(No Model.) 4 Sheets—Sheet 1.

J. B. HILL.

TRACTION DITCHING MACHINE.

No. 523,790. Patented July 31, 1894.

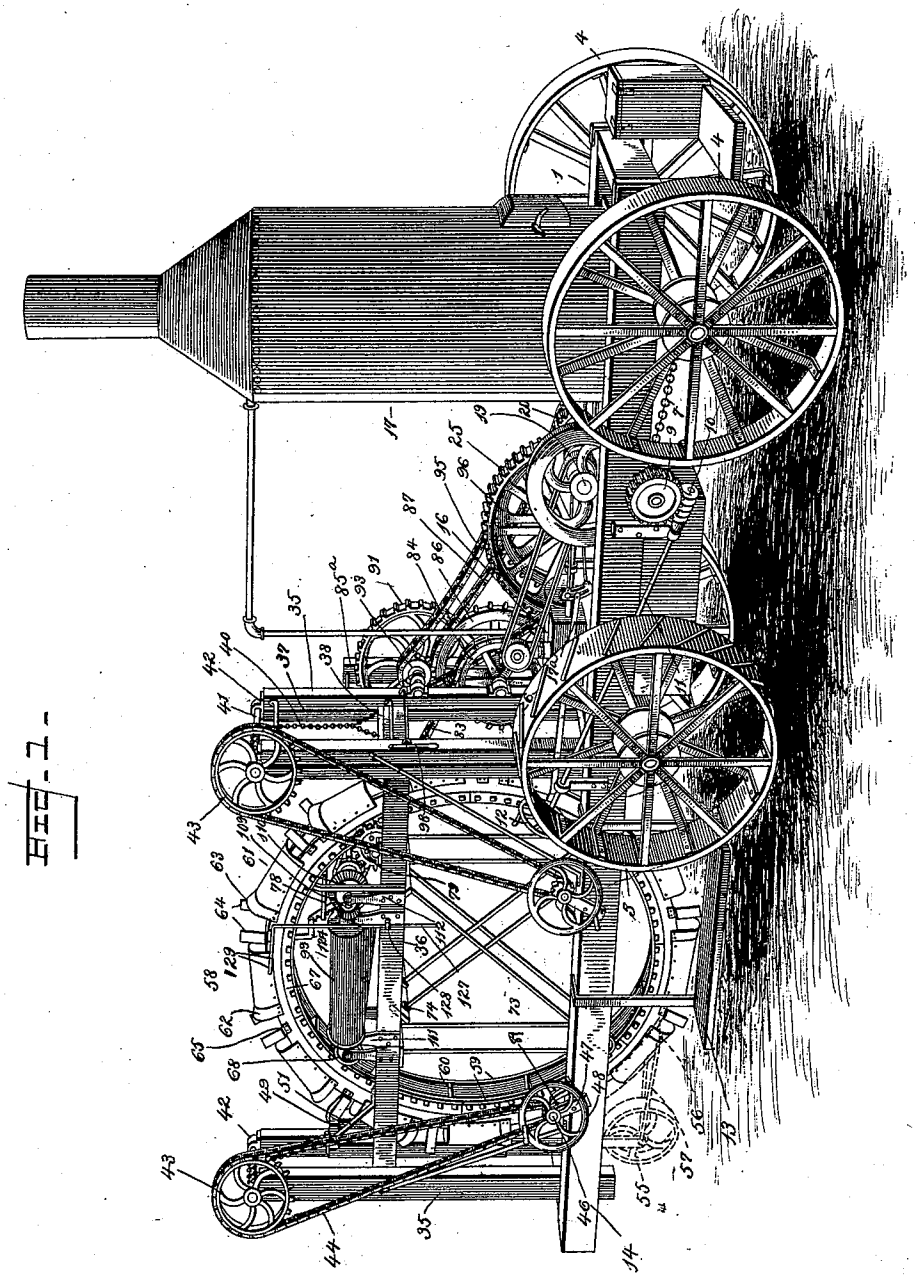

FIG. 1.

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(No Model.) 4 Sheets—Sheet 2.

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TRACTION DITCHING MACHINE.

No. 523,790. Patented July 31, 1894.

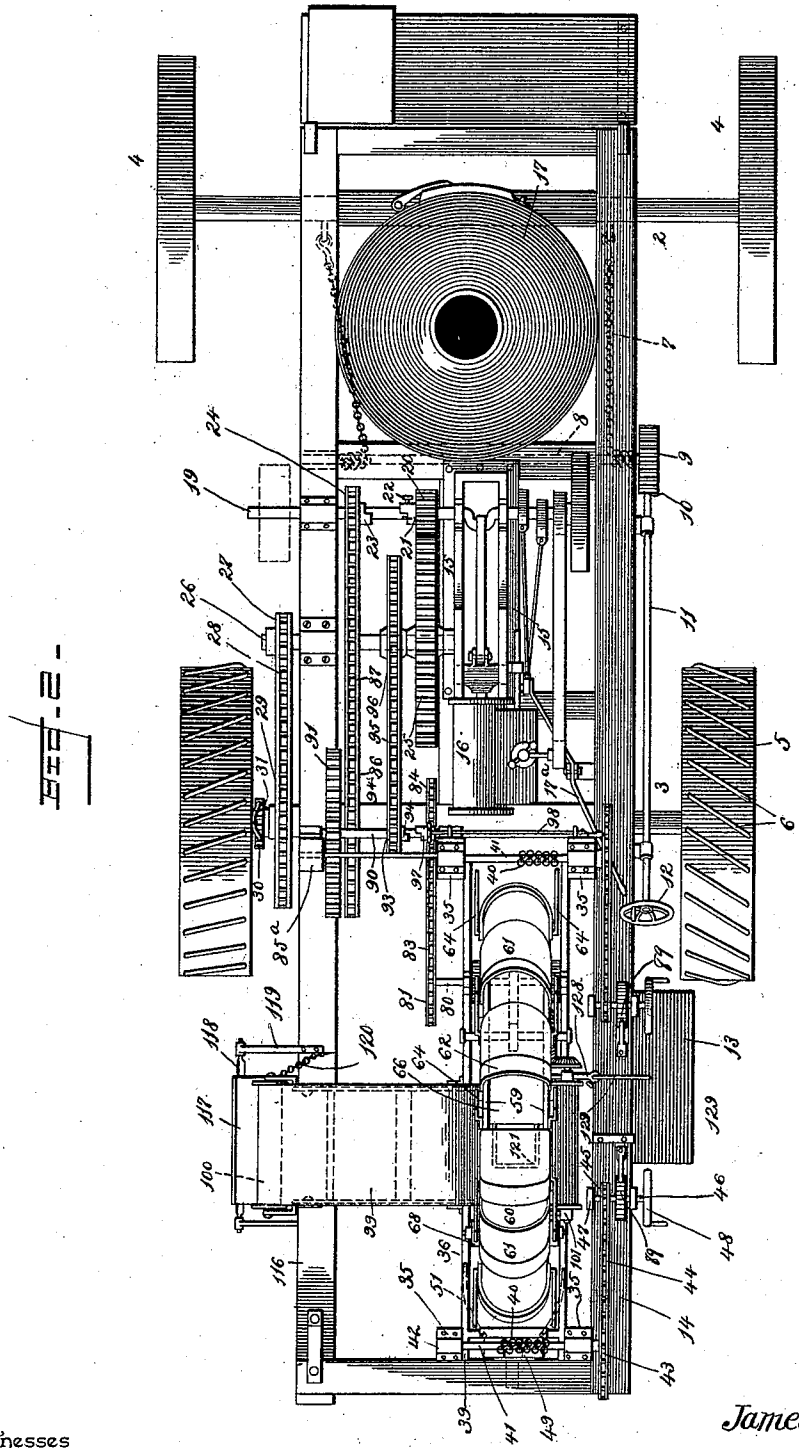

Fig. 2.

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(No Model.) 4 Sheets—Sheet 3.

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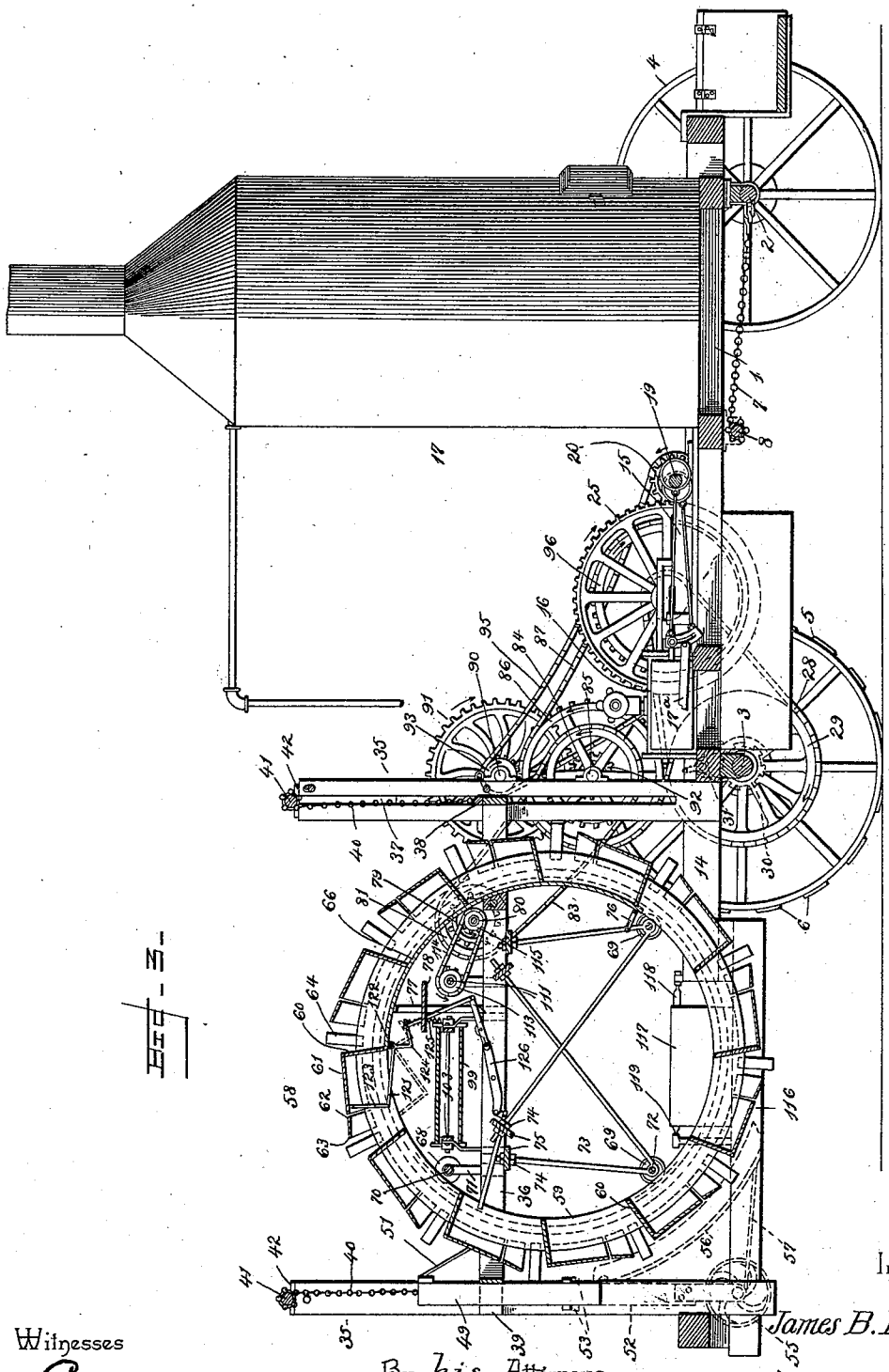
TRACTION DITCHING MACHINE.

No. 523,790. Patented July 31, 1894.



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TRACTION DITCHING MACHINE.

No. 523,790. Patented July 31, 1894.

Fig. 11.

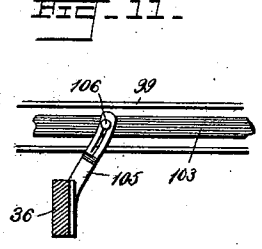


Fig. 4.

Fig. 5.

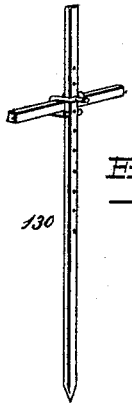


Fig. 10.

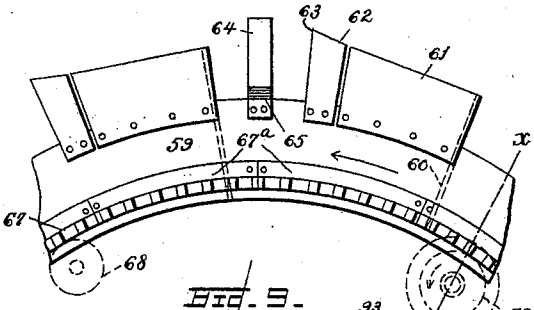


Fig. 9.

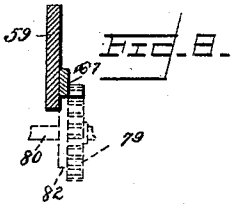


Fig. 8.

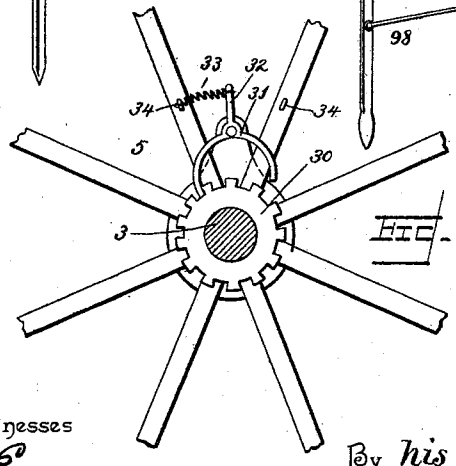
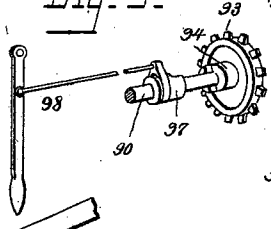


Fig. 6.



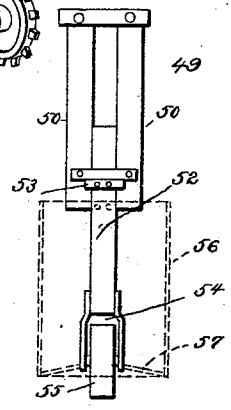


Fig. 7.

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UNITED STATES PATENT OFFICE.

JAMES B. HILL, OF BOWLING GREEN, OHIO.

TRACTION DITCHING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 523,790, dated July 31, 1894.

Application filed January 8, 1894. Serial No. 496,073. (No model.)

To all whom it may concern:

Be it known that I, JAMES B. HILL, a citizen of the United States, residing at Bowling Green, in the county of Wood and State of Ohio, have invented a new and useful Traction Ditching-Machine, of which the following is a specification.

This invention relates to traction ditching machines; and it has for its object to construct a steam propelled ditching machine which shall provide efficient means for completing a continuous ditch with a perfect grade line at the bottom adapted for the reception of the ordinary drain tiles.

To this end the main and primary object of the present invention is to provide a traction tile ditcher which may be conveniently propelled from place to place, while at the same time providing means for properly digging a trench of any length or width desired, at the same time the machine is being propelled forward.

With these and other objects in view which will readily appear as the nature of the invention is better understood, the same consists in the novel combination, construction, and arrangement of parts hereinafter more fully described, illustrated and claimed.

In the drawings:—Figure 1 is a perspective view of a traction ditcher constructed in accordance with this invention. Fig. 2 is a top plan view thereof. Fig. 3 is a central vertical longitudinal sectional view. Fig. 4 is a detail plan view of the vertically adjustable wheel frame and the laterally extended dirt carrier mounted thereon. Fig. 5 is a detail elevation of a section of the ditching or excavating wheel. Fig. 6 is a detail view showing the pawl and ratchet device of one of the traction wheels. Fig. 7 is a detail view of the rear supporting wheel or runner and the manner of mounting the same in rear of the ditching or excavating wheel. Fig. 8 is a detail sectional view on the line *x*—*x* of Fig. 5. Fig. 9 is a detail elevation of the clutch mechanism for throwing the excavating devices in gear with the traction gearing. Fig. 10 is a detail view of the leveling or grading rod used in connection with the sighting attachment on the ditching machine. Fig. 11 is a detail view showing the adjustable connection between the wheel-frame and the dirt carrier frame.

Referring to the accompanying drawings, the numeral 1 designates the engine frame of the herein described traction ditcher, and the engine frame 1 is supported for transportation on the front and rear axles 2 and 3 respectively, the front axle 2, being preferably pivotally connected to the front end of the frame, whereby the direction of travel may be properly regulated, and said front axle carries the advance wheels 4, while loosely mounted on the opposite ends of the rear axle 3 are the wide traction wheels 5, provided upon their peripheries with the calks 6, which secure a firm purchase or tread on the ground, whereby the entire machine may be moved forward in response to the propelling engine thereof, and to provide for properly guiding the machine, the turning chains 7, are connected to the front axle 2, near the opposite ends thereof, and wind and unwind on the transverse adjusting shaft 8, journaled transversely on the frame, and carrying at one end the worm gear wheel 9, with which meshes the worm 10 at the inner end of the guiding shaft 11 journaled at one side of the frame and carrying at its upper rear end the hand wheel 12, disposed conveniently near to the operator's platform 13, which is attached to one side of the rear frame extension 14.

The frame extension 14, is a continuation of the engine frame 1 directly in rear of the rear axle 3, to provide a frame for supporting the excavating devices of the machine, and to also provide means whereby these excavating devices may start a ditch from its very beginning, which is not possible in machines of that character in which the excavating devices are located intermediate of the front and rear ends of the frame, and this frame portion or extension 14 will be more particularly referred to in connection with the excavating devices, to be hereinafter more particularly described.

The main part of the engine frame 1, supported on the wheel axles 2, 3, is designed to carry the propelling devices which move the machine forward, and also to operate the excavating devices at the same time, and at a convenient point intermediate of the front and rear axles of the engine frame, a suitable intermediate bed frame 15, is built, on which is mounted an ordinary cylinder engine 16,

supplied with the requisite steam from the boiler 17 mounted on the front end of the frame 1, and the engine 16, is provided with a reversing lever 17ª, extended also conveniently near to the platform 13, whereby the direction of travel may be conveniently controlled by the operator, who also has control of the engine itself by means of the valve lever, connected with the throttle valve in the steam pipe leading from the boiler. It will thus be seen that the entire movement of the machine is conveniently under control of the operator on the platform 13.

The engine 16 is connected with the transverse drive shaft 19, which is mounted in suitable bearings on the frame 1, and the intermediate bed frame 15, and the engine drive shaft 19, has attached thereto for a sliding movement thereon, at one side of the intermediate frame 15, an adjustable pinion 20. The adjustable pinion 20 is provided at one side with a clutch hub 21, held in any adjusted position on the shaft 19, by the set screw 22, and the clutch hub 21 of the pinion 20, is adapted to be adjusted into engagement with a corresponding clutch hub 23, projected from one side of a small sprocket wheel 24, mounted loosely on the shaft 19, and adapted to provide a connection for communicating motion to the ditching or excavating devices when the machine is ditching, but when the machine is being propelled from point to point, the pinion 20 gears with a large gear wheel 25, mounted on a short counter-drive-shaft 26. The short counter drive-shaft 26, is journaled in suitable bearings at one side of the bed frame 15, and carries upon its other end outside of the frame 1, a small chain or sprocket wheel 27, over which passes one end of the drive chain 28, the other end of which passes over and gives motion to the sprocket wheel 29, mounted on one end of the axle 3. The sprocket wheel 29, carries at one side the ratchet hub 30, working at one side of the traction wheel 5, and adapted to be engaged by the double U-shaped ratchet dog 31. The ratchet dog 31, is pivotally attached to the said traction wheel and is provided with a short arm extension 32, to which is connected one end of a coiled spring 33, the other end of which is adapted to detachably engage either of the spring eyes 34, on adjacent spokes of the traction wheel. By connecting the spring 33 with either of said spring-eyes one end or the other of the double dog 31, engages the ratchet hub 30, according as it is desired to propel the machine forward or backward, it being seen that the double dog connects the sprocket wheel 29 with the adjacent traction wheel.

The devices just described, form the traction part of the machine and provide means for propelling it forward and backward, and also for operating the ditching or excavating devices supported by the rear frame extension 14, which I shall now proceed to describe.

Arising from the rear frame extension 14, and at one side of the same are the front and rear pairs of guide uprights 35, which accommodate there-between for vertical adjustment the front and rear ends of the horizontal vertically adjustable wheel-frame 36, and the front pair of said guide uprights 35, are provided with vertical grooves or ways 37, in which slide the front guide tongues 38, projected laterally from the front end of the horizontal frame 36, in any suitable manner so as to form a strong guide for that end of said frame, while the opposite side bars of the frame 36, are extended beyond the rear cross bar of the frame to form short guide arms 39, which slide against the inner faces of the guide uprights 35, at the extreme rear end of the frame extension 14, and thereby serve to hold the rear ends of the vertically adjustable wheel frame steady in its vertical adjustment. The vertical adjustment of this horizontal wheel frame is preferably accomplished by means of the adjusting chains 40, attached at their lower ends to the front and rear ends of the frame 36, and winding and unwinding at their upper ends on the adjusting shafts 41. The adjusting shafts 41, are journaled at the top of each pair of the guide uprights 35, in the bearing boxes 42, secured to the tops of said uprights, and at one end, the adjusting shafts 41, carry the sprocket wheels 43, over which pass the operating chains 44, leading from smaller sprocket wheels 45, mounted on short operating shafts 46. The short operating shafts 46, are journaled in suitable bearings 47, at one side of the frame extension 14, and carry upon their outer ends the operating hand wheels 48, which are disposed conveniently near the platform 13, whereby the operator can easily raise and lower the wheel frame 36, by simply manipulating the said wheels 48, as will be readily understood without further description.

The horizontal vertically adjustable wheel frame 36, is an open rectangular frame consisting preferably of connected side and end bars, and suitably bolted to the rear end of said frame is an upright standard frame 49, consisting of the parallel spaced bars 50, which extend above the top of the frame 36 to form an attachment for the lower end of the rear adjusting chain 40, and also the braces 51, attached thereto and to the said wheel frame 36. The parallel spaced bars 50, comprising the upright standard frame 49, carried by the wheel frame, are adapted to accommodate therebetween the upper end of the detachable wheel standard 52.

The detachable wheel standard 52, is provided at a point intermediate of its ends with the stop cleat 53, which limits its upward insertion in the standard frame 49, and at its lower end, the said standard is bifurcated as at 54, to accommodate the rear supporting wheel 55. This rear supporting wheel 55 is intended to be placed in position after a ditch or trench has been started, and is intended

to travel in the bottom of such ditch or trench and form a support for the rear end of the ditching or excavating apparatus, and this wheel attachment also carries a forwardly curved dirt shoe 56, the lower end of which travels in close proximity to the bottom of the ditch or trench.

The dirt shoe 56, is bolted at its upper end to the standard 52, and is braced in front of the wheel 56, by means of suitable braces 57, secured thereto and to the lower bifurcated end 54, of said wheel standard. The said forwardly curved rear dirt shoe 56, is substantially semi-circular in cross section as well as being shaped in the arc of a circle, and is intended to form a dirt fender for the ditching or excavating wheel 58, which travels in close proximity to the rear dirt shoe, and would otherwise drop crumbs or small portions of dirt back into the ditch or trench already excavated, if it were not for such shoe which directs all material, caught thereby, back again into that portion of the ditch through which the buckets of the wheel 58, pass.

The ditching or excavating wheel 58, is circular in shape and works inside of the horizontal vertically adjustable wheel frame 36, between the opposite side bars thereof, and this ditching or excavating wheel principally comprises the parallel spaced wheel rims 59, which are made of a suitable thickness and width of steel to withstand the work required of the wheel. The said spaced wheel rims are separated to leave a space there-between for the proper operation of the wheel when discharging the material collected thereby, and said wheel rims are held spaced apart and are firmly connected by the intermediate transverse back plates 60. The transverse back plates 60, are arranged at regularly spaced intervals between the parallel wheel rims 59, and not only serve to space and connect the same, but also form the back walls of the U-shaped dirt buckets 61.

The U-shaped dirt-buckets 61, are formed of suitable strength steel, and are fitted close at their rear edges against the upper projecting portions of the back plates 60, which project beyond the outer edges of the wheel rims to complete the back of the said buckets, and the opposite edges of the buckets 61, are secured by means of bolts, or other suitable detachable fastening means, to the outside of the wheel rim 59. This construction provides a complete dirt bucket which spans the space between the wheel rims, and is designed to carry the dirt excavated from a ditch or trench up to the point of discharge, and directly in front of the open end of the dirt buckets 61 are arranged the U-shaped ditch cutters 62.

The ditch cutters 62, are of substantially the same shape as the body of the bucket 61, but are detachably bolted at their opposite edges to the opposite wheel rims, at a point slightly in advance of the dirt buckets, whereby the entire strain of cutting the ditch is placed upon the said ditch cutters, which are provided with outer beveled cutting portions 63, projecting beyond the top of the buckets 61 to provide means for properly digging the trench.

At a point intermediate of the advance ditch cutters 62, and the back plate of the next succeeding bucket are arranged opposite pairs of side cutters 64. The side cutters 64, are provided with angled lower ends 65, bolted to the outside of each of the wheel rims, and these angled ends 65 dispose the body or blade portions of the cutters 64, out from the circle of movement of the wheel rims, and the buckets and advance cutters thereon, to provide means for lining up the sides of the ditch or trench being excavated, and thereby cutting a path sufficiently wide to permit of the body portion of the wheel passing clear through the ditch or trench without having any of its gearing clogged with earth, and thereby interfering with the free operation of the wheel.

By the adjusting devices described, the ditching or excavating wheel may be lowered to any depth desired to cut a ditch or trench of any depth to about four and one half feet, and by reason of the shape of the buckets and the ditch cutters, a ditch will be excavated having a rounded bottom conveniently shaped for any of the ordinary sizes of tile, and as the said ditching or excavating wheel is put in motion, the buckets and cutters thereof will pick up the earth directly in advance of the rear dirt shoe 56, and will then elevate it up to a point directly above the vertical center or slightly at one side of the center of the wheel, and while the earth is being elevated by the buckets the same is held in the buckets, and prevented from falling out, by means of the short segmental bottom plates 66.

The short segmental bottom plate 66, is supported in a stationary position between the lower edges of the wheel rims 59, at the front side of the center of the wheel, and in sufficiently close proximity to the inner edges of the back-plates 60, to form a substantial bottom for each bucket as it is carried over said bottom plate, and the latter has its upper end extend to a point substantially in a line above the center of the wheel, so that as each bucket passes beyond this upper end of the bottom plate, the contents thereof will naturally be discharged from the space between the wheel rims into the space formed inside of the upper portion of the ditching or excavating wheel, and onto the discharging devices to be more particularly referred to.

The ditching or excavating wheel 58, is provided on each side thereof with a circular rack flange 67. The rack flanges 67, consist of a series of short sections 67^a, bolted to the outer faces of each wheel rim at a point slightly in from the inner edges thereof to form a track for the combined supporting and centering wheels or rollers 68 and 69. The rollers 68, are mounted on each end of a

short roller shaft 70, journaled in the upper ends of suitable bearing arms or brackets 71, secured to the opposite side bars of the wheel frame 36, and rising above the same, and these rollers 68, are adapted to bear under the inner edges of the circular rack flanges 67, and thereby form a portion of the support for the revolving ditching or excavating wheel, while the rollers 69, are mounted on opposite ends of the lower adjustable roller shafts 72, journaled at their extremities in the V-shaped brace frames 73.

The V-shaped brace frames 73, comprise separate diverging brace rods having at their lower meeting ends bearings for the shafts 72, while the other separated ends thereof are adjustably bolted as at 74, to suitable transverse supporting bars 75, extending transversely of the horizontal wheel frame 36, and suitably bolted thereto. The lower rollers 69, are also supported to bear against the inner edges of the circular rack flange 67, and not only serve to hold the ditching or excavating wheel steady in its revolutions, but also assist in supporting the same, and by adjusting the bolt ends 74, of the brace rods carrying the lower rollers, the centering support for the wheel may be properly adjusted to take up any wear of the operating parts, and thereby hold the same steady in its movement.

A short attaching arm 76, is connected to the stationary bottom plate 66, and to one of the frames 73, whereby the said bottom plate will be susceptible to a simultaneous adjustment with the said frames, thereby being properly positioned at all times, and this stationary bottom plate is additionally braced in position at its upper end by an upper brace frame 77, attached thereto and to opposite sides of the wheel frame 36, and said upper brace frame 77, may support in position an upper horizontal fender plate 78, to protect the gearing at this part of the machine from the dirt or earth which is discharged beyond the upper terminal of the said bottom plate 66.

The opposite rack flanges 67, of the ditching or excavating wheel are engaged by the opposite turning cogs 79, which are intended to turn or revolve the ditching or excavating wheel, and these turning cogs or cog wheels 79, are mounted inside of the frame 36, on the turning shaft 80, which carries on one end outside of the wheel frame 36, a large sprocket wheel 81. The turning cog wheels 79, not only mesh with the teeth of the rack flanges 67, to communicate motion to the ditching or excavating wheel, but are provided at their inner sides with roller off-sets 82, which engage under the inner edges of the rack flanges 67, so as to act in the capacity of supporting rollers for the wheel in a correspondingly opposite position to the upper supporting rollers 68.

Motion is communicated to the turning shaft 80, by means of the sprocket chain 83, one end of which passes over the sprocket wheel 81, while the other lower end thereof, engages the sprocket wheel 84, mounted on the lower gear shaft 85, journaled in suitable bearings at one side of one of the front guide uprights 35, and the short bearing upright 85^a, arising from one side of the engine frame. The lower gear shaft 85, also carries at a point intermediate of its ends the large sprocket wheel 86, which receives one end of the sprocket chain 87, driven from the clutch sprocket wheel 24, which is mounted loosely on the shaft 19, and is turned by such shaft when the clutch hub 21, is adjusted into engagement therewith.

When the machine is ready to excavate the ditch, the sprocket wheel 24, is coupled fast to the shaft 19, in the manner just described, so that through the medium of the connections 87, 86, 85, 84, and 83, motion will be communicated to the ditching or excavating wheel and cause the same to dig out a ditch or trench, the depth or grade of which is properly regulated by adjusting the wheel frame through the medium of the hand wheels 48, and at this point it may be well to note that a pawl and ratchet check 89, is connected with the shafts 46, to hold the excavating wheel properly in its adjusted position.

The gearing just described provides means for turning or revolving the ditching or excavating wheel when the machine is stationary, but to advance a line of ditch it is necessary to propel the entire machine forward at the same time the ditching progresses, and to secure this result I employ a second upper gear shaft 90, journaled in suitable bearings directly above the lower gear shaft 85, and carrying at one end a large spur wheel 91, which is driven by the cog pinion 92, mounted on the shaft 85, directly under the spur wheel. Motion is thus communicated to the upper gear shaft 90, which further carries a loose sprocket wheel 93, provided at one side with a clutch hub 94, and accommodating thereon one end of a sprocket chain 95, the other end of which passes over the sprocket wheel 96, made fast on the short counter drive shaft 26, at one side of the large gear wheel 25.

A sliding clutch sleeve 97, is feathered or splined on the upper gear shaft 90, at one side of the clutch hub 94, and has connected therewith an operating lever 98, mounted in suitable guides on the front pair of guide uprights 35, and disposed conveniently near to the operator on the platform 13.

The adjustment which gears the ditching or excavating wheel with the propelling engine 16, has already been described, and to advance the ditching it is simply necessary to manipulate the operating lever 98 to throw the clutch levers 97, into engagement with the hub or clutch face of the sprocket wheel 93, and thereby connect the upper gear shaft 90, with the short drive shaft 26, and thereby provide means for simultaneously propelling the machine forward and revolving the ditching or excavating wheel. This may be effected in a very short time as will be easily understood, and by changing the size of the wheel 27, on

the shaft 19, the traction speed may be changed as desired.

The general operation of digging a ditch or trench and propelling the machine will now be apparent, and at this point it is to be noted that after the buckets of the ditching or excavating wheels carry the material beyond the upper end of the bottom plate 66, the same is discharged onto the inner end of the endless dirt carrier 99. The endless dirt carrier 99, consists of an endless belt traveling around the opposite end carrier rollers 100, the inner end of which carrier is journaled in suitable bearing brackets or chairs 101, arising from one side of the horizontal wheel frame 36, and these opposite end carrier rollers 100, are also held in position at the opposite ends of the carrier frame 102.

The carrier frame 102, consists of the opposite frame sides 103, the inner ends of which are provided with the off-sets 104, pivotally mounted at the connection of the inner end of the carrier rollers with the brackets or chairs 101, so that the outer end of the carrier will be left free for adjustment, whereby the same may be disposed at the proper angle, and this adjustment of the carrier frame may be secured by means of the short adjusting arms 105, attached to one side of the wheel frame 36, and adjustably connected to the opposite sides of the carrier frame as at 106, whereby the same may be raised and lowered when desired.

The dirt carrier 99, is disposed at right angles to the horizontal wheel frame 36, and the ditching or excavating wheel travels over the inner portion of this carrier, so as to deposit the elevated earth onto the same, and at the outer end of the frame sides 103, of the carrier frame, are adjustably arranged the bearing arms 107, which have a longitudinal adjustment on the frame sides as at 108, and form bearings for the outer one of the rollers 100, and provide means for keeping the carrier stretched at a proper tension. The inner one of the carrier rollers 100, has mounted on one of the journal ends thereof the beveled gear wheel 109, meshing with a similar gear wheel 110, mounted on the short motion shaft 111, journaled in suitable bearing arms or brackets 112, arising from opposite sides of the wheel frame 36. A sprocket wheel 113, is mounted on the motion shaft 111, intermediate of its ends, and receives one end of the sprocket chain 114, the other end of which is driven from the sprocket wheel 115, mounted on the turning shaft 80, of the ditching or excavating wheel. This completes the gearing whereby motion is communicated to the endless dirt carrier simultaneously with the movement of the ditching or excavating wheel and the forward movement of the entire machine.

The endless dirt carrier 99, is intended to deliver the dirt at one side of the ditch or trench being excavated, so as to line up the excavated earth in a position convenient for refilling the ditch after the tiling has been properly placed in position, and in order to accommodate the lowest possible adjustment of the carrier, as it may be lowered by the adjustment of the wheel frame 36, the frame extension 14, is provided at one side with a drop 116, of a width sufficient to accommodate the outer end of the said dirt carrier. The earth which is discharged or delivered at one side of the machine by the laterally extending dirt carrier is discharged against the dirt apron or plate 117. The dirt apron 117, is swung on pivots 118, at its upper end, mounted in the off-standing bracket arms 119, projected from one side of the frame extension 14, while to the lower end of the pivotally hung dirt apron is connected one end of the adjusting chains 120, the other ends of which are attached to one side of the frame of the machine, to hold the dirt apron at the proper angle according to the position in which it is desired to line up the excavating dirt.

The free discharge of the elevated earth, carried by the buckets up to the upper end of the bottom plate 66 is assisted by an automatically operated bucket-cleaner 121. The bucket cleaner 121 is pivotally supported at 122, at the extreme upper edge of the bottom plate 66 and is provided with a cleaning arm 123, adapted to work inside of the buckets as they pass beyond the bottom plate, and at its opposite ends is provided with a bell crank portion 124, to which is connected one end of a spring 125, the other end of which is connected with a suitable point of attachment to provide means for normally and sharply throwing the cleaning arm of the cleaner into the bucket to loosen up any dirt which might cling therein. A series of pivotally connecting operating levers 126, are also connected to the bell crank end of the cleaner, and the outermost end of such levers is adapted to be struck by the back plate 60, of each bucket as the wheel continues to revolve, so that the cleaner will be rapidly vibrated in each bucket as it passes to its discharging point directly above the discharge apron or carrier 99.

In most ditching machines no means are provided for positively grading the bottom line of a ditch so as to give the proper fall thereto, but in the present invention a vertically adjustable sight rod 127, is mounted for vertical adjustment in the bracket 128, attached to one side of the horizontal wheel frame 36. This sight rod 127, is disposed in a line at one side of the platform 13, and is provided with an upper horizontal sight end 129, over which the operator takes a sight so as to keep this end of the sight rod in a line with a suitale leveling stake or target 130, such as shown in Fig. 10, of the drawings. The leveling stake or target 130, may be of any approved construction convenient for the work, and is intended to be set up in a line with the ditch or trench to be excavated, and the moving part of the stake or target is adjusted at a proper height from the ground, so

that by adjusting the ditching or excavating wheel to keep the upper sight end 129, always in line with the adjusted part of the stake or target, a perfect grade of any desired fall will be insured, and this grade will not be affected by rocks or other obstructions in the path of the wheel owing to the fact that the ditching wheel is free to ride over such obstructions and again fall back to cut or excavate at the proper depth.

The many advantages of the herein described traction ditcher will readily suggest themselves to those skilled in the art, and at this point it may be well to again call attention to the fact that by reason of mounting the ditching or excavating apparatus at the extreme rear end of a traction engine, a ditch may be started or taken up by the ditching or excavating wheel at the very beginning, thereby adapting the machine for use under all conditions, besides many other important advantages belonging thereto, and I will have it understood that changes in the form, proportion and the minor details of construction, may be resorted to without departing from the principle or sacrificing any of the advantages of this invention.

Having thus described the invention, what is claimed, and desired to be secured by Letters Patent, is—

1. In a traction ditcher, the combination of the traction engine having a rearwardly extended frame and guide uprights extended above said frame, an open center revolving ditching or excavating wheel mounted for vertical adjustment between the guide uprights and geared with the engine, said wheel discharging into its open center, a side delivering apron or carrier having its inner end arranged in the open center of the wheel under the discharging point thereof, an automatically operating cleaning device for relieving the wheel from its load at the point of discharge, and a dirt deflecting apron arranged at one side of the engine frame beyond the outer end of the carrier, substantially as set forth.

2. In a traction ditcher, the combination with the traction engine, and the engine frame having a rear extension; of separate pairs of guide uprights extended above said frame extension, a wheel frame mounted for vertical adjustment between said guide uprights, an axleless revolving ditching or excavating wheel arranged to work within said wheel frame, and a series of supporting wheels or rollers carried by the wheel frame and arranged concentrically with the ditching or excavating wheel to form a journal support therefor, certain of said supporting wheels or rollers being adjusted, substantially as set forth.

3. In a traction ditcher, the combination with the engine propelled frame; of the front and rear pairs of guide uprights, an open horizontal wheel frame mounted for vertical adjustment between said guide uprights, a series of combined supporting and centering rollers supported in position above and below the wheel frame, the lower set of rollers being adjustably supported, an axleless ditching or excavating wheel, mounted to turn on said rollers, and having an open center and a side delivering apron adjustably mounted on the wheel frame and having its fixed ends disposed under the discharging point of the ditching or excavating wheel, within the open center thereof substantially as set forth.

4. In a ditching machine, the combination with the wheeled frame; of the upright guide frame, the horizontal vertically adjustable wheel frame mounted for vertical adjustment in said guide frame and carrying at one end an upright standard frame, a bucket ditching or excavating wheel supported in the wheel frame, a wheel standard adapted to be detachably mounted in the lower end of said standard frame and carrying a rear supporting wheel, and a forwardly curved rear dirt shoe attached to said wheel standard and disposed around the rear lower portion of the ditching or excavating wheel, substantially as set forth.

5. In a traction ditcher, the combination of a traction engine having front and rear pairs of guide uprights extended above its frame, a vertically adjustable wheel frame mounted for vertical adjustment between said guide uprights and carrying a series of rollers, a bucket ditching or excavating wheel mounted to revolve on the rollers of the wheel frame, adjusting shafts journaled on top of said guide uprights and carrying at one end sprocket wheels, adjusting chains winding and unwinding on said shafts and attached to opposite ends of said wheel frame, short operating shafts conveniently journaled at one side of the engine frame and carrying small sprocket wheels at their inner ends and operating hand wheels at their outer ends, operating chains passing over said small sprocket wheels and those at one end of the adjusting shafts, and a pawl and ratchet check device for each of said short operating shafts, substantially as set forth.

6. In a ditching machine, a horizontal vertically adjustable wheel frame, separate sets of upper and lower combined supporting and centering rollers mounted above and below the wheel frame, the lower set of rollers being adjustable a revolving ditching or excavating wheel having circular rack side flanges engaged at their inner edges by said rollers, dirt buckets, and cutters in advance of said buckets, and suitably operated cog wheels arranged to mesh with the teeth of said rack flanges, and provided at one side with roller off-sets engaging under the inner edges of the rack flanges to form a part of the wheel support, substantially as set forth.

7. In a ditching machine, the combination with the wheeled engine-propelled frame having a rear frame extension; of front and rear pairs of guide uprights extended from said

frame extension, and the front pair of which are provided with vertical guide grooves, a rectangular horizontally arranged wheel frame mounted for vertical adjustment between said guide uprights and provided at its front end with side guide tongues engaging said vertical guide grooves and at its rear end with short guide arms sliding against the inner faces of the rear guide uprights, suitably arranged supporting rollers mounted above and below the wheel frame, a bucket ditching or excavating wheel geared with the propelling engine and revolving on said supporting rollers, and a detachable wheel attachment connected with the rear end of the wheel frame and carrying a forwardly curved rear dirt shoe disposed around the rear lower portion of the ditching or excavating wheel, substantially as set forth.

8. In a ditching machine, the combination of the horizontal wheel frame carrying upper and lower sets of supporting rollers, a revolving ditching or excavating wheel having side flanges turning on said rollers and comprising parallel spaced wheel rims, dirt buckets connecting the top edges of the rims and provided with back plates arranged in the space between the rims, and ditch cutters in advance of the buckets, and a suitably supported stationary segmental bottom plate arranged in the space between the wheel rims and extending to a point above the center of the wheel, substantially as set forth.

9. In a ditching machine of the class described, the combination with the partial stationary bottom plate; of the ditching wheel having parallel spaced wheel rims, U-shaped dirt buckets connecting the outer top edges of the rims and spanning the space between the same, said buckets having transverse back plates arranged between the rims, U-shaped ditch cutters connecting the spaced rims in front of the buckets, and pairs of straight side cutters attached to the wheel rims between each ditch cutter and the next succeeding bucket, substantially as set forth.

10. In a ditching machine of the class described, the combination of the vertically adjustable wheel frame carrying separate upper and lower sets of combined supporting and centering rollers, a revolving ditching wheel turning on said rollers and having a circumferential series of bottomless dirt buckets, a segmental bottom plate attached to said wheel frame at one side of its center and extending up to a point above the center of the wheel beyond which the buckets thereof are emptied of their contents, and a side delivery apron or carrier adjustably mounted at its inner end on the wheel frame inside of the upper portion of the revolving ditching wheel, substantially as set forth.

11. In a ditching machine of the class described, the horizontal vertically adjustable wheel frame, a revolving bucket ditching wheel turning within the frame and provided at its opposite sides with circular rack flanges, suitably arranged cog wheels geared with driving devices and meshing with the teeth of said rack flanges, an upper set of supporting rollers mounted above the wheel frame and bearing under the inner edges of said rack flanges, and V-shaped brace frames adjustably attached at their upper ends to the horizontal wheel frame and carrying at their lower ends a lower set of rollers adapted to also be held against the inner edges of said rack flanges, substantially as set forth.

12. In a ditching machine of the class described, the combination of the wheeled engine frame having a rear frame extension, the propelling engine mounted on the engine frame and having a main drive shaft, a short counter drive shaft geared directly with one of the traction wheels of the engine frame and adapted to be geared with the engine drive shaft when the ditching devices are inactive, the revolving ditching wheel mounted for vertical adjustment and revolution on the rear frame extension, the turning shaft for said ditching wheel, suitably arranged upper and lower gear shafts, the lower of which is constantly geared with the turning shaft of the ditching wheel and the upper gear shaft and normally out of gear with the engine drive shaft, and means for throwing the upper one of said gear shafts into gear with the counter drive shaft when the lower one of said gear shafts is in gear with the engine drive shaft, substantially as set forth.

13. In a traction ditcher, the combination with the engine-propelled frame; of the horizontal wheel frame mounted for vertical adjustment above the engine frame, a revolving ditching or excavating wheel supported for rotation within the wheel frame and having circular rack flanges on its opposite sides, a turning shaft mounted on the wheel frame and geared with the engine propelling devices, said shaft carrying cog wheels meshing with the teeth of said rack flanges and provided at one side with roller off-sets engaging under the inner edges of the rack flanges to form a part of the support for the wheel, a laterally extended dirt carrier or apron mounted at its inner end on the wheel frame under the discharge of the ditching wheel, and gearing connected with said carrier apron and the turning shaft for the ditching wheel, substantially as set forth.

14. In a machine of the class described, the combination of the revolving ditching or excavating wheel having bottomless dirt buckets, a segmental bottom plate to inclose the bottom of the buckets when loaded, and an automatically operating bucket cleaner, adapted to work into each bucket as it passes beyond said bottom plate, substantially as set forth.

15. In a ditching machine of the class described, the combination of a stationary segmental bottom plate, a suitably supported ditching wheel turning over said bottom plate and having bottomless dirt buckets inclosed

at the bottom, when loaded, by said bottom plate, a spring-lifted bent cleaning arm supported in position at the upper terminal of the segmental bottom plate and adapted to work into each bucket as it discharges beyond said bottom plate, and a series of trip levers suitably connected to one end of said cleaning arm, the outer of which levers is engaged by the back plate of each bucket to impart a vibrating motion to the cleaning arm, substantially as set forth.

16. In a traction ditcher, the combination with a traction engine having a guide frame at the rear end thereof; of a horizontal wheel frame vertically adjustable in said guide frame and carrying separate sets of combined supporting and centering rollers, a bucket ditching wheel turning on said rollers within the wheel frame and discharging at the top, a laterally extended dirt carrier or apron adjustably mounted at its inner end on the wheel frame directly beneath the discharging point of the buckets thereof, and a dirt deflecting apron suitably arranged at one side of the engine frame beyond the outer end of said carrier, substantially as set forth.

17. In a machine of the class described, the combination of the engine propelled frame having a drop at one side, a bucket ditching wheel mounted for adjustment and revolution on the frame, a laterally extended dirt carrier mounted within the top discharge portion of the wheel and adapted to work into the side drop of the frame as said ditching wheel is lowered, and a dirt deflecting apron adjustably suspended at one side of the frame beyond the outer end of the dirt carrier, substantially as set forth.

18. In a ditching machine, the combination with the vertically adjustable wheel frame and the top discharging bucket ditching wheel supported for rotation within said wheel frame; of a carrier frame pivotally mounted at its inner end on said wheel frame and having adjustable bearing arms at its outer end, an adjustable connection between the carrier frame and said wheel frame to adjust the inclination of the carrier frame, carrier rollers mounted at each end of the carrier frame, and the outer of which is journaled in said bearing arms to be adjusted thereby, and the endless dirt carrier mounted on said rollers, substantially as set forth.

19. In a ditching machine, the combination of a bucket ditching wheel discharging at the top, a laterally extended dirt carrier arranged at its inner end under the top discharging point of said wheel, suitably arranged bracket arms, a dirt apron or plate having pivots at its upper end mounted in said bracket arms, said dirt apron or plate being disposed beyond the outer end of said dirt carrier, and means for adjusting the lower swinging end of said apron or plate, substantially as set forth.

20. In combination with suitable leveling stakes or targets, of a traction ditching machine having vertically adjustable ditching devices, a fixed bracket arm secured at one side of the machine frame, and a sight rod adjustably mounted for vertical movement in said brackets and provided with an upper angled sight-end adapted to be kept in line with said leveling stakes or targets to insure a grading of the ditch, substantially as set forth.

21. The traction ditching machine, the wheeled frame carrying the traction and ditching devices and the rear axle of which carries loose traction wheels on its ends, a sprocket wheel mounted on one end of the rear axle adjacent to one of the traction wheels and geared with the propelling devices, said sprocket wheel having a ratchet hub at one side, a double U-shaped ratchet dog pivotally mounted at the inner side of one of the traction wheels and provided with a short arm extension, a coiled spring attached at one end to the short arm extension of said dog and adapted to have its other end connected to a point of attachment at either side of the pivot of said dog to shift the engagement thereof with the ratchet hub, substantially as set forth.

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

JAMES B. HILL.

Witnesses:
JOHN H. SIGGERS,
GEO. C. SHOEMAKER.