IMPROVED FARM IMPLEMENTS.

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THE object of this essay is to advise the farmers of our country of improvements in some of the implements of husbandry, to facilitate the labors of the farm and garden. The developments in improved farm implements during the last ten years have been really wonderful, and the man who has not kept himself posted in regard to the new inventions of hand tools and horse implements is filled with astonishment when advised what ingenious inventors and skilful mechanics have accomplished, and what they are now doing to relieve farmers of the heavy and irksome drudgery of the farm. Indeed, the improvements in agricultural implements have been characterized by such eminent ability, that at the last international exhibition it was repeatedly observed that the Americans, by their superior ingenuity, had beaten the English on their own ground, in the exhibition of superior implements of husbandry.

My aim is to give illustrations and descriptions of the best hand tools and horse implements that are now manufactured throughout the United States. Of course there are many really meritorious horse implements that I cannot notice; and before publication there may be others brought out that will far excel anything illustrated and described in these pages. Skilful and experienced mechanics are not only surprised to see such a commendable spirit of invention among their fraternity, but they are astonished at the inventive ingenuity and skill of intelligent farmers, who aim to economize labor and appropriate the forces of the farm to the best possible advantage.

The exceedingly high wages required for manual labor in this country has prompted our farmers to bring out machinery with which they can perform the heavy labor with teams, which are far more capable of exercising muscular force than human beings. Only a few years ago a farmer was required to employ, feed, and pay a large gang of strong men to do a little work which could all have been performed in a shorter period of time by means of his idle, fat horses, if the necessary machinery had only been provided. But now we see one man and a boy, with a single team, accomplishing tasks which formerly required a score of faithful and strong laborers to perform; and by means of a team and improved machinery a given piece of work is accomplished sooner and in better order than when men performed the labor and fat horses stood idle in the cooling shade. Many of our implements, it is true, have not been brought to that degree of perfection which is desirable, yet they may be classed among our most efficient machines ever invented.

LABOR-SAVING IMPLEMENTS.

In agricultural dynamics, the effective force of a horse is computed to be equal to the power of five strong, active laborers. This fact furnishes a starting point with which to compare the efficiency of any farm implement. If a span of horses and one man can perform as much labor with a certain implement as could be done in the same period of time by the united force of eleven laborers, we feel warranted in pronouncing that implement or machine a triumphant success. On the contrary, if a man and a team of two horses or two oxen are not able to accomplish as much labor as could be done by eleven active men, the machine needs further improvement.

Most of the improved farm implements that have come into general use are capable of performing all that is required of them. Indeed, many of them possess such wonderful efficiency that a single horse or mule and an active boy can perform more labor, and do it better, than twenty men would be able to do with hand tools.

Alden's horse-hoe, noticed in another part of this chapter, affords an illustrious example of a farm implement, the efficiency of which rises far above the common standard of merit. Our best mowers and reapers, horse-rakes, hay tedders, horse-forks, and threshing machines, possess wonderful efficiency, and in some instances so far exceed the standard of merit that comparison makes the standard appear insignificant.

Although there is a growing and almost imperative demand for improved farm implements, there is still a great lack of efficient labor-saving machines for performing many of the manual operations of the farm, now accomplished by tedious and expensive manipulation.

Our late civil war stimulated inventors to bring out improved implements to enable farmers to do almost everything in the field and in the barn with horses, oxen, or mules. Had it not been for efficient farm implements during that long and bloody war, our farmers could not have mowed their grass, gathered their hay, or harvested and threshed their extensive fields of grain. As thousands upon thousands of our young men were called to the field of mortal combat, it seemed almost like an interposition of Divine Providence that inventors were endowed with sufficient mechanical skill to construct implements with which horses could perform the labor of the absent son or father, who had gone to defend his country and to fight for his wife and children. Now, the infirm and the invalid, the lame and the lazy, who could never plough the fields, harvest the grain, or make the hay of a small farm, can ride to plough the land; ride when putting in the seed; ride when scattering their fertilizers; ride when cultivating the growing crops; ride when mowing or harvesting; ride when raking, and ride in an easy seat and accomplish more hard work in one hour than could be done in ten hours a few years ago, even by laboring with all the might of a strong man.

When I revert to the days of my boyhood, when laborious manual drudgery seemed to be the destiny of the toil-worn farmer, and witness what has been wrought out in the line of improved farm implements to relieve the heavy labors of the tillers of the soil, I am cheered by the encouraging prospects which are looming up in the hopeful future, when mind, science, intelligence, and labor-saving machinery must emancipate the bondman of the farm, and lift him up to the true dignity of manhood. Mind must eventually triumph gloriously over matter; and it is incumbent on every farmer to tear away from these old practices of our fathers, in which our bodies were employed as mere machines for performing what the horse or a steam-engine should do.

AGRICULTURAL DYNAMICS.

It is of eminent importance that farmers should have a more perfect understanding of the strength of the materials of which their implements are made, and the most economical and effective velocity for the moving of different parts of complicated machinery. Manufacturers of all kinds of farm implements should understand well the laws of force and motion; and whether a given operation is performed, for the most part, by *muscular force*, or by the *momentum* of a machine, as the great efficiency of the working parts of a machine depends almost entirely on the proper weight, or the most economical velocity, of those parts that perform the operation required. I will illustrate my meaning: When a given operation is to be performed by machinery, if the work be light, it becomes necessary to increase the velocity in order to economize time, and to make a judi

cious appropriation of the force employed. When the work is heavy and the effective force limited, the velocity must be diminished. Were a person, when turning a fanning mill, to attach a crank to the journal that holds the wings or fans, and give the various parts of the mill the necessary velocity, the fatigue would be so great in a few minutes as to cause complete exhaustion. But by employing a system of wheels, so that the action of the muscles may be much slower, the labor may be continued for several successive hours with but little fatigue. This principle holds good in constructing almost all kinds of hand and horse implements. There is a certain movement, or velocity, of the various parts of almost every implement or machine which will render the working parts more effective than they would be with a slower or quicker motion, or with a higher or lower velocity.

THE NATURAL GAIT OF ANIMALS.

As we increase the velocity or speed of a team beyond a certain pace, we diminish their available force in moving a load. On the contrary, we may not be able to avail ourselves of one-half of their force, because they are not allowed to move at their natural gait.

Good teamsters, if they are as ignorant of science as the beasts they drive, understand that it is far better for their teams to take a load only as heavy as they are able to draw and move with their natural gait than to go twice with half a load, making two journeys in the same period of time. This principle is too frequently lost sight of in performing many of the manipulations of the farm and workshop where the force of man and animals is exerted.

There is a degree of rapidity in the action of the muscles of man, beasts, and birds, common to each, beyond which, if the action of the muscles be pressed, the fatigue will soon produce complete exhaustion. If a man were to attempt to move his extended arms with the rapidity of the wings of a dove, he would be very soon exhausted. If a man were to move his legs in walking or running with the rapidity of a very little lad, the fatigue would be so great on the muscles as to soon produce exhaustion. The idea to be kept in mind in adjusting the velocity of a team drawing an implement from place to place, or in propelling machinery, so as to give the correct velocity to the various parts of machinery, is to have every part move forward or revolve with a velocity which will produce the least fatigue on the muscles, and at the same time perform the operation desired with the greatest efficiency.

VARIABLE VELOCITY.

The proportion between the velocity of a body and its weight is a subject of vast importance to the tyro, particularly in practical agriculture and the affairs connected with it. In order to make the most economical disposition and appropriation of the force of his laborers and of his team, and to save the greatest amount of time, it is very important to know with what velocity both they and the machinery employed should move. There is a certain velocity necessary in almost every operation of the affairs of the farm and work-shop, from which if we increase or diminish, we do it at the expense of time, or labor, or of both. He who exercises the greatest economy in saving time, and makes the most judicious appropriation of his force in performing a given operation, will, unquestionably, succeed best in whatever he undertakes. When the force of either men or animals is employed to perform a certain operation the muscles are fatigued. The fatigue thus produced does not depend entirely on the actual force employed, but in part upon the frequency with which that force is exerted. In accomplishing every piece of work by muscular force, the exertion consists of two parts. One of these parts is the expenditure of the force required to drive the instrument or tool; and the other is the effort required in giving motion to the limbs of the man

or animal which produces the action. For example: a man in driving stakes into the ground with a sledge expends a certain amount of force in propelling the sledge against the stake; and a certain amount of force must first be expended in elevating the arms and sledge for the purpose of striking. Both of these operations produce fatigue on the muscles. If the sledge be a heavy one the greatest part of the exertion will be required in striking. But if the sledge be rather light, the exertion necessary to raise the arms and the sledge will produce the greatest fatigue on the muscles. It not unfrequently happens that, in performing certain operations in which very little force is required, if very frequently exerted, the muscles will be more effectually fatigued than when engaged in more laborious work. It is of first importance to adjust the weight of different tools, and the velocity with which they must be moved, so as to produce the greatest effect with the least fatigue of muscles.

THE CORRECT VELOCITY FOR MACHINERY.

In adjusting the velocity for a buzz-saw, to be driven by a railway or endless platform horse-power, for example, if the driving wheel be so small, and the pulley on the saw-shaft so large, that the horses must walk faster than their natural gait, they will very soon become jaded by performing a limited amount of labor. On the contrary, the driving wheel must not be so large, and the pulley on the shaft so small, as to give a very high motion, because, in the latter case, very much of the available force of the horses will be lost in merely giving the saw a certain velocity, which is all they would be able to do when the saw was not in use. There is no danger in having a buzz-saw revolve with a very high motion, providing there is an abundance of available force to keep the velocity or motion up to such a point. This holds good, also, with respect to a cylinder of a threshing machine and many other machines. Sometimes machines are geared to run with such a high motion that it requires the force of another horse-power to perform a given operation, simply because the motion of some parts of the machine is much higher than is necessary.

One of the most important considerations to be kept in mind when construct ing an implement, is to so arrange the working parts that the team or the laborer, or both, may move in their natural gait, and at the same time give the working parts of the machine or implement the most effective velocity.

HEAVY VS. LIGHT IMPLEMENTS.

Many people appear to be unaccountably stupid in regard to the most economical and convenient weight of implements and vehicles, and especially the weight of one-horse and two-horse vehicles. A large proportion of the four-wheeled and two-wheeled vehicles in use are sufficiently heavy and strong to bear three times as much, with entire safety, as they usually carry. The two-wheeled coal and dirt carts are often sufficiently heavy for a single horse without any load on them; and the huge four-wheeled express wagons are almost always built sufficiently heavy to carry with safety all that four or six horses ought to draw. There is great need of an improvement in regard to the weight of almost all kinds of implements and vehicles. A horse of ordinary size will draw, on a smooth road, one ton anywhere, with ease, besides the vehicle of suitable weight for one animal. In hauling earth of any kind, or stone, one horse would take 2,000 pounds with no more fatigue than he now feels when he hauls only seven or eight hundred pounds on a large lumbering cart, many of which will weigh ten to twelve hundred pounds without any load. It is truly suprising that intelligent men do not perceive this fact. By reducing the weight of a vehicle six hundred pounds, which could often be done with consistent strength, the team would be able to haul six hundred pounds more of earth or stone at every load, by exerting only the same strength. The same principles hold true in the construction of hand

tools. A laborer shovelling earth with a shovel only one pound heavier than a neatly made light shovel, will exert strength to no purpose sufficient to throw up one pound of earth at every shovelful, which would amount to several tons in a short period of time. Many excellent teams are well nigh ruined in consequence of a ponderous vehicle, as most teamsters are too apt to be governed by the number of pounds that is placed on the vehicle as a load, rather than by the weight of the wagon or cart, and the load in the aggregate. When farmers are hauling material of various kinds, they are not always aware of the unnecessary weight they require their teams to haul to and from the field. Hay riggings are frequently made more than one hundred pounds heavier than is necessary. If only made as light as consistent strength would admit of, a team might haul one hundred pounds more of hay and grain just as well as to draw the same number of unnecessary pounds of rigging. Ploughs are frequently made twenty pounds, or even more, heavier than is really essential to secure the necessary strength of materials. Every good ploughman knows that an addition of twenty pounds to a plough that is already as heavy as it ought to be, greatly augments the fatigue of the team, and renders ploughing far more laborious for the ploughman than if his implement were as light as ploughs might be made for ordinary work. Farmers should study the strength of materials for the purpose of ascertaining as nearly as practicable how light every implement may be made consistent with strength.

SUGGESTIONS ABOUT THE WEIGHT OF IMPLEMENTS.

The greatest possible efficiency of certain implements depends, aside from the condition of the cutting edge, on their proper weight. Implements that have a cutting edge can usually be made much lighter than they are now manufactured, providing skilled laborers are employed to use them, and providing, also, it is not necessary to increase the weight of certain parts, for the sole purpose of guarding against any casualty.

The weight of many mowers and reapers might be reduced fully one-third, and sometimes one-half, where there are no stumps, stones, or other substances to encounter, and none but skilful laborers are to run such implements. The weight of the gear wheels that drive the knives of some mowers might be made one-half lighter, and then possess double the strength required to work the knives, when the machine is moving through the tallest heaviest grass or grain that any farmer ever raises. Almost all kinds of tools and farm implements are too heavy.

FLY-WHEELS AND TOOTHED-WHEELS.

As fly or balance wheels are employed on many kinds of machinery, and frequently misapplied, it is highly important to know when a fly-wheel is an advantage, when it would be a decided disadvantage, when it is too heavy, and when not heavy enough. Many farmers, as well as many mechanics, cherish the erroneous conclusion that there is great power in a fly-wheel, as well as in large and heavy toothed-wheels which perform the office of a fly-wheel.

There is no power in a heavy wheel of any kind. It only operates as an accumulator of the effective force which is employed to drive the machinery. When the application of force, for any purpose, is intermittent, a fly-wheel may be employed with excellent effect, as the wheel will accumulate the force that drives the machinery, so that the working parts may operate more effectively than if there were no fly-wheel. I will cite instances, so that both farmers and mechanics may have a better understanding of the construction of machinery.

A fly-wheel on the journal of a grindstone would be a decided disadvantage, except when the stone is turned by the foot. The operation of grinding being one steady and continuous absorption of the effective force that is employed to turn the stone, every additional pound that is added to the journal absorbs a

proportion of the effective force of the team or steam engine. A fly-wheel on a hand corn-sheller, or hand straw-cutter, weighing 100 pounds, would not be so convenient nor so economical of the force as a lighter wheel, because a large, heavy wheel would absorb too much of the power that ought to be employed in cutting straw or shelling the grain to give motion to the wheel. The weight of a balance-wheel must be regulated by its velocity, when the power is limited. Where there is an abundance of power, a heavy wheel is preferable to a light one. It should be the aim always to have the fly-wheels, or those wheels or parts of machinery that subserve the purpose of a fly-wheel, of a weight corresponding to the effective force; otherwise there will be a loss of the available power of the team. When any part of the machinery is too heavy for the force employed to put the various parts in motion, there is a great loss of power.

When I was a young man I had a foot turning-lathe which was worked by a driving-wheel about five feet in diameter, weighing some two hundred pounds. I could drive the lathe with my foot, and turn wood at the same time, in a very satisfactory manner. At the suggestion of older mechanics, I put a much heavier wheel, seven feet in diameter, on the same journal; and I was never able to drive the lathe with my foot so as to turn out a single stick. The large heavy wheel absorbed all the effective force of my foot to impart motion to the mandrel, so that when I applied the chisel, there was no force to overcome the resistance when the gouge or chisel encountered the wood. Of course, the large wheel was necessarily removed, and another substituted that would give about the desired velocity, and which was not too heavy for the force employed to drive the lathe.

HOW MUCH IS A DAY'S WORK.

In order to appreciate the eminent advantages of employing labor-saving implements worked by teams, for doing the manual labor of the farm, let us compare, still further, the amount of labor performed by one man, without the aid of horses, with the work done by men and machines.

An ordinary laborer will thresh and clean about six to seven bushels of wheat in a day, taking the country through. In some grain districts, one man will thresh ten or twelve bushels of wheat and clean it, while in others he cannot thresh more than five bushels, if he threshes out all the grain as clean as the work is done with a machine. It must be borne in mind that it will require more hard pounding with a flail to thresh out the last quart of grain in a "flooring" than was necessary to thresh the first half bushel.

I have threshed a great deal of grain of all kinds, with my own flail; and I have talked with others who have been accustomed to thresh their grain with flails; and I have come to the conclusion that the following figures represent a fair average as to the quantity of grain that an ordinary laborer will be able to thresh and clean in a day, viz: Seven bushels of wheat, eighteen bushels of oats, fifteen bushels of barley, eight bushels of rye, and twenty bushels of buckwheat. In order to make this more intelligible, it will be necessary to double the number of bushels that one man is able to thresh, as two men will be required to clean the grain with a fanning mill.

In order to labor economically and advantageously with a threshing machine, two horses, at least, and three men are necessary. In most instances four or five men will be required, which will make a force equal to fifteen men with flails. Such a gang of hands, and two good horses, with such a thresher and cleaner as Harder's, on a succeeding page, are capable of threshing and cleaning, of the same kind of grain to which allusion has been made, one hundred and seventy bushels of wheat, three hundred and twenty-five of oats, two hundred and twenty of barley, one hundred and eighty of rye, and two hundred and sixty of buck wheat. Some manufacturers of threshing machines fix the average day's work higher than these figures. In some instances, I will acknowledge that a span

of horses and five men can do much more than the amount represented by the foregoing figures; yet I am satisfied that in the majority of instances they will not thresh and clean a greater number of bushels than I have indicated. But, even at the low figures that I have recorded, such a machine as Harder's, or Palmer's Climax, or Wheeler, Melick & Co.'s, will be found to be a great labor-saving machine for threshing all kinds of grain.

There is one consideration that should not be overlooked in this estimate, which is the much greater amount of labor performed, with far less fatigue. When one laborer can perform the work of two or more workmen with less fatigue than has usually been required, a great point is gained in agricultural dynamics.

AGRICULTURAL ENGINEERS.

What wonders have been wrought in farm implements in the brief space of forty years! The young men of our country cannot appreciate the great contrast between a complete set of farm implements forty years ago and the hand tools, implements, and machinery required at the present day to constitute a full set of implements. Forty years ago a farmer could carry all the tools required on a farm of ordinary size, in an ox-cart, at one load; but to-day, the tools and machinery on that same farm cannot be transported in six ox-carts. Let us, for a moment, direct our attention to the implements for gathering a crop of grain, and preparing it for market. Then, a cradle worth $2.50, and a rake worth twenty-five cents, a flail fifty cents, and a fan for cleaning the grain worth $1, was about all that was required; but, to-day, the mower, and reaper, and the threshing machine must be brought into requisition. Almost every operation must be performed by efficient and complex machinery, requiring years of practical experience to manage with skill and efficiency. Almost every operation is performed on the farm by some kind of implement, which requires more wisdom, judgment, and discretion to put it in order and to keep it from getting out of order, than an engineer exercises in running a steam engine.

We are a nation of scientific inventors. Every week or every month, developments in labor-saving machinery are given to the world, that astonish everybody. The man who launches forth in some new enterprise, flattering himself that the world will stand aghast before his profound wisdom, is almost overwhelmed with chagrin at the thought that some live Yankee is close at his heels with an invention which will eclipse the brightest feature in his machine. As men become familiar with the laws of matter, and acquaint themselves with philosophical and mechanical principles, they discover how easy it is to make an application of their knowledge in improving some of the implements of agriculture.

INVENTING LABOR-SAVING IMPLEMENTS.

Robert Fulton invented the steam-engine. Mechanics and engineers who lived before Mr. Fulton's time understood the power of steam; but they did not know how to confine it, so as to make its force available in driving machinery. After the principle on which the steam-engine operates was disclosed, mechanics grasped the thought and rushed forward with eager haste to make improvements in the working parts of the steam engine. There is no implement or machine, which is made of several different parts or of various forms, that was invented and brought to its present excellence and efficiency by the effort of one person. Our best and most effective agricultural implements have been developed little by little, by the united efforts of several thinking, scientific individuals. One man has invented one part, and another person has brought out another part. One man has applied his knowledge to the improvement of some invention which his predecessor had made as perfect as he was able with his limited ability; yet, there has been an untold amount of misdirected effort to bring out something useful, simply because inventors did not understand the principles of mechanics,

and did not possess that knowledge of agricultural dynamics which is essential to success. Inventors should be practical men, understanding fully the nature of the operation to be performed, the force required to accomplish a given result, and the amount of resistance to be encountered and overcome by the machine.

An inventor should understand enough of machinery, and of the labor to be performed, to determine at a glance whether more of the effective force will be absorbed in giving the requisite motion to the parts of the machine than there is in performing a given task.

STUMP AND ROCK MACHINES.

Any kind of machinery for extracting stumps or for lifting rocks may seem of little value to the farmers who reside where the country is smooth; but it should be remembered that untold numbers of townships are yet covered with forest trees and rocks, all of which must be removed before the plough, the cultivator, and the mower can be used; consequently, for the performance of this heavy work, the most convenient and effective machinery is necessary. Clearing land of stumps and stones is expensive labor; and it is a matter of congratulation to reflect that American farmers have access to the most convenient and effective machinery that can be desired for lifting heavy rocks, or for taking out large or small stumps.

Fig. 1.

CRAWFORD'S STUMP EXTRACTOR AND ROCK LIFTER.

The accompanying illustration, Fig. 1, represents the principal working parts of this powerful rock lifter.

The working-beam A, connected with a ratchet wheel B by pawls C C and cross-hangers D D, so that when the beam is rocked by means of levers E E the wheel is kept in motion, carrying around with it a sprocket or chain-wheel F, to which it is cast solid, and over which a heavy chain G passes, and is kept from slipping by flanges projecting between the links, so that the more weight there is attached the more securely it is held to the wheel; while any length of chain may be used, and a body raised to any height. To double the power and strength of the machine, a heavy iron pulley H is attached, as seen in the cut. To reverse the action of the machine, spiral springs I I, suspended from the arms of the rocking beams, are hooked to the cross-hangers, and with the same motion of the levers the wheel turns back, lowering the weight as far as necessary

Fig. 2. represents the machine suspended by sheers S S S, showing the usual method of extracting stumps, so they can be left in any position desirable. Small drags or shoes, T T T, are attached to the feet of the sheers, (by irons furnished with each machine,) so that with two connecting or drag-chains, U U, the whole is moved by a horse or oxen from stump to stump, or rock to rock, requiring but little adjusting at each operation. Or it may be moved by the more laborious mode of lifting it by pins driven through the sheers about two feet from the lower end. These pins should be attached to each set of sheers.

Fig. 2.

Three braces, V V V, are attached to the sheers (by irons furnished for the purpose) to keep them in their relative positions while moving, which should be detached when the machine is in operation with a heavy load, (unless the drag chains are kept hooked, which is not always convenient among lateral roots,) when a little adjusting of the drags is sometimes necessary. A rope, W, is attached to the handles of the levers, when it is necessary to hang the machine high, so the operator can still stand on the ground while working them. These ropes should always be attached, as with two men the machine works easier by the ropes than by the handles, except when great weight is attached. A wrapping chain is passed round the trunk of the stump or a large side root, through the eye or hook of the pulley for the double purchase, or the chain hook for the single purchase, and fastened by a self-fidding lock or ring on the end of the chain, and the machine is ready to operate; or the grapples, which are used for both rocks and stumps, can be hooked to opposite sides of the stump, under the roots, and attached to the machine as seen in Fig. 3. The sheers are the best rig for heavy loads, and owing to its utility and cheapness should be first adopted, and others added as circumstances require.

Fig. 3. represents the machine mounted on wheels, so that a rock or other heavy body may be extracted or raised from the ground, and moved off at once The carriage is easily and cheaply constructed by a man of common ingenuity and the wheels, when not needed with the machine, may be returned to the cart or heavy wagon from which they were taken.

The forward part may consist simply of a cart, or of the fore wheels of some strong wagon. The hind axletree may be ten or twelve feet long, and four by five inches square. It will not be necessary to let in iron skeins into the axle arms, as that will weaken the axletree, and the wear will be only a trifle.

Fig. 3.

The operation of this machine has satisfied the most incredulous of its utility and the great advantages to be derived from its use; and the best evidence of its practicability is the uniform satisfaction given in every case where it has been tested; and the more thorough the test the greater the approval.

It seems hardly necessary for me to add a word in commendation of this great labor-saving machine. Those persons who have had any experience in pulling stumps or removing large rocks, from cultivable fields, will understand and appreciate every part represented by the different illustrations. The name of the inventor of the working part of Fig. 1 is A. Crawford, Warren, Maine. Were a machine required at some distance from Maine, it would be more economical to have all but the working parts manufactured near home, if possible, to save the cost in transportation.

LITTLE GIANT STUMP PULLER.

The most convenient stump puller for extracting small stumps was recently invented by Parven, Bowen & Co., Vineland, New Jersey, illustrated by the accompanying figure.

It consists of a strong frame, about eight feet high, made of scantling, like a large four-legged stool. Two men can lift it bodily, by the handles, and place it over a stump, and lift the stump out of the ground quicker than they can fell the tree with sharp axes. A strong iron yoke is secured in the top of the frame. Two long iron bars extend upwards through the yoke, with a hook and chain at the lower end of the bars. One side of each of the bars is provided with notches about one inch apart. These vertical bars are worked up and down by a long horizontal lever, with a man at each end. As each bar is lifted, an iron pawl drops into one of the notches, thus holding all that is lifted.

This is a very convenient machine for taking out small stumps and rocks, and

it costs but a few dollars. I saw laborers take out stumps with one in South Jersey, where the tap roots were over six feet long.

CIRCULAR WOOD-SAWING MACHINES.

The illustration accompanying this article represents a circular sawing machine

which is extensively employed in the northern and western States for sawing cord-wood into short or long lengths for the stove. In some instances the fire-

wood is cut and split in long pieces, like long rails, and sawed short with such a machine. This machine is made by G. Westinghouse, Schenectady, New York. R. & M. Harder, Cobleskill, Schoharie county, New York, also make a similar machine for sawing wood. Messrs. Harder employ a lever on the movable table to hold the wood from turning while the saw is passing through a large stick.

One excellent feature of this machine is the plate balance-wheel, which not only prevents sticks of wood getting into the wheel, but is a perfect security against the bursting of the rim when in high motion.

Some wise ones scout at the idea of bursting a good wheel. I have in mind several instances where the balance wheels were bursted into fragments by a high motion. In one instance a man was killed instantly. In another, a portion of the wheel flew more than three hundred yards, and went through the sides of a dwelling-house. In another instance, a hugh iron wheel, weighing several tons, was broken and a large fragment went upwards through the roof of the shop, made a curve through the air over the tops of the buildings in the city of Auburn, New York, and came down more than one-eighth of a mile distant, passing through the roof and floor of a building and entering the ground. This piece of broken wheel I saw, and measured the distance the fragment was thrown. The same year, I was sawing in a machine shop, when the balance wheel on the journal of the saw that I was using, flew into more than twenty pieces, one of them passing through the floor like a bullet. Fortunately no one was hurt. Had they been plate-wheels none of them would have been broken.

WESTINGHOUSE'S DRAG-SAW MACHINE.

On those farms where the timber is sawed into shingle cuts, or cuts for staves, wagon spokes, chair rounds, or firewood, horses or steam engines may be employed with eminent advantage, as one span of horses, if the saw be in proper

order, will cut off more logs than twenty active men with cross-cut hand-saws This machine is designed to be worked by a railway horse-power. The belt communicates the motion from the speed wheel of the horse-power to the large wheel in this frame. One end of the pitman is secured to a wrist-pin, which passes through one of the arms of the wheel, while the saw is attached to the other end. On the journal of the large wheel there is a worm which works in the cog or toothed-wheel on the journal which turns the shaft bearing one end of the log. The wheel is brought in contact with the worm while the horse-power

is in motion, and the log is moved forward slowly any desired distance. The rear end of the log is supported by a small truck. The but end of the log rests on two strong cylinder-heads, the periphery of which is provided with short, strong, sharp-pointed spikes, which enter the bark of the log, or the wood, and thus prevent slipping when the power is applied to move the log endways. If desirable, this worm and cog-wheel may be dispensed with, and a wooden roller, with spikes in it, can be substituted in place of the iron journal, so that the log may be drawn endways by a lever applied to the roller.

The engraving can be readily understood by a practical mechanic, so that the machine will require no further description.

TOTMAN'S WOOD MILL.

One of the cheapest and most effective labor-saving implements that I have met with, where a farmer has not the advantage of a railway horse-power for driving a drag-saw, is a wood-sawing machine, made by Reynolds & Totman, Fredonia, Chautauque county, New York. The accompanying illustration will furnish a fair idea of the horse-power, which is a sweep power, and may be operated by one horse, or two horses abreast, which are amply sufficient to drive the saw. The horse-power is a paragon of wonderful ingenuity, and yet it is so plain that a good mechanic will at once express suprise that the device has not been thought of before. The wheels cannot be shown advantageously by an engraving; therefore I will endeavor to describe the various parts.

There are three wheels for producing the motion of the saw. The first and largest wheel is made of cast iron, about four feet in diameter, with teeth, or cogs, on the periphery. This large wheel is bolted firmly to the frame, so that it never turns around. The small pinion of the second wheel plays in the teeth of the rigid wheel, and as it turns on its own axis, it travels around the large rigid wheel. The journal of the third wheel passes down through the hub of the rigid wheel, turning in the hub as in a box. On the lower end of this journal there is a balance wheel, with a wrist-pin in one of the arms, to which the pitman is attached. All the wheels play horizontally, instead of working in a vertical position. The tramway and crosshead of the pitman work in the frame beneath the platform, or wooden trunk, over which the team travels.

I have seen one of these machines operate; and, judging from the rapidity with which the saw, when driven by only one light horse, cut off a log of hard wood, I think this is the most economical machine in use, where a farmer proposes to construct a machine solely for sawing firewood, or cuts of trees for timber. I witnessed the operation of a saw when driven by one poor horse, when it cut off a tough elm log fourteen inches in diameter in eighteen seconds.

HOW TO PUT A SAW IN ORDER.

A saw of any kind is a peculiar tool to put in order. It requires much more mechanical skill to file and set a saw than to hone a razor well. The eminent efficiency of a saw depends, if the blade has the proper temper, on the manner of

filing and setting the points of the saw teeth. There are a few general principles to be understood in filing and setting the teeth of saws of all kinds, which, if observed practically by the filer, there will be no difficulty in putting a saw in excellent condition for sawing with great rapidity. The main principles alluded to are these: the teeth of any saw must be of a uniform length, so that the points will all stand in an exact line, or circle. The very points of the teeth do the cutting; therefore the extreme ends must be of exactly an uniform height, so that every tooth may cut a little. If one tooth be a twentieth of an inch longer than the teeth on either side of it, that long tooth, when the saw is in operation, will be required to perform more than it is capable of enduring. For this reason the saw "buckles" or jumps.

This principle may be illustrated by a score of laborers carrying a stick of timber on their shoulders. The laborers represent the teeth of a saw. If a long man is placed in the middle, short men on each side of him are relieved of their burden, which almost crushes the tall man. But if all the laborers are of an uniform stature, every one must bear an equal proportion of the timber on his shoulder. The principle holds equally good in circular saws of all kinds—the cutting points must move exactly in one line or curve.

Another consideration is, the cutting points of the teeth need to be set alternately to the right and left, only a little, just enough to cut a kerf sufficiently wide to allow the blade of the saw to be worked easily back and forth. If the teeth be set so as to cut a kerf much wider than the thickness of the saw blade, the saw will not cut with rapidity and work with ease. It is a common fault with mechanics, when putting saws in order, to give the teeth too much set.

To joint a circular saw, turn it backwards and let the long teeth be ground off gradually, by striking against a piece of grindstone. A convenient way to joint any kind of saw, the teeth of which stand in a line, is to dress out two pieces of inch boards with straight edges and true sides, put the saw between the boards secured in the vice of a bench, and let the points of the long teeth extend a trifle beyond the edge, when the long teeth may be filed off even with the edge of the boards. If the edge of the saw be circular let the edge of the boards be made correspondingly circular. An inexperienced workman may joint a saw, in this way, with great accuracy.

DITCHING MACHINES.

Perhaps no more money has been expended in constructing models of other new farm implements than has been spent in vain endeavor to bring out a successful machine for making ditches. A great many patents have been taken out on devices for cutting ditches by excavation; but nothing thus far has appeared which will excavate a ditch through all kinds of ground.

The mole-drain plough has been introduced in some sections of the country, with quite satisfactory results, where the sub-soil consists of a heavy clay comparatively free from stones and gravel; but where the sub-soil is not uniform in density or compactnesss, and where there are more or less boulders of various sizes in the ground, the mole-plough is of no value at all.

I have in mind fields in central New York in which drains had been made with a good mole-plough; and all who saw the fields acknowledged that the drains in those fields were of no benefit at all. The grand difficulty was that small stones and gravel and mellow earth fell into the water-courses, and rendered the drains utterly worthless.

Several ditching machines have been made for excavating the earth by a system of small ploughs, scrapers, and elevators; but wherever the working parts encountered small stones the machines have failed. Small boulders, inbedded firmly in a heavy and compact sub-soil, present a resistance to a ditching plough that cannot be easily overcome. For this reason the earth in all such places must be dug up with hand picks, which is exceedingly laborious and expensive.

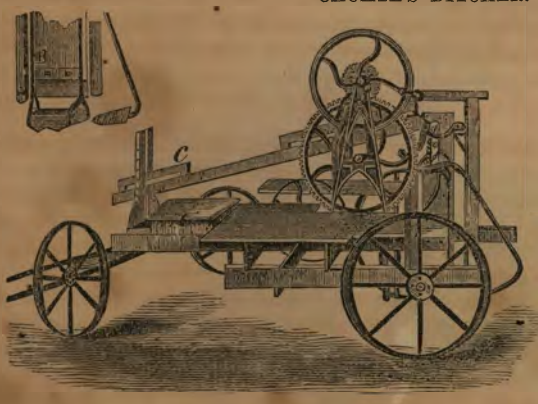
I have experimented for several years past with ditching machines; and in 1866 I applied for letters patent on a device for opening a ditch without excavating the earth. One J. A. Goree, of Alabama, applied for letters patent for a similar device, and the patent was granted to him. Had I received the patent, I doubtless should have brought out a ditcher that would operate most successfully in draining all kinds of ground.

The operation of the ditcher, which I intended to make, may be thus described: a combined beater-wedge, made of iron, having a steel edge, is dropped like a huge hammer for driving piles, with the edge downward, like a ponderous axe, into the ground, forcing the earth horizontally to the right and left. Small stones that would stop a plough would be driven by this beater-hammer either downward or horizontally into the earth. I think that a ditching machine can be made to operate on this principle in a most satisfactory manner. If such a machine can be made to operate satisfactorily, it will be of untold value to other nations, as well as our own. Farmers of America feel the need of an efficient ditching machine more than any other farm implement. Ditching is a branch of farm labor that costs more than such labor is really worth. But, for want of a proper machine, ditches must all be made, in the hardest and stoniest soils, with the pick and shovel.

I have never perceived any difficulty in the operation of such a ditching machine as I have alluded to, except the sticking of the wedge in the earth after it is allowed to drop into soft ground. However, I think that even this difficulty may be overcome by the application of a lever having a short bight or purchase, merely sufficient to loosen the wedge a trifle.

The wedge-beater can be elevated by horse-power; and, in ordinary ground, I think such a machine is capable of opening a ditch sufficiently large for tile, thirty or forty inches in depth, at the rate of one lineal foot per minute. The machinery can be moved forward by a windlass turned with a lever.

CHOATE'S DITCHER.



Mr. George A. Choate, Newburyport, Massachusetts, has in successful operation a ditching machine, which is operated by a system of wheels and levers driven by means of cranks worked by two men. The accompanying illustration represents the ditcher:

It is difficult to describe the different parts of the machine with sufficient clearness to enable a person to understand its construction, without having first seen it in operation. Two active laborers are able to operate this ditcher with a good degree of satisfaction, where the ground is not filled with stones.

Although this ditcher may be recorded as a valuable labor-saving machine, it has not been introduced to any extent, as the inventor has been seriously afflicted with sickness, so that he has not been able to attend to the manufacture and sale of such machines. If certain manufacturers of agricultural implements would open a shop for making ditchers of this kind, there would be a demand for them which an extensive manufactory could not supply.

This machine will cut a ditch of uniform width and depth. By using cutters or diggers of different widths, the ditch can be made four, five, or more

inches broad, and from one to three and a half feet deep. Three men can make a ditch more rapidly with one of these ditchers than ten active laborers with spades, picks, and shovels. The proprietor assures me that three active men have made a ditch one rod long, with one of these machines, in two and a half minutes. The cutters take out the sod in a square form, about five inches wide and twelve or more inches long. This ditcher is substantially made, is quite simple and durable in all its parts, and weighs from ten to fifteen hundred pounds. When in operation, planks are placed on the ground near the ditch, for supporting the wheels. Two men work it, while they stand on the platform; and one man moves the planks, placing them forward of the wheels.

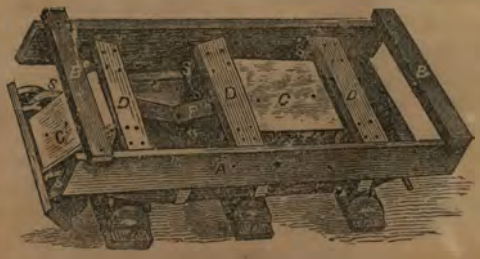
HEATH'S DITCHER.

Edward Heath, Fowlerville, Livingston county, New York, has made an experimental machine for cutting ditches, which operates tolerably well where there are no stones. It is a ponderous machine, supported on four wheels, running on a track of planks. The machine is drawn forward by means of a chain and capstan. Two horses work the machinery for cutting the ditch. The horses are attached to levers, and they travel around the machine, passing over the ditch on a plank or bridge that is moved along with the machine. It is a self-propelling machine; in other words, a certain number of circuits of the horses causes the whole machine to advance one foot or more forward. The diggers enter the ground at the bottom of the ditch and work upwards, bringing the dirt with them; and, as it reaches the surface of the ground, a scraper removes it on the bank of the ditch. There are many ditchers similar to this in various parts of the country; but as they cannot dig where there are stones they have not come into general use.

I have in mind a Mr. Thompson, in the western part of the State of New York, who has expended many hundreds of dollars in experimenting with a self-propelling ditcher, which would cut a narrow ditch, where there were no stones, at the rate of about one lineal foot per minute. But a stone as large as a man's fist would stop its working or break a wheel.

Inventors are laboring with commendable perseverance to bring out a ditcher that will be exactly what American farmers really require for ditching all kinds of land.

LAKE'S AUTOMATIC RAIL-CAR.



One of the most ingenious labor-saving implements of recent invention is a dirt car represented by the accompanying illustration:

It was invented by Jesse Lake, Smith's Landing, New Jersey; and the cars are in use at Elwood, New Jersey, and perhaps at other places. The two large boxes that are mounted on the car are removed. I saw the cars in use, where they were grading through hills; and I know it to be worthy of general introduction. I saw a span of light, old plugs of horses, that wanted a boy behind each one with a cart-whip to quicken them into a moderate walk, move off with comparative ease with a load of earth that would, without doubt, have weighed more than five tons, over an unbeaten track, where they could not have drawn twelve hundred pounds of earth on an ordinary wagon.

The chief excellence of this car consists in this: that it will run about as easily where the ground is soft as where the way is hard. The span of horses alluded to, hauled a car on which were two boxes, about eleven feet long, four

feet wide, and twenty inches deep, both heaping full of earth. The boxes were hung on a swivel, so that one man could dump them without using a shovel.

The car runs on an endless revolving platform. Were the platform of a railway horse-power constructed to revolve below the sills of the frame, so that the entire superincumbent weight should rest on the platform instead of resting on the sills, it would furnish a fair idea of the construction of this car. A, in the illustration, represents a strong plank or sill of the car; B B are cross-ties; D D D are floats, made of pieces of strong plank, about four feet long and a foot wide. There are eight of these floats. Near each end of every float, there is a truck-wheel, some six or eight inches in diameter. C C are stay pieces, and F F are couplings, which serve to keep the floats at a suitable distance apart. An iron way is bolted to the under side of the frame, so as to run over the top of the wheels that are attached to the floats lying on the ground. The difference between this railway and ordinary railroads is in this: the rail is attached to the car, with the wheels beneath the rails.

The team can be hitched at either end, as the car will run backwards or forwards equally well. As soon as the car is put in motion, a float, or plank D, is laid down forward of the car, and the last one is snatched up and rolled forward rapidly and laid down at the forward end to bear up the car, which would sink wagon-wheels in soft earth down to the hub. Such cars will, no doubt, come into general use on the farm, as a span of horses can easily haul five or more tons of compost, sand, muck, clay, stones, potatoes, or any other material across the fields when the ground is so soft that an ordinary wagon would be a good load for a team. More than this, when one man and a single team can haul five tons of material on such a vehicle in the same period of time required to haul one ton or less on a wagon, one can see how much time of laborers and horse strength are saved by the employment of such a vehicle for the purpose of transporting heavy loads over soft ground.

The cash cost of such a car is much less than the cost of a good wagon. The boxes on such a car being much nearer the ground than they are on a wagon, less labor is required to elevate earth into the boxes than into a wagon box. Where roads are being graded by carting the earth from the hills into the valleys, such a car, bearing five tons of earth, will glide over the unbeaten path of dirt with comparative ease to a small team.

PLOUGHS AND SCARIFIERS.

The common plough is an implement of husbandry of unknown origin; but the plough, as we now find it, has been brought to its present perfect form by the united investigations and costly experiments of scores of scientific mechanics. Our first ideas of the common plough are a forked piece of timber, with one prong, iron bound, and drawn through the ground to loosen the soil without turning it over. No one can determine how long this was the most perfect form of the plough. The next step was to fix a piece of wood on one side for a land side, and an inclined plane on the opposite side for the purpose of turning over the furrow-slice as well as might be practicable. This plane or mouldboard was then worked out so that the surface would be as nearly the form of the turning furrow-slice as practicable; subsequently, plates of iron were secured to the surface of the wooden mouldboard. But the common plough, in its present perfect form, has been brought out during the present century. Mr. Jethro Wood, of Cayuga county, New York, who was upbraided with the taunting epithet of a "whittling Yankee," brought out the cast-iron standard and the cast-iron point. It is said of him that he whittled away bushels of potatoes before he was able to bring out a miniature form of a plough that suited him. Large potatoes were whittled into almost every conceivable form before the present convenient and efficient curve of the mouldboard was attained. Although Mr. Wood was one of the greatest benefactors of mankind by this admirable invention, he never received, for all his thought,

anxiety, perplexity, and expense, a sum of money sufficient to defray the expenses of a decent burial.

After Mr. Wood had conceived the plan of making the cast-iron standard, and had made his patterns for having the different parts of the plough cast, he encountered almost insurmountable difficulty, as the workmen who performed the moulding were disobliging and were filled with prejudice against such inventions, so that Mr. Wood found it absolutely necessary to offer them a liberal bonus before he could induce them to attempt to mould those parts of the common plough that are moulded, at the present day, in almost every village in the country, without the least difficulty; yet, by indomitable perseverance, triumphant success crowned all his efforts in consummating the greatest improvement in the common plough that has ever been made.

HUTCHINSON'S IMPROVED PLOUGH.

After the decease of Mr. Wood, Mathias Hutchinson, of Cayuga county, New York, who is now living, brought out an improvement of great excellence in the common plough, in which the standard is connected with, or is an extension of the land-side of the plough.

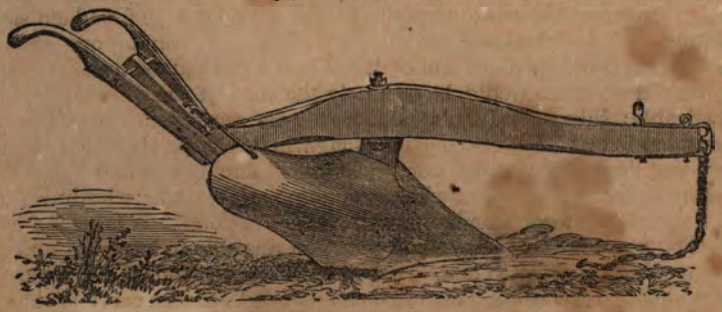
The accompanying illustration will show Hutchinson's improvement in the construction of the common plough, to prevent clogging when coarse manure and stubble are to be ploughed under. It will be perceived that the standard, which is usually attached to the mould-board of the plough, is an extension of the land-side. By this arrangement, a large open throat is formed, so spacious that coarse manure or stubble cannot clog the plough, unless such materials are allowed to accumulate in a heap so large that the furrow-slice could not cover it.

I have used one of these ploughs on my own farm, and have ploughed under long coarse manure, without being required to use any effort to keep the throat of the plough clear, where a plough having the standard attached to the mouldboard would clog incessantly.

It is a strong heavy implement; gives excellent satisfaction among the farmers on the slopes of our northern lakes, where the soil is heavy and stony.

As Mr. Hutchinson is not a manufacturer of agricultural implements, M. Alden & Co., Auburn, New York; C. C. Bradley & Son, Syracuse, New York; and Penfield & Co., Willoughby, Lake county, Ohio, are able to furnish this style of ploughs.

SWIVEL PLOUGH.

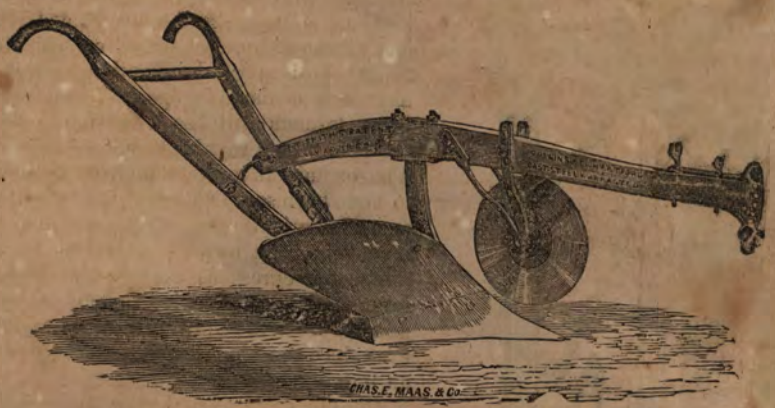


The illustration herewith shown represents a strong swivel plough for heavy work with a double team. It is made by the Ames Plough Company, Boston and

New York; and is designed for ploughing level land, by commencing on one side of the field and working back and forth, without forming any dead furrows. The team, when turning the end, *gees* around at one end and *haws* around at the other end, always turning on the unploughed ground. As a side-hill plough, I believe it operates well. When roads are being made along a side-hill, such a plough as this will be found exceedingly convenient, as the team can plough directly back and forth; whereas with a common plough, the team can plough only when travelling in one direction.

CAST CAST-STEEL PLOUGHS.

The figure herewith given represents a plough that has become exceedingly popular, and is gaining favor every year. The entire mouldboard, land-side, and share, are made of cast cast-steel. The metal is run in a mould somewhat as ploughs of cast-iron are made.



This style of ploughs is a perfect paragon of neatness and practical utility. Everybody likes them, when they are made right, with a hard temper. They are manufactured by Collins & Co., 212 Water street, New York city, and J. B. Skinner, Rockford, Illinois. No other plough will excel this implement for working in the light prairie soils of the west. When tempered hard, they never clog; but when the steel is soft as iron, so that it can be cut with the point of a jack-knife, fine soil will adhere to the surface and give as much trouble as is frequently experienced with cast-iron ploughs. This plough has been before the public sufficiently long to establish the point that steel ploughs, when the irons are hardened properly, are far superior to iron ploughs, as they will draw much easier and last longer.

But I must record objections that practical men urge against some steel ploughs. In a great many instances, they state that their steel ploughs were not properly hardened, for which reason damp soil would adhere to the mouldboard and cause much trouble. The manufacturers of this kind of ploughs claim that they can and that they *do* make the mouldboards and land-sides much harder than it is possible to harden the sheet steel, of which other steel ploughs are made. When the surface becomes finely polished, no adhesive soil will clog the plough. But when stones and gravel scratch the surface of the steel, it is conclusive evidence that the steel is not so hard as it should be. Remington & Co., Ilion, New York, and M. Alden & Co., Auburn, New York, have also been accustomed to make steel ploughs. At the Peekskill Plough Works, Peekskill, New York, there are about twelve hundred different ploughs manufactured.

PLOUGHING UNDER GREEN CROPS.

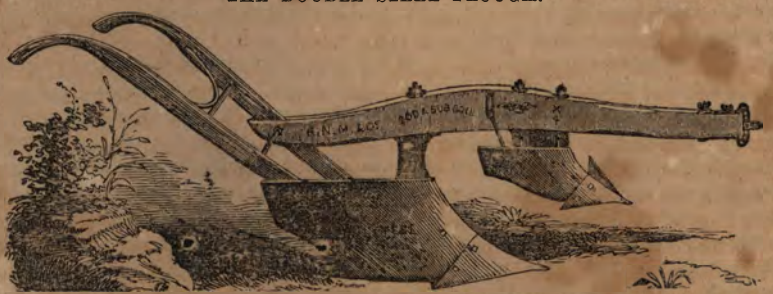
When turning under a crop of red clover, tall grass, weeds, maize or broom cornstalks, farmers have always experienced a difficulty in covering up such materials with the furrow slices. Ploughmen, from time immemorial, have been accustomed to draw under all such materials by means of a chain attached to the plough-beam and whiffletree, as repre sented by the accompanying illustration.

Although this is an ancient device, but few farmers are acquainted with this mode of dragging the tops of growing plants beneath the furrow slice with a chain; and the contrivance possessed such novelty, that letters-patent were granted to J. & L. Kilmer, Barnesville, Schoharie county New York. It is a good invention, and as it has been common property for so many years, farmers will use it without paying the patentees a royalty, from year to year. The examiners in the Patent Office ought to have been so well posted in the improvements in agricultural implements and useful inventions, that they would not have committed the egregious blunder of granting letters-patent on a device that has been in general use in the Old World and in America ever since the plough was constructed with an improved mouldboard.

The object of the small chain B extending from the large chain to the plough-rong, is to keep the bight of the large chain as far back, and upon the turning furrow slice, as it can be without being buried beneath it as it turns over.

With a chain attached to a plough in this manner, I have turned under tall maize, red clover, and weeds, so neatly that it was difficult to determine what kind of plants occupied the land previous to being ploughed.

THE DOUBLE STEEL PLOUGH.



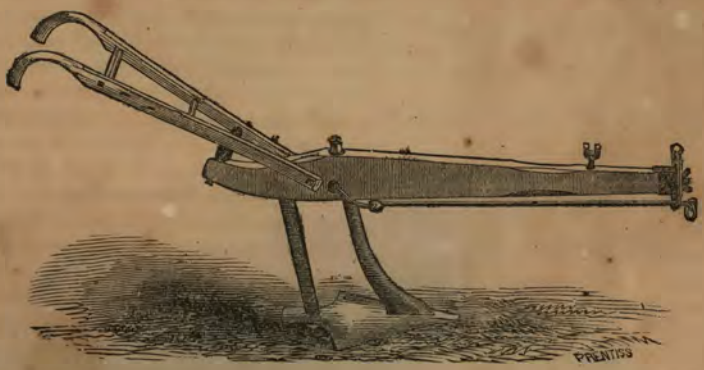
The illustration herewith given represents a steel plough similar to the far famed "Michigan sod and sub-soil plough" that has gained such a world-wide reputation.

This is manufactured by the Ames Plough Company, Boston, and also New York city. It needs little or no explanation. The figure of the plough gives the reader about as correct an idea of the implement as if he were to see the plough itself.

The question will doubtless be asked, why have two ploughs on one beam? Or, wherein consists the advantage of having a small plough in front of the large one? I answer, this plough is adapted to a peculiar kind of ploughing. When the stratum of mould which constitutes the soil is thin, and rests on a compact and cold sub-soil, this kind of plough should never be employed, as it will turn the mould which is needed at the surface, several inches beneath this cold unfertile ground. But when there is a deep soil of muck or vegetable matter resting on a clay, or clay loam soil, this kind of plough should be employed to bring up some of the heavy soil to mingle with the light soil.

SUB-SOIL PLOUGHS AND PLOUGHING.

There are several kinds of sub-soil ploughs; and certain ploughs that are more properly trench ploughs are designated as sub-soil ploughs. A sub-soil plough has no mouldboard nor land-side. The implement is properly a pulverizer.



The accompanying illustration represents a sub-soil plough, manufactured by Ames Plough Company, Boston, Massachusetts, which, I believe, has thus far given fair satisfaction. Another kind, manufactured by R. H. Allen & Co., 189 Water street, New York city, has a flange bolted to one side of the standard, which elevates the sub-soil much more than the kind represented by the illustration herewith given.

The sub-soil plough is drawn in the furrow made by the common plough. Its office is to break up the compact and impervious substratum of heavy soil, leaving it in the furrow where it is broken up. Sub-soil ploughs can be used advantageously and profitably only on those farms where the surface-soil is thin and the sub-soil exceedingly compact and not sufficiently fertile to admit of being thrown upon the surface. On many of the farms lying on the slopes of our northern lakes, where there is but a thin stratum of mould which should be kept on the surface, the sub-soil plough should be employed every season, as often as the land is ploughed, until the entire ground is pulverized for fifteen or twenty inches in depth. If a farmer has but a single team, he may work his sub-soil plough by cutting one furrow with the common plough, and then hitch his team to the sub-soil plough, and plough alternately around the land. This is a slow way to plough, but it is better to do so than not to pulverize the compact impervious soil. The most convenient and expeditious way is to employ one team to follow another, working a common plough first, and following with a sub-soil

plough in every furrow. Ground must be sub-soiled several times before the hard impervious substratum will be thoroughly pulverized.

GILBERT'S COMBINED PLOUGH.

Mr. P. M. Gilbert, Kewanee, Illinois, has invented and put into successful and satisfactory operation a combined sub-soil and surface-soil plough. I failed to get a sketch of it. The invention consists simply of a sub-soil plough or pulverizer, attached to any common plough.

The advantage consists in this—one man can hold two ploughs when this attachment is in use, whereas, when the sub-soiler is separate from the surface-soil plough, two men are required. This sub-soil attachment costs but a few dollars, and has succeeded admirably wherever it has been introduced. So soon as American farmers perceive and appreciate the importance of sub-soiling such land as requires the use of the sub-soil plough, such a plough as Mr. Gilbert's will be required as well as the common plough. I have not been able to ascertain whether this style of plough is made further east than Illinois.

PFEIL'S GANG AND TRENCH PLOUGH.

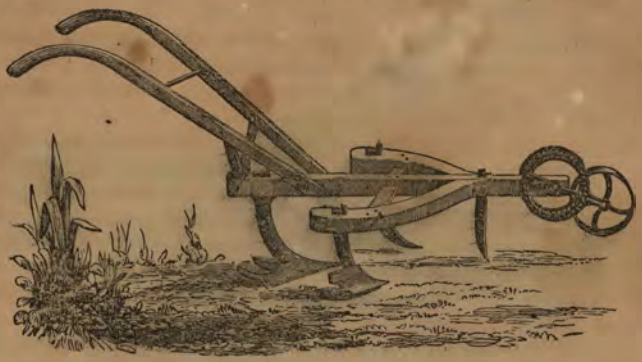
The illustration herewith given represents a gang plough made by J. C. Pfeil, Arenzville, Cass county, Illinois, which is received with no little favor at the west. Almost incredible stories are told of its excellence and efficiency in ploughing the prairie fields of Illinois and other States.

The depth of the furrow is regulated by the crank-axle, which is so arranged that the ploughs can be driven deeper or shallower, at the pleasure of the driver when the team is moving, by means of the lever. The proprietor states that this gang or sulky plough will cut a furrow from two to ten inches deep.

The illustration gives such a fine representation of the sulky plough that further description is deemed unnecessary. The committee who tested the draught of this plough with a dynamometer state, that it ran lighter by 140 pounds than other ploughs when running at the same depth and held by the ploughman while on foot.

KNOX'S HORSE HOE.

Although large numbers of this hoe have been in use for several years, the mass of small farmers do not know there is such a labor-saving implement in existence



Arranged like the illustration herewith given, this hoe is designed for cultivating Indian corn, broom corn, sorghum, potatoes, and all kinds of root crops, the first time the rows are dressed out. It is a very light and effective implement. The front tooth operates as a coulter to dig up the soil, and to give steadiness to the implement when it is in use. The two side ploughs may be changed from side to side, for the purpose of turning the earth towards or away from the rows of growing plants. The broad rear tooth cuts up the grass and weeds most effectually, and pulverizes the surface of the soil. The prongs in the rear sift the dirt and weeds, leaving the surface of the ground level, and the grass and weeds exposed to the burning sun, where they soon wilt and die. Where the rows are too close together to admit this implement to pass freely between the plants the side ploughs can be removed.

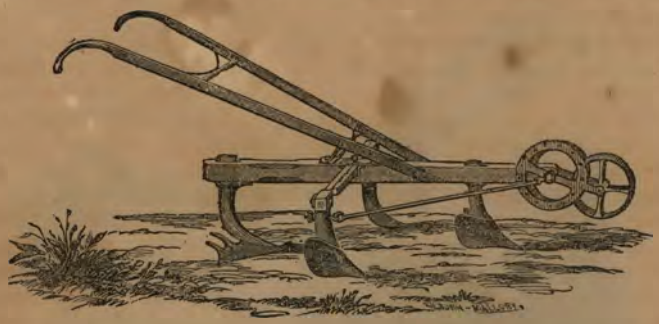
KNOX'S COTTON HORSE HOE.

The horse hoe herewith represented is similar, in some respects, to the preceding implement. The broad steel tooth is designed more particularly for the cultivation of the young cotton plants, young carrots, and all other roots where

level cultivation is preferable to ridges or hills. It is so simple that further explanation seems quite unnecessary. Teeth of several different sizes are manufactured by the Ames Plough Company, Boston, Massachusetts, and 53 Beekman street, New York city. Farmers at a distance, therefore, can purchase the teeth, and if they choose can apply them to old implements as they are worn out or become useless.

HOWE'S EXPANDING CULTIVATOR.

The implement herewith represented is made by the Ames Plough Company, and is similar to Knox's horse hoe, previously mentioned.



The forward tooth of this cultivator is a small, double mouldboard plough, which throws up two ridges. Each of the side ploughs turns a furrow towards these ridges. The rear tooth digs up the soil beneath the ridges, and the prongs sift out the weeds and grass, leaving them on the surface.

The superior feature of this cultivator consists of the expanding bars, which enables the operator to place the side-ploughs three feet or less apart, for the purpose of stirring the entire surface where the rows are four feet apart. The implement is similar to the Knox hoe, and is manufactured by the same company.

LEFT-HANDED PLOUGHS.

With some excellent farmers, left-handed ploughs are in common use; and those farmers will not be induced to use ploughs that turn the furrow-slices to the right. In some counties in Pennsylvania, almost every farmer employs left-handed ploughs only, under the erroneous impression that the plough that turns the furrow-slice to the left instead of the right hand requires less force of the team to draw it. Of course, the near-side horse or ox must necessarily travel in the furrow, where a left-handed plough is employed instead of a right-handed implement. In those localities where the left-handed ploughs are used in preference to those that turn the furrow-slices to the right, teams of horses are driven, for the most part, with a single line; and double lines for driving teams are as rare a sight in those localities where the left-handed ploughs are in vogue, as teams driven with a single line where none but right-handed ploughs are in use.

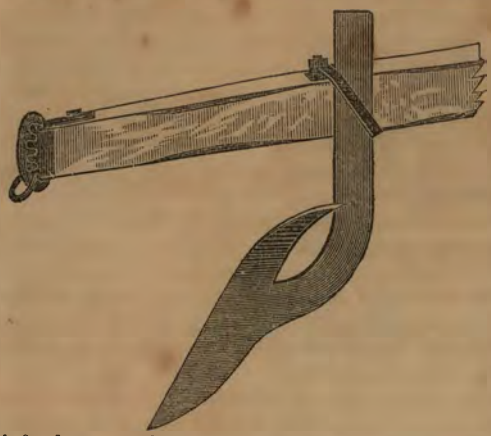
I should not have alluded to this subject, but for the fact that some farmers and agricultural writers have insisted that left-handed ploughs are superior to right-handed ploughs; and that they could commence ploughing in the middle of a field with a left-handed plough, and turn all the furrows inward; but that they could *not* do this with a plough that turns its furrow-slice to the right.

Whatever can be ploughed with a left-handed plough may be ploughed with a right-handed plough, with equal facility in every respect. One will require no more force to draw it, if constructed of the same form, than the other; one will do just as good work as the other, and no better, nor worse, so far as *force* is concerned. A man who has always used a left-handed plough only, might experience difficulty in holding a right-handed plough, until after he has had several days' practice with that kind of implement.

In this connection it is proper for me to mention that the share or point of a right-handed plough is always bolted on with a left-handed screw, while the bolt that holds the point on a left-handed plough is a right-handed screw. Every plough-boy knows this to be a fact; and he can give a philosophical reason why it should be so. But I have met with editors of agricultural papers who were utterly

ignorant of this fact until it was pointed out to them. I record these things not for practical farmers, for they are already familiar with them, but for beginners who are leaving the city and commencing farm operations, and who have almost everything yet to learn.

SPINK'S ANTI-CLOGGING COULTER.



The illustration herewith given represents a new and eminently useful coulter to prevent clogging when ploughing stubble ground, or when turning under coarse manure or clover. It can be readily attached to the beam of almost any plough with the same fastening that is required to secure an ordinary coulter in the desired position. The shank of the coulter should stand perpendicularly on the beam of the plough, as represented by the illustration. The upper part of the blade is made as represented by the figure, with the upper point bending over to the left three or four inches from a line with the shank. As the stubble or coarse manure is forced up along the edge of the blade, it is conveyed to the left of the shank and falls off the point of the blade instead of being gathered beneath the beam to clog the plough.

Any ingenious blacksmith, with this illustration before him, will be able to make such a coulter with little difficulty. This device was invented by M. A. Spink, Rensselaer Falls, New York. It has not come into general use, as very few farmers know anything of its merits, and a small proportion only have seen such a device.

MEAD'S CONICAL PLOUGH.

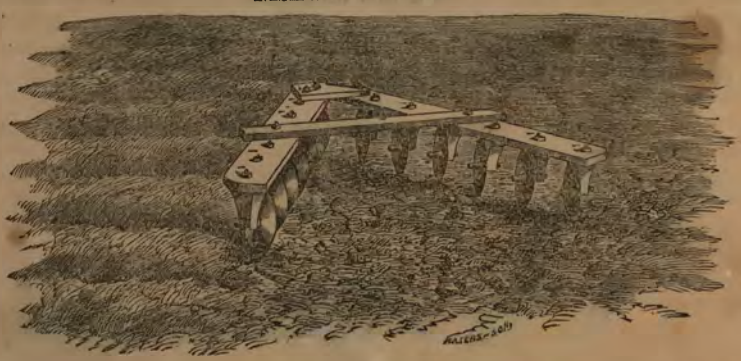
R. H. Allen, 789 Water street, New York city, has an improved plough of great excellence, denominated the "Cylinder Plough," because the mouldboard is made of a curvature to fit a perfect cylinder. The plough herewith represented received its name from the mathematical principles on which the mouldboard is constructed. The concavity of the mouldboard, instead of being made to correspond to the surface of a cylinder, is constructed to coincide with the surface of a cone, with

the large end of the cone to the front part of the plough, which is the means of giving an easy separation of the furrow-slices, as they are cut loose and turned over. By this peculiar form of the mouldboard the furrow-slices are more thoroughly pulverized than when the board is made to fit the straight surface of a cylinder.

When the furrow-slice rises on the mouldboard, the tendency is to pulverize and separate one side of the furrow-slice more than the other. This operation can be perceived when ploughing stubble ground. In this conical mouldboard the adjustment and distribution for overcoming the friction of raising and turning a furrow is very evenly balanced. I went from New York city to New Haven expressly to test one of these ploughs with my own hands. After adjusting it to run as I desired to have it, I walked behind it as it ploughed eight times in succession around the land, without any one's touching the handles, except at the ends when the team was turning around; and even then it was not necessary for me to take hold of the handles, as the plough would have kept erect when ploughing across the ends. That test proved conclusively that this plough, manufactured by Solomon Mead, New Haven, Connecticut, is about as evenly balanced as a plough can be. The draught is much lighter than most other ploughs, which is proved by the peculiar form of the share, the wing of which is uncommonly broad and lies as flat as is practicable to make it. This position and shape of the cutting edge of the share enters the ground much more easily than when the wing of the ploughshare does not lie so flatly.

This plough is adapted to all kinds of ploughing, and I know of no other plough that will excel it for turning sod or stubble of all kinds. Mr. Mead manufactures several sizes of this improved plough, and also an excellent side-hill plough, the mouldboards of which are constructed on the conical principle.

NISHWITZ'S HARROW

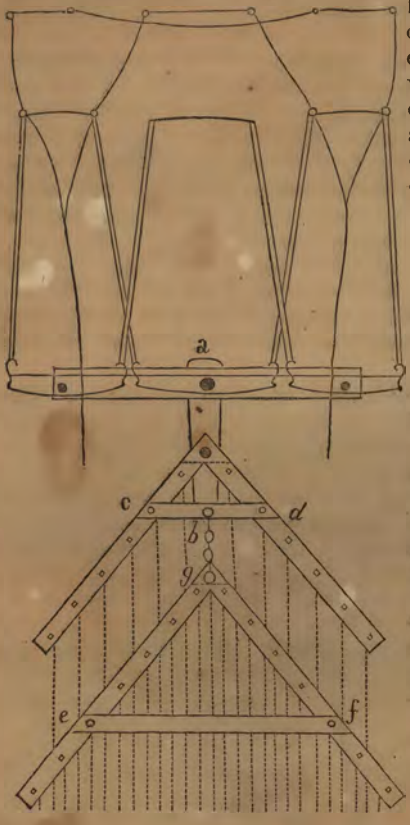


The accompanying illustration represents a new style of pulverizer, invented by F. Nishwitz, 142 First street, Williamsburg, Long island, New York. The principle of construction is quite new, but, by those who have used it, the operation is said to be eminently effective. The wooden frame consists of two pieces of hard, tough timber, about two inches in thickness by seven or eight inches wide, held in position by the cross-bar, which is firmly bolted to the side pieces, as represented by the illustration. By taking out the bolts which secure the cross-bar, the wings can be spread further apart or brought nearer together.

The pulverizers consist of several sharp-edged circular disks, about one foot in diameter, being concave on one side and convex on the other. When the wheels, or disks, are cast, a round steel pin, about three-fourths of an inch in diameter, is inserted in the mould, thus furnishing a steel journal for each disk. A bolt with a nut at the upper end is passed through a socket-standard, which holds the disks in their position.

When the pulverizer is in use the disks are set at any desired angle to the line of draught, and each disk thus pulverizes and turns over a narrow furrow-slice. The disks operate by cutting, lifting, and turning over a few inches in depth of the entire surface of the land. Wherever it has been thoroughly tested, I believe the implement has given excellent satisfaction.

In manufacturing this kind of implements it is eminently important that the clasp or loop in which the steel pins turn or work should be at least two inches broad. If they are made narrow the friction is so intense that either the gudgeon or the box will be cut out in a short period. This kind of pulverizer will evidently leave the surface of the land much lighter than the ordinary harrow, as the disks cut their way through the soil and lift it up without compressing a portion of it, as is done by common harrow teeth. There ought to be a bearing on both sides of the disk, instead of being all on one side. If the steel were to extend entirely through the hub of the disk and were supported by two boxes instead of one, the steel pins would wear much longer, and would run more easily than when the discs are supported by the bearing on only one side of the disk.



HICKS'S TRIANGULAR HARROW.

Edward Hicks, North Hempstead, Long Island, has furnished the accompanying description of a triangular harrow, which can be made in a new country, when a farmer has but little to do and has no money to expend for an expensive harrow.

The illustration shows the three-horse whiffletree bolted to the forward end of the stem-piece of the front part of the harrow, and the manner of hitching the traces of each horse or mule is clearly represented by the lines which indicate the traces. The guiding reins or lines are shown as they are employed when three horses are used. The heads of the horses are coupled together with small ropes or straps. Everything is so very plain that further explanation is not required. The timber of which such a harrow is made should be about three inches square, and be tough and hard.

CHEAP LAND-ROLLERS.

For certain kinds of work there is no farm implement of greater efficiency in pulverizing the soil than a good roller. On some farms, where the soil is heavy and disposed to be cloddy, a good roller is indispensable to thorough cultivation; but where the soil is light, always dry, and never lumpy, a roller is of little value.

Most farmers want a cheap roller. Few men feel willing to pay $25 to $40 for a roller. Farmers who have limited means and a small farm cannot afford to purchase a land-roller at such an expensive rate. A cheap, plain log roller is objectionable, because it is hard to turn around, as the team must slide one end around by main force; this is particularly objectionable when rolling young grain or grass, as the end, in sweeping around will shove the mellow earth up in a ridge.

A cheap and excellent roller may be made, by an ordinary mechanic, at a small expense. Select a log about three feet in diameter, or a smaller log will subserve a good purpose. Saw it into cuts one foot long. Let the saw be put in good order, so that the cuts may be sawed off true. Find the centre, with a compass, and dress off the periphery, so as to make a round block wheel. Eight such block wheels, having an inch and a half hole bored through the centre of each, strung on a round iron bar, with a wooden washer between the wheels, will make as cheap and convenient roller as any farmer can desire. Every wheel will revolve independently of the other. The spindle or journal should be entirely straight, the rough places filed off smoothly, and the bearings at the ends of the bar be either turned round or filed as nearly round and true as may be practicable.

When boring the holes through the centre it will be necessary to make a stay, like a four legged stool, to hold the auger when boring at a right angle to the side of the wheel.

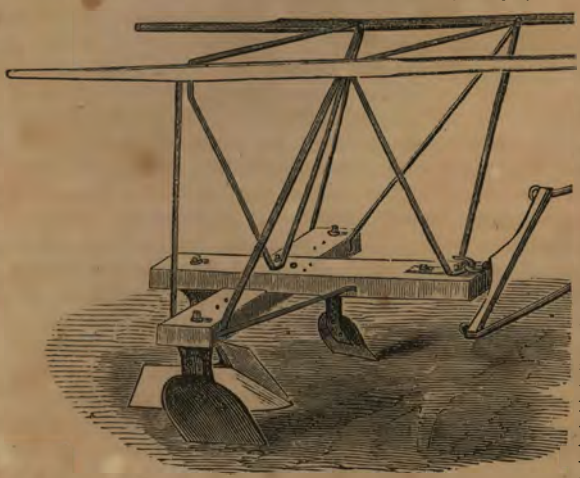
Some kinds of timber, when dressed out in block wheels, will crack badly. Therefore, to avoid large cracks, the timber ought to season one year, under shelter, with the bark on. Then there will be no cracks to injure the block wheels. Such a roller may be made of white wood, oak, white elm, or sycamore wood; the latter kind of wood is much less liable to crack badly than timber that will split freely.

The size of a roller has been alluded to frequently by agricultural writers, and in some instances small rollers have been recommended as far superior to those of a large diameter, as the small ones would crush more clods than a large one.

I have made rollers of both kinds, and have used them extensively, and my experience warrants the statement that the best roller that I ever met with was made with my own hands. It was in two sections, made of plank, was four feet in diameter, eight feet long, and would draw much easier and crush more lumps of earth than a smaller one.

The best time to roll land is a consideration of much importance. The object is to mash the hard lumps. If the ground be rolled when they are hard and dry, many of them will be pressed into the mellow earth without being pulverized. But soon after a shower all the hard lumps will fall to atoms with a slight pressure. This is the best time of all others to speed the roller, as it will do thorough work. Let it be borne in mind that a good roller for some land is quite as important as the plough, and more so than the harrow. But land should not be rolled when the surface is too wet.

ALDEN'S HORSE HOE.



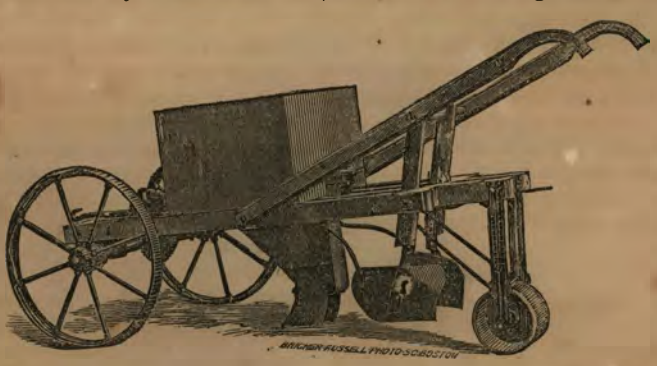
The illustration accompanying this subject represents a horse hoe guided by thills, which has recently been improved by M. Alden & Co., Auburn, New York. The machine is an excellent labor-saving implement, as I know from practical experience, having used one of them on my own farm. On stony ground, the teeth of this hoe being broader and more flat on the bottom than some other horse hoes, it will not enter the soil as quickly as those

teeth that stand at a more acute angle. This horse hoe can be employed for dressing out all kinds of hoed crops; and those who have used it among young cotton plants state that there is no horse hoe now in the market that can excel this implement for facility of handling and efficiency of operation in dressing out the young cotton plants. The large steel tooth may be attached to the frame either forward or in the rear; and the side teeth may be detached or changed to any desired angle, or set to throw the soil towards or away from the growing plants. I have met with no other horse hoe that is constructed to perform so great a variety of operations as this. By removing all the teeth and attaching a broad-winged steel tooth, one horse will hill or "earth up" more celery than can be done by twenty laborers with hand hoes. The teeth are removed from the frame and a marker attachment is boltedto it, for marking out the ground for any kind of crops. A pronged tooth is bolted to the frame, in the place of the cultivator tooth, and the implement is then changed into a potato diggor.

The thills enable the operator to manage this hoe with far more dexterity and skill than if the implement were drawn simply by the traces; and when turning the horse around at the ends of the rows, he can be guided so as to break down much less corn than if there were no thills. The braces that are bolted to the thills are so arranged that the teeth can be set to enter the ground more easily, or the pitch of the teeth may be only enough to cause them to enter the ground one or two inches.

TRUE'S POTATO PLANTER.

The illustration accompanying this article represents a potato planter, invented by Mr. J. L. True, Garland, Maine, which is drawn by one or two horses, and guided by one man by means of handles, similar to the management of a plough.



The machine is supported on two drive wheels, similar to the driving wheels of a mowing machine. The driving wheels work the dropping and cutting apparatus. In the bottom of the hopper which contains the potatoes to be planted there is a sink on each side of a slide, which is worked back and forth by means of a crank or pitman. One or more potatoes drop down into the recess, when the slide forces the potato against a knife, which cuts off all that extends below the knife. After it is cut off, the piece, or pieces, drop down into the furrow that is opened to receive the seed. The furrow is opened by a small, double mould-board plough, and the seed drops directly behind it, before the mellow soil, or clods or sods, have time to roll down into the furrow. A scraper of peculiar form follows the plough, which fills the furrow with mellow soil, covering the potatoes as neatly as it can be done by hand. Immediately in the rear of every other part of the planter there is a cast-iron roller, which rolls every row. The drive wheels make marks sufficiently distinct, where the land is well prepared, for a guide, when returning, to enable the operator to plant the rows the desired distance apart.

The seed is dropped in hills forming rows only one way. The seed may be dropped at any desired distance apart, by means of pinions of different sizes, which increase or diminish the reciprocating motion of the slide in the bottom of the hopper.

I have been familiar with this planter for several years; have worked it when planting potatoes, and I am satisfied that it is a great labor-saving machine.

SPAULDING'S POTATO PLANTER.

As I was about finishing this chapter, I was invited to see a potato planter which was being made by Edward Spaulding, 189 Water street, New York city, which promises to perform satisfactorily the operation of planting potatoes that have been cut up into sets. I shall merely record a partial description of it, as it was not completed at the time of inspection. Still, it is a matter of interest to know that such a great labor-saving machine is about to be offered to the farmers of our country.

In order to furnish an idea of its operation, I will simply state that a plough, similar to the one attached to Mr. True's planter, which is illustrated on a preceding page, opens a furrow, a distributing apparatus drops the potatoes, and a coverer hauls the soil over them. The pieces of potatoes, or the sets, are deposited in a box, on one side of which there is a system of revolving spears, operated by machinery, each of which is thrust down into a piece of potato, and carries it around to the point where it is to be slipped off the spear and dropped into the drill.

Judging from an examination of some of the parts of this planter, there appears to be nothing to prevent it, when completed, from proving a success. Should this machine not succeed satisfactorily, there is reason to believe that a similar planter will eventually be brought out, that will drop potatoes after they have been cut as accurately as it can be done by hand.

POTATO DIGGERS.

Several small fortunes have been expended within a few years past in securing letters-patent for, and manufacturing, potato diggers. Scores of potato diggers have been invented, patented, manufactured to a limited extent, and sold to farmers with the assurance that the machines would perform in the most satisfactory manner all that is required of a digger, or no money would be demanded of the purchaser. It is said that patents have been issued at the Patent Office on nearly two hundred devices for digging potatoes. And yet American farmers are chagrined at the thought that among the long array of these implements they cannot point to one that is, to all intents and purposes, an implement possessing efficiency to warrant its manufacture, unless the diggers hereafter illustrated and noticed shall prove to be the implements desired.

Digging potatoes is a peculiar operation. Inventors of horse-diggers have not appeared to fully understand what is really required in a successful digger. They have not fully understood the principles of mechanics, the science of force and motion, of friction and resistance, the correct velocity and shape of the working parts of a machine for digging potatoes, and the immense amount of labor required to plough up, dig over, and thoroughly pulverize a strip of soil one foot or more wide and half a foot in depth, and at last leave the potatoes on the surface of the ground.

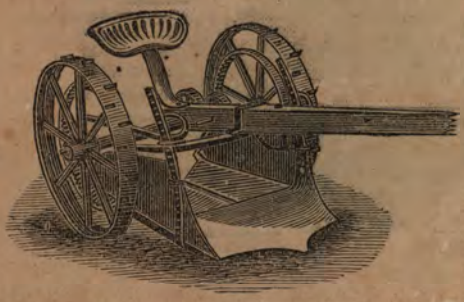
Every practical farmer understands how much force is required to simply break up a furrow slice, one foot in width and six inches deep. But a potato digger, in order to operate satisfactorily, must break up the soil, pulverize it most thoroughly, and separate the potatoes from the loose dirt. To perform such an operation as fast as a team will ordinarily move, requires the combined force of at least four or five strong horses.

The chief difficulty with all the diggers has been the imperfect manner of separating the potatoes from the dirt. The digging apparatus—the plough part—of a great many machines appeared to operate in the most satisfactory manner, but the separating apparatus failed. The potatoes would be covered up in the dirt. The consequence was that there were more than enough potatoes left buried in the loose earth than would pay a laborer for digging the crop by hand. Much more force is required to elevate the earth and the potatoes than inexperienced men usually suppose. Consequently, in calculating the dimensions of the different parts of the plough and the separator, almost every inventor has failed to construct his digger so as to bring the earth and potatoes so high above the surface of the ground that there might be sufficient space beneath the separator for the loose dirt to pass through freely. For example, we will suppose that the plough runs beneath five inches in depth of earth; therefore, in order to give sufficient room under the shaker for the loose earth to drop through readily, the under side of it must be not less than six inches from the ground.

But instead of this arrangement, the shaker, or separator, works so closely to the ground that not half the dirt can pass between the bars of the separator before the shaker rests on the ground, thus effectually preventing the passage of dirt through the shaker. Therefore, potatoes, dirt, and all must pass off the rear end of the separator; and many of the potatoes would be covered up in the earth.

In the season of 1865, Rev. J. J. Hill, Xenia, Ohio, invented a potato digger that was thought to be a triumphant success. R. H. Allen, 189 Water street, New York city, manufactured a number of them; but the machine failed to give satisfaction, as it would not separate the potato from the dirt. The machine would dig the potatoes perfectly clean; but a large number of them would be covered up in the dirt. The separator consisted of a system of forks which revolved in the opposite direction of the two drive wheels, and the tines came up between the iron prongs in the rear of the scoop-plough and lifted the potatoes, tops and all. from the prongs, and threw them in the rear of the machine.

ASPINWALL'S POTATO DIGGER.



The illustration here given represents a potato digger that is said to work satisfactorily, but I have not had an opportunity of seeing it operate. It is manufactured by Wheeler, Melick & Co., Albany, New York. Those who have seen it dig potatoes state that it performs the work perfectly, and faster than it can be done by twenty men with hand tools. The manufacturers assure me that it digs the potatoes satisfactorily, without pulling the vines. The machine is drawn by two horses abreast. The working parts are supported on two drive wheels, similar to the wheels of a mowing-machine. A shovel-plough made of plate steel is suspended by iron bars, so as to run at any desired depth below the potatoes. By the forward movement of the machine, the earth and potato tops are forced back upon the double-vibrating separator, which shakes the dirt down through the bars and delivers the potatoes on the surface of the ground, in the rear of the machine. The bars of the separator are made of steel; and the manufacturers state that it will dig well even in heavy soils and where the land is rough. The illustration furnishes a fair idea of the digger, so that a more minute description is not necessary.

CONOVER'S EMPIRE POTATO DIGGER.

The illustration herewith presented represents a two-horse potato digger, invented by S. B. Conover, 260 West Washington Market, New York city, who has been experimenting for many years with potato diggers, and has spent a vast deal of time and money to obtain a successful machine. He feels assured that this machine is a complete success. A small number only has been manufactured; and thus far they subserve an excellent purpose. The inventor states that the machine performs the work of digging and separating potatoes thoroughly and efficiently.

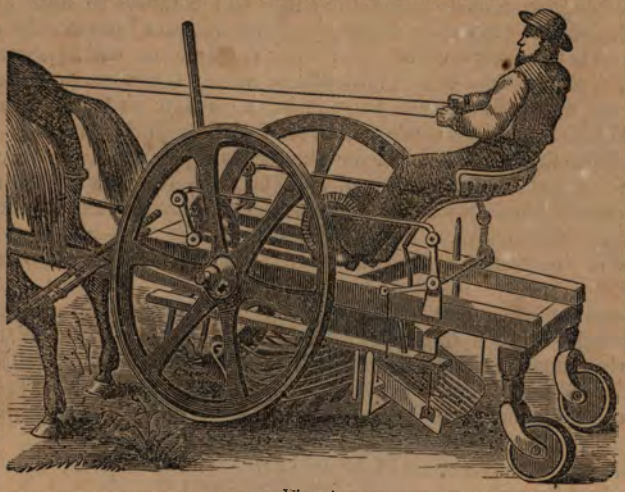


Fig 1

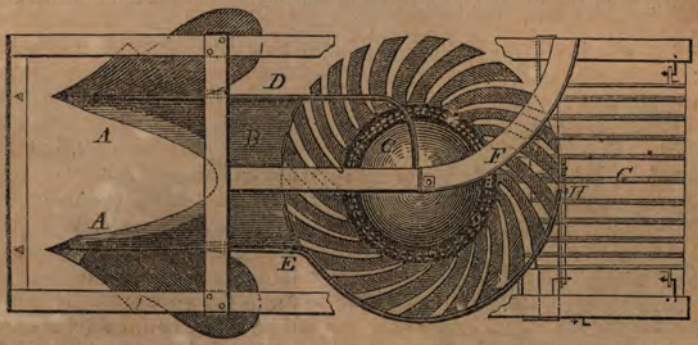


Fig. 2.

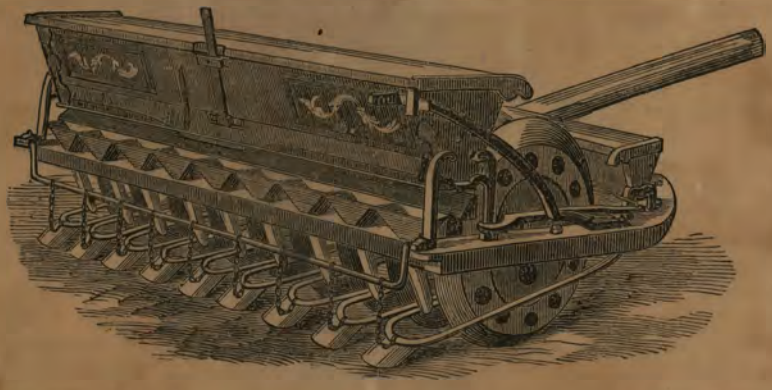
The inventor thus describes the digger with the aid of the lettered section, figure 2. It consists of a main frame mounted on an axle and driving wheel which give motion to the carrying wheel C, and screen G, with caster-wheels in the rear, and which are merely to steady said main frame, and allow the use of a loose pole so as to avoid any weight on the neck of the horses. On the axle is hung the cog wheel which gives motion to the pinion which is hung on the countershaft, on which is also the bevel wheel which gives motion to bevel pinion, which gives motion to the wheel that shakes the screen G. The supplemental frame is hung beneath the main frame, and is connected with the main frame by rods secured to the bell-crank levers placed on the main frame, and held in position, or elevated and lowered to any required depth by the lever and socket connected.

To main frame on supplemental frame is fastened the double-pointed plough A A, which goes under and takes up the middle of the rows or hills, fifteen inches wide, which, as it passes back, is taken on the carrying wheel C, which being open, lets some of the dirt through and carries the remainder back, dirt, potatoes, and vines, to shaking screen G, by which means the dirt is thoroughly cleaned from the potatoes, and the potatoes and vines are conveyed to the back end of the screen clean, and dropped on the surface of the ground. In front of the plough A A there are placed two coulters, one directly in front of each point of the plough, and fastened on supplemental frame, which catches and turns the vines and weeds in the row so that they will pass over the plough, and thereby prevent them from clogging or catching on the standards or sides of the plough. There are also attached to each, outside of the plough, shares which throw the dirt from the sides of the row. This dirt does not pass over the plough, but is thrown in the furrow out of the way of the machine. The machine is in every way under the control of the driver, whose seat is on the main frame. In trials made with this digger, the past season, it performed its task in a complete manner, taking out all the potatoes, delivering them clean on the surface of the soil, which is left level and thoroughly pulverized.

D and E represent screen guards extending around a portion of the wheel C, for preventing the potatoes and earth being thrown off the wheel until everything is brought around to the separator G. At F, is a vertical plate of steel operating as a scraper for removing the earth that may adhere to the surface. Projecting downward from the supplementary frame, over and beyond the points of the shovel plough, are two deflecting arms or coulters, the office of which is to turn or deflect inward the potato tops or vines, so that they will pass over the central part of the shovel plough to the carrying wheel without clogging the action of the machine.

BECKWITH'S ROLLER DRILL.

One of the best farm implements of modern invention is represented by the accompanying engraving of Beckwith's Roller Drill, which is constructed for



planting grain of a more uniform depth than with some tube drills. It is constructed according to the most correct philosophical and mechanical principles; and every scientific farmer will at once acknowledge that this kind of drill puts in the grain on the most correct principles. This drill consists of a series of nine cast-iron rollers or wheels placed on a wrought-iron shaft or axle, which will roll on the ground and support the frame and machinery of the drill. These rollers are 28 inches in diameter, and have a V-shaped periphery, which, by the aid of

the weight of the frame and other parts of the drill, will press small furrows in the earth to receive the seed. These rollers are made with sufficient hub to keep them the proper distance apart, seven and a half inches from centre to centre; and each one is loose on the axle and has an independent movement from each other, except the centre roller and one at the end, which are both made fast *on* and rotate *with* the axle. This end roller drives the distributing apparatus; and by the aid of the centre wheel, will make a uniform motion for distributing the seed regularly upon the most uneven ground. The frame of the drill is made of two cast-iron slide-pieces, with rounded corners in front, so as to ward off stumps and other obstructions, when passing them, and still be able to drive the machine very close to the same so as to sow all the ground that can be *ploughed* in new fields or among corn shocks, as many of our western farmers sow wheat after corn, the same fall, before the corn is removed from the field.

The box or hopper for holding coarse grain is placed behind the rollers, and is made in the usual form, and has two iron plates or jaws at the bottom, one made fast and the other movable. There is a wooden rod placed under these plates, with wire pins projecting up between and about one-half an inch above the plates into the seed. This rod is made to vibrate by suitable lever connections, a cam on the end, with roller. The wire pins running between the plates of the hopper upward into the seed will agitate and cause it to run out between the opening, which can be regulated to sow the desired quantity. The seed from the distributer is conducted down through iron pipes into the *furrows* made by the rollers. There are inverted iron hoes, or coverers, attached to the frame and drag behind the rollers and conducting pipes, to cover the seed. These coverers can be raised from the ground, when turning around, by means of a crank attached to the journal. The grass-seed hopper is placed forward of the rollers and deposits the seed broadcast. The distributer is a slide of thin flat iron, placed in the bottom of the hopper with suitable holes in it to correspond with the openings in the bottom of the hopper to regulate the quantity sowed. The seed is agitated and made to pass through these openings by a serrated rod made to vibrate in the bottom of the hopper on the thin iron slide by being attached to the levers on the cam of the end roller.

These rollers all being on the one axle, will level the ground similar to a field-roller, and leave the surface in good condition for the reaper and mower; and the rollers being loose on the shaft or axle, may be turned around easily by the team.

I think that the grass-seed distributor should be placed behind the rollers, as they will cover the grass seed too deep. Grass seed of all kinds requires but little covering. My long experience assures me that a larger proportion of grass seed and clover seed will grow when sowed *after* the last implement has been drawn over the surface than when the seed is harrowed, rolled, or brushed in. There is great danger of covering grass seed too deep. The first shower of rain that falls on the field after the seed has been sown, will cover almost every seed as deep as is requisite to insure germination and luxuriant vegetation.

Another improvement in this excellent drill, besides placing the grass-seed distributor *behind* the rollers, is forming the V-shaped ridge on the surface of a broad thin rim, say five inches wide. This style of rollers would leave the surface of the ground more even, as all the clods would be crushed when they are more than one inch in diameter. If the periphery of the rollers were of this form, the channels made by the V-shaped ridges would all be of a uniform depth; whereas, when constructed of the present form, were the soil very mellow and light, the channels would be made too deep.

The eminent superiority of this drill over the tube drills is appreciated by those farmers who have had considerable experience in growing winter wheat, or winter barley or rye. As this roller drill deposits the kernels of grain about

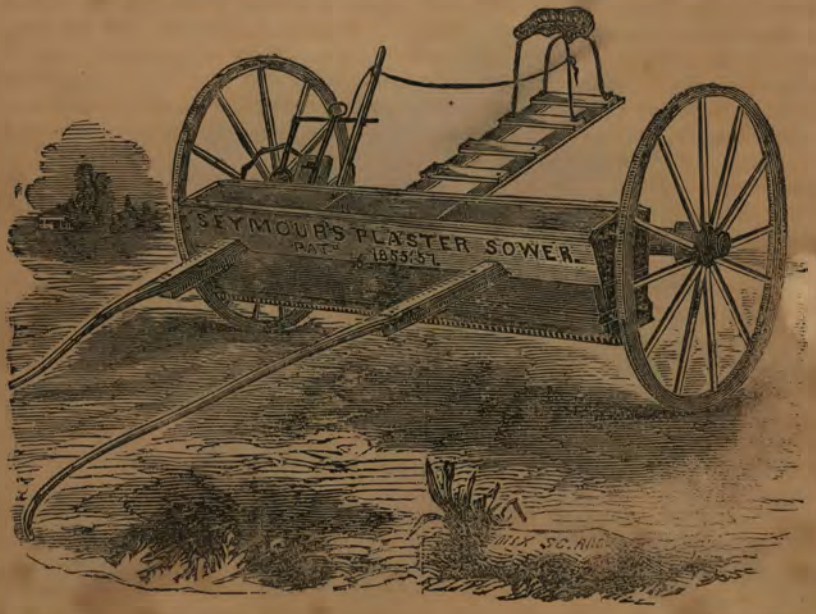
one and a half or two inches deep, the roots of the growing plants spread out nearly in a horizontal direction, more in a mass, and thus withstand more effectually the influences of freezing and thawing of the soil, and the consequent upheaving of the plants in the winter.

MACHINES FOR SOWING FERTILIZERS.

Sowing plaster or gypsum, lime, wood-ashes, or any kind of commercial fertilizers, is exceedingly disagreeable drudgery. Every farmer and farmer's boy, from the lowest laborer to the superintending proprietor, dreads the unpleasant and offensive task of scattering any of the above-named fertilizers by hand. Besides all this, laborers soon become so disheartened at such offensive employment that they will not do their work half so well as such labor should be performed.

Ashes and lime will shortly eat through the skins of their hands. Gypsum will fly in one's face, mouth, nose, ears, and hair, in such profusion that a laborer soon becomes so disgusted, that he fails to exercise proper care to scatter the material evenly. For this reason fertilizing matter is distributed very unevenly over the surface of the land if sowed by hand, and some portions of the field receive none at all. Furthermore, sowing such substances is exceedingly laborious and fatiguing.

To relieve the farmer of this expensive drudgery, P. & C. H. Seymour, East Bloomfield, New York, have invented a plaster sower, represented by the accompanying illustration, which is a fair representation of the sower in running order.



Gypsum, lime, or wet ashes may be deposited in the hopper and distributed with the most desirable accuracy. The proprietors inform me that this machine will sow damp ashes as well as when they are dry. Lumps of charcoal and all hard lumps of dry lime, or similar substances, which can be crushed by the light iron stirrers on the inside of the hopper, will not obstruct the perfect operation of the sower. The same machine will sow guano and bone dust of any kind in

the most complete manner. This kind of machine has been in use for several years past, and the proprietors assure me that not one of them has failed to give the most perfect satisfaction.

As immense quantities of gypsum, lime, ashes, and commercial fertilizers are spread broadcast annually, such a machine is of great value, as a lame man or boy can perform heavy labor with great rapidity by means of such a machine, who without it would be able to do nothing at all.

Several neighbors could own such an implement jointly, which with proper care would do all their sowing for a lifetime.

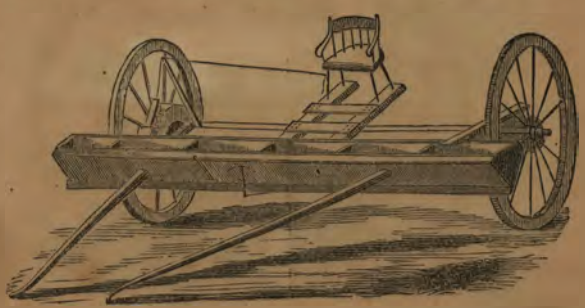
Besides this valuable farm implement, Paschall Morris, 1120 Market street, Philadelphia, Pennsylvania, and E. Whitman & Son, Baltimore, Maryland, manufacture Cooper's lime spreader, which is said to give eminent satisfaction in scattering lime and gypsum.

I allude to these things for the two-fold purpose of showing that farmers are becoming more and more interested in the great subject of fertilizing the soil, as well as in making their horses perform the drudgery of the farm.

Messrs. Seymour state that for ten dollars more they attach a grass-seed sower to this plaster sower, which scatters clover seed and grass seed with remarkable uniformity. As it is of the utmost importance to scatter grass seed evenly, and as few of the laborers of the present day are capable of sowing grass seed all over the ground by hand, such an implement is of great value.

SEYMOUR'S BROADCAST SOWER.

The illustration following this paragraph represents a broadcast grain sower, made by P. & C. H. Seymour, East Bloomfield, New York. As a broadcast sower, this implement has no rival in the country. Some farmers will not have a drill on their farms. All their seed grain must be sowed broadcast. Therefore, as very few of our laborers can be trusted to sow any kind of cereal grain, an intelligent farmer knows that it is economy to purchase such a machine, as his fields, if the seed be scattered evenly, will produce sufficient extra grain to pay for the sower.



The manufacturers state that this sower is capable of dusting every inch of ground on an acre of land with less than half a bushel of plaster, and thirty or forty bushels of lime may be thus evenly applied to the same amount of land. It sows a breadth of ten feet. It sows correctly (and in any desired quantity per acre) all the various kinds of grain and seed commonly sown by farmers, from peas to the smallest seeds, (clover and timothy *mixed* if desired,) and all fertilizers or manures of a dusty nature, which are so nearly reduced to a powder that the largest particles will pass through an aperture which will let through peas or corn, or which, having once been ground or made fine, and become lumpy by exposure, (as plaster frequently does,) can readily be reduced again to powder, by the action of the "plaster rod," which is a kind of course sheet-iron saw,

used in the machine for distributing all such manures. The distributing apparatus is regulated by opening or closing a crack in the bottom of the hopper, by means of a lever.

Each has an aperture extending through the entire length of the bottom of the box. The bottom of the box of each consists of two iron plates, the edges of which are so accurately jointed as to form a complete joint, and are so applied and fixed to the bottom of the box, that when the aperture between them is enlarged or contracted, they retain their *parallel position*. They are also provided with fixtures by which the aperture between them may be enlarged or diminished in an instant, to any size required, and there firmly secured. The fertilizers are forced through the bottom of the plaster sower by a series of knives or iron blades throughout the entire length of the box. Each of these knives is hung on a pivot in the upper part of the box and passes down through the bottom, and pivoted to an iron rod or bar having a vibrating motion.

By this motion of the knives they naturally distribute the fertilizers in the most perfect manner. The grain, seed, and fertilizers in the broadcast sower are distributed by points or pieces of thin iron, rigidly fixed to a rod or bar under the box, and which pass up through the aperture into the grain. A vibratory motion of this rod does the work. There are three of these rods with the points (or teeth, as they are usually called) of each differing from the others, and each adapted to its particular use—one for grain, one for plaster, and one for grass seed.

A fourth is added for flax seed when required.

I cannot forbear to say something in favor of tube drills. A great many kinds have been abandoned because they did not do the work satisfactorily. There are tube drills that will put in seed in a most excellent manner, where the roller drill would fail entirely. Tube drills will put in grain as well as practicable among stones, clods, and sods, where a roller drill would ride on the tops of such obstructions. Where the surface of the land is very uneven, abounding in ridges and knolls, a good tube drill will put in the seed more evenly than it can be done by any other machine. Still many good farmers think the roller drill is adapted to a more perfect condition of agriculture than the tube drill. The intelligent reader will understand the difference which I desire to allude to between the two kinds of implements.

The most perfect and reliable tube drill that is made in America is manufactured by H. L. & C. P. Brown, Shortsville, Ontario county, New York. Perhaps there are other drills made in Chicago, Illinois, and by E. Whitman & Son, Baltimore, Maryland, which will compare favorably with the "Brown drill;" but none that has yet been invented can excel this valuable farm implement. It will sow all kinds of cereal grain with the greatest accuracy, and it will plant peas and beans equal to any seed planter.

The accompanying illustration represents the distributing apparatus, which is a very ingenious and efficient arrangement for distributing seed by means of wheels revolving within a cast-iron case. The projections on the periphery turn out the grain with desirable uniformity.

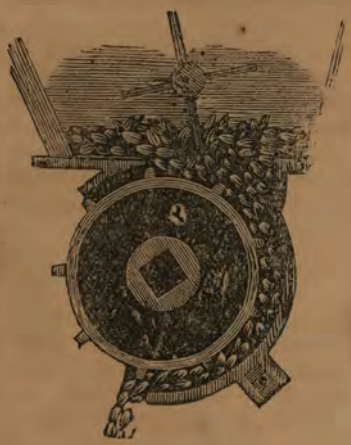


Fig. 1. Wheat run.

Fig. 2. Pea run.

DRILLING VS. BROADCAST SEEDING.

When grain is sowed by hand, broadcast, it is seldom scattered evenly, and when the team harrows in the seed, if the soil be mellow and deep, much of the seed will be passed five or six inches below the surface, while a portion of the

Fig. 1 Fig. 2.

seed is barely covered with earth. When the grain has matured the height of the stalks and size of the ears will be as irregular and disproportionate as the illustration herewith given at the right hand; but when sowed with a good drill, being distributed evenly and regularly, at a sufficient and uniform depth in the soil to receive the moisture, it all germinates at once, and comes up

healthy and strong. When sowed broadcast and harrowed a portion of the seed is left uncovered, exposed to the drying winds and scorching sun, to the fowls and birds, and that which is covered is at very unequal depths, some very deep, some medium depth, and some so near the surface that in case of drought it fails to mature for lack of moisture.

Moreover, when seed is deposited at a proper depth in gutters with a ridge of earth on each side, the growing plants are protected, in a measure, as these ridges are gradually washed down around the plants, which is not the case when the seed is scattered broadcast.

It is estimated, by some of our most successful farmers, that by the use of the grain drill they save from half a bushel to a bushel of grain per acre, and the yield per acre is several bushels greater than when the seed is scattered broadcast by hand.

Manufacturers of tube drills have experienced great difficulty in making an apparatus that would not clog when sowing any kind of grain. The distributing apparatus was so constructed that the seed would be tumbled out three times as thick in some places as it should be, and not half enough in other places. A great many grain drills, *claiming* to be perfect in this respect, have been thrown aside as utterly worthless; but Brown's tube drill is so constructed that the grain must come out just so fast, and no faster; and I have never heard a farmer raise a single objection to it.

SEED PLANTERS.

There are numerous machines for planting Indian corn, beans, peas, cotton seed, and almost all kinds of vegetable seeds that are grown in rows or drills. At most agricultural warehouses hand planters, costing three or four dollars each, can be obtained. These small planters are adapted to distributing only the seeds of carrots, beets, turnips, parsnips, &c. R. & H. Harder, Cobleskill, New York, make an excellent seed planter for putting in all kinds of seeds. At the Albany Agricultural Works, Albany, New York, they manufacture the cheapest and most convenient seed planter that I have ever met with for performing all kinds of seed planting. It can be drawn by a horse, and one man can work it by hand when planting short rows. R. H. Allen & Co., 189 Water street, New York city, make the same style of planters.

At the west, Indian corn planters drawn by one or two horses, are extensively employed for planting the seed of this kind of grain; but at the east and north very few farmers plant their Indian corn with a machine. Numerous hand planters have been manufactured, and distributed by the thousand through the country. But nearly all of them have failed to give satisfaction.

Many eastern farmers steep their seed-corn and tar it just before planting, for the purpose of preventing birds pulling the young plants. Therefore, as it is difficult to plant tarred corn with a machine, corn planters do not meet with that favor with which they are received in the corn-growing States of the west, like Illinois, where more corn is planted by machines than by hand. Furthermore, on numerous farms, the land is too stony, rooty, stumpy, or the surface is so covered with sods that neither a hand corn planter nor one worked by a horse can be made to operate satisfactorily.

DOWLAW'S COTTON PLANTER.

There are several kinds of cotton planters in use in the cotton-growing regions of the southern States; but, like the Indian corn planters of the north and west, the largest proportion of them embraces a lot of worthless machines. The most reliable cotton planter which I have met is manufactured at Hawkersville, about twenty-five miles from Macon, Georgia. The name of the manufacturer I have not been able to learn. I have not met with a person who has used it who found

any fault with its operation. This cotton planter is constructed somewhat like a small wheelbarrow; the hopper holds about a bushel and a half of seed; with curved bottom of sheet-iron, and made into two parts, capable of being compressed or separated by rods and screws. The wheel has a crank and connecting rod which give a reciprocating motion to about a half a dozen long teeth that pass just through the division of the box. The two sides can be screwed together so as to put half a bushel or less of the seed to the acre; or the orifice can be opened so as to sow three bushels or more if desired. The long teeth pull down the cotton seed as they move to and fro, and secure its dropping regularly.

This planter opens the furrow and sows the seed at the same operation when drawn by one horse or mule. It has also an attachment for distributing guano, bone dust, or other commercial fertilizing matter, which is so arranged that the guano even in windy weather may be dropped so closely to the ground that none of it will be blown away by the wind. This planter may be constructed so as to cover the cotton seed as fast as it distributes it; but by many of the most successful cotton-growers it is not thought the better way to cover the seed with the planter, especially where the land is liable to bake after a heavy rain, so so as to form an impenetrable crust on the surface, which prevents the young cotton plant from coming up.

HISTORY OF MOWERS AND REAPERS.

Most people take for granted that reapers and mowers are of quite modern invention; but such a conclusion is far from being correct. Others have supposed that some American Yankee first conceived the idea of constructing a machine for cutting grain with horses or oxen; but history informs us that reapers were in successful operation before Christopher Columbus discovered the Western Continent; and that the sickle and the scythe, in some of the oriental countries, had been superseded by reapers that were worked by one or two oxen in the early part of the Christian era.

The first account of a machine to reap grain appears to be that given by Pliny the Elder, who was born, it has been supposed, about the year of our Lord 23, more than 1,800 years ago. This historian says: "There are various methods of reaping grain. In the extensive fields of the lowlands of Gaul vans of a large size, with projecting teeth on the forward edge, are driven on two wheels through the standing corn, (oats and barley are called corn,) by an ox yoked in a reverse position, with the machine forward of the ox. In this manner the ears (or what we call heads of barley or panicles of oats) are torn off and fall into the van. In some places the stalks are severed in the middle by sickles, and the ears or heads of grain are stripped off between two hatchels."

Palladius, an eastern ecclesiastical writer, gives the following account of reapers in A. D. 391. He says: "In the Gallic lowlands they employ a more expeditious method of reaping, requiring the assistance of a single ox during the whole of harvest time. A cart is constructed, which moves on two wheels. A low box of boards is constructed on the wheels and the boards in front are lower than the rest. Behind this cart two shafts (or thills) are fastened like the rods of a sedan chair. To these an ox is yoked and harnessed, with his head turned toward the cart; and the ears, or heads, are gathered in the box, the driver regulating the elevation and depression of the teeth with a lever."

The next account of a reaper is given in proposals submitted in Britain in 1785, for constructing a reaper. This machine was propelled forward by a horse or ox, clipping the heads of grain and depositing them in a large box, which was emptied into a storeroom when full. In the details of this machine, a drive-wheel, pulleys, pinions, tooth wheels, and iron combs or teeth are spoken of. In 1799 another reaper is spoken of as being propelled by a horse, hitched behind it, which cut and laid the grain in a swath on one side of the reaper. A boy could manage the machine, and with one horse could cut a swath about two

feet wide, or rather more than could be reaped in the same time by six men with sickles.

In 1806 Mr. Gladstone produced a reaper for cutting grain, delivering the straw into gavels to be bound. Drive-wheels, pulleys, bands, &c., are alluded to in the details of this reaper.

In 1807 Mr. Plunckett constructed a machine in which a horse *drew* the machine instead of *pushing* it forward, according to the usual custom of operating reapers. After this period many inventors entered the field with reapers of an improved construction, and in 1822 Mr. Mann, under the auspices of the Highland Society of Scotland, brought forward a new reaper, which was worked with one horse, and which could reap ten acres in ten hours.

As nearly as I can remember, when I was about six or eight years of age, in 1826 or 1828, Thomas Chadwick, an ingenious mechanic of Genoa, Cayuga county, New York, constructed a rude mower, to be drawn by one horse. This machine consisted of a wheel playing close to the ground horizontally, having numerous scythe-like knives extending out from the periphery, like the spokes of a wheel. A drive-wheel imparted the necessary motion to this wheel armed with numerous scythes.

I never learned what was the cause of its failure, but since becoming a man, although I never saw the machine, I do not want to inquire why a mower constructed on that principle will not operate satisfactorily.

In 1830 a mowing machine was produced, and soon after a combined reaper and mower is spoken of. About that time the celebrated McCormick reaper entered the field, astonishing Americans, as well as the farmers of the Old World. From that time to the present day, reapers and mowers of innumerable forms have come into existence, many of which have ended in total failure, while others have proved a triumphant success.

IMPROVED MOWERS.

Although most of the mowers that are now manufactured extensively seem to be almost as perfect as machines can be, still there is room for further improvement in many of the working parts of some of the machines; and though there are many excellent implements in the Old World, the United States beats the whole world in the line of mowers, and probably reapers. It has been stated, on reliable authority, that during the year 1866 more than eighty thousand reapers and mowers were manufactured in the United States alone. In 1864, I ascertain that more mowers and reapers were manufactured in the county of Cayuga—and most of them in the city of Auburn—New York, than in any other city or county in the world; and the manufacturers of this kind of farm implements at Auburn continue to turn out a greater number of excellent machines annually, than are made in any other county in America.

Our mowing machines work beautifully. No fault can be found with the mowing. Fortunes have been expended in bringing some of them to their present state of perfection. No talent, nor time, nor experiments, nor money, have been spared in bringing out a most perfect labor-saving implement. Many men have invested all they were worth in stock for making a machine that would beat the world, and met with a grievous failure, simply because they did not understand what was requisite in order to make a perfect machine.

The reader will doubtless inquire, "Which is the best?" No man is able to answer that question satisfactorily. The "Buckeye," manufactured by Adriance & Platt, New York city, as a mower, according to the decisions of committees at trials of mowers, stands without a superior. Next comes the "Clipper," manufactured by R. H. Allen, 189 Water street, New York city. Mowers similar to them are manufactured so extensively over the entire country that it is unnecessary for me to allude to any of them, as our mowers are as perfect as we can desire.

THE NATIONAL REAPER AND MOWER.

As there is such a great variety of reapers and mowers, as well as machines that will only reap, or only mow, and as the largest proportion of them operate quite satisfactorily, I had determined not to give any illustrations of reapers or mowers. But I was so favorably impressed with the simplicity of the improved

National Mower and Reaper, invented by Ridgeway, Fox & Co., 505 West Pratt street, Baltimore, Maryland, that I could not forbear giving an illustration of this machine, rigged for mowing.

This machine is made principally of the very best wrought iron and steel. The main bar is one continuous piece of wrought iron, formed in such a shape as to make a complete frame and cutter-bar. The motion is produced by conical cams in the driving wheel, into which fits a chilled iron conical roller, revolving upon the end of a strong wrought-iron and steel crank, which connects with and gives motion to the knives.

It may be seen by the illustration that there are no gear-wheels nor pinions in this machine. It is a combined machine, and has a self-raker attached, which is said to be strong, simple, and very effective.

As this machine has so few parts, and will reap, mow, and rake off the grain, in a satisfactory manner, and combines all the requisite qualifications of strength, lightness, durability, simplicity of construction, and some other things which constitute a perfect machine, it cannot fail to supplant entirely some other mowers and reapers that will struggle long and desperately for existence.

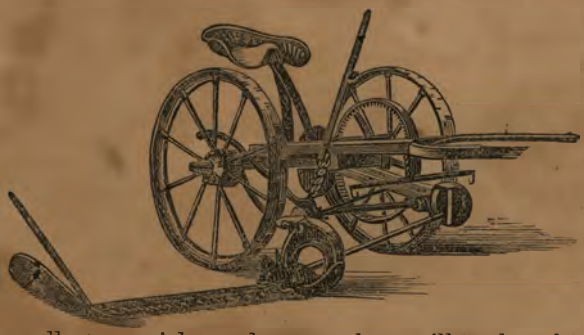
There are thousands of farmers, having but a few acres of land, who are not able to purchase a separate machine to mow and another to reap only a few acres of grain and grass. The machine, therefore, that will adapt itself to the various kinds of work to be done on small farms, is an implement that is, and ever will be, in excellent request all over our country. A machine that a farmer can work alone—that he can mow with, reap with, and that will leave his grain in gavels—is really a labor-saving machine of great value. The implement, therefore, that is the simplest, the cheapest, and at the same time quite as effective as more expensive machines, is the machine for the million.

ONE-HORSE MOWERS.

There are a great many farmers who keep only one horse, and who cut but a small number of acres of grass. If they have a one-horse mower the single

horse can mow all their grass with ease. But if they are required to employ a two-horse mower they cannot always cut their grass at the most suitable period for making the best quality of hay.

To supply the demand for one-horse mowers, R. H. Allen & Co., 189 Water street, New York city, have brought out the one-horse "Pony Clipper," represented by the accompanying illustration. The machine is guided by a pair of thills, hung on a swivel for the purpose of accommodating the horse and the mower when cutting grass on a side hill or along a bank.



I have seen this machine when mowing heavy grass, drawn by one good horse, and it mowed its acre in about seventy minutes, performing its task fully equal to any two-horse mower that is manufactured in the country. The entire machine is made in a neat and workmanlike manner, and of excellent materials; and a strong horse will work such a mower without suffering more fatigue than he would ploughing a stiff sod, when two horses are attached to one plough.

This "Pony Clipper" took the first premium at the great trial of the New York State Agricultural Society, at Auburn, New York, 1866.

A one-horse mower is also manufactured by D. & M. Osborn & Co., Auburn, New York, which has given excellent satisfaction, where a man has only one horse and but a few acres of grass to cut. If a farmer has two horses, or a yoke of oxen, he will always find a two-horse mower more convenient and satisfactory than a one-horse machine, as with a two-horse machine he can drive his haying; but if grass be heavy, and the weather hot, a light horse will make slow progress mowing.

As the Clipper is made chiefly of iron and the proportions well adjusted, and as the design is tasteful, this is a very attractive farm implement.

IMPROVED IMPLEMENTS FOR HANDLING HAY.

There are several kinds of complicated implements for loading hay, after it is cured, but up to the present time of writing there has been nothing brought out and perfected to such a degree that I feel willing to recommend it as worthy of universal adoption, or that will pay farmers for the expense and trouble of making and keeping such machines in working order.

Messrs. Niles & Gillett, Little York, Cortland county, New York, had a hay-loader in operation last season which was supported on two wheels attached to the rear end of the wagon. A kind of sweep-rake gathers the hay into bunches, when a horse fork, let down from a crane, lifts the forkful on to the load. The hay is elevated by winding the rope around a windlass attached to one of the wagon wheels. The pitching must be performed when the wagon is moving; when standing still, the pitchfork cannot be operated. When hay is in cock, or when pitching grain, the fork is thrust into the straw, and the wagon is started, the hay elevated, and the forkful swung around over the load and dropped about the middle of the rigging or load. There is no mistake about the operation of the machine. It will perform all that is claimed for it, so far as raking and pitching are concerned. But whether it will pay on an ordi-

nary farm to make use of such a machine is still a question. The machine has not been tested sufficiently to warrant the indorsement of a labor-saving implement. See remarks under the head of labor-saving machines on another page.

There are two other hay-loading machines which operate differently from the one just described. I regret having lost the names of the inventors. One kind is supported on two wheels, and attached to the rear end of the wagon; the other is secured to the fore end of the wagon. In both machines a system of revolving rake teeth gathers the hay and carries it to the top of a kind of straw carrier, when the rake teeth release their hold, and the bunch of hay carried up by each set of teeth rolls over into the end of the rigging or hay rack. One of these machines was operated by driving lengthwise of a windrow of hay, when the numerous rakes attached to the endless belts carried up a stream of hay so rapidly that the loader could not manage it as fast as brought up.

Another kind of loader gathers the hay when it is spread out over the ground, and deposits it in a perpetual stream on the fore end of the wagon.

As all these machines are comparatively new, I have suspended my judgment in regard to their practical value as labor-saving implements. Machines may be practical, fully capable of performing certain operations, yet the character of the work may be such that it will not pay to employ expensive machinery to relieve manual labor. If we had no storms of rain to interfere with making hay, and farmers could always calculate on having their hay in the windrow, or in cock, or spread out, it would be less difficult to employ machinery to place the hay on the wagon.

I do not decry these hay pitchers. If they had been in use sufficiently long to gain the favor of farmers, I would gladly record all that might be said in their favor.

HICKS'S HAY ELEVATOR AND CARRIER.

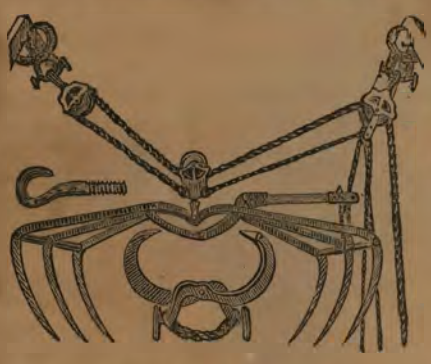
Almost every farmer knows how laborious and expensive it is to carry hay to the further end of a hay barn, or to the back side of a broad hay-mow. In some instances four or five men are required to pitch the forkfuls from one to another, which is always a very tedious and expensive way to convey hay to a distant part of the mow. The following illustrations will furnish an intelligible idea of the various parts of the elevator and carrier. It was invented by Isaac Hicks, North Hempstead, Long island, New York, and was introduced by John H. Chipman, Utica, New York This elevator and carrier can be readily applied to carrying any other material in a horizontal direction. If a hay barn be two hundred feet long, the hay may enter at one end and be carried in large forkfuls as fast as a horse can walk, to the further bay; or the forkfuls can be dropped at pleasure, wherever the man on the mow choses to have the hay deposited.

An inclined railway is made from a point over the load to the further side of the mow, consisting of a track made of two by five inch plank fastened to the rafters a few inches below the ridge of the barn by one and a half inch square

strips and twelve-penny nails. Upon this track runs a car, and a rope passes through it and through a catch-pulley attached to a horse hay fork, then back to the car; the other end passes back to the end of the barn, and returns through pulley wheels to the barn floor, to which end a horse is attached. A cross section of the railway is shown at Fig. 3. Pieces are spiked to the rafters, to the lower ends of which the planks are secured. Braces are nailed to the rafters and to the hangers to keep the track from spreading.

By a peculiar arrangement of the car, it is held in position on the track over the load until a forkful of hay is elevated to it, when it is liberated from its position and the fork made fast to the car in one operation; then it moves on the track very easily to any desired point. The operator, by pulling a cord, trips the fork, and the horse turns around and walks or trots back to the place of starting. The car is pulled back to its position by the trip cord, when the fork descends for another load. The fork comes back so easily and quickly that the horse can be kept in motion continually, elevating from 300 to 400 pounds of hay and carrying it forty to fifty feet, in a horizontal direction, and returning for another load in less than a minute.

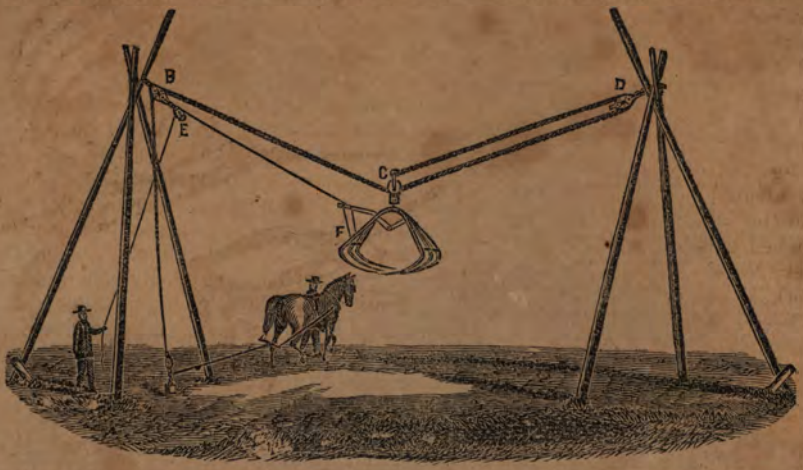
Almost everything is performed automatically where a fork is used with this elevator and carrier, which may be employed in unloading coal, when it is desirable to carry it fifty or a hundred feet in a horizontal direction. By having two movable pulleys attached to the coal tub, one horse can elevate 800 pounds of coal quarter as fast as he walks; and as soon as the tub reaches the car it is made fast to it and moves off horizontally as fast as the horse walks. The operator on the boat, by a trip-cord, upsets the tub anywhere, and pulls the car and tub back. The driver having unhooked the rope from the whiffletree as soon as the cord falls, drives back to the snatch-block and hooks on his rope again; the tub descends at the will of the operator, and is unhooked and a loaded tub hooked on. The car for coal should be made larger and stronger than the one for hay.



The illustration, figure 1, herewith given, represents the manner of securing the fork and pulleys to the rafters by means of two grapples, one of which is shown at figure 3, which is capable of receiving a large rafter. Figure 2 is a representation of a screw-hook, which may be screwed into a beam or post wherever it is desirable to secure a fixed pulley. Such a hook is screwed into the sill of the barn, and a pulley is attached to it; and the slack rope to which the horse is hitched is worked in this pulley.

The accompanying illustration represents the manner of arranging "gin poles" for the purpose of pitching hay on a high and long stack. Let us suppose, for example, that a stack is to be thirty feet long; then set up the gin poles at least forty-four feet apart, in order to allow a load of hay to pass between the end of the stack and the poles at A. The rope passes from the horse under the pulley at A, over a pulley at B, under a pulley at C, around one at D, when the end is secured at C. The operator draws the fork to him at A, and thrusts it into the hay. The horse is then started, when the forkful rises towards E, until it is sufficiently elevated to move off over the stack. The person on the stack thrusts his fork into the forkful, and pushes it either to the right or left, giving a signal, at the same instant, to the man on the load to jerk the cord and drop the hay, wherever the stacker desires to have it deposited. This saves a vast amount of laborious pitching. Besides this, a stacker can construct a stack that will settle more

uniformly when hay is pitched by a fork arranged in this manner than when laborers are required to do it by hand.



This illustration shows how three poles may be secured at the upper ends by clevises. The poles for such purposes should be long and light. The upper ends need not be more than three inches in diameter. The upper ends of the poles are kept from being drawn over towards each other by lashing the lower end of one pole to a strong stake in the ground.

It affords me pleasure to speak of the eminent efficiency of this apparatus, as I have used the different parts with my own hands, and know them to be great labor-saving machines.

Another self-sustaining horse fork may be used with this apparatus instead of Raymond's grappling elevator. This fork took the second premium in class 1st at the great trial of horse forks held at Rye, Westchester county, New York, March 4th and 5th, 1867.

WALKER'S HARPOON FORK.

Fig. 1.

Fig. 2.

The illustration herewith given represents a harpoon fork that has been in extensive use sufficiently long to test its merits. Large numbers of them have been manufactured by Wheeler, Melick & Co., Albany, New York.

The manufacturers say of this style of fork that it stands unrivalled among the various kinds of horse forks. Having been put in use the past season by nearly 15,000 practical farmers, who speak of it in the highest terms of praise, it is unnecessary for us to speak of its merits.

This harpoon fork is made of iron and steel, weighing only a few pounds. After it is thrust into the hay, the part forming the point is turned up at a right angle so as to hold the hay or straw.

PALMER'S HORSE FORK

The illustration herewith given represents an independent fork, with sickle tines, which is considered one of the best horse forks ever invented. Some farmers will have no other style of fork, feeling assured that this has no equal. It is light, strong, and easily handled by a small boy or feeble man, and can be used where hay can be pitched with any other horse fork. Rev. Nelson Palmer, Hudson, New York, is the inventor, and I think Wheeler, Melick & Co., Albany, New York, manufacture it. It is also manufactured by parties in Chicago, Illinois.

This Palmer fork, at the great trial of forks under the auspices of the American Institute, March 4 and 5, at Rye, Westchester county, New York, received the first prize, as being the best fork in the country for all kinds of work. The committee thought that this fork would pitch hay and other material equal to any other fork, and would excel all others when pitching coarse manure.

BUCKMAN'S GRAPPLING FORK.

It will be observed by the illustration, representing Buckman's horse fork, that this fork is more complicated than any others that I have noticed.

The tines are made of steel, and the heads of the forks, arms, and levers are all of iron. After the forks have been thrust into the hay, nearly in a perpendicular direction, as the upper ends of the levers are drawn together, the forks approach each other, and the lower ends of the tines are lifted so as to stand nearly in a horizontal position.

The inventors claim that by this arrangement of the different parts of the fork, an advantage is gained over the other forks for pitching fine hay, short, loose grain, fine straw, and any other material that will not hang together like flax straw.

By simply changing the fork head for a grapple head, which is furnished with each at a trifling additional cost, it may be used for raising baled cotton, tobacco, hops, barrels, boxes, and all other heavy baled or boxed articles. It is capable of raising 600 pounds with ease and safety, and it will grapple and hold any article not exceeding 3 feet in width. A large number of farmers have pronounced this fork the best in use for all kinds of work.

IMPROVED HARPOON FORK.

The accompanying illustration represents still another style of harpoon forks,

having two barbs. These forks are made of steel, are light and strong, and will operate with satisfactory efficiency. The figure at the left hand represents the fork as it appears when thrust into the hay.

The illustration on the right hand shows the fork with the barbs spread, as they are arranged after the fork is thrust into the hay. This kind of fork is manufactured by H. D. Rogers, Pittsburg, Pennsylvania, and by W. H. Field, Portchester, Westchester county, New York. I have handled this fork, and it pitched unusually large forkfuls at the trial of forks to which I have alluded in other parts of this chapter.

COMBINED FORK AND KNIFE.

The horse fork and knife herewith represented was invented by Kniffen & Harrington, Worcester, Massachusetts. Persons who have used this style of fork for pitching hay, and the knife for cutting down hay mow or stack, speak of it in high terms. The manufacturers affirm that it is the most useful implement for cutting down and pitching hay that was ever invented, as the knife is more efficient than any hay knife ever before constructed. The directions for using it are as follows: Put the fork into the hay when shut, then open it, when it is ready for working. A small rope passes over the pulley in the main fork stem, and fastens to the short handle, which, when drawn by the operator, drops the hay. When cutting hay on mow or stack open the fork and press it into the hay the depth you wish to cut, then shut and draw it out; repeat this, being careful to enter the knife so as to cut all the hay. Full six inches may be cut each time the knife can be put in. Care should be taken to keep the knife sharp when using. When sharpening the knife grind only on the outer side of each blade, or the same as when sharpening a pair of shears. To load a

wagon from a mow, cut down about two feet deep, six feet long, and of convenient width, insert the fork shut into the centre of the block, then open it and drive ahead.

A combined hay fork and knife similar to this is made by S. E. & B. Sprout, Muncy, Lycoming county, Pennsylvania, which drew the second prize at the trial of forks at Rye, Westchester county, New York, March 4 and 5, 1867, under the auspices of the American Institute. This fork, at the trial of implements held under the auspices of the New York State Agricultural Society, July 10, 1866, pitched off 1,810 pounds of hay over the large beam at five forkfuls, in two minutes and forty-five seconds. When pitching under the beam, the same fork removed 2,000 pounds of hay in one minute and forty-one seconds. The hay hangs to the shoulders or hooks in the sides of the blades.

WHICH IS THE BEST FORK.

Every farmer will, doubtless, inquire which is the best fork. The answer can be given in a few words, namely, the one that will pitch all kinds of hay, straw, or loose grain. A farmer does not wish to incur the expense of two horse forks. This is not necessary when there are forks that will pitch any material in the most satisfactory manner. A fork of almost any style will pitch long hay or loose flax that will hang together like curled hair. Every practical farmer will readily appreciate and understand the requirements of a horse fork when I allude to material to be pitched.

We sometimes have short oats—so short that the straw is not long enough to make bands for binding the bundle. Barley straw is frequently so short and slippery that one almost wants a huge scoop shovel for handling it. Besides these, some farmers have rowen to pitch, which is almost as short as chaff. The straw of red clover seed and of white clover seed is sometimes so short that it is exceedingly difficult to pitch. Many farmers use a grappling fork for loading long manure on a wagon; and in some instances they save a vast deal of hard labor by making a horse or two horses perform this laborious task.

Here, then, we have the facts for enabling us to decide, without a trial, which is the best fork. A harpoon fork can hold only a small bunch of short, slippery barley straw, a small bunch of oats, or a small forkful of short clover straw; and a man can pitch manure faster by hand than he can with a horse and a harpoon fork. But a grappling fork will hold a large bunch of any fine hay, short and slippery barley, short oats or long coarse hay, and although a grappling fork cannot be employed satisfactorily in pitching all kinds of manure, still if manure of any kind can be pitched at all with a horse fork, the grappling fork will give the best satisfaction. For some kinds of work, the harpoon fork may be preferable.

These suggestions might be greatly prolonged; but I trust I have recorded a sufficient number of hints to enable most farmers to choose a fork that will always operate satisfactorily.

THRESHING MACHINE.

Our threshing machines are as perfect as they can be made. It is truly surprising to witness their eminent efficiency for threshing any kind of grain. We have one-horse, two-horse, three-horse, and ten-horse powers. The first one that demands our notice is a two-horse railway power with a separator and cleaner, which is manufactured by R. & M. Harder, Cobleskill, Schoharie county, New York.

These machines have gained a wonderful popularity; and they are becoming more and more popular all over the country. This kind of powers and threshers is gaining favor at the west very rapidly, and I am inclined to think that the

day is coming when the railway horse-powers will entirely supplant the sweep powers. The first question that is almost always asked is: wherein does Harper's power differ from Wheeler & Melick's? They are substantially the same. The platform wheels of Harder's power are larger in diameter than those on other machines. It is therefore contended that a horse of a given weight will be able to exert more effective force with wheels of that size than if smaller ones were substituted. Other manufacturers dispute this point.

The thresher is an over-shot machine; and the entire machine is the very paragon of perfection. With two horses such a machine will thresh from 300 to 500 bushels of oats per day of ten hours, and half that quantity of good wheat, and deliver it clean and ready for market.

When ordered each thresher is built with a dust flue, for the purpose of protecting the man who feeds the machine from the suffocating dust which is often so injurious to any person who has sensitive lungs. This dust flue is simply an open passage or flue outside of the concave over the cylinder. The dust enters the flue in front of the machine and is carried out over the cylinder with the straw. This is said to be a complete preventive of the dust flying in the feeder's face.

WHEELER'S RAILWAY POWERS AND THRESHER.

Messrs. Wheeler, Melick & Co., Albany, New York, manufacture railway horse-powers for one horse, for two horses, and those sufficiently wide to admit of three horses abreast.

I cannot recommend this machine too highly. When I was on the farm I purchased a one-horse power. It pleased us well, but I soon procured a two-horse power, which gave excellent satisfaction. I used that power for almost every purpose. I threshed all my grain with it; threshed and hulled my clover-seed; chaffed all my fodder; sawed the firewood with a circular saw; worked the drag saw; ripped out laths and all kinds of lumber when building my house; shelled Indian corn; turned the grindstone, and drove my turning-lathe.

The three-horse power differs from the two-horse power only in having a middle support, which is constructed by placing iron rollers under the centre of lags, which carries two-thirds of the weight of the horses, rendering it even more durable than the two-horse power. It is also well adapted for two horses, and is easily transported, its weight being but about 250 pounds more than the ordinary two-horse power, and can be mounted on common wheels and axles, by means of frame and windlass, by which one man can load and unload in a short time.

The three-horse powers are employed quite extensively for the threshing of grain and sawing firewood. With three good horses, a set of hands can saw as much firewood as can be sawed by a ten-horse sweep power with the same saw

The erroneous idea that such powers are "horse killers," does not meet with much favor among intelligent farmers. I used a span of horses on one of Wheeler's machines for more than ten years, and I know it never injured them any more than to travel on the ground. I have seen it stated in print that the use of such powers is as cruel as slavery. I am certain that the men who make such assertions are not the proper persons to give an opinion on such a subject, as I think they have never used such horse-powers for any considerable length of time.

PALMER'S CLIMAX THRESHER.

One of the most ingenious and useful threshing machines in the country is represented by the accompanying illustration of "Palmer's Climax Thresher,"

which has been sufficiently tested to satisfy every one who knows what is required in a good thresher, that it is a machine of superior excellence. I have not only seen this machine in operation, but I have fed it with my own hands; and I know it to be all that can be desired in a machine that is designed for preserving the straw straight and unbroken. In those parts of the country where rye is grown more than any other grain such a machine is eminently desirable, as it will deliver the long straw in straight gavels more evenly than it was before the grain was threshed out.

The machine consists of two drum cylinders about five and a half feet long and fourteen inches in diameter, made to revolve towards each other. The cylinder that threshes the grain is corrugated on the surface, and revolves close to a corrugated concave, which can be screwed up so closely to the cylinder that it is impossible for a head of any kind of cereal grain to pass through without being threshed. The other cylinder is furnished with spikes which carry the straw down between the cylinders, dropping a small quantity at once, right at the entrance between the corrugated cylinder and the concave.

The unthreshed grain is fed sideways into the machine instead of lengthways.

If some of the straws enter in a diagonal direction, they will be brought out straight. The straw is carried by the carrier beyond the rear end, where it is deposited in gavels of any desired size. When the machine is in operation, two active laborers will bind the straw as fast as the machine threshes it.

Straw threshed with such a machine is much more valuable in market than if it had been threshed with a machine that breaks it into short pieces; and more than this, the bundles can be stored in a smaller space, and it is more convenient for being fed into a straw cutter after being threshed.

This machine will thresh all kinds of cereal grain as fast as spiked machines; and when the straw is long and heavy, I think it will thresh faster, with the same power, than the other threshers which shell out the grain by means of spikes.

Two horses will drive such a machine, when attached to a railway power, and do a fair business, but a three-horse railway power will give the cylinders a furious velocity; and an active man will be obliged to work lively in order to feed the machine to the capacity of the thresher.

The reason why such a machine will thresh long heavy straw more rapidly than a spiked thresher, is, that a large proportion of the effective force of the team is absorbed in breaking the straw to pieces by means of the spikes, while the corrugated cylinder works the long straw through the machine with the expenditure of little power.

With spiked machines, more of the effective force of a team is absorbed in breaking the straw to pieces than is required to thresh out the grain.

IMPROVED HORSE RAKES.

The improvements in horse rakes are as various as the machines are numerous. It seems as if inventors had exerted themselves to the utmost to devolop some-

thing new in the shape of a horse rake. There may be a better kind than the one here represented; yet whoever gets one of this style of steel-toothed rakes, may feel assured that he has a good implement. This rake was invented and

manufactured by Messrs. Sprout, at Muncy, Lycoming county, Pennsylvania, and has taken several premiums at State agricultural fairs a the best rake.

A spring toothed rake of superior excellence is now manufactured by Dodge & Co., Auburn, Cayuga county, New York.

TRACY'S REVOLVING RAKE.

The best rake, according to my idea of horse rakes, for all kinds of work, is the common wooden-toothed revolving rake, attached to a sulkey, on which the operator rides, as represented by the accompanying illustration, holding the rake

with one hand, by means of a lever and spring latch, both of which the driver manages easily with one hand. This improvement was brought out by H. N Tracy, Essex Junction, Vermont. I think this style of rake possesses advantages over the steel-toothed rakes which render it pre-eminently superior to any other rake now in use. I will allude to the points of superiority. It will rake wheat or barley stubble cleaner than the steel-toothed rakes, and will not tear up the young and tender grass, nor collect so much grit and dirt among the straw and hay as a steel-toothed rake. With this kind of wooden-toothed revolving rake peas can be raked, before the vines are mowed, into close winrows; and red clover seed can be raked cleaner, when the straw is very short, than can be gathered with any other rake, as the wooden-toothed revolving rake gathers and holds heads of clover and short hay more advantageously than most others.

CLOVER THRESHERS AND HULLERS.

Only about thirty years ago clover seed was removed from the chaff by the slow and laborious operation of pounding it out with the flail. A faithful and strong laborer who could ply the flail from morning till night was thought to perform a fair day's work if he hulled one peck, or fifteen pounds, of clean clover seed, during that period of time. In some instances farmers would tread the seed out with horses and colts. The heads were separated first from the straw, then

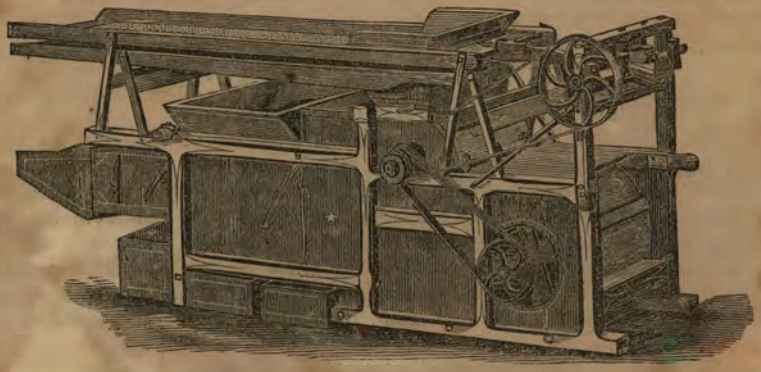
all the horses and colts that could be collected on the farm were put on the barn floor and kept moving round and round, day after day, on the chaff. It was a long and tedious job to hull clover seed. The feet of the animals, by constant attrition, wore the chaff through to the seed, and most of it would separate readily from the chaff when it was passed through a fanning mill. After the job was pronounced finished, there still remained one-fourth or more of the seed in the chaff, which was sowed chaff and all. Cleaning clover seed was an exceedingly dirty and unhealthy job, on account of the offensive dust which always arises when the seed is being hulled.

The first step towards cleaning seed by machinery was accomplished by one of the most rudely constructed machines. It consisted of an upright wooden shaft, about one foot in diameter at the lower end, and larger at a distance of four feet from the floor. A portion of it was turned off true, and covered with pieces of tin been punched full of holes. The rough side of the tin, similar to a grater, was on the outside of the shaft cylinder, which made one revolution to one circuit of the horse. This grater-shaft worked in the centre of a concave, extending entirely around the cylinder, and the inside was covered with perforated tin, which presented a rough surface. The chaff was forced in at the top, and came out slowly at the narrow opening between the cylinder and the concave at the lower end. With such a rude machine a man and a horse could hull one bushel of clean seed in a day. This was the commencement of hulling clover seed by machinery. After this a cylinder, revolving horizontally, and having the periphery covered with band iron, with the surface of the iron prepared like a rasp, was brought into use. The concave was also covered with iron, having a rasped surface. The concave of such machines can be adjusted by a screw, so that the chaff is stripped from the seed without injuring the kernels.

At the present day hulling clover seed can be performed so expeditiously that farmers do not dread to raise it as they once did.

WESTINGHOUSE'S IMPROVED CLOVER HULLER.

The illustration herewith given represents a clover huller made by G. Westinghouse, Schenectady, New York. It is difficult to pen a description that will enable the reader to understand it perfectly.



This huller is designed to be used for simply hulling the seed after the heads have been threshed off the straw. It performs the work with great rapidity and neatness. The chaff, when it leaves the huller, contains no seed that is of any value.

The combined huller consists of a thresher, huller, and cleaner, which are all in one frame, and the whole entirely covered and arranged for use on a wagon. A pulley on the hulling cylinder receives the belt from the power, and belts from

this cylinder connect with the other machinery, so that the entire operation of threshing, hulling and cleaning is done at one time. The manufacturers say:

"We have experimented extensively with different plans of making the hulling cylinder and concave, and have found that for durability and efficiency there is nothing superior to a closely spiked cylinder, with spikes case hardened, and an iron concave, and have therefore adopted this plan in our machines. Particular attention has also been given to the cleaning part of our machines. The sieves are long and wide, and so arranged that little, if any, seed will be carried over them. The shoe that holds the sieves receives a back and forward motion directly from the fan shaft, requiring but little power to operate it, cleans the seed, and delivers it at the side. The bolt attached to the huller and cleaner removes the straw left in the clover by the thresher, and feeds the cylinder evenly. It is considered indispensable by all who have used machines with it. An elevator is attached to the combined thresher, huller, and cleaner, for returning clover to the hulling cylinder which has not been perfectly hulled the first time through. We make two sizes of these machines—No. 1, thirty-six-inch cylinder, and No. 2, twenty-seven-inch cylinder. The combined threshers, hullers, and cleaners require from six to ten horse-powers, and the hullers and cleaners two and three horse endless-chain powers, or four to six horse lever powers. Their capacity depends very much upon the quality and condition of the clover, varying with the large machines (No. 1) from ten to forty bushels, and with small ones (No. 2) from five to twenty-five bushels per day.

"Clover is perhaps the most variable of any grain as regards yield and condition in which it is necessary to prepare it for market. Many times it is wet, so that it is almost impossible to rub the seed from the heads; and again, the yield is so light that an immense bulk of chaff has to be put through a machine to obtain a little seed. This variableness makes it impossible to have a machine work equally well at all times in it, and we do not claim that the machines we make will do so."

Similar clover hullers are manufactured at Chicago and other western cities. Good farmers feel that it is so much better to have their clover seed clean when they are sowing it than to scatter it in the chaff, that a clover huller is a machine of great value. In many localities, where large crops of clover seed are grown, the large combined ten-horse machines thresh and hull the seed at one operation. The tailings are returned to the huller until all the seed is hulled, and the light chaff is carried beyond the tailboard.

CHAFFING FODDER AND FODDER CUTTERS.

The improvements made in machines within a few years past for chaffing coarse fodder are numerous, but only a few of them are really worthy of notice here. A large number of devices have been patented for chaffing coarse fodder, but the number of cutters that are likely to come into general use or to give satisfaction is exceedingly small. Many good machines I shall not notice, because they are too complicated for common farmers and their laborers, who possess only ordinary ability to keep machinery in running order, and to operate such implements with skill and efficiency.

Some inventors and manufacturers have erred seriously in constructing fodder cutters by not understanding exactly what is required of a machine for chaffing stalks, straw, and hay. In some instances manufacturers have contended that a fodder cutter possessed merit just in proportion to its ability to cut or reduce fodder to a finely comminuted condition. But men who have a correct understanding of the management of domestic animals and of preparing their food, know that the fodder cutter that cuts hay or straw finest or shortest is by no means the most effective cutter.

In chaffing coarse fodder it is not necessary to cut the stalks as fine as has

been sometimes recommended in some of our agricultural journals, because experience proves that fodder digests much better after being macerated by the teeth of animals than when it is reduced so fine by a straw cutter that the stock swallow it without first crushing it between their teeth.

When corn-stalks are chaffed two inches in length a cow can masticate them with little difficulty, and there is no danger that the flinty portions will injure the animal; but when cut into very short pieces much more labor is required to do the chaffing, and the liability to injure the mouth by chewing the hard, flinty pieces of stalks is greatly increased. Short pieces of hard corn-stalks that have been cut off square by a straw cutter often wound the gums of an animal so severely that they will endure severe hunger before they will eat fodder prepared in that manner.

The stalks of Indian corn or sorghum should never be cut less than two inches long. When the pieces are longer than the diameter of the stalk they will always rest on their sides between the teeth of the animal. On the contrary, when the pieces are cut shorter than the diamoter of the stalks, the *ends* are presented to the teeth, and the flinty scale will enter the gums almost as readily as a scale of iron or glass.

There is really no advantage in chaffing prime hay for animals that chew the cud, while there is profit in cutting it one inch long for those animals that do not chew the cud, such as horses and mules. The advantage arising from chaffing prime hay for horse-feed consists in this, that the nourishment is rendered more available by being partially prepared for the stomach by some more effective mechanical means than the teeth. Horses and mules masticate their food before it is received into the stomach more than neat cattle or sheep do. Therefore there is greater need of coarse fodder being chopped for horses. Neat cattle and sheep chew their fodder but little until after it has lain in the first stomach until the hard particles have become quite soft.

Some manufacturers of straw cutters, in their enthusiasm over the merits of a new machine for cutting corn-stalks, straw, and hay, have even gone so far as to assert that it increases the value of coarse fodder sometimes one-half to run it through a straw cutter. This cannot be. If there is but little nourishment in hay, straw, or stalks of Indian corn, the simple process of chaffing the fodder by passing it through a cutter will not add to or take away from its nutritive value. If hay be poor and weather-beaten, no straw cutter will restore even a small part of the lost valuable portions that would have afforded nourishment to domestic animals. The principal advantage in chaffing coarse fodder consists in rendering the nourishment in the fodder more available than it would be were the coarse stalks not reduced fine by some mechanical means besides the teeth of the animals.

The machine therefore that will reduce the largest quantity of coarse fodder to chaff of the most approved condition, as to length of pieces of straw and stalks, with the expenditure of the smallest amount of force of teams or workmen, is the best machine for general use.

A large number of fodder cutters have been made with a knife having a reciprocating motion, up and down, most of which have failed to perform as satisfactorily as those cutters that operate with revolving knives. The grand difficulty with straw cutters the knives of which operate with a reciprocating motion, is, the knife prevents the advance of the material to be chaffed. The knife must rise to the upper side of the fodder in the feed box, before the feed rollers can force it forward. For this reason the straw or stalks to be cut do not have sufficient time to be forced forward as far as it is desirable to cut, at each stroke of the knife. Such machines will cut fodder very fine, but they operate amazingly slow. When driven with unusual rapidity some of them will not cut so fast as when the wheel is made to revolve at a slower velocity.

The philosophical reason for this is, the feed rollers do not move the fodder forward with a gradual motion, but they operate by quick jerks, which is not the

movement required for feeding rollers of a straw cutter. The rollers should move the straw forward with a steady and uniform motion.

Fodder cutters have been constructed with a knife playing up and down with a drawing stroke, across the end of the feed box. But the same difficulty was met with in machines of this kind, as, when the knife played up and down without any drawing stroke, the material to be cut could not be fed through as fast as it is desirable to cut it.

Another style of fodder cutter was operated by a knife attached to two balance wheels. The rims of the two wheels were about one foot apart, and both revolved in the same direction. The knife was secured to the wheels by wrist pins, similar to the connecting pitman that extends from one driving wheel of a locomotive to the other. The knife had a very drawing stroke across the end of a feed box. Little power was required to cut off a large box full of fodder. But the difficulty in the way of its success was, the knife prevented the fodder from being fed through as fast as it is desirable to cut it. This style of cutters is one of the most effective of all those that operate with a reciprocating motion, but mechanics and farmers have learned that in order to chaff fodder rapidly, they must have fodder cutters that operate with a rotary instead of a reciprocating motion.

REVOLVING FODDER CUTTERS.

The knives of a fodder cutter, in order to operate with great rapidity, must revolve. The knife or knives may be secured to the side or face of a wheel, or they may be attached to the periphery of a wheel or to cylinder heads. In either case, cutters are now made to operate with astonishing rapidity. In some instances circular knives have been attached to the side of a balance wheel; and machines are manufactured with straight knives, both of which shave off the fodder as it is forced out the end of a feeding box.

The circular knives gave more of a drawing cut, thus absorbing less of the effective force required to drive the machine than the straight knives. But as circular knives are much more expensive and require more skill to put the cutting edge in order, cutters with straight knives cost less and take the preference.

INDIAN CORN HARVESTERS.

In the western States there have been put in operation several horse "corn cutters," for cutting up the stalks of Indian corn, whether they are standing in hills or in drills; but up to the present writing such farm implements have not come into general use. Although it is claimed that such machines will perform their tasks in a most perfect manner, yet they must be considered as only experimental machines, requiring more or less remodelling and improving. In some instances only one experimental machine has been made, and the inventor is hoping that wealthy manufacturers will purchase territory, or pay a generous royalty for the privilege of manufacturing such corn cutters. A brief description of one of these implements may be given as follows: The frame is supported on two driving wheels which are placed sufficiently far apart for the machine to cut two rows. The machine is drawn by a single horse, and the driver rides on the machine. If the stalks stand erect tolerably well, they will be laid in gavels of convenient size for one man to handle with ease. If the stalks be heavy, and many of them laid badly, it is difficult to perform the work in a satisfactory manner.

I thought best not to give illustrations of any of these corn cutters in this chapter, as they have not been brought to that degree of perfection which is desirable for such farm implements.

CORN-HUSKING MACHINERY.

During the past year a machine has been introduced which is destined to

change the almost endless task of corn-husking into a rapid and attractive mechanical process. Such an implement has long been needed, and its introduction will afford a means of saving for the market hundreds of bushels of corn now wasted. Our enormous corn crop, amounting to nearly a thousand million bushels annually, is chiefly raised by the use of machinery. Manual labor only to a small extent is used in producing the crop up to the harvest time. Then commences the hand work. With large crops and costly labor, the corn-growers find it impossible to place the cereal in market at the most auspicious moment; much of the crop is, therefore, fed to stock without husking, and immense quantities are wasted. The husks, too, are mostly lost, because, to preserve them, every husk must be grasped by the human hand. Yet the husk crop is one of the most valuable which we produce. It would amount, if saved, according to the estimate of some persons, to not less than 8,000,000 tons annually; and would bring, at $15 per ton, $120,000,000. In Austria the husks make paper superior to that made from linen rags. The largest paper-mills in the world—those near Vienna—employ nothing but husks, brought from Hungary, and costing $40 per ton, about the price of white rags in the Austrian market. From the long fibre of the husk excellent cloth is made; from the short fibre paper of superior quality is produced, while the gluten of the husk makes excellent bread. These valuable articles are obtained to the extent of sixty per cent. of the entire weight of the husks employed. The machinery to which we allude affords a ready means of preserving these valuable substances. It receives the stalks as cut from the field, picks off the corn, cuts or bruises the stalks, and removes from the ears every vestige of husk and silk. The cleanly husked corn is deposited in one receptacle, the stalks in another, while a third receives the bright husks. The corn is thus made ready for the shelter, the husks for the baling press, preparatory to being sent to the paper-mills, while the stalks are improved for fodder. The work is done rapidly, a machine driven by one horse being capable of husking thirty bushels per hour. One man can turn the crank and feed the machine, and husk out about fifteen bushels an hour. The machine, as now constructed, weighs about 200 pounds, and costs $75. It is manufactured by Messrs. Frank Fuller & Co., 57 Broadway, New York city, and will be largely introduced the present year.

The husker, at first sight, resembles a fodder cutter. At one end of the frame which supports the machinery there are two rollers which revolve towards each other. The top roller is plain, made of hard wood, and some four or five inches in diameter. The lower roller is studded with stiff knives set securely into the surface, so that if the two rollers are screwed closely together they will cut the stalks into pieces about one and a half inches long. The stalks are fed between these rollers, but-ends first. When the but-ends of the ears arrive at the rollers, as they cannot pass through, the knives cut or pinch off the stem, when most of the husks pass through with the stalks, and the ear drops down on two small rollers, about two inches in diameter, which are set at an inclination endways, so that the ears, in slipping along in the depression made by the two rollers, have all the husks and silk stripped off them by the two rollers beneath the ear of grain. A small shaft, with small sharp spikes in it, causes the ears to revolve as they slide along, so that every side of the ear is presented to the rollers, when in motion, which seize every husk and all the silk, and strip them off as neatly as can be done by hand and with great rapidity. One horse will drive the machine to husk as fast as one man can place the stalks on the feeding box.

A point of transcendent excellence of this husker is, it will strip the husks from large ears and small ones with equal facility and neatness, without any alteration of the machinery.

Still another thing which farmers will find to be of eminent advantage by husking their corn with these machines is this: When the ears are husked by

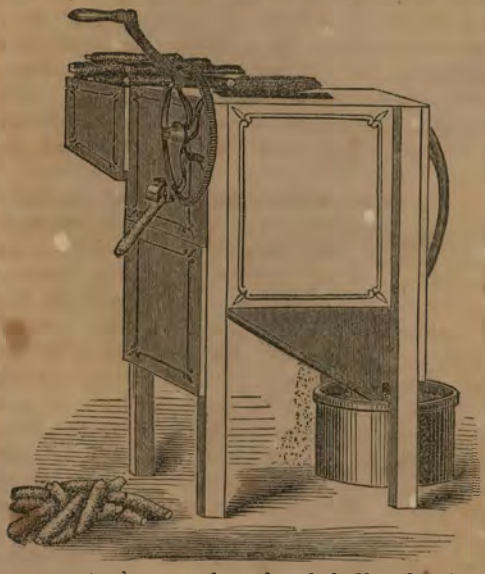
hand the stalks are always a long time in curing, as the pith is full of sap. But when the stalks have been run through the husking machine, the large ones are crushed so that the moisture will escape in a few days, and in less time than would be required to dry out and cure large whole stocks. The man, therefore, who husks corn with such a husker, will be able to dry and cure his crop of corn-stalks in a few days, and thus save a vast amount of excellent fodder which must be lost in curing if the large stalks are not crushed so as to allow the moisture to escape readily. It is the large amount of sap in the big joints and pith of the corn-stalks that causes the stalks to heat and mould after they have been secured in a stack or mow.

Another husker, which operates on the same principle, has two broad, endless aprons of India-rubber revolving together, and the husks and silk are drawn down between the belts or aprons exactly as they are taken off by the rollers in the machine previously described.

These machines are of recent invention, and they have not, as yet, come into general use, but I have been familiar with the husking of the experimental machines for several months past, and am satisfied that this husker is destined to work out a complete revolution in husking Indian corn. The mechanism of this machine will, doubtless, be greatly improved in a few more months. The principle on which it operates is the correct one, and it far transcends everything before invented for husking Indian corn.

THE BRINKERHOFF HAND CORN SHELLER, SEPARATOR, AND CLEANER.

Every farmer who raises Indian corn wants a hand-sheller and cleaner. Even if he raises several hundred bushels of this kind of grain, most of which is shelled with a horse-power sheller, a hand-sheller is always eminently desirable for shelling a bushel or two for culinary purposes or for seed. Our best farmers understand and appreciate these suggestions, as they know that seed corn will keep better in the ear than if shelled; and Indian corn always makes better meal, better mush, corn bread, or anything else, if the grain is not shelled until the time has arrived when it is to be ground into meal. Then with an efficient hand-sheller, a person can shell out a few bushels in as many minutes. Besides this, if a farmer has a convenient hand-sheller, laborers can shell his entire crop of corn during rainy days or leisure hours, when no other labor could be performed.



The accompanying illustration represents the very best hand-sheller that is manufactured, at the present time, in the United States.

This sheller has been in use but a short time; yet for ease, rapidity, and efficiency of operation, it is acknowledged by competent judges to have no equal. Shellers may hereafter be invented that will excel this one, but it is doubtful whether anything will be brought out very soon that will equal it.

The shelling is done by means of a horizontal cylinder about nine and a half inches in diameter at the ends, and twenty-two inches long. The cylinder may

be made of wood, and spiral rows of small spikes driven into the surface, the ends of which extend above the surface about one-fourth of an inch; or the cylinder may be made, in sections, of cast iron, as these are usually made, and bolted to cast-iron heads at the ends and at the middle. The cylinders are eight and five-eighths inches in diameter midway between the ends.

The cylinder makes seven revolutions to one of the crank. The balance wheel on the journal of the cylinder weighs fifteen pounds. There are twelve rows of spikes. Every ear is dropped on a table at the side of the cylinder; and several pressers attached to springs made of coiled wire press the ears up against the cylinder. As the rows of spikes stand in a spiral direction, they work the cobs to the other end of the cylinder and drive them out of a hole in the side of the sheller, as represented by the illustrations. A small metallic door is hung on hinges at the upper side of the orifice. This arrangement prevents the shelled grain from being scattered over the floor.

After the grain is removed from the cobs, it drops down on an inclined sieve, which separates the heavy chaff from the corn and delivers the clean grain ready for use, or cleaned for market, in a measure or box.

This sheller turns exceedingly easy, and it will shell green ordry, large or small ears, with equal facility as fast as one person can pick them up and drop them into the sheller. There are other kinds of shellers that will shell as fast as this one, but they will not separate and clean the grain.

HORSE CORN SHELLERS.

There are several kinds of horse corn shellers, both east and west, which shell this kind of grain, and clean it also, with astonishing rapidity. In some instances, in the west, a corn sheller is driven by a steam-engine, and the fire is made of the cobs. For a number of years the corn was only shelled and separated from the cobs; but now, cleaners are attached, so that the clean grain is all delivered in bags or measures. Shellers of this kind are manufactured in most of the large cities of the west. Power shellers of an excellent style are manufactured by some one at Penn Yan, New York.

CIDER AND WINE MILLS.

As so much attention is being directed to the cultivation of small fruit, cider and various kinds of domestic wines, numerous inventors have brought out portable mills for grinding the fruits and expressing the juice.

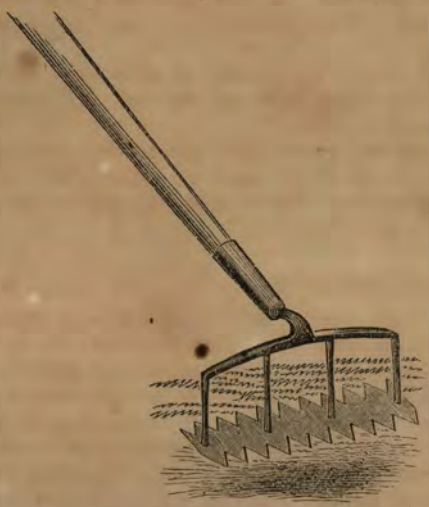
Most people want a cheap, efficient, convenient, and portable mill with which they can make a gallon of cider or wine, or larger quantities if desirable. There are several kinds that operate satisfactorily; but I believe the little portable mill illustrated by the accompanying figure, manufactured by the Peekskill Plough Works, Peekskill, New York, and by George E. Hutchinson, Cleveland, Ohio, stands pre-eminently at the head of the list, when everything is taken into consideration. This mill will grind apples, pears, and grapes, without crushing the seeds, which is an important point when making cider or wine. It will also grind all kinds of berries and cherries, and crush the pits without injuring the grinding apparatus.

Apples are first crushed, then ground into a fine pomace, which is discharged directly into the curb or into a pail. The grinding may be done by hand or by horse-power. The pressing is done by hand. The teeth of the grinder are so

arranged that no apples can clog between them. One man can grind several bushels of apples per hour, and make several gallons of any kind of wine per hour. This machine can be employed as an excellent lard press; and it is frequently employed in the dairy for pressing cheese.

There may be better mills than this, but it has not been my good fortune to meet with any that possess that compactness, convenience, durability, and efficiency which are combined in this mill. The crowning consideration is its cheapness, which at present is about $22 for the small size. The same firm makes mills of a larger size.

ALLEN'S NEW WEEDING HOE.



Among the many improvements in garden implements, we have seen none that so well commends itself to every one having a garden to improve, as Allen's new weeding hoe, herewith illustrated. It somewhat resembles a garden rake with a cutting blade attached to the ends of the teeth. This blade lies flat upon the ground, and is toothed on the two edges and sharpened. By raising or lowering the handle, the blade enters the ground to the depth desired by the operator; and by shoving and drawing cuts off all roots; while at the same time the rake teeth pulverize the soil and tear out the weeds by the roots. The tool is light, well made, and is worked with remarkable ease and facility. It was invented by George P. Allen, Woodbury, Connecticut.

IMPROVED PERPETUAL BRICK AND DRAIN TILE KILNS.

A new era has commenced in the manufacture of bricks and drain tiles. Machinery for tempering the clay, moulding the brick, and forming the tiles is now as nearly perfect as we can devise. Suitable kilns have been needed; and a vast amount of money has been expended in experimenting in constructing kilns that would require less fuel to burn the bricks and the tiles, and at the same time burn all that were in the kiln with desirable uniformity. Hitherto a large percentage of bricks and tiles were injured by being burned too much, while a portion would not be burned enough.

During the past year Messrs. Cornish & Congdon, 175 Broadway, New York city, have invented a perpetual kiln for burning *bricks, tile, pottery-ware*, and also for drying *peat*, consisting of an inclined tunnel made of brick walls, in which a track is laid, and the bricks or tiles are passed through on cars or platforms by means of a gear wheel. From 2,000 to 10,000 bricks, according to the size of the kiln, are placed upon each car, in arches, the same as in ordinary kilns. The fires are placed about midway of the tunnel, and the bricks that are to be burned are gradually drawn down to them. In this way the water smoke is carried off by a gentle heat, and the bricks prepared for a greater and constantly increasing degree of heat until they are thoroughly burned. When this is done the cars are drawn below the fires and the cooling process commences, and is graduated the same as the heating process, all the heat from the cooling bricks passing up through the tunnel, and thus aiding to burn the green bricks.

There is also a second tunnel or chamber over the main tunnel, heated to a considerable degree by the burning bricks beneath, through which passes an endless belt, and green bricks laid upon this belt directly from the moulds are carried gradually through the heated air, and by the time they arrive at the upper end of the kilm they are sufficiently dried to be placed on the cars and burned.

The proprietors of this kiln state that this arrangement of a kiln saves manual labor, as the bricks or tiles have to be handled but once from the time they leave the moulds until they come out of the kiln burned and ready for market. It also saves time as well as the necessity of drying the brick on the yard, and subjecting them to the risk of storms, &c. Bricks by this process can be thoroughly burned and cooled in twenty-four hours. The average quality of the brick is also improved. The heat being equalized, the bricks do not crack nor check, and are *all* burned of a uniform hardness and color.

This is a desideratum which has been wanting ever since drain tiles were first manufactured. Untold numbers of drain tiles have been imperfectly burned. The consequence was that when laid in ditches, they soon disintegrated, obstructing the water-course, bringing draining land with tiles into disrepute, and thus preventing the beneficial effects of under-drains on the productiveness of wet land, simply for want of a suitable kiln for burning the tiles.

Farmers will hail this excellent improvement with unbounded satisfaction, as it will not only produce bricks and drain tiles of a uniform quality, but they will have far better articles at lower rates. Such brick kilns will be of immense value to all those portions of our country that can be improved by under-draining with tiles.

IMPROVED CHURNS.

Perhaps few men have taken more critical observations touching churns than the writer, for the past twenty years; and I must say in all candor that a revolving churn, the Brinkerhoff churn, herewith illustrated, is decidedly the best churn that I have met with; and I think the experience of every unprejudiced dairymen who has used one of this kind of churns will coincide with my indorsement. It has been in use only a few years, but I have yet to learn of any instance in which this has been rejected for another revolving churn. The inventor, J. Brinkerhoff, Auburn, New York, and Hemming & Sparry, New York city, are the only manufacturers of it within my knowledge.

That part of the churn which agitates the cream consists of a round wooden journal in the centre of the box, having three systems of flat paddles, some five or six inches long, inserted into this journal like the spokes of a wheel. The paddles are about one inch wide and half an inch thick, and the flat surface on both sides is gouged out the entire length, so as to throw the cream or milk upward when the journal is revolved by means of a crank, cog wheel, or pinion. There are larger sizes than the one here illustrated; and the churn can be worked by hand or attached to a sheep-power, or dog-power, or horse-power. Numerous experiments have proven that much less power is

required to churn ten gallons of cream with such a churn than with the old-fashioned dash churn, as the paddles are forced under the cream and throw it upward into the air. The crank may be turned either way when churning. Another important point is, every part may be cleaned with facility.

WESTCOTT'S IMPROVED DASH CHURN.

As many dairymen will not use any churn but one that operates on the dash principle, I herewith give a brief description and illustration of the best improvement in the dash churn that can be found in the country.

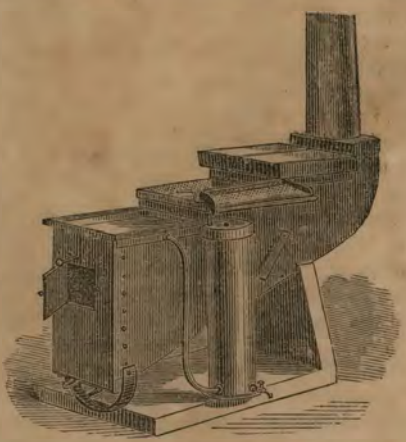
The illustration furnishes a correct idea of the churn. The dash is operated by a horizontal lever. A stiff spring is secured to the short end of the lever for the purpose of lifting the dasher after it has been forced downward, thus relieving the operator of the fatigue caused by lifting the dasher. Every one who is accustomed to use a dash churn understands that lifting the dasher constitutes the most laborious part of churning with a churn of this kind. It is true that more force is required to press the dasher downward, as the spring operates as a hindrance when the lever is descending. But it must be borne in mind that a person can press a lever downwards against a strong resistance with much less fatigue than he can lift a weight equal to the strength of a spring that will hold or lift a given weight or pressure.

At the right hand of the illustration the dasher is represented, having an adjustable flange-dasher, which may be moved up and down on the standard by means of a screw, the thread of which is cut in the standard and in the centre hole of the adjustable dasher. Many dairymen, who thought there could not be an improvement in the old dash churn, have accepted this churn as superior to any other.

H. P. Westcott & Co., Seneca Falls, New York, is the inventor and manufacturer.

YOUNGMAN'S EVAPORATOR AND REFINER.

The culture of sorghum for the manufacture of sirup and sugar has acquired a wonderful popularity in most of the States. Yankee ingenuity has made gigantic strides in perfecting machinery for evaporating and refining the juice. Cook's evaporator stood unrivalled for a while, but I believe, at the present writing, Youngman's, represented by Mead & Holmes, Rockford, Illinois, now stands without a successful rival. It has been approved by the most reliable authorities, and seems to be almost a national blessing. There is a peculiarly disagreeable vegetable tang to sorghum sirup when made with the ordinary evaporators, but Youngman's evaporator effectually overcomes this difficulty. Samples of sirup taken from the worst specimens of old, sour, unmerchantable sirups have been refined by this new evaporator and rendered fully equal to the first quality of sirup, having no taint or tang.



The accompanying illustration will furnish a fair idea of the evaporator, con-

sisting of four evaporating pans. Two of these pans nearest the smoke-stack are called the defecating pans. The pan in the middle is the evaporating pan; the one directly over the fire is called the finishing pan. Beneath the pans is a damper, by which the degree of heat can be regulated at pleasure. From the defecating pans the juice flows through a strainer into the evaporating pan. This pan still further refines the juice as well as evaporates it. Under one side of this pan is a cold-air chamber, over which the scum gathers, and whence it is removed by a beautifully operating crank skimmer. From this pan the juice flows through a filter containing granulated bone, black, where it issues through a pipe into a finishing pan. Here the heat is controlled by means of a register and cold-air chamber beneath. The heat is controlled so thoroughly that it may all be removed or be let on with great intensity, so that the finishing may be done with great rapidity, and at the same time all danger from burning may be avoided. From this evaporating pan the finished sirup flows in a continuous stream, perfectly purified and refined from all mucilaginous, gummy and objectionable substances, and equal to the best of refined sirups. It is then in the best possible state for granulation, being entirely freed from glucose. This evaporator is very light and portable, as it can be easily lifted into a lumber wagon and conveyed from place to place. The capacity of machine No. 1 is from eight to ten gallons per hour, and the consumption of wood is no more than an old fashioned box stove.

THE ORIGIN OF THE DOMESTIC TURKEY.

BY SPENCER F. BAIRD, ASSISTANT SECRETARY OF THE SMITHSONIAN INSTITUTE.

As with nearly all the animals which have been brought under domestication by man, the true origin of the common barn-yard turkey was for a long time a matter of uncertainty. As a well known writer (Martin) observes: "So involved in obscurity is the early history of the turkey, and so ignorant do the writers of the sixteenth and seventeenth centuries appear to have been about it, that they have regarded it as a bird known to the ancients by the name of *meleagris*, (really the guinea fowl or pintado,) a mistake which was not cleared up till the middle of the eighteenth century. The appellation of "turkey" which this bird bears in England arose from the supposition that it came originally from the country of that name—an idea entirely erroneous, as it owes its origin to the New World. Mexico was first discovered by Grigalva in 1518. Oviedo speaks of the turkey as a kind of peacock abounding in New Spain, which had already in 1526 been transported in a domestic state to the West India islands and the *Spanish Main*, where it was kept by the Christian colonists.

It is reported to have been introduced into England in 1541. In 1573 it had become the Christmas fare of the farmer.

Among the luxuries belonging to the high condition of civilization exhibited by the Mexican nation at the time of the Spanish conquest was the possession by Montezuma of one of the most extensive zoological gardens on record, numbering nearly all the animals of that country, with others brought at much expense from great distances, and it is stated that turkeys were supplied as food in large numbers daily to the beasts of prey in the menagerie of the Mexican Em-