(No Model.) 4 Sheets—Sheet 1.

T. L. JOHNSON.

TRACTION MECHANISM FOR CABLE RAILWAYS.

No. 362,634. Patented May 10, 1887.

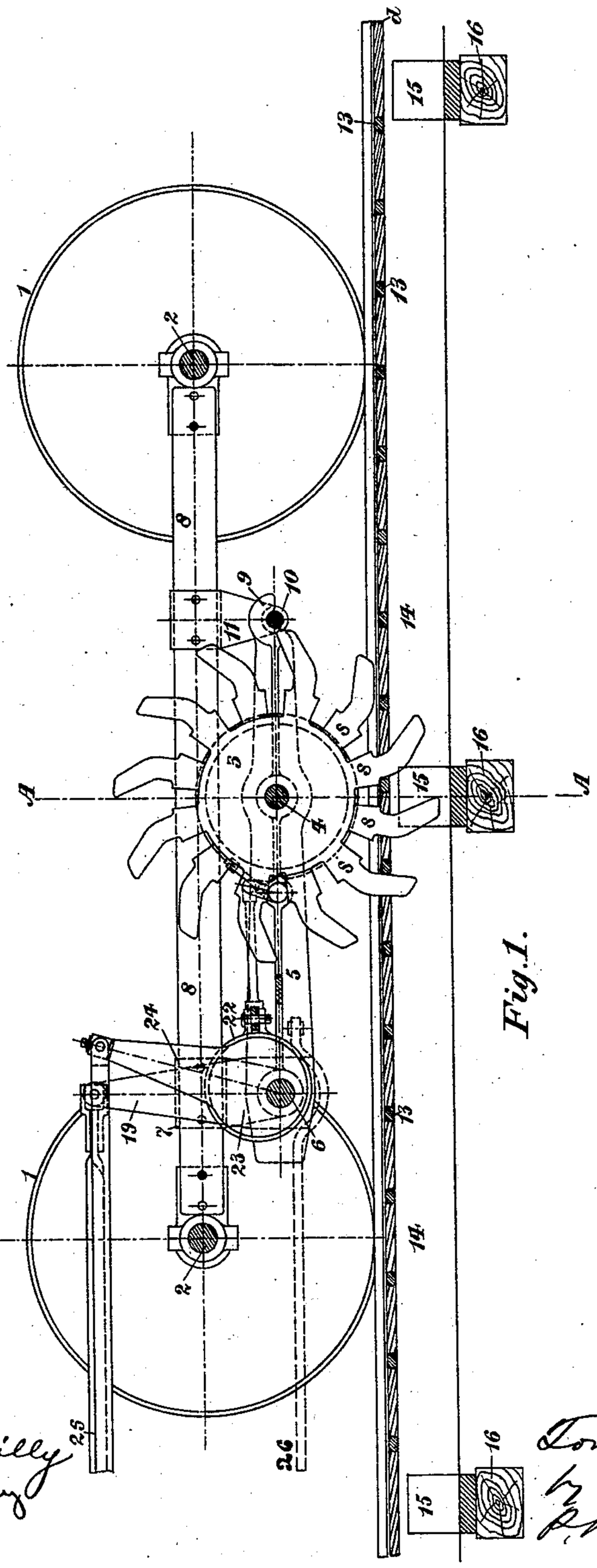

Fig. 1.

WITNESSES:
Francis P. Reilly
A. L. McGinley

INVENTOR.
Tom: L. Johnson
by E. M. Woodward
Atty.

(No Model.) 4 Sheets—Sheet 2.

T. L. JOHNSON.

TRACTION MECHANISM FOR CABLE RAILWAYS.

No. 362,634. Patented May 10, 1887.

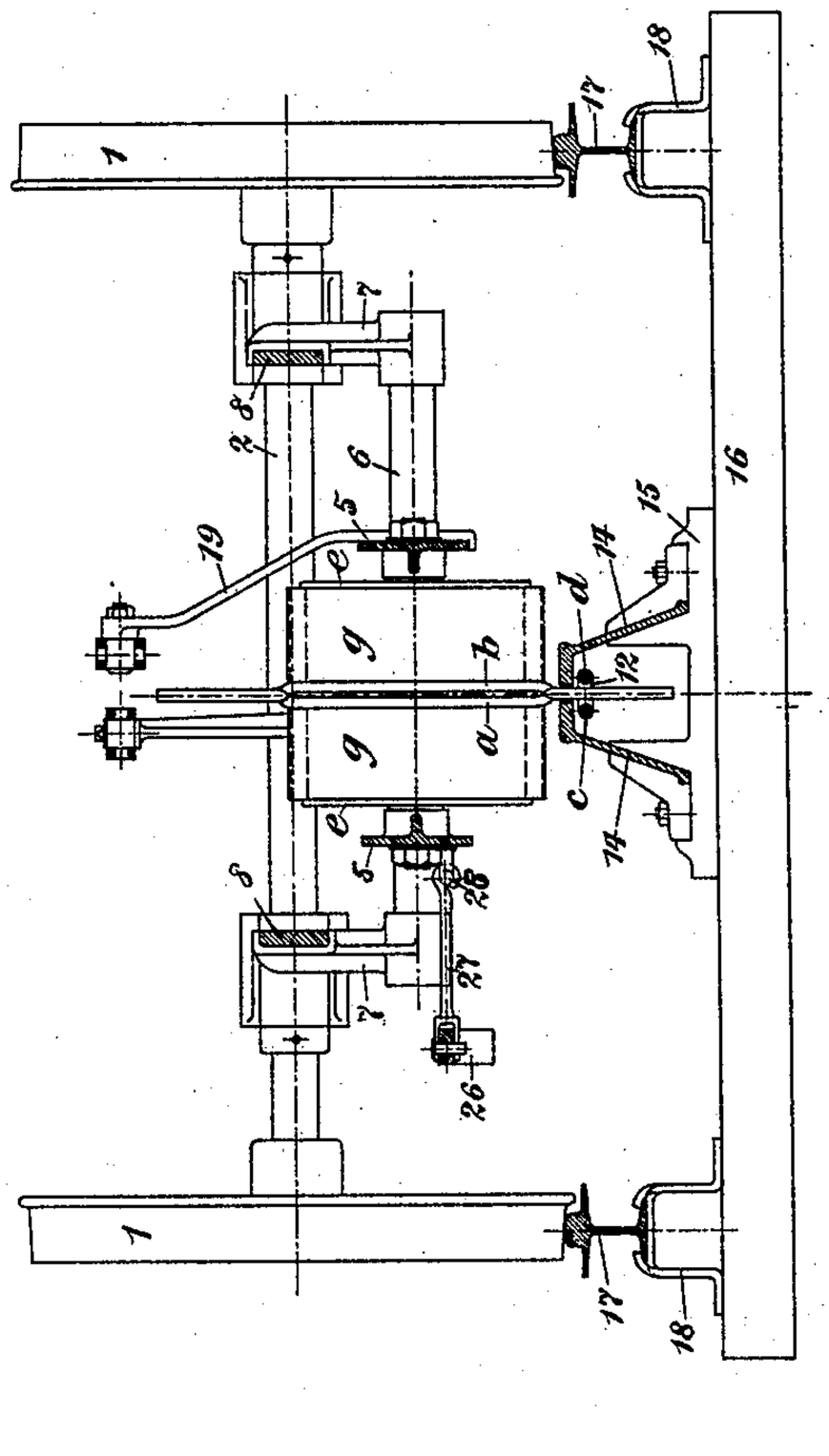

Fig. 2.

WITNESSES:
Francis P. Reilly
A. L. McGinley

INVENTOR.
Tom L. Johnson
by A. R. Dorrance
Atty

(No Model.) 4 Sheets—Sheet 3.

T. L. JOHNSON.

TRACTION MECHANISM FOR CABLE RAILWAYS.

No. 362,634. Patented May 10, 1887.

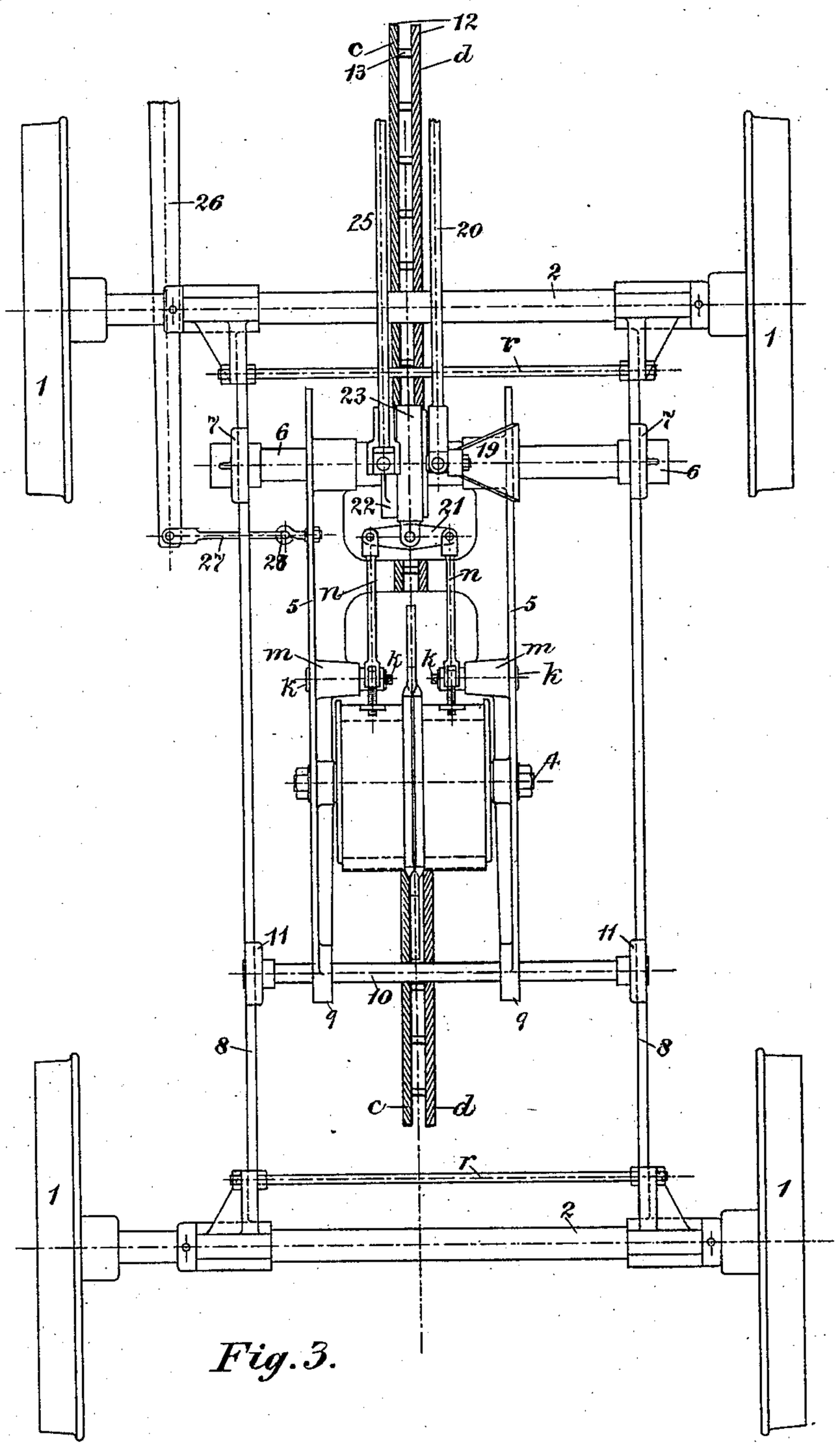

Fig. 3.

WITNESSES.
Francis P. Reilly
A. L. McGinley

INVENTOR.
Tom L. Johnson
by R. H. Townsend
ATTORNEY.

(No Model.) 4 Sheets—Sheet 4.

T. L. JOHNSON.

TRACTION MECHANISM FOR CABLE RAILWAYS.

No. 362,634. Patented May 10, 1887.

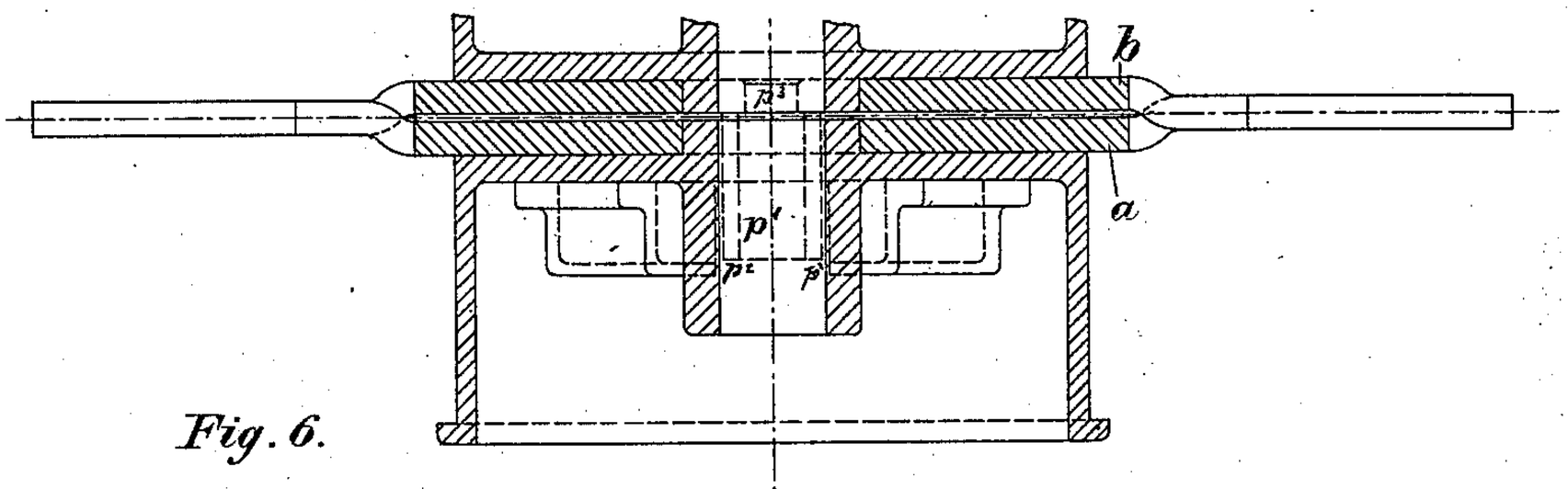

Fig. 6.

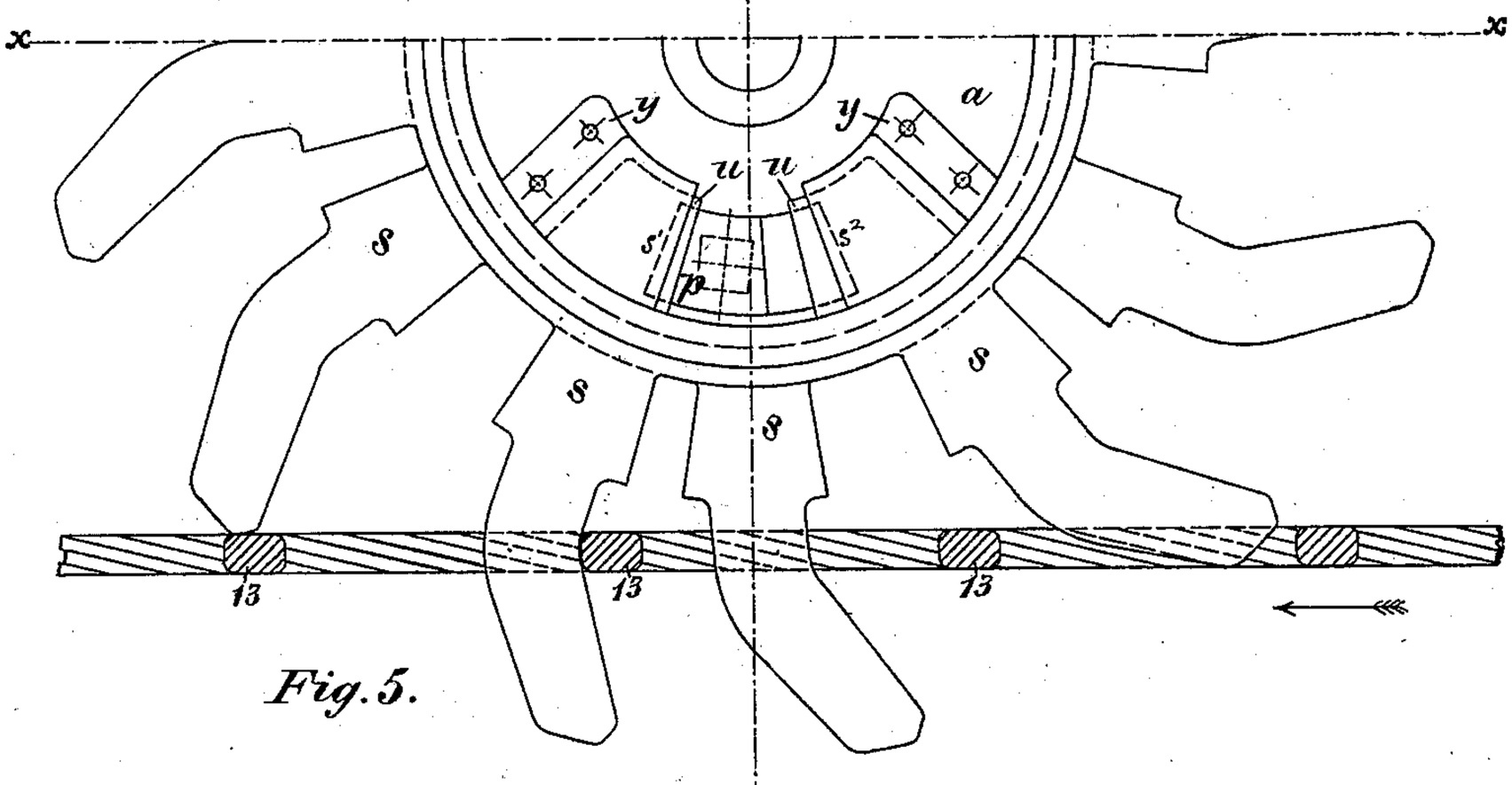

Fig. 5.

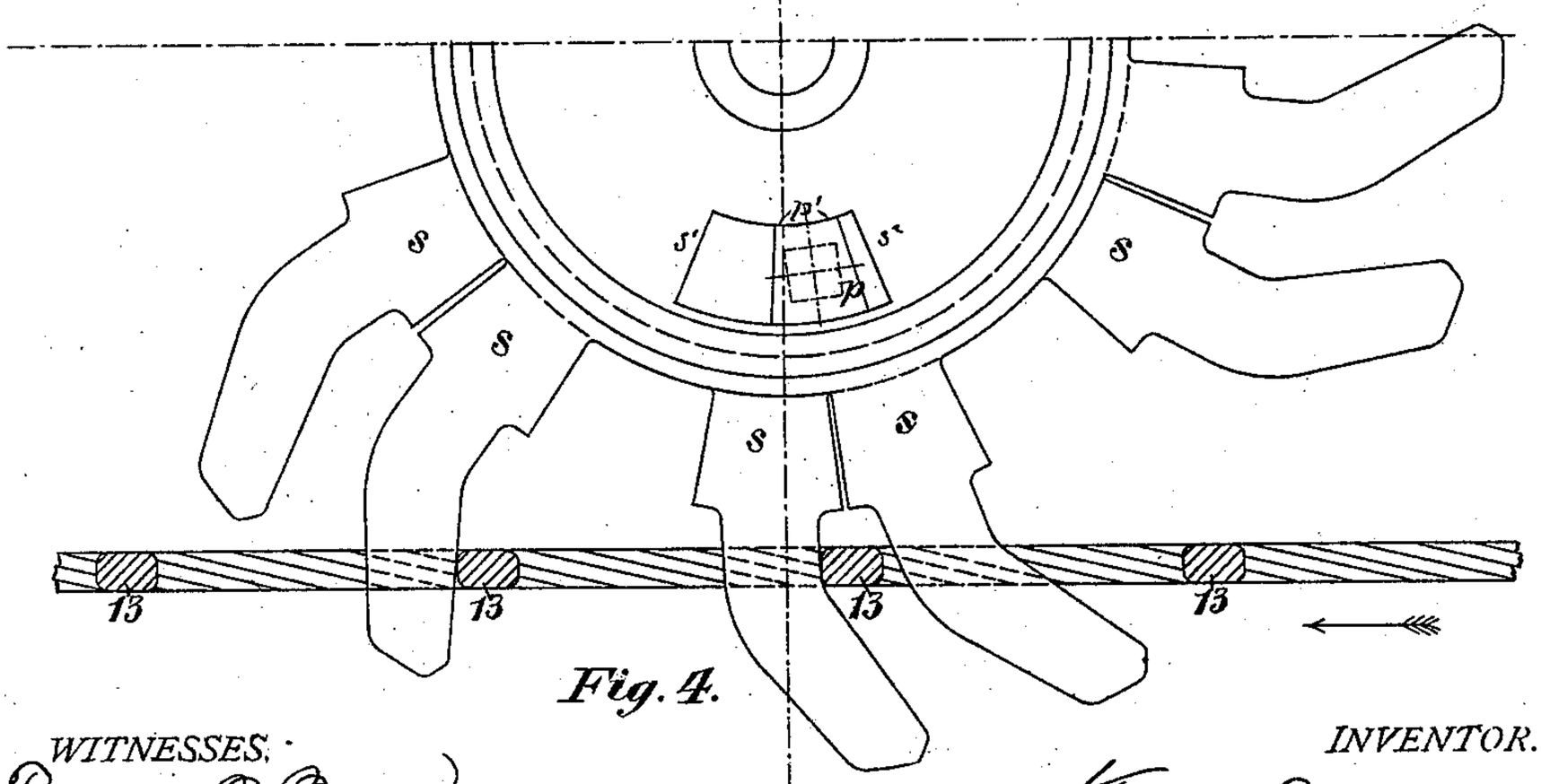

Fig. 4.

WITNESSES:
Francis P. Reilly
A. L. McGinley

INVENTOR.
Tom L. Johnson
by R. H. Townsend
ATTORNEY.

UNITED STATES PATENT OFFICE.

TOM L. JOHNSON, OF CLEVELAND, OHIO.

TRACTION MECHANISM FOR CABLE RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 362,634, dated May 10, 1887.

Application filed August 3, 1886. Serial No. 209,863. (No model.)

To all whom it may concern:

Be it known that I, TOM L. JOHNSON, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Traction Mechanism for Cable Railways, which improvements are fully set forth and illustrated in the following specification and accompanying drawings.

The object of this invention is to overcome certain difficulties which practice has shown to exist in the use of traction-disks or sprocket-wheels and double cables as heretofore constructed for the propulsion of cable-railway cars.

The invention consists in a specially-constructed traction-disk or sprocket-wheel and double cable and appurtenances therefor, as hereinafter particularly described, and set forth in the claims.

In the accompanying drawings, Figure 1 is a side elevation of the sprocket-wheel or traction-disk and its operative mechanism, showing all axles, cross-shafts, and the double cable in vertical section. Fig. 2 is a transverse vertical section through Fig. 1 at the line A A. Fig. 3 is a plan of Fig. 1. Fig. 4 is an enlarged side view of one-half of the compound sprocket-wheel detached, showing two of its sprockets engaged by the cross-stops (shown in cross-section) of the cable. Fig. 5 is a side view, enlarged, of the compound sprocket-wheel detached, showing but one of its sprockets engaged by the cross-stops of the cable. Fig. 6 is a horizontal sectional plan of the compound sprocket-wheel, taken at the line *x x* of Fig. 5.

The results attained by this invention and its mode of operation, hereinafter more particularly set forth, may be better understood by first considering the following brief statement of the difficulties heretofore encountered, above alluded to:

First. In all cable railways the cable is free to swing up and down or to sag between its carrying-pulleys as fixed points, and the frame carrying the traction-disk (where such disks, instead of grips, are used) is also made movable vertically. It is a well-known fact in the running of gearing—such as that of a rack and pinion—that when a heavy load is applied there is a tendency in the pinion to jump out of gear and leave the rack unless the pinion-shaft and rack are rigidly held in place, and this principle is found to exist between the sprocket-wheels and traction-cables of cable railways. When a heavy load is placed on a car, or when the car is on a steep upgrade, or if the car-wheels be braked or chocked after a certain amount of power is applied, there is a tendency in the cable to be depressed from the teeth of the sprocket-wheel, rather than to move the load in proper line of traction, or a like tendency in the sprocket-wheel to rise vertically out of contact with the cable. This same tendency in wheel and cable to separate is also present when first starting the car, due to its inertia, which of course is greater the greater its load. This tendency is obviously a serious objection to the use of a sprocket-wheel, unless such tendency in wheel and cable to separate can be successfully overcome.

Second. Where the sprocket-wheel and cable are used, as heretofore, the weight not only of the cable, but also the weights of said wheel, (through the medium of said cable,) its frame, and appurtenances, rest upon the carrying-pulleys. The cable, too, hanging in a series of curves between said pulleys, compels the sprocket-wheel or traction-disk to follow its undulatory path and mount over the crests of such wavy path, formed by the fixed positions of the carrying-pulleys. In thus mounting over said pulleys a blow or jar is transmitted by the traction-disk through the cable to each successive pulley passed over and to their supports or hangers. These objectionable features, heretofore unavoidable, necessitate stronger pulleys and hangers and add much to the cost of construction as a consequence; but by my invention all of these objectionable tendencies have been obviated by the firm hold and support of the cable-stops taken by the sprockets or teeth, so that in practice any load, regardless of its inertia, can be started without difficulty or danger of disengagement of wheel and cable, and the jar between the cable stops and sprockets prevented. The carrying-pulleys are also by this arrangement relieved of the weight and jar or blows of the wheel and its appurtenances, as well as of much of the weight of the cable itself. These desiderata are accomplished in the following manner: In order that the traction disk or

wheel shall properly engage the cable and thus propel the car when clamped, so as to be incapable of revolution by the traveling cable, said disk or wheel is not only provided with sprockets, but such sprockets are given a rearward bend or set so that the traveling cable will run up or mount such teeth, and thus be practically picked up and carried by said teeth. The wheel, moreover, is double or composite—that is, it consists of two or more dentated wheels mounted on a common center and provided each with similar teeth, each side tooth being inwardly offset to enter the slotway for the cable and centrally engage the cable-stops. The double cable carrying said stops is also made each cable of wires having an opposite lay—that is, the wires composing one cable are given a lay to the right, and the wires in the other cable a lay to the left—so that all tendency in the double cable to twist or kink is obviated, the lay of one cable neutralizing the lay of the other, as each tends to impart an opposite twist to the whole.

With this explanation the parts in detail, as illustrated in the several figures of the accompanying drawings, will now be described, and the mode of operation in general and detail set forth.

In said figures, the number 1 indicates the car-wheels; 2, their axles; 3, the sprocket-wheel or traction-disk, composed of the two parts *a b*, secured to a common shaft, 4. Said shaft is journaled in a frame, 5, mounted on shaft 6, so as to both slide laterally and turn thereon as a center vertically, said shaft 6 being secured fast in hangers 7, depending from side bars, 8, carried by the main axles 2 and tied together by the rods *r*. The end of the frame 5 opposite the shaft 6 is supported by its jaws or hooks 9, resting on the rod 10, so as to slide laterally thereon, secured in hangers 11, depending from the side bars, 8. The double cable is indicated by the number 12, composed of the two cables *c d*, connected by the cross-stops 13. Said cable runs on pulleys (not shown) in the cable-way between the slot-rails 14, supported and clamped in chairs or seats 15, secured to the cross-ties 16, like ordinary rail-chairs, or otherwise, as may be desired. The car-wheels 1 1 run on the track-rails 17, secured in chairs 18, spiked or otherwise fastened to the cross-ties 16.

One of the bosses of the frame 5, through the eye of which bosses the shaft 6 passes, is provided with an arm, 19, articulated to and leading from which is the rod 20, which terminates in any suitable hand-lever, (not shown,) by moving which lever over a suitable radius-bar the arm 19 may be rocked, and thus lift the sprocket-weeel 3 up clear of the cable-slot, (the hooks 9 resting upon the shaft 10,) and the wheel, rising by reason of its carrying-frame 5, rotating upon the shaft 6 as a fixed center. Each outer half or disk of the sprocket-wheel 3 is provided with a boss or drum, *c e*, having any suitable friction-surface—such as wood or other friction material. Said drums are spanned by brake-straps *g g*, preferably of metal sufficiently flexible for the purpose. Said straps may be provided with friction-surfaces, of wood or other suitable material, instead of the circumferences of the drums *e e*. The lower ends of said friction-straps are secured to studs *k k*, fast in bosses *m* in the sides of the frame 5 5. The upper ends of said friction-straps are jointed each to a link, *n n*, which at its other end is jointed to the end of a beam, 21, jointed at its center to an eccentric-strap, 22, spanning an eccentric, 23, loosely mounted on the shaft 6 and operated by the arm 24 and rod 25 by any suitably-attached hand-lever. (Not shown.) It is evident that by turning said eccentric-arm 24, as above indicated, said friction-brake straps will be tightened or loosened at pleasure, and thus simultaneously clamp or release each part *a b* of the traction-disk 3. The said parts or individual disks *a b* have each similar-shaped teeth or sprockets *s s*, inclined rearward, as shown in side view, and offset inwardly, as shown in Fig. 6. Said individual disks are normally held with their teeth *s s* in a nearly uniform or regular pitch by a pin, *p*, fast in one part, *b*, but projecting through the side of the other part, *a*, in a slot therein, between a pair of spring-boxes, *y y*, on the part *a*, and provided with rubber or other springs, *u u*. The springs *u u* allow said pin *p* to be centered, with some play between them, and thus the teeth *s s* are held in practically uniform pitch until said teeth are radially displaced, as will now be described.

The shape of the pin *p* is indicated in plan in Fig. 6 by the inner dotted lines, p', and the outer dotted lines, p^2, corresponding to the full lines, similarly lettered, in elevation in Fig. 4, said sides of the pin thus forming radial lines, which, if prolonged, would meet in the center of the wheel.

The letter p^3 indicates the dotted lines, showing the square head of the pin *p* riveted in the disk or wheel *b*. The slot in the disk *a*, wherein the pin *p* is permitted to travel, is bounded by the lines indicated by the letters s' s^2. Said slot is shown in full lines in Fig. 4 and in partly full and partly dotted lines in Fig. 5.

A compensating pitch is necessary to allow the hook-shaped teeth to enter between the cable-stops without striking a stop, which would otherwise happen owing to the fact that each tooth is so hooked. The practical working of this arrangement, therefore, is that the outgoing teeth are wide apart and the incoming teeth correspondingly close together. This action is caused by the friction-brakes retarding the revolution of each disk or wheel as soon as the point of a tooth is left by an outgoing stop; hence the traction disk or wheel, as illustrated in the accompanying drawings, is made of two or more dentated disks or wheels placed side by side, each movable on a

central shaft in common, by which means a changeable, adjustable, or compensating pitch of teeth is secured. Said teeth being hooked or curved in two directions, both radially rearward and laterally, will securely engage and pick up the cable under its stops, when the several disks composing the complete traction-disk are locked or retarded by the friction-brakes shown, said disk being held from descending below a certain plane, but permitted to rise, as hereinbefore explained. Thus the strongest tension or pull may be exerted upon the car by the cable without any tendency in the curved teeth to slip off or leave the stops of the cable, or for the cable to slide or slip off the teeth, while at the same time much of the weight of the cable is thus carried suspended by the car supported upon the rails of the track. The carrying-pulleys are thus relieved of much of such weight, as well as from the weight and jar of the traction-disk and its frame when said disk passes over them, and said disk is carried along in a plane instead of in an undulating path, as heretofore explained it would otherwise necessarily travel.

It will be observed that, as shown in Figs. 4 and 5, but one tooth and stop are engaged in one figure and two teeth and stops in the other figure. Thus by the arrangement shown there is always engagement of one tooth and stop and not more than two of such engaged. The teeth in the two disks forming the sprocket-wheel are limited in play past each other by the compression of the springs acted on by the pin *p*, or by the edges of the boxes or guides within which said springs are secured. All lost motion and jar between stops and teeth are prevented, and great smoothness of movement and efficiency of operation of all parts of the mechanism are thus obtained.

Lateral motion of the sprocket-wheel is permitted in rounding curves, or in changing the direction of the slot-rails, by the whole frame 5 sliding automatically upon the shaft 6 and rod 10. Said frame may also be slid laterally by a hand-lever (not shown) suitably placed and jointed to the rod 26, which at its opposite end is connected by a link, 27, and eye-bolt and pin 28 to one side of the frame 5.

Having thus fully described my said improvements as of my invention, I claim—

1. A compound dentated traction-wheel for cable-railway cars, consisting of two or more disks or wheels adapted to independently rotate, and having teeth or spurs peripherally disposed thereon and rearwardly inclined, so that the cable may run up thereupon, whereby the weight of the cable may be partially taken from its carrying-pulleys and the cable carried when so held by said disk in a plane parallel to the plane or planes passing through the centers of the successive carrying-pulleys, substantially as and for the purposes set forth.

2. A compound rotary traction-wheel for cable-railway cars, consisting of two or more dentated wheels, each outer wheel offset laterally, for engaging a traveling cable, substantially as and for the purposes set forth.

3. A compound traction disk or wheel for cable-railway cars, consisting of two or more independently-rotary parts, as *a b*, each provided with curved teeth or spurs, as *s s*, for engaging a traction-cable, substantially as and for the purposes set forth.

4. In combination with a double traction wire cable, consisting of two single cables provided with cross-stops, a compound traction disk or wheel, consisting of two or more dentated disks or wheels free to rotate on a central shaft independently of each other, whereby said cable and traction-wheel are caused to run true to each other and a compensating pitch secured between the teeth of said disk and the stops of said cable, substantially as and for the purposes set forth.

5. In combination with a traction-cable for cable railways provided with driving-stops, a compound rotary traction disk or wheel constructed of two or more dentated disks or wheels, each of which is provided with friction-brakes for locking or clamping said parts, and with an adjusting-lever therefor, whereby when the teeth on said wheels are brought into engagement with said cable-stops and said wheels clamped the requisite pitch or variation in pitch of said teeth and cable-stops is automatically established by the travel of the cable, substantially as and for the purposes set forth.

6. In combination with the car-wheel axles of a cable-railway car, a frame, as 8, secured to said axles, substantially as described, and an oscillating frame for supporting a rotary traction-disk for connecting the car and cable, substantially as and for the purposes set forth.

7. A compound rotary disk for a railway traction-cable, consisting of two or more independently-rotary disks, as *a b*, connected by a stop-pin, and springs on the sides of said disks, whereby a limit of motion past each other is provided for said disks, substantially as and for the purposes set forth.

8. In a cable-car mechanism, a traction-disk or sprocket-wheel mounted in an oscillating and laterally-sliding frame, as 5, pivoted at the end on a horizontal shaft and resting upon a horizontal rod at its other end on jaws or hooks, whereby said frame is adapted to raise said wheel vertically and slide the same horizontally, substantially as and for the purposes set forth.

9. In a cable-car mechanism, a traction-disk or sprocket-wheel mounted in an oscillating frame, as 5, pivoted at one end on a horizontal shaft and resting upon a horizontal rod at its other end on jaws or hooks, whereby a limit is fixed to the depression of said wheel, substantially as and for the purposes set forth.

10. A compound rotary disk for a railway traction-cable, consisting of two or more independently-rotary disks, as *a b*, each provided with friction-brake straps, as *g g*, for clamping

said disks, in combination with rods, as *n n*, a double-ended lever, as 21, and an eccentric-strap, as 22, and eccentric, as 23, operated by an arm, as 24, whereby said brake-straps are simultaneously tightened or loosened at will, substantially as and for the purposes set forth.

11. The combination of two single cables united by cross-stops secured through the strands of each cable, said strands being laid up in one cable with a right-hand lay and in the other cable with a left-hand lay, whereby said opposite lays are caused to neutralize the effect of each other in tending to twist the cable in opposite directions, and the same is thereby completed and preserved free from kinks and twists in the direction of either lay, substantially as and for the purposes set forth.

TOM L. JOHNSON.

Witnesses:
A. I. DU PONT,
JENNIE TURNER.