THE RECIPROCATING

Screw Mowing Machine.

WILLIAM FARR GOODWIN'S
PATENTS.

MANUFACTURED BY THE

NATIONAL IRON WORKS,

New Brunswick, N. J.

WILLIAM E. KELLY, - - Proprietor.

POINTS OF SUPERIORITY:

It has no Gear or Cog Wheels of any kind,

IT HAS NO CRANK MOVEMENT,

IT HAS NO JOURNAL OR BEARINGS THAT REVOLVE,

Except the Main Axle,

IT IS THE LIGHTEST-DRAFT MOWER MADE,
IT IS SELF-OILING, COMPACT, DURABLE,
EASILY HANDLED AND ATTRACTIVE,
PERFECTLY BALANCED.

THIS MOWER is on Exhibiton at the Centennial Exposition in the Agricultural Building,

AT	ALSO AT	AND AT
COLUMN LETTER Q.	COLUMN LETTER R.	COLUMN LETTER R.
COLUMN NUMBER 18.	COLUMN NUMBER 17.	COLUMN NUMBER 15.

Sept., 1876.

A NEW MOWING MACHINE.

The following is an extract from the March number of the *New Jersey Agriculturist:*

The idea of mowing or reaping by the aid of machinery is not altogether a modern one, as many suppose. Pliny describes a machine used about A. D. 50 on the plains of Rhaetia, having somewhat the form of a common cart with two wheels, in front of which was placed a comb-like bar, which stripped off the ears of wheat and delivered them into a box, the straw being allowed to stand; the propelling power was an ox, harnessed in the rear of the machine, and pushing it before him. In 1786 we find record of another reaping apparatus made by Pitts, which was constructed with a cylinder fitted with combs, which pulled off the ears of grain and discharged them into a receptacle made for that purpose. Previous to 1822 the cutters were made with a rotary motion, but about that time a reciprocating motion was given to them by Ogle. In 1806 a patent was taken out in England for a front draft side cutting machine, but having a revolving knife. During the year 1837 a machine was put into successful operation in this country by Obed Hussey, to which he applied saw-tooth cutters and guards. Cyrus McCormick patented his celebrated reaper in 1824, which he constantly improved upon, and received the first medal at the World's Fair in London in 1851. It had a sickle edge sectional knife, reciprocating by means of a crank movement, with the bearing on the driving wheels. The motion generated in the driving wheels was conveyed to the knife by means of gear wheels. Until recently, all the mowing machines in successful operation have more or less of gear wheels in their construction. Many cam movements and various applications of the endless screw have been tried, but without success. A few years ago Mr. Wm. Farr Goodwin invented a mowing machine, using a peculiar arrangement of the worm wheel and screw. This machine proved an excellent one. More recently, however, a direct application of the screw and nut has been made by the same inventor, and by actual trial has proved itself superior to anything yet produced. This invention is in the form of a new mechanical movement, an entirely new discovery, and we find a description of it in a paper read before the Middlesex Farmers' Club, by Mr. Wm. E. Kelly, at their meeting held December 6, 1875, and published in the *Fredonian* Dec. 8, 1875, from which we extract:

Mr. President and Members of the Middlesex County Farmers' Club:— * * * * The objective point in the construction of a mowing machine is to cut the greatest amount of grass or grain in a given time with the least amount of power, or if you have a given amount of power, then to cut the greatest amount of grass in a given time. Now if we can, by any mechanical appliance, reduce the loss by friction to a minimum, and transmit the power from the driving wheels to the cutter bar, with less loss of power by friction than in other machines, we have gained a great improvement, and one which will be appreciated by all intelligent farmers. This has been accomplished in the mowing machine shown you to-day.

Without further introductory remarks, I will proceed to explain, as best I can, the new mechanical movement invented by Mr. Wm. Farr Goodwin. You have always understood

The driver's seat is behind the cutters, and also behind the axle, so that his weight is made use of in balancing the machine; and as we have done away with gear wheels, we are not compelled to make provision for the numerous changes of position of gears, and their getting out of line on the different shafts in such machines, incident to all gear-wheel machines when run over uneven ground. The main axle answers for the main and only shaft in the machine, and as the movement is entirely on this shaft, it cannot get out of line, no matter how uneven the ground, or in what position the machine is.

The height of the cut is regulated by a single lever, and this can be done while the machine is in motion, without the driver leaving his seat. The points of the guards can be raised for passing over stony ground, or depressed for cutting tangled or fallen grass instantly while the machine is in operation. The cutter bar can be put in any position just as well while the machine is in motion and knives working, as when stationary. Two levers control the entire working of the machine. One of them raises or lowers the cutter bar, and also swings the frame and cutting apparatus of the machine clear of the ground; and as there are no gear wheels to hang down, under the machine, a clear and free way is made for any obstruction that may be encountered. This also avoids the dragging along of the grass when the gear wheels project downwards, as in other machines, where the grass is very heavy. By the use of the same lever, the cutter bar is thrown into an upright position, and firmly locked.

This machine we claim is the lightest-draft mower made, and in support of said assertion, would state that by actual trial with full-sized machines we have obtained the following remarkable result: with the knife detached, and by raising the driving wheels sufficiently to clear the ground, we have operated the entire movement from the driving wheels to their connection, with the cutter bar inclusive, by only one pound weight applied to the rim of the driving wheel.

With the knife in, and the machine all connected, 3½ to 4 lbs. weight on the rim has accomplished the same result, showing but little loss of power by friction. To appreciate this remarkable fact, try a machine of any other construction in the same manner, and see the difference. This Mower has never been exhibited but at three fairs (and that its first season). But at every such exhibition it has taken first premium as the best mechanical movement for operating Mowing Machines over all the standard mowers generally exhibited at State and County fairs.

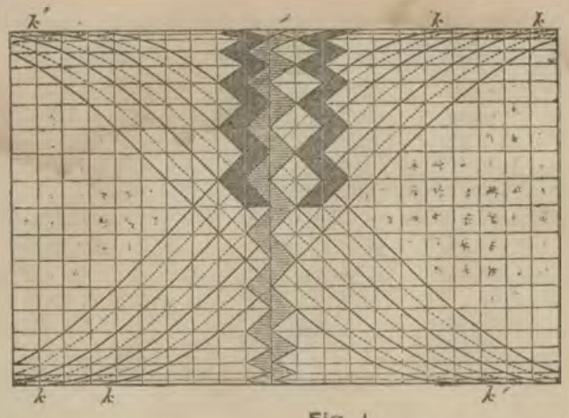

Fig. 1.

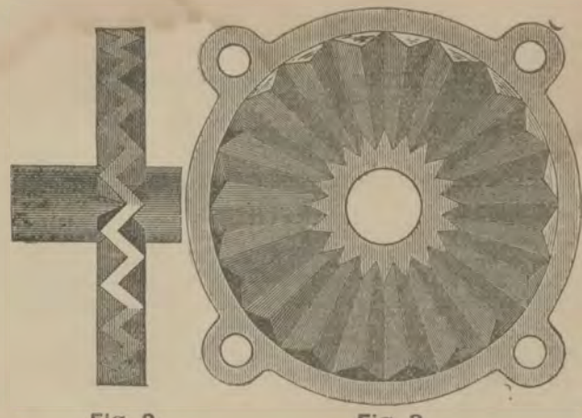

Fig. 2. Fig. 3.

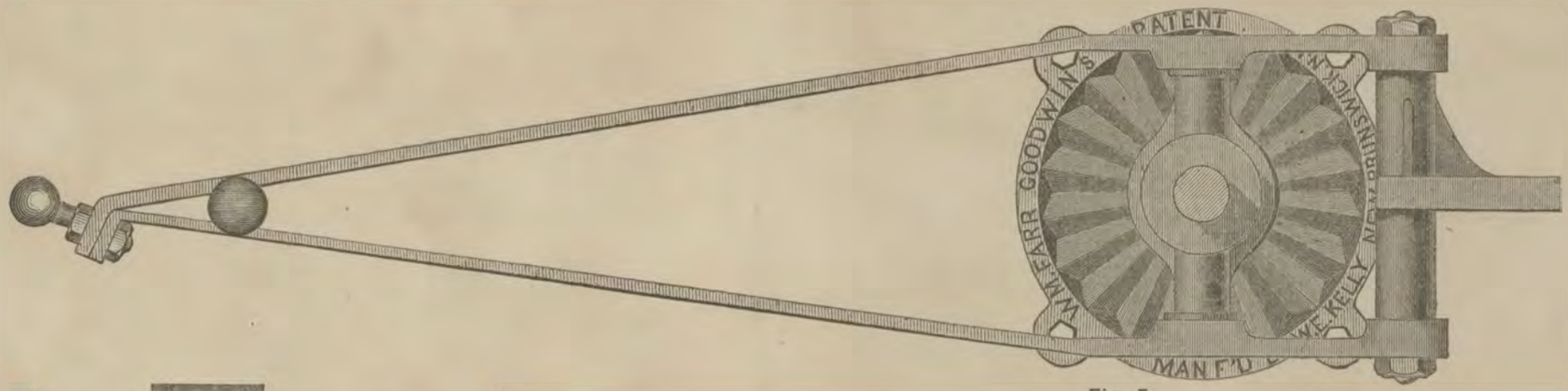

Fig. 5.

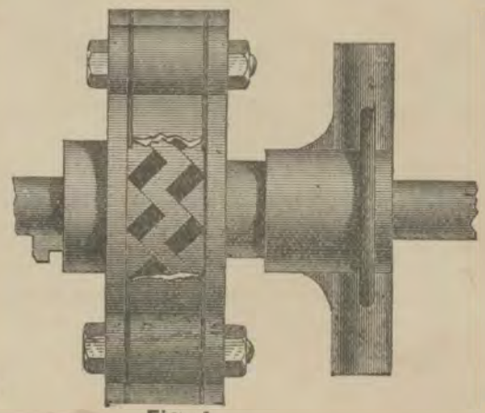

Fig. 4.

FIG. 1.—Shows the method of laying out the centre and outside section of the mechanical movement. By the use of right and left-hand threads of screw and nut. More fully explained on page 6.

FIG. 2.—Shows the centre or bolt section.

FIG. 3.—Gives an exterior view of one of the outside sections.

FIG. 4.—Shows the movement, cross-head and part of the shaft connected together, with a portion of the ring of movement cut away, showing internal construction.

FIG. 5.—Gives a view of the same movement, cross-head, standard or pivot and vibrating lever, with buffer and joint to which is connected the knife.

IN introducing the RECIPROCATING SCREW MOWING MACHINE to the public, we offer a Mower that we claim is superior to any now in the market. It is the latest one introduced, and we think it undoubtedly the best. The improvements do not consist simply in a different arrangement of cog wheels, or in some small improvements of detail, which in many cases have been called improvements in other machines, and in some cases sufficient to warrant the giving a new name to the machine, but still retaining the same system of construction, embodying more or less of gear wheels and shafts, with a crank movement to convert the rotary motion of the wheels into the reciprocating movement of the knives. Every farmer who has used a mower knows that these are objections, and very strong ones too, against every one of the above-mentioned features in such machines. In the Mower now offered, the improvements are all real and tangible, and consist in a radical change in the system of building Mowing Machines, so far as the "mechanical movement" part is concerned, and also of other important improvements in the arrangements for handling the machine. We have introduced an entirely new method of converting the rotary motion of the driving wheels into the reciprocating movement of the knife, without the use of any gear wheels whatever. To parties who have always used gear-wheel machines, this may seem a strange thing; but the Reciprocating Screw Mower has not a single gear or cog wheel in its construction, neither has it any shaft-journal or bearing that revolves, except the main axle. There is no crank motion whatever, and no small crank wheel connected with the end of the knife, to become constantly heated and out of order on account of its velocity. The whole weight of the machine is supported by the two driving wheels, and the entire weight is made use of to give motion to the knives. The driving wheels are arranged to work either together or independently of each other, so that short turns can be made either to the right or left with the knives continually in motion. By dispensing with all cog wheels, we also do away with one of the great objections urged against cog-wheel machines, which is the continual clogging of the same with mud or grass. The power obtained from the forward motion of the wheels of the machine is imparted to the shaft from the *rim of the wheels*, by means of arms and notched teeth on the rim of the wheel. In consequence of this, the least forward movement of the wheels will instantly impart motion to the knife without the machine creeping forward on the grass and clogging the knives, as is so often the case with other machines. The notcheda rms can be instantly thrown in or out of connection with the rim of the driving wheels.

that an acute angled wedge, when driven into most substances, after the driving power is removed, would retain its position and hold all it has gained, while a lever would bound back, and if used in lifting a weight, would cause it to be lowered when the power at the end of the lever was removed. Now an obtuse angled wedge will not retain its position after the driving power is removed, but if force is applied to the side of the substance in contact with the sides of the wedge, the wedge will be ejected from the opening. This principle of the obtuse wedge is made use of in this new movement to convert rotary into reciprocating motion. A wedge is simply a double incline plane, and we may define a screw to be a revolving incline plane, so that the inventor has very appropriately called the combination "a reciprocating screw." You all understand the working of the ordinary bolt and nut. In this, a continuous rotary motion of the nut in one direction will give a rectillinear motion to the bolt if the bolt is kept from rotating but in only one direction. Now in order to get a rectillinear motion of the bolt in the opposite direction, and still have the nut revolve in the same direction as before, you will have to reverse the direction of the threads; and if, in the first case, we had a right-hand screw, in the second case we should have a left-hand screw. This is the principle involved in this new movement. The pattern for the one now before you, which I will explain by this model, was made as follows: A cylinder of wood, eight inches in diameter, is laid out with 19 right and 19 left-hand threads around its circumference. This pattern would be used in a reaper. These threads will of course cross each other and form 19 points of intersection. By following the right and left-hand threads from each of these points, we get a line of intersection. If we should pass a plane through each line of intersection perpendicular to the axis of the cylinder, we would virtually cut the cylinder into two pieces, and the section would present 19 corrugations, or V shaped grooves, and corresponding projections radiating from the centre to the points where the right and left-hand threads intersect. A section of the nut is made in the same manner, and of course corresponds exactly with the section of the bolt. The section made from the bolt has a sleeve cast on one side of it. This sleeve fits loosely around the axle and serves to transmit motion from the inside of the nut to the lever. The sections being all alike, the bolt section is fitted in between the two nut sections in the same manner as the bolt is fitted in the ordinary nut in a common Jack screw. One section of the nut has a hub by which it is fastened to the main axle, and rotates with it. The other section of the nut is on the opposite side of the bolt section, and rotates with the first-mentioned nut section, being fastened to it by means of a rim, a band and a bolt; as before mentioned, the bolt section is placed between the two nut sections, and enclosed in a cylindrical box formed by the two nut sections and the band joining them together. The hub or sleeve of the bolt section passes through an opening in one of the nut sections, and is fastened to a lever. The motion of the bolt section is therefore communicated to the lever, and through it conveyed to the end of the sickle or knife of the mowing machine. It is obvious that by this combination of the right and left-hand screws into one, a reciprocation of the internal section or bolt is obtained by the continuous rotation in one direction of the two outer sections or nuts, provided the bolt is secured from revolving, but still permitted to vibrate in line with the axis of the nut. The axle is secured from moving in the direction of its axis by flanges or collars bearing against the framing.

We recognize the principle of the screw in this mechanical movement, from the fact that its rotation is concentric with its axis, while its reciprocating motion is parallel with its axis of rotation, and all the threads or grooves are in full bearing equally all around its centre at the same time. This gives an equal distribution of power on every part of the circumference. As before mentioned, the bolt section must be made secure from rotation, and this is done by means of a cross-head attached to the outer end of the sleeve. The ends of the cross-heads are turned cylindrically, and are really used as a sort of journal bearing, to which the lever is attached, and by which it is operated. The fulcrum of the lever is attached to the main frame of the machine at a point five inches behind the centre of the axle. The lever is 30 inches long, and the power being applied between the fulcrum and the point of resistance, at a distance of 25 inches from the resistance, and five inches from the fulcrum, we have a leverage of five to one. Again, as the power is applied between the fulcrum and the point of resistance, a movement of one-half an inch at the point of application of the power will give us a movement of three inches at the point of resistance. The point of resistance of the lever therefore travels six times the distance that the bolt section moves; the movement in the mowing machine now before you is made up of 23 right and 23 left-hand threads, consequently we have 46 cuts of the knife to every revolution of the driving wheels. The circumference of the driving wheels on the machine before you is 85 inches. The machine, therefore, would advance that distance for every revolution of the driving wheels, and the knife would travel a distance of 138 inches. Another point of peculiarity consists in the use of india rubber buffers. These pieces of rubber are entirely independent of the motive power, and are placed in a part of the framing so that the lever near where it is fastened to the knife will strike them at about the end of its stroke, and very greatly assist in reversing the motion of the lever; and they not only reverse the motion with advantage, but impart

some of the motion of the one stroke to the next succeeding one, it being a well understood fact that if you project a body against a spring or highly elastic substance, the projected body will recoil with nearly the same force, less the loss by friction and atmospheric resistance. The value of this feature you will better appreciate by trying it with a bar of iron in your hand, moving it between the rubber buffers, and then try to accomplish the same thing without them. Another point of interest is the fact that the entire screw movement is enclosed, as it were, in an air-tight box, and the air contained therein forms an elastic cushion which materially assists the reciprocating movement of the bolt, causing it to reverse its movement without waiting for direct power from the driving wheels to do it. By placing a little oil or other lubricating substance in this tight box, the movement is kept constantly lubricated, and as the oil cannot escape, it is virtually a self-oiling movement.

Having mentioned the principle details, I will state in general that there is no part of this mowing machine which makes an entire revolution except the driving wheels and axle. Hence there is no rotary motion except the bearings of the axle, and a circular motion of one-sixteenth of an inch of their circumference of the journal bearings of the lever. You will therefore perceive that by this new movement the rotary motion of the driving wheels is converted into the reciprocating motion of the knife in the most direct and simple manner, and with the least possible friction. In other mowing machines now in the market, the same thing is accomplished by means of gear wheels. But as every journal bearing of these wheels must revolve, and the tendency of the wheels being to separate, we have every journal acting as a friction brake, consuming a great amount of power. With the cutter bar taken out of this machine before you, the entire movement can be started and operated by a power of two pounds applied at the circumference of the driving wheel. This I now show you by actual test. This mowing machine will not heat and cause loss of time just at the moment when time is the most valuable, as the motion is slow on all its bearings. The friction of the screw and nut section is distributed over 23 threads all in contact at the same time, giving a large amount of surface, which, as before stated, runs constantly in oil. The point of greatest velocity in the combination is at the end of the lever where it connects with the knife. But as this is not a rotary motion, it is not liable to create much friction.

Altogether this movement, as applied to mowing machines, is extremely simple, compact and strong. It cannot be otherwise than durable, and as there is such a great saving of the applied power, it must be the lightest draft machine now made.

Besides the radical improvement made in transmitting the power from the driving wheels to the knife as previously described, we find in this new mowing machine, which is called "The Reciprocating Screw Mowing Machine," of which a view is here presented, many fine points of detail. The apparatus for raising and lowering the cutter bar, and for adjusting the angle of the same, is very complete, and a marvel of ingenuity. The arrangement for throwing the machine in and out of gear is extremely simple and effective, and is so made that the knife will start in motion with a movement less than $\frac{3}{4}$ of an inch of the periphery of the driving wheels. All the bearings are self-oiling. A rudely constructed mowing machine, with the above-mentioned mechanical movement, was exhibited and took the first premium at the New Jersey State Fair, held at Waverly, N. J., 1875; Somerset County Fair, 1875, held at Somerville, N. J., and at the Hunterdon County Fair for 1875, held at Flemington, N. J., being its first season, and the only Fairs at which it was ever exhibited. We would refer any parties desiring further information to Mr. William E. Kelly, National Iron Works, New Brunswick, N. J., where the machines are now being manufactured.

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