

AMERICAN INDUSTRIES.—No. 73.

HARVESTING MACHINES.

Inventions which have resulted in great industries and the development of great natural resources will always be subjects of deep interest to the student of history and political economy. The cotton gin rendered available the vast agricultural resources of the Southern States, and the correspondingly great cotton manufacturing interests of England and New England. The reaper did as much for Northern agriculture, making possible the harvests which have taxed the powers of transportation, reversed the balance of our trade with Europe, and carried our national prosperity to the highest level.

America is the birthplace and home of the reaping machine. Here it was invented and first successfully introduced, here its greatest achievements have been won, and here it has proved itself one of the factors in transforming a continent from a state of primitive solitude to be the home of fifty million enterprising people engaged in all the arts and manufactures of civilization.

When we look back fifty years and remember that the reaping hook and grain cradle were the only means the farmer then had of securing his crop, we are led to wonder how many centuries must have elapsed before the land west of the Alleghenies could have been settled as it is to-day, not only to the Mississippi, but from ocean to ocean. The reaping machine has not only made this possible, but has made farming profitable on a scale never dreamed of before. In Minnesota and Dakota there are grain farms of from ten to thirty thousand acres, whose princely owners purchase and operate reaping machines by the score and by the hundred.

The first successful reaping machine put in use was invented and constructed by Cyrus H. McCormick, a native of Rockbridge County, Virginia, in 1831, a patent upon which was granted by the United States in 1834, and this original machine is recognized as the type and pattern after which all others of subsequent date have been modeled.

The manufacture of this machine was commenced in Virginia, but not until 1845 at Cincinnati, Ohio, did the annual product reach a large number. During that year 500 were constructed and sold. In 1846-7-8 some machines were manufactured at Brockport, N. Y., on "royalty." With discriminating judgment Mr. McCormick foresaw that Chicago was to be the center of trade in the Northwest, by reason of its favorable geographical position and superior shipping facilities, and he therefore transferred the manufacture to that city in 1847, building 500 machines in the new shops. In 1848, 700 machines were made and sold, and in 1849 the figure reached 1,500. Here the first works for making the reaping machine were erected, and the improvement of the machines themselves vigorously commenced, and from that time onward the development of this great industry has been commensurate with the strides which Chicago has made.

Soon after this, Mr. McCormick induced his two brothers, William S. and Leander J., to come from Virginia to Chicago to assist him in the manufacture of the machine. The former continued with him until his death in 1865, and the latter until now having an interest of one-fourth in the corporation, the remaining three-fourths belonging to Cyrus H. McCormick.

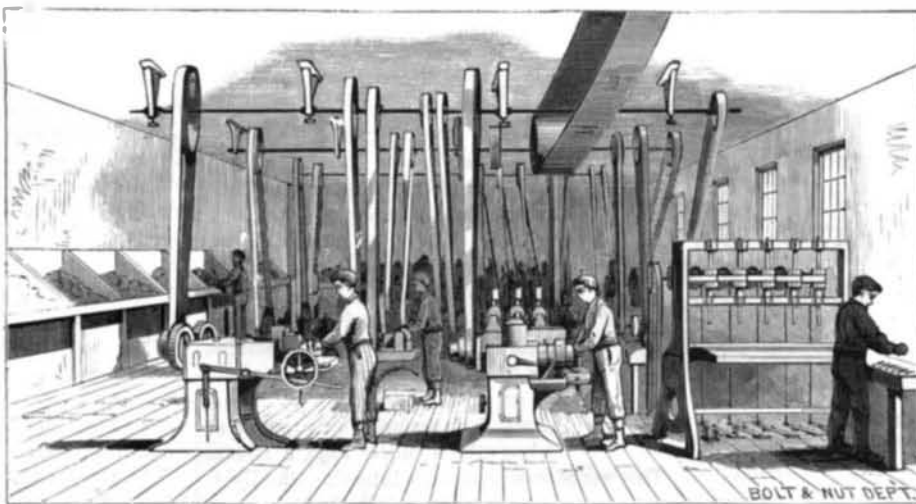
The works of the McCormick Harvesting Machine Company, a view of which, together with the various departments, we have represented on our first page, are situated in the southwestern portion of the city of Chicago, upon the bank of the river, and at a point where all the vast network of Chicago railroads centers.

Ten rooms, 100x60 feet, occupied by the wood-working department, are fitted with the most improved machinery for planing, sawing, shaping, and dressing the various wood parts of the machines. The construction of the main wheels for the harvester is an interesting study in itself, and in this alone are involved more than a dozen processes in wood and iron work. We have shown in the engraving the last operation in its construction that of putting on the tire.

The greatest interest to an observer centers in the machine shop. Looking down the long aisles of machinery, the attention of the visitor is drawn to the many curiously shaped machines of special design necessary in the various processes of the iron work.

The tendency now is toward the extensive use of iron in the construction of the machines, which insures greater strength and

lightness, and gives the machine a more attractive appearance. As a consequence, the lathe work necessary is largely increased, and this renders specially designed machinery and tools indispensable. For example, the introduction of the inclosed gear frames for reapers, mowers, and droppers necessitated a machine which could bore all the holes required for shafts, etc., at one operation, and several of these are in use, which cost thousands of dollars to build.



BOLT AND NUT DEPARTMENT.

The boring of the rake posts, cams, iron frames of binders and reapers, and many other parts of the machines needs such special machinery as we have alluded to.

This perfection of the work renders easy the renewal of any part in the field, should any piece become broken or worn, and insures the exact duplication of it at any time thereafter, so long as the patterns may be preserved. The blacksmith shop is a large building provided with all

The foundation of all reaping machines is the sickle-bar, which our artist has graphically represented on the first page, and it is well worthy of note that the original cutting apparatus invented by Cyrus H. McCormick, fifty years ago, has never been superseded or improved in its essential features. A large building in the center of the rectangle contains the grindstones upon which the knives are ground, the tapping machines for serrating the edges of the sections or blades, the machines for rolling the bars, and the room for assembling all the parts necessary to form the complete cutting apparatus.

From the iron and wood working departments all the material for the construction of the machines passes to the paint shops, where the rude contrasts of wood and iron in their natural colors are made to blend harmoniously and with pleasing effect to the eye, by means of the artist's skillful brush. The spacious paint shop, comprising more than a dozen rooms, 100x60 feet, are constantly crowded to their fullest extent, and only the most skilled labor is employed in the final decoration of the machines.

The packing departments, which we have not space to illustrate, are of unusual interest to the casual observer, this work being a science peculiar to itself.

The contents of the packing boxes are of such varied shapes and sizes that only long experience and practice on the part of the packers enable them to place them in perhaps one-half the cubic space that an unskillful person would require. The shipping is conducted with great system, and the facilities are such that from twelve to twenty cars can be loaded and dispatched each day. The repair department is a small world of business in itself, embracing as it does the parts of all the McCormick machines made during the past twenty years. All the duplicate parts on hand can be known at once, and any part that is wanted for repairing any McCormick machine can be produced on demand.

That the machines may constantly meet the requirements of the farmer in every respect, and for experimenting with new devices, a corps of draughtsmen, pattern and model makers are employed.

The company finds itself under the necessity of enlarging its manufacturing facilities during the coming season to meet the naturally increasing demand for its productions.

A most interesting department to all scientific persons, in this manufacture, is found in the patented inventions which enter into the construction of the machines, and in the patents which the company hold for the use and protection of their business. To one not familiar with the details of this interest, the importance and magnitude of the operations herein involved would be almost incredible. The original patents of Cyrus H. McCormick, granted in 1834, 1845, and

1847, expired before any material return for his labors accrued to the inventor, and when endeavoring to obtain their extension at the Patent Office—a right which was accorded almost every other inventor of such prominence—Mr. McCormick's claim was refused, not on the ground of its invalidity, but because the invention was of too great importance to the world at large to admit of being

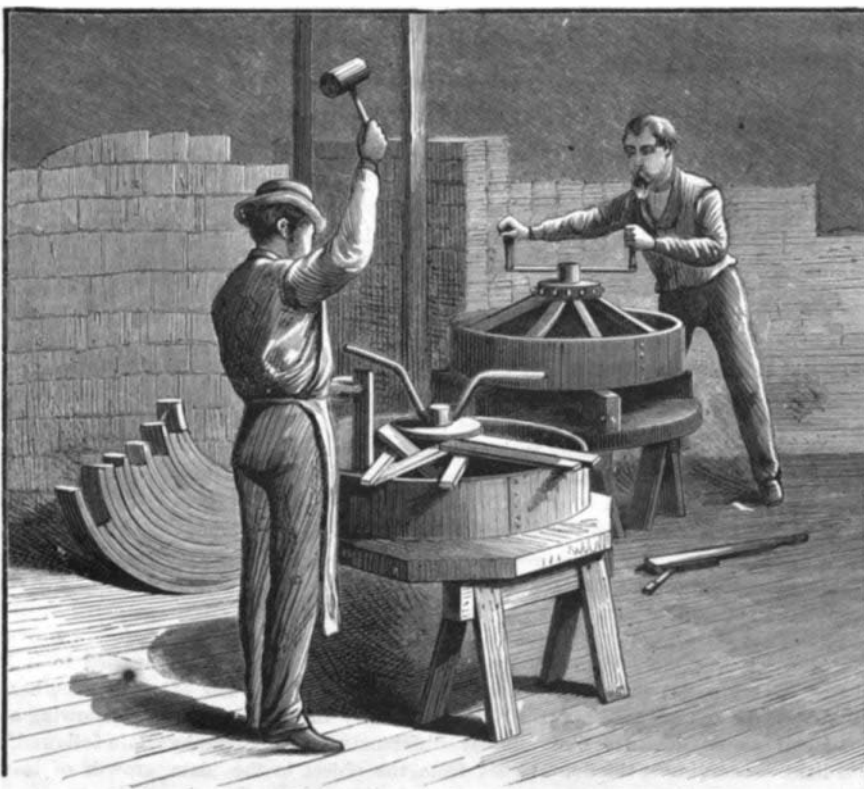
placed virtually under the control of one man, as would be the case should the patents referred to have been extended. Thus were the essential features of his invention made public, and the inventor was forced to come into competition with other manufactures of the product of his own brain. In improvements upon the original, therefore, lay his greatest chance of success, and in this, as in the first machine, he was foremost. With the introduction into general use of the reaping machine, the attention of inventors on every hand was drawn toward further improvement in this direction, and applications for patents upon every conceivable mechanical device which could be utilized in connection with harvesting machines have flooded the Patent Office from that time to the present. To the extensive manufacturer, therefore, it becomes a matter of necessity to protect himself from being assailed on every hand by speculators in patents upon every important new feature developed by him, and by obtaining control of or interests in such patents as might bear upon the forms of his construction and manufacture. It affords, therefore, to the McCormick Harvesting Machine Company a power not possessed by other competing manufacturers, that they are the owners of and hold interests in hundreds of patents of this nature. Especially in the development of their twine binder is the



SETTING UP MACHINES.

the appliances for cutting, punching, forging, and shaping the various pieces of wrought iron used in the construction of the machines.

The foundry is a fine structure, 245x90 feet, with two wings, one of them 80x60 feet. Here about 75 tons of pig-iron, from its two cupolas, are daily transformed into castings of all descriptions.



MAKING HARVESTER WHEELS.

value of this self-protection evident, for claimants are constantly arising to share, if possible, in any advantage which may accrue from the use of a particular device tending toward the improvement of the machines.

Comparing the machines which the McCormick Harvesting Machine Company and all their competitors now manu-



THE 1847 MACHINE

facture with the original reaper invented by Cyrus H. McCormick, as constructed by him in 1847, it will be found that all the vital elements of successful and practical work are retained intact, namely, the cutting apparatus, divider, reel, platform, attachment of the horses; yet from step to step the advancement has been in taking away all manual assistance from the machine, making it as far as possible entirely automatic. The addition of a seat or stand enabling the raker to ride on the machine instead of walking by its side; the substitution of the self-rake for the hand rake; the placing the binder stand upon the machine, whereby the men bound the sheaves while riding, instead of lifting them from the ground; the substitution of the automatic binder for the manual labor; and, finally, the automatic trip, whereby the size of the sheaf throws the binding mechanism into operation, are all consecutive steps in the progress of invention and development of the reaping machine.

Few of our readers can have any idea of the magnitude of this branch of industry. In all the harvest fields of the world the McCormick machines are at work, and the farmers of Australia, New Zealand, France, Italy, and Russia, are as familiar with their superior merits as are the farmers of Illinois, at whose doors they are manufactured. We believe that the verdict of the leading scientific and mechanical authorities of the present day is unanimous in placing the McCormick machines in the lead of all others. At each successive World's International Exposition, from the World's Fair at London, in 1851, to the Melbourne Exposition of 1880, the highest honors have been without exception awarded to the McCormick reaper.

The great extent of this trade at home and abroad will be better understood when we say that there have been built and sold over 300,000 of the McCormick machines since 1849, beginning with an annual product of 1,500 machines, and increasing as the country developed, until the present annual production exceeds 30,000 machines.

It is estimated that there are at this time 200,000 McCormick machines in existence, capable of harvesting annually 60,000,000 acres of grain and grass, an area equal to the entire surface of the great States of New York and Pennsylvania, requiring an army of 200,000 men and 400,000 horses, and furnishing employment for tens of thousands engaged in handling and transporting the vast grain crops of the world. And the man whose brain evolved the idea of a successful reaping machine, and who carried the thought into deeds, and whose energy and shrewdness put this vast force at work, is alive among us to-day, enjoying his well-merited honors and success. His name will go down to posterity as one of the great benefactors of the human race whose victories have been won in the successful effort to lessen toil and bless mankind. What the future of the reaping machine will be when the vast territories of the unexplored far away Northwest—the great grain belt of the world—shall have been brought under cultivation, we leave to the imagination of the reader, our duty as journalists being to trace the early history and present standing of this very important branch of national industry.

Simple Ventilator.

Dr. McKinnon, of Windsor, Ont., has sent to the *Canadian Lancet* a sketch of a stovepipe ventilator, which may not be new in principle, but which will, no doubt, be found useful as it is simple. The stovepipe is surrounded by a cylinder of sheet iron, having a diameter large enough to leave $2\frac{1}{2}$ inches of space between it and the pipe. The vitiated air of the room is admitted through an opening or openings at the lower part, and it passes upward as it is heated between the pipe and cylinder for 18 or 20 inches, according to the height of the latter, and then enters an opening in the stovepipe and passes away with the smoke.

The Heliograph in War.

The extensive use of the heliograph by the British forces in the Zulu and Afghan campaigns has given a wonderful impetus to the art of signaling by means of flashes of light. The heliograph itself as now perfected leaves little to improve upon; but it is of course only applicable so long as

the sun is above the horizon. Hence, the attention of inventors is chiefly concentrated upon improvements in lamps for signaling at night. As our readers are aware, the alphabet used is a combination of short and long flashes, corresponding to but not exactly identical with the dots and dashes of the Morse telegraph system. The most obvious plan for signaling at night is to use a lamp with a movable diaphragm, which will shut off the light for long or short periods as may be required. An English inventor some time since contrived a lamp in which a jet of pyrotechnic mixture, consisting largely of powdered magnesium, was propelled into a spirit flame by means of bellows. This arrangement gives long or short flashes of intense light, which would be visible for many miles. M. Mercadier has lately proposed a cheaper, and at the same time an efficient form of apparatus for the same purposes. It consists of an argand burner for oil or gas, to which is supplied on pressure of a key (like a Morse key), a stream

of oxygen. This gas of course at once intensifies the light, and signaling can be carried on without difficulty.

RECENT DECISIONS RELATING TO PATENTS.

United States Circuit Court.—District of New Hampshire.

MONCE vs. WOODWARD.—PATENT GLASS CUTTER.

Clark, J.:

Letters patent No. 91,150 to S. G. Monce, June 8, 1869, for tool for cutting glass, declared invalid in view of testimony establishing the fact that similar tools had been made and used before the invention thereof by Monce.

This patent was for the rotary disk glass cutter—a steel cutting wheel set in the end of a handle.

Supreme Court of the United States.

CROUCH, APPELLANT, vs. ROEMER.—PATENT SHAWL HANDLE AND STRAPS.

Shawl straps with handles attached to a leather cross-piece having loops at the ends being old, it is no invention to stiffen by artificial means the leather cross-piece, which had before been made as rigid as it could be by thickness, doubling, and stitching. The use of known equivalents for some of the elements of former structures, to make them somewhat better, is no invention.

Appeal from the Circuit Court of the United States for the District of New Jersey.

Mr. Chief Justice Waite delivered the opinion of the court.

United States Circuit Court.—Southern District of New York.

WARING, JR. vs. JOHNSON.—PATENT CHECK BOOK.

Blatchford, J.:

1. Reissue of letters patent No. 8,199, granted to G. Waring, Jr., April 23, 1878, held to be valid.

2. Where an invention is claimed as the "combination, in a check book, of checks and stub-pieces of substantially the same size, so united that two checks lie between every two stub-pieces, substantially as specified and set forth," it is immaterial, in view of the state of the art, whether the defendant's book has the line of perforation between the check and the stub leaf at the top or bottom of the stub leaf or at the leaf end of the check.

3. It will not invalidate the reissue that the claim is broader than the claim of the original patent, provided that it is "for the same invention" shown and described in the specification and drawings.

William Ennis.

William Ennis, inventor, of Troy, New York, died at sea, March 29, in his fifty-ninth year. Like so many of our persistent and successful inventors, Mr. Ennis acquired the knowledge utilized in his inventions by actual experience and personal study and investigations, his opportunity for early schooling having been but the slightest. Most of his inventions were improvements in furnaces and related apparatus for domestic and manufacturing purposes. For many years he was engaged in the manufacture of hot air furnaces. He invented the duplex heating furnace, and took out a number of patents for improvements in metallurgical processes. His later work was in connection with an apparatus for economizing fuel, and the sea voyage which ended his life was undertaken to make the necessary preparations for the application of his invention to the steamship Richmond, of the Old Dominion Line.

PHENOMENA OF OPTICS AND OF VISION.—M. TREVE.—The author mentions the fact that the flame of a lamp appears brighter, and that a vertical shaft, a post, or mast is seen more distinctly through a vertical than through a horizontal slit, while a house, a landscape, or the disk of the sun or moon is perceived more clearly through a horizontal slit. He finds similar differences in photographs according as the light passes from the object to the plate through a vertical or a horizontal slit, and ascribes the results to the action of diffused light.

Correspondence.

Fuel from Hay, Straw, Flax, Etc.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of the 16th inst., you refer to the want in parts of the West of a machine for preparing flax straw for burning as ordinary fuel. This is true. Not only is a machine needed for preparing flax straw, but all other kinds of straw and also prairie hay.

In a large portion of the West straw of all kinds is allowed to rot in the field or is burned in the stack. Thousands of tons of wheat straw are burned every year as soon as thrashed, and this, too, in a country where fuel is scarce and high. Prairie hay that costs only the cutting and stacking also goes to waste in vast quantities. If this wealth of hay and straw could be compressed into bricks convenient for burning in an ordinary stove, thousands of dollars might be saved to the hard working farmers on our Western prairies—provided, of course, that the desired machine be not too expensive, or could do its work cheaply. Possibly it would be best to have the hay or straw cut into short pieces before being compressed.

Hay stoves have been invented and are in use in some localities, but it takes a large amount of time to twist up the hay by hand and feed the stove, besides keeping the room constantly littered with loose particles.

The market value of prairie hay in this portion of the West is from \$2 to \$3 a ton. Plenty of it may be contracted now for \$2.50. Straw has no market value. The writer of this, last fall, burned the straw from 160 acres of wheatland as soon as it was thrashed in order to get it out of the way, and in doing this only followed the common practice of the country. At the same time wood is worth \$6 to \$6.50 a cord, soft coal \$4 to \$6 a ton, and hard coal \$10 to \$14 a ton.

W. C. HAYWARD.

Garner, Iowa, April 18, 1881.

[Our correspondent's suggestions are useful, and we hope that some of our ingenious readers will be led to study the subject of utilizing the products he mentions. But if soft coal can be had at \$4 a ton, we doubt whether hay fuel, no matter how compressed, could compete with it. The fibers will probably have to be utilized in some other way than as fuel. Paper pulp might be made, for example.—Eds.]

The New Mineral Hiddenite.

To the Editor of the Scientific American:

A late publication in your "Correspondence" column from Mr. J. A. D. Stephenson, of Statesville, N. C., in which he claimed the discovery of this mineral, demands answer from me.

The definition of hiddenite in Dr. J. Lawrence Smith's own words is, "an emerald-green variety of spodumene," and it is this variety only that I consider myself the discoverer of.

To show to you that it was in truth a discovery, I will state that I was not searching for the mineral when I discovered it. It was while I was at work here with a corps of men pushing forward a systematic investigation of this mineral belt for the purpose of discovering a mine of the true emerald (species beryl), that I unexpectedly came upon the vein eight feet below the surface that contained the new mineral.

Mr. Stephenson said to me last week that "the specimens he obtained were either colorless or only slightly yellowish green." He had never seen them having a pure emerald-green color until he saw those I had unearthed.

Now it follows, then, that the mineral he obtained was not hiddenite, but simply a variety of spodumene, not characteristic enough in color to merit a new name.

Mr. Stephenson has never made or caused to be made any scientific investigation of either the locality or of the mineral, and by reason of such neglect has forfeited any rights he may have had in this matter.

As you are well aware, it is to the person who gives the animus or momentum to an investigation that leads to a discovery who receives the honor.

Even the discovery of the variety Mr. Stephenson obtained does not belong to him, but very properly, under the laws of priority, to the farmer (Mr. J. W. Warren) who first found it in the soil here and subsequently sold it to Mr. Stephenson.

I would only too cheerfully accord to Mr. Stephenson any rights he might have in this matter; and I do freely accord to him, and to the mineral specimens he has sent North from this interesting region, the incentive to my present work here, and whatever, if any, success I have attained.

WM. EARL HIDDEN.

Stony Point, N. C., April 26, 1881.

A Remedy for Scale Bugs.

At a recent meeting of the California Academy of Sciences, Dr. Gibbons exhibited a large bunch of beautiful roses of exceeding fragrance, and in full bloom, which he gathered from a bush in his garden which two months before was overrun with scale bugs and nearly dead. He applied to it a mixture of crude petroleum and castor oil, with a feather, daubing it slightly on the leaves and stem, not allowing any to fall to the ground or reach the roots. Rain followed, and the plants were throwing out their first growth of leaves, to which the scale bugs were directing their attention. Now no sign of any scale insect can be seen in the whole garden.