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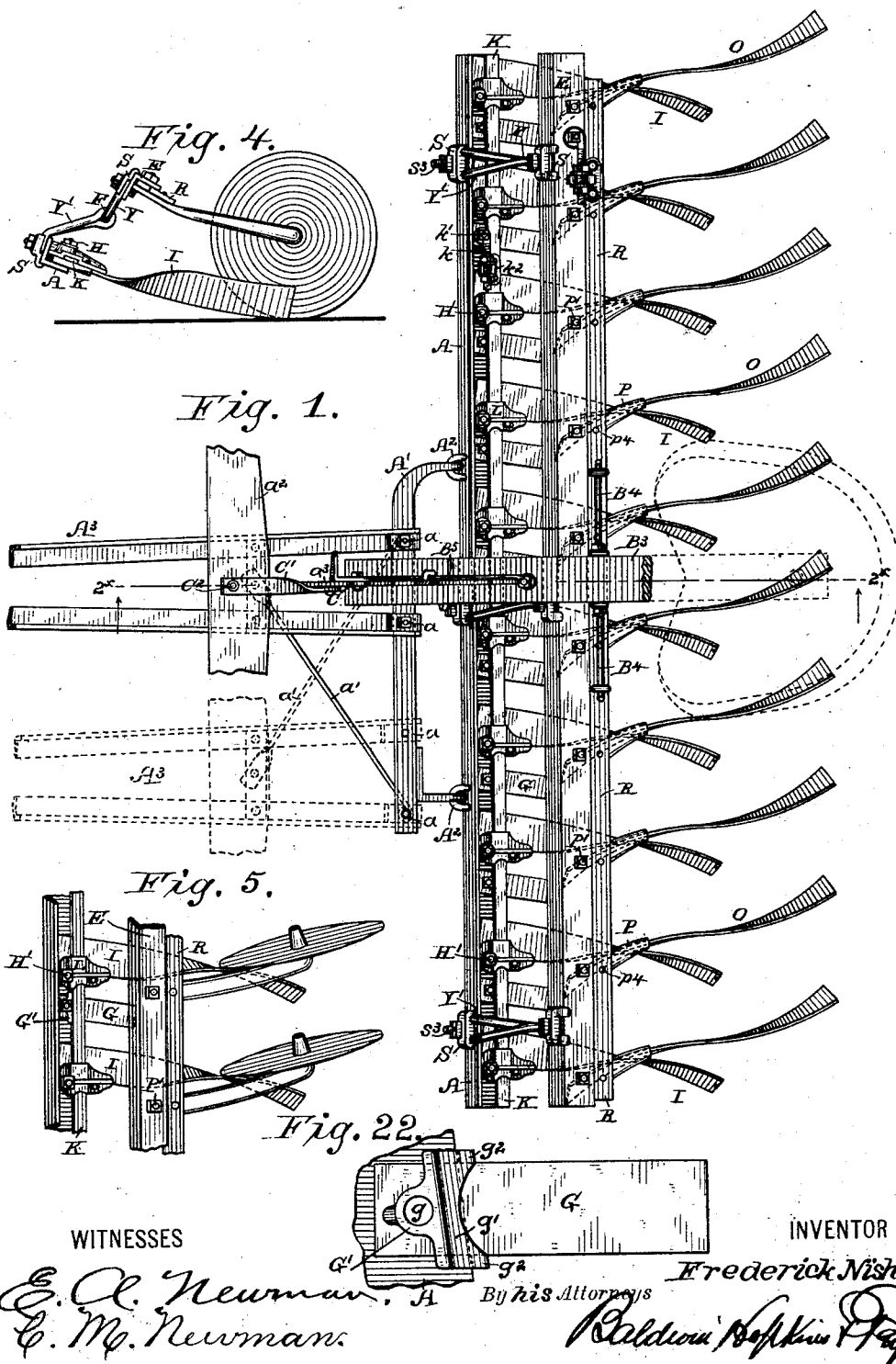
6 Sheets—Sheet 1.

F. NISHWITZ.

HARROW.

No. 360,614.

Patented Apr. 5, 1887.



(No Model.)

6 Sheets—Sheet 2.

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HARROW.

No. 360,614.

Patented Apr. 5, 1887.

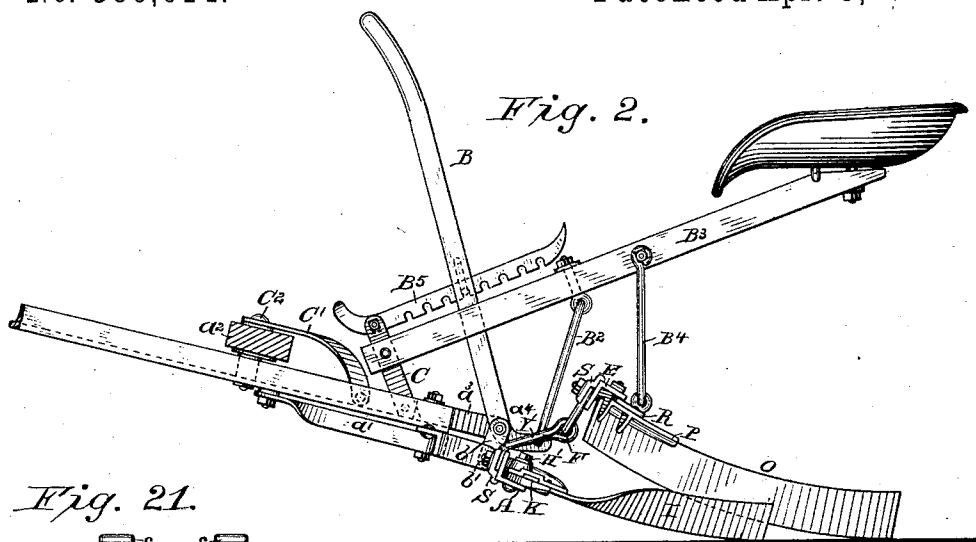
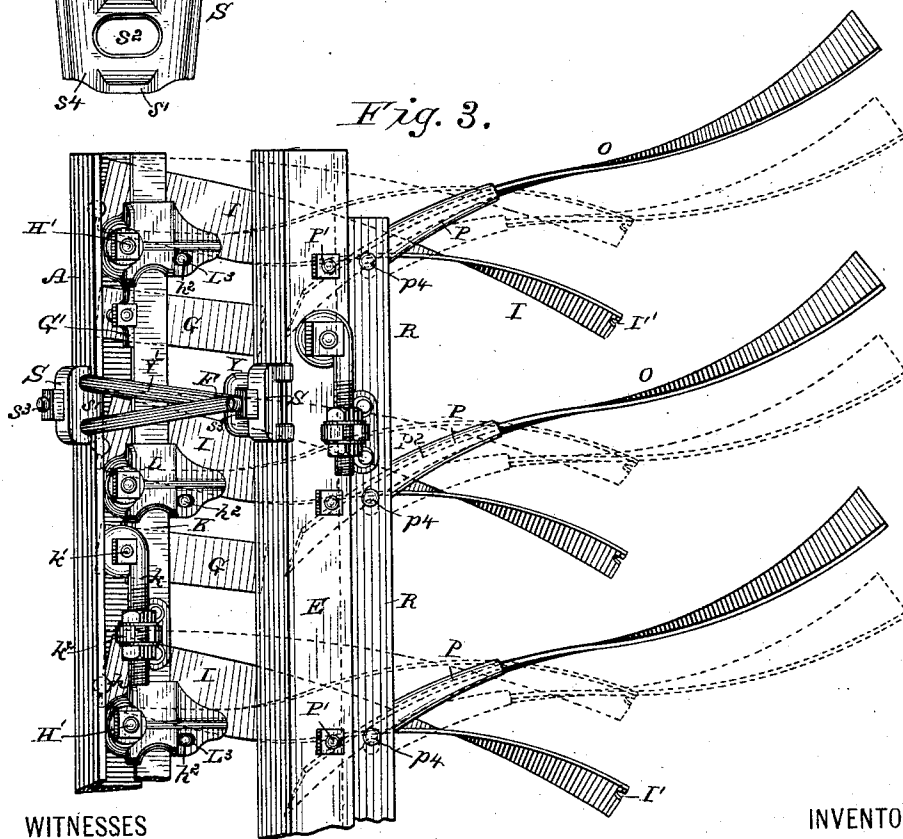
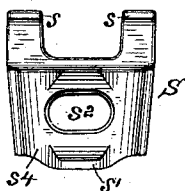


Fig. 21.



WITNESSES

INVENTOR

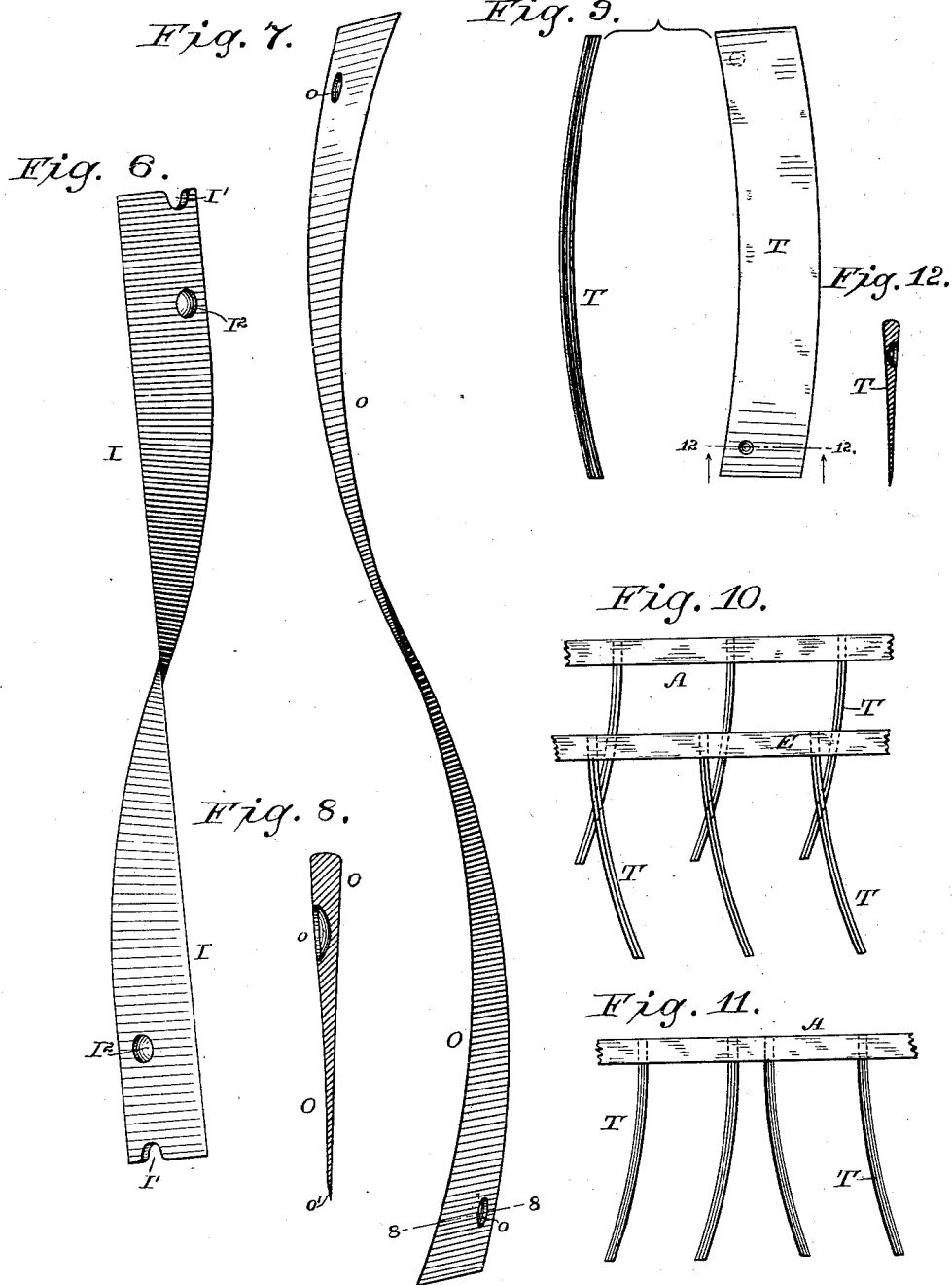
E. A. Newman,  
C. M. Newman.

By *his Attorneys* *Frederick Nishwitz,*  
*Roldwin, Hopkins & Payne.*

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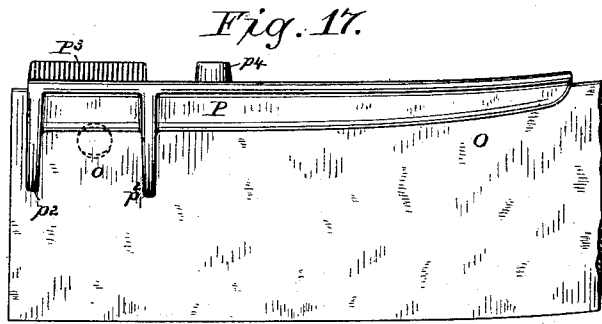
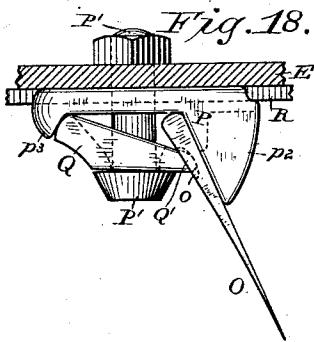
Baldwin, Hopkins & Rogers.

F. NISHWITZ.

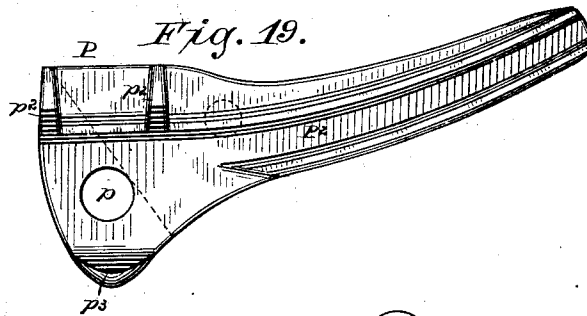
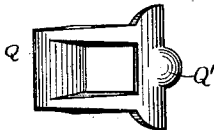
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No. 360,614.

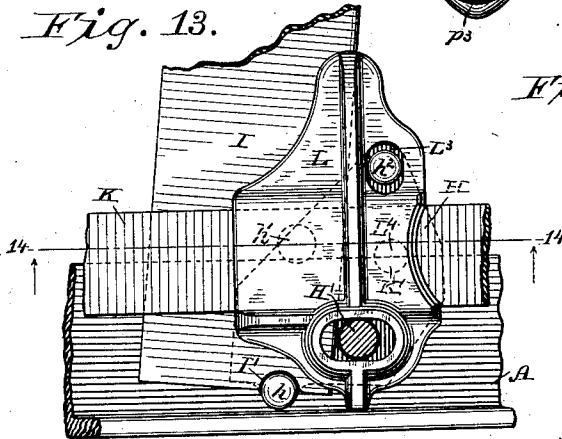
Patented Apr. 5, 1887.



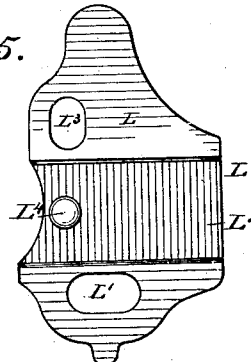
*Fig. 20.*



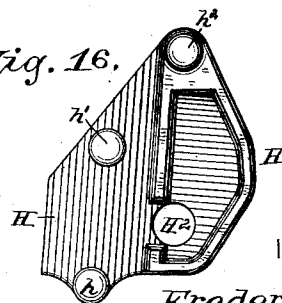
*Fig. 13.*



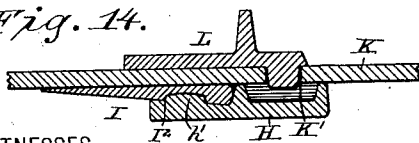
*Fig. 15.*



*Fig. 16.*



*Fig. 14.*



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(No Model.)

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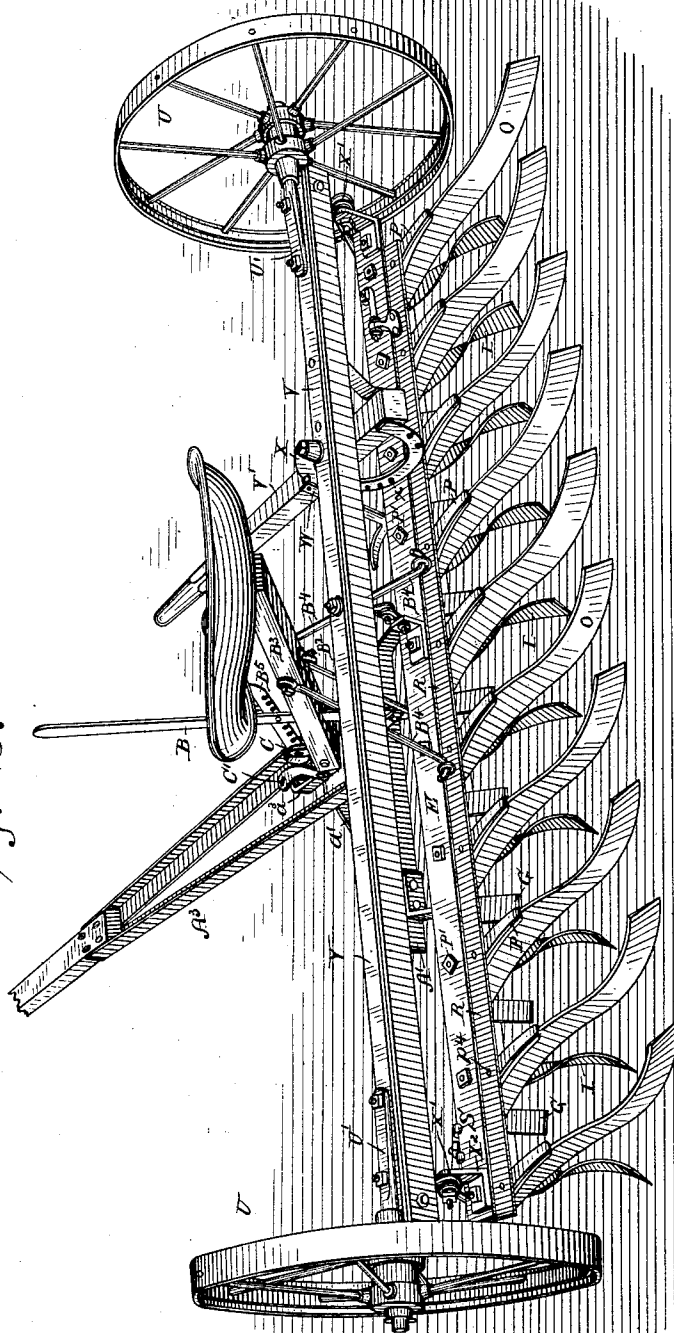
F. NISHWITZ.

HARROW.

No. 360,614.

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Fig. 23:



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(No Model.)

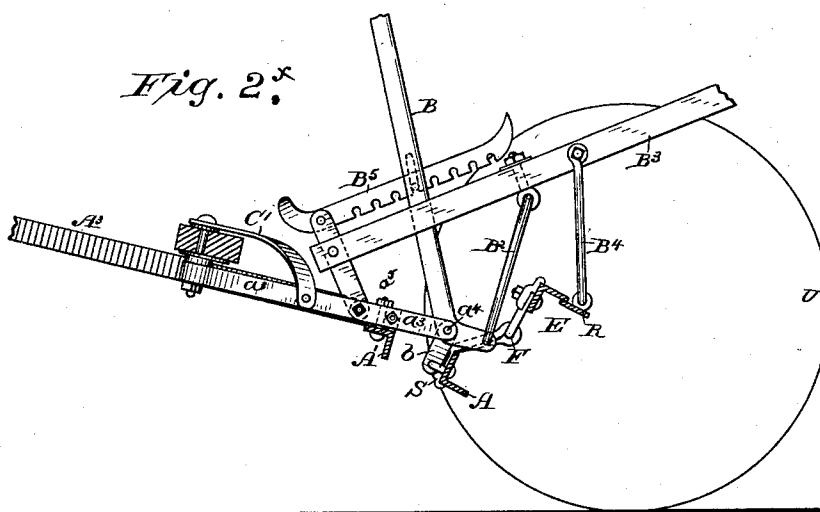
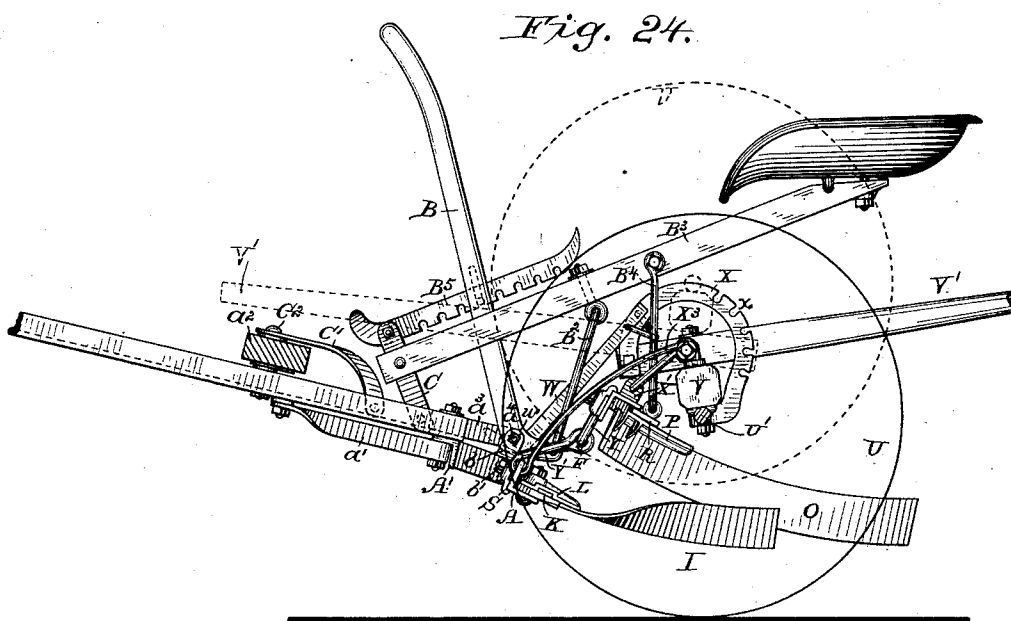
6 Sheets—Sheet 6.

F. NISHWITZ.

HARROW.

No. 360,614.

Patented Apr. 5, 1887.



WITNESSES

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INVENTOR

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# UNITED STATES PATENT OFFICE.

FREDERICK NISHWITZ, OF MILLINGTON, NEW JERSEY.

## HARROW.

SPECIFICATION forming part of Letters Patent No. 360,614, dated April 5, 1887.

Application filed December 18, 1886. Serial No. 221,983. (No model.)

*To all whom it may concern:*

Be it known that I, FREDERICK NISHWITZ, of Millington, in the county of Morris and State of New Jersey, have invented certain  
5 new and useful Improvements in Harrows, of which the following is a specification.

My invention relates to that class of harrows upon which numerous patents have heretofore been granted to me. The particular  
10 type of machine which I now illustrate is that shown in my Patent No. 262,820, patented August 15, 1882.

The object of my invention is to improve the general construction of the class of harrows to which I have referred, and my present invention therefore embraces many points  
15 applicable to them all, while other features of the invention are specially designed for use in connection with the particular type illustrated in the patent above mentioned, though these  
20 latter are not necessarily restricted to such a machine.

I will now describe specifically the particular organization illustrated in the accompanying drawings, without, however, in any manner  
25 intending to limit myself to the specific details of construction therein shown.

In the accompanying drawings, Figure 1 is a plan view of the machine without a sulky; Fig. 2, a side elevation; Fig. 2\*, a transverse  
30 section on the line 2\* 2\* of Fig. 1, omitting the teeth; Fig. 3, a detail plan view of one end of the machine on a larger scale. Figs. 4 and 5 are detail views of a modified construction, in which cutting-disks are carried upon the  
35 rear gang-bars; Fig. 6, a perspective view of the form of tooth employed on the front gang-bar; Fig. 7, a similar view of the tooth used upon the rear gang-bar; Fig. 8, a sectional view, on a larger scale, showing the manner in which the cutting-edge of the tooth is ground. The grinding is the same for both forms of  
40 tooth shown in Figs. 6 and 7, and but one end view is therefore necessary; Figs. 9, 10, and 11, detail views showing the use of similar teeth upon the front and rear gang-bars; Fig. 12, a sectional view, on a larger scale, of the tooth shown in Fig. 9. Fig. 13 is a detail view, on a somewhat enlarged scale, showing the  
50 connection of a harrow-tooth with the front gang-bar; Fig. 14, a section through Fig. 13 on the line 14 14. Figs. 15 and 16 are detached

views illustrating the castings for connecting a tooth with the gang-bar; Fig. 17, a detail side view illustrating the manner of connecting  
55 a tooth on the rear gang-bar; Fig. 18, a detail end view of the matter shown in Fig. 15; Fig. 19, a detail bottom view of the casting which connects the harrow-tooth with the rear gang-bar. Fig. 20 is a detail view of the  
60 clamping-casting by means of which the harrow-tooth is locked in position in the casting shown in Fig. 17; Fig. 21, a detail view of a casting which is bolted to the front and rear  
65 gang-bars and serves to hold the connecting hinge-links; Fig. 22, a detail top view illustrating the manner of connecting the spurs or crushing-teeth to the front gang-bar; Fig. 23, a perspective view of the improved harrow  
70 arranged in connection with a carrying-sulky; and Fig. 24 is an end elevation of the same.

The front gang-bar, A, is preferably formed of angle-iron, and the draft-yoke A' is connected to it by hinge-connections A<sup>2</sup>. The pole A<sup>3</sup>, which is preferably bifurcated at its  
75 rear end, is bolted to the draft-yoke at a, as shown in the full lines in Fig. 1, or may be shifted to adapt the machine to three horses, as indicated by the dotted lines, the draft-yoke being made sufficiently wide for this purpose.  
80 In either position the pole is braced by a brace-rod, a', one end of which is bolted to a cross-piece connecting the bifurcated sections of the tongue and the other end to the draft-yoke A'.  
85

The double-tree a<sup>2</sup> is connected by a pivot-bolt, as usual, with a draft stub or bar, a<sup>3</sup>, (seen in the plan view, Fig. 1, and in Figs. 2 and 2\*,) which is secured at a<sup>5</sup> to the draft-yoke, and has its rear end connected by a  
90 bolt, a<sup>4</sup>, with a link, b, pivoted to a projecting ear or staple, b', secured centrally on the front face of the gang-bar A. The same bolt, a<sup>4</sup>, serves as a pivot for a hand-lever, B, which passes through a slot in the seat-standard. The forward  
95 end of the seat-standard is pivoted to a bar, C, having its lower end bolted to the draft-bar a<sup>3</sup>, its upper end being bolted to the rear end of a rod or link, C', the forward end of which is held by the same bolt, C<sup>2</sup>, which  
100 connects the draft-rod a<sup>3</sup> and the double-tree. That portion of the hand-lever prolonged beyond its pivot a<sup>4</sup> extends rearwardly and is connected by a pivoted rod, B<sup>2</sup>, with the seat-

support B<sup>3</sup>. Similar pivoted rods, B<sup>4</sup>, are connected with each side of the seat-standard and extend to the upper face of the rear gang-bar, E. The hand-lever is locked in its various

positions by a pivoted rack-bar, B<sup>5</sup>, which engages a pin on the side of the lever. At three points, preferably near the ends and middle, the front and rear gang-bars are connected by hinge-connections F.

There are two hinge-connections between the front and rear gang-bars, formed by interlocking links, made preferably of round iron. The links Y on the rear gang-bar are in the form of a staple, while those, Y', on the front bar have a twist in the middle, forming eyes which interlock with the staple-links Y to form hinge-joints. The free ends of each piece are secured to the gang-bar by a casting, S. (Shown in detail in Fig. 21.) The figure is a view of the under side of the casting. It is preferably formed at one end with two fingers, s, bent at right angles to embrace the corner of the angle-iron or gang-bar. The opposite side is formed with a bent lug or finger, s', which embraces the edge of the gang-bar. On each side of the bolt-hole s<sup>2</sup> is formed a depression or socket, in which the ends of the bent hinge-links fit. As clearly seen in Fig. 3, the clamping-bolt s<sup>3</sup>, which passes through the casting and gang-bar, will firmly hold the ends of the hinge-links inserted in the sockets s<sup>4</sup> in the castings. The construction is identical for both the front and rear gang-bars.

The arrangement of laterally-shifting pole is analogous to that described in my Patent No. 262,975, while the arrangement of draft-bar, hand-lever, and seat-supports is analogous to that shown in my Patent No. 262,820, though, as will be perceived, the construction in each instance is somewhat modified. The construction gives a flexible machine, which may be readily conformed to the conditions of the soil upon which the harrow is working.

The most important improvements in the present organization relate to the harrow-teeth and to the manner of connecting them with the gang-bars, and these I will now proceed to describe.

The front gang-bar, A, has its angle or corner toward the front, with one flange or side extending upward and the other to the rear, and is provided with trailing harrow-teeth of the general type disclosed in my earlier patents, arranged alternately with short flat crushing-spurs, as also shown in those patents. The spurs are connected to the gang-bar in the manner illustrated specially in Figs. 3 and 22—that is, the spur G is clamped upon the bar by a casting, G', formed with a hole, g, for the passage of the clamp-bolt, which passes through the gang-bar, spur, and casting, so as to firmly clamp the three together. To prevent the spurs from turning on the bolt, the casting G' is formed with lips or lugs g<sup>2</sup> at each rear corner, which turn down against the rear edge of the gang-bar, so that when the bolt is screwed up tightly the flat faces of the lugs g<sup>2</sup>,

bearing upon the rear straight edge of the gang-bar, prevent the parts from turning. The upper face of the casting G' is formed with a right-angled recess or socket, g', for the reception of an endwise-moving adjusting-bar, as appears more fully below. The manner of connecting the trailing teeth on the front gang-bar appears more specially from the enlarged views, Figs. 13, 14, 15, and 16. The casting H, of which Fig. 16 is a top view, lies flat upon the upper face of the gang-bar, and the clamp-bolt H' extends through the hole H<sup>2</sup>.

The end of the twisted trailing tooth I lies flat upon the casting H, and is formed with a recess or notch, I', in its end edge, which fits around a stud or projection, h, on the casting H, and with a depression, I<sup>2</sup>, in its face, into which a stud or lug, h', on the casting H enters. The tooth is shown specially in Fig. 6, and the relation of the tooth and casting H is indicated by the full and dotted lines in Fig. 13. Obviously, with this engagement between the tooth and casting H, they will have to move together if either be turned upon the bolt H'.

The endwise-moving adjusting-bar K lies upon the upper face of the tooth, and over the bar and bolt H' is placed a casting, L, of which Fig. 15 is a bottom view. This casting is formed with a bolt-opening, L', elongated somewhat in the direction of the length of the gang-bar, through which the clamp-bolt H' passes, and with a transverse depression or socket, L<sup>2</sup>, in which the adjusting-bar K fits. It is also formed with an opening, L<sup>3</sup>, elongated in a direction parallel with the side of the tooth, or, in other words, at right angles to the elongation of the bolt-hole L'. A stud, h<sup>2</sup>, on the casting H enters the opening L<sup>3</sup> when the casting is placed in position, as above mentioned, and as fully shown in Fig. 13. The casting L is also provided with a stud, L<sup>4</sup>, which enters an aperture, K', in the bar K. All the parts are clamped together by a suitable nut. If the clamp-nut be loosened and the bar K moved endwise, the effect will be that the bar will move the top casting, L, by reason of the interlocking-joint L<sup>4</sup> K', and this will accomplish the rocking of the bottom casting, H, on the clamp-bolt H' by reason of the interlocking-connection L<sup>3</sup> h<sup>2</sup> between the upper and lower castings, L and H. By loosening all the clamp-nuts, therefore, the entire gang of teeth on the bar may be rocked upon the clamping-bolt, so as to throw their outer ends either to one side or the other, as may be desired.

The particular means for moving the adjusting-bar and the purpose of giving the teeth this horizontal swinging adjustment are presently described; but before doing so I desire to refer more particularly to the teeth and their connections with the gang-bar.

Upon reference to Fig. 6 it will be noted that the teeth for the front gang-bar are twisted about midway of their length and are similarly shaped on both sides of a central transverse line, sockets I<sup>2</sup>, for engagement with the

lugs on the casting H, being formed on opposite sides of each tooth in corresponding positions near its ends. Obviously it is entirely immaterial which end of the tooth is connected to the gang-bar, as above described. This being the case, of course the teeth may be reversed end for end for any reason desired. This capacity in a trailing knife-cutting tooth forms one of the distinguishing features of my invention.

Upon reference to Fig. 3 the arrangement for shifting the adjusting-bar K will be clearly understood. An eyebolt, *k*, embraces a bolt, *k'*, on the gang-bar, and its opposite screw-threaded end passes through a socket in a lug, *k''*, formed in a bracket secured to the shifting bar. A check-nut is provided on each side of the lug. By loosening the clamp-nuts on the ends of the various bolts H', the bar K may, by means of the devices just described, be shifted endwise to rock all of the trailing teeth upon their bolts.

Of course the harrow may be built without the capacity of rocking the teeth horizontally, and any suitable devices for connecting the teeth with the bar may be employed.

It will be observed that the teeth are not perforated. This I consider an advantage, for the reasons that they are not weakened at the points of connection with the gang-bar, and there is no aperture in the trailing ends of the teeth to collect rubbish. The details shown are those which I prefer to employ, and I also prefer to use the endwise-shifting bar in order to rock the teeth horizontally upon the bolts H'; but the invention is not limited to such an operation, nor to the particular details of construction or form of teeth shown.

I will now describe the manner of connecting the teeth on the rear gang-bar. This bar is formed of angle-iron, having the apex or corner turned to the top and front.

The devices for connecting the teeth O to the rear gang-bar are shown more especially in Figs. 17, 18, 19, and 20. A casting, P, of which Fig. 19 is a bottom view, is formed with a bolt-hole, *p*, for the passage of the clamping-bolt P', which also passes through the gang-bar. When in position the upper face of the casting P is drawn up against the under face of the gang-bar. The casting is widest at its front end, and is narrower and curved laterally toward the rear. In this curved rearward extension is formed a curved socket, P<sup>2</sup>, in which the thicker or upper edge of the curved harrow-tooth O fits. The casting P is formed with lugs *p'*, against which the side of the tooth O is clamped, as seen more especially in Fig. 18. This clamping is accomplished in the following manner: Upon the side of the tooth O near its end is a depression or socket, *o*, and when the tooth is in position in the casting P it will be firmly held therein by a clamping-casting, Q. (Shown in detail in Fig. 20 and also in Fig. 18.) This casting is formed with an opening, through which the clamping-bolt P' passes, and on one side has a teat or

enlargement, Q', which fits in the socket *o* in the side of the tooth. The opposite side is formed with a curved widened end, which fits in a correspondingly-curved shoulder or side piece, *p''*, of the casting P. When, therefore, the nut on the bolt P' is screwed up the casting Q will clamp the side of the tooth against the lugs or shoulders *p'*, and the parts will all be rigidly held in position.

I prefer to make the rear teeth adjustable by swinging them horizontally with reference to their clamping-bolts, and to accomplish this purpose I form upon the upper face of the casting P a shoulder or block, against which an endwise-moving shifting bar, R, works.

Opposite each tooth the shifting bar is formed with a socket or aperture, in which a lug, *p'*, on the upper face of the casting P engages. The edge of the shifting bar adjoining the gang-bar extends under the gang-bar somewhat, so that it is held against vertical movement. By loosening the clamp-bolts of the several teeth and shifting the bar endwise, the teeth will be swung upon their pivotal clamping-bolts and their outer ends turned either one way or the other to a limited extent. The manner of effecting this adjustment is precisely the same as that described in connection with the teeth on the front gang-bar, and is clearly shown in Fig. 3. Specific description is therefore unnecessary. This part of my invention is also not limited to the special details of formation of the teeth and the connection with the gang-bar, as such matters may be varied.

Upon reference to Figs. 6, 7, and 8 it will be perceived that the teeth for both the front and rear gang-bars are formed with like ends. In other words, they are alike on each side of a central transverse line, and, as before described, the teeth for both bars are so formed that either end may be connected with the gang-bar without changing the cutting relation of the teeth to the soil. By such an organization I accomplish a very useful and economical result—that is, when the ends of the teeth have become worn down or dulled from constant use in gritty soil the entire gangs of teeth may be reversed end for end and the machine practically equipped with entirely new sets of cultivating devices. So far as I am aware, I am the first to propose or accomplish such a result in connection with trailing cutting-teeth of the general character described.

The material of which I prefer to make the teeth is rolled steel of the general cross-section illustrated in Fig. 8, which is an enlarged sectional view on the line S S of the tooth illustrated in Fig. 7. The view shows the socket *o*, by means of which the tooth is clamped in position on the gang-bar. An enlarged cross-section of a tooth, I, for the front gang-bar would be identical, and it is therefore unnecessary to illustrate it.

As before remarked, the sockets *o* or I<sup>2</sup>, by means of which the connection of the teeth

with the gang-bars is effected, are in each tooth formed on opposite sides near the ends, so that when the teeth are reversed their cutting relation to the soil will not be changed.

5 As seen in Fig. 8, the cutting-edge of the tooth is ground off or beveled, as indicated at  $o'$ , on the side in which the clamping-socket  $o$  is formed. Both teeth I and O are similarly ground on the side in which the clamping-socket I<sup>2</sup> or  $o$  is formed, and about the middle of the tooth the grinding is, of course, changed from one side to the other.

As shown in cross-section, Fig. 8, and as also seen in the end view, Fig. 18, I prefer to form the harrow-teeth of hollow rolled steel. Such a shape makes the tooth self-sharpening, and as it wears down the cutting-edge is not materially impaired.

The material of which the teeth are formed is preferably hollow-rolled on one side only. If, therefore, the shape of the tooth due to this cause was not modified at one end, when the tooth was reversed the hollow side would come against the straight faces of the lugs  $p^2$ . It is desirable to avoid this, and I therefore at one end of the tooth change the shape, so that the tooth will be hollow on the side upon which the opening I<sup>2</sup> or  $o$  is formed. This is very readily done by the dies in which the teeth are struck or formed into the shapes illustrated.

In Figs. 9, 10, 11, and 12 I have indicated teeth of another character, which may be used on my improved machine. These teeth T may be merely curved laterally and made slightly rocker shape and without any twist. Both the teeth of the front gang-bar and rear gang-bar will of course have to be connected with a bar, so that the blade of the tooth stands vertically, as indicated in Fig. 10. Any devices for connecting the teeth with the bars may be employed. In reversing teeth of this character end for end, the teeth of the front gang-bar and those of the rear gang-bar will have to be transposed. When a machine having a single gang-bar is used, and the teeth on one side of the central line of draft arranged to turn the earth in one direction and those on the other in the opposite direction, teeth such as shown in these figures when reversed must be changed to opposite sides of the draft-line, as is obvious.

My improved reversible trailing-teeth will, by preference, be mounted in gangs upon a common gang-bar, in substantially the manner illustrated; but I do not limit them to such use, as they might be mounted in gangs arranged obliquely to the line of draft, and instead of being mounted on a common gang-bar each tooth might be carried on an individual support.

Figs. 4 and 5 do not require specific description. The construction illustrated is that shown in the other figures, and already described, with the exception that on the rear gang-bar cutting-disks are mounted on rearwardly-extending arms in the place of the

trailing-teeth illustrated in the other figures. The manner of connecting the rearwardly-extending arms to which the disks are attached may be different and more simple than that already described—namely, the flattened end of each bar is clamped to the gang-bar by a bolt and nut without the intervention of a casting. Lugs on the upper faces of the arms engage in apertures in an endwise-shifting bar in the same manner and for the same purpose described in connection with Figs. 17 and 18.

I will now describe the connection of a carrying-sulky with my improved machine, as shown in Figs. 23 and 24.

Sulky or carrying wheels U are shown as mounted upon crank stud-axles U', bolted to the main axle V. The axle may, however, be straight and have the wheels mounted directly on its ends. A lever, V', is shown as rigidly connected with the axle in convenient proximity to the driver's seat; but the lever or axle rocking device or mechanism need not necessarily be mounted on the axle. By rocking the lever back and forth the main axle will be rocked and the harrow raised or lowered with reference to the carrying-wheels, as presently appears.

Between the rocking axle and the harrow there are three hinge-connections, X', one near each end of the harrow and one about the middle. The construction may be as follows: Brackets or eyebolts projecting from the axle are hinged or pivoted to brackets X<sup>2</sup>, on the upper face of the rear gang-bar, and from each pivot-bolt of such hinge-connection a pivoted rod or link, X<sup>3</sup>, extends to and is pivotally connected with the front gang-bar in any suitable way. Of course this pivotal or hinge connection between the sulky and axle, which is arranged parallel with the gang-bars, and preferably in quite close proximity to them, may be formed in any suitable way.

The machine is held in any position in which it may be thrown by a detent-arm, W, pivoted on the front gang-bar at  $w$  and engaging with notches  $x$  in a curved rack, X, one end of which is connected with the under side of the axle and its opposite end with the lever V. This is a simple and compact construction, retaining all the flexibility of the harrow proper. By removing the hinge-connections X' the harrow may readily be detached from the sulky when desired.

The driver from his seat on the machine may rock the main axle to lower the carrying-wheels into the position indicated by full line in Fig. 24, when the machine may be transported without contact of the harrow-teeth with the soil; or the axle may be rocked to elevate the carrying-wheels and permit the teeth to rest upon the soil. This organization gives the capacity of regulating the depth of cut of the teeth.

Several arrangements of sulky attachments for connection with my improved type of harrows are shown in patents heretofore granted

to me; but the general organization shown is different from what has been done prior to my invention.

Having now described my invention embodied in a machine of practical and efficient construction, its general method of operation will be readily understood by those skilled in the art. I desire, however, to call special attention to several features.

As to the horizontal adjustment or swinging of the teeth on their clamp-bolts, I prefer to give the gangs this capacity, in order to perfectly adapt them for work in all kinds of earth. For instance, where the soil is covered with loose weeds or trash of any kind, it is desirable to bring the teeth on the front and rear gang-bar more in line with each other, so that they will cut through the trash and prevent any liability of the machine clogging. This position of the teeth is indicated by the dotted lines in Fig. 3. Where, however, the machine is operating upon soil upon which the weeds are standing, then the teeth should be set farther apart, as indicated by the full lines in Fig. 3, so as to thoroughly operate upon all portions of the surface traversed and cut out the weeds.

I am aware that gangs of rearwardly-projecting teeth have been provided with means for adjusting them horizontally. I am aware, broadly speaking, that heretofore curved trailing teeth having a twist or curve in them to turn up the earth and to cut under the soil have also been used in combination with adjusting devices of the general character described.

The castings S, for connecting the hinge-links with the gang-bars, have their bolt-holes elongated in the direction of the length of the gang-bars. The purpose of this arrangement is to allow a certain amount of play to the gang-bars in adjusting the endwise moving bar to swing the teeth horizontally. Of course, in every instance when the proper adjustment has been made it would be best to screw up all the clamp-nuts, so as to hold the parts in their adjusted positions.

Referring again to the teeth, it will be observed that in side view the teeth O of the rear gang-bar especially, but also the teeth I of the front gang-bar, present a rocker shape or curved line from front to rear, and are formed with a slight curve or twist, so that they act with a draw or knife cut upon the soil. I prefer to shape them thus.

Having special reference to the side elevation, Fig. 2, it will be perceived that this rocker shape or curve in the rear teeth is more marked than in the teeth of the front gang. One purpose of this is to permit of the rear gang-bar being placed at a considerable elevation above the front gang-bar, as clearly seen in the figure, so as to afford a large area of discharge for the debris or loose earth cut up by the front gang of teeth. The general curve or rocker shape of the teeth also causes them to act upon the soil more favorably and with

greater ease than if their lower edges in said view presented a straight line.

So far as the reversible character of the teeth is concerned, in this connection it is desirable to use hollow-rolled steel, for the reason that when the teeth are reversed they present the same kind of a cutting-face to the soil as they did before. This is a marked advantage, aside from the fact that the teeth thus shaped are self-sharpening.

I am aware that ordinary cultivating colters or shares have been made reversible end for end, and I do not therefore claim such subject-matter.

I claim as my invention—

1. The combination of a support or carrying-beam and an end-for-end reversible trailing knife-cutting harrow-tooth projecting rearwardly therefrom and having a continuous cutting-edge.

2. The combination of a support or carrying-beam and an end-for-end reversible trailing knife-cutting harrow-tooth adapted to be attached to the support by either end.

3. A trailing knife-cutting harrow-tooth formed with substantially like ends and adapted to have either end secured to a carrying-bar, substantially as set forth.

4. The combination of a carrying-bar, curved or twisted harrow-teeth substantially similarly shaped on opposite sides of their central transverse lines, and mechanism whereby the teeth may be secured by either end to the bar.

5. The combination of a carrying-bar, unperforated trailing knife-cutting harrow-teeth formed with substantially like ends, and clamping mechanism whereby the teeth may be secured to the carrying-bar by either end, substantially as set forth.

6. A curved trailing reversible harrow-tooth formed of hollow-rolled steel and similarly shaped on opposite sides of a transverse central line.

7. The combination of a carrying-bar, end-for-end reversible trailing harrow-teeth shaped so as to present a rocker shape or curved lower edge from end to end in side elevation, and mechanism for attaching the teeth to the bar by either end.

8. The combination of a front gang-bar having harrowing or cultivating devices upon it, a rear gang-bar arranged upon a higher plane, end-for-end reversible curved or rocker-shaped harrow-teeth upon the rear gang-bar, and devices for securing said rocker-shaped teeth to the gang-bar by either end.

9. The combination of a flat knife-cutting harrow-tooth formed with a depression in its flat side for engagement with a clamping or holding device, a carrying-bar, and devices for securing the tooth to the bar.

10. The combination of a carrying-bar, trailing knife-cutting harrow-teeth formed with substantially like ends and curved between their ends, and devices for connecting the teeth to the bar by either end.

11. The combination of a carrying-bar, harrow-teeth formed with substantially like ends and twisted between their ends, and devices for securing the teeth to the bar by either end.

12. The combination of a gang-bar, end-for-end reversible trailing harrow-teeth formed with a twist or curve to adapt them to cut under and turn the earth, devices by which the teeth may be secured to the gang-bar by either end, and adjusting mechanism for swinging the rear ends of the teeth horizontally, substantially as and for the purpose set forth.

13. The combination of a front gang-bar, twisted trailing end-for-end reversible harrow-teeth having flat ends for attachment to said bar, a rear gang-bar, and sinuous or S shaped end-for-end reversible trailing teeth on the rear bar.

14. The combination of a front gang-bar having end-for-end reversible trailing teeth thereon which act on the soil in a uniform direction or manner on both sides of the central draft-line, a rear gang-bar, and end-for-end reversible trailing teeth on the rear gang-bar which act on the soil in a uniform manner on both sides of the central draft-line.

15. The combination of the front gang-bar, the casting H, formed substantially as illustrated, the adjusting-bar K, the upper casting, L, formed substantially as illustrated, the harrow-tooth I, and the clamp-bolt.

16. The combination of the rear gang-bar, the casting P, formed substantially as described, the harrow-tooth provided with a socket or depression near its end, the clamp-casting Q, and the clamp-bolt.

17. The combination of the gang-bar, the rearwardly-projecting harrow-teeth, the casting or clamping device by which said teeth are connected with the gang-bar, the sliding adjusting-bar connected with said castings, and the adjusting-bolt for effecting the adjustment of the sliding bar.

18. The combination of the gang-bar, the harrow-tooth formed with a notch upon its end, a casting or fastening device by means of which the tooth is connected with the gang-

bar having a lug or projection which enters the notch in the end of the harrow-tooth, and clamping devices for holding the parts together.

19. The combination of the front gang-bar or frame, the draft-yoke or frame, the laterally-shifting pole, and the shifting diagonal brace *a'*, extending from the yoke to the pole and adapted to be shifted to either side of the pole, according to its position.

20. The combination of the axle, the carrying-wheels, a trailing-tooth harrow having its transverse gang bar or bars which carry the trailing teeth arranged in front of the rocking axle, a hinge or pivotal connection extending from the axle to the harrow, and mechanism for rocking the axle, for the purpose set forth.

21. The combination of the rocking axle, the carrying-wheels, mechanism for rocking the axle, a trailing-tooth harrow, hinge or pivotal connections between the harrow and axle, a rack carried by the axle, and a pivoted detent mounted on the harrow, substantially as and for the purpose set forth.

22. The combination of the rocking axle, the wheels, a trailing-tooth harrow consisting of flexibly-connected transverse gang-bars carrying trailing cutting-teeth, pivotal rod-connections between the axle and transverse gang-bars of the harrow at or near the ends of the gang-bars, and mechanism for rocking the axle, for the purpose set forth.

23. The combination of the rocking axle, the wheels, a trailing-tooth harrow consisting of flexibly-connected transverse gang-bars carrying trailing cutting-teeth, hinge or pivotal connections between the axle and harrow, and mechanism for rocking the axle, whereby the relation of the flexible harrow to the soil is varied.

In testimony whereof I have hereunto subscribed my name.

FREDERICK NISHWITZ.

Witnesses:

ARCHD. GRACIE,  
EDWARD C. DAVIDSON.