being much employed. But the experiences of one country, or climate, are not like those of another; and the customs of husbandry adapted to one portion of the earth are seldom suited to another portion; so that one nation has not borrowed so much from another, or profited so much from its real progress in the line of agricultural inventions, as in those of many other arts of peace, or of the art of war, especially; for in the latter, one nation must keep pace with another, or consent to be reckoned as an inferior power, and suffer the consequences of weakness or want of skill — be "absorbed," "annexed," or "trampled out of existence," it may be.

We have not the space to indulge in speculation or philosophizing as to the various reasons which have retarded progress in the line of labor-saving implements of husbandry; but we may remark, *en passant*, that in ancient times more than now, man seems to have been more of a pastoral animal than an agriculturist proper. He lived more with and upon his flocks, and upon the fruits of trees and vines, and less upon the cerealia and cultivated vegetables, than the race now does. We find Sir Anthony Fitzherbert declaring himself as follows in his "Boke of Husbandrie," in 1534 (the first agricultural work published in England): "A housebande cannot thryve by his corne without cattell, nor by his cattell without corne; shepe, in myne opinion, is the most profitablest cattell that any man can have." Sir Anthony had then had forty years' experience as a farmer, and undoubtedly uttered the then prevalent opinion on the subject.

The contrast between the primitive Sickle and the Mower and Reaper of these days is as wide almost as between that of darkness and light; or more fitly perhaps, and less exaggeratedly, may be, between the classic "fig leaf" of the primal garden, and the toilet of the modern belle with her deftly woven silks, her laces subtly wrought by aching fingers, her cashmere shawl made of the exquisite wool of unborn lambs, and her diamonds, found after years of the discoverer's ceaseless searching, and set in braided gold.

A pertinent comparison or contrast of the past condition with the present state of mechanics as related to agriculture might be made between the Norman Plow and its driver (as represented in the article on "Axes and Plows" p. 114,) and the Mower "at work" in the field, as it appears in this article, with its wondrous conjunction of power and celerity of operation, "its weird combina-

tion of mechanic powers," and its marvelous adaptation of means to the ends of victory.

But we cannot probably better serve the reader at this point, than by presenting him with the various methods of gathering grain, grass, etc., from the remotest antiquity to this time, in a description which, we trust, will not be found wanting in pleasing interest and positive value.

The time-honored sickle, still in use, is the earliest known reaping implement. We find it mentioned both in the Hebrew legends, and the Christian scriptures. That it was used by hand only, and not as a part of a machine, may be inferred from a passage in Isaiah xvii. 5. This was obviously the case in Egypt, judging from the bas reliefs upon some of the buildings and tombs, where reapers are represented using sickles, some with smooth, and others with serrated edge. Two of these ancient Egyptian iron sickles, much rusted, are displayed in the "Gallery of Egyptian Antiquities," in the British Museum, London. In Java, an instrument has been in use from time immemorial for reaping grain, which is described in Sir Thomas S. Raffles' history of that island. The description of the "ani ani" being very vague, it is difficult to form a correct opinion of the manner in which it is used; and the figure does not remove the doubt. We surmise, however, that the reaper takes one of the parts in each hand, and in passing them, like the blades of shears, over each other, the straw is cut, and by the same act the head of grain is thrown into a basket or apron worn by the reaper.

The first account of a machine to reap grain appears to be that given by Pliny the elder, who was born A. D. 23. He says, "In the extensive fields in the lowlands of Gaul, vans (carts) of large size, with projecting teeth on the edge, are driven on two wheels through the standing grain, by an ox yoked in a reverse position. In this manner the ears are torn off and fall into the van." Such an idea of a reaping machine is very like that of the ancient war-chariots, to the sides of which great blades were fastened, and the horses thereof driven into the ranks of the opposing army, thus to reap a harvest of human heads. As Palladius (an Eastern prelate, born A. D. 391) gives a similar account of this machine in the following words, it is more than probable that its use was continued through centuries. After describing the forms of the van and the attachment of the animal, he continues, "All the ears are caught by the teeth, and fall in a heap into the

cart, the broken stalks being left behind. The driver, who follows, generally regulates the elevation or depression of the teeth, and thus, by a few courses backwards and forwards, the whole crop is gathered in the space of a few hours. This system is useful in open level places, and in those where straw is not absolutely wanted." In vol. iv. p. 205 of the "Annals of Agriculture and other Useful Arts," collected and published in 1785, by Arthur Young, F. R. S., etc., appears what is believed to be the earliest proposal for a mechanical reaping machine in Great Britain. In vol. viii. p. 161 of the same work (1787), there is an account of a reaping machine, suggested by the descriptions in Pliny and Palladius, and invented by William Pitt, of Pendeford. It consisted of a reaping or rippling cylinder, composed of numerous parallel rows of curved teeth. This tooth cylinder is suspended in front of a two-wheeled car, and motion communicated by means of a pinion and cog-wheel, connected to the car-wheel by a band and pulley; the iron combs of the cylinders hatcheling off the heads of grain and dropping them into the box behind. In "Walker's System of Philosophy in Twelve Lectures" (1799), there is a description of a reaping machine, though by whom invented, or when, does not appear. The movement of the cutters is represented as being circular. The knife wheel is put in motion by a pulley fixed on its axle, and made to cut like shears against the sharp edges of steel points projecting beyond it into the standing grain, the cut wheat being removed from the platform by a lever attached to the axle of the cutter-wheel. The whole is pushed forward by a horse.

The first patent for a reaping machine in England was obtained by Joseph Boyce, of Pine Apple Place, Mary-le-bone, on the 4th of July, 1799. On the 20th of May, 1800, letters patent were granted to Robert Mears, of Somersetshire, for a machine reaper. This was an apparatus worked by hand, although propelled upon wheels. On the 15th of June, 1805, Thomas J. Plucknett, of Kent, England, obtained a patent for a reaping machine, in which the motive power or "team" was placed behind, and the cutting apparatus suspended beneath and forward of an axle connecting two large driving wheels, and worked by gearing. The cutter was a plain, circular, smooth-edged plate. The Edinburgh Encyclopædia, vol. i. p. 262, gives a description of a reaping machine, having an arrangement for gathering grain, and delivering it in small sheaves, produced in 1806, by Mr. Gladstone, of Castle Douglass. In this

machine, "the horse goes in front beside the uncut grain." This is the first mention of a harvesting machine where the horses go before the machine, and beside the uncut grain; and it is the first reaping machine we have an account of which had an arrangement for gathering the grain, and delivering it on the ground in sheaves or bundles. The cutter was a smooth-edged circular knife, acting upon the grain confined against strong wooden teeth which projected forward and above the blade. The cutting edge was kept sharp by means of two small circular pieces of wood, coated over with emery placed below and above it, and made to revolve rapidly against it.

On page 422 of Loudon's "Encyclopædia of Agriculture," there is an account of a reaping machine designed by a Mr. Salmon, in 1807. Its cutting operation is like that of a pair of shears, to which power is transferred from the driving wheels by gearing similar to that very generally adopted in reapers at the present day.

Up to this time all the different devices for reaping machines were very complicated. The invention of Henry Ogle, schoolmaster of Remington, in 1822, marks the commencement of a new era in reaping machines. Mr. Ogle seems to be the first who invented and used a reciprocating cutter. His machine was one of extreme simplicity. From a trial of this machine, it was estimated that it would cut fourteen acres per day with ease; but Mr. Ogle, schoolmaster, says, "Some working people threatened to kill Mr. Brown (the maker of the machine) if he persevered any further in it, and it has never been more tried." Up to this period, notwithstanding the ingenuity which had been expended upon reaping machines, none had been produced which has stood the test of time, or which embraced all the principles that have been incorporated in the effective reapers of the present day; but in 1826, the Rev. Patrick Bell, of Scotland, invented an apparatus for reaping grain, which is the oldest known machine that is still in use. This may be said to be the advent of successful reaping by machinery. In this (Bell's) machine there was the adjustable reel, as in Ogle's clipping cutters; a method of raising the cutters, and also a mode of delivering the cut grass in line on the ground, to allow any number of binders to work after it. Various trials were made with this machine in 1828 and 1829. One made in September, 1828, in the presence of fifty farmers, elicited from them a signed declara-

tion, that moved by one horse it cut an acre per hour of oats. In September, 1829, the same machine was worked at Monckie, in the presence of a large number of persons, who also attested that it cut half an acre of heavy lodged oats in half an hour. It was also tried in a number of other places in the same year. It is described in Loudon's Encyclopædia of Agriculture.

Although there is unquestionable proof respecting the successful working of this machine in 1828, it does not seem to have attracted much attention, as it was lost sight of entirely, until England was awakened to the utility of reaping machines, in 1851, at the Great Exhibition. "The credit of effecting this (the whole English press has declared) is undoubtedly due to American inventors, whatever may be the ground for disputing the novelty of the two rival American reapers" (McCormick's and Hussey's). After the accounts regarding the American reapers at the World's Fair were published abroad, it was claimed that the American reapers were no more than copies of British reapers, and that one of Bell's machines had been early sent out to America, from which, it was hinted, the American inventors had supplied themselves with ideas. One of Rev. P. Bell's horse power reaping machines was imported by John B. Yates, in 1834, who used it about two years, until the time of his death, after which we have no account of its being continued in use. It is not probable, therefore, that the inventors of American machines are at all indebted to Mr. Bell or any other foreign inventors for their ideas.

About this time the attention of inventors, in different parts of the world, seems to have been awakened to the importance of harvesting machinery. One was invented in Odessa, in 1831, one in Vienna, in 1839, and one in Australia, in 1845. From this period up to the time of the Great Exhibition in London, in 1851, there were nine letters patent issued in England for reaping machines and improvements thereon. The World's Fair was the commencement of a new era in the department of agricultural machinery — of reaping machines particularly. From the closing of the Crystal Palace, in 1851, to the end of the year 1852, there were no less than twenty-eight inventions registered, and English patents granted for inventions relating solely or partially to reaping and mowing machines. Few of them are of sufficient interest and present importance to demand a notice.

The foregoing descriptions embrace the history of reaping machines in foreign countries up to the year 1853.

American Reapers.

The attention of our countrymen was directed at an early period to the importance of reaping machines, and we find that a patent was granted on May 17, 1803, to Richard French and J. T. Hawkins, of New Jersey. In a letter written by the son of the inventor, he says that his father constructed a working machine, and tried it in a field of rye, and that it cut a large quantity of the grain. Why it was dropped he cannot tell. The reaper was supported on the wheels — one wheel extending into the grain. The horses drew in front, or rather at one side, opposite the cutters, which were a series of scythe-knives, revolving on a vertical spindle — a rotary reaper. Beneath the cutters were long wooden fingers, extending some distance into the grain, and supporting the grain to the action of the revolving cutters. Directly behind the cutters were fingers that passed between the cradle fingers, and removed the cut grain, which fell to the ground ready for binding.

Obed Hussey's machine was patented in 1833, and contained nearly all the main features of those used at the present time. His machine was intended to cut both grain and grass, and had a reciprocating knife and a slotted guard finger, both of which are now used on all harvesters.

As Hussey's, therefore, is still in use, and was a successful machine from the first, it must embrace features peculiarly fitted to accomplish its work. The first public trial in the harvest-field with Hussey's reaper took place on the 2d of July, 1833, before the Hamilton County Agricultural Society, near Carthage, Ohio. Dr. Wallace, secretary of the society, gave a certificate, dated the 20th of November, of that year, in which he states, "that he saw the machine operate on a field of wheat, which it cut clean and with great rapidity, and that it established one point satisfactorily, namely, that it was constructed on a principle to operate." There was also a certificate of nine witnesses of the same trial, in which they state, "that although the machine was not well constructed (mechanically merely), its performance far exceeded their expectations." In 1834 this machine was introduced into Illinois and New York, and in 1835 into Missouri, in 1837 into Pennsylvania; and in 1838 Mr. Hussey removed from Ohio to Baltimore, Md., where he continued to manufacture his reapers.

We will now let Mr. Hussey speak for himself. "There is no account of any successful reaper in ancient times, and it is well known that England and Scotland never produced any up to the time of the London Exhibition of all Nations, in 1851; it consequently follows that the claim of priority is clearly confined to the

AT WORK.

United States. The question therefore is, who originated the successful reaping and mowing machine?

"I do not desire to urge any unjust claim for myself, but I wish to maintain the credit which is justly due to me. It is known to the country, and by farmers in particular, that there are at the present day several successful reaping machines, which are known

by different names; but it is not generally known that all of them, without exception, embrace substantially the principle invented by me, and exhibited by myself in successful operation, in the harvest field, as long ago as 1833; and however surprising and unexpected this statement may appear, it is nevertheless true, that there is no successful reaping and mowing machine now in use without it. Most of the reaping and mowing machines of the present day are of recent date; nearly all of them are little more than copies of my invention. The old Roman machine seems to have been little more than a cart, backed up to the wheat. This mode of approaching the grain was followed by the Scotch and English inventors from the remotest period in the history of reapers down to 1854. The earliest of these English and Scotch machines appear to have been constructed on the rotary principle, the cutting instruments being placed on the periphery of a large horizontal wheel, which revolved near the ground. Bell, of Scotland, at a later period used scissors. His machine presented to the grain a row of pointed blades, which operated like a series of tailors' shears, but it was soon pronounced a failure.

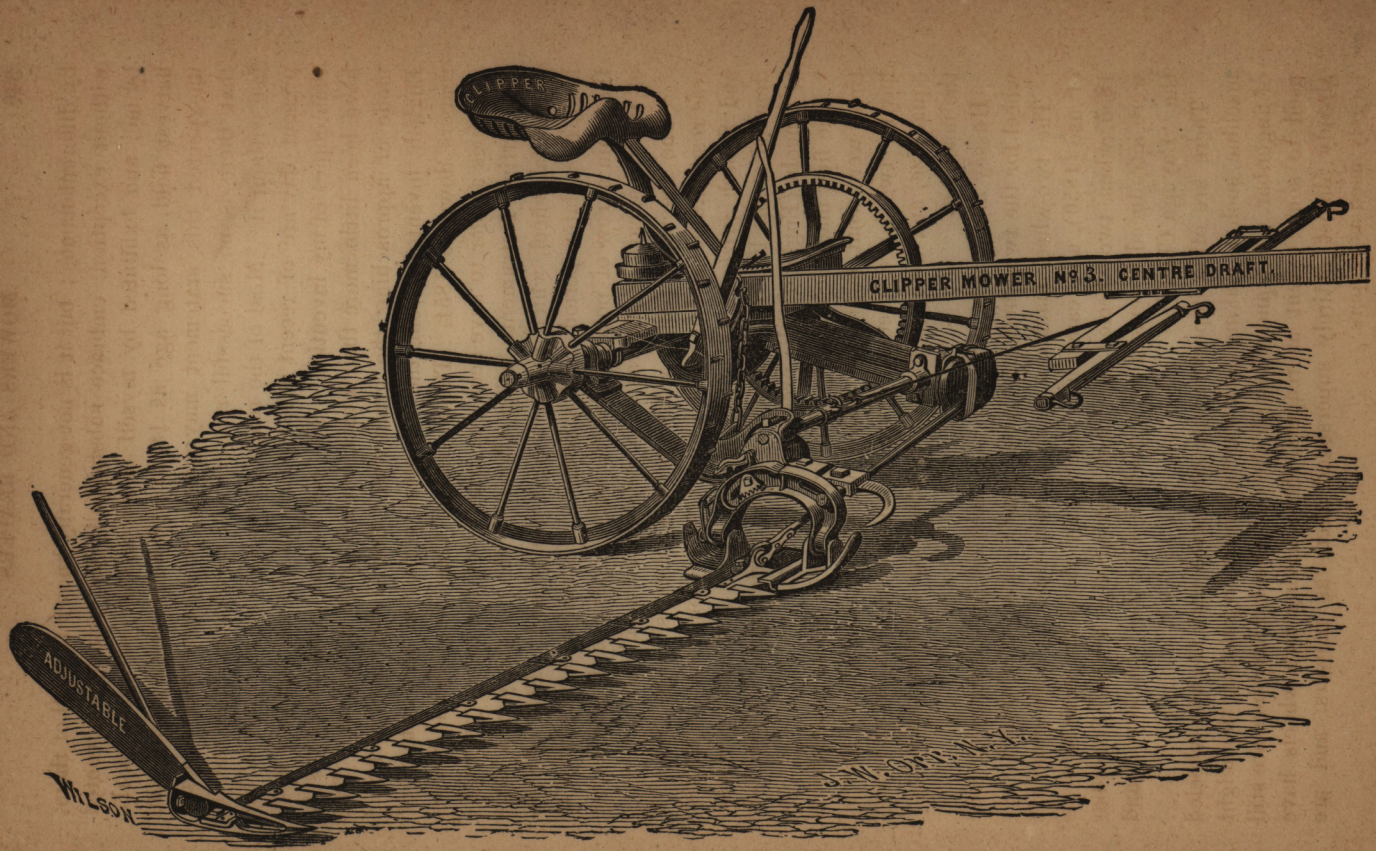
"The American reaper woke up from a long sleep in 1851. It was resuscitated, and flourished for a brief season, took the English and Scotch prizes in 1851, by especial favor, and was again condemned at the late meeting of the Royal Agricultural Society, held in Lincoln (England), the present year (1854)."

The first machine made by Hussey, as well as others made at that time, were what might be called two-wheeled machines; that is, having two large wheels to support the frame, of equal or nearly equal size, and with the finger-bar extending out from the side of the machine.

Hussey afterwards changed his machine by substituting one wheel for the two-wheel previously used: so did McCormick.

The two-wheel machines seem at that time to have gone out of use (1850), and came into use again about the year 1854, or 1855, when two-wheeled machines having the *hinged* finger-bar were introduced, foremost among which were the "Buckeye" and the "Cayuga Chief."

There are other improvements connected with the two-wheeled machine, such as making both wheels drivers, regulating the height of finger-bar, etc.; and although the one-wheeled machines are still used to some extent as reapers, those having two wheels have already almost entirely superseded them as mowers, and are largely used as reapers.



CLIPPER, MEDIUM SIZE.

The leading principles in the operation of harvesting machinery, may now be considered as fully established, and the attention of inventors and manufacturers will, no doubt, be directed to further simplifying the construction of the parts, and adding to their convenience and ease of management.

In the application of principles already established, there are now used in all first-class mowers, two driving wheels, which support the body of the machine, and give motion to the knives, through the gearing; a frame which supports the gearing, and to which is attached the cutting apparatus and the draught-pole; the gearing; the cutting apparatus, consisting of a reciprocating knife, operating in and supported on a finger-bar, with shoes at each end, and having guards or fingers projecting in front to protect the knives and assist in cutting. In addition to these, the reaping machines have reels and platforms for the purpose of gathering the grain, and delivering it on the ground in gavels suitable for binding.

Although the general arrangement of these parts is similar in the machines now most prominent before the public, there are many, and in some instances material points of difference in their construction; and we mention, as some of these points, the style of driving wheels, some being made of cast and wrought iron, others of cast only; the manner of connecting the driving wheels to the gearing, so as to best admit of throwing the machine in and out of gear; the number of gears, some having two, and others three pairs; the frame, some using iron only, others wood; besides different devices for uniting the finger-bar to the frame, so that it will conform to the inequalities of the ground, and be raised, to clear obstructions, while at work, and secure convenience in transportation. Some finger-bars are made of iron, and some of steel, and differ in shape. The guards or fingers also differ in shape, and are made from different kinds of metal. The manner of attaching the draught is of the utmost importance, in order to avoid, as far as possible, what is called "side draught," and differs in some of the leading machines; also the location of hand levers convenient to the driver, to enable him to adjust the cutting apparatus, with as little inconvenience as possible, to the surface of the ground, and to raise it over obstructions.

Particular attention has been given within the last few years to the cutting apparatus, which includes the finger-bar, knife, and fingers. The first finger-bars were made of wood, but now

wrought iron and steel are exclusively used. The knives have been the subject of many experiments, to determine the proper motion, and the best size for a blade or section. The fingers or guards were first made of wood, next of cast iron, then of wrought and malleable iron, afterwards improved by the use of steel cutting plates. A solid cast-steel guard is used on the so-called "Clipper" machine.

The earliest machines made would cut only dry and coarse grass, and work on uplands; and it was thought, until within a few years, that it would be impossible to mow grass while the dew was on. A good machine of the present day, however, will mow in all kinds of grass, whether wet or dry, coarse or fine; and some builders warrant their machines to work well in any place where the farmer is willing to ride or drive.

The competition among builders has been, and is now, very great, and has stimulated invention, until more than two thousand patents pertaining to harvesting machinery have been granted in this country.

Probably the machine which has been brought to the greatest perfection at the present time is the Clipper mower. It is the invention of Mr. Rufus Dutton. We quote from the report of the great trial held at Auburn, N. Y., in 1866, when fifty-four different machines were on exhibition, including nearly every harvesting machine of any importance in the country. "Among the candidates for the favor of the agricultural public, few have made more determined or more ingenious efforts to carry away the palm, than the inventor of this machine. He has proposed to himself to construct a machine which shall have the greatest strength with the lightest material, aided by the best possible workmanship, combining security for the driver, convenience of management, and adaptation to uneven surfaces; and, in short, which shall meet all the wants of the farmer in the greatest possible degree. . . . The mechanical execution of this machine reflects the highest credit upon Mr. Dutton, the inventor; in this respect it surpasses all the rest. All the bearings are as smooth as machinery can make them, all the joints are closely fitted, all the working parts are mathematically in line, all the materials of which it is composed are of the best that can be procured."

In 1867 the "Clipper Mower and Reaper Company" was organized, with a large capital and ample facilities for manufacturing these machines, and has already become the representative house

in this line of manufactures. The company constructed extensive and expensive machinery expressly for this purpose, and now manufacture the "Clipper" machines, greatly improved in every respect, both in materials used and in workmanship, also in style of finish, over those used at the Auburn trial in 1866. The

PASSING AN OBSTRUCTION.

engravings represent this celebrated machine in the field at work. Their manufactory, of which we present a view, is at Yonkers, N. Y., the company's business centre being New York city.

For four or five years past, from eighty to ninety thousand machines have been made annually in the United States, and the

capital employed is not less than ten million dollars. A large number of establishments are now engaged in this business, among which may be mentioned, as the most prominent, those making the "McCormick," the "Buckeye," the "Kirby," the "Wood," and the "Clipper" machines, each of which turns out a number of thousand every year.

But perhaps one of the best, among the late improvements on mowing machines, is the *steel guards*, controlled by letters patent, and used exclusively on the "Clipper" machines. These have been perfected at a great cost of time and money, and are worthy of especial notice. They are forged from solid cast steel, and after being shaped under a drop-hammer, the slots are cut, by milling machines, perfectly smooth and uniform in all respects. The cutting surfaces and points are then hardened, while the remaining parts of the guards, to secure the greatest strength, are left untempered. The hardened points do not become dulled or bent by stones, or other obstructions, so as to catch fine or dead grass, or anything else; after being ground and polished they are ready for the finger-bar. No arguments are required to convince any one of the superiority of steel for this purpose, as it is more than twice as strong as the best wrought iron, and three times stronger than malleable iron. These guards will not break with the roughest usage. On over twelve thousand machines, hardly an extra one has been required to supply breakage — a fact which will suffice, we think, to demonstrate these steel guards as an advanced and needed step in the line of a great progress.