

# PROGRESS IN AGRICULTURAL MACHINERY

a youth publication

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BULLETIN 596 C - JUNE 1955

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# Progress in Farm Machinery

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Our grandfathers and great grandfathers have seen v e r y remarkable changes in farm machinery during their lives. Some of them have used the old-fashioned cradle for cutting wheat and oats, the scythe for mowing hay and the corn knife for cutting corn. Many have used the horse or ox-drawn double-shovel cultivator for cultivating corn and potatoes. It is certainly a long step from those simple hand tools and the very early horse-drawn implements, to the large tractor-drawn or self-propelled machines of today. Of the many changes that have taken place in Missouri agriculture in recent times, none has been more important than this. It has almost revolutionized our agriculture. The purpose in writing this bulletin is to provide a better appreciation of these changes and their effects on the farmers through the years.

The pioneers who settled this country brought as many of their belongings with them as they could find room for in one or perhaps two covered wagons, and they trailed the beginning of their herds behind. They brought with them a few well selected tools and metal parts for making new equipment and repairing wagons on the way. In many cases they found room for one of the wooden breaking plows then in use in the East.

When the land for the pioneer farm had been selected and the site for the



The pioneer seeking a new home.

cabin chosen, there were three things that the families must do during the first season. First, they must provide for a supply of water for themselves and their livestock; second, they must plant some grain and vegetables to carry them through the winter ahead; and third, they must provide a cabin for themselves and a shed for the livestock.

The buildings were usually located near a spring or running stream, and the clearing was made around this site to give better protection from Indian attacks. The timber was often dense, shading the ground completely. Crops required sunshine; therefore, it was necessary to clear the land before it could be planted.

It is not the purpose here to go into all the difficulties, hardships, and heartaches that came to the pioneer family, but it is necessary that we know something about the work they had to do to appreciate the importance of their machines.

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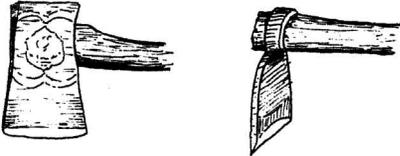
<sup>2</sup>Dean and Director Emeritus

*Acknowledgments.* The organizations listed below kindly assisted in providing illustrations for this publication. The Farm Equipment Manufacturers' Association, J. I. Case Company, International Harvester Company, the Ford Company, Lowden Machinery Company, Danuser Machine Company, the Ferguson Company, and the Gravelly Company.

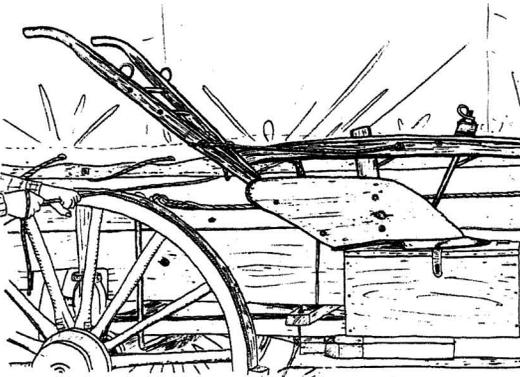
## IMPLEMENTS USED BY PIONEERS

The early tools and implements were selected for doing the work of clearing the land, preparing for, planting and harvesting the crops, and for shaping logs and poles for use in constructing buildings and fences. These were the machines of the pioneer agriculture. We usually think of a machine as a combination of wheels, gears and bearings, but Webster defines the term as follows: "A device or contrivance for making more effective use of power." In this sense almost any tool is a machine.

The ax is a machine, according to Webster. It is a flattened piece of steel weighing 3 to 4 pounds, with one or both edges in the form of a broad wedge, sharpened for cutting wood. It has a wooden handle about 3 feet long



The ax and the grubbing hoe, two very important implements in pioneer days.



The pioneer plow found a place in most of the covered wagons that came out West.

by which a man can swing it and bring it against a tree with much force. The weight of the ax, and the speed with which it strikes is sufficient to force the sharp edge into the wood. By the skillful use of the ax, a man can fell an ordinary tree in 15 to 20 minutes. The ax thus enabled the pioneer to use his strength more effectively and, therefore, it can be considered a machine. Trimming trees and cutting logs and poles to the lengths needed in construction work were accomplished by the man using the ax.

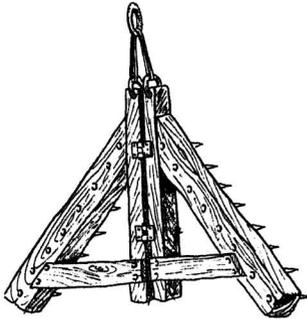
Where stumps and roots were to be removed, the grubbing hoe was used to clear away the soil, exposing the outer roots so they could be cut with the ax at a point well below the plow line. If a plow was not available, or if the area was not large, the soil was often prepared by loosening it with the grubbing hoe.

The early plows were made of wood, with the exception of the plow point and, in some cases, metal strips on the moldboard. They would not compare favorable with today's plows, but they served to stir the new or virgin soil and enabled the pioneer farmer to plant some crops.

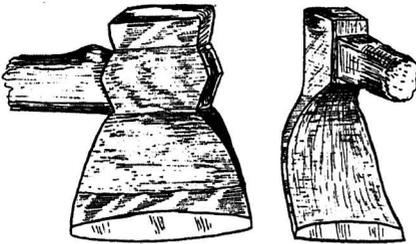
The virgin soil was filled with black organic matter (the rotted remains of roots and stems of plants that had accumulated for many, many years) which made it mellow and easy to work. The pioneer farmed the land for many years before all of the stumps were removed. He needed a harrow for smoothing the plowed soil that would not catch on these stumps but would



A brush harrow made with material at hand.



An A-harrow would slide around the stumps.



The broad ax and the adz were tools for shaping logs for buildings.



The pioneer cabin built for protection from the Indians as well as the weather.

pull around them. He used a brush harrow or built one with a frame in the shape of the letter A. The harrow teeth were driven into holes in the frame, and it was pulled from the point of the A so it would drag around the stumps. The mellow soil was easy to work, and the harrow was all that was needed to prepare a good seed bed. The land produced well with little cultivation.

As soon as sufficient land had been cleared and planted in crops to carry through the winter, attention was turned to the problem of building a cabin. During the process of clearing, this project had been always in mind. Trees were felled and logs cut to fit into the cabin which was to receive attention when crops had been planted. The farmer would drag or roll these logs to the building site and place them in order of their use. An ax with a broad blade, called a broad-ax, was used in making a flat surface on opposite sides of each log that was to go into the walls of the cabin or house. Another tool called an adz was used in shaping the framing timbers and roof supports. For making shakes or shingles for the roof, logs were cut into 24- to 30-inch lengths, and thin pieces were split from them.

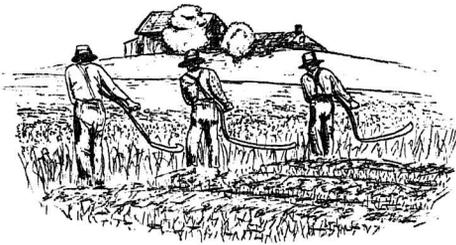
Building with logs was heavy work and required much ingenuity and patience. Many times the home could not be completed the first summer, and it would be necessary for the family to live in the covered wagon through the first winter. Of course time had to be taken out from the work of building to care for such crops as were grown.

Hay was cut with a hand sickle or a scythe. The scythe consisted of a curved

blade fastened to a long handle, so arranged that a man could cut a four or five foot swath and lay it at one side in a windrow. The blade was set so that it would cut with a slicing action as the sharp edge moved through the standing grass. This was difficult work in the hot weather of the harvest season. However, the scythe enabled the farmer to use his energy much more effectively in cutting hay than was pos-



Cutting grain with the sickle.



Mowing grain or hay with the scythe.



Cutting and bunching grain with the cradle. This method was used for many years.

sible with the hand sickle. After curing or drying, the hay was placed in piles or shocks in the field for further curing after which it was stacked for winter feed.

The cradle was used by most early farmers to cut their grain. This machine was similar to the scythe except that it had a heavier and wider cutting blade and also a set of wooden fingers mounted just above the blade to gather the grain and allow the operator to lay it in neat piles ready to be bound into sheaves. The man was required to swing the cradle in an almost complete circle to cut the grain and lay it down ready for binding. This was a still more difficult and exacting task than cutting with the scythe.

The persons who bound the grain followed the man with the cradle usually collecting two or three bunches into one by pushing them together as they walked. They would pick up a handful of the straw and make it into a band, then pick up the pile of grain and tie it into a bundle. These bundles or sheaves were set up in shocks and covered with a sheaf to turn the rain. After they were dry, they were hauled to the building site and stacked or threshed.

Threshing was accomplished by loosening the bands on a few bundles, piling them on a smooth clean place on the ground or a threshing floor, and then pounding the unthreshed grain with a *flail*. The flail consisted of a rather long pole and a short pole, each about two inches in diameter, connected together with a section of leather or chain. The pole making the handle was about six feet long and the other, two

or three feet. By lifting and swinging it, the short pole would strike through-out its length and thresh the grain from the straw. When the grain had been threshed from the heads the straw was removed with a fork, leaving the grain and chaff on the ground.

A dry, windy day was usually selected for the threshing operation. The grain and chaff were thrown into the air so that the wind would blow the chaff to one side and the heavier grain would fall back on to the ground. When the grain had thus been separated from the chaff, it was placed in storage to be ground into flour or fed to the livestock.

The pioneer farmer made many machines or tools to help him in his work. On practically every farm one could have found an assortment of wooden mauls and wedges, in different sizes. Split rails were used in making fences for the yards and pastures.

Buckets, baskets, hinges, and door latches were made from wood by the farmer. The door latches were made so that they could be lifted from the outside by a string extending through a small hole in the door. To lock the door the string was pulled inside. At times, to make the neighbors welcome, the pioneer would leave the string out and from this comes the old statement that "the latch string will be out when you come."

As the land was settled, wagon roads and railroads were built, and trails were established through the back country so that it was possible to sell those products which could be moved out to shipping points on the railroads. Livestock could be driven to market, and

this encouraged the farmers to increase the size of their fields and herds.

Oxen and horses had been used in a limited way in the pioneer agriculture but now, with the availability of markets for farm products, there was rapid increase in the use of animal power in farm work. This brings us to a new era in machinery development, the adaptation of farm machines to animal power.



Threshing with the flail, another very old practice.



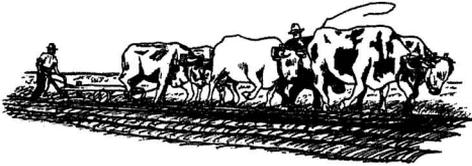
Winnowing grain to remove the chaff.



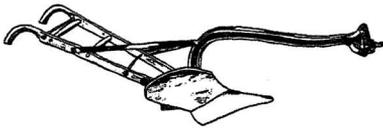
A foot knife designed to help with the task of cutting corn.

## THE ERA OF ANIMAL POWER

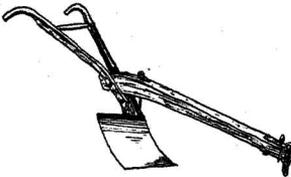
Two machines were demonstrated in the 1830's which mark the beginning of a period of rapid expansion in the use of animal power in the work of farming. In 1831 McCormick demonstrated a machine which utilized the power of the horse for cutting grain, a task that had been accomplished only



The prairie breaker required three or four yoke of oxen to turn the tough sod.



The steel beam was more satisfactory and soon replaced the wooden beam plow.



The steel moldboard plow was essential for plowing crop land.

by the physical effort of man for centuries. A few years later, John Deere gave to the world the steel plow, replacing the inefficient methods of stirring the soil, with a machine that cut and turned it with greatly reduced effort.

These two machines ushered in the era of machinery designed to use animal power. Development was slow. An increase in the size of fields could be made only by clearing more land and preparing it for cultivation. The amount of clearing accomplished each year depended upon the amount of time the farmer could give to it during the season. No doubt a considerable amount of his time was required to cut the sprouts and new growth, in order to keep the forest from taking back the fields that were already in use. Crops had to be planted, cultivated, and harvested and so the wonder is that the farmer was able to make any progress in expanding his farming area.

Most of the farming of this period in the timbered areas was carried on among the stumps and roots. Oxen were well adapted to this work. They were strong. They moved slowly and they would pull whenever they were called upon to do so. They pulled by means of a yoke on top of their necks so that the steep angle of pull gave them traction and great lifting and pulling power.

Each year some stumps would be removed until finally the field was completely cleared, ready for use of the new machines that were to come. The num-

ber of machines designed for use with oxen was rather limited. The large wagons for hauling, the breaking plows for plowing timber land and the prairie breakers were best adapted to oxen. Most of the other machines developed in the period were made for use with horses and mules.

### Machines for Plowing

The first steel plow had a wooden beam. A wooden moldboard was covered with a thin sheet of steel, bent to a curve that would turn the furrow slice. The draft was reduced, compared to the earlier wooden plows, and the soil was more thoroughly crumbled. John Deere, an early plow maker had many problems to overcome in establishing his plow business. A rumor to the effect that a steel plow would poison the soil retarded its use for some time, but the increased efficiency and quality of work accomplished, soon overcame the effect of this rumor.

The operator walked behind the plow, keeping it in position by holding the handles. In early times there were other machines that the farmer had to control with his hands. Some men placed the lines around their waist so they could guide the team and hold the plow at the same time. Others trained their teams to respond to the commands "gee" and "haw". Gee meant to turn right and haw to turn left.

A full width cutting edge was necessary for plowing the prairie sod. The most common width was 24 inches. This prairie breaker plow had a steel cutting edge and a slatted steel moldboard. It required from four to six yoke of oxen to pull it, depending on the type of sod and soil conditions.

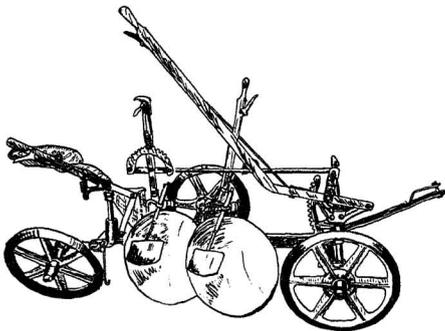
Before many years the two-wheel "sulky" plow, equipped with a seat for the man to ride and drive the team, came into use. It was equipped with two levers, one for leveling the plow and the other for lifting it at the end of the field. It was called a "sulky" plow because of its similarity to the sulky then in common use for transporting people. The three-wheel sulky had many advantages over the two-wheel one. The center of gravity was lowered, making it safer for the operator. An additional plow bottom was soon added, making a two bottom or gang plow, with eveners for a four horse team. As the mellowness of the soil became less, due to lack of proper management, five horses were often necessary to pull it. In this case, three were hitched back with two in the lead. Special eveners were provided to equalize the load.



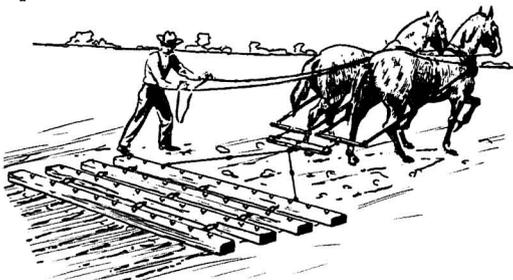
The two-wheel sulky plow was equipped with a seat for the driver.



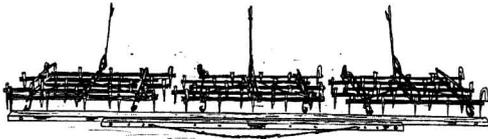
The three-wheel sulky was more stable and less difficult to handle.



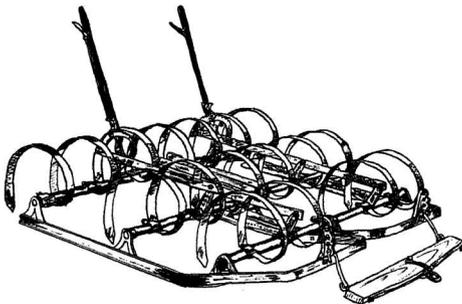
The disk plow is used on soils that are hard to plow.



The wood frame harrow was made to cover a wider strip.



An all-steel adjustable harrow could be set to secure the best quality of work.



The spring-tooth harrow was a more effective cultivator than the smoothing harrow.

In some sections of the country, the soil was too hard to plow with a mold-board plow. To meet this situation, disk plows were developed. They gave better penetration but usually did not do as thorough a job of loosening the soil or in covering surface material. One manufacturer constructed a single disk plow with an arrangement for turning the disk so it would throw the furrow either to the right or to the left. The purpose in designing the plow was to make it possible to turn all the furrows up hill in the plowing operation.

### Preparation

The "A" frame smoothing harrow was used to some extent in this period but soon gave way to a harrow made up of two or more sections fastened to a full width draw bar. The frame in the first harrows was of wood with steel teeth inserted in it. The divisions or sections made the harrow somewhat flexible for work on uneven ground. After a number of years the steel frame adjustable harrow was developed. Each section was equipped with a lever for adjusting the angle of the teeth. If there was trash on the surface, the teeth could be set at an angle to prevent it from collecting under the harrow frame.

The spring tooth harrow was an excellent tool for preparing fall plowed or early plowed land for corn. It was very effective where there was no loose trash on the surface. The disk harrow was made with either solid or notched disks. When the disks were set to run in a straight line they rolled along without turning the soil. When the two sections of the disk were changed

into a V-shape they penetrated the soil and cultivated the surface. The depth of cut varied with the amount they were moved out of line. This was a good tool for working cornstalk ground and was instrumental in saving much of this fibrous stalk material to improve the mellowness of the soil.

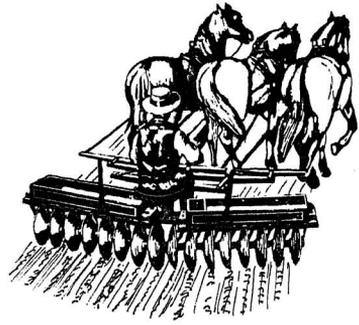
The smooth roller was an early development but the cultipacker was a much more effective tool. It was made up of a series of wheels with sharp V-shaped rims. Each wheel cut into the soil and pulverized the surface layer.

### Machines for Planting

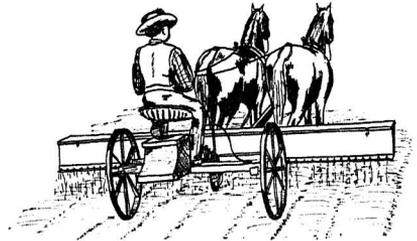
With the coming of the larger fields, different machines were developed to speed up the work of seeding grain and grass crops. An early type of seeder consisted of a long box fitted with a shaft for agitating the seed and causing it to run out through openings in the bottom of the box. These openings could be closed or opened by use of a lever to govern the amount of seed sown.

A machine known as an endgate seeder utilized the principal of sowing by hand. The grain ran from a hopper onto a revolving paddle wheel which was operated at high speed. It scattered the grain over a strip from 16 to 24 feet wide. A sprocket fastened to the spokes of a rear wheel on the wagon furnished power to drive it.

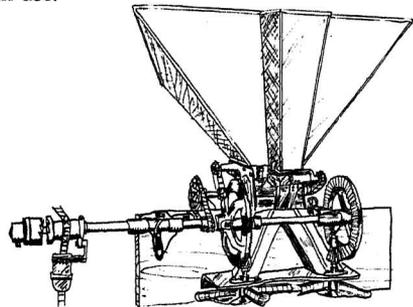
In an attempt to secure more uniform planting and coverage, a machine known as a drill was developed. It was designed to open shallow trenches into which the seeds were scattered and covered to a uniform depth. The first type used a small shovel or hoe to open furrows usually about 8 inches apart.



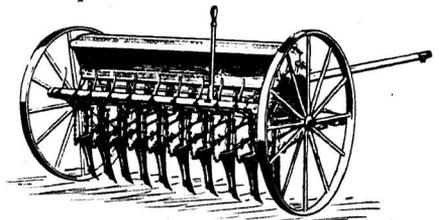
The disk harrow was necessary where the soil was cloddy and in poor condition.



A broadcast seeder was a great improvement over the hand seeding method that had been in use.



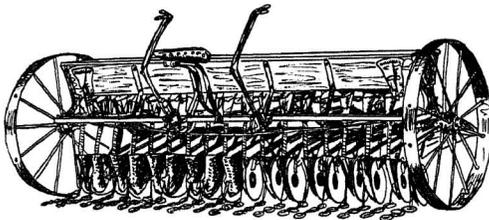
An endgate seeder. It would seed a wide strip on each trip across the field.



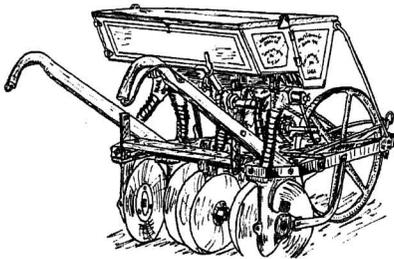
The hoe drill, an excellent seeding machine for clean ground.

These shovels had sides or shields to keep the furrows open until the seeds were planted. Chains with rings attached dragged behind to cover the seed. If there was trash on the ground it would often collect on the shovels causing trouble. In later models disks or pairs of disks were used as furrow openers. These would cut through surface trash and proved to be quite effective.

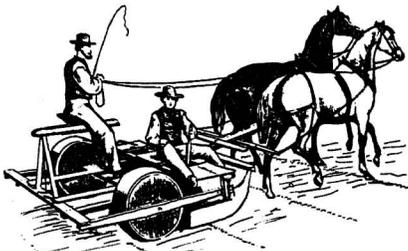
Farmers were anxious to follow the



A drill with disk openers equipped with drag chains to cover the seed.



A one-horse drill for seeding wheat between the corn rows in the fall.



A hand-drop corn planter, for planting the rows straight both ways.

corn crop with wheat. If they cut and shocked the corn they could accomplish this but if they did not cut the corn it was necessary to seed the wheat between the rows of corn before the crop was harvested. To do this a small drill was developed to go between the rows. These were sold in rather large numbers for a time but were later replaced by the larger drills.

### Row Crop Planters

The first horsedrawn corn planter was made with a hand operated drop. Steel runners penetrated the soil to the desired depth. They were divided at the back to give space for the corn to fall to the bottom of the channel. Sometimes press wheels followed to pack the soil around the newly planted seed. Hills were dropped about 3 feet 8 inches apart in the row. The bottom of the seed box consisted of a round steel plate with holes near the outer edge. The holes were made the proper size to hold two, three, or four kernels of corn. Each time the drop lever was moved one of these holes would come over an opening and allow the corn to drop through. In the years that followed there were many improvements in planters in securing accuracy of drop and placement of the corn in the hills. As weeds came to be a serious problem the fields were check planted so that the corn could be plowed in two directions.

The hand drop planter was replaced by the check row machine in which the drop was made by means of a wire with metal buttons fastened to it. This wire was stretched across the field and anchored with a metal stake at each end. The wire was threaded into the planter

which was driven along beside it. Each button operated the drop lever, planting as many hills across the field as there were buttons on the wire. Special planters have been made for cotton, potatoes and other crops, too many to be described here.

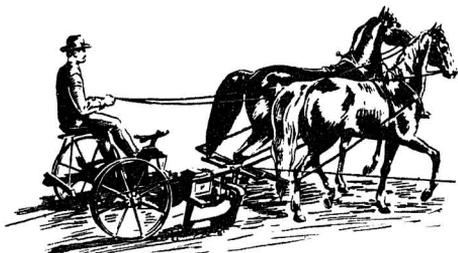
### Row Crop Cultivators

Among the early developments in machines for cultivation was the single shovel and later the double shovel cultivator. Two shovels were fastened to a single beam, one slightly ahead of the other and set far enough apart so that they would cultivate a strip about 20 inches wide. The machine was pulled by one horse. The double shovel was almost standard equipment for cultivating row crops for many years.

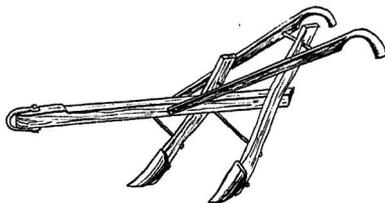
The need for greater accomplishment per man led to the development of a machine known as the tongueless cultivator. It consisted of two double shovel cultivators spaced in front by a steel arch. A singletree was fastened to each beam so that each horse in the team pulled the cultivator on its side of the row. This doubled the amount of cultivation a man could do in a day.

The spring-lift, tongue cultivator, came next, with many advantages over the tongueless type, particularly in transportation and in ease of handling. The beams were balanced by springs, making them easier to guide and to lift at the end of the field.

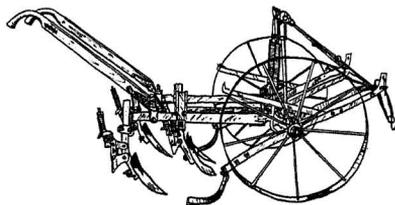
The next improvement in cultivators was the provision for the operator to ride while he was cultivating. Foot stirrups were provided for guiding the cultivating beams to take out the weeds without injuring the corn. The increase in corn acreage made it necessary



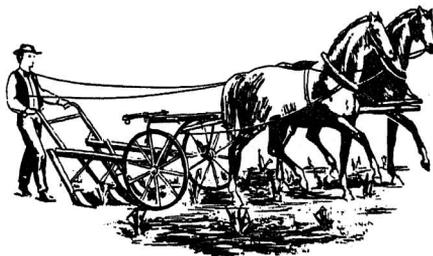
The wire check-row corn planter was a great improvement over the hand-drop type.



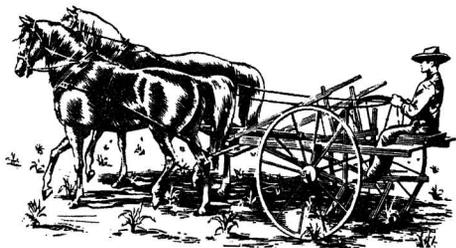
The "double shovel" was the main tool for cultivating corn for a number of years.



The tongueless cultivator was made from two double shovel cultivators mounted side by side.



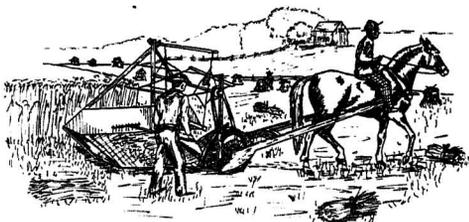
The tongue cultivator was easier to handle and soon was used almost universally.



The next improvement was the riding cultivator.



Soon the manufacturers had provided for cultivating two rows instead of one.



McCormick's reaper, the first machine to cut grain without the power of man.



A larger machine where the driver and a man to rake off the grain both rode.

for the farmer to cultivate more acres per day. The two-row cultivator with foot controls, enabled a man to handle the three- or four-horse team needed to pull this machine. In the four-horse hitch, the two teams were moved out, leaving vacant the center space ahead of the operator.

Sweeps and spear point shovels were used generally in the latter part of the animal power era. The depth of cultivation was decreased and more thorough coverage was obtained.

### Grain Harvesting Machines

McCormick demonstrated his early reaper in 1831. His was the first machine to use the power of the horse for cutting grain. For thousands of years this work had been done by men using sickles, scythes or cradles.

McCormick, and his slave boy "Jo" cut about one-half acre at the first demonstration with this machine and they were forced to guard the reaper to keep the men who worked with cradles from burning it. These men felt the reaper would take away their means of making a living. Before many years the machine was made larger. Both the driver and the man who raked off the grain rode on the machine. It required two horses instead of one to pull it. Later some ingenious man made a mechanical rake to sweep across the platform and remove the piles of grain as they were cut. This machine was then called a "self rake reaper".

The next major development was the "Marsh Harvester," built by Marsh Brothers. They placed a canvas belt back of the cutter bar to carry the grain to one side, up and over the drive wheel to a binding platform. Two men

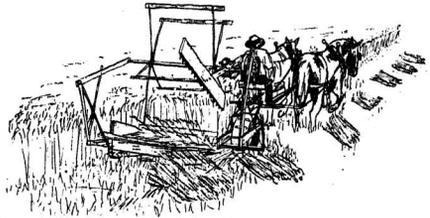
rode on the machine and bound the grain. Tying or binding the grain on a Marsh Harvester required fast work if the grain was heavy. Riding and binding was much more difficult than doing the same amount of binding in the ordinary way. During this time many men were working on the problem of designing a mechanical tying mechanism. Most people of that time thought it could never be done. The first machine that did the work successfully used wire to tie the bundles. It was known as the "wire binder."

However, small pieces of wire would break off, creating a danger for the cattle that fed on the straw. Pieces of wire also mixed with the threshed grain and damaged milling machinery. Use of a magnet to remove iron and steel had not begun. Hence, flour millers objected to the use of wire to tie grain bundles.

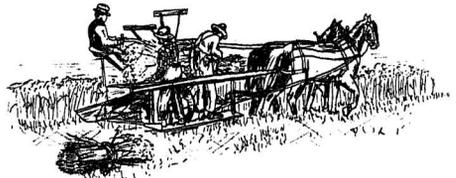
After a few years a twine binder was made. It was improved from time to time and was used by thousands of farmers over a period of more than half a century.

Shocking grain required a great deal of walking to collect the bundles. To reduce this extra labor binders were equipped with bundle carriers. The binder operator would allow a few bundles to collect on a carrier and then dump them in rows convenient for shocking.

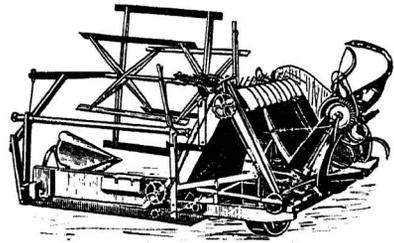
Before the binder was made obsolete by the combine the manufacturers had perfected a machine to set the bundles into shocks, doing away with another difficult task in the grain harvest. During its long period of use the grain binder was developed to a high point of perfection.



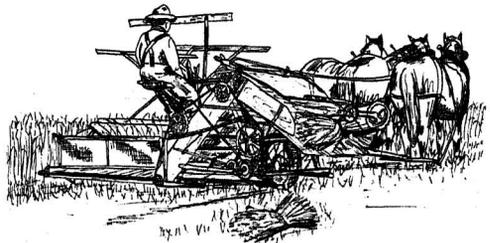
The self-rake reaper aided the North in the production of food during the Civil War.



With this Marsh harvester three men could cut and bind 10 acres in a day (1860-83).



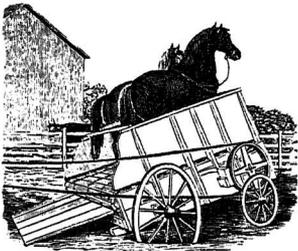
The wire binder served a short time and was then replaced by one using twine.



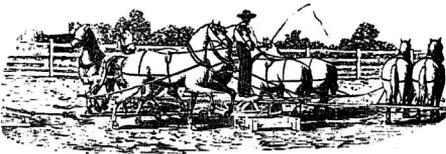
The twine binder came in 1883 and is still used on some farms.

## Adapt Animal Power to Threshing

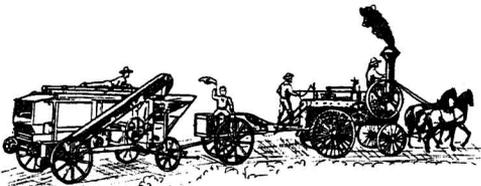
Threshing in the period of animal power required some means of applying this power to driving machines that used rotating parts. This had been accomplished in many machines that moved through the fields by using the ground wheel drive. Stationary machines created a new problem. One of the early machines for solving this problem was the so-called "tread mill."



The tread mill used horse power to drive small stationary machines.



The "horse power" was used to drive threshers, grinders, and other machines.



A portable steam engine. Usually from four to six horses would be needed to move this equipment.

This consisted of a continuous belt arrangement with cleats fastened across it. The belt would be locked, one or two animals would be placed in the chute and a gate closed behind them. The upper roller supporting the belt was connected by a jointed shaft to the thresher or other machine to be driven and when the platform was released it was necessary for the animals to keep walking. Their weight caused the belt to move down, thus driving the machine. The tread mill was equipped with a governor that was set at about the ordinary speed at which an animal could walk without over-exertion and which would also keep the machine running at the desired speed.

Another machine of those early times was called a "Horse Power." It consisted of a central gear box to which power arms, usually four, about 14 feet long, were attached. Teams were hitched, one to each of these power arms. Lead poles were provided to guide them in a circular path around the central gear box. A driver located on a stand in the center kept all of the teams pulling an equal share. A tumbling rod or power shaft extended from the horse power to the thresher or other machine to be driven. Thousands of these horse powers were used in the period from 1850 to 1880. These machines were built in different sizes.

The steam threshing engine, transported at first by teams, was soon made to move on its own power. It was then called a traction engine. It was the forerunner of the present day tractor. It came into the period of animal power to do the work of threshing and was used to provide power for the saw mills

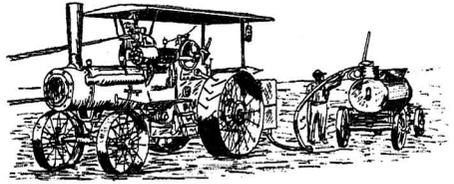
which were so important in that period.

The first internal combustion on gasoline engine tractors were similar in many ways to the steam traction engine. They were large and heavy, suited only to the work of plowing and operating the large threshing machines. These large, heavy tractors served for a short time near the end of the animal power period.

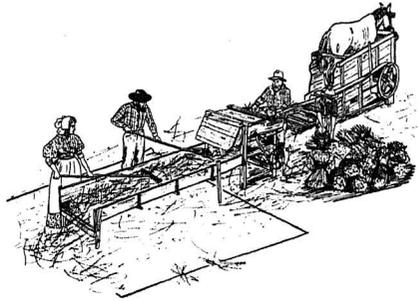
### Grain Threshing Machines

The development of the threshing machine was a gradual process. The first development beyond the flail, which had been used for thousands of years, was the threshing cylinder. The cylinder was built with projections or teeth extending out from its surface. These teeth passed between similar ones fastened to a stationary bar or concave. This cylinder was used for some time as an independent machine. It was a great improvement over the flail. The cylinder was driven by power from a tread mill in most cases. The grain was winnowed and the straw and chaff removed for feed or bedding.

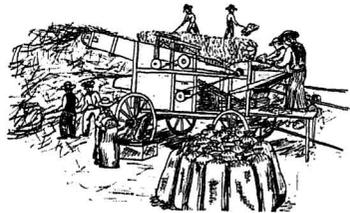
A machine called a fanning mill was built to take the place of the old method of winnowing the grain. Later these two machines were combined into one to be driven by the horse power described previously. The grain bundles were opened and the straw was fed into the cylinder in small amounts but in as nearly a constant stream as possible. The straw came off the straw racks at the rear of the machine where men were stationed to take it away and transfer it to the stack. Dust from the threshing would collect at this point so that removing the straw was a difficult and disagreeable job, especially on a



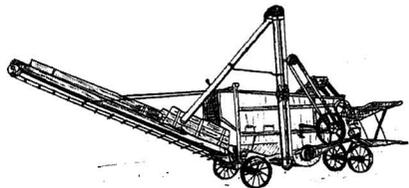
This engine moved on its own power and was called a traction engine.



The "Ground Hog Thresher" with a straw rack attached. Straw was raked off by hand.



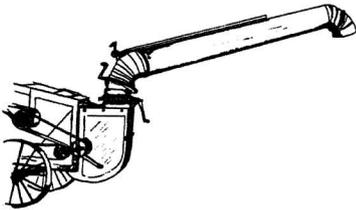
The threshing and cleaning operations were combined here in one machine.



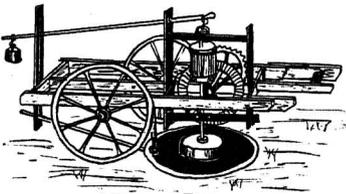
The straw carrier and grain elevator were added and machines were enlarged.

hot day. A carrier which was later devised for handling the straw could be raised as the stack was built up. This was an improvement in that the straw stackers were on the stack where there was some air movement. However, on the larger jobs, much of the straw had to be moved a considerable distance by hand.

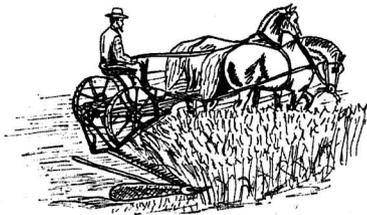
The next step was the swinging stacker which was geared to move slow-



A so-called "wind stacker" was added in later years. It was not very popular with farmers.



A revolving knife mower, 1822. One of the early attempts to cut grass by use of horse power.



A two-horse mower. This machine, like the grain binder, was regular equipment for many years.

ly back and fourth depositing the straw in a semicircle around the rear of the machine. The men followed the stacker moving some of the straw to widen the stack.

The so-called wind stacker consisted of a large blower attached to the rear of the thresher, having a swinging delivery pipe to carry the straw to the stack. This mechanism reduced the number of working and wearing parts. However, it was more popular with the manufacturers than with the farmers.

These threshing machines were not strictly farm machines; that is, they were not owned by each farmer. Usually some man in the community owned a threshing machine and would thresh the grain for the farmers in a community at a specified amount per bushel.

The threshing ring had an influence in the organization of the community. Neighbors knew each other better when the threshing run was finished and they were held together by sharing in this community task.

### Hay Harvesting Machines

The mower was a by-product of the work done on the grain reaper. The ground wheel drive and the cutting mechanism that had been developed were modified to meet the requirements for cutting hay. Pointed guards were placed on the cutter bar to extend into the grass to hold it during the cutting operation. The cut grass fell on the ground back of the cutter bar as the machine moved forward.

Two-horse mowers were made to cut from 4- to 7- foot widths and were almost standard equipment on farms in this period. Many improvements were made in construction and in the func-

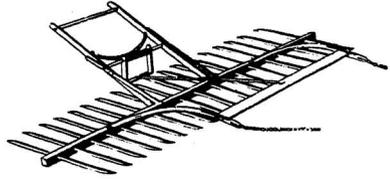
tion of different parts through the years and the task of cutting the hay crop was transferred from the efforts of men equipped with scythes to the power of work animals.

Hay rakes of the revolving type were made available in this period. They were pulled into the hay until the desired amount had been collected and then dumped by tilting the rake until the teeth would catch in the sod, turning the rake over and dumping the load.

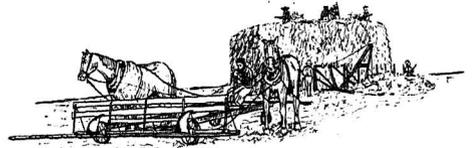
The next development was a machine called a "Bull rake," which had long wooden teeth extending forward from the main frame. One horse was hitched to each end of the frame to pull the rake until a load was gathered. The driver would move the load to a stack in the field. By turning the horses around and pulling in the opposite direction the rake was pulled from under the load, leaving it to be pitched on to the stack by hand.

A two-wheeled rake known as a dump rake used curved steel, spring teeth to collect the hay. The driver rode this rake and it could be dumped by pulling a hand lever to raise the teeth. A later improvement consisted of a foot pedal dump which used power from the wheels to lift the rake.

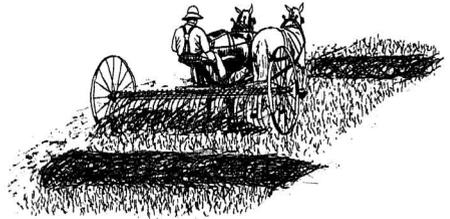
Pitching hay from the windrow or shock onto the wagon is heavy work, especially in the temperatures prevailing at harvest time. A hay loader which transferred this task to animal power was welcome. A rake loader was made up of a series of rakes with teeth pointed forward on the underside of the rake bars which extended to the top of the loader. The lower ends of these rake bars were mounted on a crank shaft



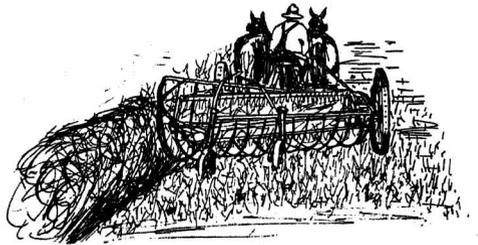
The revolving rake. Many of these rakes were made by the farmers themselves.



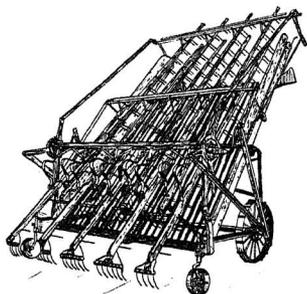
The so-called "bull rake" was a valuable labor saver.



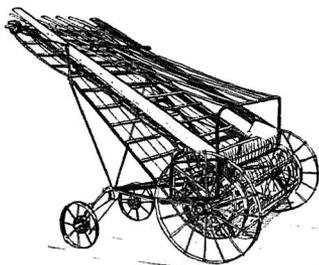
An early model of the dump or sulky rake.



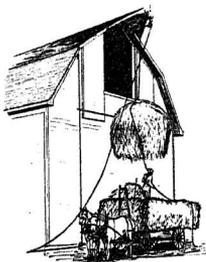
The side delivery rake rolled the hay into a loose windrow.



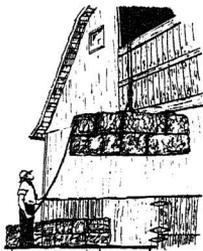
The rake type hay loader, elevated the hay and pushed it forward on the load.



The cylinder type hay loader required more work in loading the hay.



Transferring loose hay from the load into the barn.



Hoisting bales into a barn, using a grappling fork.

turned by the ground wheels. The rakes gathered the hay and the forks pushed it up an inclined surface onto the wagon. Another type of loader had a cylinder type rake to collect the hay and a web elevator to move it up an incline onto the wagon. These hay loaders were rather widely used throughout the middle west for many years.

### Machines for Placing Hay in the Stack or Mow

Various types of forks were developed for lifting hay from the wagon by use of a team or single horse. These forks were made so they could be pushed down into the hay and then set so they would not pull out but would lift the hay from the wagon. A long trip-rope was attached and the man on the load would pull the rope and release the hay when it had reached the desired point in the barn or on the stack.

The so-called hay carrier in barns was a useful machine rivaling the binder in the length of the period during which it met the needs of the farmer. The most successful type was built to operate on a track suspended from the rafters in the barn. It was made to serve as a point of lift until a pulley attached to the fork entered the carrier. This released it from a fastener on the track and allowed the load to move into the mow. The trip rope on the fork was used to drop the load of hay and pull the carrier back to the man in the wagon.

The overshot stacker was used in combination with a bull rake; the bull rake to bring the hay in from the field and the stacker to lift it on to the stack.

With this combination of machines there was no hand work until the hay was deposited on the stack.

### Harvesting Corn

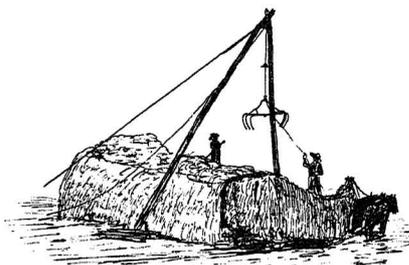
For many years corn was husked by hand. At first the corn was cut and placed in shocks. Then, after it had cured, the ears were husked, the fodder was reshocked or hauled to the feed yards, and the ear corn was hauled to the crib for storage. As the corn acreage increased farmers began husking corn from the standing stalks. The man worked beside the wagon and the team soon learned to move ahead a short distance as he moved up to the front of the wagon. Most of the corn was scooped into the crib by hand. In those days the man who husked 80 bushels of corn, hauled it to the farmstead and scooped it into the crib, earned 2¢ per bushel or \$1.60 per day for himself and team.

When the farm gas engine became available the farmers who had considerable acreages of corn bought portable elevators that had been developed to relieve them of the work of scooping. Cribs had been built comparatively low to make scooping less difficult. This made it necessary to move the elevator frequently to distribute the corn in the low cribs.

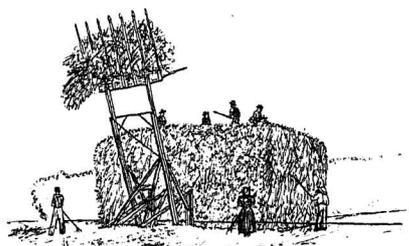
A machine known as a husker shredder was developed in this period to husk the corn and shred the stalks of that portion of the crop that had been cut and shocked. The shredded fodder made some feed and the waste was excellent for bedding in livestock shelters.

### Machines to Lighten Chores

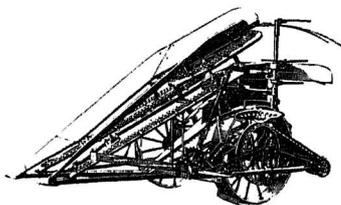
With all the machines to utilize the power of animals there was still much



An A-frame pole stacker for use in moving hay from wagon to stack.



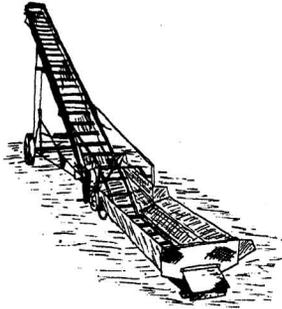
An overshot stacker combined with a "bull rake" took the hand work out of haying.



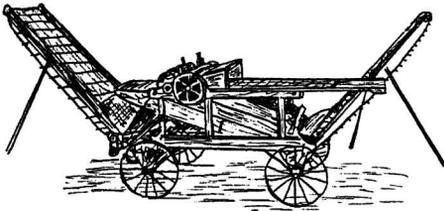
An early corn binder. This machine relieved the farmer of some very heavy work.



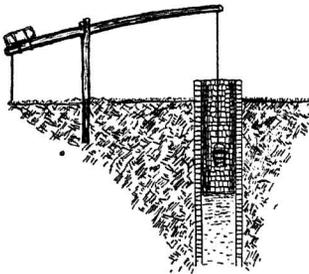
The first mechanical corn husker.



A grain elevator was essential after the mechanical corn picker and grain combines were developed.



The husker-shredder principle was a good one.



Well sweep to which the "Old Oaken Bucket" was attached.



The old fashioned windlass for lifting water from a well.

chore work for the farm family to do. Many improvements were made in machines and equipment to reduce the time and effort required in operating the enlarged farms. Supplying livestock with water was one of the important chores. In the early days, springs and running streams were common but as the forest and the prairie sod were removed these sources dried up in many areas and the farmers found it necessary to dig wells to supply their needs. At first, the water was drawn from the well by use of a bucket and rope. The first machine to help with this task was called a sweep. The rope attached to the bucket was tied to one end of the sweep and a heavy stone or log to the other. It was balanced so that it was necessary to pull down on the rope to lower the bucket into the well but it was much easier to lift it when filled.

Later, a windlass was made to wind up the lifting rope on a small cylinder by turning it with a crank. A device for lifting water was made later by attaching small cups to a chain. The chain ran over a sprocket and hung down into the water in the well. By turning the sprocket the cups were lifted to pour the water into a spout extending from the pump.

At a later date, wooden pumps were made to lift water from the well. After many years pumps were made of iron. They were more efficient but the wooden pump was very satisfactory for the shallow wells used at that time. These pumps brought the water to the top of the pump where it ran from a spout that was provided to deliver it into a bucket or wooden trough. To avoid the work of carrying water to points at a higher level it was necessary to en-

close the pumping mechanism and force the water through pipes to the point where it was needed. These were called force pumps.

Tread mills were sometimes used for pumping water but the windmill later became a popular machine for this work. The farmers built or purchased large tanks that would hold a three- or four-day supply, so that they would not run out of water if the wind failed for a few days. The windmill wheel was placed on a high tower to get it above the tree tops. Many farms were equipped with one or more windmills in the 1880's and '90's.

The gasoline pumping engine was used extensively for pumping water in the time following the windmill. It was more dependable and could be used for other purposes around the farm. In many farm homes, a tank was placed in the attic of the house, or on a tower beside it, to furnish water for household use.

### Feed Grinding Machines

Many of the early farmers bought what was known as a sweep mill. A horse or a team hitched to the sweep travelled around it to operate the burs and do the grinding. Some farmers now store the grain which will be ground before feeding, in a special building. A room near the center of the storage building is equipped with a grinder which can be driven by the farm tractor or a built-in motor. Grains are mixed as they go into the grinder. Supplements are added as the grain is fed.

### The Cream Separator

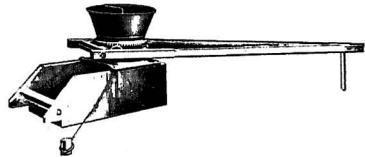
There was little sale for whole milk in these early times but cream and butter were in demand in many areas. Sep-



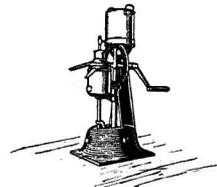
Hand pump that was used to bring water into many farm homes.



A windmill was almost standard equipment for pumping water before the introduction of the gasoline engine.



This sweep grinder used horse power for grinding feed.

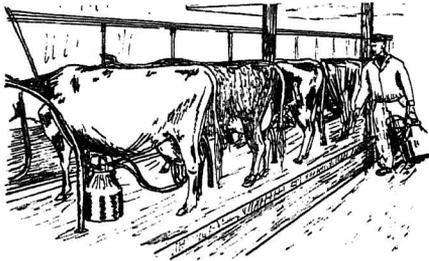


The cream separator ended hand skimming and reduced the work required to care for milk.

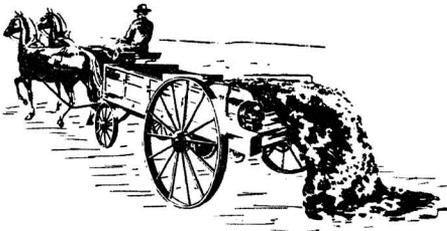
arating the cream from the milk required considerable space and equipment. A machine known as a "cream separator" was developed for this work. This was a great advance over the old method of storing the milk in crocks and jars in a cool place until the cream would rise to the top and could be skimmed off.

### Machines for Milking

Milking has always been one of the tasks that require a considerable amount of time. As dairy herds were enlarged the importance of this chore increased. Milking, like the tying of bundles of grain, was considered to be a task that could not be done by a machine. However, when it came to be an important chore, men began to study the problem and finally perfected a ma-



Milking machine in use in a stall barn.



The manure spreader reduced labor and improved the use of manure.

chine that has relieved the dairy farmer from this work.

When cows were milked in their regular stalls it was necessary to keep the whole barn clean enough for this food-handling process. In addition the cleaning of the cows and application of the machine required a considerable amount of stooping. Today the most modern dairies have clean "milking parlors" where only a few cows are milked at a time on an elevated ramp.

### Manure Spreading Machines

For many years manure had been hauled to the field in wagons and spread by hand. A machine known as a manure spreader was developed. This spreader not only saved time and energy but enabled the farmer to get the most value from manure in building up the soil. It also helped in a disagreeable job for many men.

### Farm Communications

Improvements in communication were of great benefit to farm families. In the early part of the period the only method of communication was to send some member of the family on horseback or on foot to deliver important messages.

The telephone was a most wonderful invention for farm families. Wonderful as a scientific achievement, but still more important for the contacts it made possible. It brought farm people into close touch with their neighbors and the outside world. Some of these early farmers lived to see the day when they could have mail delivered to them each day, listen to information and entertainment through the radio, and even see programs on television.

## THE ERA OF MECHANICAL POWER

There is no sharp dividing line between the period where animal power prevailed and the time when mechanical power took over. In the pioneer period when human power was used for most of the work, men had begun to make some use of animal power. In like manner, at the end of the animal power period, mechanical power was being used for threshing, some plowing, and other kinds of work.

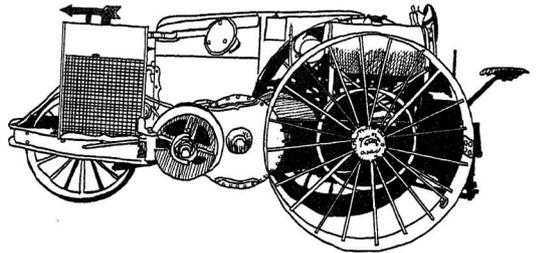
In the early years of the mechanical era, tractors were made to take the place of horses and mules. They were built to pull the machines that the farmer already owned. Different hitches were necessary and some machines were built heavier to withstand higher speeds and the increased power of the tractor.

These early tractors made it possible for the farmers to speed up the work of plowing and they were especially helpful in harvest time when temperatures were usually high. As was true in the development of many other machines, they were often built for use in one specific job. One tractor was built especially for the job of plowing. Another was made to do the work of cultivating corn and another was best adapted to belt work. However, before it was to find a real place in agriculture it was necessary that one tractor be able to perform all of these tasks.

Progress really began with the introduction of the "all purpose" tractor, on rubber tires and equipped with hydraulic or electric controls for all important parts. It was not only necessary for it to do the varied tasks common to farming but it had to be designed for quick

change for use with different machines. It also must relieve the operator from as much of the physical work as possible, so that he may be alert to all the tasks of farm management in addition to his work in the field.

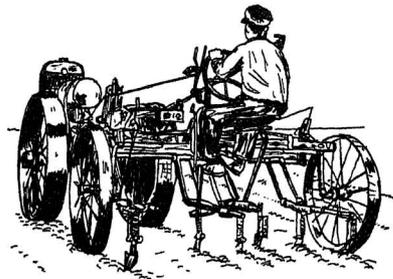
The general purpose tractor has been made in three and four-wheel designs. In the four-wheel type, extension axles



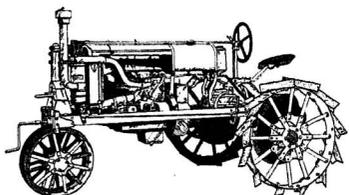
Tractor built solely for plowing. The front and the right rear wheels ran in the furrow.



Tractor built for cultivating only. It was very successful for this one job.



A tractor designed to pull different farm machines. It was called the "universal tractor."



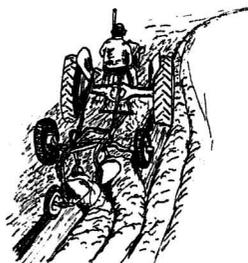
Three-wheel, "all purpose" tractor. It was the first tractor for all kinds of work.



Four-wheel, "all purpose" tractor. Both front and rear axles could be lengthened.



Most companies build a size for every farm with machines to suit every job.



Plows were first designed to be pulled behind the tractor as they had been with horses.

are provided so that the wheels run outside the two center rows of crops.

### A Tractor Size for Every Farm

Most machinery manufacturers recognize the desirability of the family farm for American agriculture and have designed efficient and convenient machinery suited to different enterprises and sizes of farms. Diversification (producing numerous types of products), which requires machines for many different crops, is giving way to more specialization in production. For example, many dairy farmers equip their farms with machinery for raising small grain, hay and pasture, purchasing concentrates from those who are better equipped with land and machinery for producing them. Grass silage, made from small grain or hay crops has made it possible for them to reduce the investment in machines and reduce the labor needed for their operation.

### Tractor Plows

Most plows are mounted on the rear of the tractor and are controlled by a hydraulic lift. A small control panel is located beside the steering wheel. A movement of a lever on the control board opens a small valve admitting oil under pressure into a cylinder to lift the plow. Another lever lowers the plow to the proper depth. Convenient adjustments enable the operator to level or tilt the plow in either direction. The plow can be released and the tractor hitched to another machine in a few minutes. In many areas the farmers profit greatly by using two-way plows. This is especially important on terraced land. By plowing with the terraces and throwing all furrow slices up hill, the down hill movement of the

soil by erosion is reduced. At the same time there are no dead furrows opened to expose the subsoil and concentrate runoff.

In sections where the rainfall is limited and where the soil is porous, it is desirable to leave a cover of trash or grain stubble on the surface when preparing the land for seeding. To loosen the soil without turning under this surface material, a special machine has been devised. It is called a subsurface or field cultivator. Such mulch or trash farming not only increases the amount of moisture that enters the soil but retards evaporation, saving soil water for the crops to follow.

### Machines for Planting

Corn planters in two- or four-row sizes will drill corn or space it in hills of two, three or four stalks as desired. They can be set to drop the hills at the desired spacing in the row. Close spacing may be used on rich or heavily fertilized land and fewer plants per acre on less productive soil. Corn can be planted for cross cultivating by using the check wire.

The grain drills, up to 8-foot widths, are mounted to be carried on the tractor for transportation. They are equipped with grass seeding and fertilizer spreading attachments, combining three operations in one. Larger drills are trailed but have hydraulic controls for lifting and controlling the depth of planting.

### Cultivators

Instead of the special tractor for the work of cultivation of row crops, the modern machine for this work consists of an attachment for the regular tractor. The shovels for cultivating



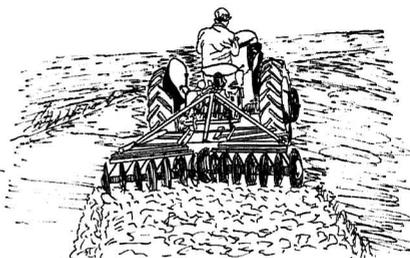
Mounted plows are easily attached to the tractor.



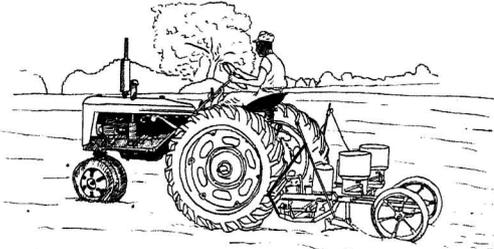
A subsurface cultivator leaves the vegetation as a mulch on the surface instead of turning it under.



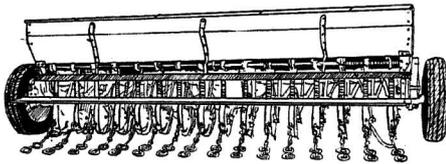
Two-way mounted plow. Two-way plows should be more widely used, especially on terraced land.



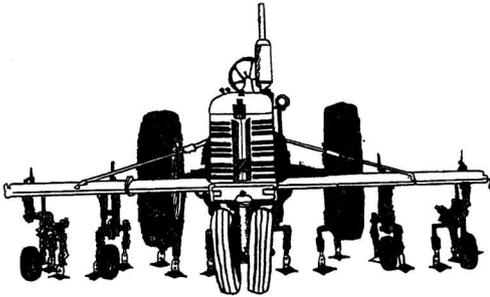
The mounted disk harrow can be lifted for transportation or turning.



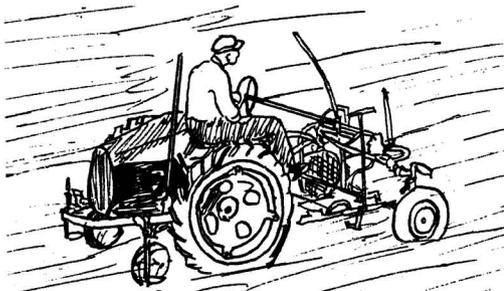
A modern corn planter can be lifted for turning at the end of the field.



A modern grain drill, grass seeder, and fertilizer distributor combined in one machine.



Corn cultivator mounted on a general purpose tractor.



Different machines are mounted in front and pushed ahead of the tractor.

close to the rows are often mounted on the front of the tractor and the shovels to cultivate the remaining surface between rows including the tracks left by the tractor are mounted on the rear. These are made in one-, two-, or four-row models to meet the needs of different sizes of farms.

Spear point shovels or sweeps are used in different sections of the country, the emphasis being on cultivating the surface to destroy weeds without injuring the roots of the corn.

### Grain Combines

With the development of the process for drying grain, the combine has come to be used successfully for harvesting grain in the Middle West. It is difficult for us to realize the change which the combine brings in the harvesting of grain crops. All of the processes of cutting with the cradle, tying into bundles, shocking in the field, stacking, flailing and winnowing are now done by this one machine. The farmer needs only to guide it through the field and keep it in adjustment. For the small farm there is the four-foot cut combine which is pulled behind the tractor. For larger acreages there is the self-propelled combine, usually made to cut a 12 foot swath.

The combine was made originally for small grain but it was soon adapted for harvesting clover and alfalfa seed, soybeans, some types of kaffir corn and, at present, some combines may be equipped for use in harvesting corn. The development of a harvester to use on all of the crops grown will be welcomed by the farmer. It will reduce the number of machines that he will need to buy. Such a machine may be in the

future. Competition between companies in the farm equipment manufacturing business has always been effective in supplying what the farmer needs and wants.

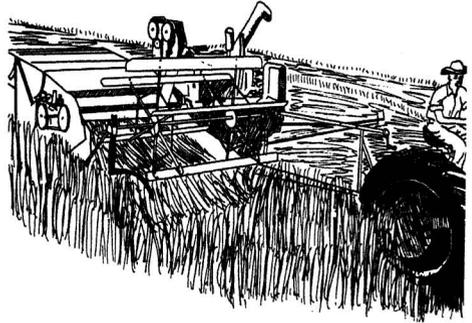
### Hay Harvesting Machinery

The mower is one of the quick-hitch machines being supplied by today's machinery manufacturers. This is important to the farmer because the work of cultivating corn, and harvesting hay and grain must often be fitted into the busy days of early summer. He may need to change from one kind of work to another several times during the day.

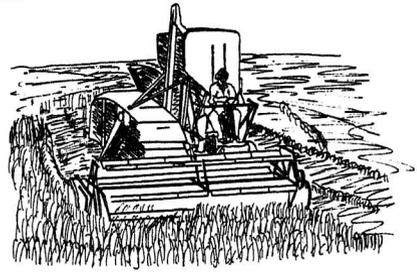
When the hay is cured in the field it is raked into windrows soon after mowing. When it has cured sufficiently, the one man pick-up baler enables the farmer to bale the hay ready for storage in the barn or in piles in the field. It is interesting to note that the farmer may operate the tractor and do none of the handwork formerly associated with the hay harvest. Almost all hay handling is by machine.

When hay is cured in the windrow, and then baled, it can be piled in barns or stacks without attention to further curing. If, however, the hay is baled when the leaves are still green as in a harvest season which is not favorable for drying, then special equipment is needed to complete the drying process in the barn or stack. Fans driving heated air through the hay reduce the moisture content to such a point that it will be safe for storage.

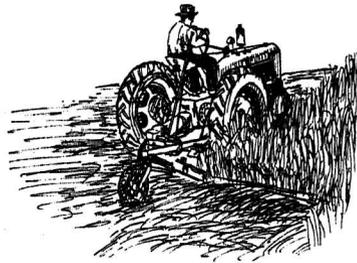
Some balers produce rectangular shaped, often called square bales, and others cylindrical shaped round bales. The round bale is made with an opening in the center. This provides venti-



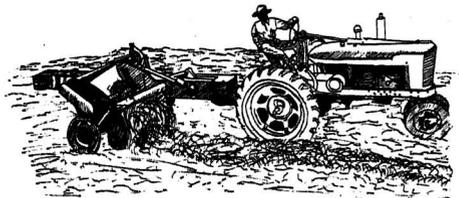
An 8-foot cut combine for the medium sized farm.



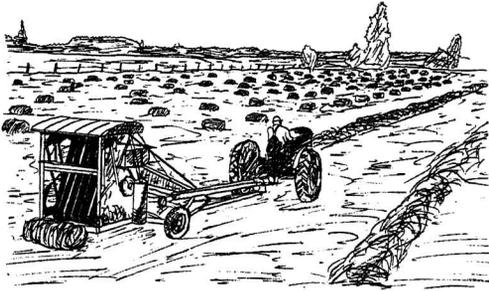
The self-propelled combine for the large grain farm or for the farm power contractor.



Mower to be attached to the tractor. Mowing can be speeded up regardless of hot weather.



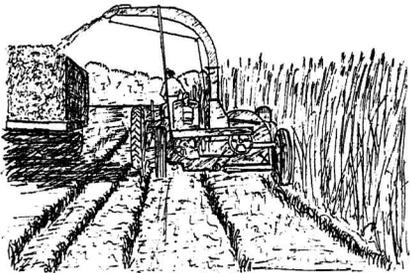
One-man pickup baler. An achievement in design and a marvelous help on today's farms.



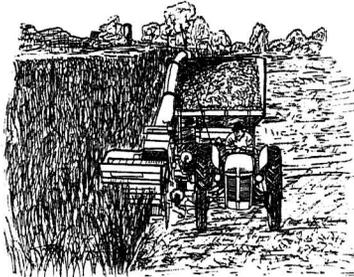
Machine for making "round bales." They store well and can be rolled instead of carried.



A bale loader eliminates most of the lifting in loading hay.



Cutting and chopping forage for silage.



Chopping and loading green hay ready for the drier or the silo.

lation through the bales. Due to the cylindrical shape, the bales will not pile as closely as the square bales.

### Forage Harvesters

Forage harvesters may be used in a number of ways and with different crops. They were developed first to cut corn in the field and chop both stalks and ears into short lengths for use as silage. This machine is pulled through the field to fill a wagon or truck driven or pulled beside it. It was made to work on kaffir corn and finally adapted for use on any of the crops that can be used for making grass silage. Hay may be cut and chopped, delivered into a wagon or truck and dumped into a trench or bunker silo, or it can be blown into a regular silo or into a barn equipped with a drier for curing it into high quality feed.

If desired, the hay can be cured in the windrow, picked up by the harvester, chopped and blown into the wagon. It can then be blown into a barn for storage, again providing a way of harvesting hay by use of mechanical, rather than physical power.

The forage harvester fits into another new management program; namely, the feeding of grass or pasture crops in the dry lot. The amount of grass needed is chopped each day and placed in the feed bunks. This allows the cows to use all the feed they consume to produce milk instead of utilizing part of it in the trip to and from the pasture. There may be less damage to the pasture and it will enable the farmer to reduce, if not to eliminate, the interior fences on the farm. Self-unloading wagons complete the mechanization of this chore.

## Corn Harvesting Machines

The one-row corn picker is suited to the smaller farms. It may be mounted on the tractor or pulled behind. Gathering shields run on each side of the row of standing corn, and rollers driven from the power-take-off of the tractor mash the stalks and push the ears off. The ears fall on conveyors which take them to the husking rolls where the shucks are removed. A conveyor takes the husked corn to the wagon driven or pulled along beside the husker. The two-row picker is usually mounted on the tractor and the hauling wagon trails behind. This machine enables one man to double the amount of corn gathered with but little extra effort on his part.

The development of drying equipment has made it possible to harvest corn at an earlier date than formerly, making it possible to prepare the land after corn for the seeding of wheat. If corn is shelled at the time it is harvested, the moisture in the cobs will be left in the field, reducing the amount of drying by about 50 percent. The storage space required is reduced about one-half. The problem of securing uniform air circulation through the corn is decreased. Processing and feeding are less difficult than with ear corn. The picker sheller is designed to husk and shell the corn and if desired to shred the stalks and spread them back on the land.

## Farm Irrigation

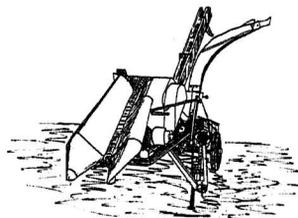
Water may be pumped from a stream, a well, or perhaps released from a pond and delivered to furrows between crop rows so arranged as to spread it across the field; or it may be



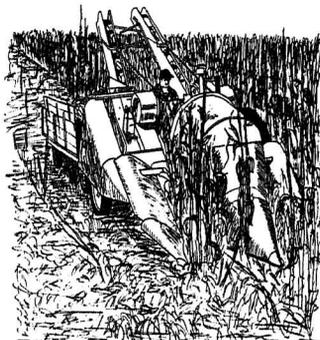
Chopping field-cured hay to be blown into the mow or stack.



Power unloading wagon delivering chopped silage to the blower at the silo.



One-row corn picker for the small farm.



Two-row corn picker for the large corn farmer or contractor.



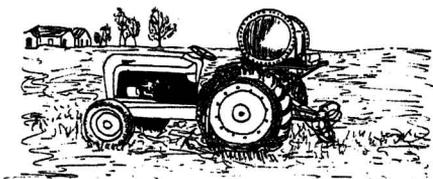
The potato harvester is a great labor saver in the potato growing areas.



Sprinkler irrigation. Water is pumped into pipes under pressure and sprinkler heads distribute it.



Spraying machinery for killing weeds or insects is now widely used.



Equipment for applying liquid fertilizer is coming into use.

necessary to apply the water by sprinkling. In some years, rainfall is well distributed through the growing season and in sufficient amounts for good crops, but in other years the timing or the amount of rain may be the cause of crop failures. In these years one to three applications of an inch or more of water may save a crop. If streams are not available it is necessary to build reservoirs or sink wells to secure a water supply. As our soil is improved by good management there may be less need for irrigation, but at present there are few years when one or two irrigations would not increase the yields.

### Spraying Machines

In former years, farmers cultivated their corn three and possibly four times to keep the weeds under control. Today many farmers are using chemicals to kill the weeds, thus reducing the need to one or possibly two cultivations each season.

The use of machinery for applying sprays to control insects and crop diseases is now common. Great advances have been made both in the development of new sprays and in the machinery for their application.

Liquid fertilizer is now applied by machines in many communities. Moreover, some of the solid fertilizer formerly applied by farmers is now handled by contractors who have equipment for doing it. These are new and important developments.

### Special Machines

The garden tractor is a useful machine on the average farm. It can be used to cultivate the garden and mow the lawn and field fence-rows.

Digging post holes is a task common

to the farm. Mechanical diggers are designed for use with most farm tractors. Many of these machines will dig a post hole to a depth of 30 inches in less than one minute, thus greatly reducing the time of fence repair or construction. In digging trenches for foundations or water lines, a series of holes in the trench will greatly lessen the task.

Erosion and the removal of earth when manure is taken from yards and sheds requires that earth be brought in to maintain proper grade for drainage. The tractor mounted scoop is an excellent tool for this work and for loading the manure. Handling manure by hand is a difficult task. One man with a manure loader can work with greater speed and much less exertion.

## INFLUENCE OF MACHINERY ON AGRICULTURE

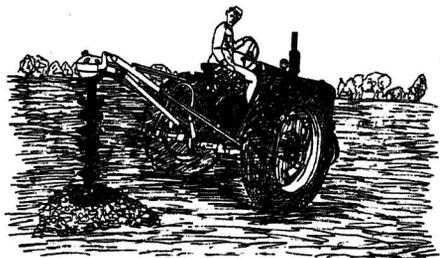
In this review of the development of machinery for the farm we have found great and continuous progress. The farmer and his family have changed from the use of their own labor to managers of power, far in excess of their own physical strength. For example, to equal the accomplishment of one modern farmer with a self-propelled combine it would require a large number of men with cradles, and flails, in addition to all those needed for the processes of binding, shocking, and stacking the grain.

Figures for the last 40 years, have been worked out by the Department of Agricultural Economics of the Missouri College of Agriculture, which apply to this state. To produce an acre of corn in a field of average size in 1910-13, required 24.5 man hours. In 1953 only 8.5 hours were needed, or 35 percent as much time. An acre of oats in 1910-13 required 10.1 man hours and in 1952 only 3.8 man hours, or 38 percent as much time. The figure for winter wheat for the early date was 12 man hours and for the later date 5.2 man hours, or 43 percent as much. For soybeans 21.8 man hours were required in 1910-13 and 6.4 man hours in 1952, or only 29

percent as much. If these four percentage figures are averaged, it will be seen that in a cropping system made up of these four crops, the average number of man hours required per crop in 1952 was about 36 percent of what it was in 1910-13. In other words, the production of an acre of these crops takes only about one-third as many man hours as



Hauling with the tractor wagon.



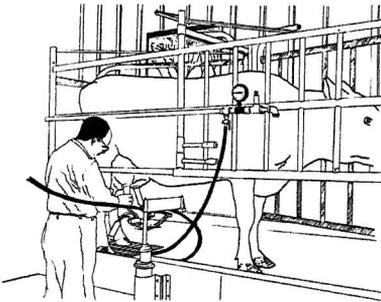
A power post hole digger will dig a hole in a minute.

it did 40 years ago. This is one of the reasons why the percentage of people now on farms in Missouri has declined so much.

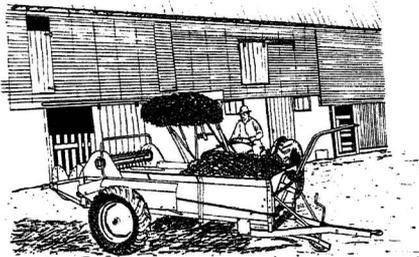
### Brings Many Advantages

There are many advantages in the widespread use of improved farm machinery. These new machines have made it possible for the farmer to establish many new practices which research has shown are beneficial to agriculture. Among these are new methods of preparing seedbeds for crops, plowing down fertilizer, harvesting crops quickly to retain quality and lessen waste, and building terraces, along with many others.

One of the greatest values of farm machinery is the increased speed with which many operations can be accom-



On some farms milking is a standup job, mostly one of supervision and care of equipment.



Even manure loading has been mechanized.

lished. Plowing and seedbed preparation can be pushed rapidly in the spring whenever the weather is right. Farmers sometimes keep their plows and some other machines going night and day when weather conditions permit. If a long time is required in preparing land, rains may come which will delay planting for weeks and greatly reduce yields. Speed in harvesting crops may be just as important as speed in getting them planted. On the whole, this speed with which work may be done is of very great importance to the efficient farmer.

### Tractors Changed Use of Land

The widespread introduction of the tractor brought a tremendous change in agriculture. The demand for, and consequently the price of work animals, was greatly decreased. As a result, the number of horses and mules in Missouri decreased from 1,295,000 in 1920 to 389,000 in 1950, a 70 percent loss. It is interesting to know that this loss in numbers of work stock released about 2,000,000 acres of land formerly needed to produce feed for these animals and permitted its use for the growing of products for human food. In other words, this has made possible a much larger production of grains and other products in the form of beef, pork, lamb, dairy, and poultry products for human consumption.

### Tractors First Used to Expand Acreage

Through the use of tractors the so-called family farm increased in size in many cases. Most of the men on the largest of these farms raised crops instead of animals. They spread their

activities over more acres than they could farm efficiently, thus causing a depletion and waste of the soil. However, times are changing. In those parts of Missouri where the extensive, soil exhausting systems had developed, the farmers are using more of their crops for the production of beef, pork, lamb, dairy and poultry products. This is better for the land and in most cases it is more profitable than the sale of crops.

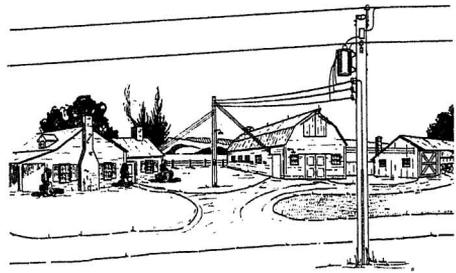
When the farmer and his family take up a balanced farming program they raise those crops which the farm will best produce and maintain livestock or poultry enterprises to change these crops into more profitable products to be sold from the farm. They maintain and build up the soil so that the business can be depended on for the future. Therefore, it seems reasonable to conclude that the size of the family farm will be determined more by the ability of the farm family to produce and change crops into beef, pork, and other products than on its ability to crop large acreages.

In order that they take advantage of modern developments in machinery and management, farmers must plan their farms and farmsteads to use these developments effectively. All fields must be accessible from the farmstead and laid out for proper soil and crop management and the efficient handling of the livestock. The farm family is no longer an isolated unit but it is coming to be part of the community. Village and farm children may attend the same school, the families may go to the same church and belong to many of the same organizations. They have mail delivery, the telephone, radio and they may have television. Many have modern homes,

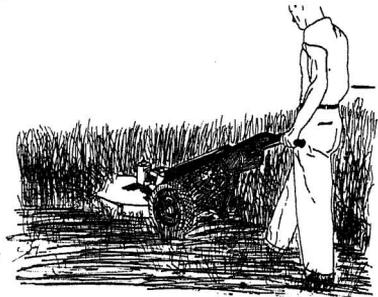
located in surroundings not confined by city lot boundaries. Every good farm home has possibilities in its location that city people often drive many miles a day to secure.

### Some Unsatisfactory Results

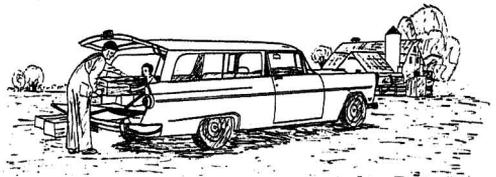
In spite of all the improvements in farm machinery there have been developments that have not been satisfactory. Some should be mentioned.



Electricity is an essential for the modern farmstead.



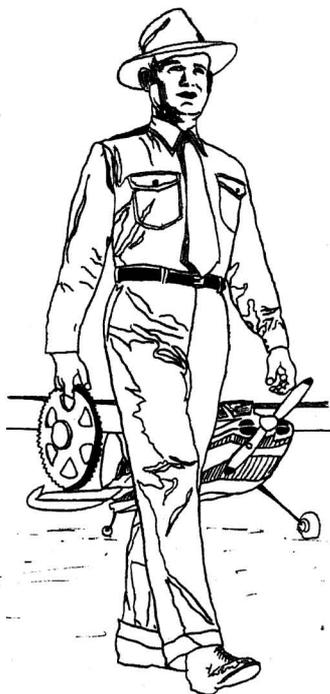
The garden tractor does the work in the garden and mows the lawn.



The farm family probably benefits as much from the automobile as from any other machine.

### Increase in Number of Farm Accidents

The farm has always had a large number of accidents. The great increase in the use of power machinery in Missouri and other cornbelt states has resulted in a sharp increase in accidents on farms. As would naturally be expected, the tractor is most important in causing this increase. In 1953, the tractor caused more deaths than four other important causes combined. One of the greatest dangers is that of allowing young boys to drive tractors. It is while they are learning to drive that the dangers are greatest.



The flying farmer returns with repairs for a machine in the busy season.

There are dangers in handling all types of farm machinery, particularly plows, corn harvesters, combines, field silage cutters, and haying machinery. Many men take chances with these so that hands or arms are sometimes badly mutilated or even lost.

### High Costs

High investment in mechanical equipment increases the financial risks in the business of farming. Power and machinery require an investment of from \$6,000 to \$20,000 on a family farm. In the days of animal power a poor crop or low prices reduced the income but did not call for cash payments on such large investments.

### New Responsibilities for Farmer

With all his advantages of today, such as relief from great physical exertion, direct contact with local and world affairs, interesting and challenging work and a satisfactory place to live, the modern farmer has new responsibilities. The pioneer farmer was forced to protect his family from starvation, from attacks by Indians and wild animals. Today, the farmer must protect his family from unwholesome influences in the community by taking part in public affairs dealing with government, schools, churches and farm organizations. These modern responsibilities may not be as immediately dangerous as those of the pioneer but they require more intelligence and education. These are responsibilities that cannot be delegated to machines but must be carried on the shoulders of men.