(No Model.) 4 Sheets—Sheet 1.

# J. M. SMITH.

## DITCHING MACHINE.

No. 343,613. Patented June 15, 1886.

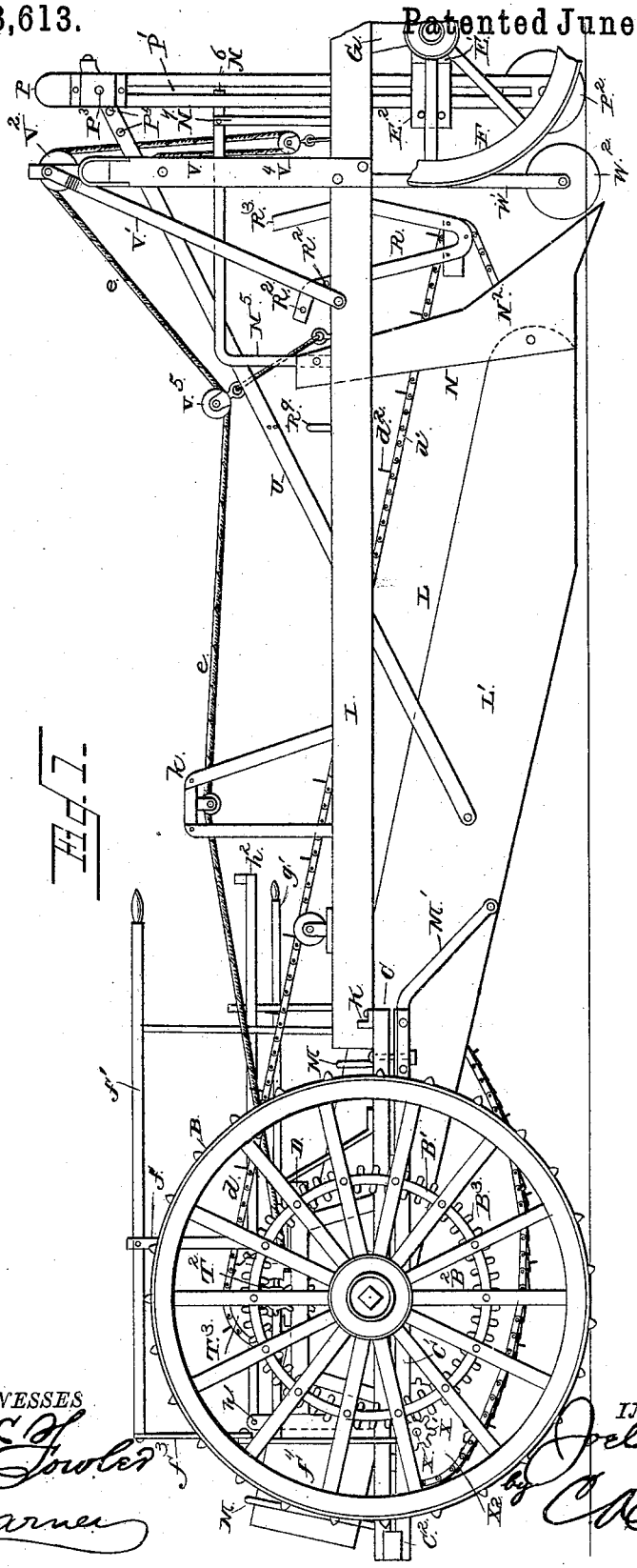


Fig. 1.

WITNESSES

M. E. Fowler

J. W. Garner

INVENTOR

Joel M. Smith

by Crowell & Crowell

Attorneys

(No Model.) 4 Sheets—Sheet 2.

# J. M. SMITH.

## DITCHING MACHINE.

No. 343,613. Patented June 15, 1886.

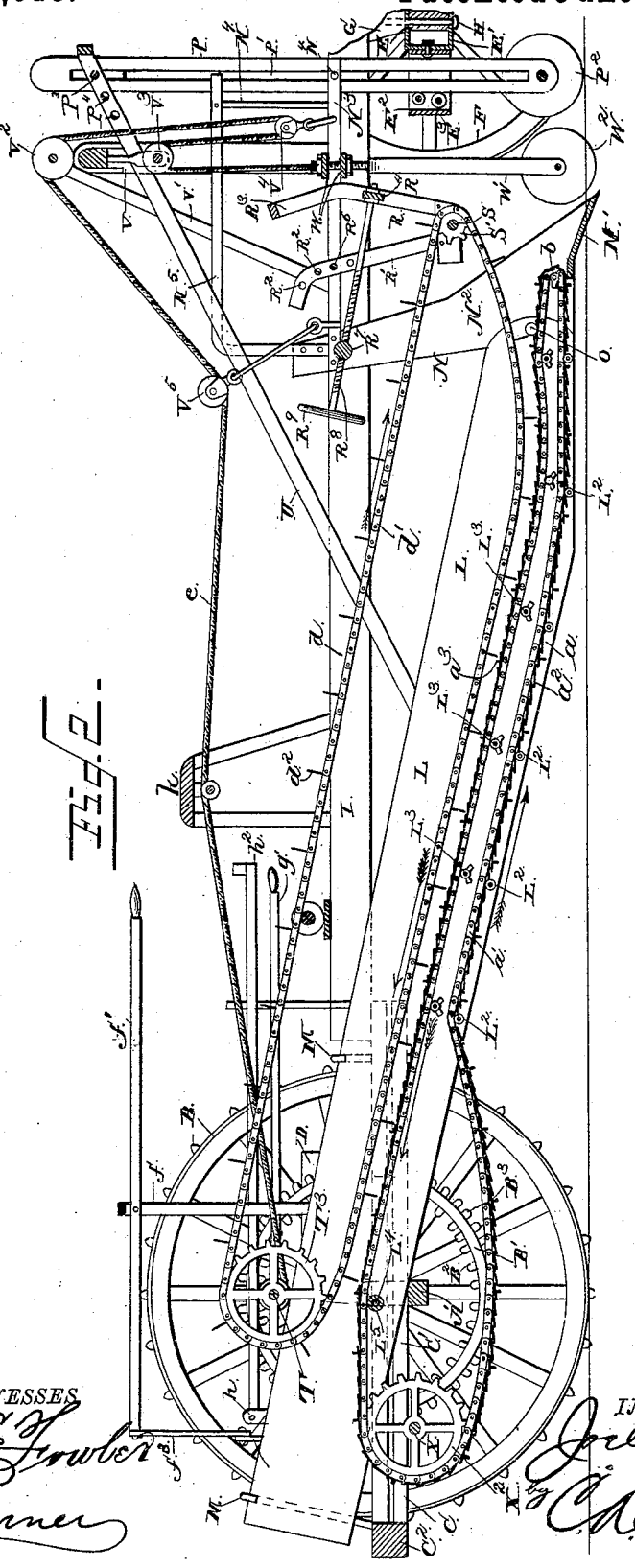


Fig. 2.

WITNESSES.

M. E. Fowler

J. W. Garner

INVENTOR

Joel M. Smith

by C. A. Snow & Co

Attorneys

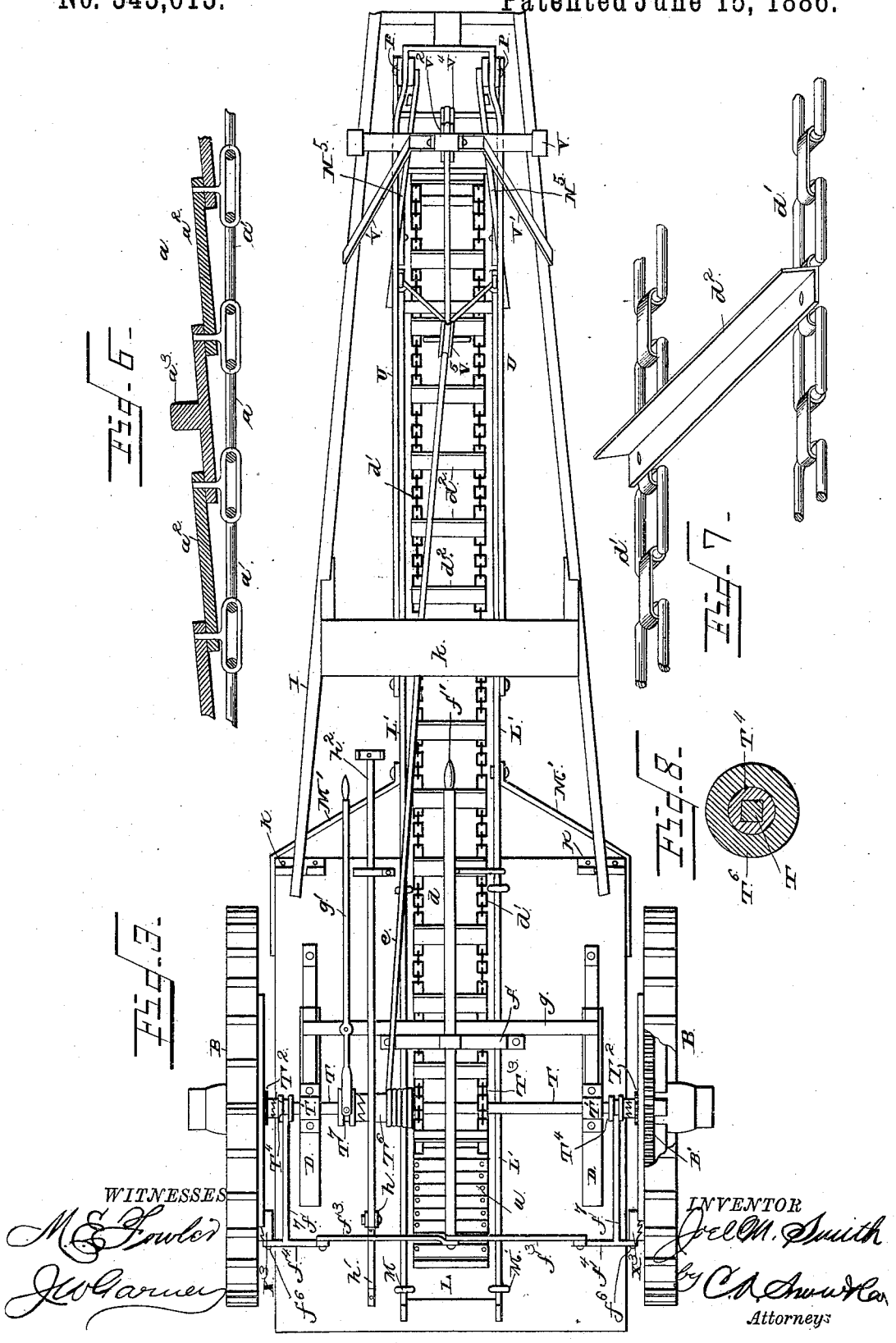
N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 4 Sheets—Sheet 3.

# J. M. SMITH.

## DITCHING MACHINE.

No. 343,613. Patented June 15, 1886.



WITNESSES

M. E. Fowler

J. W. Garner

INVENTOR

Joel M. Smith

by C. A. Snow & Co.

Attorneys

(No Model.)

4 Sheets—Sheet 4.

# J. M. SMITH.

## DITCHING MACHINE.

No. 343,613. Patented June 15, 1886.

Fig. 5.

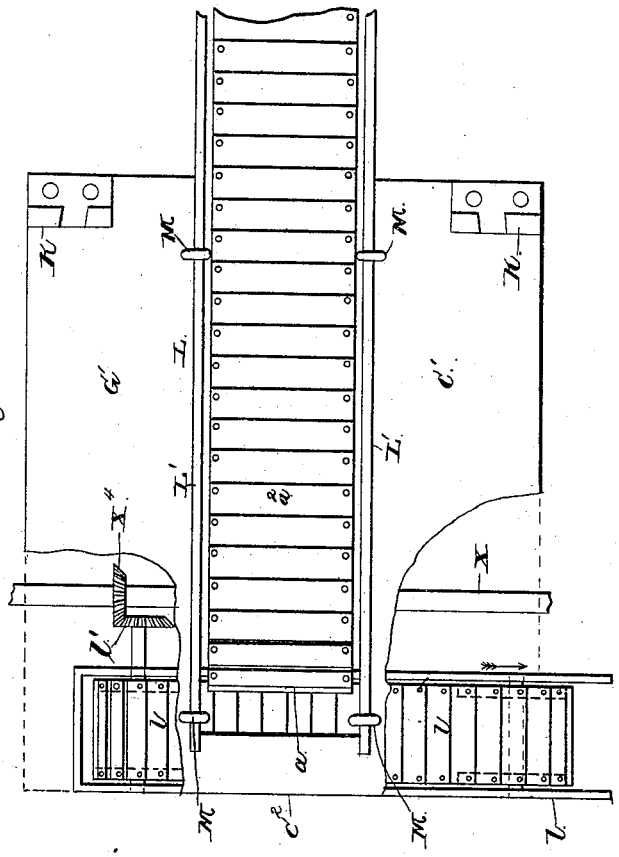
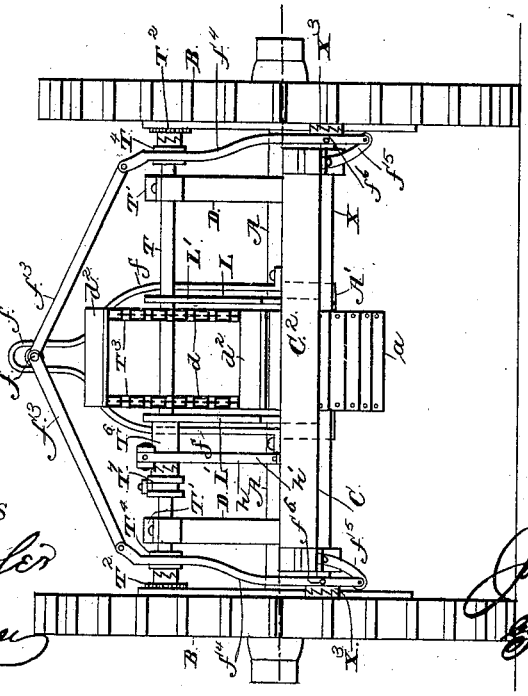


Fig. 4.



WITNESSES

M. E. Fowler

J. W. Garner

INVENTOR

Joel M. Smith

By C. A. Snow & Co

Attorneys

# UNITED STATES PATENT OFFICE.

JOEL M. SMITH, OF MOUNT PLEASANT, IOWA.

## DITCHING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 343,613, dated June 15, 1886.

Application filed October 22, 1885. Serial No. 180,639. (No model.)

*To all whom it may concern:*

Be it known that I, JOEL M. SMITH, a citizen of the United States, residing at Mount Pleasant, in the county of Henry and State of Iowa, have invented a new and useful Improvement in Ditching-Machines, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to an improvement in ditching-machines; and it consists in the peculiar construction and combination of devices, that will be more fully set forth hereinafter, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of a ditching-machine embodying my invention. Fig. 2 is a vertical longitudinal sectional view of the same. Fig. 3 is a top plan view of the same, a portion of one of the driving-wheels being broken away to disclose the subjacent gear-wheels. Fig. 4 is a rear elevation. Fig. 5 is a top plan view of the rear portion of the machine, partly broken away to show the transverse carrier. Fig. 6 is an enlarged detailed sectional view of a portion of the endless carrier. Fig. 7 is an enlarged detailed perspective view of a portion of the auxiliary carrier; and Fig. 8 is an enlarged detailed transverse sectional view of the drum.

A represents the rear axle, which is bent to form a central depression, A′. Driving-wheels B are mounted on the spindles of this axle, and to it is secured a U-shaped frame, C, composed of the side beams, C′, and the rear transverse beam, $C^2$. The side beams are composed of double thicknesses of timber securely bolted together.

D represents stanchions, that are secured on the upper sides of the side beams of the frame C, over the center thereof.

E represents the front axle, which is provided with wheels F, of considerably less diameter than the driving-wheels, and this front axle is pivoted to a bolster, G, by a king-bolt, H, in the usual manner. On the upper side of the bolster are securely bolted the front ends of the side beams, I, the rear ends of which rest in metallic blocks K, that are secured on the frame C.

The frame C, the side beams, I, and the bolster constitute the main frame of the machine, and as the side beams are secured at their front ends to the bolster, and have their rear portions resting in the blocks K, it follows that the main frame is extensible—that is to say, capable of being lengthened or shortened—by sliding the free ends of the side beams back and forth on the blocks. The side beams, I, converge or approach each other at their front ends, as shown at Fig. 3.

L represents the elevating box or trough, which is composed of the sides L′, and is without either top or bottom. The rear end of the elevating-trough rests on the depressed portion of the rear axle, and is secured to the frame C by rods M, which are secured to said frame and extend up on the outer sides of the trough, and have their upper ends bent over the top edges thereof, as shown. Brace-bars M′ also connect the trough and the frame C. The lower front end of the trough is pivoted to an excavating-plow, N, as at O. This plow has an inclined scoop or cutter, N′, and two parallel vertical side arms, $N^2$, in between which the lower end of the trough is pivoted or hinged.

Near the upper ends of the arms of the plow are secured horizontal metallic bars $N^3$, that extend forwardly to vertical sliding metallic standards P, which latter are slotted, as at P′, throughout their lengths. A wrist-pin, $N^4$, connects the front ends of the bars $N^3$, and the projecting ends of said pin are secured in the slotted standards. The front ends of the bars $N^3$ are thereby rendered vertically movable in the standards P. Rollers $P^2$ are journaled at the lower ends of the standards, which rollers run in the bottom of the ditch in advance of the plow and support the standards. If preferred, shoes or slides may be substituted for the rollers, and are sometimes advantageously employed instead of the rollers when the ground is soft and wet. A U-shaped link, E′, is pivoted to the front axle, and a closed link, $E^2$, is swiveled to said link in rear of the axle. The lower ends of the standards P pass through the link $E^2$ and are guided vertically therein when they are raised or lowered by rollers $E^3$, that bear against the rear sides of said standards.

To the upper ends of the arms of the plow

are bolted bent metallic bars $N^5$, which extend vertically for a suitable distance, and then horizontally, above the bars $N^3$ and parallel with the latter. The front ends of the bars $N^5$ are bent outwardly at right angles, as at $N^6$, and enter the slotted standards, as shown. Vertical rods $N^7$ connect the bars $N^3$ and $N^5$ near their front ends.

U represents brace-rods, that are pivoted at their lower ends to the elevating-trough and at their upper ends are secured to the standards P by a wrist-pin, $P^3$, passed through any of a series of openings, $P^4$, in the upper ends of the brace-rods. From this construction it will be understood that the front ends of the brace-rods U may be moved vertically in the standards P. A vertical frame, V, rises from the side beams, I, near the front ends of said beams, and this frame is braced by rods V', and has a pulley, $V^2$, at its upper side and a pulley, $V^3$, somewhat lower down. A pulley, $V^4$, is attached near the front ends of the bars $N^3$, and a pulley, $V^5$, is attached near the rear ends of said bars by a link. The bars $N^3$ are connected at a suitable distance from their front ends by cross-bars W, from which depends a vertical standard, W', having bifurcated lower ends, to which are journaled revolving colters $W^2$, that run in rear of the rollers $P^2$, and cut the sides of the bottom of the ditch in advance of the plow. The upper end of the standard W' is screw-threaded, and nuts are on the said threaded portion, by which the colters may be adjusted vertically with regard to the bars W.

R represents a frame, which is formed from a single bar of metal bent to form parallel substantially V-shaped sides. The rear arms, R', of these sides have a series of openings, $R^2$, in their upper portions, and the front arms, $R^3$, are connected together by a transverse bar, $R^4$. A pivotal bar, $R^6$, connects the bars $N^3$ and extends through two of the aligned openings $R^2$, and thus pivots or suspends the frame R between the bars $N^3$. A transverse rock-shaft, $R^7$, has its end journaled in the vertical arms of the plow, and through the center of this shaft passes a screw, $R^8$, having a hand-wheel, $R^9$, at its rear end, and at its front end swiveled in the cross-bar $R^4$. By turning the screw the lower end of the frame R may be moved or swung either forwardly or rearwardly. In the lower end of the frame R is journaled a shaft, S, having sprocket-wheels S'. The driving-wheels B are provided at their inner sides with gear-wheels B', having interior spurs, $B^2$, and exterior spurs, $B^3$. A transverse shaft, T, is journaled in blocks T' on the upper sides of the stanchions, and extends across and above the elevating-trough. This shaft has at its outer ends loose pinions $T^2$, that mesh with the interior teeth of the driving-wheels. Sprocket-wheels $T^3$ are securely fixed to this shaft, on opposite sides of the center thereof, and the lower sides of these sprocket-wheels extend down into the elevating-trough near the inner sides thereof. That portion of the shaft T between the loose pinions is squared, as shown at Fig. 8, and has sliding clutches $T^4$, to engage with the loose pinions and lock them to the shaft, and the latter has also a sleeve, $T^5$, on which turns a loose drum, $T^6$. A sliding clutch, $T^7$, is on the shaft T, to engage with the drum and lock the latter to the said shaft, for the purpose to be hereinafter explained.

X represents a transverse shaft, that is journaled in blocks secured to the under side of the frame C, and this shaft has loose pinions X' on its ends, that mesh with the exterior teeth of the wheels B'. Sprocket-wheels $X^2$, of the same size as wheels $T^3$, are secured to the shaft X, and have their upper portions extending into the elevating-trough in rear of the wheels $T^3$. Sliding clutches $X^3$ are also on shaft X to engage with the loose pinions and lock them to the shaft. A miter gear-wheel, $X^4$, is secured to the shaft X, for the purpose to be hereinafter explained.

$L^2$ represents a series of rollers, that are journaled on transverse rods that connect the sides of the elevating-trough at or near the bottom edge thereof, these rollers and rods extending from the front end of the trough to a slight distance in rear of its center. A transverse rod is secured between the vertical arms of the plow slightly above its bottom, and on this rod are journaled a pair of small sprocket-wheels, *b*.

$L^3$ represents a series of small sprocket-wheels, that are journaled on transverse rods which connect the sides of the trough, and are located slightly above the rollers $L^2$. A rod, $L^4$, connects the sides of the trough near the rear end of the latter, and on this rod are mounted a pair of rollers, $L^5$.

*a* represents an endless carrier, which connects the sprocket-wheels *b* and $X^2$, and forms the bottom of the trough. This carrier is composed of the endless sprocket-chains *a'* and the transverse connecting-plates $a^2$, which are secured to the sprocket-chains, as shown in Fig. 6, and overlap each other slightly, like scales or armor-plates. At a suitable distance apart throughout the carrier the plates are provided on their upper sides with longitudinal projecting ribs or flanges $a^3$, one of these ribs or flanges being formed with or secured to every fourth, fifth, or sixth plate of the carrier, accordingly as may be required. The upper portion of the carrier is supported on the small sprocket-wheels $L^3$ and the rollers $L^5$, and the lower portion of the carrier passes over the rollers $L^2$.

*d* represents an auxiliary endless carrier, which connects the sprocket-wheels S' and $T^3$. This carrier is composed of the endless sprocket-chains *d'*, which are connected together at suitable intervals by transverse angle-plates $d^2$, which depend from the lower side of the auxiliary carrier and come nearly in contact with the upper side of the carrier *a*, the lower side of carrier *d* and the upper side of carrier *a* being contiguous to and parallel with

each other, only a slight space intervening between them.

*e* represents an elevating-rope, which is secured at one end to the cross-bars W, passes over the pulley $V^3$, under pulley $V^4$, over pulley $V^2$, and under pulley $V^5$, and from thence to the drum on the shaft T, to which drum the other end of the rope is attached.

*f* represents a substantially inverted U-shaped standard, which is bolted to the frame C, and rises therefrom, one arm of the standard being on each side of the elevating-trough. In the upper end of this standard is fulcrumed a hand-lever, *f'*, the rear end of which is connected to the meeting ends of the rods $f^3$. Levers $f^4$ are pivoted at their lower ends to the lower ends of brackets $f^5$, that depend from the lower outer sides of the frame C, and the upper ends of the said levers $f^4$ are connected to the outer ends of the rods $f^3$. The levers $f^4$ are connected with the sliding clutches $X^3$, as at $f^6$, and have arms $f^7$, that connect the said levers with the sliding clutches $T^4$. A transverse bar, *g*, connects the stanchions D, and on this bar is fulcrumed a hand-lever, *g'*, that has its rear end connected to the sliding clutch $T^7$.

*h* represents a standard that rises from the frame C in rear of the drum $T^6$. This standard has a rearwardly-extending brace, *h'*, and to its upper end is fulcrumed the rear end of the brake-lever $h^2$, which bears on the drum and extends forward a suitable distance. A seat, *k*, is supported above the side beams, I, of the main frame, and in proximity to the free ends of the levers *f'*, *g'*, and $h^2$, so that a person on the seat may readily reach any of the levers. By moving the lever *g'* the drum may be disconnected from its shaft, and cause the elevating-drum to unreel the elevating-rope and thereby lower the plow, the lower end of the elevating-trough, and the rollers $P^2$ and the revolving colters to the ground or the bottom of the ditch, and the rapidity of the descent thereof may be governed by bearing down upon the brake-lever. When the free end of the hand-lever *f'* is raised, the idle-pinions on the shafts T and X are locked to said shafts, causing the latter to rotate when the machine is drawn along by the team hitched to it, and thereby operate the carriers *a* and *d*, causing the said carriers to elevate the loose dirt that is cut from the ditch by the plow and colters, as will be readily understood.

A transverse endless carrier, *l*, is located at the rear end of the machine, as shown at Fig. 5, which carrier is geared to the miter-wheel $X^3$ by a miter-wheel, *l'*, thereby causing the said carrier to move in the direction indicated by the arrow and deposit the dirt which is discharged upon it by the carriers *a* and *d* on one side of the ditch. The carrier *l* is similar in construction to the carrier *a*. When it is deemed necessary to raise the elevating-trough, plow, rollers $P^2$, and the revolving colters from the ditch, the lever *g'* is shifted to lock the drum to the shaft T, and thereby causing the drum to reel up the elevating-rope and raise the cutting apparatus.

It will be noted that the plow has two horizontal forwardly-extending beams, arranged one above the other, the front ends of which are attached to the standard P and are free to move vertically in the slots made in the said standard. The elevating-rope is attached to these beams, and tends to raise the plow in a vertical line. The brace-rods U, which have their lower rear ends pivoted to the elevator-trough, have their front ends pivoted to blocks which are located normally in the upper ends of the slotted standard P, as shown in Figs. 1 and 2 of the drawings. When the elevating-rope raises the plow in a vertical line, the elevating-trough, by being pivoted to the plow, is also raised therewith, and at the initial movement of the said trough a forward thrust is imparted to the said brace-rods, and they bear against the upper end of the standard P and very slightly tilt it forward, thus causing the front ends of the horizontal plow-beams to impinge firmly against the sides of the slots in the standard. This arrests the forward thrust of the brace-rods U and binds the front ends of the plow-beam securely to the standard, and as the said plow-beams are being raised by the elevating-rope, it follows that the standard P, with the rollers $P^2$, must of necessity rise also. By lowering the free end of the lever *f'* the idle-pinions are disconnected from the shafts T and X simultaneously, and the operation of the carriers immediately ceases. When the lower end of the trough and the cutting apparatus are lowered, the carriers tighten, and for this reason the latter are made of sufficient length to allow suitable slack to be taken up.

It is essential to the proper operation of the machine that the lower side of the auxiliary carrier bear approximately against the opposing upper side of the carrier *a*, and to always accomplish this I provide the swinging frame R to carry the lower end of the auxiliary carrier *d* and the screw to move the frame, whereby the auxiliary carrier may be slackened or tightened to any necessary extent.

By having the upper ends of the brace-bars U adjustably secured to the standards P, the latter may be always maintained in a vertical position, and thus cause the plow or cutter to run level in the bottom of the ditch and cut the latter smoothly and evenly.

I do not desire to limit myself to the precise construction hereinbefore described, as it is evident that many modifications may be made therein without departing from the spirit of my invention.

Having thus described my invention, I claim—

1. The combination, in a ditching-machine, of the vertically-movable standards P, having rollers or shoes at their lower ends, the plow or cutter connected to said standards, and the elevating-trough having its lower end hinged or pivoted to the plow or cutter, substantially as described.

2. The combination, in a ditching-machine, of the vertically-movable standards P, having the rollers or shoes at their lower ends, the plow or cutter connected with said standards, and the elevating-trough having its lower end hinged or pivoted to the plow or cutter, the said trough being also connected to the standards P, substantially as described,

3. The combination, in a ditching-machine, of an extensible frame or body, the elevating-trough supported near its rear ends, and the vertically-movable plow or cutter secured to the lower end of the trough, substantially as described.

4. The combination, in a ditching-machine, of the vertically-movable standards P, having the rollers or shoes at their lower ends, the cutter or plow, the bars connecting the plow or cutter to the standards P, the depending standards carrying the revolving colters in advance of the plow or cutter, and the elevating-trough hinged or pivoted at its lower end to the plow or cutter, substantially as described.

5. The combination, in a ditching-machine, of the elevating-trough, the vertically-movable plow or cutter pivoted or hinged to the lower end of the trough, the endless carrier *a*, the auxiliary carrier *d*, and the movable frame R, carrying the lower end of the auxiliary carrier, whereby the latter may be slackened or tightened, substantially as described.

6. The combination, in a ditching-machine, of the elevating-trough, the vertically-movable plow or cutter pivoted or hinged to the lower end of the trough, the endless carrier *a*, the auxiliary carrier *d*, the swinging frame R, carrying the lower end of the auxiliary carrier, and the screw for moving the swinging frame to slacken or tighten the auxiliary carrier, substantially as described.

7. The combination, in a ditching-machine, of the vertically-movable standards P, having the rollers or shoes at their lower ends, the plow or cutter connected to the said standards, the elevating-trough having its lower end pivoted or hinged to the plow or cutter, and the elevating rope and pulleys for raising and lowering the movable standards, plow, and the lower end of the trough, substantially as described.

8. The combination, in a ditching-machine, of the driving-wheels, the elevating-trough having the cutting apparatus at its lower end, and the endless carrier *a*, the shaft T, geared to the driving-wheels, the auxiliary carrier *d*, driven by shaft T, the elevating-rope, the drum loose on shaft T, and to which the rope is attached, and the clutch for locking the drum to its shaft, and thereby connecting the drum with the driving-wheels to raise the trough and cutting apparatus as the machine advances, substantially as described.

9. The combination, in a ditching-machine, of the driving-wheels, the elevating-trough having the cutting apparatus at its lower end, and the endless carrier *a*, the shaft T, geared to the driving-wheels, the auxiliary carrier *d*, driven by shaft T, the elevating-rope, the drum loose on the said shaft, and to which the rope is attached, the clutch for locking the drum to its shaft and thereby connecting the drum with the driving-wheels to raise the lower end of the trough and the cutting apparatus as the machine advances, and the brake-lever bearing on the drum to control the descent of the cutting apparatus and the lower end of the trough when the drum is disconnected from the shaft T, substantially as described.

10. The combination, in a ditching-machine, of the driving-wheels having interior and exterior gear-teeth, and the elevating-trough having the cutting apparatus at its lower end, the endless carrier *a*, the shaft X, having the sprocket-wheels for driving the said carrier, the loose pinions meshing with the exterior gear-teeth of the driving-wheels, and the sliding clutches to lock the pinions to the shaft X, the auxiliary carrier *d*, the shaft T, having the sprocket-wheels for driving said carrier, the loose pinion meshing with the interior gear-teeth of the driving-wheels, and the sliding clutches to lock said pinion to shaft T, and the levers for moving the sliding clutches simultaneously to throw the carriers *a* and *d* in or out of gear with the driving-wheels, substantially as described.

11. The combination of the frame C, supported on the rear axle, the side beams secured at their front ends to the front axle and having their rear ends resting on frame C, and movable back and forth thereon to lengthen or shorten the body or main frame, and the elevating-trough secured at its rear end to the frame C, and having the cutting apparatus at its front or lower end, substantially as described.

12. The combination, in a ditching-machine, of the main frame, the front axle pivoted thereto, the pivoted link E′, the closed link $E^2$, swiveled to link E′, the elevating-trough supported at the rear and having the cutting apparatus at its front or lower end, and the vertically-sliding standards P, working in link $E^2$, and having rollers or shoes at their lower ends, said standards being connected to the cutting apparatus, substantially as described.

13. The combination, in a ditching-machine, of the vertically-movable standards P, having the rollers or shoes at their lower ends, the plow or cutter connected to the said standards, the elevating-trough having its lower end pivoted or hinged to the plow or cutter, and the brace-rods U, pivoted to the trough and having their upper ends pivoted to the upper ends of the standards and movable or adjustable therewith, substantially as described.

14. The combination, in a ditching machine, of the vertically-movable standards P, having the rollers or shoes at their lower ends, the cutter or plow, the bars connecting the plow or cutter to the standards P, and the vertically-adjustable depending standards W′, car-

rying the revolving colters in advance of the plow or cutter, substantially as described.

15. In a ditching-machine, movable frame R, carrying one end of the auxiliary carrier, whereby the latter may be slackened or tightened by the movement of the frame, as set forth.

16. In a ditching-machine, the combination, with the driving-wheels, of the endless carriers *a d*, driven independently from the driving-wheels, shafts T X, having connecting-gearing for driving said carriers, and the sliding clutches on the said shafts for connecting or disconnecting them to or from the driving-wheels, as set forth.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in presence of two witnesses.

JOEL M. SMITH.

Witnesses:
C. H. PETERS,
J. H. DRAKE.