History of Farm Machines

The Plow

After the hoe, the plow was the first implement devised to assist the farm worker in tilling the soil. This was due to the availability of work animals and to the large amount of energy required for preparing a seed bed. Looking back into the far distant past it is easy to imagine how the farmer, who used a crude forked stick for loosening the soil, conceived of using a larger stick of the same general form to which he could attach his faithful ox, thus greatly reducing his effort and increasing the area of land cultivated. Even today, with modern plows, often one-half or more of the total energy used in growing a crop is used in plowing or the primary tillage operation. Iowa Experiment Station studies reveal that in a normal situation, where a total of 31 horsepower-hours is used for growing and harvesting one acre of corn, 13 to 15 horsepower-hours were used for plowing.

The primitive plow has been described as "a mere wedge with a short beam and crooked handle." In time, it was "fitted with a removable share of wood, stone, copper or iron wrought to a suitable shape." The next step was to add a rude wooden moldboard to turn a furrow slice.

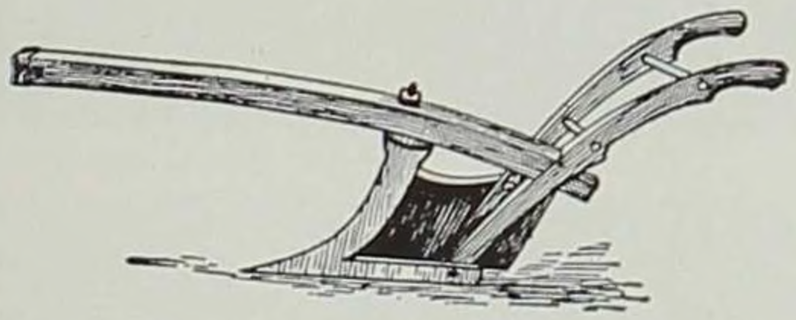
THE PLOW

Early Egyptian Plow.
From Butterworth.

Ancient British Caschrom.
From N. Y. Agr. Soc. Trans. 1867.

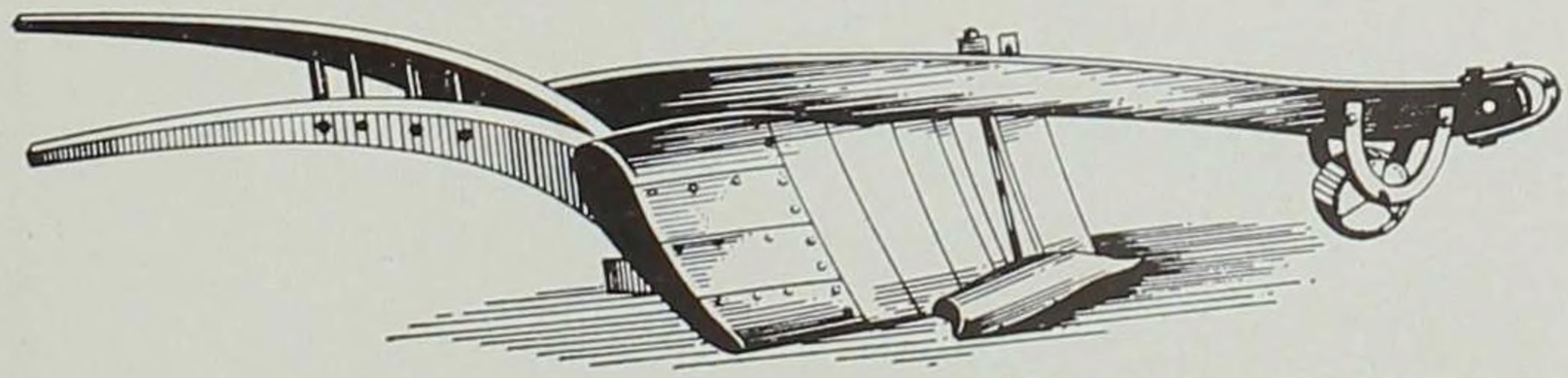
Hand plowing with swing fork in China.

Chinese native plow.
Photos by author. 1947.



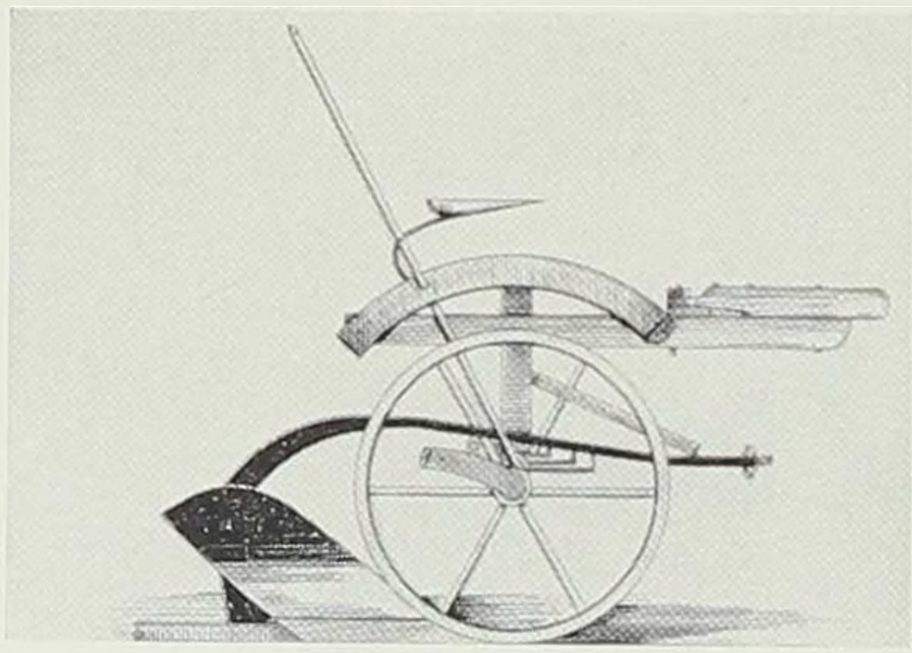
Charles Newbold plow—patented 1797.
From N. Y. Agr. Soc. Trans. 1867.

John Deere steel walking plow.
From Ia. Agr. Soc. Rept. 1867.



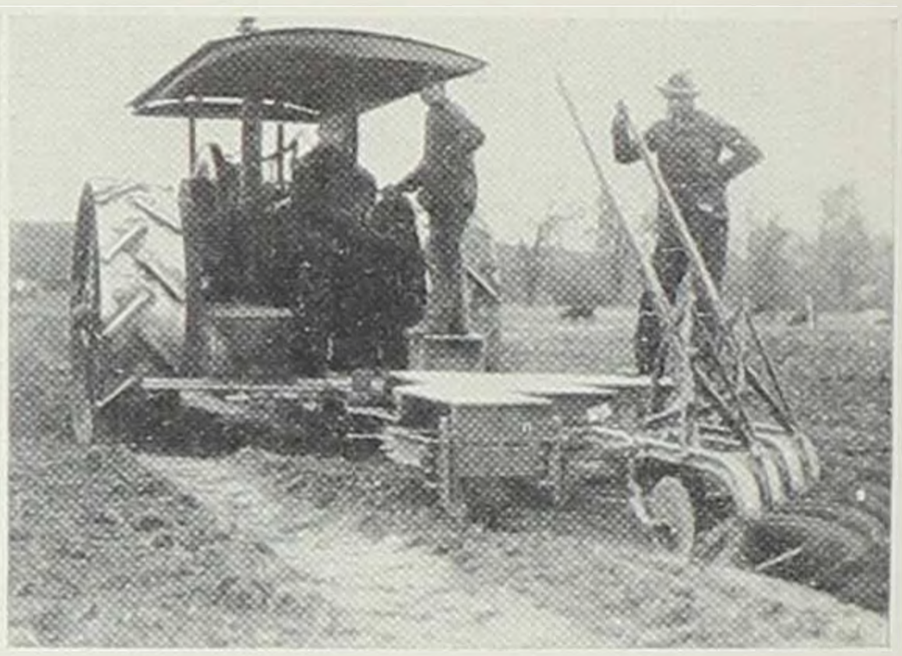
From N. Y. Agr. Soc. Trans. 1867.

Daniel Webster's Plow—12 feet long and capable of turning furrow 2 feet wide and 1 foot deep, 1837.



Sulky plow patented 1875.

Sketch after Ardrey.



Early tractor-drawn plow.

Photo by author.

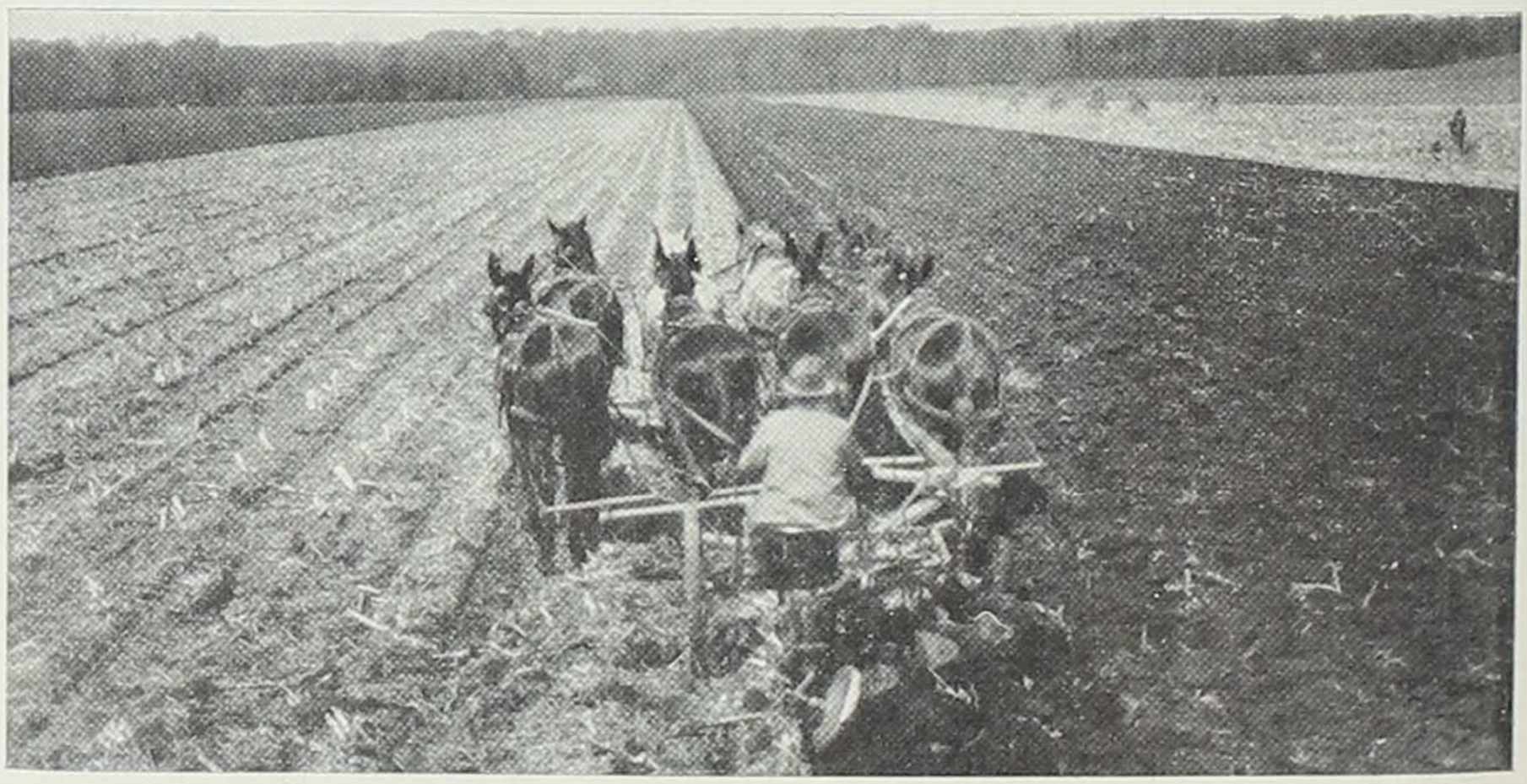


Photo by author.

High-lift sulky for horses, designed to compete with tractors.

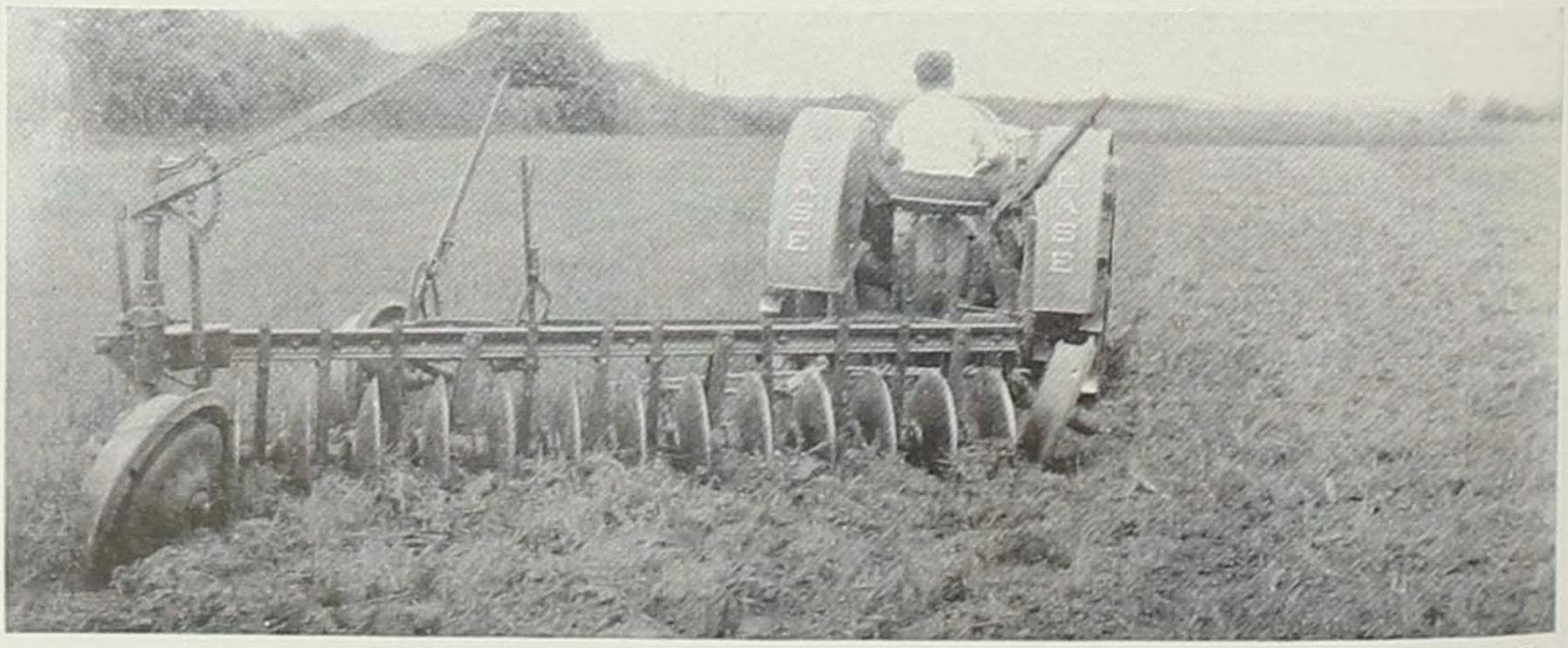
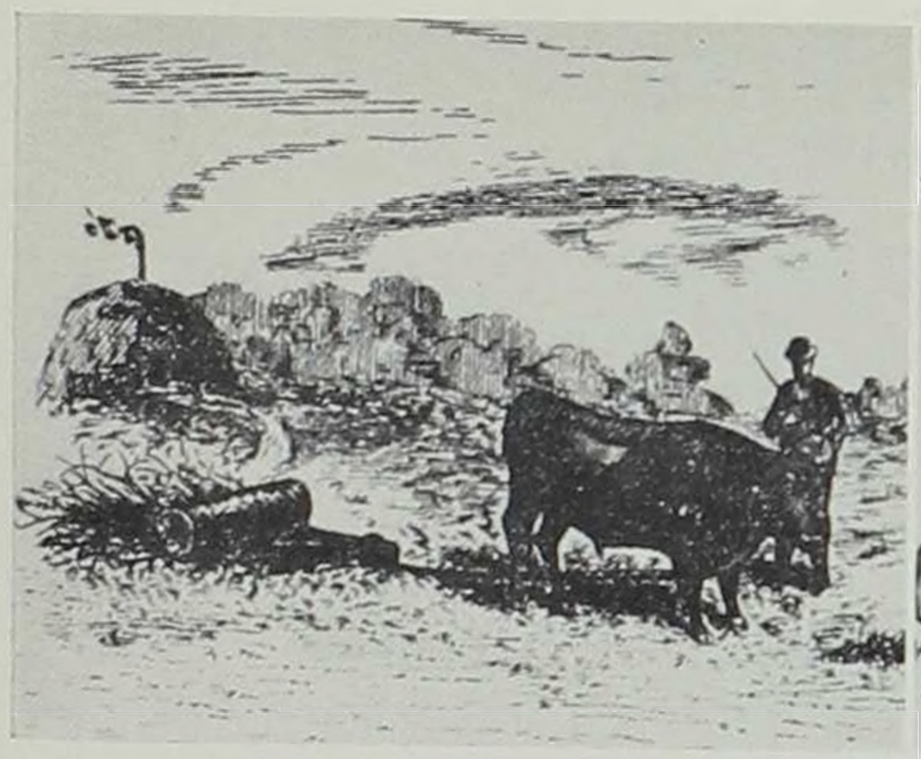


Photo by J. I. Case Co.

One-way or harrow disk plow.

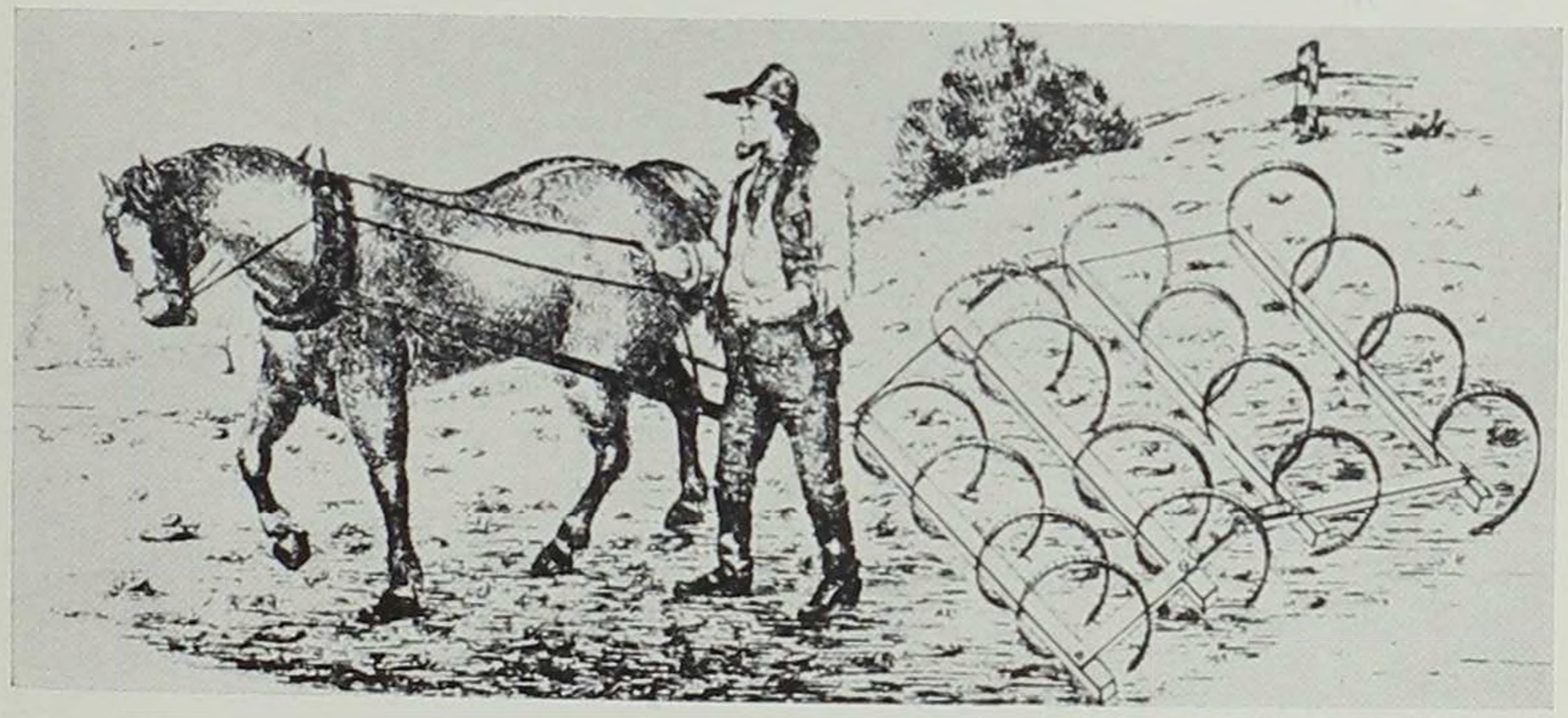


Primitive brush harrow.

From Butterworth.

Early disk harrow of 1877.

From Butterworth.



From Butterworth.

Early spring tooth harrow of 1869.

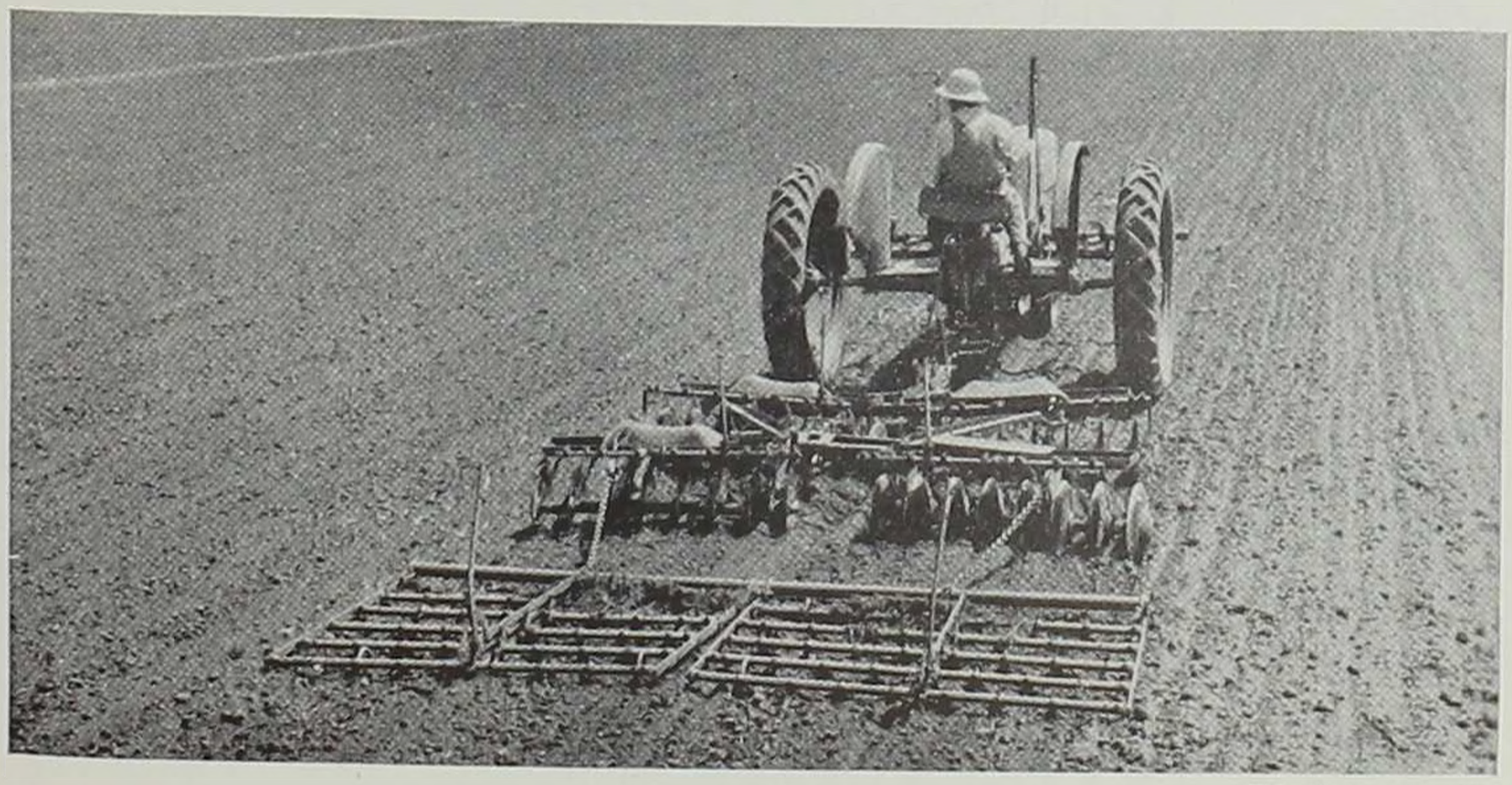
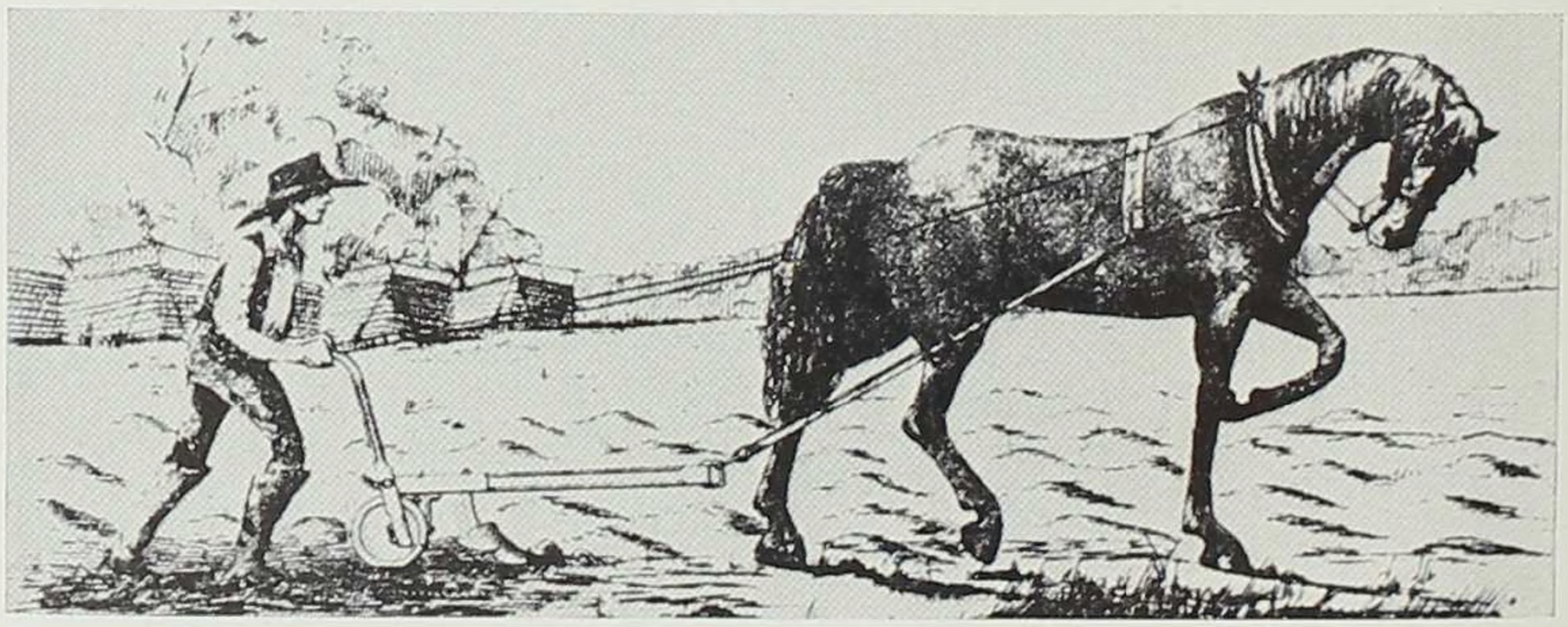


Photo by Spedd.

Modern tandem disk harrow with adjustable spike tooth harrow.

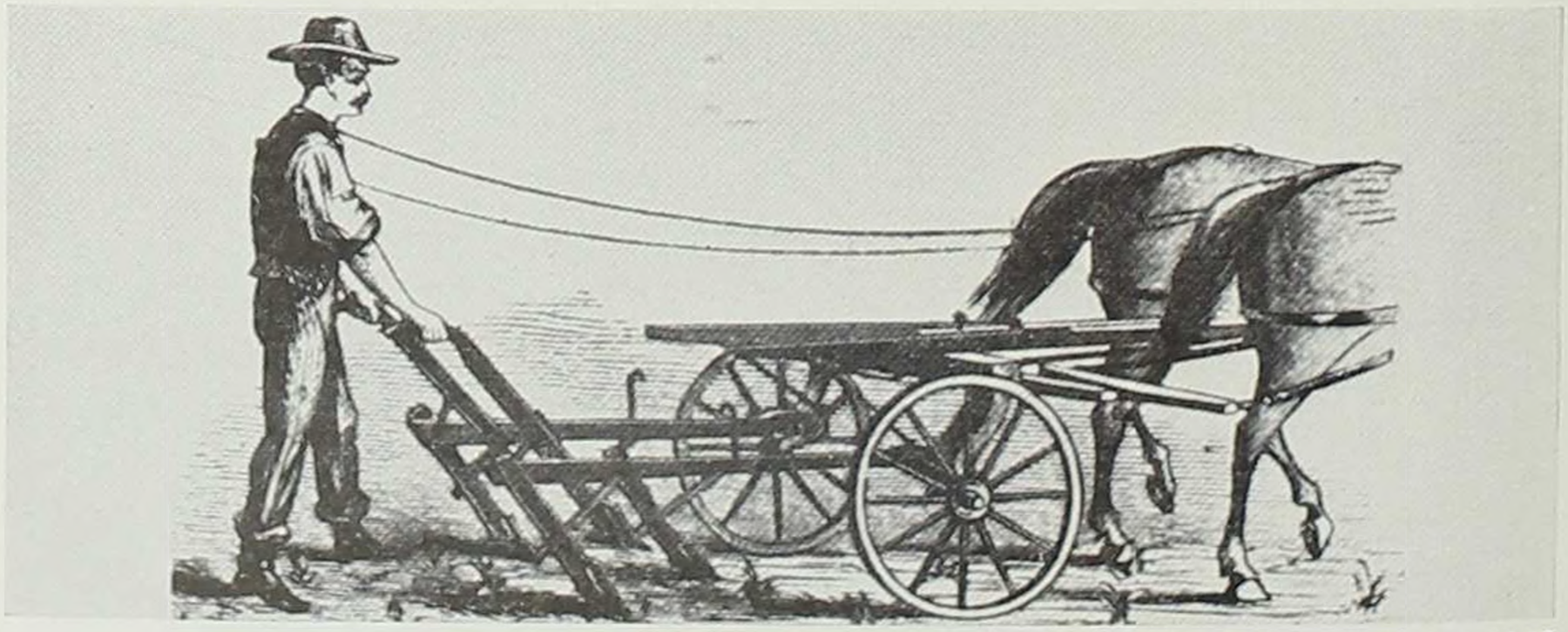
From Butterworth.

Egyptian harrow as reconstructed from ancient records.



From Butterworth.

Horse drawn cultivator of 1837.



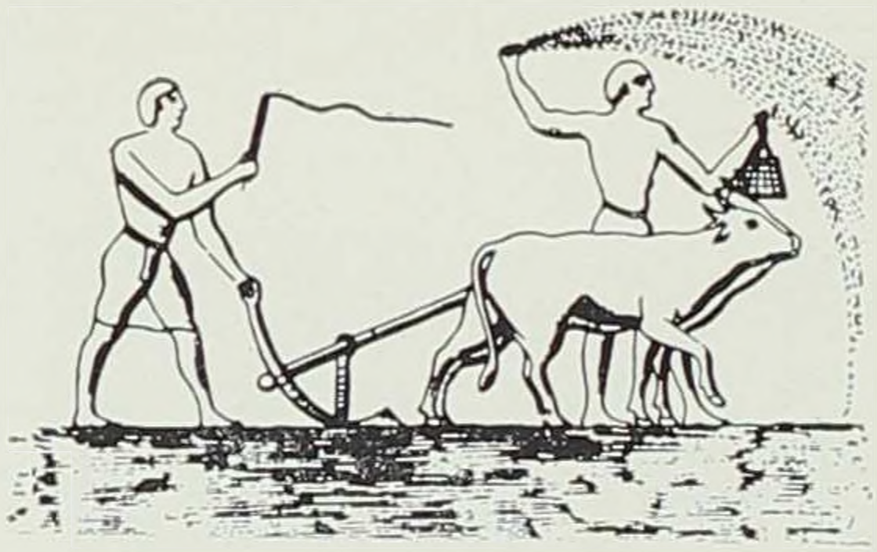
Ia. Agr. Soc. Rpt. for 1867.

Straddle row cultivator shown at Iowa State Fair.

Photo by Oliver.

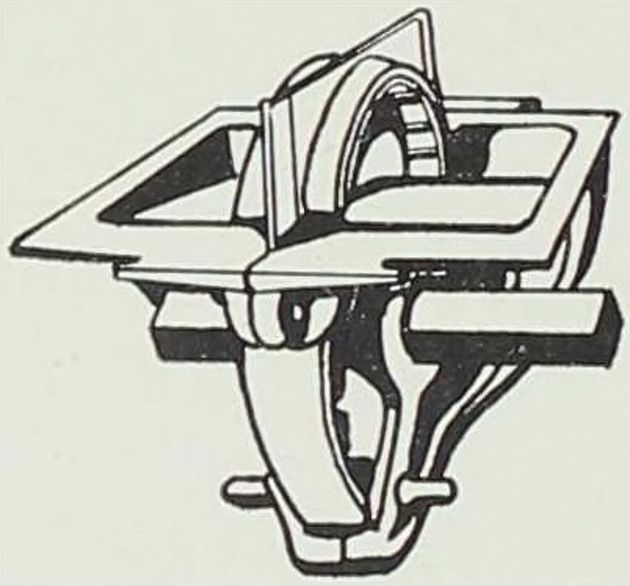
Mounted corn cultivator.

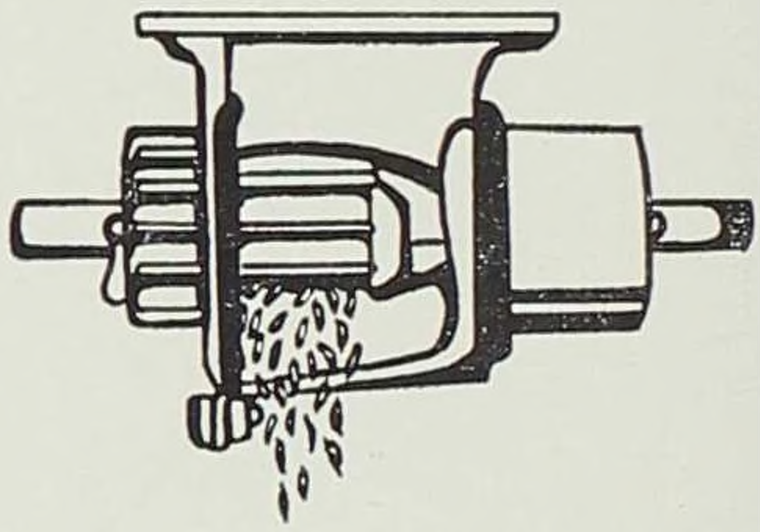
SEEDING & PLANTING MACHINES



Early wheelbarrow seeder.
Still used for grass seeding.

Left — Egyptian sowing by hand.
From Butterworth.

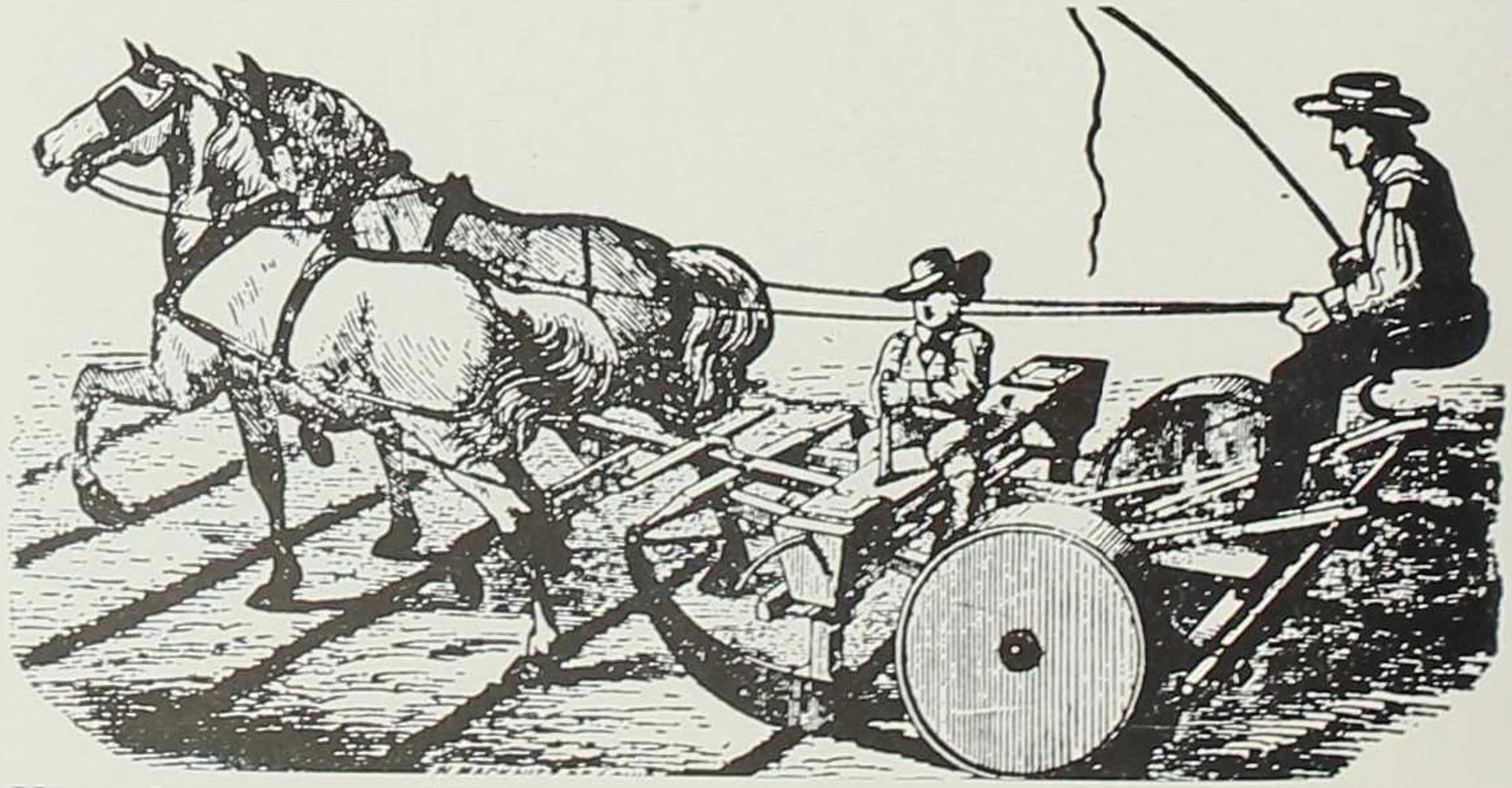




Feed mechanism for metering the seed.

Hand planting with hoe.
From Butterworth.

Hand planter.
Opening handles releases seed.



Horse-drawn planter showing cross-marked field and seed dropping mechanism.
Ia. Agr. Soc. Rpt. for 1867.

Modern disk drill. *From Minneapolis-Moline.*

Horse-drawn corn planter. *Photo by International.*

Photo by author.

Direct connected four-row tractor garden drill.

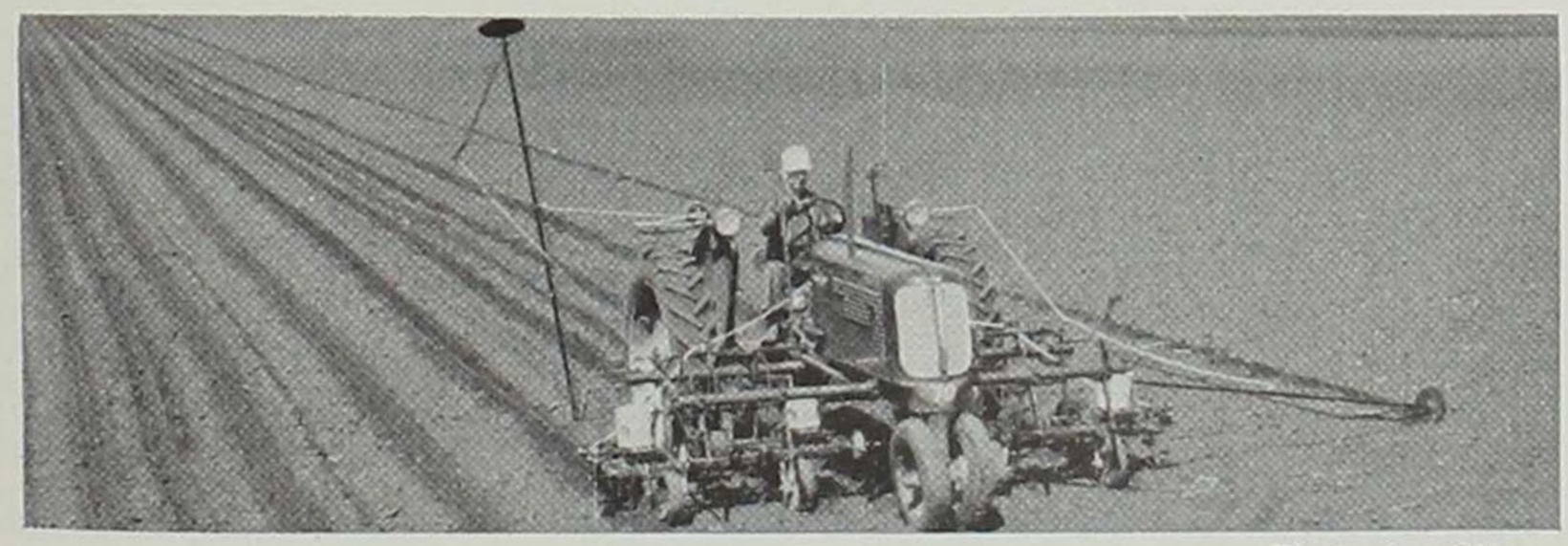
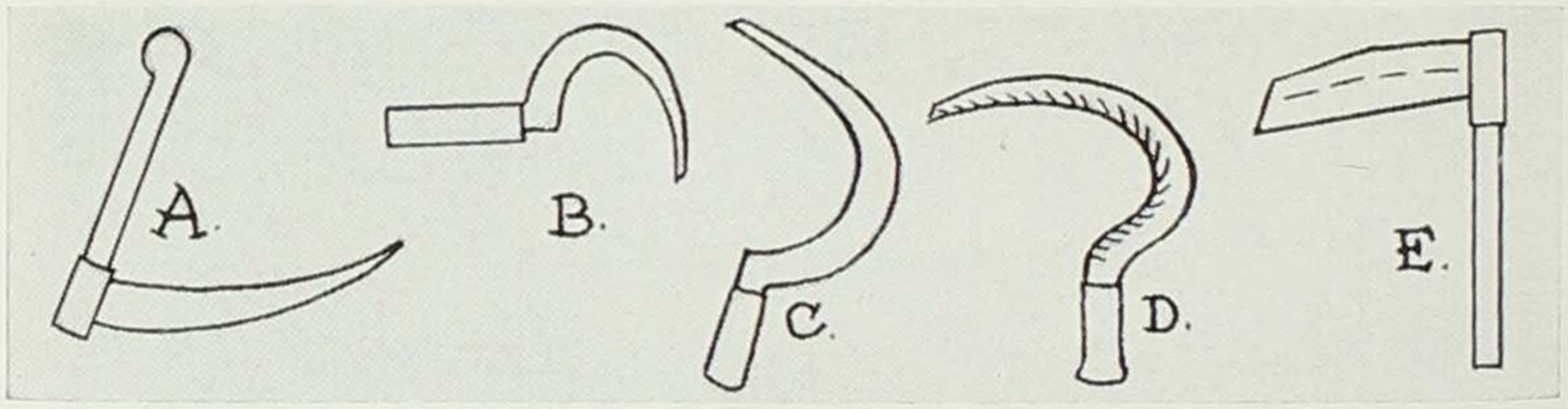


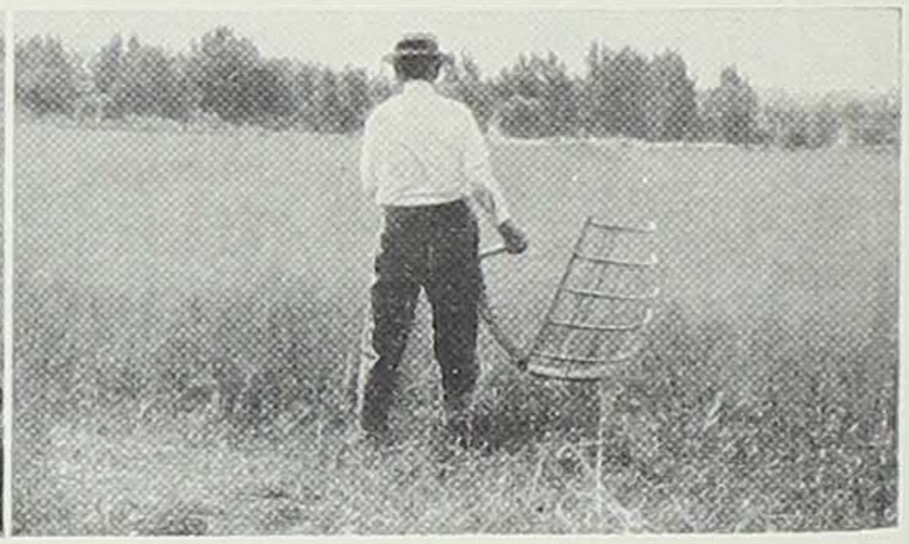
Photo for Oliver.

Four-row tractor planter with check rower.



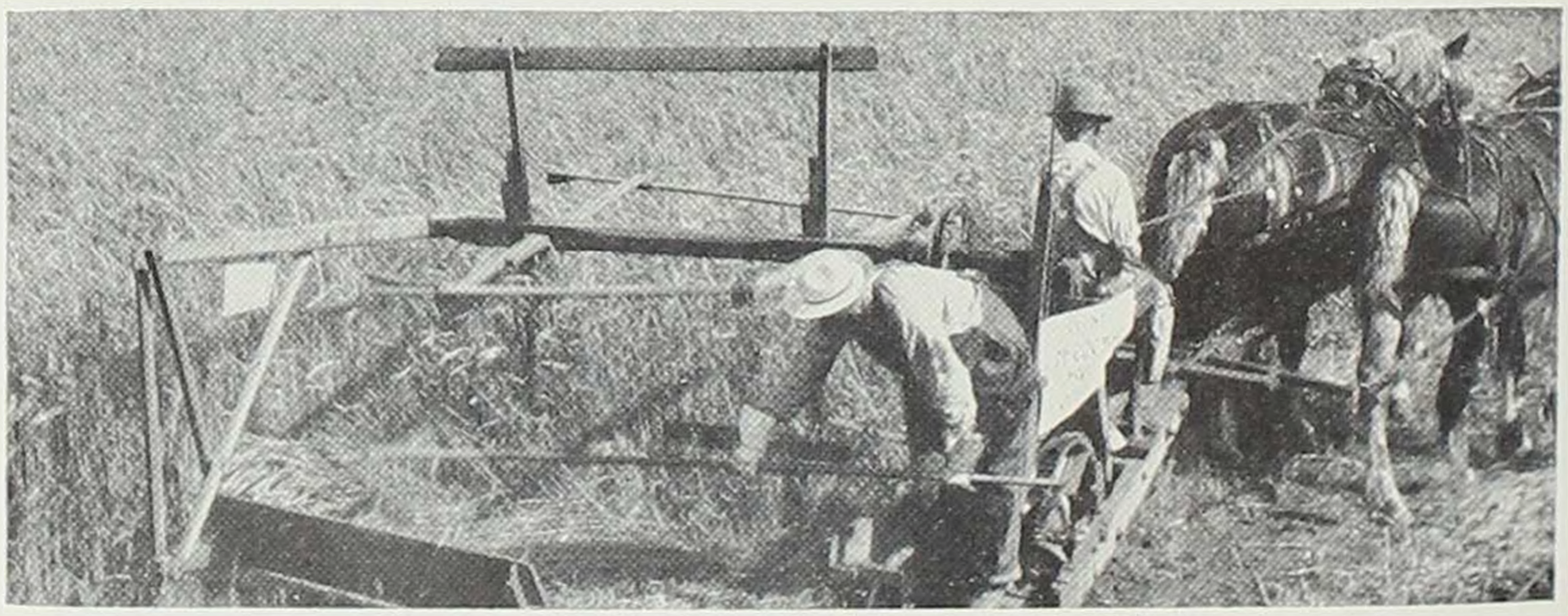
Sketches of hand sickles by author.
a. Egyptian; *b*. early Middle Ages; *c*. late Middle Ages; *d*. toothed; *e*. Chinese.

Harvesting rice with hand sickle.

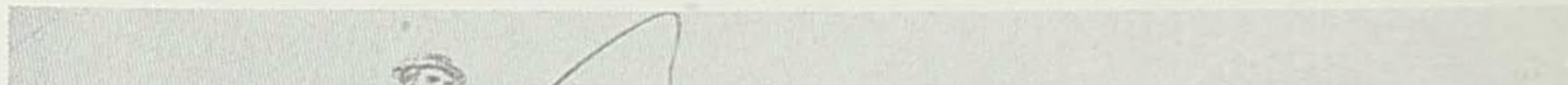


American grain cradle.

Photo by Deere.



Replica of McCormick harvester of 1831.



A self-rake reaper of about 1879.

From Miller.

Photo by Oliver.

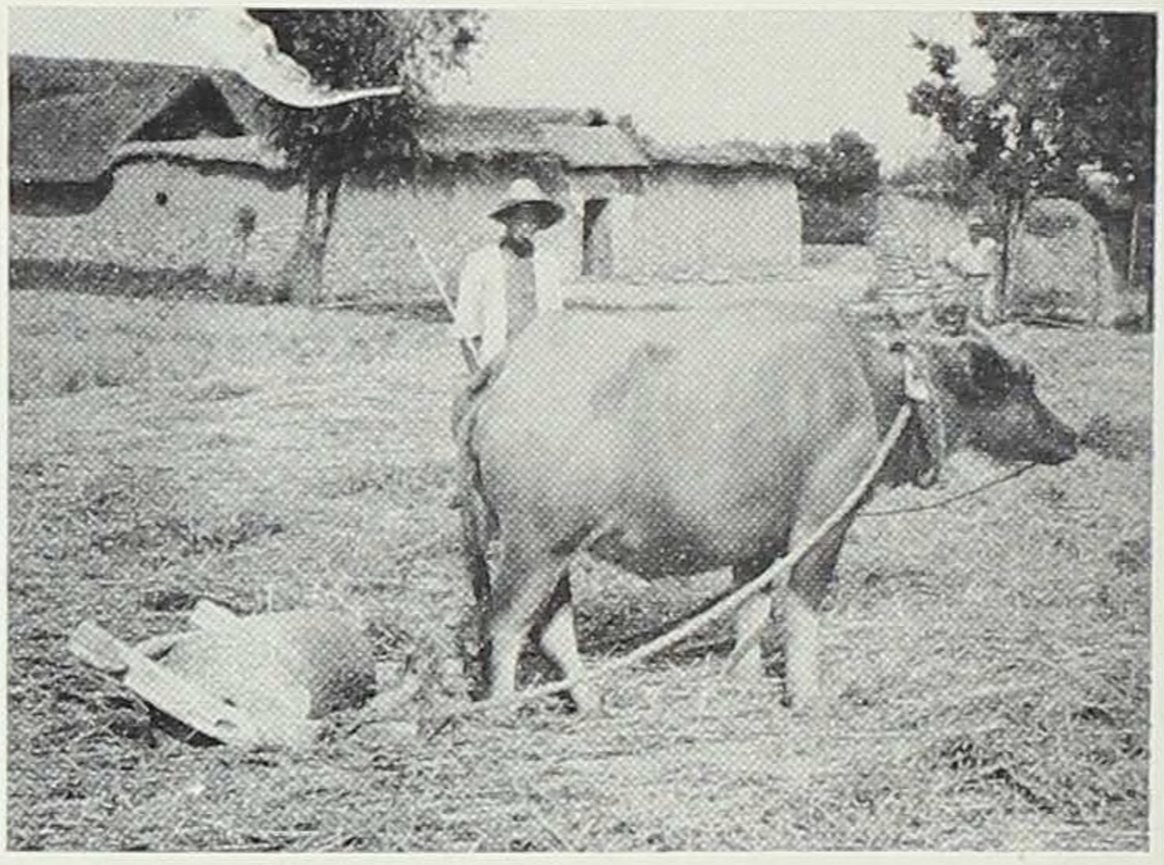
The self binder of 1890 and later.

Photo by Allis-Chalmers.

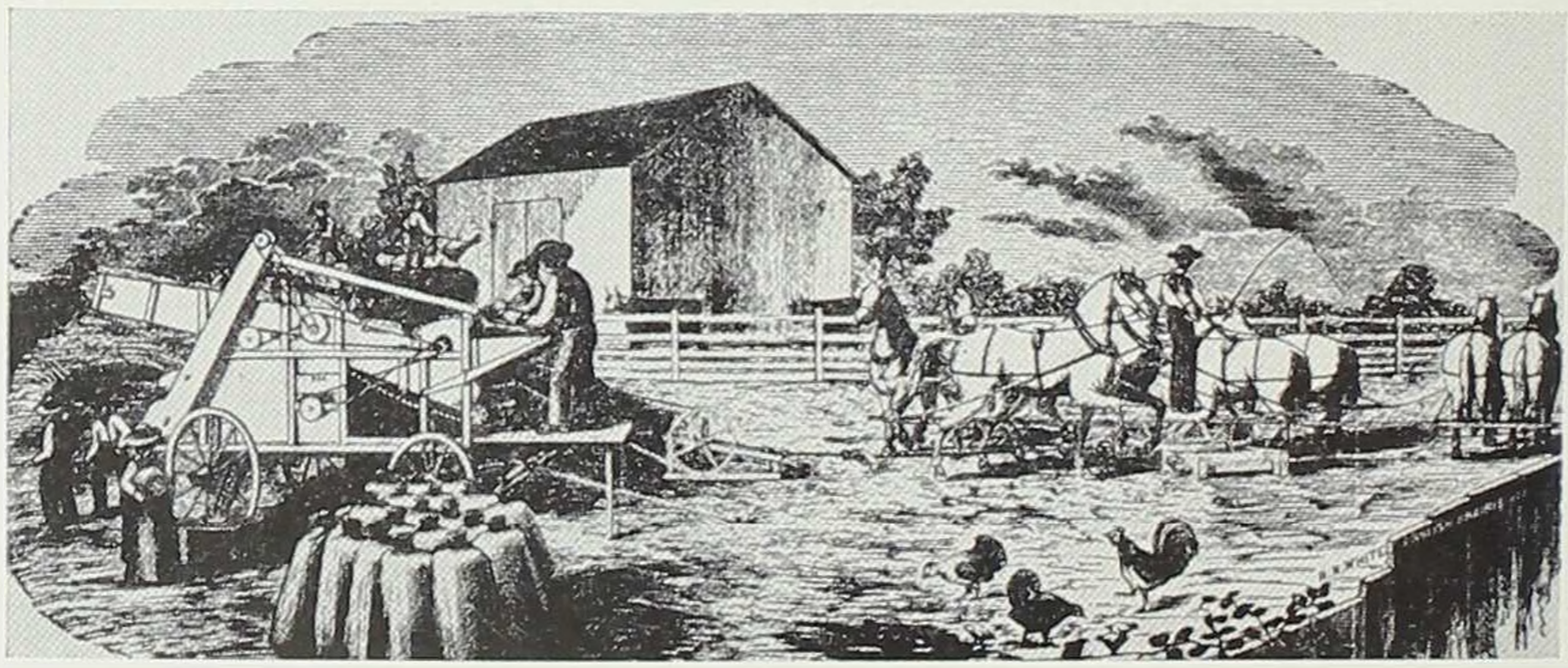
Modern combined harvester thresher as used in Middle West.

Photos by author in 1947.

Flail still used in China.



Stone roller drawn by buffalo.



Hand fed stationary thresher of 1873 as used in Iowa.

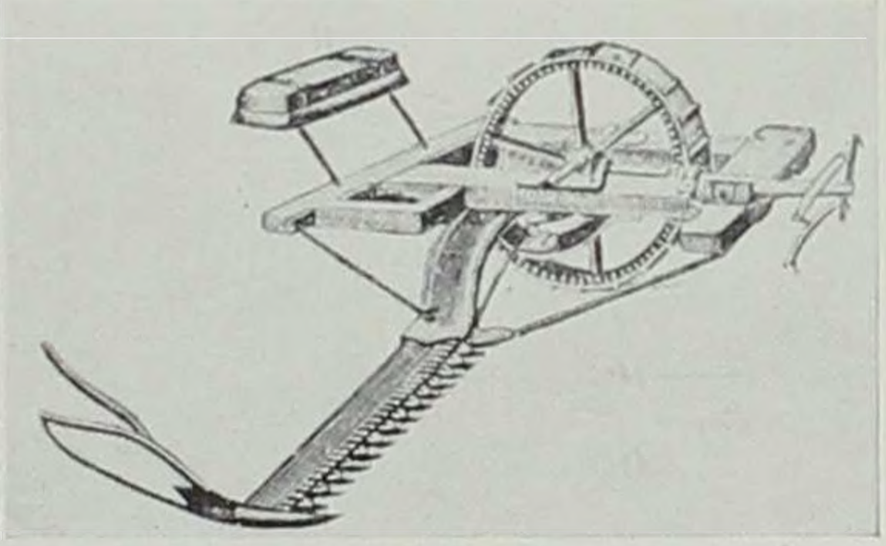
Photo by Case about 1920.

Thresher equipped with self-feed, wind stacker, and grain weigher.

HAY MAKING MACHINES

The scythe.

Left — after Butterworth.
Right — after Miller.



Mowing machine, 1847.

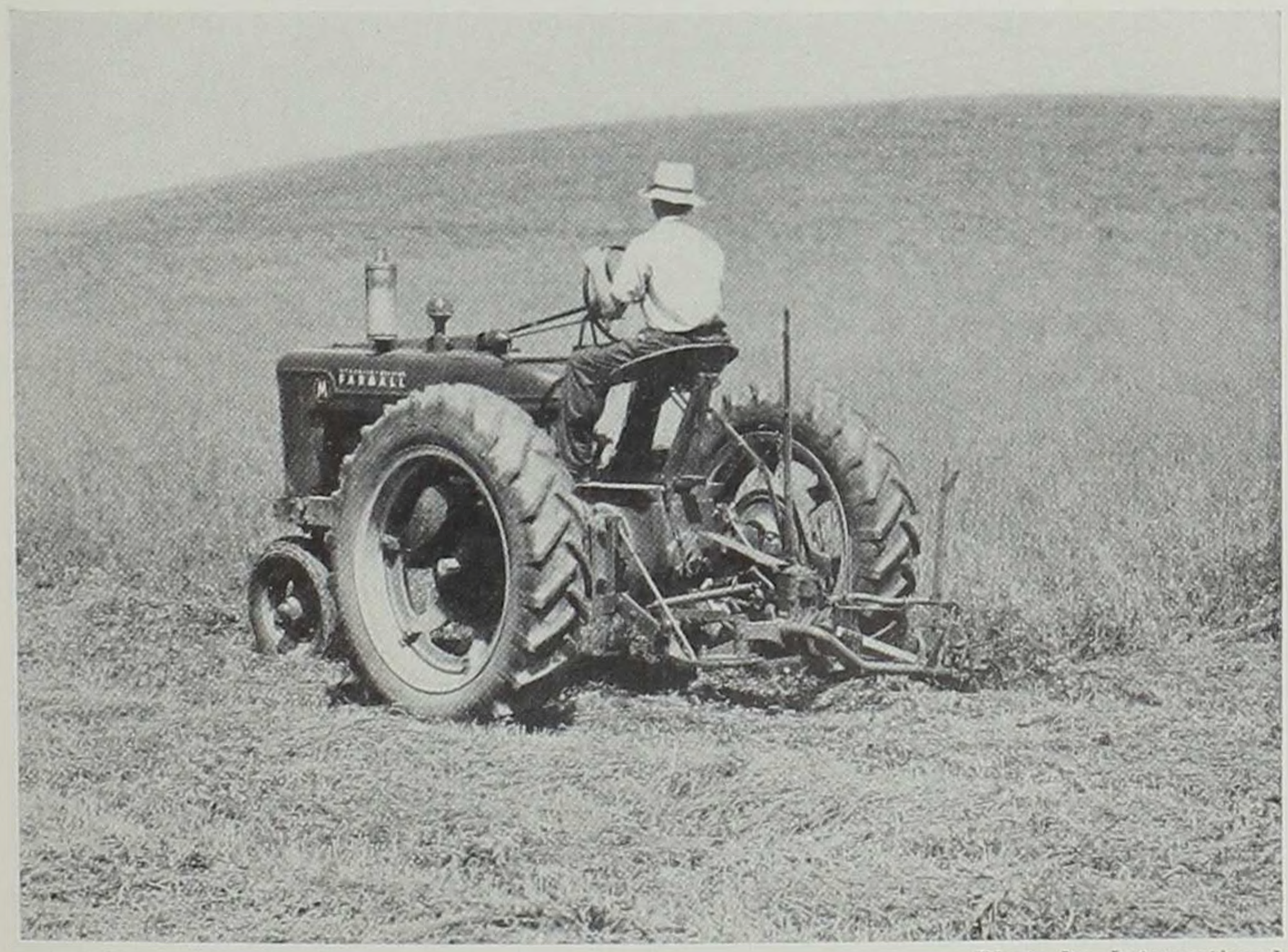
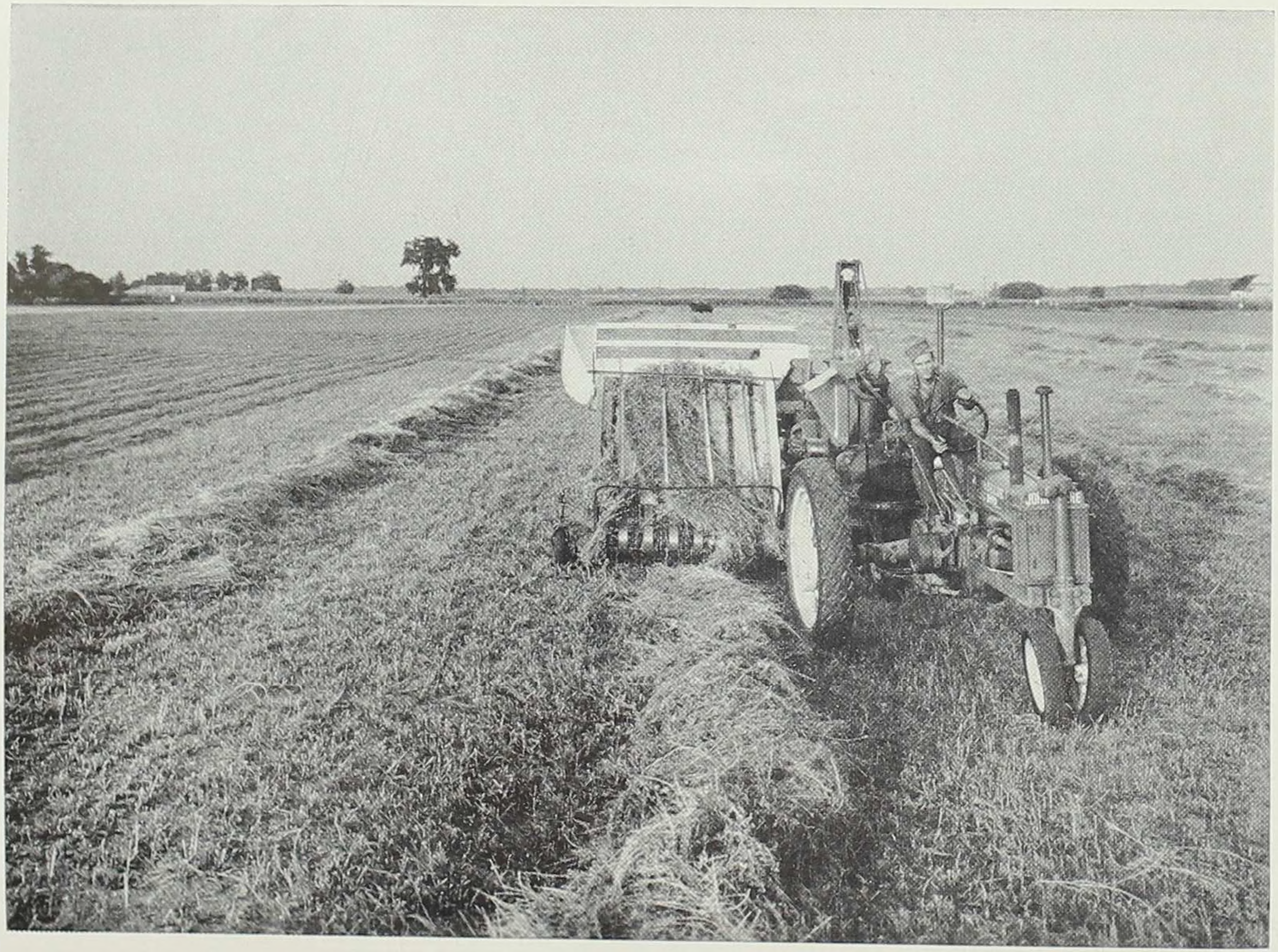


Photo by International.

A direct connected tractor mower.



A windrow pick-up field baler.

Photo by Deere.

Oxen were used at a very early date to pull plows, as indicated by the diagrams on the most ancient monuments of Egypt, dating back as far as 3,000 years before the Christian era.

Some of the oldest records mention the plows of the time. The book of Job, believed by scholars to contain some of the earliest writings of the Old Testament, speaks of "the oxen plowing" and again it is stated that "Elisha was summoned from plowing to assume the role of the Hebrew prophet."

A description of the plow used by Cincinnatus and Cato is given by Virgil in the *Georgics*. This plow, although formed with pieces of wood and pointed with metal, did not have a moldboard for turning the furrow slice.

There is no record that the Pilgrims brought a plow with them when they came to America in 1620 although it was mentioned in the records of the colonies that they brought wheat and oats for seeding. The soil in the forest areas, which the Indians had cleared by burning, was loosened by hand tools, spades, mattocks, and hoes. The seed was broadcast by hand and covered with a crude harrow made of tree branches.

The Indians showed the Pilgrims how corn could be planted in beds of soil prepared with a rake. The production of grain was so low that the farmer could raise but little more than the requirements of his family. Later, plows were imported,

and by 1637 there were thirty plows in the Massachusetts Bay Colony. It appears that the Pilgrims learned considerable about plow making during their stay in Holland on their way to America. This may have been responsible for the importation of the Dutch plow later.

The Dutch are credited with important improvements in the making of plows and appear to have made the first attempt to devise one which would turn a furrow slice rather than simply loosen the soil. To turn a furrow, provision for a landside to receive the side thrust of the moldboard was necessary.

The Dutch plows were sent to England and Scotland and underwent considerable improvement there. Rotherham, England, became the center of plow making and its name was given to the plows produced there. It is recorded that in 1720, Joseph Foljamke took out the first English patent on a plow with moldboard and landside sheathed with iron. The Rotherham plow continued in use without much change for several decades. George Washington imported a Rotherham plow to the United States and used it for many years, but it is recorded that when the plow needed repairs there were no skilled smiths available.

Another step ahead was the making of the share, moldboard, and landside all of iron. James Small of Scotland introduced such a plow, with the share made of wrought iron, and he continued

to manufacture it for more than fifty years. In 1785 Robert Ransome of Ipswitch, England, introduced chilled iron shares which were harder than steel.

The historical records pertaining to the development and introduction of the all iron or steel plow indicate that, in spite of the fact that the improved implement performed superior work with the consumption of less power than that required by the clumsy wooden plow, it was not readily received by the farmers of the time.

In England in 1835 Sir Robert Peel presented a farmers' club with two of the most advanced types of iron plows. Some years later he visited the neighborhood and found, much to his amazement, that the new plows were idle and the old clumsy wooden ones still in use. Upon inquiry as to the reason, a member of the farmer group replied, "Sir, we tried the iron, and we are all of one mind that they made the weeds grow."

A similar story is related concerning the introduction of cast-iron plows in America. An improved plow, the first of its kind, was patented in 1797 by Charles Newbold of New Jersey. After spending a considerable sum furthering its introduction, he abandoned the attempt because the farmers of the time asserted that the iron plow poisoned the soil and prevented the growth of crops but stimulated the growth of weeds.

Thomas Jefferson became much interested in

the improvement of the plow and prepared and presented a treatise on the proper form of the moldboard to the French Academy in about 1788 when he was the American ambassador to France. His interest in the plow was stimulated by watching farmers at work. The following entry was made in his diary while stopping for the night at Nancy, the capital of the duchy of Lorraine: "Oxen plow here with collars and hames. The awkward figure of their mould-boards leads one to consider what its form should be. The offices of the mould-board are to receive the sod after the share has cut under it, to raise it gradually and to reverse it." The entry was accompanied with sketches showing the form of the moldboard as Jefferson would have designed it.

Daniel Webster, the American statesman, was also interested in the improvement of the plow and had a very large and cumbersome model built after his plans. At one time Webster is reported to have said, "When I have hold of the handles of my big plow — and observe the clean mellowed surface of the plowed land, I feel more enthusiasm over my achievement than comes from my encounters in public life at Washington."

Jethro Wood of Scipio, New York, who received his first patent on a plow in September, 1819, is given credit for a very large contribution toward improving the form and shape of the plow. Although Wood's plow, through his con-

tinued effort to improve it, became a standard generally copied by plow manufacturers, he was unrewarded for his efforts and died a poor man with his family in want. William H. Seward said of Wood, "No man has benefited his country pecuniarily more than Jethro Wood and no man has been as inadequately rewarded."

In 1833, John Lane, a blacksmith of Chicago, made a plow with a wooden foundation but armored with steel strips cut from a saw blade. This plow proved to be eminently successful in the black loams. John Deere, of Grand Detour, Illinois, in 1837 was making plows in a similar manner using first saw blade steel and later specially rolled steel plate imported for the purpose. In 1847 Deere moved to Moline, Illinois, and established the first of the factories that now bear his name.

Some difficulty was experienced in using steel: if it was made as hard as desired it was brittle. In 1868 John Lane, a son of the blacksmith who made the steel plow of saw steel, was given a patent on soft-center steel. By welding two high carbon steel blocks on either side of a low carbon block, the welded block could be rolled into a plate with the hard steel on both surfaces. This soft-center steel plate could be heat-treated, making the surface very hard while the center remained tough and strong. Soft-center steel has been used continuously to the present in the manufacture of

plows for the black soil of the Midwestern states.

With all of the early plows, the plowman walked behind the plow and guided it with one or two handles extending to the rear. In 1864, F. S. Davenport patented a "sulky" plow attached to a carriage on which the operator could ride. Many accessories and conveniences were added as the years passed such as colters, high lift, steering with a tongue, and interchangeable parts. Even in the midst of general enthusiasm for new machinery, however, some farmers held back and decided that riding plows and cultivators were for lazy farmers. Others promptly rose to defend the new machines, one farmer in Van Buren County stating that "having followed the plow for over thirty years" he would "just as soon ride as walk."

The disk plow has received much attention from inventors and designers seeking to reduce the draft of the plow. Two brothers, M. A. and I. N. Cravath, were among the first to secure patents on the disk plow. Although the disk plow has not come into general use, it has been especially adapted to hard or sticky soils which are not easily worked with a moldboard plow. A wide disk plow with disks mounted on a common shaft, known as a one-way or harrow plow, has been developed for the shallow cultivation of semi-arid land, but such a machine unfortunately has never been introduced in Asiatic countries.

Perhaps the latest important development in the

plow has been the mounting of it directly on the tractor with a power operated lift and control. These mechanical controls relieve the operator of any strenuous effort in adjusting or raising the plow. This plow, controlled through "finger-tip" or "feather touch" levers, is very fascinating and appeals to the operator. These lifts and controls have become so popular that they have been adapted to many machines. Power lifts and controls are also provided for machines drawn behind the tractor.

The Harrow

Since the earliest times, it has been customary to complete the seed bed after plowing it with an implement to pulverize the soil and smooth the surface. The earliest harrows were made of branches of trees arranged to lie flat on the surface of the ground. Animals were used at a very early date to draw these harrows. Iron was used as early as available for making harrows. The twentieth chapter of Second Chronicles contains the following reference to harrows of iron: "He cut them with saws and with harrows of iron." Pliny, in 79 A. D., wrote, "After the seed is put into the ground, harrows with long teeth are drawn over it."

The harrows that took the place of tree branches had wooden frames and metal teeth or spikes. These have been succeeded by all-metal harrows with levers for varying the pitch of the teeth.

According to the patent office records, the spring tooth harrow was patented in 1869. This implement cultivated the soil deeper than the spike tooth harrow. In 1877 a harrow with sharp edged concave disks was patented and has become an implement of almost universal use. It has good penetration and does not clog in the stubble or crop residues left on the surface of the fields. A number of forms or types of rollers, pulverizers, and packers have been developed and used for reducing the clods and firming the soil.

Often it is desired to loosen soil without the inversion obtained with a plow. In fact, a system of crop growing known as "mulch culture" is based upon the premise that it is best to leave the crop residues, such as stubble, on the surface to aid in controlling loss of moisture and in reducing the erosive effects of surface run-off.

The Cultivator

Many crops, notably corn, require cultivation of the soil between the rows for loosening the soil to receive rain and for the control of weeds. The lighter hoes were formerly used for this purpose and in a sense the first cultivator was an enlarged hoe with two handles, one to which the animal was attached and the other held by the operator for steering the implement. The second step was to make a gang of two shovels, called the "double shovel," and the third was to attach two gangs to a cart forming a "straddle row" cultivator. The

early single and double shovel cultivators were made by local blacksmiths, but the general form or type was quite well established.

In 1867, Blanchard's *Hand-Book of Iowa* described the planting of corn as follows:

> The ground is plowed in early spring, one team and a man plowing two and one half acres per day. Next, the field is laid out in rows four feet apart, one team marking four rows at once with a marking machine, which is a simple shaft or piece of joist, sixteen feet long, with four sled-runner shaped planks inserted in it four feet apart, and a tongue attached to hitch the horses to. The next process is to drive across these rows thus made with a corn planter. One man and team will plant ten acres per day. When the corn is well up in the blade the cultivating process is commenced by dragging or harrowing it. Two rows are gone over at once, the team straddling a row, and the harrow teeth so set as to stir the ground thoroughly each side of this row to the next row, each way. A sulky plow is sometimes used instead of a harrow. This is a gig-shaped machine on two wheels, with diamond shaped teeth projecting downwards from the axle. The driver rides on his seat and goes over the field two rows at a time, in the same manner as with the harrow. Next comes the cultivator, drawn by a single horse, going through one row at a time. After the corn has been gone through with the cultivator, it is generally ploughed through twice more with a shovel plough, and laid by till harvest. The corn is generally husked on the stalk, and stored in rough cribs made of rails built cob-house fashion, when it is ready for market.

When tractors were first available to the farmers they were not suited for the cultivation of intertilled crops. Important improvements in the de-

sign of the tractor for such crops was to provide clearance to pass over growing crops and the design of the cultivating machines for direct attachment to the tractor.

Seeders and Planters

Machines for seeding and planting crops developed slowly. This may have been due to the fact that seeding and planting can be carried out effectively with hand tools. Seed broadcast by hand can be covered with a harrow and larger seed can be placed in a soil pocket made and covered with a hoe.

Jethro Tull, of England, an ardent advocate of thorough tillage, wrote a treatise on the subject "Horse Hoeing Husbandry." He urged that grain should not be broadcast but planted in rows and cultivated. He devised a combination drill and cultivator.

An American patent was granted in 1799 to Eliakim Spooner but nothing came of his machine. M. and S. Pennock, of East Marboro, Pennsylvania, obtained a patent on a drill in 1841. The Pennock Brothers made their machine in considerable numbers. Agents in Iowa did everything possible to increase the use of wheat drills. In Mount Pleasant, Renchelor and O'Daniels were agents for the Pennock wheat drill in 1858 and offered to take as their pay "the increase over the common method of sowing, off of forty acres."

One of the essential requirements of a grain

drill is to supply the seed evenly in the row. This led to the development of various styles of "force feeds" for metering out the seed. The early furrow openers were simply pointed tubes. Later the shoe was devised, which consisted of a long sloping curved blade spread and open at the rear through which the seed could be dropped. This type of furrow opener is universally adapted to corn planters. The sharp runners assisted in the making of straight rows. Now nearly all drills are supplied with single or double disk furrow openers because this type gives less trouble from clogging.

In 1839 D. S. Rockwell was granted a patent on a corn planter, which had many of the features of a modern machine. The number of kernels was metered out by a pocket or cell in a slide which passed under the seed box. The early machines were operated manually — the field being laid out with a cross-marker indicating where the hills should be placed. First a marker was added to help with the spacing of the rows, and the location of the hill in the row was determined by a wire having buttons spaced to locate the hill where desired. An improvement in accuracy was obtained with the "cumulative drop" or the use of single kernel cells in the seed plate for counting the kernels one at a time to form a hill of any desired number of kernels. With the coming of the tractor, corn planters were designed to plant two, four or more rows at a time.

The Harvester

The first tool devised for harvesting was the one-hand sickle. With this tool the standing grain is grasped with one hand and severed with the sickle held in the other hand. The sickle continued in use for many centuries without much change; in fact it is still used in some countries today. In the United States it was enlarged into a two-hand tool and provided with fingers for gathering the grain into an even bunch as it was cut. This hand tool, called the "cradle," easily doubled the capacity of the reaper. It is reported in the United States census for 1880 that the cradle came into general use in America during the last quarter of the eighteenth century.

A review of the work on reaping machines indicates that there were a number of machines made during the eighteenth century but none were made in sufficient quantity greatly to affect the harvesting task. In 1828 Patrick Bell, a minister of England, built a harvesting machine. The grain was cut with oscillating knives similar to scissors. A canvas apron carried the cut grain to one side, depositing it in a windrow. A reel was also provided for holding the grain against the cutter bar.

During the second quarter of the nineteenth century, when Iowa was being opened to settlement, there was a very active interest in harvesting machines. Two men stand out prominently in the development of the reaper — Obed Hussey of

Baltimore, who was granted a patent December 31, 1833, and Cyrus Hall McCormick, who received a patent June 21, 1834. Hussey's machine had a reciprocating sickle but no reel or outside divider. McCormick's machine had both but used a saw to cut the standing grain. At first the honors for inventing the reaper were equally divided, but as the years passed, McCormick received more and more recognition and Hussey dropped out of the manufacture. In 1878 McCormick was elected corresponding member of the French Academy of Science as "having done more for the cause of agriculture than any other living man."

In 1858 C. W. and W. W. Marsh of Illinois designed and built the Marsh harvester which provided an elevator for elevating the cut but unbound grain to a table where attendants, riding on the machine, could receive it and bind it into bundles. In 1870 the Marsh Harvester Company made over 1,000 machines. This company later became the Deering Harvester Company of Chicago. In 1870 George H. Spaulding invented the packer, a device for making a bundle. In 1869 John P. Appleby furnished the twine knotter which completed the self-binder.

The expense of reapers would have been a deterrent to their use, had it not been for the credit system. The big selling point of the reaper was that the farmer could pay for it out of his profits. Notes carried a 6 per cent interest charge and

were payable, in the Corn Belt states, after "hog-killing time." At the agricultural fairs reapers "drew almost as large a crowd as the horse races." By the end of the sixties a wide assortment of "imported" agricultural implements was supplied to the farmers of Iowa by the merchants of the market towns. Of the reapers, Manny's and McCormick's were the most popular.

The old and the new carried on, side by side. While the scythe, the hoe, and the grain cradle were still used, the new reapers, mowers, threshers, cultivators, corn planters, and wheat drills were gaining in popularity. Many of these implements were manufactured in the east, particularly in Ohio and New York. Frontier localism opposed buying these "foreign" importations, however, and each new manufacturing plant in Iowa was greeted with an elaborate "puff" in the newspapers. Plows were manufactured in almost every town in Iowa, while a "very superior" reaper and mower was made by Rose and Harrington in Washington County. Patented tools of popular makes were also manufactured in various Iowa localities on a royalty basis, thus satisfying the desire to patronize local industries.

The Thresher

The original method of threshing grain was to beat the grain loose from the straw and chaff while spread on the threshing floor with a flail or by the treading of animals, or a roller drawn by oxen.

Threshing machines were developed in Scotland and England by Michael Menzies and Andrew Merkle, respectively. These machines simulated hand threshing in that there were flails driven by water power.

In the United States there were a number of patents granted on threshing apparatus, but to Hiram A. and John A. Pitts of Maine is given credit for designing and building a successful machine. In the twelfth census in 1900 it was reported that "the first noteworthy threshing or separating machine in the United States which was noticeable was that of Hiram A. and John A. Pitts of Windrop, Maine, and it is said to be the prototype of the machines used at the present time."

During the period while the reaper was under development, the header, which clipped only the heads to be elevated into a wagon, was proposed. Such a machine was patented by George Esterly of Wisconsin in 1844. Several combined harvester-threshers were made as early as 1846 by John Hiram Moore and his family, residents of Michigan. One of these machines was shipped to California in 1854 where it is said that 600 acres were harvested in that year. It was not until the years during and following World War I that the combined harvester-thresher was tried in the wheat area of the Middle Western states. It at once came into great favor. New varieties of grain have been developed, making such a machine more

practicable. These varieties stand well and do not shatter when ripe.

Iowa farmers bought an increasing number of new machines until their investment in farm equipment at the present time exceeds by 40 per cent that of any other state. In early days farm machines were often not housed between periods of use but left exposed to the weather. For such neglect farmers were often criticized. The editor of the Osceola *Republican* complained in 1870:

> Pass through the county and it is no infrequent sight to see a costly mower on the prairie just where the farmer concluded that if we had a mild winter he had enough hay cut. It is true the "implement" will be handy to hitch to next haying but how long will it last exposed to sunshine, rain, or prairie fires, and is it paid for; other costly labor savers are remaining in the last ditch, others stacked against a breach in the fence, and so we might point out what we consider some of the causes why our farmers have long faces because of the low prices of pork.

J. BROWNLEE DAVIDSON