the Gas Plant the next day, the Superintendent, Mr. Klyce, stated he wanted me to learn to operate the Water Gas Machines. I knew the Plants well both in theory and design due to my work at Port Huron, but I had never been an operator. So he took me to the Water Gas Plant and turned me over to the Operator. It was arranged that I should work the regular day shift five days a week as a start. So far so good.

The following pages from E. R. Riegel, "Industrial Chemistry," Reinhold 1937, describe the Plant. Then my description follows:—

The Plant was similar to the Port Huron Plant. It consisted of three firebrick lined steel tanks about 12 feet diameter. The first one,

about 20 feet high, lined with fire brick, had a hearth about 4 feet from the bottom, and an inverted cone top with a cover about 4 feet diameter that could be opened by releasing the locks and rolling to one side on tracks. The bottom of this cover was level with the brick operating floor. The grate at the bottom provided space for ash removal, inlet pipes for air and steam, and it was provided with doors for some ash removal. The top could be opened with little difficulty and coal dumped in every few hours by an overhead carrier at about two tons at a time. The ash was removed by doors above the grate.

Air was forced in at the bottom for two minutes, the coal pile about eight feet deep was heated to a white heat, the air was cut off, and steam was blown in for 3.0 minutes, and the 5 minute cycle repeated.

There were pipes with hydraulic driven valves for the air, steam, and a brick lined pipe without a valve to a second chamber similar to the first one except it was filled with firebrick in a checkerbrick fashion with about half the space filled in each layer with brick or about two inches apart. The hot gases from the first tank or Generator passed to the second tank through a brick lined pipe. Thus the hot gases from the Generator heated the checker brick to a red heat. Some air or secondary air was mixed with the gases from the generator during the heating period and these burned in the second chamber or Carburetor.

From the carburetor the gases passed at the bottom through a short pipe to the third brick lined chamber or Superheater. Actually this third chamber was about double the height of the other two chambers or about 30 feet. It was closed with a hydraulic lift cover which opened to a stack on top of the Plant. A smaller pipe fed air to the bottom of the Superheater for "tertiary" combustion of any gases left unburned in the carbureter.

The hot gases and the burning of some of these gases heated the carburettor and superheater checkerbrick to a white heat. The heating took place for two minutes to give the 5 minute cycle. Then the stack was closed and steam was blown into the generator and reacted with the carbon in the coal to form hydrogen and carbon monoxide and a little carbon dioxide. This hot gas with a heating value of about 300 BTU per cubic foot at 60 degrees F were mixed with the gas released in coking the coal and decomposing the oil to give a gas of about 535 British Thermal Units or BTU per cubic foot which is

about ths same as that of gas formed in coke ovens. In fact there were coke ovens at the Pontiac Plant and the gas from the two plants was mixed, cleaned, and sent out through the City gas distribution system to the City's homes, primarily for cooking at that time.

The various valves were operated automatically by hydraulic pistons (4-inch dia) which in turn were operated by an automatic machine which changed the valves in a set cycle every five minutes. When desired the automatic machine could be turned off and the valves operated by hand levers on the machine.

There were a number of temperature and pressure gauges for the Operators' use. Also the color of the stack gases and the noise of the machines told the Operator what was going on. Due to my work at Port Huron and in the University I understood what was going on in theory and somewhat in practice.

The Plant was in operation for three shifts. Ash removal and maintenance work took place in the day time on my shift mainly.

When I reported to work, I was told that I would be working on the Water Gas Plant as the Operator's helper. The Operator turned out to be about 55 years old. He had been an Operator for years. The helper whom I releaved was a negro of near retirement age.

The first day I just watched. Then, I began to take an active part in Operations. By the end of the first week I was operating with no difficulty. The Operator had had some 30 to 35 years experience. He knew how to run the Plant but he had no idea what was taking place in the Machines or Generators or what was meant by the Water Gas Reaction. This is

$$C + H_2O = CO + H_2$$

or carbon from the coal plus steam or water produces carbon monoxide and hydrogen. The products are both poisonous and a fire hazard or explosive. Heat is absorbed in the reaction. The heating value of the gas is about 300 BTU/ft^3.

There was a night operator and others from the maintenance crew who were experienced operators and who operated over the weekend and who worked on maintenance to make up their 40 hours per week.

So the second Monday at 8 AM, the night operator turned the Plant over to me. Things went fine at first. There were two generators in operation, both on automatic operation. The work was to watch and when necssary make adjustments. No detailed operating records were kept and this bothered me. Only overall daily oil, coal, and steam along with production records were kept.

During operations each hour or so each machine would be shut down and the top plate or cover removed and about two tons of coal would be charged or dumped into the generator from an overhead storage bin. The charging machine was a "truck" or electrially driven car that ran on rails and held the two tons of coal. This would be filled during operations by filling from the overhead storage bin. The bin in turn was filled with coal by an elaborate series of conveyers and elevators from an outside railroad switch or coal dump.

Each "charge" was carried out by shutting the machine down, removing the charging door over the generator, moving the electrially driven charging car over the generator, and charging two tons of coal. This whole operation took about four minutes and was repeated about each hour.

Also during each day each Generator was shut down for about an hour for ash removal. There was a rotating "work crew" of four men that did this and other jobs around the Plant. Each day at 0900 to 1000 this crew would show up. At the end of the "cycle" of the Generator or at the start of the air blow, the machine would be shut down for the ash removal operation.

As soon as the Machine had been shutdown the four "doors" on the side of the machine just above the grate would be opened by the four men on the work crew, the ash would be removed by simply pulling it out by long handled shovels and letting it drop on the floor. It would then be sprayed with water to cool it, and after the cleaning was done, the ash would be shoveled into wheelbarrels and dumped outside for sale as "land fill" material.

The removal of this ash from the Gererator was hot, dusty, and very hard work. Long handled shovels and bars were used. Usually it took the four men about one half hour to clean the ash from a Generator.

The reason for presenting the above detailed procedure was that sometimes the six or eitht feet of red-white hot coal above the ash and which was partially coked and which normally arched over the ash was not well coked or for some reason would drop down on the ash as fast as it was removed. In this case it was ordinarily left until the next day even though this resulted in inefficient operation. Of course it was possible to remove the ash with a couple of tons of red hot coal. This could be done with long handled tools used by the men. But the Plant was down for an extra hour or so. And it was very hot and heavy dusty work.

The "work crew" consisted of four men that I'll never forget, a Mexican who was a very good worker but who understood no English, so everything had to be shown to him, a Polock who could understand English when he wished to do so, and two negroes one of which was a continuous talker usually razing the others and giving advice freely to everyone but both negroes were good workers.

So the first day that I was alone on the job and just a week over the day I started to work at the Plant, the Polock had "Bad Luck." The hot coal above the opening that he was working at fell down and he could not remove the ash. This happened when I was on the opposite side of the Machine. I believed that he dropped the coal down by removing a little ash and dropping the coal down by jabbing it with his long shovel. But I said nothing except to close the door and clean up what ash he had removed. The other three men did their work well.

But the next day I stayed directly behind him. When he got part of the ash out, he deliberately poked the partially coked coal over the ash, again dropping it down over the ash. He turned to me andsaid, "No can get ash out. Coal fall down." I told him to pull the hot burning coal out and quench it. "No can do." "Go ahead and do it." So he started very slowly to work. A few minutes later the other three men had completed their jobs which I inspected and approved. Then they came around to the Polack and started to help him. I stopped them by saying, "No, he wants to do it." One of the negros again started to help him and I repeated my statement. All three men were looking intently at me. They recognized what the Polock had done.

Then one of the negroes broke into loud laughter, slapped his leg, pointed at the Polock, jumped around in glee, and kept up a steady stream of advice for the Polack. Even the Mexican smiled.

I then suggested to the Polock that the Machine was down, time was expensive, and he had better work fast. He did so while the others stood around and continued to give him loud and vociferous advice. By the end of the hour the Plant Foreman and two or three repairmen had come in to see if anything was wrong. And each one had a good laugh and additional advice for the Polock. He appeared to appreciate the advice. That was the only time the coal "fell down" and caused any trouble that whole Summer. Nor did I ever have any further trouble with the work crew. The incident did cause an extra hour of down time.

So the Summer passed quickly. After the first couple of weeks, I knew the work, the crews were cooperative, and the men that I relieved and who relieved me had become friends. So things went well. There were two other things of interest.

In Mid August one of the two machines, when it went on the air blow portion of its cycle, did not sound right. I listened for a few minutes until I believed that I had located the trouble. Air was blown into the bottom of the Generator to heat the coal by combustion. The hot gas from the generator next passed to the Carburetor and secondary air mixed with it to burn the combustible gases and the gases passed to the Superheater where more air was charged as mentioned above. This third stream of air was small and a 12 inch pipe was used.

After listening for a few moments I believed that there was something wrong with the valve in this teriary air line which resulted in the slight change in sound. The stack gas had a slightly different color. So I shut the machine down and called the Head of the Maintenance Crew. He came up to the operating floor with a couple of Mechanics and Pipe fitters. The Head Mechanic disputed my belief in the broken valve. He knew the machine and had worked there for years. The valve appeared to work perfectly in that the valve stem seemed to be okay. Then the Plant Superintendent, Mr. Klyce, who had been a Water Gas Operator at one time showed up. All disputed me and claimed there was nothing wrong. But I insisted. Actually I was afraid of an explosion in the stack that might cause damage or even knock it down. It was about 15 feet tall and probably weighed a ton or so. Finally I stated that I knew something was wrong at the valve as the sound was different. I stated that I believed that it was not safe to operate and so I had shut the machine down. Then it was agreed to take the valve apart. It was a gate valve and one of the gates had become detached due to a broken lug.

But had the Superintendent told me to start the Plant, I was prepared to walk off the floor or in plain English quit as I believed that an explosion could occur.

But from that time on the Superintendent took the attitude that I could do no wrong. He knew that, if an explosion had occured, the Machine would have been shut down for weeks for repairs. And where the gas for distribution would have come from would have been a real problem for him and Consumers Power.

One other accident occurred during the first Summer near the time that I was to leave. One Machine acted up, so I shut it down. I believed that water was getting into the ash pit. So after a few minutes, I opened the ash pit door. It was filled with water near the boiling point. It flushed out and I jumped away but some splashed over the top of one shoe. The burn was bad enough that some skin came off with the sock. The Doctor dressed it and I returned to work the next day.

A word about clothing may be of interest. Due to the heat my work cloths consisted of heavy winter wool underwear, wool socks, coveralls, high shoes, a broad brimmed hat, and long sleeved leather gloes. Normally goggles are used but since I wore glasses, I normally omitted the goggles.

After signing off from the Pontiac Gas Works in September, I went by train to Helmer, Indiana to spend some time with Winifred Denman and her Family. She met the train in Wolcottville. We spent two days, I believe, at her home and around Helmer. Then her folks took us back to Ann Arbor. Winnie was in Nursing Training at the University Hospital and living in a Dormatory near the Hospital. I was still living at the Schwenkmeyers.

Graduate School

I entered the Graduate School with six hours of Advanced Credit. I held the Michigan Gas Association Fellowship during my work for the Masters Degree. This met that I was to do some Research for the Gas Industry and presumably continue in the Gas Industry after I left the University. Actually, I took a heavy course load for my Masters Degree. I had a private office. I did some work on comparison of Water Gas Plant Tars and wrote a reprt on them but the amount of work that I did for the Gas Association was relatively small due to my heavy class load. We did continue the work at Port Huron but only for a few weekends.

The Courses that I took included two Courses in Advanced Chemical Engineering Calculations. These were quite simple. I do not remember much about other courses.

The Summer after receiving my Masters Degree I returned to Pontiac to the Gas Plant for work. When I arrived, Mr. Klyce immediately informed me that the lady across the "Court" on which he lived had a room for rent. He took me there at once and I rented the room. The people were the Kings with whom I became long time friends and later their daughter, Margaret, who was a Dietitian at the Ford Hospital and Winnie became good friends. We visited each and forth until Winnie and I moved to Arkansas. Andrew King had been in business with the Fisher Brothers who started General Motors. But he left them when they started to do that as it would have been necessary for him to have worked every evening for several years. He had been a shop Superintendent in an Automobile Factory. At the time that I lived with them, he was Superintendent of the non teaching staff of the Pontiac Schools. We became good friends immediately and they treated me as a member of the Family from the first day there. I had my meals at a home a couple of doors down the Court.

Frequently that Summer the Klyces called on me as a fourth in bridge as Mrs. Klyce's sister lived near and they liked to play bridge.

The work at the Gas Plant was interesting. I was assigned as a Mechanic and relief man. As a Mechanic meant that I did pipe fitting most of the Summer. The Plumber with whom I worked would make a measurement, walk to the Shop, cut a piece of pipe, return, install the single piece, go to the Shop for the next fitting, install it, measure the next piece of pipe, etc. When I began working with him, I began "laying out the job" or making a sketch with measurements of the entire particular job under way, go to the Shop, cut all pieces of pipe, assemble the pipe and fittings as complete as possible, and only do the final assembling on the job. He never could understand how this could be done.

Also I relieved as Operator on the Water Gas Plant when needed. This took most of August as I relieved the two Operators during their vacations.

The Office help consisted of a male clerk and a stenographer. So when the clerk went on vacation, I relieved him. This required doing the necessary calculations and preparing the Daily production reports for the Plant. When Klyce went on vacation, I took over his office and duties that couldn't be put off. In fact I did

every job in the Plant except run the "pusher" on the coke over Plant and the Secretary's job in the Office. I did run the coal charger on the Coke Oven Plant for a day; but the pusher requires a lot of experience as an over push can break the ceramic brick walls and cause a very extended down time. I took many coal samples including unloading cars at Midnight etc.

To take a "coal sample" is a bit of a complex operation. You select at random during unloading each car about two tons of coal. This is mixed by shovelling over several times; the pile of coal is flattened and quartered by dividing into quarter sections and rejecting two of the opposite quarters; the coal is reduced in size by running through a grinder; mixed and quartered; ground to a smaller size; mixed and quartered; etc until you have a half pint or so of 100mesh screen size. Of course the grinding beyond a quart of coal is done in the Laboratory.

In September I went to Helmer, my folks came down, and Winnie and I were married. Our wedding trip consisted of a train trip back to Ann Arbor and getting settled to go to work. The next Fall we took a long trip which we called our "wedding trip." We have had many long trips since then.

Since the "Great Depression" started in the Fall of 1929, business was still very poor and there were very few jobs. So I entered the Graduate School to work toward the Doctors Degree in Chemical Engineering. This consisted of one Year's work for classes in Physics, Chemical Engineering, and Mathematics and one year working on a Thesis.

Winifred had graduated as a Nurse. So she worked as a Registered Nurse. I had a Teaching Assistantship in Fuels.

We lived in a flat that had adequate but not really good furniture. The second year we lived in an Apartment in the same Apartment Building that I had been a Janitor in as a Freshman. Here we had a three room well furnished Apartment.

My work towards the Doctor's Degree, like Gaul, consisted of three parts: Teaching Assistantship in Fuels, Course Work, and Thesis. These are discussed below.

As a part ot the Teaching Assistantship I had an Office in the Chemical Engineering Building, an Assistant in the Fuels Laboratory to help me in setting up the Fuels Experiments, maintenance, of equipment, assistance in classes, etc. I had been the Assistant when I was a Senior.

The Fuels Laboratory consisted of a large Laboratory with Desks and equipment for running coal analyses including heating values, petroleum analyses except distillation, gas analyses, etc.

I was also responsible for general planning, supplies, etc for the Laboratory. Each session began with a half hour of lecture which I presented. This was supposed to include background information in the particular fuel, the methods of analysis, etc. I also had to review and grade the Reports turned in by the Students.

Actually the work was quite simple but it was time consuming. We had about 30 Chemical Engineering students each Semester. These were divided into two sections which met one afternoon each week. In addition the Mechanical Engineers used the Laboratory for one afternoon each week but I did not give lectures to them, or grade their reports.

I do not remember much about the Courses that I had to take for the Masters Degree. One course was taught by one of the Older Chemical Engineering Professors, Professor Badger. He had a National reputation but he was a very poor lecturer. The second course was taught by Professor Baker who was an excellent teacher and lecturer. It was on Distillation, etc.

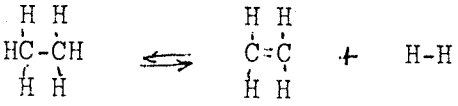
For the Doctors Degree work I had one year of course work and supposedly one year doing the Thesis. The Courses that I remember best were Physics and Mathematics. The Physics Courses were of particulat interest. Professor Colby taught the first course which dealt with gases, etc. He was an excellent Lecturer and presented a very interesting series of talks on all aspects of gases. The Second Course was taught by Professor Barker. It dealt with the Physics of Solids.

I also had a course in the Mathematical Theory of Heat Transfer. This was taught by Professor Churchill. He was very interesting. Actually he spent most of the time of three hours per week just lecturing and demonstrating the work on the Board. Since there were only two of us in the Course, it was quite informal and we interrupted when we didn't understand and could discuss the work at any time. It was a most difficult course and I spent six to eight hours preparing for each session.

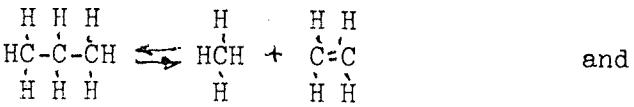
There was also a course on the Physics of Solids. The fissioning of heavy metals had not been discovered. We studied crystals, etc. This was presented by Professor Barker who was not an excellent

Lecturer. But this course helped me when I got into the Nuclear Field in 1948.

During the second year I worked on my Thesis. The subject was sort of suggested as I had been working for the Michigan Gas Association. It was on the Pyrolysis of Propane. The work was intended to show some of the reactions that take place in oil cracking in a Water Gas Plant. I ran propane through a quartz tube at various temperatures and then analyzed the gases the best I could by distilling at slightly above liquid air temperatures. Because of instabilities of the furnace due to different electrical loads in the Building, all runs in the quartz tube or "cracking furnace" (a tube about 2 cm diameter and 110 cm long) had to be made between 0200 and 0430. I did the best I could with analyees of the gases formed by distillation from liquid air cooled liquids. I did not get what I considered excellent results as there was always traces of liquids and tars formed which were too small to analyze. But the



equilibrium established by others was always checked by my analyses. So I considered this a satisfactory check on my work. The main equations were



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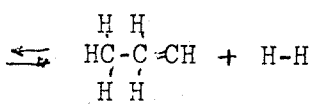


must have been in agreement.

Anyway Professor Alfred White, the Department Head, praised my work and the University gave me the Degree. Since then improved methods of analysis of gases using physical means has permitted very rapid and more accurate analyses than distillation which required about twelve hours per sample.

David Fox, who was mentioned above, worked on the catalytic effects of some metals in petroleum cracking. After nearly a year's work, he got his equipment and conditions down pat and got all his experimental work done in one weekend.

Employment at U.S. Rubber Products, Inc

When I completed my work for the Doctor's Degree in December 1932, I tried to get a job. But there were no jobs available due to the socalled great depression. Actually, I had completed my Thesis in mid December 1932 or near the bottom the Depression. No Company was hiring anyone. I applied to several Oil Companies by letter as this was my preferred work. I received a number of polite but negative answers. Only one was interested. It was a small Oil Company in Louisiana. However, no definite offer was made. Possibly had I not accepted the postion at US Rubber Products, this Company would have hired me and Winnie and I would have had quite a different life. So goes one's chances!

But in March 1933, almost at the worst part of the Depression, a letter came in to the Chemical Engineering Department from the United States Rubber Products in Detroit. This was referred to me. So I went to Detroit for an interview and was offered a job at a very low salary. But I accepted the job.

So Winnie signed off her duty as a Special Nurse at the University Hospital, we loaded our Worldly goods in our old Studebaker, and drove to Detroit. There we rented an Apartment at $30 per month near enough the U.S. Rubber Company for me to walk to work and even home for lunch.

The Apartment was a socalled three room affair with the living room looking on the Alley. The building was on Field Street just south of Kerchaval and one block East of East Grand Boulevard. Thus, we were about 3/4 mile from the Belle Isle Bridge at the edge of the fancy part of Detroit or Indian Village. The Rubber Plant was located on the East side of Jefferson Avenue a block south of the Belle Isle Bridge.

After one year Winnie bought furniture and we moved to an upper flat at 1008 Baldwin Avenue. This was, I think, two blocks east of East Grand Boulevard and just off Lafayette Street and about three blocks north of East Jefferson Avenue. We had a rather comfortable five room upper flat.

Winnie did the buying. This was interesting because in February 1934 very few people were buying furniture. While we were living in the Apartment, we bought a filing cabinet. In looking for this Winnie had shopped around and purchased a cabinet on West Jefferson Avenue just off Woodward Avenue.

When I reported to work, I found that I was to operate a machine designed to measure the stresses in Automobile tire fabrics by measuring the changes in the stresses on the bottom of the groves in the tire tread. Admittedly this was an experimental program. The grooves are essential to release the water during rains and prevent "floating" which can occur at surprizingly low speeds on water covered pavements, particularly asphalts. When floating occurs, the driver loses direction and speed control.

The equipment consisted of a plate glass mounted so that different loads could be put on a tire by a complicated machine and the movement of the rubber at the bottom of the groves in the tread could be measured through the glass plate. This was done by coating the bottom of the groove with black paint and placing on this paint a mark of white paint. The movements of the white paint could then be measured by a measuring microscope. All very simple except that the white mark was not flat or perpendicular to the microscope and accurate measurements were impossible.

After a few weeks of work I had come to the conclusion that we could not tell much about what was happening to the fabric but that we could tell quite a bit about what was happening in the treads. Nevertheless, for a total of a couple of months, we continued to try to work something out.

Actually, I was supposed to be working for Dr. Bull who worked for Mr. Sloman. Dr. Buckmaster (?) was a fabric man and he also worked for Mr. Sloman. Both Dr. Bull and Dr. Buckmaster were helpful but Sloman always thought he knew more about tires than anyone else; so he never showed up in the Laboratory.

In a couple of months I was getting discouraged with my lack of progress due to the equipment and, I realized afterwards, with the lack of dialogue with people who understood what I was trying to do. Actually, I don't think anyone did. But one day just at quitting time the representative of the Los Angeles Plant, which was a part of US Rubber, showed up. He had been in a few times and gave me encouragement and advice. I have forgotten his name.

Anyway, the Los Angeles representative was always friendly. He asked how things were going and I told him that I couldn't figure out how measuring the movement of the tread or surface rubber would tell us what was going on in the fabric. There were then four layers of Sea Island or high strength cotton fabric around the tire laid at 45 degrees to the center of the tread in alternate

layers at 45° to the center line with two partial layers under the tread. He then asked if I learned anything. I think I surprized him when I answered that I had learned how not to make a tire. He immediately became very interested. No one else had seemed to care what I had done or learned.

I then demonstrated that the movement of the tire on the road under loads resulted in alternate high compressive forces and high tensile forces at the bottoms of the grooves. This, apparently, was new to him. I then explained that the bottoms of the grooves should be very carefully filletted to reduce the strains at the surface that resulted in cracking or failure of the rubber tread. He then asked me to make a drawing which I did. He then stated that he would send my freehand drawing to Los Angeles and have tires made and tested. I do not know whether or not he told anyone else at Detroit; but I always thought that he did not.

Anyway, almost weekly this man came in just at quitting time to talk to me for a half hour or so. Together, we discussed how tire treads should be designed.

After about four months total, I was transferred to the Tire Test Branch and the stress work was stopped. I never wrote a report on what I did. But the Los Angeles tests had demonstrated how to make treads that would not crack and "their ideas" were adopted by Detroit.

I then worked for four months on Indoor Tire Testing. The tests consisted of running all sizes of tires against electric motor driven wheels 24 hours a day in an air conditioned room. The wheels were about 10 feet in diameter. The tires were mounted on truck wheels and "loaded" by weights which gave usually very high overloads. The wheels were driven at 30 or 45 miles per hour surface speed. Higher speeds caused overheating compared with road contacts and air cooling due to vehicle movement.

Usually tire failure would occur in a few days. Special wheels with bars to simulate road roughness were also used.

After a few months I was told that I had been transferred to the Eighth Floor. The Offices were also on the eighth and ninth floors; so I jumped over production from the basement to the offices as the production was on the first to seveneth floors. When I reported to the Eighth Floor I found that I had a desk next to Mr McVaugh, Head of the Tire Test Division. He had two Asisstants and there were two Secretaries.

My duties were the writing of all the Formal Reports of the Tire Test Division. One of the girls kept the detailed milage records of Road Tests etc on individual cards. These cards gave mileages, loads, any data on speeds, and general conditions of the roads. The second girl was a secretary assigned to McVaugh and me but she mainly helped me. So I began full time writing and analyzing data. I had not taken Report Writing in College as I disliked writing. But after writing many reports - something over 2000 - four books and editing many hundreds of reports, I am still writing. With my present experience I could have analyzed the tire testing that I did and come to valid conclusions in a few days.

The writing job quickly reduced to routine. The girls would get the cards covering individual tires on a given test in order with all the data such as mileage, wear, failures, etc. I would look these over and tabulate any data possible, study the purpose of the tests, analyze all the data, and write a report about the work and results. McVaugh would look over some of the Reports before they were sent out; but usually we had talked enough about any given test during the running of the tests that we were all more or less familiar with the particular tests and the results. Also I frequently discussed some of the tests with the Test Engineers for whom the work was being done.

It should be emphasized that the Tire Test Branch wrote the Reports and the Test Engineers did not. Before I got into the show the various tire test Engineers wrote the reports in simple reports which listed the test data without comment. The Test Engineers wrote their own reports. So the Reports issued had been covering only details about the tests, special results such as bad road conditions etc. such as how the tests were made. No Conclusions or Recommendations were included by the Tire Test Division. But as soon as I started writing the Reports I added Conclusions and Recommendations as I saw them. This caused considerable argument as the Test Engineers did not always agree with my statements. The Engineers claimed that they were the only people who knew all the circumstances and we should state only the results or data obtained. So I was not always admired by the Test Engineer for what I said but the Director of the Development Division insisted that I continue writing Conclusions and Recommendations.

Some of the tests may be of interest. The series of tire tests for radical changes in design were quite extensive as all people remembered many ideas that did not work out well. The various tests were:

a. Laboratory Tests

The Company had extensive Laboratories for development of new fabrics and various rubber compositions including synthetic rubbers. I never had a part in these tests as long as I was in the Tire Test Division. Actually, the composition of the various rubber stocks was very carefully guarded secrets and only a few people knew the complete story of what was going into the tires.

b. Indoor Wheel Tests

When a new rubber stock or fabric or a new method of manufacture was ready for tire tests, a group of tires would be made up for tests. This was done in a special Department. Some of these were sent to the Tire Test Division for test on the Indoor Wheels. Each tire had a serial number and a card on which all data about the tires were recorded. At the end of the tests in the Wheel Division or on Road Tests etc these cards would be sent to us. We would analyze the data and tabulate the results and prepare a summary or short Report of the Tests. Frequently, we had to go back to get more details etc.

c. Road Tests on Company Vehicles

We had one truck, loaded with paper I believe, that was on the road most every day and sometimes for more than one shift. It was used for testing tires usually under heavy overload conditions. So there were two or three drivers who drove nearly eight hours per day and covered over 1000 miles per day on a set run which included various road conditions.

There were also several stock cars or regular production automobiles usually Fords which were operated in the same way using special automobile tires. On a three shift basis these cars were also operated over 1000 miles per day.

As a result a set of tires could be worn out in a few weeks or months.

d. Road Tests Using Various Fleets

These road tests using taxis, buses, and trucks were most important to us. Many tires would be placed on regular vehicles and checked periodically. Failed tires would be returned sometimes to us for our examination as well as the data on the tests.

Actually, very large numbers of tires were under test at all times. Two men in our office were kept busy handling the details of these tests. Again, I had very little to do with the tests until I got the cards for the individual tires. Usually as the tests progressed one of the girls would make up Summary Sheets.

Some of the Fleet Tests were interesting. For example several Bus Companies such as the Burlington Transportation Company used our tires. These contracts were of interest as we could have a large number of tires on test with high milage rates. The Burlington ran our tires at very high daily rates of 1000 miles or so. Since these tires were sold on a mileage basis, it was necessary for the tires to run over 60,000 miles to pay out. At that time that was a very high mileage.

e. Surveys

Occasionally the Company would make tread wear surveys. For example, a number of Test Engineers would go out on a warm Sunday all day and check the tires on new Ford cars. This was done at busy intersections in Detroit.

When a car stopped for a traffic light, one or four men would place depth gages on one or all four tires for wear readings. At the same time a fifth man would take the Driver's attention by offering him a cigar or a bar of candy at the same time explaining what was taking place. Occasionally a driver would object but by that time the light would have changed, our men had the data, the drivers behind the car were honking their horns, and our men had disappeared in the traffic. While explaining what was happening, the cigar man would glance at the speedometer thus getting the mileage for the car. But most people understood and were very cooperative and thanked our people for the cigar or candy.

So we were able to get wear data on Goodyear, Goodrich, and Firestone tires in comparison with the US Rubber tires. Other makes of tires were not checked.

These data were sent to us for analysis and a report. One year the whole rubber tire industry was greatly upset by Goodyear Rubber Company. They advertized a very much longer lasting regular automobile tire. The advertizements made great claims for tire life and our road tests of their tires confirmed their claims. But as a Chemical Engineer I was quite skeptical and I never have been

known not to air my skepticism and did then. But the road tests on our vehicles had confirmed the Goodyear claims.

So when we got the data on Monday morning, I immediately calculated the averages for the four kinds of tires and these confirmed conclusively the lower tread wear for the Goodyear tires and the expected much longer life of the tires. But having had a course in graphical methods and being skeptical, I plotted all the data for the four Companies' tires. As noted above experience had demonstrated that rate of wear on new tires is much faster than on partially worn tires possibly due to the side motion of the ribs on the new tires. But when I plotted the data, the Goodyear tires showed very low rates of wear up to about 10,000 miles at which point the wear rates became very rapid and the tires overall life expectancy was only about half of the tires' life for the other makes. Actually soon after our Survey, Goodyear suddenly stopped advertizing the new tires. I believe that all unsold tires were removed from the Dealers' stocks.

Most of the tests were quite routine and improvements in the tires were small but steady. The use of rayon in place of cotton cord was the first significant change in tire life. Changes became rapid after I left the Rubber Company. Finally, the use of synthetic rubber in place of natural rubber resulted in great increases in tire life. In fact now it probably should not be called a Rubber Industry except that we talk about synthetic rubber.

During the year or so that I worked in report writing I did get into several arguments with the Test Engineers who wanted me to support general ideas of theirs and disagreed sometimes with my Recommendations. But the Head of the Development Division always said he wanted our opinions.

Later I transferred to a Development Laboratory being set up to develop improved tire cord. However, I only helped in setting up the Laboratory as soon thereafter, I left to go to the University of Detroit.

One thing of interest was that the equipment Company that made Tire Test equipment had come out with a new type of cord strength tester. Instead of a vertical weight, this new one had a constant weight on a track and the track was built so that it tipped at a constant rate of change of angle and not of load.

It was sold to us on the basis of constant increase in load rate. Not only did it have the wrong basic design but on delivery it was found that the weight was not that as specified but rather the manufacturer apparently had made up a specified weight and then put on wheels and axles, recording pens, etc. It was about 1.5 lb over its claimed weight. Also there was a great deal of friction. So I had troubles. But the troubles were the kind that were not expected; so corellation with other data caused time loss at first. So we were able to do little real work before I left.

We also had a new type of cord fatigue equipment built. I left before we got many tests done; but it did seem to work well.

But about one month after I transferred to the cord development job, I was offered a position at the University of Detroit as Assistant Professor of Chemical Engineering; so I left the Tire Company and we moved across the City, see page 707.

One item, the purchase of our furniture should be discussed further. When we dicided to move from the apartment into a flat we had to buy furniture, see page 736. Winnie went back to the Furniture Shop on West Jefferson Avenue where she had purchased the filing cabinet and purchased the furniture for the flat on Baldwin Avenue in Detroit.

Winnie tells the story as follows: "When I went into the store, the front room was all cluttered up with desks and there was no one in sight. I almost left as it looked so deserted. In a moment a very well dressed lady came in from the back room. When I asked about filing cabinets, she asked me to go into a back room with her. The room was filled with various types of filing cabinets." After buying the cabinet, which we are still using in the office, at about half price of what Hudson's Department Store would have charged, Winnie asked about other things. She was told that they would get anything we needed. As a result, when we moved to the Flat on Baldwin Avenue, Winnie bought almost all the furniture that we now have through them. For example, we wanted a longer davenport than standard which they ordered from the Alsbruch Furniture Company for us. We still are using it even though it has been recovered two or three times. The bedroom set was made by the Grand Rapids Furniture Company from oak and we are still using it. The dining room set was ordered for us. Also a couple of years later when we moved to the west side of Detroit, they sent their truck to move us at no profit and only the labor cost.

We also bought a couple of living room chairs from them. One of the chairs had a big oil spot on the seat. I cleaned it with a pint of gasoline - the chair which we are still using was sold to us for $19.

This furniture has been moved at least as follows: Baldwin Avenue to Prairie in Detroit; to Fayetteville; to Aberdeen to storage; to Havre de Grace; to Aberdeen Proving Ground and there to a second house; to Arkansas; to Detroit; to Oak Ridge; to Downers Grove; to Naperville; to Bethesda; to Downers Grove; and to Lafayette, and used for 43 years.

Teaching Experience

I have had considerable teaching experience. But I have become confused on dates. I do remmeber most of the places in proper sequence and a little about what I taught. These are discussed vevy briefly below.

A. University of Michigan; 1930-1932.

I have mentioned my Teaching Assistant ship at the University of Michigan, see pages 733-734. The work, as noted previously, consisted of a discussion of Fuels Testing and supervision of the Fuels Laboratory.

B. University of Detroit, 1936-1938.

The work at the University of Detroit consisted of presenting Lectures, Quizzes, and some supervision of Laboratory Work in Organic Technical Processes, Thermodynamics, etc. Professor Charles Duncombe was Department Head and Fater Shiple, was Head o the Chemistry Department. Dr. Henderson and Dr. Eichenger, both of the Chemistry Department, and their wives became very close friends of Winnie and me. We had many evenings of the six of us - frequently Father Shiple was included.

C. University of Arkansas, 1938-1941

At the University of Arkansas I was the only Instructor in the Department of Chemical Engineering. We had only 9 or 10 students in each Class. I taught Chemical Engineering Operations, the Laboratory such as it was, Organic Processes, and Thermodynamics.

We became friends with the Steinbachs and Dyers of the Chemistry Department and Dean and Mrs. Stocker and the Head of the Mechanical Engineering Department, whose name I have forgotten. We still correspond with Dr. steinbach and Mrs. Dyer.

D. U.S. Army, 1941-1945

During the World War II at Aberdeen Proving Ground I gave many Lectures on various subjects. These were never organized into regular series of Lectures but covered many subjects.

E. Wayne State University, 1946-1948

After World War II I was Head of the Department of Chemical Engineering at Wayne State for two years. This was a difficult position as each of the three men teaching Chemical Engineering when I was hired thought he should have been made the Head of the Department. Professor Selheimer resigned. I had known him at the University

of Michigan as he was an older man than I was. The others were very uncooperative.

I taught the same courses that I had at the University of Detroit. I also gave the Lectures in Materials in the general course that all the Engineers had to take. One of these was my nephew, Howard A. McLain.

As this was just after World War II we had many ex-soldiers. One class which was taught by Mary Worsham was interesting in that she had large quiz sections of ex-soldiers - all men years older than she was. But she was an excellent instructor and they soon forgot that she was feminie.

F. University of Tennessee, 1948-1949

After leaving Wayne State University I went to Oak Ridge National Laboratory. There the University of Tennessee immediately appointed me Professor of Nuclear Engineering - of which I knew practically nothing. In November 1948 I organized a two day information meeting for industry on Nuclear Energy to be held at the University in Knoxville. Otherwise, I did nothing but when I resigned from Oak Ridge, the President of the University sent me a very kind letter thanking me for all the wonderful things that I had done for the University!

G. Argonne National Laboratory, 1949-1958

Sometime in the early 1950's I suggested to Dr. Norman Hilberry that Argonne was not doing enough to educate their "own" people. This led to my presenting Classified Lectures at 0830-0930 every Monday morning during the regular School Year to Argonne Employees for four years. The attendance varied. Some lectures would be presented to perhaps 100 or more and the next lecture would be less than 50 amd sometimes less than a dozen. But this was fine with me as I believed that only those interested should show up.

These Lectures were subsequently issued in Classified and later declassified versions. Copies were literally sent all over the World. I have had to autograph copies in Spain, Germany, and India. I believe that those lectures had more to do with development of Nuclear Technology than many of the other textbooks. I presented the design of the Engineering features of Power Plants. Apparently, they were considered as more autoratative than the Textbooks which had been issued by others.

In 1955, I think it was, President Eisenhower introduced the Atoms for Peace Program. As a result Argonne organized the International

School for Nuclear Science and Engineering. This included Lectures and Laboratory work. I organized the work and Kenneth Winkleblack was appointed to give the Lectures. But Ken resigned about that time to go to Atomics International. So, one working day plus a weekend, I was told that I had to give the Lectures.

So I moved from my large office with the beautiful furniture into a small den and presented the Lectures.

One thing of interestis that Winnie and I had the students out to the house for Dinner in two groups of 25 each. The Secretaries helped Winnie and she served a sort of goup. To many of the Foreign Students, this was the highlight of the trip to America as they got to see a home. One man claimed that he took over fifty pictures - mostly of Winnie in the kitchen.

There were two students from each of several Countries including Spain. One of these was Jodra. There were two from several Countries including Japan. The Japanese students were very quiet and reserved. I could not get any response at first from them. At about the middle of the Course, they came into my Office one day and asked if they could talk to me. What had happened was that they had been warned before they left Japan that the course would be a hoax and a trap. So they had looked for misstatements, misfacts, etc. At the end of the four weeks they had concluded that we had been telling them the truth. From then on, they were very friendly. When they reached home, they sent Winnie several yards of beautiful cloth for a present. One was the Chairman of the Japanese Atomic Energy Commission the last I knew of them. When Winnie and I were in Japan, I wanted to call them and go see them but Winnie was afraid that the others in our group would know about it and would be jealous or something.

Later I suggested that Argonne do more for the Universities. So we organized a Summer Institute of six weeks lectures and Laboratory work based on that of the International School. I think that about 50 University Professors attented. These included Professor Valmar Bergdolt and Professor Robert Eaton of Purdue University. I presented the Lectures. We also had an extensive Laboratory and Demonstration Program. Then Purdue continued the same type of course to University Professors for the next three Summers. I gave the Lectures even though we still lived in Downers Grove. Then we moved to Lafayette where I spent about half time at Purdue University before retirement.

Early McLain History

My Aunts and Uncles had a very small book which presented the History of the Scottish Covenanters. I read this book when I was about fifteen; but I do not remember much about what was said. The Encyclopedia Britannica, 1950 Volume 6 page 615, presents a brief History of the Covenanters. But there is nothing expecially related to the Families or seemingly to our History. We have no indication that any of our Ancesters took part in the Covenanter's affairs or rebellions except that all of our Scottish Ancesters became Presbyterians and they chose to leave or were driven out of Scotland.

Winifred, Raynor, and Neal McLain were responsible for collecting information and genealogy data; no records or old letters have been checked. In fact we do not believe many records other than the Official Records of Marriages, Births, and Deaths, exist. Thus, only brief sketches of the various Families can be presented. The older dates and names should be taken as of questionable accuracy.

The various Families apparently followed the "Classical Migration" of the Scotch-Irish from Scotland to Northern Ireland, New England, Western New York, and Southern Michigan. As noted we do not know where any of the Families lived in Scotland. Apparently, about 1660 the move to Ireland from Scotland occurred. Whether the Family or Families moved to unoccupied land or drove the local people out is unknown. But the Elliotts, according to my Mother, lived in County Antrim. This is located Northeast of Lough Neagh in Northern Ireland. Our Encyclopedia Brittanica, 1950 page 611 of volume 12, states in part:

"The Anglo-Irish were the top of the social ladder. They comprized the landlords, the official classes, the bishops, and the clergy of the Protestant State Church, the few large farmers, and the retinue of the aristocratic establishment. The Scoto-Irish were the business men and farmers of the north-east corner. With few exceptions, the Irish Catholics were the peasants and labourers of the country."

All the Elliotts and McLains were Protestants and presumably Presbyterians when they moved to Vermont or it would have been talked about. Apparently, they were mostly farmers or blacksmiths.

Some of my Mother's people, either Elliotts or McLaughlins, settled on a farm near Brandon, Vermont. Later some of the Elliotts moved to near Leicester (then called Moscow), New York.

Also some of the Elliotts moved about that time to Tecumseh, Michigan. Some of the Jacks moved to near Conesus Lake, New York. The dates of these moves are unknown.

The Denman Family, apparently, was originally Danish as the name Denman is a shortened form of Danemen. Nothing is known of the Denman Family until nearly Civil War times. Only a little is known of Winifred's Mother's Family or the Copelands.

The Elliotts in Tecumseh, Michigan, were blacksmiths. As noted above they were distant cousins. Their ancesters came from the same County in Ireland as my Mother's Ancesters; but I do not know the exact relationship..

My Mother's Father and my Uncles on the McLain side of the Families sometimes told stories about the traditions and life in Ireland but I do not remember any of these stories.

We have no information or exact dates of the migration to Vermont or any details of their farm, housing, or what they did except apparently all were farmers. Winnie and I and my parents and Aunt Jenny Elliott-McMann visited Brandon once. We looked up the cemetery and located the graves. The gravestones were in poor shape.

There were relatives by the names of Boyd and Jack who lived in and near Geneseo, New York, when I was young. How they were all related and how they were related to the McLains, I do not know. The Elliotts and Chalmers were also related.

My Father's sister, Jane McLain, married her first cousin, Albert Jack, who lived East of Geneseo, New York, see Chart 2. Their son, Elmer, was my only first cousin. My Father's other Brothers and Sisters, Fulton, George, Ella, and Mary never married. They continued to live most of their lives on the Homestead some two miles southeast of Tecumseh, Michigan. Mary died in 1921 when I was 16. About 1930, Fulton, George and Ella moved to a home in Tecumseh.

My Mother's sister, Jenny Elliott, married James McMann. He had two daughters by a previous marriage: Eva and Bertha or "Bee" as she was called. Both were married and lived in or near Leicester, New York.

May Elliott married John DeMeyer, see Chart 10. He was of Dutch Ancestry but I have no other knowledge of him. They had three daughters Hazel, Margaret, and Marion and one son, Elliott, see Chart 10. Their home was in Kalamazoo, Michigan. It was this Family that we became close to and with whom we visited and continue to visit frequently.

After their marriage my Mother and Father lived on farms very close to his Brothers and Sisters. The first farm was directly across the road from the north portion of my Uncles and Aunts farm, see the Map of the McLains' farm. Later they moved to another farm a short distance East of the Schoolhouse mentioned later. I had three older Brothers, Elliot, Leigh, and Raynor, see Chart 1.

My Mother's Father, Thomas Elliott, had at least two Brothers, see Chart 3. I know nothing about Adam. The other Brother, whose name I have forgotten, kept a rather detailed diary which I read when I was a boy. It is now in the Clemens Library in Ann Arbor, Michigan. The diary covers his attempt to go to California during the Gold rush in 1848. But he got only to Panama as in crossing the Isthmus, he got malaria. After he partially recovered, he returned home. His diary gives an excellent account of his trip and troubles.

Fulton McLain Family, Chart 1

When the first McLains came to the United States is not known. Apparently, Fulton McLain, (- - 1847)(if Fulton is his correct name) came to Michigan and spent some years as a "Fur Trader" in and near Flint, Michigan. I know nothing about him except I have a note that his wife was named Nancy (- - 1832). Apparently, their son, also named Fulton McLain (1828 - 1879), was the first person of whom we have certain records. I do not know where he was born.

We know that Fulton McLain (- - 1847) "took up land" about two miles Southeast (three miles by road) of Tecumseh, Michigan, in 1833. His son, Fulton McLain (1828 - 1879) married Jane Jack (1833 - 1916). I know nothing about their background or education except Jane Jack McLain (1833-1916), my Grandmother, could read and write well. I remember her only where she sat and how she looked.

So the "Story" that I can tell starts with the McLain Family "taking up land" about two miles Southeast of Tecumseh, Michigan. Apparently, the farm of 160 acres or so was purchased from the Government in 1833.

Originally the farm consisted of about 100 acres of "upland" and about 60 acres of "river bottoms." Later an adjoining plot also of about 160 acres was purchased. About one half of this was upland and one half creek and river bottoms. Also at about this same time some 60 acres or so of the original upland farm was sold to a Boyd Family. I believe these "Boyds" were related to the McLains but I have no idea how. A small area in the Southeast corner was "donated" as a Public Cemetery and a portion near the house was, I believe, "donated" as a School Area. The Cemetery is now a part of the Holloway Cemetery for legal purposes.

Thus the Farm as I knew it consisted of about 120 acres of upland and 140 acres of creek and river bottoms or a total of 260 acres. Some 20 acres of this land was of intermediate level and was farmed. Much of the low land was subject to flooding by the creek or river. Some of the lowland was swampland. The road along the East side is now the Tecumseh-Holloway Road.

When "taken up" the land was apparently all heavily forested. The area was in the mixed maple-oak deciduous woods area but it contained a great many different kinds of trees - probably near 50, including those on the River Bottoms and Uplands.

The farm generally sloped from the Southeast to the Northwest toward the river and creek bottoms. So the first homes, those of both the McLains and Boyds, were built in the Southeast well back from the future road on high ground. There was a small pond about 100 feet across which apparently was used as a source of water until a cabin was built and a well dug. By the time I was a boy the road had been built across or through the pond by filling in a roadway through it.

We can only surmise today what difficulties these socalled "Pioneers" met. The first problems were of course water, food, and shelter in that order; so a pond or a stream was an essential - at least in the neighborhood. I believe this was why the first Pioneers always settled near a river or a creek. Game for food was probably less of a problem at first than water as the water had to be carried from the source daily. Surface ponds or streams that did not dry up annually were essential. Game for food was plentiful and men like to shoot game or their fellowmen.

We can only assume that a portion of the trees were cut and used to build leantos and later log cabins and log barns. From what I was told and observed on Islands the forests were composed primarily of very large and old trees including many oaks with quite open ground due to the thick leaf cover of the mature trees. Of course there were trees of many kinds and ages mixed in the forest. I remember oak and maple trees four feet diameter but these were uncommon. I helped saw up a curly maple over a foot in diameter which would be quite valuable today.

No vestiges of the first buildings on the McLain farm were left when I was young but I do have a faint memory of being told that the first log cabin was located in what was then the apple orchard. However, the Boyd log cabin mentioned later was still standing and in use as a store house and the Boyd cabin in New York was still in use as a home when I visited it. The Michigan log cabin was two stories while that in New York was a one story.

So my description below may not be very accurate. As mentioned leantos were probably used for the first Summer. Leantos could be built in a few days and would give some protection against wind and rain.

Log Cabin Construction

The following description was based on what I remember of the two log cabins mentioned and what I was told. It may differ in some details from reality.

The construction of log structures for use as houses or barns was very hard work. As an example the steps necessary for a cabin 14 ft by 24 ft inside dimensions are:

a. Select a well drained area reasonably close to a source of year round water such as a pond, creek, or river. Remember, that the women must have water not only for drinking but also for cooking, dish washing, etc. So far as I now American women in the Midwest did not wash clothes in surface ponds or streams. The Indian women probably did so as do the Spanish and Mexican women, at least up to a few years ago. This means that several buckets of water had to be carried daily. Also the wooden buckets used then were very heavy when waterlogged.

b. Dig a trench about 36 inches deep (in Michigan) or to below frost depth. Fill the trench with to a few inches above ground level with large field stones or small boulders for the foundation. This was not always done but only a few large stones were used simply laid on the ground. The foundation walls should be built under the inner cross wall because of the necessary cut for the door. The floors were built up a foot or so from the ground.

c. Cut 12 trees that have trunks 12 to 14 inches diameter. Cut logs from these trees that are straight for a length of 28 feet. After hauling to the cabin site by oxen (dragged on the groung), remove the bark on two sides and smooth the logs by removal of wood to an even 12 in. diameter ovee their full lengths. The bark was usually left on the rest of the logs. Notches three inches deep were cut top and bottom for the cross logs to lock into the logs for the cross walls at the ends and to make the second room. This was done by sawing into the logs to a depth of three inches on two sides and cutting the wood between the saw cuts out with an axe.

d. Cut 18 logs 19 feet long in a similar manner.

e. I believe that the doors and windows were cut after the walls were assembled and held by boards nailed on the insides of the openings. Care had to be exercised in cutting the various end nothches and in cutting the doors and windows so that the finished building had workable doors, windows, and a fireplane.

f. I believe that the cabin was built up to the top of the doors and windows and these were cut in the logs. After this was done the top logs making up the triangular spaces for the roof ends and between the rooms were placed one at a time as they were fastened in place by the roof boards. The roof was made up from sawed logs or boards and split shingles held in place by nails.

Construction was carried out by rolling the logs up timbers placed as supports. Log chains around the logs and pulled by oxen would raise a heavy log in a few minutes, simply by unrolling the chain as the log rolled up the supports. Otherwise, several men would have been required to roll up the large logs. For "modern" cabins using six inch diameter logs, one man could do the job by lifting one end at a time.

It is assumed that the Pioneers brought tools, nails, and door fittings as well as windows with them. They also must have had log chains as well as a wagon and horses with proper harnesses.

Each log cabin included a fir place and a chimney built of rocks and lime mortar. It is assumed that the mortar was made from lime burned on the spot.

Actually, construction of such a cabin would not have required over about two months time. But meanwhile the settler had to

clear land and plant his first year's crops of corn and oats. Wheat was planted in the Fall.

Living in a leanto for a couple of months in the summer would not have been too bad. Mosquitos and flies would have been bothersome but fish and all kinds of game; some wild vegetables, and all kinds of berries would have been available.

The first beds and chairs were probably brought by the pioneers as were cooking utensils etc. Once the Pioneer Family moved into the cabin, cooking was done in the fireplace and crude beds of boards and untanned furs were available. In some cases dirt floors were used until boards were sawed out and used.

It appears that meat was roasted on spits in the fireplaces and cooled in large iron pots. In all cases gardens must have been started quickly, wild vegatables wer used, and soon there were corn, potatoes, and other vegetables in great abundance.

Hogs, cattle, chickens, and possibly tamed turkeys were brought with the pioneers. Field crops of corn, wheat, and oats were planted. In the winter dried fruits, grains, and lots of game were available. Canning was not used until later. Pumbkins and squash were used and they kept until January.

Corn, wheat, and oats supplemented by grasses furnished food for the stock. Probably only wild grasses were harvested in quantity the first year. Also birds were common. These included wild turkeys, ducks, geese at times, and smaller "game" birds must have been very common. Also beaver, muskrat, and rabbits were used. Passenger pigeons were so common in Michigan that one shot would kill several at their roosts. Fish were very common even in small ponds that did not dry up.

Special mention should be made of the wild plums. They were very plentiful in an area near my Grand Parents home. There were probably some wild apples but most apples came in later but as a child, I at many wild apples. The plums were all gone. We picked and ate many quarts of wild blackberries and wild black raspberries. Wild strawberries were available but they were scattered and not very plentiful.

Then too, in the Fall there were hickory nuts, walnuts, butternuts, and hazelnuts in very large quantities. They harvested these by the bushel.

Fish of several kinds were plentiful and used. I can name only a few of the varieties that we caught in the River when I was young; but these included: common and black suckers, rock and black bass, sunfish, stone rollers, pickerel, shiners, etc.

In reference to nuts we frequently when I was young had about three bushels of hickory nuts, four bushels of walnuts, two bushels of butternuts, and a half bushel of hazelnuts.

The crops raised each year probably included corn, wheat- planted in the Fall, and oats. Hay probably was harvested by cutting wild grasses. The first year only corn and possibly oats would have been planted. But the second year wheat and oats and possibly clover would have been planted but this is surmize on my part. The hogs and cattle would have been turned loose in the woods. This is difficult with the hogs as they tend to wander. Perhaps they were never turned loose. I do not know.

So life the first summer would have been taken up with building a leanto, a cabin, a leanto for the stock, crops, and as soon as possible building a log structure for the horses and cattle and a pen for the hogs. In addition the men had to build the smoke house, start digging a well, and building more log structures for the stock. This helped clear land at the same time. In the winter wood was cut for fuel but this and building the cabins helped to clear the land. Also in the winter, wild animals were hunted, possible hogs and cattle were killed for food, and wood was cut for fuel and logs for the cabin and first log barns.

The potatoes, dried fruits, nuts and corn were thus available in large quantities by the first winter. Since game of all sorts were available, diet must have been excellent and in large quantity without killing any of the cattle. By the second winter hogs and cattle must have been available for use as well as all the grains and wild things mentioned above.

My Uncles' and Aunts' Home

As noted my Uncles, Fulton and George, and my Aunts, Ella and Mary, never married but continued to live until I had finished College on the original farm southeast of Tecumseh, Michigan. The following pages describe the Home and Farm as I knew it as a young boy.

By that time the log cabin had been replaced by a large brick and wood home, the log barn had been replaced by a large well built general storage and cattle barn, a horse barn had been built, and a grain and general storage barn had been built; but there was an older barn which was used for fodder storage and in the summer for grain storage until it was threshed. The upland had been cleared and their manner of living had been changed to that of the high standard then in common throughout the Midwest. The house contained a kitchen about 12 by 15, a dining room about 15 x 15, and various bedrooms plus a large living room or parler which was not usually used as most of the day to day living was in the dining room which was used as a reading room in the evenings.

The older barn mentioned above mentioned above should be described in detail as it represented the type of construction used throughout the Midwest for several decades I believe. The barn had two bays and a driveway between the bays. Each bay or storage area was perhaps 20 x 30 feet and there was about 20 feet between the foundation and the eves of the barn. The center driveway was about 18 x 30 feet. The foundation consisted of large field stones about 3 ft diameter and 2 ft high. These had simply been laid on the ground. They had probably been lying around on top of the ground or partially buried where they had been left by the glacier. They could have been moved on a sledge hauled by oxen. The frame of the barn was simply built on top of these stones.

These old frames were of great interest to me. I never could understand why they were designed as they were but they were built, literally by the thousands all over the Midwest. The main frame members, both vertical and horizontal, were made of the centers of oak trees and were 10 inch by 10 inch. These timbers were hand hewed almost to exact size. But I never could understand why they spent so much effort to hew out the timbers from the logs. The floor supports were cut from smaller trees and simply smoothed on what was to be top or the contact with the floors and the bark was left on the rest. Why they did not simply cut the beams from the trees and work the ends where they fitted together, I don't know. Perhaps the corners beams would have required some smoothing on two sides.

About four feet from all corners of the frames wherever two of the large pieces of the frames came together, cuts were made for the use of braces that were used for rigigity. These braces were cut to exact size and planed so they were extremely smooth like high priced furniture. The ends of the braces were cut so that a tongue was left about four inches long. These fitted into cuts made in the beams both vertical and horizontal. These cuts in the beams and the end cuts on the beams which fitted together like fine furniture were made and smoothed like furniture.

Then holes about 1 1/8 inch diameter were drilled through the joints of the vertical and horizontal joints and two oak pins were driven in to hold the pieces together.

These joints were made with such great care that the carpenters must have had the feeling of people making fine furniture and they were proud of their work.

The assembling of these oak frames must have been a real problem. Actually, it is possible that each section of the finished frame of a house or a barn was assembled; then the cross or tie parts of the frame were laid out for use. Then a "Barn" or "House" raising was announced and all the neighboring farmers were called in and all responded in the free exchange of work. But the beams and the cross pieces must have requited 25 to 30 men to raise the partially assembled frames and fit in the cross frames and the braces for these cross pieces. Each setion of the barn had to be held almost in exact shape before the oak pins could have been driven in.

It is probable that the erection was carried out by the use of several jib poles. One corner post could have raised by the men using two jib poses and block and tackle gear. These would have had two or three pulleys to each block similar to those used on sailing ships with which the men would have been familiar. So it would have been natural to use these on land. With two block and tackle sets, six men could have raised a courner post to the vertical position. Then this could have been held vertical by ropes tied to small stakes driven into the ground some distance from the barn. Then a second side or end post could have been raised and held by stakes. Then a top cross beam could have been raised and placed in position. Then the whole section could have been pulled together by other block and tackles. Once aligned the pins would have been driven in locking the whole section together. By repetition the entire frame would have been assembled. I believe that a 30 by 70 foot barn frame could have been assembled by 25 men in two or three days.

Once the frame of a barn or house was in place the rafters could be placed by two men. These rafters were sqwed but not planed. The roof boards were sawed and the shingles were split, I believe, in the first barns built in the Midwest. By the time I was a boy all the split shingles had been replaced by sawed shingles made of California redwood as this wood did not rot as fast as the Midwest woods. The side boards were white pine one inch thick by 10 to 12 inches wide. The spaces between these boards were covered by strips nailed over the crasks. Even these strip pieces of wood were finished with a circular taper on the sides to give beauty. No wonder the farmers were proud of their barns.

Actually the houses were built with nearly the same types of frames and the same care. Whitewood or tulip was used for some

of the siding and the window sashes and window frames. Workmanship was excellent on the windows and doors and the frames. Men at that time took more pride in their workmanship than they seem to do now. Unions have replaced apprenticeships.

Little attention was given to heat losses in these homes. My Uncles' and Aunts' home, for example, was a brick structure set on stone and mortar walls. It consisted of a basement which could be entered from the outside or inside the house, a frist floor with a kitchen, dining room, living room, and parlar. Upstairs there were, I believe, four bedrooms.

The construction of these houses was something like the following: a basement or cellar was dug; the walls for the foundation to below the cellar depth were built up; these walls were continued to the height of the house foundation walls; and around the outside of the house and for the inner walls. These walls were at least 36 inches below the surface to avoid frost heave and cracking of the walls.

Since the glaciers had rounded the stones as found in the fields, larger stones than required were broken by mauls and the flat broken surfaces used on the inside and outside of the walls to give reasonably uniform surfaces to the walls. Actually, all the masonry was excellent. The mortar, I believe, was made from burned limstone and sand.

The frames of the older houses including those of my Uncles' and ours were made of hand hewn oak logs as previously described for the older barns. These were assembled on the foundations just as the barns were on the large stones. After the frames were up, sawed planks of 2" by 8" or 10", or joists as they were called, were placed on the side walls and support cross pieces of the frame, with the 8" or 10" vertical. The floors were laid on these joists. The floors, in turn, were sawed of 1.5 to 2.0 inch hardwood some 8 inches wide. Then the walls of brick and mortar in the case of my Uncle's home and of oak and whitewood clapboard in the case of our home were built up. The brick of course would be laid by a brick mason who would also build the firsplaces and chimneys. In our house the outside clapboards were made of whitewood. There were, I believe, two fireplaces in my Aunts' and Uncles' home and none in ours.

The roof boards were made from any wood available I think. These were 1" by 2.5". The shingles were made originally I think by splitting ash or maple and later they were replaced by California redwood shingles as the redwood was less subject to rot, apparently due to its higher resin content as compared to ash or maple.

The window and door frames as well as the windows and doors were usually purchased ready for installation but this may not have been possible at first. In the older log cabins these had been made from sawed lumber by the builders. The windows were made with whitewood or tulip frames with small 8 by 10 inch panes in two sashes. The glass panes were apparently made by blowing glass tubes, then cutting the tubes lengthwise, flattening, and cutting. This left the panes slightly different thicknesses, and not completely flat; this left the glass so that slight distortion was the result.

To return to the out buildings, in addition to the older barn, there were newer cattle and horse barns. These were built of heavy timber frames. The pieces of lumber for the frames had been sawed from trees. Otherwise, they were similar to the older barn described above. There was also a newer grainery of two stories. The first floor was used to store grains in large bins, buggy storage, and small tools storage with a workbench. The second floor was used as storage for old and unused stuff. There were also two corncribs and hog pens etc.

Our House

Our house was built sometime before 1900. Its construction was very similar to that of the barn described above. Hewed oak beams with the axe marks on them were used for the frame. The small beams to support the lath and windows were sawed from oak. The rooms were finished on the inside by lath and plaster and the house was finished on the outside with clapboards. These were tapered whitewood about five inches wide. There was no heat insulation. There were sufficient spaces around the doors and windows that the wind whistled through. When I was young, we repaired the house. At that time large pane windows were installed and some of the cracks were filled but no real attempt was made to insulate the house except a paper liner was installed under the outer clapboards as a wind barrier or the west side of the Living Room.

Originally the cellar of about 20 by 30 feet had a dirt floor. The walls were built of stone and mortar. But when I was in High School, we covered the floor with about four inches of concrete. The cellar was equipped with shelves, bins, and barrells for storage of 25 or so bushels of potatoes, 50 gallon crocks of burned clay with smooth surfaces for salted meat, 20 gallon crocks for use for storage of cooked ham in grease which kept for months, etc., plus storage for several barrels of apples, and 300 or so quart and two quart cans of fruit and vegetables.

The first floor of the house consisted of a parlor about 16 x 20 feet; twp bedrooms on the first floor and three bedrooms upstairs; a dining room; a kitchen; a storeroom with an upstairs; and a "woodshed" on the rear. The cellar was under the front part of the house. Actually I believe that the house had been assembled from two older houses.

The house was reasonably comfortable except in very cold weather or very hot weather. There were of course no thermostats and heat regulation, such as there was, was by adjustment of the stove dampers or air inlets and pipes to the chimneys, opening doors, etc. Heating of the house was furnished by the "kitchen stove" or "range" and by a wood fired stove in the dining room. When I was about 10, my parents bought a "hard coal burner" which had isinglass windows through which you could watch the hard coal burning. This isinglass was not a glass but thin sheets of mica or mineral silicates. It was set up in the Parlor in November and used with a continuous fire until April at which time it was removed to a back room for storage.

There was an upright wood or coal stove in the dining room. This was also removed to the back room for storage from the middle of May until mid September. The kitchen range furnished heat for the kitchen and for the dining room on cool summer days. The kitchen range also heated water in a "reservoir" at one end that held perhaps 10 gallons.

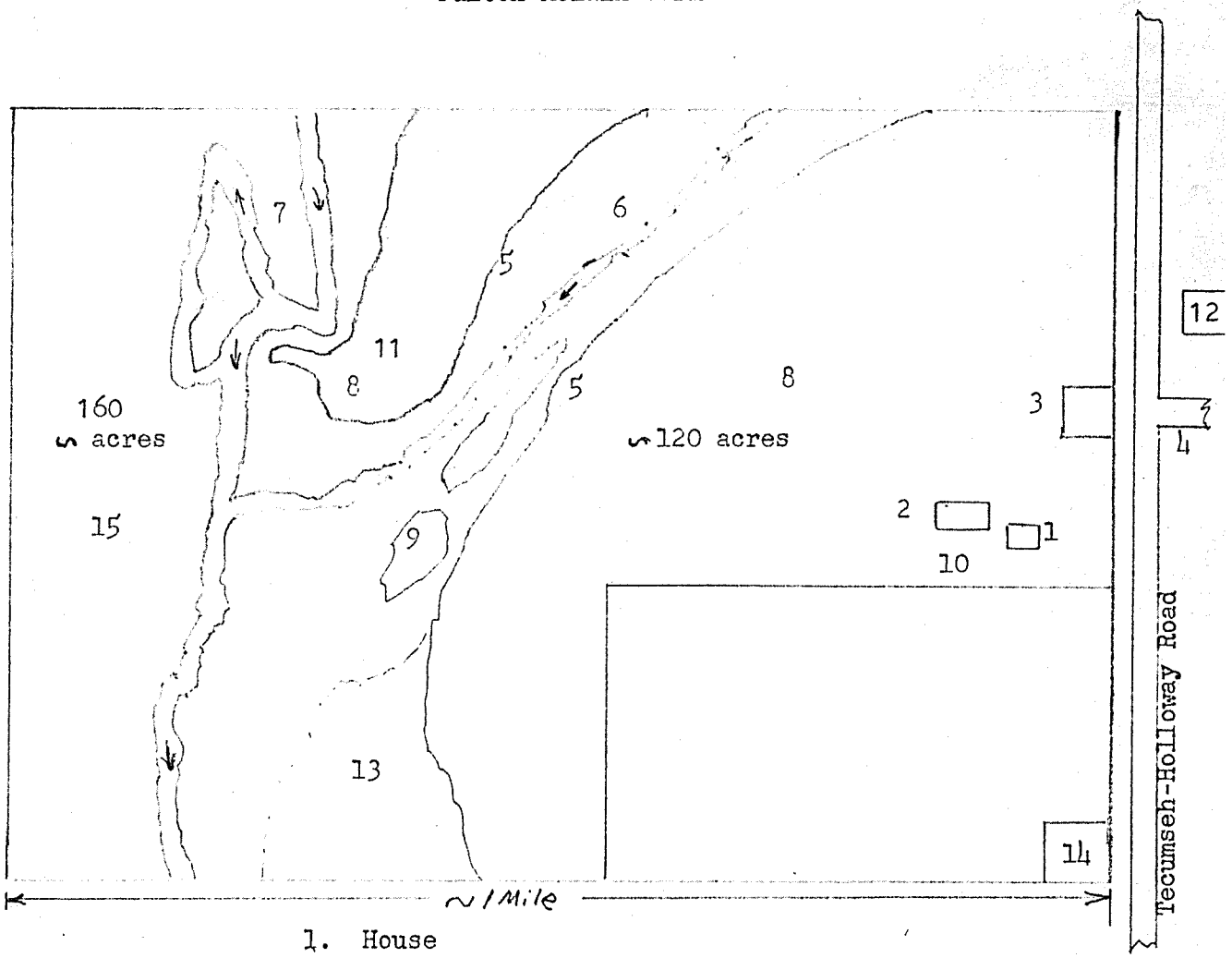
Since wood was burned for cooking and part of the house heating, it was necessary to remove the ashes daily from these stoves and from the hard coal stove in the winter. This was a dirty dusty job.

The ashes from the older stove which was used in the dining room were removed from the ash pit with a small shovel and placed in a hod or pail and carried from the house and dumped in the garden. The ashes from the cook stove were removed in the same way. When the hard coal heater was in use, it was necessary to remove the ashes daily. But they would drop through the grate into a tray that could be removed and carried from the house.

The wood for use in the heating and cook stoves was cut each year. Its cutting, reduction to usable sizes, handling, etc was a very important winter job. These operations are described later.

It should be noted that firing and caring for wood stoves is a continuing chore. The cook stove was fired with sticks about 2.5 x 2.5 inches by 16 inches. These were split from sawed blocks of wood which had been cut from sizable trees. The sticks of wood as used varied from square to triangular to flat. Cutting the trees and handling and splitting the wood will be discussed later. But the fires had to be watched constantly as the "drafts"

Fulton McLain Farm



1. House
2. Barns and Barnyard Area
3. Schoolhouse
4. Road to Henry McLain Farm, my original home
5. Escarpment
6. Creek
7. Raisin River
8. High Ground
9. Swamps
10. Orchards: apples, peaches, cherries
11. Old Indian Field ????
12. Original home of the Henry McLains
13. Intermediate level field
14. Cemetery
15. River Bottoms

Not to Scale

on the air inlets and the stack drafts had to be adjusted frequently to control the rate of burning, and fuel had to be added frequently. When the oven or the top of the stove was being used, fuel had to be added about every half hour. This consisted of 1 to 3 pieces of wood as mentioned above. When the fire was not being used, the drafts or controls for the air inlet were closed and burning was reduced to near zero. It was unusual for a fire to burn overnight in the cook stove. So a fire had to be started each morning with kerosene poured on small sticks, old shingles, etc to get a flame large enough to ignite the two inch wood pieces, or coals (burning pieces of wood) had to be carried from another stove in a pan to start the wood in the kitchen stove.

The heating stove once a fire had been started by small pieces of wood was fired by "chunks" of wood something like 4 x 7 inches by 16 inches long. Since these small sticks and chunks or blocks of wood were either small limbs or split from larger pieces of logs, they varied greatly in size.

As noted above, there was some flexibility in the controls of the stoves. The top of the cookstove could be cool enough that water would not boil with the oven at a low baking temperature of the top could be a dull red hot for popping corn.

The fire in the cookstove was allowed to go out at night as it was very hot and humid in the kitchen in summer. Due to shade trees the heat in the kitchen was not too bad except on very hot and high humidity days. In the winter it was below zero on windy days outdoors at times so we had to stay near the stoves to keep warm.

For lighting in the evenings and early mornings in the winter we used kerosene lamps and lanterns. These lamps gave off limited amounts of light, so that it was necessary to sit near a lamp to read. The lamps required "filling" or addition of kerosene daily. The fiber wicks were trimmed about every other day.

The kitchen stove or range had two cooking places directly over the fire. Two lids or openings could be removed directly over the fire by removal of circular lids about 8 in. diameter. To one side there were four cooking places under which the smoke passed before it went to the stack to the chimney. The oven was directly under this part of the stove. There was a ten to fifteen gallon reservoir for heating water at the end of the stove nest to part where the hot gases went to the stack. So the fuel economy was good as it was used to heat the top of the stove, the oven, and the water reservoir.

My Uncles' and Aunts' Farm

On page 750 I referred to my Uncles' and Aunts' farm on which my Father grew up and on page 755 I discussed the farm buildings and I presented a sketch on the farm layout on page 761. The following pages are intended to present a more detailed discussion of the actual farm with emphasis on the farm and living practices after starting with "Taking up Land."

All the Histories that I have read about Pioneer Life on the Farm hve tended to glorify the Life instead of emphasizing the lonesomeness, drugery, and dirt involved. But perhpas an early Whiteman's life in the Midwest was no worst than most earlier independent people — or perhpas a little better! Only those early people who "owned slaves" had an easy life by today's standards. But there were good points such as the rotation of the seasons and crops, working together to build a "cabin" and a "farm," to collect food, to raise a family, and at the same time bo build a Home and a Farm. Everyone had to work very hard and long hours.

If we contrast the life of the Pioneers with that of the present day, we can easily see that Street Gangs of boys and young men and girls of various ages were impossible without the "labor saving" devices we have today. The boys and girls on the isolated farms were too busy and had too much work to be able to form "gangs." Have we advanced or are we losing the benefits of Civilization?

The "Taking up Land" was apparently quite easy. The land in Southern Michigan had been surveyed prior to 1830. So, after locating the area that he wished to purchase, my Grandfather had to register and make the necessary purchase which was essentially a fee for the Registration of the Titles, etc. I have no information just how this was done but a single trip to Adrain at the County Seat should have sufficed.

In passing I should note that the Federal Surveyors that made the surveys of the Midwest did a remarkable job considering the circumstances of the heavy forests; the lakes; rivers; and ponds; the wild animals and Indians; mosquitos; and "deer flies," etc. The errors in their surveys were only a few inches between various stakes. Perhpas I should note that the "various stakes" were buried posts at each half mile on the main routes. These stakes were charred wood buried several feet deep.

In order to check the "line" between our farm and the next farm East my Father and his farmer, Albert Cadmus, dug up the half mile marker at the East side of our farm. It was exaclty in line with the center of the road and the "line fence" between the farms. This was a double check on both the marker and the line fence.

As mentioned earlier a part of the original land of my Grandfather's Farm was sold to the Boyds and a cemetery and a school area were dedicated to the public, see page 761. Then an adjecent plot was purchased.

The escarpment in the sketch ran nearly West and gradually turned to the Southwest and finally to the South. Another escarpment on the North side of the creek ran West and then turned South between the creek and the Raisin River with a high bank protruding into the river valley. This forced the river to flow West with a branch actually flowing north for a quarter mile or so before turning West and then South as shown on the sketch.

Along the escarpment, in a few places, there were swamps perhaps a city block across. These ran for perhaps a quarter of the distance along the escarpment. They contained a coarse march grass, mostly in tuffs, a foot or more in diameter, no trees and a only a few bushes. The grass was perhaps one foot high. The swamps were boggy due to springs at the foot of the excarpment. Between the tuffs there were wet paths made by the cattle although the cattle did not eat the marsh grass. In one place a spring had been dug out and tiled to supply drinking water. This was located at the bottom of the escarpment along a road across the swamp. The trench was about two feet deep and a stream perhaps a couple of inches deep and about six inches wide ran continuously. We frequently obtained water there.

These marches as we called them contained snakes which probably lived on mice and birds and what other rodents they could carch. There were blue racers and common rattlers. Apparently, when my Father was a boy the woods and swamps contained many of the larger prairie rattlers which we seldom saw. But we did kill many blue racers and common rattlers. Sometimes we killed a garter snake but these were uncommon. They were probably eaten by the larger snakes. I remember watching a large snake eating another at least half its size.

When we were young, we went barefooted in the Summers at home; but we were always required to ware shoes when we went to the woods because of the snakes. But I was never struck or had a snake attempt to bite me. My Father stated that when he was yound, they almost always killed one or more snakes, mostly rattlers, each trip to the woods in the warm weather. The common rattlers that we killed were about three feet long while the blue racers were about five to six feet long.

There were hazelnuts growing along the bottom of the escarpment at the edge of the swamp. Nearly every Fall we spent time picking

some of these. They were easy to pick but difficult to shuck.

Once while we were picking hazelmuts, we watched a large blue racer eat a toad that had a much larger diameter than the mouth of the snake. The snake must have been days digesting the toad as the snake gradually worked the toad into its mouth. The toad was alive even though its hind legs appeared to be nearly digested by the snake.

I was told that my Grandfather contracted to build a Schoolhouse on the property dedicated to the State for a school and they paid him $900 to build the Schoolhouse. This was the first School that I attended as I went through the sixth grade. All three of my older Brothers attended that School also.

Farming in the Midwest

The purpose of this section, which is extensive, is to present a rather detailed description of Farming in the Midwest as it was carried out when I was a boy. There have been many books written on this subject but all those that I have read omitted the references to the drugery, the dirt, and the lonesomeness that went with the Farmer's lives and they have omitted likewise the friendliness and and pleasures that existed. I remember the old statement, "A neighbor means a lot when the nearest one lives three miles away." We lived close to many neighbors and changed work with them.

But today in the Cities we look for our friends perhaps miles away and we make frequent visits further from our homes than the early Farmers ever did. But we have more rapid transportation. And we have a choice. On the farms everyone had to be the neighbor of the others. The reason for this was that frequently jobs arose that one man could not do; so he had to ask his neighbors to help. But since all of the Farmers had similar backgrounds and experiencies, they had much in common. All helped his near neighbors willingly and without any thought of money exchange. Even a large door that got blown off a barn in a windstorm required a neighbor to help replace it as two men were required to lift the door.

The farming practices in the Midwest have undergone three revolution since the White man drove the Indians off the land. These may be designated approximately as follows:

1700-1880 Oxen Power
1880-1930 Horse Power
1930- -- Fossil or Organic Fuels Power

During these periods there were many changes with wide overlaps in time and locations. For example, one farmer used horses for power long after his next door neighbor used a gasoline powered tractor. Also a great many inventions were made by Americans during this period. These affected the Families and their ways of life - and that of the whole World.

My Grandfathers used oxen and later horses, my Father and Uncles used horses, and had I remained on the farm, I would have used tractors as my Brothers did. My Grandfather threshed with a flail; my Father threshed with a hired private or neighborhood owned coal or petroleum fueled engine driven thresher, and had I remained on the farm, I would have used a petroleum fueled privately owned harvester-thresher. So it goes.

My Grandmother McLain kept a spinning wheel in the dining room, spun yarn, and knitted socks until just before she died. My Mother made her own clothes. By the time I was a boy, we bought all of my clothes. But we did repair our own shoes. But all my life I have used maunfactured socks and clothes.

But let me return to the main story and start with the Indians.

a. Indian Practices.

I know very little of the Indian culture in the Midwest, except that corn was grown. In addition to raising corn the Indians collected many wild fruits, possibly some vegetables, and nuts. Further, game, fish, and birds were plentiful.

As mentioned above there was an Indian corn field on my Aunts' and Uncles' farm. Probably - but we do not know - the field was cleared by girdling the trees by cutting through the bark and cambrian layer beneath the bark, so that the trees died. Once the wood of the trees had throughly dried out, the forest could be set on fire and the limbs and most of the tree trucks would have burned. I believe this process was used by both the Indians and pioneers but I do not remember any reference in Histories about it. It is so natural that it must have been used.

Actually a very dry stump will burn well below the surface of the ground if rain does not occur. In fact a large stump that is well dried may burn for several days below ground level enen to the point that parts of the large roots are burned for two or three feet below ground level.

Between the stumps, the ashes would have enriched the soil. There would have been only a thin grass; so the land could have been worked a bit by the Indian women (and the Pioneers.) Presumably the Indian women used only hoes made from clam shells and animal bones tied to sticks and wooden digging sticks. Reasonably good crops could have been raised at least for several years after burning the dead trees. My Father stated that when the land was taken up, there were cornstubs in the field.

In addition to the corn the Indian women may have raised beans and other crops. But this is unknown.

The area used was near water needed for cooking, drinking, and washing both clothes and bodies. In fact water could have been obtained during a siege.

The Western part of the high ground (8 in the sketch on page 761) was the highest ground in the area with steep banks on all sides except to the East - nearly vertical on the North - so it must have been used as a Fort by the Indians.

As mentioned previously game animals such as bears, deer, and smaller game such as rabbits, muckrats, beaver, and woodchucks, and fish were available in quantity as were several kinds of nuts in the Fall. Birds were also plentiful. These included quail, paasenger pigeans, ducks, geese, etc. How and if the Indians captured these is not known. They certainly could have been shot by arrows and killed by sticks.

The combination of the corn, game, and nuts must have resulted in a high protein excellent dier, see page 754. The above is partially conjecture but it is certain that all the foods mentioned were available and used by the Indian women. They also had fish and small game plus many native vegetables and fruits.

Of course I do not know the practices of the Indian women but by selection they developed corn in many varieties. Then they learned to raise respectable crops and to use it as an important food. They must have used care to keep birds from eating it as well as to plant and hoe the growing corn. The harvesting of corn by the Indian women must have been a joyful time as the ripe ears are easily picked. Drying is necessary and storage is easy - a dry mice-free area. The hardest work occurred in the Spring when the corn field had to be worked. But the soil was loose due to the freezing in the Winter. At this time the immediate "hill" areas where the seeds were to be planted had to be dug up, probably by digging sticks, and aired by the clam hoes, the seed dropped in holes, and covered. After the seedlings were one to two inches high, the soil around the hills had to be hoed to hold the moisture, and this hoeing had to be repeated after each rain until the corn

was 18 or so inches high. Then only occasional weeding by chopping or pulling the weeds would be necessary until Fall.

During the latter part of the Summer the field would have needed protection from squirrels and presumably andy of these animals that dared enter the corn field ended up in the food pots.

A field of 10 acres or about the size of this field would have produced as much as 150 bushels of shelled corn. This is low by modern standards but may be high for the Indians. This is about 9,000 to 10,000 lbs or enough food as supplemented by fish and game to have ged twenty five people one pound per day for a year. Not bad!

b. Oxen Power, 1700-1880

On page 750 the "Taking up of Land" was mentioned and on page 752 the construction of the Log Cabin was described. As mentioned, all disappeared by the time I was old enough to have rmembered it. My Father, when I was young, described driving oxen, and there was an old oxen yoke in the storage area of the grainery when I was young.

I have described the cabins and log barns that were used initially. I assume that land was cleared as described above by the Indians. Certainly, a great effort would be required to remove the stump of a 4 foot thick oak tree. In fact it probably would have been nearly impossible with the equipment available to the Pioneers let alone the Indians. To do so would have meant digging out and cutting all the roors and even then it would have been difficult for oxen to have pulled such a stump from the hole.

The cleared land must have been quite rich and only a few acres would have been necessary to raise wheat and corn for a family. Game and fish and wild fruits, nuts, etc. were relied upon for a large part of the food. From year to year the crops of wheat and corn would have increased as the stumps rotted and additional land was cleared. This would have increased the availability of meat from hogs, chickens, and cattle to supplement that from wild game, fish, and birds.

Wood was cut and used as fuel. Probably at first there was enough down wood to have sufficed for a year or two. I believe that the early Whites had "crosscut" saws as well as steel axes. These would have allowed cutting large trees, cutting the limbs, and part of the tree trunks into usable wood with the main trunks used for building frames and lumber. The Indians had only stone axes which were hardly suitable for felling large trees but they could be used for girdling the trees. But collecting firewood was "womens work" to the Indians.

The actual detailed conducting of all the necessary work is difficult to describe as I did not witness many of the early practices when I was young. The steel moldboard plow, the corn planter, the wheat planter or drill, the various horsedrawn harvesters, and the threshing machines which were used when I was a boy had not been invented and they were not invented until the end of the 1700-1880 period. Also most of the Pioneers were too poor to have invested in such tools had they been available. The rifles and Conestoga Wagons plus the hand tools, harnesses, etc were expensive enough.

The late 19th and 20th Centuries were the times of most of the "great inventions" even though Benjamin Franklyn and others had made important inventions such as the "Fanklyn Stove." One invention of the greastest significance to the Pioneers had been made by the New England gunsmiths in the 1700's. This was the Long Rifle. Presumably, the people who moved into the Midwest in the 1800's had both long rifles and shotguns.

Let me try to describe, then, how the people lived. This is based on some observations and some discussions that I overheard.

First, I have described in some detail how a log cabin was built. There is currently (June 1978) a motion picture of a man building a log cabin in Alaska being shown on television. This picture shows the man notching small pine logs and building a cottage or log cabin. But he notched the logs on one side only so they were not locked to prevent movement. He also cut out the boards for the door and window frames before laying up the logs. It was stated he built the "cottage" in about two months - which checks the extimate that I had made previously. I had assumed that oxen and log chains were available. He had to use smaller logs than I had seen in the older log cabins built in the Midwest. These were about 12 inches diameter while he used six to eight inch logs. He had stripped the bark off the entire trees or logs . This was not done in the Midwest. He used fibers between the logs while mud was used with the fibers in the Midwest.

Second, there was the problem of cooking. This must have been done in the leantos until the cabins were built and it was possible to use pots hanging on spits in the fireplaces. But an outside fire surrounded by stones perhaps 8 in. diameter and an iron spit would have made a suitable substitute except in windy and stormy weather. Meat or vegetables could have been dropped into a pot containing water, hang over a fire, and cooling would have been rapid with no problems except to refurnish the fire with small sticks from time to time. The Indians had cooked for centuries using clay pots set on the fires or hung on wood spits over the fires. Also roasts can be cooked by covering them with clay and burying in the ashes. This is also applicable to potatoes and any Boy Scout can testify. Of courese slices of meat and other things can be held over the fires.

Later cooking and baking in the cabins was done by hanging pots on iron spits over burning logs or "pieces of wood." Baking was done by placing a steel plate over the coals or carbonized wood and laying the dough or pie crust on the steel plate.

Third, there was the problem of light. The fireplace and candles were used in the cabins. Candles were made, I believe, by my Father's people as there was a tin candle mold for eight or ten candles in the old wooeshed when I was a boy. Candles were made of beef tallow and cotton or other fibers such as linen. The cotton wicks were placed in the centers of the mold tubes and hot tallow poured around them. The tubes were about seven inches long and 5/8 inches in diameter with a closed sheet at the bottom except for a small hole in each tube bottom for the wick. A form at the top held the tubes and linen or cotton strings in place. The candles were then made by simply pouring in the hot tallow. After cooling the candles were pulled out ready for use.

It will be noted that the wicks were not made as they are in modern candles. Today the wicks are made of several twisted fibers with one of the pretwisted strands of fibers held at a higher tension than the others during twisting. As a result, on burning the unburned wick is continuously tipped to one side where it is burned in the candles flame. It was not so in the older system since the wicks did not burn and it was necessary every 10 to 15 minutes to snip off the unburned wick with a "candle snipper." This was a sm a small scissors with a small spoon on the side for catching the part of the wick that was cut off as it was still burning.

Fourth, to solve the problem of heating I believe it was normal to keep the fires in the fireplaces burning all night no matter how hot it was inside the cabin. Matches had not been invented. So, if the fire went out, it was necessary "to strike a fire." This meant that a piece of steel had to be struck against a rock such that a chip was knocked off at a red heat; this chip had to fall into a soft easily igniible mass of fibers; and the chip had to be blown such that it gave up enough heat to ignite the fibers, and these had to be blown or fanned until a flame was generated. Small wood fibers and wood splinters could then be ignited from them and a regular fire in the fireplace generated.

If that could not be made to work and a fire started, someone had to walk to a neighbors cabin to get "fire." This was carried in a pot with some charred wood that would slowly burn until the fire could be used.

Fourth, there was the problem of fuel. This was simply wood that was cut to proper size and dried. More will be written about this later.

The match based on phosphorous was invented in 1827 but it was not used extensively according to the Encyclopedia Britannica until about 1850. Charles Dickenson wrote that by this method on a damp English day a person might get a light in half an hour "with luck." Fire was also developed by rubbing two sticks together. But flintlock guns used flint chips against steel to ignite the powder. I have read that some forest fires are supposed to have been set by limbs rubbing one another in winds.

Fifth, the food supply has been mentioned. I believe that most Pioneers in the Midwest arrived at the new Homesites in the Spring in order to be able to plant some corn and possibly some oats and vegetables. Wheat was planted in the Fall. Potatoes, vegetables, and corn were probably planted early between killed trees. As mentioned previously, cutting the cambrian layer below the bark prevented the trees from leafing out and the trees would die. Also, there were always some open glades where large trees had fallen and rotted. The stock was pastured on the grass and hay was cut as described later in the open glades and non wooded areas except the swamps.

Thus, we may conclude that there was ample corn, beans, and vegetables plus all the wild fruit and nuts as well as game and fish available. Oats may have been planted the first year. Wheat would have been planted in the Fall. I know that my Grandparents used wild plums very extensively for jams - canning as we know it had not been invented. But they did make jams etc which would keep to Winter. Other than plums and raspberries there seems to have been only some wild vegetables. But I do not know what these were - if any.

Sixth, clothing was solved in two ways. Dried firs were available from the animals that were killed. These could be softened in two ways - by tanning and by chewing as was done by the Indian women. True tanning was not followed until later when the dried firs, which became very stiff, could be sent to tanneries for tanning. This was done with cattle and horse hides and presumably with wild animal firs. But bear and buffalo skins were used for bedding and deerskins were used for clothing. To the best of my knowledge there were no buffalos in the Midwest at that time. I believe that some tanning was done by the women but I do not know what was used.

Later most clothing was made from wool. Sheep were kept and washed before shearing in the Raisin River. When I was young, the area where the sheep were washed was called the "Old Sheep Pen." Here the sheep were washed in a shallow part of the river. But by the time they were driven to the barn for clipping, they must

have been as dusty and dirty as they were to begin with. Perhaps they were sheared near the "sheep pen" but the wool would have required drying before it could have been folded into bundles, or it could have been taken to the cottage or cabin for drying.

The sheep were sheared with steel hand clippers. These were made with spring handles so that clipping could be rapid. The blades were about four inches long and made of thin steel. The blades tapered from a point a point to about two inches across in a length of four inches of cutting blade. This increased width made it less likely to cut the skin.

After shearing the wool was washed. Spinning followed. My Grandmother had a spinning wheel in her dining room when I was a boy. She still spun wool for socks enen in 1915 and later. The spinning wheel was made almost entirely of wood. The main foot driven wheel was at least five feet in diameter. The yarn spinning wheel was about one inch in diameter; so the ratio was about 60 to 1. The thread spinner was fed cleaned wool by hand. The tread size was controlled by the rate of feed of the raw wool to the spinning thread. Cord size and thus threads per inch were controlled by the feed and thread size was not uniform.

I know that vegetable dyes were used but what my Grandmother used, I do not know. Anyway she dyed wool and knitted socks when I was young. In earlier days she may have made some cloth but I never heard about it. Nor do I know anything about dyes she may have gathered and used.

By the time I was a boy, most clothing was purchased ready made. The exception was women,s dresses. Cloth was purchased and the women made their own dresses using published paper patterns. They also made some clothing for children, particularly girl's dresses.

So every home had a sewing machine when I was young. This also had not been invented in the earliest times. The great American invention period occured later.

Turning again to the Pioneers, I know very little about the crops that were raised in the first few years. Certainly corn and probably wheat were planted the first year. But wild vegetables and fruits were certainly collected and probably were supplemented by wild vegetables. Potatoes and other vegetables were planted including pumpkins and squash.

Since meat was plentiful, the effort was placed on a cabin and a barn. A well also had to be dug soon but whether that wes done the first Summer, I do not know. Once these basic requirements were met, clearing the land by killing the trees and burning the dead wood would have been important.

Life was hard and the work days must have been long. The harvesting of the corn may have followed the Indian manner but this is doubtful as the stalks and leaves were very valuable cattle feed. So the efforts would have been to cut and cure wild hay and to cut and care for the cornstalks as well as the corn. With hay and some oats and corn it would have been possible to feed the pigs and cattle and horses through the first winter. Lqter the problems would have been simple in comparison. In any case life must have been hard with long hours of hard work.

Later, they raised cattle and pigs as well as chickens. In the summers the cattle were pastured in the woods up till modern or very recent times. The horses were fed hay at all times and oats were added in times of plowing and very hard work. The cattle were fed hay, corn fodder or the stalks and leaves after the corn had been removed from its husks. The hay as discussed later consisted of alsike, clover, and timothy. The early and later crops consisted of corn, wheat, oats, and hay. The corn and oats were ground together and used as hog feed and supplemental feed to the cattle. Oats without grinding were fed to the horses as supplemental feed during plowing and very heavy work times.

The cash crops for the farmers consisted of the sale of hogs, cattle, wheat, and cream and butter and eggs. This economy was the same until very recently. Sometimes hay was baled and sold but this was not the common thing as it was beneficial to use the hay and manures to build up the land and thus increase tis productivity.

I believe that most of the early Pioneers brought needles and iron objects such as axes, hammers, saws, etc as well as cooking utencils with them. Plows, harnesses, wagons, and other farm tools were also brought. Thus they had to purchase very few things locally during the first few months - in fact stores were not available and it would have been difficult to have made many such purchases. Flour grinding was done at home until large commercial mills were built. But the water driven grain grinding mills were built in the Midwest soon after 1840.

The women's work appears to have been that of women of all ages — care of the children, care of the cabins, gathering food, preparing the food, cooking, and baking, serving the food, cleaning up the cooling utensils and dishes. Endless work as always. There were very few of the modern tools. The women had pans for food preparation and dishwashing, cooking utensils, a spinning wheel, and possibly a loom and a few ceramic crocks. Otherwise, she had to "make do" with only limited outside resources and she was expected to and did assist in care of the garden, collection of wild fruits and vegetables, cut and cure the meat, etc etc, see page 771.

To summarize my Grandmother apparently did her cooking and baking at first over the fire in the fireplace. The tools consisted of cast iron pots hung on spits and pans for baking. Bone spoons were used at least in some homes buy my Grandparents probably had silver. Otherwise, I have no onformation. The economy was based on sale of meat and wheat as discussed later.

The care of the cabin may have consisted of "airing" the fur covers by taking them outside occasionally for a few hours, sweeping the floors with a cornhusk broom, making up the beds by throwing up a few furs, etc. Gathering food, making clothing, and cooking plus care of the children must have kept her busy. Water had to be carried about one city block in a heavy wood bucket until a well was dug. It is assumed that the cattle, horses, and hogs were driven to the pond twice daily. Once a well was dug and a pump installed, it was necessary to pump water into a trough for the stock. Such a trough was made from a half of a split log at least 12 in. diameter by hollowing out a portion of the center wood. Meat obtained from cattle, hogs, and wild game had to be prepared as discussed later. There was no canning but jams etc. were made. Fruits were dried. The fires had to be watched continuously, and the candles "snipped" frequently, etc., etc.

Meanwhile the men had to build the necessary buildings, plant, care for, harvest, and thresh the crops. These processes are discussed below.

Since the periods up to 1880 and beyond overlap and since most of my information applies to the latter part of the second period, I have described the operations under the Farming 1880-1930 period.

The furniture of the Pioneers included chairs, tables, and beds. Some of these were well made and were beautiful to look at. But some of the Pioneers had very little purchased furnitre except a table, a few chairs, and possibly a bed. Some were made of small sticks covered with loose skins and some chairs were simply pieces of wood. But after one or two seasons, this situation would have changed as crops were generally good and prices of wheat, for example, were much higher than today when we correct for the value of the dollar. This we tend to forget. The Midwest, I believe, except for bad years such as the early 1880's, developed very rapidly as crops were good and prices were also good.

So "stick Beds" were used in a few log cabins until split board beds could be built - usually in a few days. Very early these split board beds, when used, were replaced by comfortable springs and feather mattresses. Probably most couples brought chairs and tables with them.

In the early times the people lived in much more dirt or filth than today, work was a drugery, and expecially the women had a very much harder life. The conditions, which we, as Tourists, see the poor in India, were not far from the "life style" of Midwest farm women until relatively recently. The present electrical powered home in which the women have many motors to do the work plus the use of canned and frozen foods has changed Women's Life Style.

On arrival at a Site for a future home, the first requirements were food and water as described above. Then the animals had to be provided for. Following that I believe that the trees near the log cabin were girtled so that crops would not be shaded, corn and garden crops such as potatoes and pumpkins could be planted. Apparently wild hay was used the first year. Then attention was given to the construction of the leantos for the people and animals. Until the leantos were built the people must have lived in the wagons most of the time and for sleep. A recent book, "Centenial" describes some of the difficulties referred to here.

As soon as the leantos were completed, the men would spend as much time as possible away from the growing corn crop digging a well and preparing a foundation, cutting logs, and building a cabin which was necessary for use by early Fall in the Midwest. Collection of wild foods would take only a small amount of time. Diets were excellent due to the high protein content and certainly there was little malnutrition or starvation.

On most early farms the supply of water or "digging a well" must have been the most important consideration. In the Midwest this must have been done as it was later by use of hand tools, a spade and possibly a pick, and an overhead rope lift. Since most farms needed only to dig to 20 to 30 feet, this was not too difficult. On my Uncles' and Aunts' farm it was necessary to dig to about 90 feet. To do this it was necessary to first build a lift over the proposed well. This consisted of two sets of two logs set in the ground to form an X about four feet above the ground. The logs forming the X were locked in place by ropes, so that a cross log could be laid over the proposed well and a bucket rope wound around the log. By means of handles some two feet long attached to this cross log, the rope could be used to raise a bucket of dirt.

The well was then dug by filling a bucket with dirt, raising it, and dumping to one side. A slow but workable process requiring for a 25 foot deep well perhpas two weeks for the "man in the well' and his wife or a neighbor who raised and dumped the dirt. The well was then lined with stones and mortar or with brick and mortar. The main difficulty arose in digging these wells in digging below water depth as two or three feet of dirt had to be removed to provide water space. This space would be filled by stones with water storage provided by the space between the stones. At least this was the case in one well I saw dug when I was a boy. In this well instead of lining with brick, large tile were used and stones used ouside of the tile all the way to the top. The well was then lined with stones in mortar or brick. At least some of the early Families had to use wood pumps. These consisted of pine logs drilled to form pipes; and a cloth or leather covered wood pole with a leather flap valve. On the farm that I grew up there was a well in a low area some one-eighth mile from the house. This well was only about 15 feet deep. We used it only occasionally in summer. Until a pump was purchased the water would be drawn by use of a bucket and rope.

After building leantos for themselves and stock, planting some crops, and digging a well, the Pioneer Family turned to building a log cabin for their own use and later log barns for the stock. Also some fences had to be built early for the stock. These were made from rails. The rails for fences were cut by chopping or sawing down trees, cutting the trucks into about 10 foot lengths, and splitting them as mentioned earlier into rails 3 to 4 inches diameter. This was very hard work. For example, Abraham Lincoln was noted as a rail splitter. These rails were then used to build a "barnyard" for the cattle and horses and a "hogpen" for the hogs or pigs and sheep. Rail fences were "laid up" of 8 to 12 rails at nearly 90° angles. In most cases they were about 4 to 5 feet high. The rails in most fences when I was a boy were held in place by small posts or stakes about 2 inch diameter. These were driven into the ground and held together by wires about four feet above the ground.

While the men were clearing some land and using the wood for rails etc and burning off some of the timber, the women had to plant vegetables such as beans and cabbage and collect wild

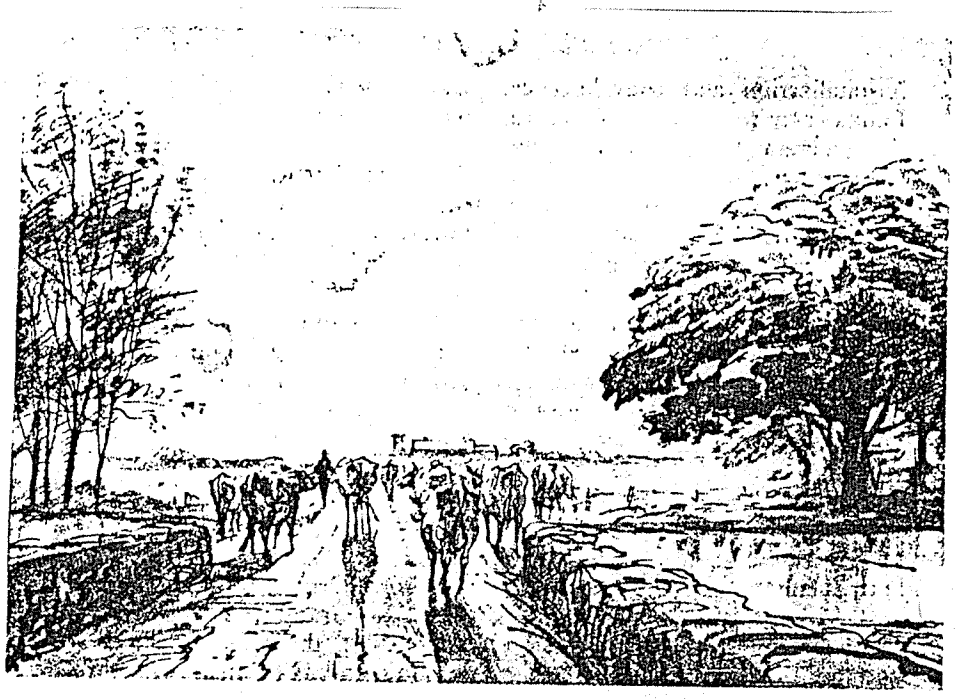
fruit for the first winter's use. Fish and game were caught and shot for fresh meat during the first summer. In early fall a hog could be killed or a deer shot. The wild fruit that was collected included wild plums that have been mentioned. In addition wild raspberries and blackberries must have been available. I do not know of other fruits or vegetables. Nuts were gathered as mentioned earlier. The grinding of grain was practiced by some Pioneers but near Tecumseh, Michigan, a public mill was built early but I do not know the date. This mill consisted of a dam in the Raisin River, an installation of a grinder or mill stones driven by the water, and facilities for feeding the grain and collecting the ground meal.

So only such staples as suger, salt, soda, pepper, raisins, etc needed to be purchased. Iron and steel objects such as knives, axes, saws, and scyths, and such items as harnesses etc were purchased. But hides, furs, as well as grain and possibly hay were available for sale. Wood for fuel and lumber were available everywhere but at the price of heavy work.

Over many years horses gradually replaced oxen but as indicated above I have tried to break up farming practices into the three periods in which oxen, horses, and fossil fuels furnished the largest fraction of the energy used on the farms other than man himself. Of course the changes occurred over many years but the dates I have used are probably as good estimates of the changing periods as any. 1925 might be better than 1930. But the number of topics under "how we lived" in the 1880-1930 Period is so great that I have pages of Outline. So rather than try to make a consistent continuous story, which is just impossible, I have tried to make as consistent a story as I can. But there is bound to be overlaps and blanks in the story - because it is more like an "Encyclopedia of Farming Practices" than a story.

By 1880 much of the area near my home had been "taken up" by farmers. So the houses and barns were quite similar construction to those being built in the 1850's. That means that the foundations of the houses were stone and mortar and of the barns just stones; the frames were hewed oak, and the houses were covered with whitewood or tulip shiplap while the barns were covered with white pine siding. By the time I was a boy most houses were painted with white lead while the barns were painted with iron oxide and lenseed oil to give the common red painted barns of the Midwest.

But most of the land had been cleared. Crops consisted of corn, wheat, oats, and hay. Vegetables and fruits probably were similar to those is use when I was young.



My Father's Farm

He was attuned to the land in a way that many modern farmers seem to have forsaken. And he was his own man to the last

Condensed from ROLLING STONE
HOWARD KOHN

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EXCEPT FOR 4½ years in the Army, his day began the same way for 50 years. He awoke before dawn, pulled on overalls that smelled of the barn, gathered the milk strainer and pail, and went to the night pasture to call the cows: "C'mon, Bossy! C'mon Bossy!" In the morning silence his voice was loud but patient. The cows understood and ambled home.

In winter, when the cold kept the cows in the barn, he groped in the darkness for the light switch, then went right to work, perched on a handmade stool, swishing milk into his pail. When our knees grew strong enough to hold a pail, my father—the Old Man, as we have long called him—taught us how to sit under a cow and persuade her to give up her milk. Eventually there were six of us kids, and he had all the help he needed, though he always filled his pail faster than any of us.

Even today the Old Man probably could outdo his kids. His body is firm, back straight, shoulders strong, movements filled with vigor. His face, a weathered brown, has an undefeated look that comes from keeping faith with the land.

Like his father and grandfather before him, the Old Man worked the land, but never abused it. He spent long days in the summer sun hoeing irrepressible ragweeds and thistles, preferring this endless task to the modern alternative of chemicals. I remember in the '50s when DDT and other insecticides and herbicides were first used profusely in Michigan—sometimes producing thick, choking clouds. But a few farmers, my father among them, disdained the synthetic remedies.

For a long time we kids tried to change his mind—hoeing was the most tedious of all farm jobs, and we could not fathom why the Old Man rejected a more efficient substitute. He listened to our sermonizing tolerantly. Then he punctured our spiel. You shouldn't believe everything the

chemical company says, he told us. Just wait and see.

The Old Man was no scientist—he had dropped out of school after the eighth grade to work on the farm—but he knew nature. And he was right; the new ways were not always as reliable as the old, time-tested ways. On a Sunday afternoon in early September, he took us on a tour of the county. The bean fields were only a few days from harvest, and in many fields that had been entrusted to chemical treatment the weeds had prospered, strangling the crop. By comparison, our fields were orderly and vibrant.

My father's philosophy was not to embrace change for its own sake. He was not motivated by nostalgia or a fear of modern advances. But thinking for yourself, he felt, started with doing for yourself. Feeling the soil under your feet taught you where it was sandy and needed more manure so it wouldn't blow away. All the diesel tractors in the world couldn't grow you a crop once the topsoil was gone.

Gradually, however, the Old Man had to modernize. The thresher retired first, in 1951. In its place he brought home a gleaming red combine with dragon teeth and a long belly that cut and threshed the grain where it stood in the field. In 1956 he added a hay baler and later a corn picker.

I remember the day Colonel and Fanny, our old plow horses, were sold. The stable seemed eerie that night, and the wind whinnied in ghostly reminiscence. But instead of replacing the horse-drawn implements—manure spreader, hay mower, rake, disk, spike-tooth drag, wagons—my father remodeled them, removing the wooden stays and leather grips and installing long metal tongues that could be bolted to the back of a tractor. He continued to use a scythe for trimming the undergrowth next to the barn and sheds, sharpening it to the song of a whetstone as farmers did centuries ago. Each winter Saturday we gathered on the old threshing floor, where the winds blew razor-sharp through openings in the walls, and mixed corn and oats in a primitive grinder to feed the cows and pigs cooped up in their stalls.

My father did things as Grandpa had taught him, and we learned by observing and following. If I don't show you, he would say, then you're not going to know how. Sure, maybe you'll be smart in lots of other ways. But being smart doesn't mean you know how to do anything. He remained resolute as a callus in resisting the temptation of work-saving devices like fancy milking machines. He figured he was helping us a lot more by putting us under a cow with a pail between our knees.

My father was determined to be his own man in his own place, at one with the land. But in the '60s old verities seemed to founder and the Old Man's life became more complicated. He had always resented the government as an incompetent meddler and he prided himself on delivering milk with far less sediment and bacteria than state standards allowed. Now uninvited bureaucrats began stopping by the farm. One inspector insisted he should trim the matted hair from the tails of our cows because in swatting flies they sometimes flung mud into the milk pails. A clipped tail, however, would have left a cow's shoulders covered with flies, and since the inspector's alternative was a fly sprayer filled with DDT, my father scorned the advice.

Other government men followed with more suggestions. No longer, one said, should our cows drink from the creek; it harbored germs. The creek should be fenced in and replaced by a tin trough. My father obliged him with a trough but not with fences since we knew the cows would only slice their udders trying to outwit the barbed wire.

In March 1967, a National Farmers Organization (NFO) organizer visited Beaver Township. The NFO is the most radical of the farm organizations, and the organizer exhorted us to withhold our milk from the market until the price went up. Boycotting was a notion as foreign to my father as government regulations. As truckers were reluctant to cross the picket lines, my father loaded his milk cans in the pickup, and shortly after dawn, before the pickets arrived at the cheese factory in Linwood, he defied the NFO and delivered the milk himself.

When the strike was over, the price at the cheese factory had not budged, though prices for Grade-A milk had increased slightly. But since my father's milk wasn't eligible for Grade-A designation—because he did not have a special milk house—the strike cost him money.

Throughout the '60s there were hard times. One afternoon in September 1960, a small cyclone rolled the bean rows against the fence in tangled clumps to rot in the rain that followed. The next year the beetles encroached, and then a hailstorm swept over, leaving the corn ravaged. My father recovered from these vagaries, but the burden weighed on him and made him look older.

Wheat, which sold for as much as $3 a bushel in the '50s, plunged to $1.75 a bushel in the '60s. Between 1960 and 1968, a third of all American farmers gave up the struggle, but my father's stubbornness saw him through. In 1969, though, the Linwood cheese factory closed down, and the Old Man had to have his milk cans trucked 35 miles to an ice-cream factory in Saginaw.

Meanwhile, scientific farming was beginning to display its darker side. In 1969, Michigan became one of the first states to ban DDT because of its wide-ranging toxic effects. A few years later, a fire retardant known as PBB, a pernicious poison, was accidentally mixed with cattle feed commercially distributed in the state. More than 500 farms had to be quarantined. Scores of cows died, and people who had unwittingly drunk their milk claim to have suffered memory loss and nervous disorders. My father was spared this plague because he still ground his own corn and oats for feed.

But governmental afterthoughts and chemical disasters were no impediment to the forces that were eliminating everything the Old Man had lived by. When the Saginaw ice-cream factory burned down in 1974, he managed to find a trucking route that delivered his milk to a cheese

factory in Pinconning, the only place within 40 miles that still accepted milk in cans. For two more years he got by until, in October 1976, the Pinconning cheese factory streamlined its production, banishing facilities for milk cans. The Old Man had either to build a modern milk parlor or sell his cows.

The cost of modernizing the barn could have easily reached $25,000, and, he knew, it would have only postponed the farm's fate. His children had all gone on to other careers. He was proud of us and betrayed no sign of disappointment. But there was no one to succeed him. So my father put up his cows for sale.

In May 1977 a truck took away the final load of cows and calves, leaving behind just one cow my father kept to provide milk for him and my mother. In the same month he turned over 80 of his 120 acres to one of Bay County's biggest farmers. A percentage of the yield goes to my father under a sharecropping arrangement.

But the farm will never be the same. For the first time pesticides have violated the land, and my father says that the new chemicals are killing the earthworms, which help keep the dirt loose and arable. He believes continued use will turn the soil to putty.

My father's way, the old way, has just about disappeared. Farms today are big business. More food is being produced than ever before, but by fewer farmers. In 1935, one in every four Americans lived on a farm. Today only one in 25 does. The older farmers, men like my father, are forced out by changing economics. Like aging horses put out to pasture, they are made to wait out their days in idleness.

Last summer, the Old Man farmed the back 40 by himself. It was his final farewell. He will be 62 come spring, and will retire so he can qualify for Social Security. After that, he says, he will sell the farm.

The Old Man's hands are rough and his face is lined. But the scars and creases are from a life of honor that will, I hope, make the leaving a little easier.

c. Horse Power, 1880-1930

But there were many changes in the farm practices in addition to the change from oxen to horses as the main power source. Many farmers had replaced their work horses with gasoline driven tractors and most farmers had replaced the horse drawn buggies and wagons by automobiles and trucks. There were more railroads in 1930, more newspapers, and the telephone had revolutionized coummunications between Families. Also the way-of-life of most Families had changed tremendously from one of partial isolation to one of close knit communities based on the telephone as well as local meetings, local newspapers, etc. The spread of the use of electrical power had extended to towns and to many farms. The introduction of the automobile, especially in the 1920's, changed the life of the farmers perhaps more than any other factor except that of the use of the farm tractor in place of horses. This occurred mostly in the 1920s, so I chose 1930 as the turning point. Many farmers still used horses in the early 1930s but their numbers were dropping very rapidly. Beginning, especially during World War I, trucks replaced horse drawn wagons for moving materials, especially delieveries in Cities. As the trucks became larger, they replaced the branch line railroads beginning about 1925 and extending into the 1930's.

Then there wer many other changes which are discussed below. Some of these were mentioned in an article that was published this year of 1978, "My Father's Farm," see pages 778-780. This article presents some of the changes that have taken place for better or worse. I believe some for the worse as I think that the farmers are mining the Midwest.

It is very difficult to draw an accurate picture of Farm Life say in 1910 or in the middle of the period under discussion as it varied so much from family to family. What I am writing covers what I witnessed and took part in but there were great differences between Families in a single neighborhood. Changes were going on in all the homes and on all the farms continously. For example two of our close neighbors purchased automobiles before we did simply because the men were young enough to learn to drive while my Father never learned to drive an automobile and my youngest brother and I were too young and my older brothers had left home. But I learned to drive when I was 14 and one of my brothers purchased a car at that time and my Father purchased one a year later but he neven learned to drive.

So it went!

It is necesaary to discuss the Neighborhood in which I lived before I can go into details of our early life. This is necessary to "set the stage." An article in "Rolling Stone" as condenced in the "Literary Digest" for 26 July 1977 is presented on

pages 778 - 780. This represents the philosophyof the early Farmers as well as anything that I could write. My Father, my Uncles, and my Mother's Father all had the philosoply that it was necessary to continously "build up" the land or make it more productive. This we tried to do.

In our neighborhood there were Scotch-Irish, English, and German farmers. All these had respect for the land, especially the Scotch-Irish. Most tried to build up the productivity of the farms. Also, in our neighborhood, as in others at the time, the Farmers changed work during threshing. Also neighbors could be asked to help when needed in hay baling, etc, and, especially when something went wrong, as mentioned earlier. If a high wind blew a heavy barn door off, a neighbor could be asked for help replace it with only a "Thank you" when it was done. But, if you asked a neighbor for help, you were expected to help someone, either him or another neighbor, in turn. While the amount of grain raised by farmers varied, all helped in threshing without thought of extra payment by the farmer with the largest crop. On the other hand the farmer with the largest farm was expected to make his river bottoms, for example, available for fishing, swimming, etc without a "Thank you."

The children all went to the same District School. They played together and hung "May Baskets" on one another.

While there was never a typical day for a Farmer, all had to feed and take care of their stock of horses, cattle, and hogs. The morning chores consisted of feeding the horses and cattle, cleaning the stables, feeding the pigs, milking the cows, and taking care of the milk. These same operations were repeated in the evening except bedding for the stock had to be provided in the evening.

So I will try to describe the work on a typical farm which raised diversified crops.

Our farm consisted of 80 acres or one half of one quarter of a square mile Section in Southeast Michigan. The farm was located about three miles by road southeast of Tecumseh, Michigan. This was on the northern edge of the Midwest Corn Belt. The farm had been cleared of timber many years before I was born. All the stumps were rotted. There was a pond of perhaps an acre that was not plowed in one place, see page 784.

The land had been glaciated and consisted of Glacial Till which consisted of varying amounts of clay, sand, sandy loam, and gravel. Most of the farm was a sandy loam with some clay or a

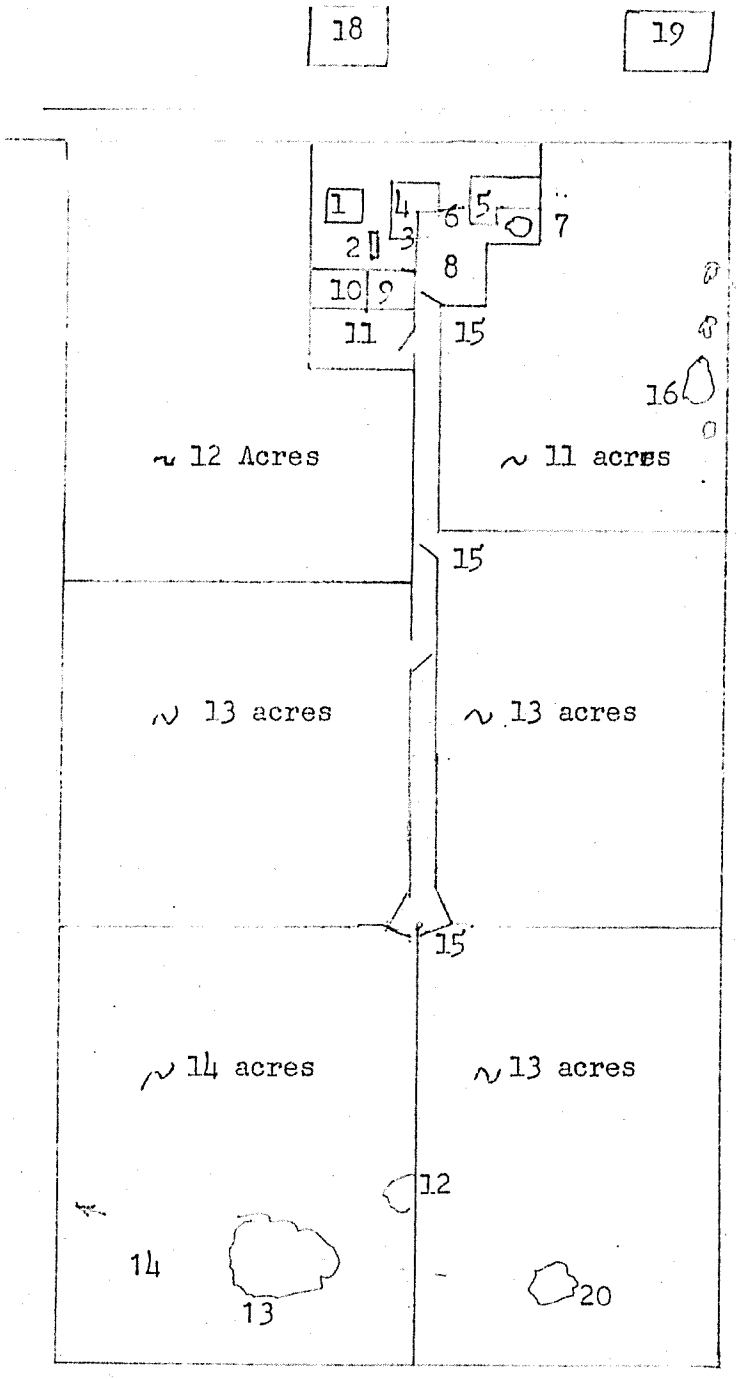
dark grey soil. But there was an area of near muck, another samall area of red clay, large areas of sanddy soil, and one area of near pure gravel. At one place there was a depression which normally contained some water. The south end of the sotuhern field was made up of considerable gravel . Around the pond there were many cocalled field stones, some quite large. These field stones were presumably brought in by the last glacier and simply dumped as the glacier retreated. The stones varied in size from small stones of negligible size to a few as large as 5 ft diam by 7 ft long. The materials were mostly granite. Some other rock minerals including considerable sandstone were mixed in.

It is interesting to note that about 1905 a second mill and flour mill was built on the Raisin River about two miles south of the older mill near Tecumseh. This new mill was powered by a drop in water level of about 8 ft created by a dam. While this dam was mainly dirt and gravel, the waste wear or portion of the dam over which flood water glowed, sometimes at considerable depths, was made of lumber that carried the water about 12 ft from the top of the dam and the water dropped about four feet on to stones about two feet diameter - all from my Father's farm. There must have been many wagon loads of stones most of which were 18 to 24 inches diameter. They were hauled about two miles from our farm.

But when I was young there were many more stones to be removed from the fields, especially in the area near the pond. Each time this field was plowed, we would go over the area and pick up those stones brought to the surface by "frost heave." This act consisted of using what we called a "stone boat" hauled by a team of horses. The stone boat consisted of two 4 x 6 inch runners about 8 ft long; on these were spiked 2 in. thick cross planks bo give a "boat" or platform 4 x 6 feet. There were no wheels. The boat was hauled by means of a log chain attached to the frone cross plank and pulled by a team of horses.

The boat was simply hauled next to a large stone, the stone rolled on to the boat by hand, and smaller stones added to make a load. This was hauled to the side of the field and the stones rolled or thrown into a pile, see 12 on page 784. This pile, when I left home, was about 8 ft high, 12 ft wide, and 25 ft long when I left home. About 1/4 had been contributed by me.

In a few cases stones too large to roll on the boab were broken by a heavy maul. Also some stones were too large to break with a maul. In this case a trench was dug around the stone to below the bottom of the stone and a few inches under it. A fire of brush wood was then built around the stone and kept burning.



1. House
2. Corncrib
3. Horse barn and hog pen
4. Grainery
5. Cornstalks and hay storage*
6. Cow barn
7. Strawstack
8. Barnyard
9. Peach orchard
10. Garden
11. Apple orchard
12. Stone pile
13. Pond
14. Tiled drain
15. Gates
16. Hickory nut trees
17. Gravel road
18. Kennedy home, later my Brother Raynor's home
19. Wellever and Gatt home, later my Brother Elliott's home
20. Gravel pit

* This barn was about 70 ft long by 40 ft wide

Henry McLain Farm

After a day or so the stone would be heated enough that the thermal strains plus striking with a maul would break large pieces off the stone. In this way even a stone about 6 ft diameter by 8 ft long was broken up and hauled off the field. But most stones that were "burned" were smaller, perhaps 2 to 3 feet diameter.

My Father found many arrowheads in this pond area and even I found one large perfect arrowhead hear the pond. Apparently game such as deer had come here for water and the Indians came to hunt the deer and other game and also to get water.

Working the Land

Today, one may see a large tractor with several plows or heavy disks moving swiftly across a field. That was not the case when I was a boy. Work was done by horse power, literally, as most work was done by horses pulling plows, rollers, drags, cultivators, mowers, wagons, etc.

First, let me return to earlier times and start with the land as our Forefathers "took up the land" from the Government. Actually, perhaps we should discuss the area as the Indians found it.

The "natural state" of the land in the Midwest was one of a forest of large trees mostly oak and maple, or the climax mixed deciduous forest as mentioned previously. Between these large trees were many varieties of other trees, perhaps nearly 100 different varieties. One winter we cut some 25 different varieties of trees in one small area. Due to the shade of the larger trees and occasional "forest fires" there was relative little under brush although there were scattered small trees among the "climax forest" trees.

The Indians changed this forest only a little. Probably fires were started occasionally by the Indians and they did collect and use considerable amounts of the dead limbs and trees for fuel. And in small areas they raised corn and vegetables as noted above. But the effects the Indians with their low population and their stone axis were small.

But, when the White man came in and cleared the land by killing and burning all the trees on the upland, the effects were great. The Indians apparently always camped near water, a pond or a stream. But the cleared land of the White man was rapidly washed after plowing, hills became eroded etc. But in Southeast Michigan the land was quite flat and washing was small even after the White farmers began to plow and work it.

When I was in High School, we ditched the low area and drained it for farming, see 14 on page 784. The ditching consisted of digging by hand a ditch some 800 feet or so. We hired professional ditch diggers to do this. This ditch was only about 3 ft deep except at the West edge of the pond where the land was higher and the ditch was about 7 ft deep. A line of 5 in. diam tile were laid under the pond and thence to lower ground to the West. These tile drained the pond and swamp and the land became a part of the field.

The operations in working the fields consisted of plowing, rolling, dragging, and planting. The plowing was done in the conventional way of "turning" over the soil and burying the grass, weeds, corn stalks, wheat stubble, manure, etc. The plowing that we did was done by a socalled walking plow. This plow consisted of a tapered moldboard that raised and turned the dirt over. The cutting edge at the bottom was renewable as it received rapid wear. This was known as the plow point. It was made of cast iron with a machined cutting surface. The point could be sharpened by chipping the frone edge with a hammer. Ghe plow would cut and turn dirt about 8 inches deep and 16 inches wide. It was guided by a man walking in the furrow just cut by the plow and it was drawn by three horses. One of the horses walked in the furrow previously cut and into which the plow was turning the soil.

Obviously, plowing was hard work for the team and it was necessary to rest the team a few minutes after each round trip the length of the field. So to plow a 12 to 15 acre field about a full week was required. This was hard work for both the horses and man. Some farmers had plows equipped with wheels on which the farmer could ride. But these did a poorer job as the walking plow could be guided easily and it made a smooth field.

After plowing the fields were usually, but not always, rolled to smooth the ridges left by plowing. There were three kinds of rollers in use. The first consisted of two logs, each about four feet long, through which a hole had been drilled lengthwise for a rod that was simply attached to a frame for the man to ride on and the team to haul the logs. In the second type the logs were replaced by two steel rollers about two feet diameter and four feet long. This is the type we had. In the third type, the rollers were made of one inch diameter steel bars set about one inch apart on the outside of frames that made large rolls about like the solid steel covered bars mentioned above. The latter type tended to break up lumps of dirt better than the others. All three types tended to flatten the land and break up chunks of dirt.

We usually had to go over the back fields or our farm after plowing and pick up the larger stones - that is anything over a couple of inches diameter. Rolling the field was not very hard on the horses as the load was comparative light and even though the ground was rough pulling the roller required little energy and the team of two horses seemed to rather enjoy it compared to the plow.

Following the rolling the field was "dragged." There were two kinds of drags. First was what we called a "spring tooth." This was made of four rows of spring teeth about 18 inches long which dug into the soil from 4 to 6 inches. These teeth were about 1.75 inches wide. They had enough "spring" that they would bend enough to clear any obstacle such as a large stone or old stump without breaking. The springtooth did an excellent job of breaking up and airating the soil. The springtooth was made in two sections, each about 4 ft wide. Then sometimes we dragged the fields with a toothed drag which simply had steel teeth that were held vertical and broke the surface to a depth of only two or three inches. The load on the two or three horses was not great.

After plowing, rolling, and dragging, the fields were planted with corn or oats in the Spring or wheat in the Fall. In other words the procedures for preparing the land were the same for corn, oats, and wheat. There were two differences in that most of the manure was used on the corn fields in the Spring. This happened because the corn was planted later than the oats and there was more time to haul the manure to the fields before plowing for corn. The second difference was that sometimes the farmer wished to plant wheat directly follwoing the corn and this met that there was too little time to remove the corn from the field before the wheat was planted. The farmers got around this difficulty as follows.

Ordinarily corn was cut by two procedures - hand and machine. In cutting corn by hand the farmer would first bend over two hills of corn consisting of some three or four stalks each at the point at which he wished to have the shock of corn. The two hills would be twisted together to form an arch which had a small amount of support. He would then cut eight hills of corn by walking away from the shock area as he cut four hills of corn and walk back while cutting four more hills of corn. This gave him an armload. This would be leaned against the arch formed by the two hills. He would then repeat the operation and place a second load on the opposite side of the two hills-arch. This would give a small shock which would be bound with a single stalk of corn. Then the rest of the corn necessary to form the full shock would be cut and stood against the small shock. After this was completed a rope would be used to pull the corn together for tieing with a string.

Let me turn back and present more details about corn. I have mentioned preparing the soil for corn above. But it is necessary to return to the subject of care of the corn as corn must be given great care until the plants are several inches tall. It is not like the grasses of wheat, oats, etc. So I must go back and discuss preparing the fields for the corn.

Ordinarily, the cow and horse droppings as mixed with straw and corn stalks were cleaned from the barns daily and thrown out in the barn yards. In the spring these yards were cleaned by loading the partially rotted manures on a wagon and hauling to the corn field. This was a hard smelly job. The manure was loaded on to a wagon by means of forks. Once the wagon was loaded, it was hauled to the field and unloaded in piles about three feet diamter by two feet high by means of a hooked fork. Then the manure in the piles was spread by a fork and each fork load broken by shaking and throwing so that the manure was spread quite evenly over the ground. Later plowing buried the manure. Some Farmers had manure spreaders which were equipped with blades to spread the manure over the field. The blades were driven by chains from sprochets attached to the wheels. These sprockets also drove chains that moved the manure to the rear by means of boards in the box of the spreader.

Usually the manure was used on the corn fields because corn was planted later in the spring than oats or barley and because the corn was the most valuable crop as it was one of the important foods for the cattle and hogs and brought the farmers their largest incomes.

It was necessary to cultivate the corn for a month or six weeks to break up the soil to retain moisture and kill weeds by burying them until the corn obtained a height of 6 to 8 inches. But it was usual to cultivate the corn until it was 18 to 24 inches tall. By that time it would shade the ground somewhat and inhibit weed growth by the shade and also by water removal from the ground. The corn would be deep enough rooted so that weeds would not seriously harm it.

When the corn was about two feet tall, growth was rapid and no further work was required until it was cut in the Fall. But many farmers, including my Father, believed that the few weeds growing in the cornfield, which had not been killed by the last cultivating were harmful, so we sometimes went through the field in mid July, when the corn was too tall to cultivate with the normal cultivator, and pulled the larger weeds by hand.

To cut corn by hand, as mentioned on page 787, the farmer used a "cornknife." This consisted of a semicircular blade of steel

about 1/8 inch thick and one inch wide and about 15 in. long curved to about 30° and attached to a wood handle about 18 in. ong. The inside of the curve was ground to give a sharp cutting edge. The farmer would place his left arm around a hill of corn of three or four stalks and swing the blade to cut the corn stalks from 4 to 8 inches aboue the ground. He would then move to a second hill and cut it. This would be repeated for about eight hills to give an arm load of corn. This was then carried to the shock.

"Corn Binders" were also in use. These consisted of a machine drawn by two or three horses that would cut a row of corn by moving blades driven by a drive wheel turned by the movement of the binder. When about eight hills had been cut, the corn load would trip a device that tied a string around the bundle of corn, and the bundle was dropped. These bundles were then picked up by hand and used to make shocks of corn as described above.

But if the farmer wished to sow wheat in the field following the corn, the corn would be cut by walking out from the shock and cutting six or eight hills close to the ground as he walked back to the shock. This placed the rows of shocks some 50 feet apart. Nomally, as indicated, the corn was cut about 8 inches above ground but for wheat, it was cut as close to the ground as convenient or about 2 to 3 inches.

Immediately following the cutting of the corn the land between the rows of corn would be dragged and planted to wheat with a regular wheat drill. The space in the rows of shocks between the shocks would be worked during the fitting by cross dragging. Then this space would be planted by broadcasting by hand a couple of handfulls of wheat between the shocks. This was then buried by cross dragging. After the wheat was up a couple of inches and the ground frozen hard in the early winter, the farmer would remove the corn shocks by loading on to a wagon drawn by two horses. This did not hurt the wheat as it was planted so that it came up or grew in shallow furrows which were not broken by the horses.

But the normal procedure for winter wheat planting on a plowed and dragged field in the fall and for oats and barley in the spring as well as the bulk of the fall wheat planting was done with a "drill" as described below. The drill consisted of two wood bins about 8 inches wide and 16 inches deep with doors on top and openings in the bottom for dispersal of the grain and fertilizer carried in the wood bins. This box was mounted on two wheels and kept in the upright operating position by a tongue or timber attached to the main part of the drill and passed between the horses and attached to the horses' collars.

This was done by a cross yoke and straps. Across the space between the horses was the usual neckyoke and they were attached to the usual whiffeltree by the tugs etc. by attachment of the harness tugs to the singletrees. Thus the tongue held the drill in upright position.

The two boxes mentioned above were equipped with small feeders also operated by the turning of the wheels that fed the grain and fertilizer to tubes that carried the grain and fertilizer to shoes where they were discharged about two inches below ground level. There were about 20 of these grain tubes. The amounts of fertilizer and grain could be adjsted readily by movement of slides that changed the sizes of the discharge holes.

A word may be useful about the seed used. Ordinarily each farmer sowed the seed that he saved from his own field the previous year. This meant that there was no upgrading of the wheat. So ocasionally the farmer would buy new seed from a regular seed development company. The fertilizer was of course purchased. The fertilizer used included potash, phosphate, and fixed nitrogen.

It should be noted again that the Midwest Farmer during the period in which I grrew up grew much of the food for the livestock and horses and also for his Family's needs. The Pioneers had been quite independent in many respects and their outside purchases were relatively few. But during the time I grew up, there were many additional outside purchases but not as many as today in which the Farmer is now a specialist. Many Farmers grow only one or two drops, have a garden, and some fruit, and buy most of their supplies both for the farm and for the house.

The Farm Crops

I have mentioned several crops and the rotation of the crops. Here, I intend to go into more detail concerning the crops and how they were raised, harvested, and utilized.

The procedures followed when I was a boy could result in maintenance of the fertility of the soils. In fact my Father had respect for the land and attempted to build up the fertility. Other farmers were less careful of the fertility, see pages 778-780. As an example, we seldom sold hay or straw as we believed that these should be returned to the soils. And we purchased considerable amounts of artificial fertilizer containing nitrogen, phosphate, and potash. Some neighbors did sell hay and used

limited anounts, if any, of purchased fertilizers. As a result the productivity of our farm visibly increased over a few years while that of both of our closest neighbors visibly decreased.

The actual farm practices have changed in the American Midwest very rapidly. This has been due to a number of investions and increases in the Farmers' motive power - from oxen to horses to motor driven tractors. Some of these investions are discussed here.

The people that came to America came from several Countries. As neighbors, they exhibited different procedures for doing work. While this has not been emphasized by Historians, I believe it was very important as it led to discussions about how things were being done and why the procedures were being followed. This is the road to invention and change.

There wer many needs and opportunities for new inventions. The Long Rifle has been mentioned. But there were other needs or perhaps opportunities is the better word. The wider fields of the Midwest invited inventions of tools and procedures that would permit Farming on a larger scale. At a later date this was true of the Plains further west.

What effects the "Black Death" and other diseases, autocratic rule, and high taxes, had on the wishes of people to imigrate to Aerica is not known. But in Europe there was a general avakening of culture and invention. So the poeple migrated to America because of interest in the Country and their expected imroved prospects. Some part of the migrations to America may have been due to over populations in Scotland and Ireland and later in Italy. Of course, the potato famine was important in Ireland. The Indians reacted on the newcomers as both were curious as to how the others lived. This raises another question that I have often wondered about. Why did the population in Europe increase so rapidly after the discovery of America? Was it due to the importation into Europe of the potato and corn and what was the effect of quinine and gold?

The Eastern Seaboard and the Midwest invited investions as the areas that could be farmed were larger and more productive than some others and could be farmed if tools were available. This led to a whole series of inventions. So, it was not just a

coincidence that many inventions were made in the United States, it became a part of the culture. This led to many things: Africulture and Mechanical Celleges; the need for inventions of such devices as the mechanical reaper, the corn planter, the steam driven grains separator or grain thresher, etc. While the railroad was invented by Trevithik in Germany, it quickly developed after introduction into the United States. Thomas Edison lived in an age as a boy when inventions were being talked about. One of his first, an automatic telegraph repeater, that told his supervisor in Toledo that he was "on the job" as a telegraph operator in Lenawee Junction while he slept peaceably, was an investion in the spirit of the times. He was lucky to be fired before a severe accident occurred and many people killed. Incidentally, when he made this invention, he was the telegraph operator at Lenawee Junction, Michigan, a few miles from where I grew up.

So farming in the Midwest changed very rapidly between 1880 and 1960. Before about 1880 power was supplied by oxen and horses and by water wheels. True steam locomotives and engines were used but they were not the largest fraction of the power supply. Beginning in the 1840's locomotives driven by steam and factories operated by steam became very important. Steam engines have been used only a limited amount in food production except in transportation, threshing, etc. Beginning after the Civil War steam locomotives became the basic long distant power transport source. Railroads ran everywhere in the Midwest. They provided easy transport to free markets. Further, they provided much more. They provided rapid delivery of newspapers and magazines. These in turn aroused an alertness that combined with the wealth of productive land provided an outward viewpoint on the part of the people. This outward view resulted in Lincoln's Agriculture and Mechanical Colleges and many other things.

As an example, a farm boy near Holloway, Michigan, had an idea for a "wire fence" instead of the rails and barbed wires then in use. So he developed a die for binding two cross wires together by means of a short piece of a third wire. He sold his idea to a neighbor for a few dollars. He in turn set up a wire fence company in Tecumseh and soon Tecumseh and Adrain were centers of wire fence manufacture.

Farm tools were advanced rapidly by Miwest inventors. McCormick and Ford are ust two of the names that should be remembered.

Turning now to the Midwest Farmers. After clearing the land of trees it was found that the soils were rich, the growing season sufficient, and rains usually frequent enough to produce excellent crops. So the Farm Families from East of the Applalation and Allegheny Mountains found rich land that was heavily forested and that the land could be easily and quickly cleared as noted. Also the Farmers found that their crops could be raised easily on quite a large scale compared to those raised in Europe or the Coastal States.

Then, many specific inventions were made in the Midwest. These include many farm tools. I do not know when the moldboard plow was invented but it was a tremendous improvement over the wood plows used previously. I have mentioned the stick plow and the wood plow. But the smooth polished iron plowpoint and moldboard resulted in less friction and there was less strain on the horses or oxen and the plowed field was uniformly plowed with most surface materials well buried. A log chain mounted properly to drag surface materials under the falling dirt was also useful.

The improvements of the drags, cultivators, and other farm tools resulted in greast increases in productivity of the Farms. These early improvements were made by many people. Then there came the inventions based on steel rather than wood and iron points. Many of these inventions were made in the Midwest. These inventions included the corn planter, improved cultivators, McCormick reapers and mowers. Then the improved corn planters and insulage cutters were invented and used. These are dis cussed somewhat below. The latest series of inventions made since 1930 are discussed in the next section.

I have described how the forests were cleared by girdling the trees, fires, and time for the stumps to rot. During this period the farm tools used must have been of the simplist kinds - spades, hoes, and hand cutters such as knives and scyths with wood hand rakes and wood forks. But by the time we are discussing inventions of iron and steel horse drawn tools were rapid.

As soon as the fields were cleared sufficiently to permit plowing the fields were plowed with the wood plows, rolled by log rollers,

dragged by wood frames with iron rod pegs, and harvesting was done by scyths and flails. These were the early tools. They are discussed here as forerunners of the tools that were used during the horse powered era. I have also discussed some of the organic fueled operated tools to present the contrasts and to keep the short stories in contrast. This means that the next large section dealing with organic fueled tools will be short.

Presumably the Indian women used digging sticks to prepare the field and chamsheels or stones attached to wood sticks to plant corn and pumpkins and for hoeing during the Summers. Harvesting was simply done by picking off the ears and carrying them back to the Indians' wood or dirt huts.

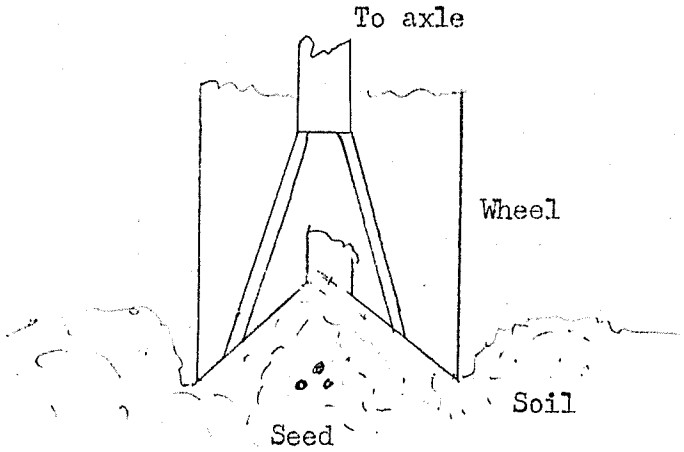
What was used for fertilizer, if anything, I do not know. The Eastern Indians were at least stated to have used fish but whether this was done in Michigan I do not know. But when I was a boy, a part of the fertilizer used on the corn fields was cow and horse and pig manure. The corn fields were covered with this manure and it was plowed under and the fields were worked with horse drawn tools. The planting of the corn was mentioned but not described except that the Indian women sowed the corn by a crude hoe.

The whitemen had hand tools and a horse drawn planter when I was young. The hand corn planter consisted of a frame and handle about 3 feet long. There was a handle on top, a box that could carry about a quart of shelled seed corn and a feed device that was rotated by a foot petal that dropped the corn from the box into the ground, three or four kernels at a time.

So the farmer would walk back and forth across the field and every three to four feet he would jab this devise in the ground,push it forwark and the tip would open and a few kernels of corn would be dropped into the ground. As he moved forward, he would step on the hill, thus closing the hole and covering the corn.

By the time I was a boy we had a "corn planter." This consisted of a frame drawn by two horses. There were two wheels. Just ahead of the wheels were cutters which cut through the soil leaving a slit about one inch wide. The cutter was hollow at the back and open at the bottom. But the wheels were wide and angular with open spaces between two steel half wheels that forced dirt over the corn as indicated in the sketch.

The corn was normally planted in "hills" of three or four seeds. This was done by plates with holes in the bottoms of the seed



boxes on the planters. These plates were rotated by the wheels and they fed individual seeds of corn to the bottom of the drills which were the cutters or tapered hoes just in front of the wheels. The corn was dropped from these plates through small gates that were opened by a wire which was stretched the length of the field. About every 3.5 feet on this wire were tabs of wire that caught a trip on the planter and opened the gates at the bottom of the cutters. Thus, every 3.5 ft, the 3 or 4 kerpels of corn could be dropped. At the end of the field the Farmer would pull the stake wo which the trip wire was attached and move it. Since there were trips on each side of the planter, the farmer would move the wire about 7 ft.

The accuracy of this sustem was great enough that the farmer could cultivate the fields crosswise as well as lengthwise. Of course the corn could be drilled without the wire and it would be spaced about every foot or so withous being in hills. But weeds would grow between the individual plants.

The corn required about one week after sowing to sprout and "come up" or grow enough to break the surface of the ground. Sometimes we would drag the field with the spike tooth drag just as the corn was breaking through the ground. This did not appear to hurt the corn but it did kill the small weeds and it broke up the surface of the ground if it had become hard due to rain and it retained more moisture.

Today the farmers plant the corn rows close together and not in hills as the tractors can operate higher off the ground. The rows of corn are close together as space for the tractor tires only is required for cultivators while previously it was necessary to have the rows of corn far enough apart that horses could walk between the rows.

Soon after the corn got about three inches tall the farmers cultivated the field. This was done when my Father was a boy

by use of a single horse pulling a wood cultivator. This was support for several wrought iron teeth some eight inches long which extended below the wood frame and dug two or three inches into the soil. The device was pulled by one horse and guided by a man with two wood handles attached to the rear of the wood frame of the device. The front of the device had a small wood wheel that kept the device operating at a uniform depth. Iron or steel tipped cutters were used. Later the crude wood frame was replaced by a steel frame. On this the steel teeth were bent sufficiently forward to dig into the ground about three inches with no effort on the part of the operator. There was also an adjustment of the horizontal width or distance between the blades. Both devices would effectively break up the soil and bury the weeds in a field of young corn.

When I was a boy, the operations differed from the above. The cultivator we used was a two wheeled device with two five toothed sections spaced about six inches apart and attached to the frame so that it could be swung several inches to the right or left so it would not "cultivate out" any corn hill not in the exact line of movement. The device was drawn by two horses that walked on the sides of the row of corn being cultivated. The corn was cultivated from three to four times during its growth. For very small corn a pair of shields about 4 inches apart were bolted on the inside of the two cultivator sections. But these shields were removed when the corn was 6 inches or more high. So the cultivator theeth or small spades threw dirt along the corn and buried the roots more deeply. But as the corn grows to four or five feet tall it sends out roots from two to four inches above the ground. These would be buried and the corn would be less likely to be blown down in a storm when it had reached full growth and had a heavy ear.

By late August or early September the corn would be formed and ripe enough to be cut. This meant that the kernels of corn were formed and the stalk had died and the kernels "dented" due to the drying. The leaves would be partially dead and dry.

The corn on our farm was usually cut by hand. This has been described above. About 100 hills of 3 or 4 stalks each with attached ears would be cut and carried to the center of the area for the shock and be set up as a shock. The top of the shock would be pulled together with a rope and ring and then a piece of binder twine would be tied around the top. The idea was to tie the top just below the tassels tight enough that water from rain would drain down the outside of the shock rather than through the entire shock and thus possibly cause rotting of the corn.

I have mentioned the husking of the corn. Usually, in the Fall the corn was cut by hand, wheat sowed in one of the two fields of corn, and then the corn husked in the field by hand, the husked corn hauled to a crib, and the stalks hauled to the cow barn for later use as cattle feed. And the seed corn hung in the attic.

We had two corn cribs, one that held perhaps two hundred bushels and one that held about 1200 bushels. This larger crib had a central partition of boards some two inches wide and an inch apart to provide ventilation andair movement through the corn. The outside also was covered with boards 2 inches wide and 1 inch apart to provide ventilation. The outside walls were sloped outwards with height to prevent moisture entering the open slits between the boards.

As described below the corn was husked by hand for most of the time but we did use machine husking some also. This permitted selection of the seed corn when husking by hand. The large well filled out, particularly at the outer end, ears were selected. In husking these were broken off the stalk with several individual husk leaves attahced. When the husked corn was collected from the field, these ears were kept separate. What we did was to tie two of the seed ears together by the husks and hang them in the attic of the house on wires strung between the rafters. Here the corn was kept dry. In the Spring the corn was shelled by hand so the kernels near the ends could be rejected.

Today seed corn is grown by commercial growers or Farmers that raise corn for seed only. These farmers drill two types of seeds and "cross breed" by cutting the tossils off the corn plants that are being used to produce the seed. Thus, the fertilizing pollen is received by the seed plants from other plants and self pollinization is prohibited. The difficulty is that people must go through the fields and cut the individual tossils off the corn plants which are producting the seed.

The present procedures differ from the way we worked the corn fields in that they are plowed by tractors hauling several plows at higher speeds than horses walk and the tractors do not need rest. The farmers also do the fitting of the land in one step by using a roller and/of other tools behind a tractor. Seeding is done by planters that seed several rows at a time instead of the two that could be done with horses. The seed is not placed in hills or spots with three or four seeds each but in rows. The farmer cultivates several rows at once instead of a single row which we did with a two horse cultivator. Then the corn is harvested by simply pulling the ears off the corn stalks with no thought of the value of the stalks as cattle feed. In fact people including our Congressman Fithian, have just gotten a

Project for Purdue University to study conversion of farm wastes to ethanol for motor fuel. My remark is "How silly can we get?" But Brazil is supposedly spending billions of dollars on a similar project.

When I was young, many farmers used corn for silage. We did not do so. For insilage the corn is cut when it is nearly but not quite ripe. It is then chopped up and blown into silos or a concrete block vault some 30 to 35 feet high and 12 feet diameter. In the silo it partially ferments but does not rot. It can be used to feed cattle all winter.

In respect to cattle feed it is necessary to point out that cattle have four stomachs and they reguritate their food after partial digestion for further chewing. So they are able to use most of the food value not only of the corn kernels or grain but of the whole plant. Like humans they live on the bacteria that digest their food.

Our practices differed in that the corn was cut as described above for preparing a wheat field. The same procedure was followed except that the shocks were placed further apart in the rows of shocks and the rows were closer together. This permitted cutting the corn in four hills out and four hills back to cut down the walking during the cutting of the corn. The corn was husked after drying in the shock by pulling a shock down and by sitting with one's knees on the corn and husking the ears out by hand. The only tool was a sharp point about one inch long attached to a leather partial glove. Each ear would be husked out by pulling the husks off one side with the steel tool and then off the rest of the ear by clasping the remaining husks and pulling them off the ear. The ear would then be broken off the stalk and husks and thrown into a pile where the shock had stood. Usually a corn shock would be down into six bundles. After husking these bundles would be tied by strings, shocked into larger shocks of four of the unshucked corn shocks to one of the husked corn shocks. Later these shocks of corn would be hauled to the barn and the corn would be used to feed the cattle during the winter.

Each feeder bin in the cattle barn provided for two cows in that it was just long enough to take a bundle of stalks. So each night and each morning a bundle of stalks would be placed in the bin, the string cut, and the cows would proceed to eat the leaves including the remaining husks from the ears of corn and the upper part, about half the length of the stalks. This provided most of their feed. Supplements included meal, a ground mixture of corn and oats, about two quarts night and morning, and some hay which included timothy (poor in proteins) and clovers (high in proteins).

A number of items have been left out of the above discussion. First, the husked corn was thrown into piles at the center of a ring of the six bundles of stalks from each shock. It should be noted that in the fall there were rains and frequently snow but the area under each shock was protected and the ground was dry. So the husked corn was thrown into this area.

Second, every few days during the husking period the corn would be picked up and hauled to the corn cribs in the barn area. This was done by placing higher sideboards on the wagon box to a total depth of about two feet, 3 feet wide, and 12 feet long to give a box that would carry about 70 cubic feet by stacking a bit in the middle. This is about 60 bushels of corn. The corn from each shock would be picked up by hand and thrown into a bushel basket. When the basket was about two-thirds full, it would be emptied into the wagon. Since each shock provided about two bushels of ears, three partial fillings of the basket would be made. The wagon was pulled by the team of horses to near the piles of corn. At a word they would move forward and stop on command next to the next pile. Since this was light work for them, they were happy to be out in the field.

When the wagon box was filled, it would be hauled to the barn area and stopped close to the corn crib so that the corn could be shoveled from the rear of the wagon box and thrown through small doors in the side of the crib. Again, the horses would be cooperative as they knew just how far to back the wagon up when called on to do so.

The corn shoveled out at at first was on the boards at the back which were provided by placing them on the top of the regular box which was one foot high and the second box had no backboard. Thus these two 10 inch wide boards gave a starting place for shovelling. The shovel was the regular scoop shovel still in use today. Shovelling off a wagon load of corn required about 15 minutes.

The corn stalks after thoroughly drying in the field were loaded on a wagon with side racks to give a base about seven feet wide and twelve feet long. These would be pitched on to the wagon with a long handles fork by a man on the ground (normally my Father) to a person on the wagon (normally me) and they would be stacked up on the wagon in alternate rows on the sides. They overlapped enough in the middle to form a solid load. After driving to the barn they would be unloaded by a long handles fork and thrown into a bay or section of the barn.

The stacking of the corn stalks in the barn bays was really a three man. job. One man was required to pitch them off the wagon into

the bay. This was easy until the level of the stalks in the bay got over the head of the man on the wagon. Then it became hard to throw the bundles to the level of the stalks in the bay. Actually, in building the older barns the cross beams were located about 14 feet above the floors of the barns. So the man on the wagon could pitch the bundles over this beam and that was about the limit.

In all cases the man in the bay would be required to pitch the bundles to a third person or carry two bundles at a time to the place for storage. So usually a third man or boy was talked into, hired for, or more commonly told to stack the bundles away. This was done by picking up the bundles after they were pitched to him and laying them in orderly rows. While I was a boy, that was my job.

My Uncles, who lived near us, either had to do the work slowly with only one man carrying and laying the bundles in rows or hire someone to help. So, for several years I was hired by them to help on Saturdays in hauling and stacking the corn stalks in the barn. It was not too hard work as the weight of the bundles was about 30 pounds. But there were a lot of bundles.

As noted above the cattle were fed cornstalks in the winter but this was supplimented by ground corn and oat meal and some other feeds. The corn at that time was not a complete food as the protein acid, lysine, was not available in the corn. But the oats in the meal provided lysine and other protein acids as well as the corn. Further, the horses were fed clover and timothy hay. Some of this was always thrown out so the cows would pick over the manure pile and eat the clean hay that got thrown out. Then they were fed hay at noon as a supplement to the corn stalks and meal. The hay was a mixture of clover and timothy. The clover was a high mixed protein feed.

The calves were normally taken from the cows immediately or at least very soon after birth, much to the unhappiness of the cows. The calves were fed whole milk for a few days, a couple of gallons twice a day. To get them to drink, it was necessary for a few days to let them suck on a finger in the milk pail until they learned to drink. But after a few days a finger on their nose was enough to get them to drink.

Then they were fed skimmed milk plus some auxiliary feed. This varied. At times we would mix a commercial feed in the skimmed milk and at other times we would just give them skimmed milk. A few weeks after birth they would begin to eat hay. So we would give them alphafa or red clover mixed with timothy and therefore a high protein food diet. This was usually supplemented by a small amount of ground meal made from a mixture of corn and oats. With the mixed milk and feeds, they grew rapidly and were fat.

We seldom sold calves. Many farmers did so. Such calves were fed well until six or eight weeks old when they were sold as veal calves. Since veal calves are killed when they are very young, the meat is very tender and brings a high price. The true veal calf was always fed only mild until it was sold.

When my Father was a young man, from 30 to 40 years of age, he made sort of a specialty of veal calves. He would buy day old calves and feed them until six ot eight weeks old and sell them as veal calves. Sometimes he would be feeding a dozen calves.

When I was young, we usually raised our calves and fatted them for beef for sale at about two years or when they were nearly full grown. Each winter we killed one of these animals, for our own use. Since we chose the youngest heifer, the meat was excellent - almost "baby beef."

We also made pets of our animals. For example, some of the cows would come up to me whenever I was not friving them somewhere and would want their heads or necks scratched. But once my Father came into the barn through the back door and the end cow, who was actually one of the pets and wouldn't hurt anyone, had her head in the manger. He must have hit her hip as he opened the door. Anyway she was frightened and didn't recognise him; so she kicked. She caught his knee between her foot and the door post. He was a criple for a couple of weeks.

We usually kept eight cows. This meant there were six being milked all the time. Each cow was bred about 4 to 6 weeks after her calf arrived. As she was milked from the time she dropped her calf, milking would be continued for about ten months and she would be "dried up" by only partial milking

about a month before calving time. Breeding was done by leading each cow to my Uncles" farm and utilizing their bull as they had a larger farm and kept a bull.

The steers and heifers that were to be sold were kept on dry feed of cornstalks and hay in the winters and on pasture in the summers until nearly two years old. The last few months before being sold they were fattened by giving each one about two quarts of meal two times a day.

All our cattle were dehorned when they were six to eight weeks old. This was done by sawing off the very small hrons with a hack saw. This was always painful as the skin was cut and there was bleeding. But my Uncles never dehorned their cattle. As a consequence the older cows dominated the herd and frequently kept the younger cattle from the water tank for hours at a time.

We disposed of the older cows, the steers, and all but one of the heifers by selling them. This was done by driving them to Tecumseh, three miles away, on a Saturday morning. There they would be weighed and placed in a small stock yard. In the afternoon, they and others, would be loaded on railroad stock cars and shipped to Buffalo over night and Sunday to arrive in Buffalo for the Monday morning market.

Before I was eight or ten years old the cattle and hogs were sold to local buyers who would visit the farm and look over the stock and make an offer for the hogs and cattle. This meant that the farmers were at the mercy of the stock buyers. So when I was about ten, the farmers near Tecumseh organized a Farmers" Cooperative Association into which each Farmer paid $100, I think. A feed and farm equipment store was purchased in Tecumseh. Also the farmers as a group, began to ship their stock, hogs, cattle, and sheep to Buffalo. At Buffalo the stock would be sold to the slaughter houses or others by auction. Immediately the offered prices at Tecumseh rose. But most of the farmers in our neighborhood shipped to Buffalo.

Usually, three or four of the farmers on our road would agree on a shipping day for the cattle as it took four to six men to drive the cattle the three miles into town on the public

roads and herd them into the stock yard. While the cattle had been driven by children as well as adults, they had always been on the farms where they had been born. I started driving the cattle when I was eight. The cattle were easily excited by new surroundings and an excited steer can be a bit of a problem. Only the greater fear of being struck by a well directed stone will have any influence on a steer. And, if excited, a steer does not notice stones striking him.

So, to drive the cattle, four to six people would work together, usually three in front and three behind. All gates along the road would be closed and driveways would be guarded by one man as the cattle passed. But quiet talking to the cattle and keeping a good watch on them resulted in little trouble.

Once in Tecumseh the cattle would be driven up side streets. People in automobiles and trucks usually turned off or stopped. So the cattle had the right of way; or they might have taken it. And once in the stockyards the cattle were in wood fenced spaces and they quickly calmed down. After being weighed on a small acale, they were allowed to move about and were fed. That was the last we saw of them. In the afternoon a railroad car would be moved to the gate and the cattle driven by the railroad men on to the car.

The cattle we sold included two year old heifers, old cows, and young steers. As a 20 year old caw is old, they were usually sold at about that age and were replaced by two year old heifers or purchased cows.

In one case we had one of our best cows run over the gestation time and she did not drop her calf on schedule. So we shipped her to Buffalo on the basis that she could be killed for use as baloney meat. But she dropped her calf on the railroad car and was sold as a cow and calf at an excellent price.

Since we had normally seven or eight cows and the gestation period was about 11 months, we had seven or eight calves each year. These were normally raised to sell as beef cattle, for use as cows, or for own use. Since we killed one hefier each year, we normally sold five or six cattle yearly for beef. The process of selling has been described. The old cows were sold at about 10 to 12 years of age for baloney beef while the heifers and steers were normally sold as prime beef.

The killing of a beef was quite simple. It required two men for best results even though one man could do the whole job. The process consisted of leading a heifer on to the main barn floor where there was a 4 in. dimeter steel ring securely attached to the oak floor near the outside door. The rope on the heifers neck would be passed through this ring and her head pulled to the floor. A strike with a maul or the head of an axe on her forehead would kill her instantly. Then she was bled by slitting her throat, skinned, and dressed. The carcess would then be strung up by ropes on the overhead cross beams just inside the outside doors.

The dressing consisted of slitting the belly, recovering the liver and heart, and dumping the stomack, lungs, intestines, etc out of the door where the hogs ate most of it. After cooling for several hours the carcass would be slit by saving down the center of the backbone and cutting the halves into two quarters. These would be placed, one at a time, on a wheelbarrow and wheeled to the house and placed in the basement.

The skin would be sold to a feed and farmers supply store in Tecumseh.

Our use of the beef consisted of cutting the front quarters and backbone sections into roasts. The hind quarters were hung in a back storage room of the house that was not heated and the meat frozen. When desired steaks would be cut off by partial thawing and cutting the meat as needed. Thus, we had fresh beef from early December to late March.

The breast and a good part of the remainder that did not make good roasts or steaks such as the neck etc were cut into 4 or 5 pieces and thrown into brine. A small amount of sodium nitrate would be added to color the meat. This became the corn beef that we used when there was nothing better to eat. The fresh steaks and roasts lasted to early Spring while there was enough corned beef to last all summer.

All was very good eating as it would have been classed as Prime Beef in most butcher shops. One year Dad sold beef that brought the highest price for the season on the Buffalo Market. Other times the beef brought near the highest prices as it was always prime and the cattle looked in excellent condition and were clean.

Actually the corned beef excellent if you were used to the taste. As a salted meat, it would keep for months in the basement. There was enough of it along with hams, shoulders, and pork to provide all the meat the Family needed during the Summer. While we did buy fresh meat in the Summers, there was always

croned beef, smoked ham and shoulders of pork, and salt pork as well as chickens and rabbits. So we didn't starve. Just to vary the diet, a couple of times each Summer we had squab or pigeons.

The raising of hogs was an entirely different procedure than that of raising beef. While there were two products, milk and meat, with beef, there was only meat with the hogs. But the hog "meat" really resulted in various cuts of meat including fresh pork, smoked hams and shoulders, sausage, and lard. Sometimes we made "head cheese" also.

We normally kept three sows and each bore from six to ten young pigs twice annually. One or two of each litter might be killed while very young by the sow since she would sometimes lay down on one or more of the very young pigs. So we raised about 30 pigs in two batches annually. The young male pigs were cadrated at four to six weeks when they very small.

Normally we did not keep a borer but drove the sows to my Uncles' and Aunts' farm and utilized their borer as they always kept a pure bred one. Since we sold the sows after only a few years, this upgraded our stock.

The young pigs grew very rapidly and after only a couple of weeks they would eat some food. We fed the sows and young pigs a mixture of what we called swill. The swill was table and kitchen scraps simply thrown into a pail. Garbage is a more modern name except bones and cans etc were not thrown into the swill. As we canned many quarts of fruit and vegetables, all the peelings, cores, etc were utilized. Actually the chickens and pigs ate a large quantity of scraps. The swill as fed to the pigs was mixed with "meal" which was a ground mixture of corn and oats.

The pigs had the run of the orchard or pasture land. One of the difficulties with pigs is that they like to root or dig for roots and worms as well as eat grass and clover - in fact pigs and humans are a lot alike in that they will eat and grow fat on most any food.

To keep the pigs from rooting in the soil and tearing up the grass etc, it was necessary to put rings in their noses. A pig's nose is built up with a thick hard muscle - tendon material in front and at the top of his nose for rooting or tearing up the dirt. Brass rings about one half inch diameter were set in this nose part. Small pigs got along with one ring but some of the old sows required a half dozen. Of course the sows learned what was about to happen when they saw us coming with ropes and pliers. By placing a lasso over the upper jaw

and through the mouth a pig can be held since the nose and teeth are such that the rope will not slip off. But the first problem is to catch the pig. This is relatively easy as during feeding you get the pigs in a box stall or pen. It is then easy to drop the loop of rope of 1/2 inch thickness over the nose and into the mouth and quickly pull a hitch on the nose. Then, while one man holds the rope taut, usually around a post, the other inserts a ring in the nose of the pig. For small pigs this is easy but for old sows that may weigh close to 300 pounds, this requires a loop around a post and considerable effort on the part of the people. Also a sow will pull the rings out of her nose, so about every six months you have to add three or four more. She doesn't like the procedure.

The hogs were sold when they weighed from 300 to 325 pounds or so each. This was at about 6 to 8 months. Six or 8 were loaded into a wagon with side boards and hauled by a team of horses to the Decumseh market on Saturday. Here, they were weighed, loaded on stock cars, and shipped to Buffalo for sale on Monday.

Pigs are gregarious animals but they do not welcome outsiders. For example, two sows that have been raised together will kill a strang sow placed in their pen with them. They will run the new sow and fight it until it dies of exhaustion. In open forest a strange sow would be driven away. Pigs are den animals and do not wander much from home but a fence is simply a challenge.

To limit cross breeding my Uncles purchased a new or young borer from outside every few years. As pigs were short lived, we replaced the sows with young pigs every 10 to 12 years. The old sows were fattened and sold.

Pigs in some ways are one of the most maligned animals due to their habits. Since they have no sweat glans, as horses, cattle, and humans do, they must keep cool in hot summer days by getting into the shade and, if possible, into water. If water is not available and mud is, they will roll in the mud. As the mud will cover their bodies, they give the impression of wishing to be dirty. Actually, they will keep themselves very clean if there is opportunity to do so. Hogs will always designate one part of their den or pen as a

toilet section which they will always use. This habit probably developed since hogs are den animals in the wild.

The question of butchering or killing and dressing a hog is different from that of beef. The skin of a beef is loose and easily removed while that of a pig is firmly attached to the meat and it cannot be removed easily. Since it cannot be removed, it cannot be used to make leather as the skin of cattle, horses, and sheep and forest animals such as deer are. So the hogs are handled differently during the killing and butchering process.

First, the hog on a farm is caught, laid on its back, and its throat cut so that the jugular vein is cut. The hog is then released. It will stand up but bleeding is rapid and the hog dies in a few minutes. This contrasts with the killing of beef which is done by a blow on the forehead and bleeding is carried out later.

Second, the hair must be removed. This is done by "scalding" the whole hog immediately after killing. This is done in a tank of near boiling water. This in turn requires discussion. To get enough boiling water to scald a 250 to 300 pound hog, it is necessary to have a tank that holds at least a half barrel or so, perhaps 40 to 50 gallons. Such a volume of hot water could be prepared on a cook stove. But we had a special stove and tank for it which was set up near the point at which the hogs were hung for butchering.

This water heater or stove consisted of a thin circular steel firebox with a door and a short smoke stack. The box was about 4 feet diameter and 3 feet high. A cast iron tank that held about 50 gallons of water was placed in the top of this circular firebox. A fire would be built with wood and kept burning for five or six hours before butchering time. That meant an early morning start of the fire. Then about nine or ten o'clock in the morning the real work would start.

As mentioned the pif was killed by bleeding. It would then be hauled to near the hot water tank. About five pails of the hot water were placed in a barrel set at a 30 degree angle to the horizontal and the pig was pushed into the hot water. After swishing about for a couple of minutes, the pig would be pulled out and reversed lengthwise and swished in the water for a couple of minutes. This was hard work even for two men to handle a 300 pound pig.

After this hot water treatment, the hog would be hauled on to a platform - actually wood planks on a sleigh were used - and scraped. The scraping was done with a very dull knife or a specail circular tool. This scraping removed the loosened hair and all the dirt etc on the skin. After this was done the skin would be washed.

The hog was then ready to be hung. Prior to butchering a pole or trunk of a tree about six inches diameter by 30 feet long would have been stripped of its bark. This pole would have been hung up on cross poles at a height of about six feet above the ground. The hog was hung by cutting slits above its hind feet back of the main foot tendons and putting a pole through the hole behind the tendons and hanging the pig from the large pole nose down. Then the belly of the pig would be slit, the heart and liver removed for use, and the rest caught in a pail and discarded.

The hogs were aloowed to hang for several hours for the meat to cool. They were then lowered one at a time and carried to the cellar of the house. This concluded the butchering as such. Sometimes, the carcesses were cut in two by cutting off the heads and sawing the rest of thecarcass down the middle of the backbone. The first evening or the day of the butchering, we had liver for dinner - which I didn't and don't like.

The next day the carcasses would be cut up. This was done by sawing the backbone, if it had not been done before the carcasses were taken down, cutting out the hams and shoulders, and cutting the sides pieces into strips. The hams and shoulders and the side pork that was not to be cut into sausage and lard meat were put into ceramic crosks with a partially saturated aalt solution. A part of the side meat would be put int small crocks and salted for later use as "salt pork." Only the leanest parts of the side meat would be saved. The rest would be cut up into lard and sausage. The scraps of muscle and fat were ground and made into sausage. This was placed in pans and cut out as slices for frying as needed. A few times we did make sausage links. To do this the upper part of the intestines were removed and cleaned. Then the lining was removed and the rest used by pushing the suasage into the casing with a special press.

Other trimmings and much of the side meat would be cut up by stripping out the muscle or lean. This was mixed with the trimmings and ground into sausage. The fat would be stripped off and along with the inside fat or leaf lard around the kidneys it would be cut up into pieces less than an inch in cubes and "tried out" by heating enough that the fat would melt and separate from the connective tissue in the fat. Part of the lard, about 50 pounds, would be kept for our own use and the rest sold to local grocery stores.

The tenderloin or muscle next to the backbone was removed rather than to make porkchops. This would be cut up and fried just as pork chops are. But the backbone and some meat would be cut into roasts which did not have much meat but were tasty.

Chickens and eggs were also sold. The chickens were sold by placing about a dozen in a box or crate and selling them to local dealers in Tecumseh. Eggs were placed in the regular 30 dozen crates and were either sold at the door to men that picked up eggs for a living or to the grogercy stores in Tecumseh.

When I was young, in the mixed economy of the farms, the eggs and cream or butter sales were expected to run the household and cover outside food, gasoline, clothing, etc purchases while the sale of the stock of hogs and cattle were expected to pay taxes, morgage, if any, send the children to college, and pay for any automobile. Actually, this was not quite the case. But sales of wheat and hay added to the economy.

As an aside, I have mentioned that my Uncles and Aunts helped my parents in respect to use of stock breeding and wood for fuel. When my Father married, his mother stated that, since he would not have a direct use of the Farm, that he could use it for cutting wood, fishing, and stock breeding as long as he lived. My Uncles and Aunts always very willingly complied with her wishes. Also they traded work most of the time during the harvest seasons. Actually, when my Uncles and Aunts died, the estate was left to the five Grandchildren, my cousin Elmer, my three brothers and I. It becme the basis for some Corporation stock that we owned at one time.

Turning back to the crops, I have mentioned oats, barley, and wheat. On page 789 I mentioned the design of the drill used for planting wheat. While corn was the most important crop, wheat was a cash crop and oats and barley were important as was the hay.

Wheat and sometimes small amounts of hay were sold. Otherwise, our income came from cream and eggs with some supplements from fruit, vegetables, and occational sale of chickens, etc.

The oats and barley were normally planted following corn. We usually sowed a full field of oats and about a half field of barley. This meant that about 13 acres of oats and 6 to 7 acres of barley were sowed, see page 784. The oats and barley were planted as discussed for wheat on page 790 except no fertilizer was used.

We also raised hay as mentioned previously. But we sowed the seed differently. Clover seeds and especially timothy seeds are very small. A bushel of clover or alphafa and a half bushel of timothy will seed a 10 acre field. The seed should be buried but only to a half inch or so for best results. Also the small plants need protection. All these conditions occurred for a few days usually in February or March.

While we had frost depths of up to 16 inches of soil, there were warm days in February or March that melted the snow and thawed the ground to a depth of one inch or so. If this happened, freezing at night would freeze the ground but there would be a maze of small cracks due to the expansion of the surface on freezing. In the morning these would be frozen hard so that a person could walk over the field. That was clover and timothy planting day!

The planter consisted of a very light wheelbarrow with a spoked wheel about thirty inches in diameter. Across the wheelbarrow was a feed box or seed box 16 feet long and 4 inches square. On the bottom of this box every four inches were half inch diameter holes into a tube the length of the feeder. One half inch diameter holes were cut from this tube through the bottom and a rope passed between the holes and through the tube. This rope was moved back and forth by two wood boards about 3/4 by 1.5 inches that were hit by the spokes of the wheel. The rope was moved a half inch or so back and forth and this moved seed from the holes to the box to those open to the ground. By adjusting the distance the wheel spokes moved the rope, the farmer could adjust the amount of seed per acre. Usually one to two bushels of mixed red clover, alsike, and timothy would be spread over a ten acre field.

In actual practice the farmer would wheel this device over a field in early morning in February, preferably on a sunny day. The seed would almost entirely bounce or be blown into the small cracks in the frozen field. The first melting of the surface which would usually occur the day of sowing would

cover the seed to the proper depth. All very clever!

As the winter wheat grew in the Spring, it protected the young clover and timothy seedlings. By June when the wheat was cut, the clover and timothy would be several inches high. The wheat would be cut with about four inches of stubble and this would continue to protect the young clover and timothy. By Fall these would be strong well rooted plants. During the winter would break down and largely rot. The next Spring the mixed clover and timothy grew rapidly. By mid June the clover would be thick and matted about 16 inches tall and in bloom and the timothy would have grown to a height of four feet or so.

We never planted rye; but those farmers that did handles the same as we handled wheat as it was planted in the Fall, harvested in June, and threshed along with the wheat in July or August.

I have mentioned oats and barley. These were planted in the Spring as early as all danger of frost was over or Mid April. The seed beds were prepared by plowing, rolling, and dragging as discussed for corn. The seeds were planted using the same procedures followed for wheat except the fertilizer was omitted. Both the oats and barley grew rapidly and were harvested as described below for wheat. While the wheat was cut in late June or early July, the barley and oats were cut later in July. We never grew rye. Oats produced 50 to 60 bushels to the acre and wheat and barley 40 to 50 bushels to the acre, usually but not always as sometimes rain would be scarce and yields less. Corn produced 120 to 140 bushels of ears or about 2/3 of this of shelled corn to the acre.

In order to follow the summer's work it is necessary to turn to the subject of haying. After cutting the hay we sometimes pastured the fields and sometimes allowed the clover to grow again (the procedures used in haying are discussed below.) Timothy is self pollenizing by transfer of pollen by the winds. To the best of my memory we never cut timothy and threshed it for seed. But clover is a different type of plant as the blossoms are polonized by transfer of the pollen by bumblebees. Honey bees collect alsike clover and pollenize the plant but they cannot do so with red clover.

The first clover crop, however, blossoms in June before there are many bumblebees in Michigan since they are killed by the cold winters. But the wueens hatch out in the Spring and build nests so that by July bumblebees would be plentiful and the second crop of red clover would be polonized. So some years, following haying, the clover would be allowed to grow and form seed. If this was done, the clover would be cut in

September and threshed. We usually got from one to two bushels of seed per acre. This was so valuable that it was stored in the house.

So far as I remember we never cut timothy or alfalfa for seed. Alfalfa was planted precisely like clover. But it differs from clover in that it can be cut each season two or three times for hay. Usually, the second and especially the third crop is smaller that the first crop. It, too, was cut just as it broke into bloom or when the plants had full growth and not too much cellulose had developed in the plants. Usually, the sedond and third crops were smaller than the first one.

The procedures used in haying today differ from the ones we used. In early times, up to about 1850, hay was cut by a scyth, or even earlier, by a hand clipper. The earliest cutters probably were wood strips into which chips of stone had been set. But, later, steel blades set in handles were used. I have seen Mexicans cutting hay by such cutters. To cut hay with this tool you rest on your knees as you swing the cutter and move forward several inches with each swing.

The next improvement was the use of the scyth. This consisted of a wood pole about two inches diameter and six feet long, bent a bit for convenience, and equipped with handles. This was called a snath. To one end of the snath was attached a blade about 33 inches long. The blade was thin steel about two inches wide. By swinging the scyth a circular strip of hay about 6 in. wide and 6 ft long can be cut. The person swinging the scythe steps forward with each swing. The scythe will also pile the hay as it is cut into a strip at the left of the mower or man swinging the schthe.

Scythes were still used when I was a boy for opening up grain fields by cutting a small patch at the gate for entry of the team and binder and for cutting grass and weeds.

But to cut a ten acre field of hay or wheat with a scythe is quite a job. So few fields that large were planted until improved cutters were available. For grain cutting the scythe was fitted with a wood frame with 4 or 5 thin wood rods that carried the grain to the end of the each swing and left it in a pile. Cradling as it was called, was used in the country until nearly 1900 and it is used in Asia and South America until today. After cradling the wheat or oats were bound into sheaves about 10 in. diameter by use two handfuls of grain twisted together. The sheaves were then shocked or stood in groups of about 10 sheaves and two sheaves were bent and placed on top to shed the rain.

I have discussed corn planting, its harvesting, and threshing of wheat but I have not mentioned the raising of oats and barley nor the harvesting of hay. So turning to the harvesting of the hay, it was cut when I was a boy with a tool called a mower. This device was a great improvement over the scythe. It consisted of a two wheeled machine with a tongue and whefftletree for use with two horses. The tool was made mostly from alleable cast iron. The frame consisted of a casting through which the axle drove a gear which in turn drove a 90^{o} shaft; this in turn was fitted with a small wheel to which was attached an eccentric at one end that drove a horizontal bar. This horizontal bar, in turn, drove a cutter about five feet long made of steel to which was attached three-cornered knives about three inches long and three inches wide at the back and tapered to a point at the front. These were moved rapidly back and forth through the slots in one inch diameter rods about six inches long, tapered in the front and attached to a heavy bar on the tool. These slots on these points were lined on the bottom with steel cutting edges that were held in contact with the sharp knives on the cutting bar. Thùs, a clover or timothy stem that entered this slot was cut off. The hay as cut fell to the rear of the cutting bar. The height of this cutter bar was adjustable. The driver rode on a seat of the device.

One of the troubles with this mower was that the knives on the cutting bar had to be sharpened frequently. This was done by grinding them on a sandstone grindstone turned by a boy, sometimes me. The old sandstone grinders were not fast cutters of the steel blades; so the sharpening took nearly an hour of continuous grinding. This had to be done after cutting about ten acres of hat or twice to three times each haying season. About the time I entered high school, we bought a small carborundum grinder that could be driven by the person holding the knife blade. The carborundum wheels cut the steel rapidly so the sharpening of the knives became a small job.

But a two horse McCormick mower was able to cut a five foot wide strip as fast as the horses could walk. This meant that 10 acres of hay could be cut in a day. This contrasts with cutting with a scythe in which it took many days to cut ten acres. Also in the hand tool days the hay was raked by a wooden rake. Pictures have been painted and frequently printed of these operations. While cutting had and grain by scyths and hand

tools may have been romantic, it certainly was very hard work and resulted in very low productivity. With such tools most people lived on farms at what we call a subsistence level.

After cutting, the hay was allowed to wither and dry in the sun for two days or so. By that time most of the moisture in the hay was removed by the sun and winds. It was important that the hay was not allowed to dry to the point that the leaves would break off the stems. In case of rain the hay was allowed to dry longer. If rain continued, it was sometimes necessary to go through the field and raise the hay off the ground, shake a bit, and let it down easily on the ground to permit easy air flow through the hay and foster drying. Continued rain sometimes resulted in molt on the hay but this was not common. There were tools on the market but we did not have them to perform this work by horses.

The hay was then raked by use of a team of horses and a rake consisting of about 30 heavy wire (about 7/16 inch diameter) rods which were attached to a frame which had two light steel wheels and which was pulled by two horses. The rake rods could be raised as desired to leave the hay in rows about avery 50 feet. The rows of hay were about 20 inches high and 40 inches wide.

After raking the hay was "bunched" by hand. This consisted of picking up the hay in fork fulls and placing it in bunches about 4 ft diameter by 4 feet high. This operation had to be carefully done so that the stems of the hay sloped from the center to the outside from the bottom to the top so that rain would drain to the sides and not wet down through the center of the bunch. When properly done, a heavy thunder shower would only wet the hay to a depth of a couple of inches or so and a day's sunshine would result in complete drying of the rain water. The hay was left in the field in bunches sometimes for a week or more to continue drying.

The hay was then tranferred to the barn by wagon. One man on the ground would pitch the hay on to the wagon with a long handles fork. A second man on the wagon would "load" the hay by properly laying each forkful so that a load about two feet

wider than the racks on the side of the wagon and as high as eight feet above the racks which was as high as it could be loaded and taken through the doors into the barns.

At the barns the hay was usually unloaded by mean of horse drawn hay forks. A hayfork consisted of two blades about three feet long held about two feet apart by a cross frame at the top. This fork would be pushed into the hay and, by means of a handle, each blade would be "set" by short blades near the bottoms of the long blades that could be turned into the hay by a handle on the top. These blades were about four inches long. They could be tripped or released by a half inch rope held by the man on the wagon. The hay fork itself with the load of hay or about 1/8 of a wagon load was raised by a one inch rope that was formed in a loop and hung from a small car on a steel track in the top of the barn. One or two horses would pull the rope raising the fork and its load to the top of the barn at which point the fork top would trip a latch holding the car over the wagon. This car was run on either a wood beam 4 by 4 inches or a light steel track. When tripped, it easily was pulled along the top of the barn to over the bay where the had was to be stored. The load was then tripped by the man on the wagon with a light rope and the car pulled back to over the load by the same rope. A full wagon of hay could be unloaded in six or eight forkfulls. When the hay was unloaded by hand, it meant that the man on the wagon had to pitch all the hay off a fork-ful at a time.

When the hay was dumped into the haymow, as it was called, in the barn, a man had to spread by a fork over the area for storage.

We placed each year several tons of hay in the two haymows in the larger barn and in the attic or storage area over the horse stables. There was a small space directly over the cows that had to be filled by hand. That meant that the hay had to be unloaded by a man pitching the hay through a small door by hand. Another man had to carry this hay to the back of the storage area and slowly fill the space with the hay. We usually filled this space with alfalfa for the calves.

After drying the wheat sheaves were transported by wagon to the barns and placed there until threshing took place. These procedures are discussed later.

But today all these operations have been stopped. The horses which were our source of energy for plowing, preparing the soil for crops, and harvesting have been replaced by liquid fueled tractors and the corn stalks are not recovered for cattle feed. However, the cattle are turned into the fields in many cases after the corn has been harvested and they do eat a small part of the leaves.

When I was young, many farmers cut their corn just before it was dead ripe. The whole plant, stalk, leaves, and ears were chopped up and blown into silos or tall stack like storage bins. This precess has been discontinued also. But there are many silos still left standing. The cattle are fed alfalfa hay and grains which result in a high protein diet.

The use of mechanical equipment, as noted previously, has resulted in the planting of corn that is in rows that are closer together than was possible when horses were used to cultivate the corn and thus they had to walk between the rows. This has resulted in more stalks per acre and greatly increased yields. Artificial fertilizers rather than manures are being used. While very large crops are being raised today, it is questionable whether or not the soils are retaining their productive life or are becoming less productive with time. So far this possible loss in productivity has been very small or not noticed. But over centuries it must be appreciable. This is the basis for my statement that the Midwest Farmers are mining the soils.

Turning to oats and barley, these were planted in the Spring. The seed beds were prepared by plowing, rolling, and dragging as discussed for corn. The seeds were planted using the same drill and procedures as used for wheat except that no fertilizer was used. Both the oats and barley grew rapidly and were harvested as described below for the wheat. While the wheat was cut in late June or early July, the barley and oats were cut in late July. We never greq rye. Oats produced 50 to 60 bushels to the acre and wheat and barley 30 to 50 bushels to the acre. Corn produced more as ears or up to 120 to 140 bushels to the acre and about 2/3 of this as shelled corn.

Let me turn back to earlier times and discuss how the crops were handled. The Indians, apparently, did not sow seed crops other than corn but I believe that they did collect some wild seeds. But there is no reference to this in our Families, so I will not discuss the subject.

There is a famous painting, "The Sower," which shows a woman hoeing a field and a man broadcasting grain. If you look twice at the painting, you obtain an understanding of the "life" of our "peasants." The painting shows a man throwing the seed about and the woman doing the hoeing and hard labor.

The field is about two acres. Apparently, the field was "plowed" or more properly worked by spading with a wood spade. If you have tried to spade a garden with a spade, consider for a moment doing that work with a wood spade instead of a steel spade. Now consider working the area with a wood hoe. The spreading of the seed by broadcast is very easy but the seed then must be covered with a wood rake.

The Romans used slaves in groups to pull primitive plows and probably wood drags. The seed was probably spread by broadcasting as was done in the painting. The Southern people in the United States uwed slaves to plant, cultivate, and pick cotton but I believe the plowing was done by oxen, mules, or horses. So the stories we hear of slavery in America were not as bad as the stories that could be told of Ancient times. While Galley Slaves are mentioned frequently, the Field Slaves are not discussed often. The lives of both must have been "Hell on Earth." Of course many slaves were well treated but the Galley Slaves must have lead the worst life possible.

I have mentioned the Amerindian women and their corn fields; but these were relatively small and there was no selling or trade in corn. The main foods were meat and fish with corn being less important than grain was to Rome, as there could not have been many wild animals in Italy in Roman times.

In the United States the land was very productive for a few decades after clearing, especially as most Farmers manured their fields. This compares with the use of night soil elsewhere in the World. So crops were good.

Improved Tools

The need for improved tools became apparent early in North America. But why the same "need" had not been recognized and why Americans became inventors is a problem that no one has solved. Was it the mixture of races or was it the impact of the Indian on the Whiteman? Or both? Certainly the first "settlers" in the United States began to make inventions. But why? Historians have mentioned the inventions made by Benjamin Franklyn and the long rifle, but there were many others. Perhaps the "Challenge" as some Historians including Toynbee have suggested was the cause of the inventions or was it the higher general education level of some of the farmers and business men? Was it due to the diet or to higher use of proteins including more meat by those who came to the United States?

European peasants and farmers at that time apparently had a high starch diet due to lack of meat. In comparison some Historians state that the Amerindians used fish for fertilizer. In any case they had a low population density. Apparently they did not use cornstalks for fuel but probably let them rot in the fields. They also used the fields as toilets and areas for throwing unused food etc, thus they served as fertilizers.

The white man, as noted, girtled and burned the tops of the trees. They also kept their animals in barns in the winters and probably from the earliest days, used the manure for fertilizer.

The Indian women apparently ground the corn on stones by pounding. I have not heard of the use of querns in the Midwest where I grew up. Possibly the women partially ground or cracked the corn and, after some soaking, the corn was baked or simply mixed into a gruel and cooked slowly over an open fire after further grinding. While Mexican women may have used Metakes for grinding corn, these apparently were not used by the Amerindians in the Midwest.

The Amerindians greatest problem was probably wood for cooking and heating. Historiansseem to have neglected this problem. The women must have spent an hour or two each day gathering wood and bringing it back to the huts. Whether they girtled trees to be able to obtain dry wood, I do not know. But I believe they must have done so to form corn fields.

Toynbee's Thesis that History is a series of Challenges or that Necessity is the Mother of Invention is only partially true. For example today most inventions and developments are made by professional Scientists and Engineers whose

salaries are paid to make inventions. Also today the fundamental knowledge of the structure of materials is well known as most, if not all of the fundamental Laws of Nature, are understood. So it is probable that there will be few new inventions of such importance as the steam engine, railroad locomotive, fission reactor, etc in the future. There is still the Fusion Reactor to be developed and there may be a possibility of some new source of power but this is doubtful. Utilization of fusion energy will probably be developed but the time schedule is in doubt. But there appears to be little chance of ever developing a source of energy that we do not now know of.

The Pilgrims found the Indians planting corn but the Pilgrims brought the "grass grains" wheat, barley, rye, and oats with them. So all these crops were raised. Did the difference in culture of the two types of grains awaken the Pilgrims to other considerations? At any rate the long rifle was made to fill a demand. A musket is not much use to shoot wolves or Indians. This statement is made in spite of the fact that European Wars had been fought by muskets for years. By the time my Grandfather came to Michigan there were bog iron deposits known. In the 1700's and early 1800's there were many of these deposits worked and small furnaces using charcoal and bog iron ore were in use. Further, many of these bog iron deposits were in heavliy forested areas. So charcoal was easily made from the surrounding forests. Limestone deposits were also generally available. So iron became plentiful compared to earlier times. I believe that without these bog iron ore deposits, progress in this Country would have been much slower. The story of the canals and railroads has been told without proper emphasis that it was the local iron ore deposits that were the basis for the iron and steel used to dig the canals and supply the rails for the railroads.

At any rate, especially in the 1800's, the availability of land, world markets due partially to the development of the railroads and steamships, and iron tools permitted people in the Midwest to start farming on a larger scale than used previously. But the tools that were available were mostly hand tools. Plows were made of wood with iron points, shovels, and other tools were made mostly from wood. But the availability of iron suggested iron tools and these were invented. Improved plows, drags, rollers, and corn planters were invented. Then the inventions of the 19th Century made the big step to horse drawn tools. Cattle and horses had been used to pull wood plows but these were limited in use compared with the steel moldboard plow invented by Thomas Jefferson. Even though this plow required walking behind and guiding, it was

a great improvement over the earlier plows. I learned to plow with such a plow pulled by three horses. This plow turned the soil over and buried the manures and debris. For comparison, I watched a man and woman plowing in India a few years ago. This was a poor Family. They had a horse and a cow which were pulling a stick plow. This tool was a piece of a log about three feet long, seven inches diameter at the largest section, and sharpened at the front. It was guided by handles at the back and pulled by slats nailed to the sides at the rear. These slats were attahed to the whiffletree by chains. Both the horse and cow were nearly skin and bones and the people were emaciated and terribly thin. The man was guiding the plow and the woman was beating the horse and cow. To do any kind of a job the fields had to be plowed twice, the second time across the furrows of the first time.

It should be noted, that in India, the main fuel for cooking used by these very poor people was cow dung. The cows roam the streets in some Cities such as Calcutta picking up what they can find to eat and leaving dung for use as fuels by the very poor. For example, I watched a woman collecting dung one Sunday morning in downtown Calcutta. She would get a handful and plaster it on the side of a light post. I assume that the following morning she would scrape off what she had collected the day before. But Calcutta is warm the year around and sleeping in the streets is not too uncomfortable. There was also a wagon drawn by oxen picking up corpses in the Victoria Park. Nevertheless, there are as many middle class people in Calcutta as in the United States Cities of similar size and in all of India as in all of the United States. But in the Midwest on the better farms, there has been good pasture most of the time and when it becomes very dry in August some years, the Farmers supplement the pasture with other feeds.

On the farm on which I grew up each of the roadsides probably were larger in area than the Indian farm mentioned above. The land on our farm was productive and not worn out by years of over production and lack of fertilizer and manures. Also our land had been glaciated not too many centuries ago and it contained most of the rare elements in normal quantities. The Indian Family very likely was using what manure they could collect from the horse and cow for fuel. This is common in India. Early every morning women collect the manure from wild cows in Calcutta and the cows do part of the garbage collection, as noted above.

Many inventions have been made in America. Some of these are discussed below. The moldboard plow has been mentioned. Others are described in detail in various reference books available in every library.

The various plows have consisted of the wood plow, the cast iron moldboard with separate point or cutting face, and the multiple steel plows used with tractors today. The wood plow was usually pulled by two oxen until the invention of the horse collar when horses began to be used. The wood plow would cut a furrow perhaps 10 inches wide by 6 inches deep. The cast iron iron plow was usually pulled by three horses even though two horses could pull it. This plow cut a furrow 12 to 16 inches wide and 6 to 8 inches deep. With this plow weeds and grass and manure could be completely buried; and when equipped with a drag chain long weeds 6 to 8 feet long could be completely covered. The next step was the use of the petroleum fueled tractor with two to six plows. These plows cut clean furrows and buried the debris. The tractor did not tire out and require frequent rests every quarter mile or so. So the amount of land that could be plowed per day increased from a half acre to one acre and then to several or many acres per day. Further, the effortrequired of the man lessened from one of hard work to hold the wood plow in the ground to one of relatively ease in guiding the walking horse plow to one of real ease in guiding a tractor in an air conditioned cab with canned music of his choice.

There were improvements in other devices. The roller was converted into a combination roller-drag by manufacturing some thirty rollers that packed the soil some, broke up the lumps of soil, and by thin sections at the center of the rolls acted almost as a drag. Large discs that cut the lumps and raised the soil to break it up were used. The seeders themselves were improved and used to work the soil also.

I have mentioned broadcast of seeds such as wheat, oats, and barley and described the drills and corn planters. These were just made larger and wider to plant broad strips each trip across the fields. These tools were possible only when drawn by large petroleum fueled tractors. Further the corn cultivators which were horse drawn only cultivated one or two rows at a time. The new cultivators cultivated up to 12 rows at once.

I have discussed harvesting of the corn. The grains were harvested in early times by hand cutters. I have seen persons on their knees clutch a couple of dozen speers of wheat, cut them with a curved knife and lay them down to form a bundle, this was the old way. Then when my Father was a boy, they used a cradle. This was similar to a scyth except there were 4 or 5 wood rods above the knife or blade that caught the wheat or oats and the stalks could be laid in bundles. The scyth is a wood handle about six feet long with two handles and an iron end piece to which a blade about 3 feet long is attached. By swinging it in a quarted circle a swath about six feet long and six inches wide can be cut. After cutting the bundles were bound by use of some of the grain itself into bundles about 10 inches diameter. These could be shocked into small vertical stacks with about eight bundles vertical and covered with two bundles bent and placed to cause water to run over the edges of the vertical bundles in case of rain. Pictures of such shocks are frequently shown on Calendars etc.

The next step was the indroduction of the machine cutter. This was a device which was pulled by one horse and thus moved at the rate a horse walked. A drive wheel about two feet diameter rotated by the moving vehicle drove a cutter about two feet long which was horizontal to the movement. This cutter thus cut a strip about two feet wide of grain. This grain fell on to a table. A man walking alongside raked off the grain every time there was enough to make a bundle. Later this had to be picked up and bound by hand. But it was a great improvement over the use of a schthe.

The next step was the McCormick Binder. This device was pulled by three horses. This cut a swath about six feet wide, the grain fell on to a moving canvas platform and this fed the grain stalks getween two canvas platforms which raised the grain and fed it to a binder. Originally, this device automatically dropped the bundle of grain so that it could be picked up and bound by hand. But soon a "binder" or device that wrapped a string around the grain, tied a simple knot, and cut the string was invented and attached. After tieing the bundle was dropped on to a side carrier that could carry six bundles. This carrier could be dumped at the discretion of the operator or in rows for shocking.

Grain Threshing

It is obvious that grain that is overripe can be shaken so that quite a bit of the grain is lost on the ground; so it was necessary to cut the grain when not too ripe.

After the grain was cut and stood in the shock for a couple of weeks, it could be threshed immediately or placed in barns and held until threshing was convenient. When I was young, we and my Uncles almost always placed the grain in the barn. This was done by use of a team and wagon. One man would pitch the bundles of grain on to the wagon and the man on the wagon would pick them up and lay them in overlapping rows until they had a load too high to continue loading or about seven feet above the racks of the wagon which was the maximum height for loading with a fork. The barn doors were built to provide space for such a load.

Inside the barn the unloading became a three man job just like that of handling corn stalks mentioned above. One man would pitch off the bundles from the wagon on to the bay. Since the bay was being filled up, this was usually on to wheat already laid in the bay; but soon the depth got too high for this, and they were pitched into a circular area built up in the edge of the bay. A second man in the bay or this circular area would pitch the bundles on to a third man or boy who picked them up and laid them in rows in the bay. I frequently did the latter job both at home and for my Uncles when I was a boy.

Wheat, oats, and barley were all treated alike. But sometimes we would thresh directly from the fields. This is discussed below.

The most primitive method of threshing must have been by hand in which seeds from each head were broken loose between the fingers and the chaff allowed to separate by dropping the mixed grain and chaff on to a blanket. In a mild wind the hulls were easily separated and blown away from the grain. The next method was that of the use of a flail. This was in use when my Father was a boy. This was a very ancient process. A few years ago I saw flails in use in Mexico to thresh wheat.

A flail is just what the name implies. It is simply a stick about two feet long tied by a string, usually leather, to a stick about three feet long. A sheaf of wheat, for example, is

laid down on the ground or on a wood platform and the heads of the grain such as wheat simply flailed with a flail or stick attached by a leather thong to another stick or handle. This breaks the individual kernels loose. The grain and chaff are then poured slowly in the wind to blow the chaff out of the grain.

The next step was the threshing machine. This device consisted of a feed of the grain to a rotating cylinder that has a number of three inch tall teeth or steel spikes which are rotated at high speeds between stationary rows of similar spikes. Dry grain is simply fed between the spikes and cylinder. The grain and chaff are almost instantly broken apart or separated - the whole device is known as a separator or threshing machine. Following the cylinder are screens that allow the grain to drop to a conveyor. An updraft of air is maintained through this screen and the air carries the chaff and straw on to the blower through which the air is drawn with the chaff and straw being blown or dropped from the device. In the older machines the grain was elevated and dropped into a bagger at the side of the machine. Today the grain is elevated and dropped into a box.

When I was young, these separators were hauled and operated by steam engines. These steam engines were wonders in themselves. Steam engines had been developed in England and Germany some three hundred years ago and they had been used for over one hundred years on railroads. The engine converted part of the heat of burning coal into energy for moving goods on rails. But this engine was made to move on roads; so it had large wheels. The engine consisted of a single piston about 8 in. diameter with a travel of about 14 inches. This piston was driven by steam at about 125 psi. There was a flywheel and governor. When the piston stopped on dead center, it was necessary to turn the power takeoff or belt drive wheel by hand.

The "boiler" consisted of a firebox about 3 by 4 feet with a height of about 3 feet. Coal was burned on the grate. The boiler proper was of the tube type about seven feet long and three feet diameter fitted with 2 in. diameter tubes.

The engine burned coal and it was necessary for a man and waterwagon to go along with the engine. Water was obtained

from the creek near our home and fed directly to the boiler of the engine.

But the system worked. Actually, it was a very great improvement over threshing by flails.

So threshing met watching the engine which was always belching dark coal smoke pull the separator into the yard, watch it move around and push the separator into the barn, and then watch the man place a belt between the drive on the engine and the separator pulley that drove the separators various shafts and devices. This drive belt was made of leather and heavy fabric and was about 8 inches wide. The engine had drive wheels about 6 ft high and 18 inches wide and 3 ft high front guide and turn wheels.

To operate the system there was an engineer, a mechanic to operate the threshing machine, and a man that drove a pair of horses and hauled water in a wood tank mounted on a wagon. He let me ride along a couple of times when he drove to the creek for water - the creek water was soft water and did not cause scale in the engine's boiler like the well water would do. Coal was always furnished by the Farmers. So before the threshing machine arrived, it was necessary to go to Tecumseh with the wagon and get 1000 lbs of soft coal.

With these devices we would thresh out about 400 bushels of grain a day. About a dozen men were required for the threshing in addition to the "threshing machine" crew. There were six men or so required to pitch the bundles of grain from the storage mows in the barn to the two men feeding the machine. Then there were four or five men required to carry the grain from the thresher to the grainery or storage area for the grain and to dump the grain into the bins and shovel the grain back away from the dump area. One man was required to stack the straw as it was blown from the separator through a long pipe. This was a very dusty and dirty job. The straw pipe could be moved to right or left or elevated as needed. It also could be extended and had a muzzle on the end that could be opened to permit straight exhaust or partially closed to blow the straw close to the end and this end piece could be turned to right or left; so the man on the machine that operated the blower could work with the man stacking the straw to deliver the straw where it was desired. So the total crew was 12 to 15 men.

When I was a boy, I almost always carried grain. Sometimes I worked in the grain bin, shovelling the grain back toward the back end of the bin. The men carrying the grain usually carried about 1 1/2 bushels or about 80 to 90 pounds per load. This was carried in cloth sacks.

Since the theshing machine crews were always from some distance away, we had to furnish food and beds for them. Also, at noon, we had to furnish lunch for all the men or about fifteen as one or two lived near enough that they went home for lunch. This meant that Mother with help from the neighbors and my Aunts had to cook for the men and the other people around or 15 to 18 people for lunch. This was necessary for only one or two days. The neghbors helped by bringing in pies etc and Mother helped them in return.

So, when we were small boys, we looked forward to the excitement.

Later, the Farmers in our neighborhood bought a gasoline driven tractor and a grain thresher of separator. This was a smaller unit and it did not require such a large crew for its operation but it did not do the job so quickly. With this neighborhood owned machine, we usually threshed directly from the fields as the machine was more readily available. It should be noted that when the farmers used flails, the threshing took weeks; so barns and long time storage was essential. But with the large threshing machines, storage was comparatively short. Then with the neighborhood owned machines, storage was not needed and the barns were no longer required; so they were neglected and have been torn down or not used at present. Further, the use of machines lessened the need for horses and horse barns and hay mows. And the cattle are fed in large feeding stations and not by individual farmers.

When we threshed from the fields we had five or six wagons with teams and six men on the wagons and three men on the ground pitching the bundles of grain to the men on the wagons. Otherwise things were quite similar except we did not need a water wagon or coal as we used petroleum fuels.

Nevertheless, everyone regretted to see the old steam engine and its smoke and dirt go. Most of the excitement and exchange of work and labor has disappeared. The glamor has gone!

1930 - ------, Fossil or Organic Fuels Power

I have mentioned the importance of the introduction of the steam powered threshing machines, the steam powered railroads and ships, and the growth of the use of the automobile and trucks. But these were only a few of the changes in the Farmers, Laborers, and Management's lives. The inventions mentioned plus the wider use of automobiles and trucks, the larger blast furnaces and steel and metal processing mills, the wider use of electricity and gas and petroleum in transportation and manufacture revolutionized farm life as well as industrial life. These changes occurred rapidly over the decades 1920-1940. Beginning in the 1940's, especially after World War II, there was an increase in size or capacity of Farm Equipment to the extent that one Farmer now is able to work, or carry out all the operations to work a 300 acre or even larger farm compared with the maximum of 80 acres or so when I was young; and two acres with hand tools.

The importance of this Revolution has not been stressed by Historians and others although everyone has mentioned it. As a matter of fact the Farm population in the Midwest has greatly decreased while the total population has increased.

This is not the place to go into details relative to these changes since I was not directly involved. However, my Brother, Raynor, and my Brother, Leigh, were involved in many of the changes. I have written only a few pages about it.

Prior to the use of steam engines, power was derived from water, horse, cattle, and human sources. But the development of steam and internal combustion driven engines along with the further development of water power and that of large coal, oil, and gas fueled steam and nuclear powered plants and electrical generators has furthher revolutionized our civilization. We are still in the midst of these developments. The invention of the microscope was probably the most important invention of all time as it permitted the development of the scientific and technical knowledge necessary to develop steam

engines and the tools now in use. All hail to Lowenhoek!

As noted when I was a boy, we took corn and oats to a water powered mill to have them ground into meal. But later many Farmers ground their own corn and oats into meal by use of the gasoline driven tractors or by electrical power. Now the Farmers are tending to specialize and raise only one crop and purchase many of the things that we raised or grew when I was young on our own farm.

The utilization of the larger tractors, especially those capable of plowing four or more furrows at once, has reduced the time to plow, plant, raise the crops, and thresh or pick the corn. Thus, they have increased the work productivity per man to the extent that most Farmers have sold their land to their neighbors or they have purchased their neighbors farms. Thus, the use of larger scale equipment has resulted in a large decrease in the farm population. This trend has been fostered, perhaps intentially, by the Farm Equipment Manufacturers in that larger and more efficient tractors and larger tools have been made available to the Farmers presumably at a higher profit to the quipment manufacturers as much of the older equipment was replaced by larger equipment even though the older equipment was not worn out. But perhaps the long term profits are down due to less numbers of sales. In order to use the larger equipment efficiently the Farmers have been pushed into buying more land. The results have been:

a. Higher capital investments in both farms and equipment per Farmer in the Midwest.

b. Increased labor force for manufacturing as the fraction of the work on the farms has been reduced from possibly 90% in 1800 to 6% today. Thus, most men now work in Industry, Management, or in the socalled Service Organizations. Also earlier retirements are frequently made by both Farmers and Laborers. And the hours for Labor have been reduced from 10 to 12 hours per day to 8 hours per day and from six to five or even four days per week. Longer vacations are being taken. When I was a boy, many steel workers spent 12 hours per day, seven days per week at work. They now work 32 to 40 hours per week. Thus Farming has changed from a

drugery and heavy work into almost a continous vacation for those Farmers who raise corn or wheat only. Certainly much of the hard repeditive work has been reduced and farming is not now the labor intensive industry that it used to be.

c. Along with the larger fields and less physical work by the Farmers there has been an improvement in the varieties of grains produced. The most significant of these is of course the high lysine corn developed at Purdue University and the improved rice varieties developed in Mexico and India. But the increased yields of corn, wheat, and other crops have been very significant also.

d. While we transported corn and grains to the mills by a team of horses and a wagon, today most Farmers grind their own meal by aid of their own tractors.

e. And today much of the corn and grains are sold to Farmers that specialize in feeding animals.

f. Many of the farmers' families now purchase canned fruits and vegetables and processed meats rather than raising and processing them. This has been of particular importance to the women as they no longer have to spend so much time canning and drying fruits and vegetables for winter use.

The trend towards use of larger tools has, thus, increased the investment in the tools and land. This has increased each Farmer's income and this along with the rapid inflation caused by Labor's increased demands and expansion of the Government with unbalanced budgets has increased the apparent wealth in that land purchased with a large morgage has been paid off with less valuable money.

But perhaps the most significant factor, as indicated above, has been the increased rate at which a farmer works. This not only has allowed a farmer to raise crops on more acres but has allowed him to have more leisure and, at the same time, the work has been less strenerous and more comfortable with less dirt.

But there is a question whether the changes have been beneficial or harmful to the land.

How did all this come about? Several books have been written about what happened but only a few about "Why?" At least one author, Toynbee, has indicated that it was the need or challenge. But it was more than that. Not only was there a need and a challenge, but the impact of the Indian cultures on the Europeans was important. Then, too, there was a high protein diet, probably well balanced as it included clams, fish, and various native vegetables; and there was a small mixture of peoples as well as the cultures. Did the slaves that Thomas Jefferson own inspire him to make inventions or was it the leisure provided by them, or the impact of the Indians' History that motivated Jefferson to be so productive? Or was it the opportunity to use the inventions that led him to make them?

What will be the long term effects of the six to eight hour day in America and the rest of the World? How many of these people with nearly a third of their time for leisure will react by writing, making inventions, etc rather than just watching television or ball games and drinking beer?

Use of Farm Tractors

While horses were used by many farmers after 1930, their replacement in the West by petroleum fraction driven tractors began around 1920 to 1925 and the replacement was nearly complete by 1935 and in Europe a bit later. While the changes were gradual and smoe farmers used horses for several years after their next door neighbors used tractors, farmers in the United States made the change on the whole between 1920 and 1935.

The ancient peoples used water power to a limited extent. Much of the development occurred in Europe in Germany and surround ing Countries. The Romans were inventive and built extensive water systems for Cities but they did little to develop water power to drive machinery. So it was near 1700 before the importance of steam driven machinery was recognized in England and Germany. From then on the use of steam powered machinery grew rapidly for power, railroads, ships, and machinery; and finally its application to self propelled engines to drive grain threshing equipment. But when gasoline and oil fueled Otto and Diesel Engines were developed in this Century, their use became rapid as they could be built in small very light weight self propelled units. This was due to the fact that combustion of the gases or liquids could occur within the working cylinders and the boilers were dispenced with. The fuels used had a higher heating value or energy equivalent perpound of fuel and petroleum and natural gas became very cheap fuels. It was a simple step to build a light weight

high powered engine and to use it in place of horses and mules or cattle to draw plows and other farm equipment and to drive farm equipment such as grain threshers and feed grinders. The gasoline and Diesel engines were built in small units and each farmer could afford one or more tractors. These could pull one or more plows, they did not tire out and need frequent rests, they did not have to be cared for three times a day, and fed whether or not they were in use. On the other hand they did not act as friendly as many well cared for horses did. But both have unpleasant odors.

The petroleum powered tractor, as indicated, could pull two or more plows without rests at double the rates that a horse walks. So a 10 acre field could be plowed in one day or less rather than five or six days. The "fitting" by rolling and dragging was combined and done in another day. Larger corn planters which planted several rows instead of two rows were introduced. So a present day farmer may plant 100 acres or more of corn while a farmer when I was young, could plant only 10 to 20 acres by use of horses. Of course before the modern plow was invented by Jefferson, plowing was done with a stick plow or even by hand tools, see page 834 of a picture of the use of a stick plow. Many farmers all over the world still use them. The farmer shown on the picture was probably using oxen. The same speedup or use of machinery was carried out through the cultivation, cutting, and husking and possibly shelling the corn in the field directly from the standing stalks.

The loss has been that the farmer must purchase fertilizer and does not have the manures to maintain the fertility of the land. How long the present practices can be maintained without loss of productivity of the soils is unknown.

In the Midwest the corn raising has become the major farm activity. This has replaced the mixed farming that I knew as a boy in which cattle, horses, and hogs produced manures to assist in maintaining the fertility of the soils. We also purchased manufactured fertilizers containing nitrogen, phosphorous, and potash but there was less emphasis on nitrogen as this could be replaced by growing clovers.

As noted above while there has been an increased rate of doing farm work, also there has been a larger investment in larger farms. This has been necessary due to the higher investment in larger tools and the need for their maximum use to justify the investment. This has resulted in specialization, as noted, on the farms to reduce the numbers of tools.

The use of larger tools and farms with this increased specialization has resulted in more leisure for many farmers as most farmers have no stock at all and, thus, are free to travel etc in the winters. The larger tools have required specialization in single crops to reduce the investment per acre in the tools. There has also been a very rapid development of new and more specialized varieties of crops.

But there is a different picture possible in that the single crop system may result in loss of the rarer elements from the soils. Thus, what the long term future is can not be even guessed at today. Also the effects of artificial fertilizers over long periods are unknown. Other than the rare elements the changes should be slight; but the organic materials introduced by the grasses including the clovers and alphafa may prove to have been of value. But up to the present the benefits look real. Farming is a much easier life than formerly. The use of electricity in the farm houses has been especially helpful to the farm housewives. Instead ofcanning fruits and vegetables and butchering, they buy most of their foods ready for use.

The corn and other grains, except wheat, are fed to hogs and cattle in feeding stations. These are operated by farmers who buy large amounts of feeds and feed large numbers of hogs and cattle. The calves are purchased from milk producers and western plantations and fed in large lots until they are grown and fattened for market.

The conversion of the farms in the Midwest from mixed economies with cattle, horse, hog, and chicken barns to unit producers with the livestock raised by others that specialize in feeding hogs or cattle has resulted in abandonment of the barns, construction of hugh grain storage bins, specialized feeding stations for the cattle, hogs, and chickens. But the droppings are not returned to the farms but are wasted. It is now proposed to convert these and the cornstalks into ethyl alcohol or gasohol for use as motor fuels. While this can be done, it appears to me that the land will be mined to obtain motor fuel. I believe it is self destructive to the farmers in the Midwest as the manures and organic matter should be returned along with the bones to the land.

Rather than the mixed farming with the rotation of the crops discussed earlier of corn, wheat, hay, oats, and pasture, we have only one crop repeated yearly. An individual farmer raises corn and has specialized equipment to do so on a large scale. This consists of plows, fitting tools, seeders, cultivators, and corn harvesting equipment. There is little need for

large barns. The wheat farmer owns tools to plow the land, to work the land, and to plant wheat; and in the next summer to cut and thresh the wheat in the field and to spread the straw over the land. This process is very efficient in labor and time. But it requires more threshing outfits than needed when I was young, but the investment may not be higher as the farms are larger and the machines much smaller, and more efficient. Certainly it is more efficient in respect to labor but the total investment in equipment may be higher.

I have no idea about the total minerals and fuels required to manufacture the specialized equipment used today compared with the smaller less specialized equipment used when I was a boy; but I believe that the total investment in materials, neglecting costs, is about equal. But the use of natural resources including petroleum is certainly greater today. When I was a boy, little was purchased off the farm compared with today. The fuels purchased for operating the farm equipment and used in transportation are much higher today. But the fuels used in producing the equipment per acre of farmed land are probably about the same. This means that the extra natural resuurces used today are due to the use of natural gas and petroleum fuels to manufacture the nitrogenous fertilizers and to mine and purify and transport the ammonia, potash, and phosphates.

When I grew up, the farmers sold their wheat at any time during the year as each farmer had his own grainery or storage facilities. Each farmer could and usually did trade wheat directly for flour at the flour mills. For example, we traded wheat for flour once every one or two years and we had from one to a dozen 50 lb bags of flour in the attic of the house. Mother baked bread, cookies, cakes, etc; so the flour was used rapidly. We usually got several hundred pounds each time we exchanged wheat for flour and the flour lasted for three or four years. Today the flour is sold to large bakers who make the bread and deliver it to various food stores or to homes. When we needed to buy bread, we bought it directly from the Bakery, and sometimes from the Baker that made it. The net result has been that now there are less people involved in baking the bread but there are more people involved in distributing the bread. Have we progessed or retrogressed? Certainly the women have much more leisure as they purchase the baked and canned goods instead of producing them. The men have shorter hours and less really hard muscular work such as required to cut corn by hand and plow with a walking plow.

Milled Feeds

In addition to the corn and wheat, we raised oats every year and barley some years. These were sowed, cut, threshed, and stored as described for wheat. For use they were ground with corn to form meal and used as hog and cattle feed. The cattle were fed meal only during the winter when pasture was not available. But they loved to eat the meal and they also were very happy to be turned out on the green grass and clover pasturage in the spring. They would stand near the gate to the pasture field and bawl by the hour in the spring before the grass, clover, and timothy had enough growth for pasturage. That was their only way of communicating their wishes to us. But they did know enough to make their wishes known in no uncertain terms.

The procedures for grinding the corn and oats and barley are described below. First, about 40 bushels of corn were loaded into the wagon box from the corn crib. This was done by hand by shovelling into a basket and carrying to the wagon. Then, about 25 bushels of oats or oats and barley were bagged from the grainery and loaded on top of the corn. The load was hauled to one of the local mills by the team. There the small grains were unloaded and the corn shovelled into a feed to a corn sheller. The shelled corn and the oats and barley were mixed about half and half and ground. After grinding it was bagged and returned home to the grainery for use as feed for the pigs and cattle.

There were two local mills. Both of these were located on the Raisin River and were powered originally by water power. Actually, there were three dams on the river in a few miles. Just north of Tecumseh there was a dam with about a 20 foot fall that had been built to generate electical power. As the power needs of the Tecumseh area soon grew out of the production of this power plant, a steam plant was built alongside it. Then the Tecumseh Company was taken over by Detroit Edison Company as the Tecunseh Plant was too small to be economic and to compete with the large steam turbine plants.

Today the environmentalists and the Federal Government are talking about all the power that can be generated from many such small Power Plants. But are the economics different today than those that caused these plants to be closed some years ago? A Nuclear Power Plant can be built for $1.5 to $2.0 billions and produce 1,200,000 kilowatts or about $1500 to $2000 per kilowatt of installed capacity while a small plant such as the one mentioned here would cast about two to three times as much per kilowatt capacity. While fuel costs are

saved with the water powered plants, the capital costs and labor or operating costs for the small plants are several times those for large Nuclear Power Plants which may have low fuel costs, especially the breeders. Apparently, the economics now as in the past favor larger efficient plants.

The second dam was built in the 1830's. The dam was probably built by oxen pulling scrapers and shovels and wagons loaded by hand tools. This dam had a total fall of about 20 feet. A feed and flour mill had been built in 1833 to grind corn and oats to meal and to dehull wheat and grind it into flour.

As an aside it is interesting that this mill was built on the site or near the actual site of the Pottowattomies' Council Ground. So the name Tecumseh came from the Indian Chief.

This particular mill was in operation when I was a boy and it was still being operated by the Hayden Family that built the mill a hundred years previously. About 1930 the mill was converted from water power to electrical power. At the same time a small water powered electrical generator was installed; but this proved to be too small to be economic and it was used for only a few years. The last I knew the dam had been cut open or it had washed out and there was free flow of the water.

The second mill had been located about 1.5 miles below the upper mill dam. This had been built about 1905. It had a fall of about 15 feet. On page 783 I mentioned that many stones had been hauled from our farm and used during the construction of this dam.

The mill had a water powered corn sheller, a stone mill to grind the corn, oats, and barley and also several small flour mills, all operated by the water wheel by use of belts. The feed mill consisted of two stones: one flat and rotated and a top one with a small central hole for feeding the grain. These stones had grooves a couple of hundreds of an inch deep cut in them. The lower stone was rotated with a belt from the water wheel shaft. It took about two hours to grind a grist as described above. As the corn and oats were ground, they were elevated by small buckets on a belt and fed into a bagger on which a man hung our bags for us to take back home.

Before leaving the topic of corn reference should be made to th work of the Department of Agriculture of Purdue University in respect to breeding lysine into the corn. This has been most beneficial to the peoples of the World. I used to say

that I could tell by his walk if a man ate corn as his principle food; but this is no longer possible. People who ate corn used to walk with a characteristic shuffle but after eating high lysine corn for a short time, the people, especially the young, walk with a stride swinging their arms and laughing like the young people in Lafayette. This stride used to be characteristic of only the people of the West European and American Countries.

While working in India, it was common to see a man or woman walking with a shuffle. They also had other characteristics - a hopeless vacant stare and emaciated bodies that few Americans have ever seen. The legs and arms of these people were almost uniform in size with little flesh or muscle over the bones. Why?

I have mentioned the hopelessness of the man and woman plowing. This is common. But next door there may be a Middle Class family that would be right at home here in Lafayette in University Circles. The same thing is true in Mexico. For example, many of the poorer people, especially in the more arid central part of Mexico, who have eaten corn most of their lives, walked with a shuffle. I to not know what effects the high lysine corn has had but I presume that the Mexicans and Indians now have a healthy look and walk with a stride. Over population is a long time problem. But now any Indian Family with three children is compelled to undergo operations to prohibit further babies. But Mexicans, being Catholic, have no such Laws but rather the women are told by the Priests to have many children as God will bless them for it. But the last time we were in Mexico, very few people walked with a shuffle due at least in part to the use of the high lysine corn and increased diets with fish and meat and other proteins. At any rate the Young People in Mexico walk with a stride like young Americanos. But the population is growing so rapidly that starvation may soon become general in Mexico. And the last time I was in India, where I was working North of Bombay, the young people walked with a stride, swinging their arms like the young people in Lafayette. Their facial expressions had also changed from the characteristic drawn or tense look to one of hope and almost a happy-go-lucky view of most American young people. Of course, in Calcutta there were the old women picking over everything in the streets for fuel and any possible thing of value. These were haggard and they all had a hopeless look on their faces.

In Mexico and Spain I have visited well to do and middle class families with the same types of furniture, foods, etc that we have. The main difference in these homes from ours is that there are maids to prepare the foods, serve them, and do the housework. This is also true in India except that the cooking is usually done by the house boy.

But the foods differ between Spain, Mexico, and India. Basically, the food is the same as ours in Spain and Mexico except that in Spain, there will be more fish, shrimp, and wines. Well-to-do Spanish people have shrimp and fish nearly every meal. There are several kinds of shrimp in the Bay of Biscay and these are cheap and plentiful at the markets.

But in India the food is served with large amounts of various seasonings most of which are tongue biting. This custom apparently grew up when the Middle Class people tried to cover up the taste of partially rotted foods by use of pepper and other condiments. I remember being invited to the home of an Engineer in India. His wife said that she told the House boy to use only the tinesst amount of their pet condiment. I ate my serving of the food but it nearly choked me. Its no wonder that Columbus discovered America on the way to India - it may be that he wanted to get lost! But other than their excessive use of contiments, to our tastes, the food in India and Mexico is excellent and very similar to ours - at least in the middle class families that I visited.

In Argentina the situation differs again, at least in Buenos Aires, as the country and the peoples are more like Norte Americanos. Their foods are not only similar to ours but they use reasonable amounts of condiments. When I talk of Argentina, I can only refer to Buenos Aires as that is the only part that I have visited and I only spent two weeks there presenting lectures to people in the Junta de Energia Nuclear. There were about a dozen men from the Nuclear Engineering Department. Frank Foote of Argonne had been there before me and presented lectures on Metallurgy and I discussed the Nuclear Power Plants.

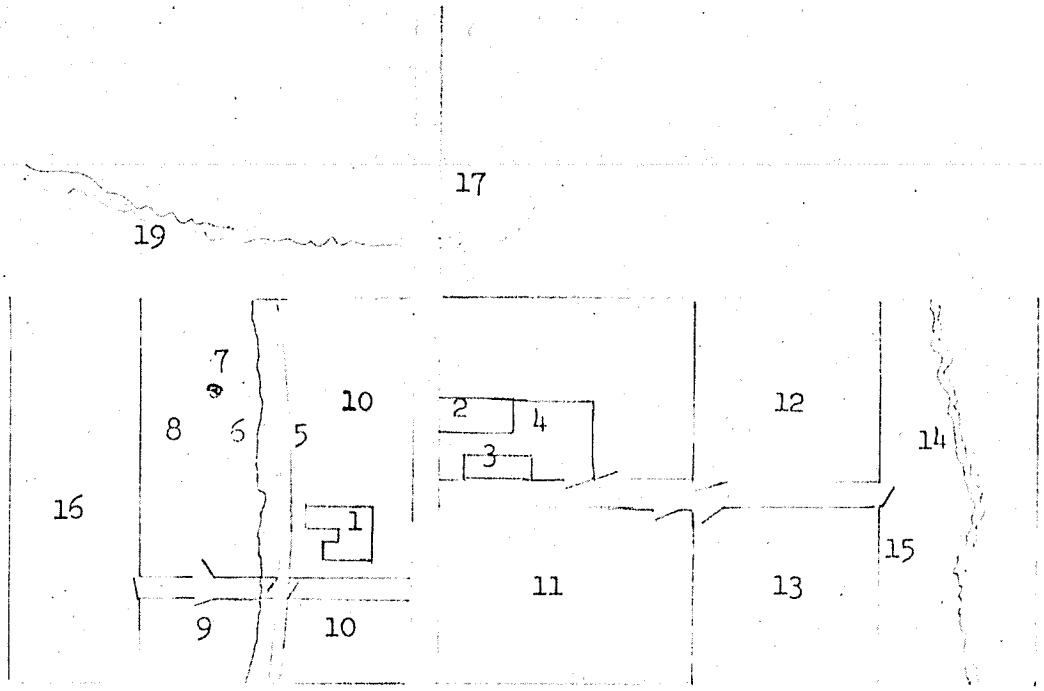
An Engineer, whose name I have forgotten, from the International Atomic Energy Agency, whom I had known in Germany, was there at the same time that I was. So he and I ate and did other things together as we had much in common. The main difference was that he could speak fluently German, French, Italian, Spanish, Portugese, and English. On the Saturday night that I was there, we had dinner together. This is worth mentioning as it was quite different from the usual run of affairs. Many dinners are just dinners!

Buenos Aires is essentially an Italian City in character. So they carry on the Italian customs, even to the way the girls approach men - they are quite direct. But in the purely Italian part of the City down by the Water Front on Saturday night, some of the resturants have Italian dinners with a difference. First, they remove the regular tables and replace them by benches made of two boards 10 inches wide, approximately. The seats are simply benches with no backs. Then the tables are placed so that a person sitting on one bench is in close back-to-back contact with the person behind you. Then every man is placed in between two women with one at his back and one in front of him. Flirtation seems to be assumed or expected as you are in close contact, back-to-back, side-to-side, and knee-to-knee. But it is all very genteel!

Then the food is served on very small plates: a couple of shrimp, a piece of lobster, a piece of fish, another piece of fish, a piece of beef, etc. There are no tools such as forks but spoons were provided with the coffee but wines were the regular drinks as two or three were passed along to us. Everything was eaten with the fingers. At the same time an excellent violinist and a couple of female singers entertained us all evening. Apparently everyone was expected to sing whether or not he had a voice or knew the language. This all begins at 2000 and at 2400 everyone gets up, thanks his or her neighbors for the social evening, and all apparently go home. Since all the people knew the songs - except me - and were excellent singers, it was all very enjoyable.

When Winnie and I were in India, we went to Shinagar which is supposed to be cooler than the lowlands. Actually, it was cold with snow nearby all the time we were there. It rained most of the time. So it was not very enjoyable living on a houseboat in the Lake. I still prefer Mexico, but Winnie is afraid of lawlessness since many Americanos have been robbed - or at least this has been the reports.

The Indians have now passed a law that any family that has three children must undergo operations on one or both parents to prevent future pregnancies. But Mexico, being Catholic, has no such laws or regulations. The Church favors very large families for the Glory of God or the Catholic Church, I'm not sure which. Mexico deserves a better future. Perhaps the oil fields off East Mexico will provide cash for a time but they should expend it for birth control and Nuclear Power. Perhaps they will but it is a Catholic Country. But I don't understand! And I don't think I ever will.



1. House
2. Sheep Barn
3. Cow and Horse Barn
4. Barnyard
5. DL&W Railroad
6. Escarpment
7. Spring
8. Orchard
9. Field
10. Garden
11. Field
12. Field
13. Field
14. Creek
15. Field
16. Woods
17. Road to Greigesville (Wadsworth)
18. Road to Leicester (Moscow)
19. Creek

Thomas Elliott Farm

~ 120 Acres

My Mother's Home

While there are a great many things that I have not discussed relative to the farms in Michigan, there is considerable overlap between those items and the similar items in respect to my Mother's home in New York State. So I have chosen to break off the discussion of my own and my Father's homes in Michigan and discuss my Mother's home. I plan to continue the discussion of the Michigan farms after discussing the New York farm.

A sketch of the layout of the Thomas Elliott farm is presented on page 841. The Family lived on the farm from about 1870 until around 1935; so Mother was born and grew up there.

I do not know very much about the history of the Elliott Family. In fact I am not sure that they were Covenanters but they did live in Ireland before coming to the United States. At any rate they migrated to near Brandon, Vermont, perhaps about 1700, but I do not know. My Mother told the story that during the trip from Ireland to America by ship, they had a very rough passage on the saling ship. They had to cook their own meals. But on the first day out her Grandmother threw the silver overboard with the dish water.

The Elliotts like the McLains were Scotch-Irish and the Families were related but I do not know how. All were Presbyterians. My Mother sometimes told stories about things that had occurred in Vermont. I believe that her Mother had told her these stories. At least her Mother, Sophia McLaughlin, after her marriage to John Elliott, moved to a farm about two miles north of Leicester and a mile south of Greigsville, New York. These towns were then called Moscow and Wadsworth, see page 841. This, apparently, was about 1870 but I do not know the date. The first date that I am certain of/1892. My Father visited my Mother's home when he was 26 and she was 18 and, as a result of the meeting, they soon became engaged and were married in 1894. I know nothing of their Courtship or Marriage.

What tools the Elliotts brought from Ireland to Brandon, Vermont, or how they lived there I do not know. They were farmers and presumably used those tools and built log cabins like those of others at the time. I visited the graveyard at

Brandon once with Winnie and my parents. We looked up the graves but I did not obtain/or names dates of those buried there. At the time of the move to Vermont the farmers had plows, drags, and probably other tools. With a moldboard plow it would have been possible to break thick sod soils once the roots of the trees had rotted. Before that the space around girdled trees could have been broken up where there were no roots by steel spades and hoes as the grass or sod would have been thin. Before the moldboard plow was invented, the stick plow and the iron or steel hand tools would have permitted some digging of the soil and hoeing and cultivating of the corn fields. This would have been more than the Indian women could do with their wood digging sticks and clamshell hoes.

My Grandparent's house where my Mother was born and grew up consisted of a central section with a fancy hallway and a large parlor on the first floor and four bedrooms upstairs. There were two wings of one story. Each had a sitting room and a bedroom. One of these bedrooms was used by my Grandparents. The other living room was used by the family as a living room when I was young. There was also a dining room and a kitchen on the first floor. I think that this wing had two bedrooms on the second floor but I am not sure. Back of the kitchen was a woodshed.

Also when I visted the place, the various fireplaces - one in nearly every living room or eight total - had been closed by being boarded up and the house was heated by three wood burn ing stoves and the kitchen cooking stove or range. Actually, in the winter only three rooms were heated and the other half dozen or so were closed up.

The house had been very well built with walnut paneling around the fireplaces, decorations around the doors, etc. To me, as a small boy, it was something to run and play in. My first memory of the house - I had been there several times before - occurred when I was about seven. My parents took me by train and we went from Tecumseh, Michigan, to Toledo. There we waited for hours for a Chicago to New York train that we took to Buffalo. It was Christmas time and at Buffalo we got into one of the worst blizzards. There was no public transportation operating between depots even though it was below zero and a blizzard. So we walked even at -8F for the 1.5 miles between the New York Central and the Delaware, Lackawanna and Western Depot. I would have taken this walk as an expected thing had not everyone made so much over it. But we made it. There we got the "milk

train" on the Lackawanna - we were probably a good part of the passengers as it only ran about 60 miles. Anyway, it stopped at most of the road crossings to discharge empty milk cans. So the train stopped at "Teeds Corner" less than a half mile from the house and we walked to the house. I was a little boy, so they had me go in and surprize my Grandparents - which I remember very well.

I remember one other thing about that trip. While there we decided to go to visit my Uncle Burt and Aunt Janey, and my only first cousin Elmer Jack. They lived near Groveland Station about 12 miles east of my Grandparents home. So we took a team and sleigh and drove. Since there was over a foot of snow and the roads were very well drifted closed, the farmers had opened gates and made gates or openings through the fences and everyone simply drove through the fields. Only horse drawn cutters and sleighs could be used as no automobiles or trucks could be gotten through the deep snow. The team had been used to deep snow and when they broke through a deep drift they simply stomped down the snow and made a track.

Now of course the roads are kept open for automobiles and trucks. And, of course, no one has horses, cutters, and sleighs.

My Mother's home and the farm were located on what is now New York Route 36 about six miles west of Geneseo or 12 miles west of Conesus Lake. The farm was located about two miles north of Leicester and one mile south of Wadsworth and about five miles west of the Gennessee River at the western edge of the Valley. The farm consisted of about 120 acres of which about 40 acres was west of the road and 80 acres east of the road. The area east of the road was low flat land with a creek near the east end. The barns were located east of the road and the house west of the road, see page 841. The house was located just below an escarpment that had a total change in elevation of 30 feet or so over a short distance.

When my Mother was young, perhaps 10, there was a rumor that a railroad was to be built across the farm at the edge of the escarpment. As this railroad, which was the Delware, Lackawanna, and Western, was built, it was located back of the house with room for a driveway between the woodshed and the railroad fence. As a result of the grading, there was a mound of dirt inside the fence and this reduced the noise of the wheels on the rails. As the locomotives were coal burning steam engines, there was a large amount of engine noise and smoke when the trains were going north up the grade out of the Genesee River Valley. There were frequently two locomotives on the front of the train and one on the rear as

a "pusher" on the freights. The freight locomotives were being operated at nearly full throttle at seven miles per hour, so they were very noisy and very smoky.

The DL&W did have some pride as the overnight passenger trains between Buffalo and New York burned hard coal and , thus, had less dirt and black smoke than the soft coal fired locomotives in use at that time on the freights. But even though these trains were well kept up, they could not compete with the through Chicago to New York trains. For some reason, the Lackawanna stopped at Newark and it was necessary to take a ferry across the Hudson River to New York City proper. This was also true of the Baltimore and Ohio and the Erie Railroads.

When I was young, the Lackawanna track was kept up in excellent shape. There was rock ballast, the rails were held to the ties by four screws rather than two spikes, and the track was very strait. In fact it was the best roadbed that I have ever seen. But, now, the DL&W is in bankrupcy, it carries little or no freight, no through passengers, and much of the route has been abandoned. But it does operate cummuter trains near New York City as a part of the Federal System or Conrail.

When I was very young, my Mother went "East" as she called it, nearly every summer. So I got to go many times, one year twice. I never stayed long but my three brothers spent a month to several months each there, when they were young. Leigh went to school one year at the Greigsville High School. My Grandmother died when I was eight and my Grandfather died a few years later. I don't remember many details of my visits but a few things do stand out. I was there when Halley's Comet was seen very brightly and,since it was talked about in great detail, I remember the excitement but not the comet. I was only five. And I remember the sheep as we had no sheep at home. Later we spent several Summers there for two to several weeks, so I remember the house and barns and other surroundingsvery well.

After my Grandparents died, the farm was sold and my Aunt Jennie, married,and moved to Leicester. She had two step-daughters, one named Bee or Bertha near my age. When I was in High School and again in College, I visited my Aunt for a few days. When she died, we lost track of the family.

My Mother told many stories about her home. For years when she was young, they raised hops. During picking season, they had as many as 30 girls and many men who worked for a month or so as pickers, and all ate and slept in the house. When I knew the place, they raised wheat, peas, beans, and hay. The hay was used for horse and sheep food and the wheat, peas, and beans were sold as cash crops. They also sold milk and raised sheep for sale.

The peas, when ready to harvest, were mowed by a McCormick mower drawn by horses, raked, and loaded on horse drawn wagons by forks. They were hauled to Greigsville by horses. Greigsville was about one mile north of the farm. At Greigsville they were run through a "sheller" which was a Diesel driven machine that hulled the peas. As the farmers exchanged work, there were several men and wagons working together in each field.

The shelled peas were hauled by truck to Mt. Morris to a canning factory. As the canning had to be done the same day the peas were cut, there was a push to cut the peas at the maximum size but still not overripe and to haul them to the sheller. So there were several farmers working in the fields together; mowing, and hauling were done at the same time.

The barns were located across the road from the house as indicated on page 841. These barns were old and not well kept up. There were sheep, horse, and cow barns with space for storage of hay. They raised wheat, peas, and beans, as noted above, for sale and oats and hay for horse, cattle, and sheep feeds but very little or no corn as they raised sheep but not hogs. They also had a few chickens for eggs. The wheat, oats, and hay were handled as we did in Michigan. The beans were pulled with a special machine when ripe, allowed to dry in the field, and then shelled in a thresher as we threshed wheat.

The house was hugh for a farm home. It had been built when fire places were used for both cooking and heating. Apparently, the family that built the house planned that servants would do the cooking and baking. There was a masonry fireplace about six feet square with an open top

fire or fireplace over a closed oven in the basement or cellar of the house. The wood fuel was placed in two open fire places at the ends with the stack or chimeny at one end. It must have been a very hot and smokey place to work on a hot summer day. But, by the time that I visited the house, the cooking was being done on a regular cast iron range in the kitchen on the first floor.

On page 841 a "spring" is indicated as located in the orchard northwest of the house. Water from this spring was piped to the house where it was discharged into a barrel in the kitchen. The overflow from this barrel, which was above the sink, was piped to the barns where it discharged into a tank for the cattle and horses. The overflow from that tank was piped to the sheep barn for the sheep, and that tank's overflow was run into a ditch that ran along the land to the creek. So water was no problem as the spring ran at all times and gravity provided the energy to keep the water flowing to the house and barns.

The geology of the area was interesting. There was an outcrop of shale along the railroad cut. This shale contained many fossils. The creek, indicated as 19 on page 841, had cut a deep valley or "gulf" as we called it through the shale. This was perhaps 45 feet deep at the deepest point. As a result we could walk up this creek for about a mile to a falls of some 20 feet. Above the falls the valley widened and we lost interest. It was in that creek that we found most of the brachiopods. Below the falls the creek bed and valley were very narrow with just space enough to walk along the creek bed when the water was low. We sometimes killed snakes in that valley but usually they would get into deep holes and we could not catch them. The fish were very small minnows and we never bothered them but the snakes apparently lived on the minnows.

When I was young, the milk was taken in 10 gallon cans every morning by horse and wagon to the railroad station at Teed's corner. This was perhaps a half mile from the house. The "milk train" stopped to pick up cans of milk about every two miles and took the milk to Buffalo. On the return in the early evening the train stopped to leave the cans and they had to be picked up, washed, and prepared for use that evening. As the train carried a coach car for

passengers, a total of two cars, we frequently rode that train as mentioned previously. The through passenger trains such as the "Phoebe Snow" stopped at Mt. Morris some six miles away. One train stopped at Leicester, some two miles from the Farm each day.

Occasionally, when the sun had gone down in the Valley, it would shine on Geneseo and Dansville on the east side of the valley and these towns would seem to be "floating" in the sky. Dansville's buildings particularly showed up some evenings even though the sun was down and it was quite dark in the valley. Dansville was nearly 20 miles away.

I think that both the Elliotts and McLains were related to the Boyds. Whether the Boyds that lived next to my Father's home and the Boyds in New York were related, I do not know. I assume that they were. But there was a Mrs. (or Miss) Boyd living near the south end of Conesus Lake when I was young that my Father called his Aunt. I remember visiting her in the two room log cabin in which she lived. One evening m y parents with me drove a cutter and horse from my Uncle Bert's home to visit her. It was the only "log cabin" that I was ever in that I knew was still being used as a regular home. I know nothing of her family.

Mrs. Boyd took pride in showing us a patched hole in the front door of the cabin. The hole had been chopped in the door by a man trying to get into the cabin at night. When he stuck his head in the hole, Mrs. Boyd's Mother, who was alone in the cabin, struck the man with an axe, killing him instantly. It was also related that her mother nearly went crazy as a result.

Other than the above and the fact that part of the farm in Michigan was sold to a family by the name of Boyd I know nothing else except once I heard someone say that the Boyds were cousins.

As an adult, Elmer Jack, my only first cousin, was a sailor on an ore boat on the Great Lakes. He died many years ago. He was married and I met his wife once but I know nothing of his wife's family. Elmer was an excellent banjo player. He wanted to go to an Engineering College but his Father objected. Why I do not know as he was an excellent student and interested.

To repeat again the Jacks, Boyds, and McLains were related and Uncle Bert and Aunt Janey were first cousins. Just how the Elliotts were related to them, I do not know. My Father once said in jest that he had a cousin living in every block in Geneseo. Even though this was an exaggeration, it did indicate the large numbers of distant cousins in the area.

To return to the Railroad, the Delaware, Lackawanna, and Western was apparently built to serve the steel Companies in Buffalo. But it was poorly laid out. Also it had to compete with the New York Central and Erie Railroads for through freight west of Buffalo. Both the Central and Erie ran west of Buffalo but the DL&W did connect with the Wabash which ran from Buffalo to Chicago and St.Louis. The New York Central had the advantage of operating up the Hudson River and along the the south edge of Lake Ontario and Lake Erie; so it had less grades, or as it called ifself, the "Water Level Route," which it was not but it was closer than the Lackawanna to that title. The Erie generally followed the Lackawanna except near my Grandparents area. The Erie crossed the Genesee River at Portageville above the Falls and Gorge on a very high tressle and thus missed the long grades into and out of the Genesee River Valley.

As an aside the three Falls at Portageville and the Rapids in the River between Portageville and Mt. Morris were set aside as Letchworth State Park. But the Federal Government built a dam at Mt. Morris for power and flood control. This has flooded the rapids in the River. These were very beautiful. I suppose that the Valley is now a power boat Lake and used for those with power boats to play in and not as a thing of beauty and for canoists.

When I was in College, I spent six weeks at Aberdeen Proving Ground. On the way home I stopped at Leicester to see my Aunt Jennie and her family. One day the young Presbyterian Minister, whose name I have forgotten, and I borrowed a canoe, talked his girl friend into driving us to Portageville, and we canoed down the rapids - or perhaps I should say walked and canoed as we had to make many portages but these were all around single rocks or rock ridges. Most of the trip was in a very narrow valley or gorge 20 to 30 feet wide at the bottom and 100 or so feet deep. There was little water; so we had frequent

short portages over very short rock dams. It was a very memorable trip - but it can't be repeated thanks to the dam builders and water power enthusiasts. It is used by motor boats today.

There were three Falls at Portageville, each about 20 feet high. The water depth was only about 20 inches deep over the Falls. This whole area is known today as Letchworth Park. The name Portageville is self explanatory as there was a portage from Mt. Morris around the High Banks and Falls of some twenty miles. The goods were moved by wagons over this whole distance.

Another experience that is worth mentioning is that when I was about 12, we drove a horse and buggy to Mt. Morris and took the Pennasylvania train from there to Rochester. This railroad should have been maintained as a historical monument as it followed the Genessee River Valley with all the turns of a wandering river. It was the crookedist railroad that could be imagined. I remember that at Rockester we visited two of the City's Parks. I was impressed by the care of the Parks and the fresh green of everything. The only other Park that has so impressed me that I have visited was the Butchards Gardens or Vancouver Island. I believe that the train from Mt. Morris to Rochester had a very small steam locomotive and two small cars.

The whole area in which my Grandparents lived is underlain with rock salt. When I was young, there were rock salt mines at Cuylerville in which the salt was mined manually in bulk and a solution salt plant about five miles east of Mother's home. When I visited my Aunt Jennie when I was about 16, I was taken down into the salt mine at Cuylerville by a neighbor who worked there. Later a salt mine was opened just north of Griegesville on the DL&W Railroad as the Cuylerville and the solution mines had to operate their own railroad and this caused extra shipping and switching charges. There was also a bulk mine at Retsof but I never visited it. There was nothing special about these mines and plants. Later, I visited the salt mine under the City of Detroit. All salt mines to be profitable must be able to work deep beds of very high purity salt.

As noted on page 611, Winnie, Lugene Hungerford, and I visited a potash mine. Potash occur with salt; so the mines are almost identical except that the potash miners are after a

thin band of a mix of potassium chloride mixed with sodium chloride in a salt deposit. The potash is separated from the common salt by solution and partial precipitation. This is one of the classical Chemical Engineering Operations. Flotation is also used extensively.

Living in Michigan

The detailed way in which all middle class farmers lived in the early 1900's were similar; so the crops and how they were raised were similar in both areas. The following pages discuss a number of items that were similar in both areas. As noted the New York people raised some sheep but we raised some rabbits for our own use. Otherwise the farm practices were very similar. The various topics are discussed almost at random although I have attempted to leave the housekeeping topics to the last. I have discussed planting and hauling wheat. Oats and barley were handled in exactly the same way as wheat except that the oats and barley were planted in the Spring and ripened later than the wheat. We did not use fertilizer on the oats and barley. In New York the beans were pulled and left in the fields in small bunches to dry for a few days before they were taken to the barns or thresher as they were threshed in the same way as wheat. The residue stalks had a higher protein content than wheat and oat straw and therefore were used as stock feed or fodder.

It is important to note again that in the mixed production farming as practiced in the Midwest when I was a boy, that we not only rotated the crops, used manures to maintain the fertility of the soils, but we produced most of the feeds for the stock and for our own consumption. In no way could we have been called specialists. This habit of home production had developed over the Centuries by noticing that rotated crops did well and that production of one's own food and other products was economic. This habit was particularly important to the Midwest Pioneers since it was expensive to bring in foods from outside. In fact, it was found that very few foods from outside were really needed. Salt was found where the animals had found it at the Salt Licks in Kentucky and probably in Western New York. Other than salt and minerals such as lead for buckshot, iron for tools, guns, knives etc nearly all products were produced locally.

As an example, we raised most of the fruits, vegetables including potatoes, eggs, most of our meat, and all of our milk and sometimes we made butter and other times we sold cream for which some was exchanged for butter. Our purchases of food included sugar (occasionally by the barrel), salt, raisins, bananas and oranges, condiments, sometimes meat, etc. We produced our milk and frequently made butter. Lard was produced and sold. My Mother made bread, cookies, and cakes. The flour was obtained by trading wheat as noted above. Later in life my Parents purchased more items because of my Mother's health. Today we purchase almost all of these items. Meat is cut up ready for cooking, bread and cookies are ready to serve. Chickens are ready to cook while we had to catch them, kill them, pick the feathers out, and clean them before cutting up for cooking.

Fruit and Vegetables

The History Books mention "Johnny Appleseed." I do not know his real name but he had a missionary zeal to spread the culture of apple trees in the Midwest. As a result of his zeal and the general desire of the Midwestern Pioneer Farmers to be independent and to provide all their own food, most farmers did set out quite a number of apple trees. For example, our farm had a sizable apple orchard with two or more trees of the following varieties: harvest, northern spy, baldwin, wagner, greening, and others. When I was very young, we picked and barrelled 8 to 10 barrels of these each Fall. The barrels were made of wood staves and they held about three bushels each.

But when I was about seven years old - I just remember the apple orchard as it existed then - or about 1910-1912, there was an introduction of Japanese "scale." This is a small parasite about 3/32 in. long and 1/32 in. wide. It grows on the bark of apples and other fruit trees and schrubs. It lives by sucking sap from the bark. When a tree or schrub is seriously attacked by scale, it will die in a couple of years, the branches die first and then the trunk. We have scale on some our shrubs in Lafayette. Each year's new growth is killed the following year. In Japan the scale has natural enemies and it has never been a serious parasite;

but in the United States, it spread very rapidly as it had no natural enemies. Within two or three years most of the apple trees were badly damaged and the small limbs killed. As the small limbs died, we cut most of the trees for wood. But the large limbs and trunks were alive. About that time the Dow Chemical Company developed and introduced a spray containing arsenic and possibly other poisons that killed the scale. This was called a Bordeau mixture; why I never knew. We purchased a hand pumped spray equipment and a barrel of this Bordeau Mixture and sprayed our apple, peach, and plum trees. This was repeated Fall and Spring.

Gradually the few apple trees that we had not cut grew new tops. We trimmed out the dead limbs and continued to spray at least twice each year. A few of our Wagner and one Northern Spy tree lived and grew new tops. We also set out harvester and other trees, so in a few years we did have some apples again. We also bought apples from some of our neighbors. And I helped pick apples for one neighbor two Falls.

The spray equipment consisted of a barrel of Bordeau mixture; a barrel for the spray mixture diluted for use; and a hand pumped spray equipment. This latter consisted of a small liquid pump that could be set in a barrel designed to hold liquids but that had a large bunghole on the side. This pump could be worked by hand and a second person could direct the spray hose, with its nozzle, and various tools.

Each Spring and Fall we would mix up a barrel of spray mixture of a couple of gallons of Bordeau mixture in a barrel of water. With this mounted on a wood sled drawn by horses, we would go through the various orchards and spray the trees. Some of our neighbors who had not cut their trees, began spraying and actually saved most of their trees.

We had two pear trees which were not bothered by scale; so we had two or three bushels of Bartlet pears in the Fall and a couple of bushels of a winter pear that kept till January. We also had one tree that had a few pears each year but these did not ripen til April.

We had perhaps 50 peach trees of different kinds. Since peach trees only live a few years, each year we raised a few trees

from seed and "budded" the young trees when they were a few months old. It was necessary to plant the seeds in the Fall and the pits would be broken by frost and the moisture the young trees would come up in the spring to be budded. To bud a tree a vertical slit about 1 inch long is cut vertially through the bark of the young tree and just the bud and a very small amount of bark is cut from a mature tree and inserted in the slit. String is wound around the bud to keep it in place. In a few months the bud will grow enough that the top of the original tree can be cut off leaving the bud as the main truck. This tree will produce fruit of the original tree from which the bud was removed.

Our peach trees were bothered by borers that drilled through the bark and killed the trees. So it was necessary to coat the trunks of the trees two or three times each year with a mixture of lye and water. This was done with a broom.

Grapes did not seem to have any natural enemies. Perhaps this was due to the fact that they were very native to the States. So we had early to late varieties in great abundance. These included Delawares, brightons, Niagras, Concords, etc. All were very good eating. We usually sold several bushels each year. We also had quite a number of common red cherries but for some reason there were no sweet cherries until about the time that I left home. But our neighbors had large sweet cherry trees and they were happy to have us pick them on shares of 50/50; which we did - or rather I had to do so. So each year we picked sweet cherries and not only ate them fresh but canned 30 quarts or so. There were several plum trees on the farm but the varieties were not well chosen. We did have a couple of trees of blue plums which produced all we wanted to eat and can but none for sale.

I have mentioned before that wild plums grew near my Grandparents farm but there were few left when I was young. I just remember eating them but I do not remember their taste or much about them. But we had several trees of a poor variety and a few trees of large blue plums which were delicious.

We had quite a lot of red raspberries. These were picked for sale as well as canning. I remember selling them in quantities.

One time we picked 32 quarts of them one Saturday. I took them to Tecumseh to sell but I could not sell them as the Grocery men said that it was too late in the day, actually it was late afternoon. I was of course using a horse and buggy. As I left town, I saw a man and woman on the street that had prevously purchased fruit from us. I stopped and called to them and asked the lady if she would like to buy some red raspberries. She bought the whole lot at a good price even though she said she would have to can them all that evening. But she really got a bargain. The berries were excellent. If she had not bought them, Mother would have had to can them that evening.

The red raspberries were grown in the garden. But black raspberries grew along the fences all around the farm. These were wild or native. They were everywhere along the old rail fences. But they were hard to pick as they were very small. However, they are my favorite fruit and they are excellent to eat out of hand and cooked. We canned quantities of them as well as ate them fresh.

But it was the strawberries that were the most prolific and about the hardest to pick as it had to be done on one's knees. We had four or five rows across the garden each about 75 feet long. There were several varieties and the season lasted for several weeks. At that time we had no "ever bearers." They had not been developed. But we usually sold several 32 quart cases as well as canning many cans for our own use.

The strawberries, cherries, and raspberries were the most difficult to pick due to their small sizes. The other fruits were fun to pick by comparison. In addition to the fruits mentioned we raised watermellons and muskmellons in great quantities but usually we did not sell many of these. Muskmellons were sometimes sold by the bushel.

The result of all the fruit was that beginning with the early strawberries, we not only picked and had fresh fruit to eat out of hand and on the table, but we sold large volumes of some fruits and purchased others. I have mentioned the cutting of most of our apple trees; so we had no apples for sale and we bought some each Fall. But we did sell

all the others except cherries, wild black raspberries, and black berries. Normally we sold few currants but we used all we needed of both the red and white varieties. For our own use both fresh and for canning, the strawberries had to be hulled or the top stems removed and the cherries had to be pitted (some were canned without pitting but that was not the usual case.)

Canning of the fruit was done by cooking, adding sugar, and placing in sterile cans. We used the regular Mason glass jars with rubber gaskets and zinc tops. We seldom had any fruit spoil. We sometimes dried apples but that was mostly an experiment as we never did more than a bushel or so.

Mother also canned currant jellies or rather the juices pressed from the cooked fruit for making the actual jellies later. She also canned wild black raspberries and the red raspberries from the garden along with strawberries, cherries, peaches and plums, pears, and apples, and many vegetables.

We also raised pumpkins for cattle feed and for pumpkin pies. Actually, the pumpkins were planted for use in making pies but we always had so many that the bulk were used for cattle feed. After the corn came up in the Spring, we would go through the fields and plant a few pumpkin seeds here and there in the corn hills. By the time the pumpkins were up large enough to begin to spread between the hills of corn the corn would be too high to cultivate and the pumpkins could and did send out runners through the corn. Then after or just before cutting the corn we would go through and pick up the pumpkins. Usually, we would have two wagon box loads. After taking out a few to take to the house the others would be placed in the barn for cutting up as cattle feed. The cows loved them. They were high protein and probably did taste good to the cattle.

The squash were raised in the same way. I remember that one year when I was in High School that I picked a wagon box load of Hubbard squash one Saturday - these are large late Fall very dark green variety with a yellow meat. They are usually about 8 in. diameter and a foot or so long. Compared to cherries and raspberries, they are easy to pick and they fill a bushel basket quickly. I took the load to Tecumseh

and the man at the first store that I stopped at bought the whole load at three cents per pound. Since I had a big load of over a ton, I got over $60 which was a lot of money those days. So I thought that I was rich. It was quite a bit of money for a bunch of squash that produced better than normal. My Father had said that they wouldn't bring enough to pay for the picking and driving to Tecumseh. The usual price would have been a few cents a piece or maybe $5 for the load. They were worth that as cattle feed.

Chickens

In addition to cattle and hogs we raised chickens to eat, to sell, and for eggs to eat, use in cooking, and to sell. Usually, we had about 200 hens. This represented a large amount of work, but the eggs that we sold paid the grocery bills - or about did so.

We had two hen houses. These buildings were about 14 x 20 and 20 x 20 feet of one story. They were made of wood with very light construction. They were simply set on stones as were the barns. This kept the bottom timbers dry and inhibited rotting of the wood supports. While they kept the rain and snow off the chickens, they did not protect the chickens from the low winter temperatures.

Each day we had to collect the eggs which varied from 150 or so in the Spring and Summer to just a few each day in the coldest winter weather. The eggs were collected by my next oldest Brother and me from the hen houses and other places that the hens liked to use. There were about a dozen nests made from boxes about 16 inches square in each of the two hen houses. These were about eight inches deep and filled with straw. The hens would spread the straw around and lay their eggs. Each day in the warm weather we collected from 1 to 6 eggs from each nest.

In addition to the nests there were roosts, simply made from poles about 8 ft long and 2 in. diameter about 4 ft from the floor. About a dozen of these were located at the back of each hen house.

But the hens especially in the early summer laid their eggs in isolated and hidden places. If they could find or scratch a hole, they liked to get under one of the barns beneath the floors. It was difficult to find these nests. Sometimes a hen would lay over a dozen eggs in such a hidden nest and then "set" on the nest until some of the eggs hatched or about three weeks - just like all birds do in nature. When I was small, I had to crawl under the barns to get these eggs.

When I was quite young, we let the hens that wished to "set" do so in the hen houses. In this case we would place 12 to 14 marked eggs in the nests. The word "set" refers to the physiological changes that took place in some of the hens. They stopped laying eggs and their temperatures went up and they became apparently very stupid in that they would hardly move even when actually they were picked up, they hardly left their nests even to drink or eat for three weeks, and they staid on their nests until the eggs hatched at the end of three weeks. When several of the eggs had hatched, they would leave the nest with the young chicks, forgetting the other eggs that were hatching.

The Mother hen would give off a sound that we have interpreted as a "cluck" every few seconds and the chicks would follow her call. The mother hen would spend full time each day finding food and protecting the young. Each night she would simply find a secluded spot, sit down, and call the small chicks which would crawl under her wings next to her body and sleep overnight. She would continue this until the chicks were half grown and they could find their own food and fly into a tree or some such place to "roost" or sleep overnight. By instinct chickens in the native state are ground living birds with nests on the ground or in an elevated hole in a tree. It is natural for them to roost in trees. Their food consists of worms, bugs, and grain and large amounts of grass. In fact they seem to eat anything that moves or they can tare apart exceptcellulose.

We had about a dozen small coops for the hens with baby chicks. These were made of boards four feet long set at a 90° angle and two feet across with a minimum of framing or simply a 2 x 2 inch piece two feet long at the 90° angle and at the two ends away from the angle. Then boards were nailed at 45° on the edges of the first set of boards to produce a triangular half boxlike building. On one side the longest boards were made with a couple of two inch cracks open at the longest edge. Then the whole box would be set on the ground so the 90° angle would be the top. The small chicks could run in and out through the spaces between the 2 inch boards but the hen was trapped.

A dish of water and feed was provided for the hen and chicks. Bread crumbs were used for the first few days and any scraps of food and grain were fed the chicks and hen from then on. After a couple of weeks the hen with the chicks would be let out of the coop during the day. They would return to the coop each night. The chicks grew rapidly. In a few weeks they were able to take care of themselves and after a couple of months the hen would abandon them. Soon after the hen abandoned them, the chicks would in turn abandon the small coop and join the older chickens in the regular hen houses at night.

Each day the eggs would be gathered in baskets. After cleaning the eggs would be placed in regular 30 dozen egg crates and sold each week. At times we sold the eggs to men that visited the various farms weekly to purchase eggs. At other times we took the eggs to one of the grocery stores in Tecumseh and sold them to the store keepers. The sale of the eggs just about paid for our groceries. We had few eggs in very cold weather and extra cash in the Spring and Summer.

My Brother Leigh married Lillis Howard. Her Father had made something of a business of chickens and eggs and kept many more hens than we did. But most Farmers in our neighborhood kept from 100 to 200 hens and, thus, had from less than a dozen to 150 or more eggs per day varying with the seasons.

We normally raised 100 or so young chickens annually. Some died or got killed. Also we killed and ate many of the roosters. But usually we sold 50 or so older hens and young roosters annually. Thus, the chickens added to our economy by utilizing scraps, keeping the yard partially mowed, furnishing meat and eggs for our use plus enough eggs to just about pay for the groceries and small items such as nails, socks, haircuts, etc. But the chickens were a nuisance since they left droppings everywhere, they were noisy, and feeding the baby chicks was a bother. Further, each day the eggs had to be gathered, cleaned, and packed for sale.

I have mentioned the milk and cream. Actually, we sold about 5 gallons of cream weekly. As a result the income from the eggs and cream just about paid for necessary weekly food, hardware, and miscellaneous purchases but not the large items such as taxes. This is the opposite of the City dweller and the modern farmer who raises a single crop. But each of these may have a garden.

The sale of hogs, cattle, and wheat, and sometimes hay in large amounts brought in funds for purchase of horses, farm equipment, paid the taxes, furnished the funds for large building repairs, etc. Actually, my parents had had enough left over to pay for their farm, travel some, and live a full life with some money left for savings.

Garden

I have mentioned the garden and fruit in several places. It is my purpose here to discuss the garden in more detail. Our garden proper was perhaps 100 by 200 feet. It was located directly back of the house so that my Mother could obtain vegetables easily.

Each Spring manure and the straw, which had been used to "cover" the strawberries, asparagus, and rhubarb during the winter to protect them from ice and snow was raked off them and spread over the garden. The garden was plowed and worked with a roller and drag as early as the soil was warm and the weather permitted.

As soon as the danger of frost was over, about 1 May, lettuce and radishes were planted. A bit later we planted peas and potatoes followed by sweet corn, beans - both string and lima, parsnips, and salsify. Sometimes we planted second crops of lettuce, radishes, and peas, potatoes and corn.

The amounts varied as there were only a few feet of radishes in double rows and lettuce in one row. There were two rows across the garden of 100 feet or so of Lima beans, parsnips and salsify in double rows, and several rows of potatoes and sweet corn. The asparagus consisted of about a dozen plants that lived for years. Each Spring, soon after the frost was out of the ground, the asparagus began to grow and show sprouts above ground. When they were a few inches tall, they were cut a couple of inches below the groundlevel. They were available for use for about two months.

We hunted asparagus along the fences as it had become wild. This wild asparagus could be located by the dead stalks of the previous year as well as by memory of the previous season"s crop.

We had several plants of rhubarb or pie plant in the garden. The rhubarb came up early and was used for pies and sauce by June. Rhubarb pies and sauce were loved by the rest of the family but I got along with very little as I hated the stuff.

Thus, the earliest vegetables were asparagus, radishes, and lettuce which, if not killed by a late frost, were ready for use by early to mid June. Normally, we expected peas and new potatoes for Fourth of July dinner. Sometimes the peas would be very small and the potatoes no larger than walnuts but they got eaten anyway. Usually the new potatoes were simply washed and cooked skins and all. Usually we began to pull the radishes when they were very small, less thana quarter inch in diameter, and ate them. Of course we had to "thin" the radishes as they were planted too close together in the rows to develop well - at least that was what we said to one another. Sometimes the early corn and lettuce would freeze and we would have to replant.

From the Fourth of July on, we had summer squash and other vegetables in quantity. There were always 10 to 20 tomato plants and numerous cabbage plants. These were usually started from seeds in the house in March; so that they were several inches high when we set them out in the garden in early May. Watermellons

and muskmellons of several varieties were started early, usually in the house; so that they were nearly ready to "run" when set out in the garden. As noted on page 856 we raised pumpkins and winter squash or Hubbard squash in the cornfields in very large amounts. Most of the pumpkins were fed to the cattle by cutting them into slices a couple of inches wide - this was necessary as they could not bite into a pumpkin and they were too dumb to break it with their feet. The squash would keep until late winter in the cellar. As noted we also sold many squash.

Pototoes require special care as dirt should be pulled up around the growing plants to protect the small underground plants with their growing potatoes. This also provides support for the green tops. This was done as soon as the potato plants were about 10 inches high. This was done by cultivating to spread some dirt on to the plant roots and finished by hand hoeing.

The tomatos and cabbage along with the muskmellons and watermellons were planted in early March in pans of dirt in the house in the back storeroom where it did not freeze; so that by the 10th of May, after which we seldom had frosts, they could be set out or transferred to the garden. By that time the mellon plants were about six inches tall and ready to tip over and "run" or spread over the ground.

The remaining parsnips and salsify were dug as soon as frost permitted and used fresh or stored for a time in the cellar for later use. Corn was planted at least three times to extend its usefulness.

The care of the garden required cultivating with a single horse cultivator three or four times each summer. The cultivator had about eight teeth about 2.5 inches wide on a steel frame with wood handles for guidance and a wheel in front to keep the teeth at the right depth. There were means for adjustment of the width of the strip being cultivated by moving the teeth closer or wider apart. Usually the garden would be prepared as noted above and after the vegetables had obtained a growth of two or three inches above ground, the area would be cultivated. This would be followed by hoeing the ground close to the plants which had not been disturbed by the cultivator. After each heavy rain and a few days for the surface to dry, the whole area would be cultivated again. Then some hand work was required with a hoe to break up the soil near the plants, remove weeds in the rows of vegetables, and loosen the soil around the growing plants.

It should be noted that the horses hated this job. Only one horse was used and they were used to working as a team; the rows were short and there was constant turning; and the horse was being yelled at constantly not to step on any vegetables.

From mid May until frost in the Fall there were many vegetables. In October pumpkins and squash were placed in the cellar for winter use. The salsify and parsnips were partially placed in the cellar for winter use and partially left in the ground for use fresh from the garden in the Spring. We raised summer squash as well as the larger Hubbard squash for winter use. The Hubbard squash and pumpkins were raised in the corn fields, see page 857. While we did not raise celery, we usually bought 100 or so stalks in the Fall. This along with the squash, apples, pumpkins, and potatoes was stored in the cellar which was cold but did not freeze. Thus, during the Summer we not only purchased very few vegetables, but we sold some vegetables to the neighbors and to the people we knew in Tecumseh. We picked, ate, and canned fruit beginning with the strawberries of several kinds, red and black raspberries, red, black, and white cherries, two or three varieties of blue and white plums, several varieties of peaches, and two varieties of pears. Even though we raised some apples, we usually had to buy some from one of the neighbors. We had replaced the trees that were killed by the Japanese scale but the replacement trees were too young to bear well.

In the Fall and Winter we sold potatoes, 30 to 50 bushels, pumpkins, and squash.

All this required considerable labor on the part of all of us, especially we boys, as my Father was normally busy with the plowing, planting, and harvesting of the field crops.

When I was about eight, a cucumber pickle factory was opened in Ridgway, about three miles from our home. It seemed like a good idea for us to put in some cucumbers and sell them to the factory. After all there were four healthy boys in the family. This we did to our regret - and only once. First, we planted nearly an acre. Second, we had no idea how many cucumbers will grow on an acre nor how backbreaking picking that many cucumbers can be.

By mid July or early August the cucumbers were beginning to bear in quantity. Then the fun started. I was too young to help much but my three older brothers and my parents began to spend hours daily picking and sorting cucumbers. Then we began to hire neighborhood boys and girls to help pick cucumbers. By September we had about a dozen people working after school hours. Each night we had to take a wagon load or 20 bushels

or so to Ridgway to the "Pickle Factory." Never again did we raise cucumbers.

But there was another side to the picture, the cucumbers brought cash in quite large amounts. Among other things we purchased our first phonograph, numerous records, etc. The phonograph was of the old cylindrical record type with a wood horn. We used it and enjoyed it for years.

One other crop that we sometimes raised was sorghum. This is related to sugar cane. Its sap contains sufficient sugar that, when concentrated, it may be used in place of sugar. I understand it was raised in quantity to feed to slaves in the Southern United States prior to the Civil War. When I was young, manyFarmers raised it in small amounts. To process the cane a factory had been built at Brittan about six miles from our home.

To raise the sorghum was quite easy as it was sowed in hills very much like corn. It was planted in May in hills about two feet apart in rows about 3.5 feet apart. About 4 or 5 seeds were dropped into each hill just like corn planting and the sorghum was cultivated and cared for just like corn. By September the sorghum plants were about six feet tall. The stalks were about 5/8 inch diameter compard with corn of about 3/4 inch diameter. Instead of forming ears like corn on the side of the stalk the head formed the grain or seed. Occasionally diseased corn will produce a few kernels on the tassel.

The sorghum was harvested by going through the area and stripping off all the leaves. Then the heads with the seed were chopped off for cattle feed and the stalks cut and bound into bundles for ease in handling. These bundles varied from 5 to 6 feet long. A wagon load of these bundles were taken to Britten. Usually the Sorghum Factory was too busy to process the sorghum and we would leave two 50 gallon crocks and return later for the sorghum. The molasses or sorghum plant consisted of steam engined power crushing rolls and evaporators for "boiling the sorghum down to molasses." This meant thatthe sap was simply concentrated by boiling until it was a thick mixture of sugar and various impuriities, mainly proteins.

Some of our neighbors raised sugar beets but we did not do so. There was a sugar beet factory at Blissfield about 15 miles south of where we lived. I visited the plant once when I was a Chemical Engineering student at the University of Michigan. In passing it might be pointed out that a Sugar Beet Plant is a Chemical Engineers "Paradise" due to the very many complex and complicated operations required to make sugar from sugar beets.

We used sorghum sirup on pancakes and sometimes as a sauce and simply ate it with bread and butter. But a few gallons lasted

for two or three years. Mother used it to a limited extent in cooking.

In addition to the meat which we obtained from three or four hogs, a beef, and many chickens, we raised rabbits for food. It was my job for several years to feed and water these rabbits. We had several hutches made of boards and netting on the sides with a regular shingled roof. These were about 4 by 5 feet and four feet high, and raised a few inches off the ground. We placed a box in each one for a house and covered the bottom with straw and partially filled the house with straw.

It was necessary to feed and water the rabbits each night and morning A little clover or alphafa hay was fed to them regularly. They also appreciated any grain such as corn or scraps such as carrot or potato peelings. In fact they seemed to be happy with almost any vegetable. They were especially fond of lettuce or cabbage; so we fed them the outer leaves and stalks.

A rabbit is easy to dress as it is only necessary to kill it with a blow on the back of the head, skin, and dress it.

In summary we had freshbeef and pork in the winter and chickens and rabbits the year round. We also had corned beef and smoked hams and shoulders and salt pork at all times. So everyone had a high protein healthful diet.

Dairy Products

I have mentioned the cattle and dairy products. And I have described the butchering of a beef on page 805. We milked from 4 to 6 cows daily and processed the milk by separating the cream for sale for butter. The processing of the beef is described below. The beef was first cut into quarters. The front quarters were cut into small pieces and placed in saturated brine with a small amount of sodium nitrite to color the meat a bright red. The rear quarters were hung in a back room and frozen. Just enough was allowed to thaw out for us to cut off steaks and an occasional roast but we usually had steak once a day all winter and well into the spring. Since we always killed the beef when it was quite young, the beef was very tender. After the fresh beef was used up and it was too warm to keep fresh meat (we had no refrigeration or ice), we used the corned beef. The meat was simply boiled until tender. After one has developed a taste for corned beef, it is delicious. There was enough of the corned beef that we were able to use it all summer along with salt pork, hams, chickens, and rabbits.

We always milked from six to eight cows twice daily. This produced about 8 gallons of milk each time. The cream was separated from the milk and the skimmed milk fed to the young calves.

The separator was made by the deLaval Company. Essentially the separator depended upon the difference in specific gravity of the milk and the lighter cream due to the fat particles present in the milk. About 3% of the milk was butterfat. The skimmed milk contained about 0.1% butter fat and the cream contained about 20% butter fat. The skimmed milk was fed to the calves. The cream was taken twice weekly by one of the neighbors or by us to a "creamery"that purchased the cream from many Farmers and churned the cream and made butter. Sometimes we made butter in a small hand operated churn at home.

To return to the discussion of the farm there are many subjects which I have not discussed. I have tried to place these in a logical sequence without success. So, the subjects are presented in a random order.

I have mentioned cooking and baking and the vegetables and fruits. Farm women had more to do than modern women that live in towns and cities. First of all the purchase of foods from outside, as mentioned previously, was not easy. It was necessary to harness a horse, hitch the horse to a buggy, and drive miles to the nearest town. While this sounds easy, it was always a bit difficult, especially in summer. For example when the horses had been turned out to pasture, they resented being rounded up and driven back to the barns. At night and regular feeding times they always showed up but when you wanted them in mid morning, it was necessary to walk to the field and drive them to the barn. The only weapons we had were the use of oats or a special feed which we never used in summer and stones. As noted all the animals resented and tried to avoid well directed 3/4 inch diameter stones thrown at their sides.

Then the horse had to be harnessed. For pulling a buggy the harness was light and easily thrown on to the horse's back and strapped in place. But the horses' work harnesses weighed up to 20 lbs. In this case a heavy collar was first fitted over the horse's neck and buckeled. The collar was a leather covered batch of heavy fibers. Where it fitted against the horses shoulders, it was about five inches wide and thin over the neck. It was buckeled at the top. Since the collar weighed about 12 pounds, it was not easy to fit it on the horse. We always used pads under the collars. These were cloth covered hair pads about one inch thick. They protected the shoulders from the rough leather and also spread the load on the horse's shoulders.

While harnessing a horse sounds easy, it should be remembered that

a harness for field work weighs about 20 pounds and the horse is about 5 1/2 feet tall at the shoulder. It was necessary to throw or lift the harness on to the horse's back, buckel the harness under the horse's tail, under its belly or stomach, and in front. Then another smaller piece or bridle had to be placed on the horse's head in place of the halter used in the barns. The bridle was used to drive or guide the horse. It had an iron rod about 1/2 inch diameter that fitted into the horse's mouth so that a pull on one or the other side would indicate a change of direction to the horse. God saw to it in planning the horse that it had no teeth at the back of its open lips; but only teeth in front for pulling grass or picking up things and teeth to masticate the food further back in his mouth. I have always thought this was excellent forward planning on God's part. Cattle have teeth continuously in their mouths; so direction has to be imparted by a stick or, in well trained oxen, by word of mouth. Of course well trained horses will respond to word of mouth also.

But our horses were always guided by a pull on the iron rod or bit in theirmouths. A person in a buggy or guiding a plow could easily guide the horses as they needed very little guidance except in turning. But it was necessary to continuously hold the reins and let the horses know that you were about. Like people they seemed to appreciate some guidance.

We always treated our horses as half pets and half slaves. Whenever we went near them, we talked to them and patted them. We also fed them well and they were always fat and appeared well nurished, see page 786.

Every person that used horses had tales to tell about their horses. For example Winnie's Father or "Pop" was a Country Doctor living in Helmer, Indiana. Helmer is a very small town in Northeast Indiana. He had a very large and extensive "practice" or many patients, mostly farmers in the area. He drove horses until about 1915. Since he was sometimes called by farmers for emergencies such as bringing a baby into this world of tears and laughter (over 1300), he frequently had to drive home at very late hours. Sometimes he would go to sleep. When the horse got to the barn where he lived, the horse would whinny to wake Pop up.

The above story points up the difference between driving horses and riding in buggies at night with no lights and today's automobiles. This was always done until about 1915 as no lights were used with horses and buggies. When automobiles became an occasional hazard to the buggies,lights had to be used as they are in those areas in which the farmers still use horses and buggies. But in 1915 the roads were gravel and travel was essentially all local. Everyone that owned an automobile drove slowly on country roads. The maximum speed at night on those roads was 15 to 20 miles per hour.

For trips over 10 to 20 miles everyone road the electric interurban cars or steam railroad trains. The local railroads, steam and electric ran everywhere in the Midwest. But most of them have been torn up and none of them run local trains that stopped few miles, are no longer used except as commuter railroads around the larger cities. The trains have been replaced by local buses and automobiles.

When I was a boy, we lived near three railroads. There were trains to Detroit, Toledo, Jackson, Adrain, and from there to other places. None of these trains operate today. Two of the railroads have been torn up and two are still operating freight trains.

We have gained in personal convenience with the automobile but at great materials and farm area losses. What of the future as population continues to increase rapidly? Starvation? The ills of insufficient foods? I keep saying that we are mining the Mid-west and that the building of houses on large areas as we tare up the rich soils is a crime against future generations. Roads use thousands of acres. Both road and house builders use bulldozers as if the land was infinite. Starvation in the near future is the result - witness Mexico and India. Up to the present the Scientists and Engineers in the United States, Canada, and Western Europe have kept ahead of the population growth. But it is only a question of time - and a short one too, probably less than 100 years and within the lifetime of some persons now living and certainly within the lives of our Grandchildren - before starvation or at least poor diets will become a problem to those living in the United States. I believe that it is only a few decades before the population density in the United States will catch up to the productive capacity of the land. But as of the moment we seem to be optimistic. For example we are sending large amounts of grains to other Countries and the farmers are complaining of low prices. Even Congressmen such as Fithian are trying to get us to use possible foodstuffs for conversion to ethyl alcohol for mixing with gasoline to make our petroleum last longer. How silly can we be! Does he not know that natural gas is used to make fertilizer to grow the corn? Every Engineer recognizes that the procedure is not cost effective. Even worse it is not resource effective.

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There are a number of topics that I have not discussed that appear to be connected with my life and experiencies. These are disconnected and fit under no specific category. So, I have written them up and placed them in this autobiography as a part of the whole story. There are obvious overlaps and many discon-tinuities.

Labor Saving Devices

The people growing up in the Western Civilization today can have no concept of living conditions before the Industrial Revolution and those conditions even today in such Countries as Idian and Mexico. I have never visited Brazil, Australia, or China (I have been close enough to look into China from Hongkong and I have been in Africa only to change airplanes at Cairo Airport at 0300 in an absolutely dry sand desert.) So I can speak only of Mexico, Guadamala, India, Indonesia, Argentina, North America, and Europe.

Most Americans have seen the painting, "The Sowers." This picture should be studies by every West European and American including the Canadians. The picture shows a Farm Family sowing grain. But the Farm consists of an acre or so of land with a very small cottage. The man and woman are working this land with wood tools. It is the products of this land that must keep them alive for a year, provide seed for the next season, and provide some funds for purchases of food, clothing, fuel, etc that they cannot produce or scronge for themselves. What they cannot raise or find in the neighborhood, they must do without. Probably they have rented the land that they are spading and the owner demands and gets one half to two thirds of the crop and he may not furnish his share of the seed for the next crop. I have mentioned the Family in India plowing a half acre with a stick plow, a very poor horse, and a cow which was also very very poor. One cannot ever forget such a picture - nor that of women collecting fresh cow droppings and plastering them on light poles to dry, knowing that that is their only fuel part of which they may have to sell to purchase rice or grain as rice is too expensive for them to use. And yet as I have stated, there are as many middle class people in India as in the United States. The Indian Middle Class people live just like we do except that they have servants in their homes. They simply ignore the poverty stricken people around them.

Thus India and Mexico are displays in contrasts of the West in living standards. But the poor are so poor that they have no hope for the future. As mentioned India is trying to limit population growth, while I believe Mexico and South America are not. The Preists in Catholic Countries keep telling the poor people to have many children as God will bless them for

for doing so. Perhpas the idea is that the Catholics will outbreed the Protestants and others and thus become the dominant Church the World over. But, it seems that the idea, like many others, is and will contribute to a great deal of suffering due to the lack of food and to malnutrition. In fact it is already doing so in Mexico. What hope do people have? Mexicans have oil, or so it is reported, but this will not last forever and it will only lead to misery when it runs out - unless it is used to build Nuclear Breeder Reactors - both uranium and thorium. Of course the oil revenues can be used to build such Reactors but these are frowned upon in the United States today. It seems that Jimmy Carter and the Environmentalists have no idea of the standard of living in Mexico, India, and elsewhere. Apparently, Jimmy Carter is just trying to get votes by being so Goody-Goody! Again, I ask, "Why?" What of the Future?

The typical housewife in the United States has many labor saving devices. For example, Winnie and I have the following electrical devices in our home. This is probably typical of most Middle Class homes in the United States today. This is also true of most of Europe.

Kitchen:

Motor Driven:		Static:
Refrigerator	Clock	Lights
Deep freezer	Mixer	Radio
Garbage disposal	Can opener	Television
Ventilating fan	Stirror	Stove, cooking oven
		Telephone
		Toaster

Remainder of the House:

Motor Driven:		Static:
Grinder	Drill	Lights
Dehumidifier	Hedge trimmer	Radio
Furnace - 2 motors and control	Rug cleaner - 2	Television
	Furniture cleaner	Telephone
Razor	Phonograph	Heater - portable
Sewing machine	Attic fan	Clothes drier
Washers - 2 motors		Heater - water

These are all electrically operated. The price of fuel is going up and the cost of electricity is increasing to the point that it is a drag to poor families. Why President Carter cannot see the need for the Breeder Reactor and why all Nuclear Power Plants are so overdesigned, I cannot understand. I believe that Boiling and Pressurized Water Reactors can be built at 2/3 of present costs by simply cutting back on the designs. I have never believed that Containment Vessels are justified. I do believe that the ASME Pressure Vessel and the API Piping Codes are justified but, why inflict additional safety requirements on Nuclear Power Plants, is beyond my comprehension. If we would spend a bit of the money putting maximum speed controls of 55 or perhaps 50 or even 45 miles per hour on automobiles, it would add much more to reduction of persons being killed as a result of accidents and at the same time it would save much of our fuel.

Farming Procedures

While I have discussed various farming procedures, there are several others that I have not mentioned. Some of these are discussed in the following pages. Due to the varied subjects, they appear to be disconnected but there is a connecting link in that all were a part of the regular round of events, some daily and some annual. To review a bit, the taking up of land, clearing, the raising and harvesting of crops, construction of buildings, and digging of wells have all been mentioned quite at random. I have also mentioned the milk, vegetables, and fruits that we raised, used, and sold. But there are many subjects that I have not discussed. Some of these are discussed below in no particular order.

It is obvious that many items of food were raised on the farms. But there were many things that were purchased when I was a boy. Nevertheless the framers were more independent than they are today as they raised many types of things and much of their foods.