2 Sheets--Sheet 1.

W. H. WARD.

Friction Power-Brake.

No. 167,044. Patented Aug. 24, 1875.

FIG I

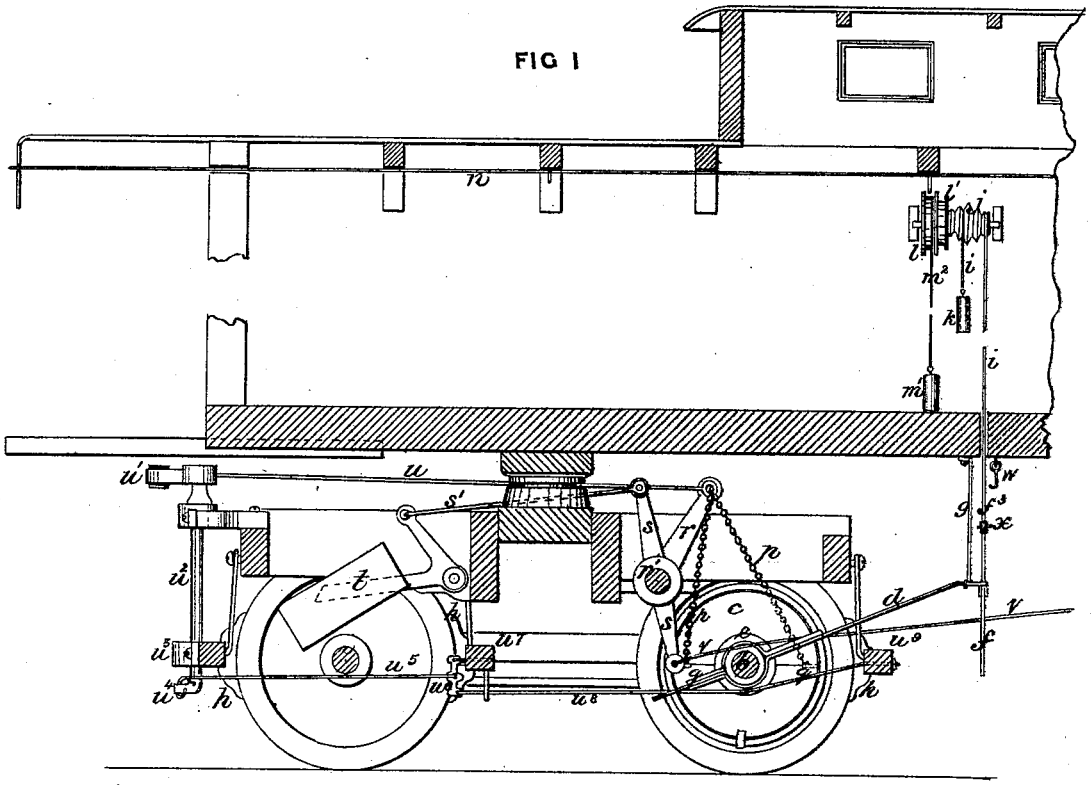
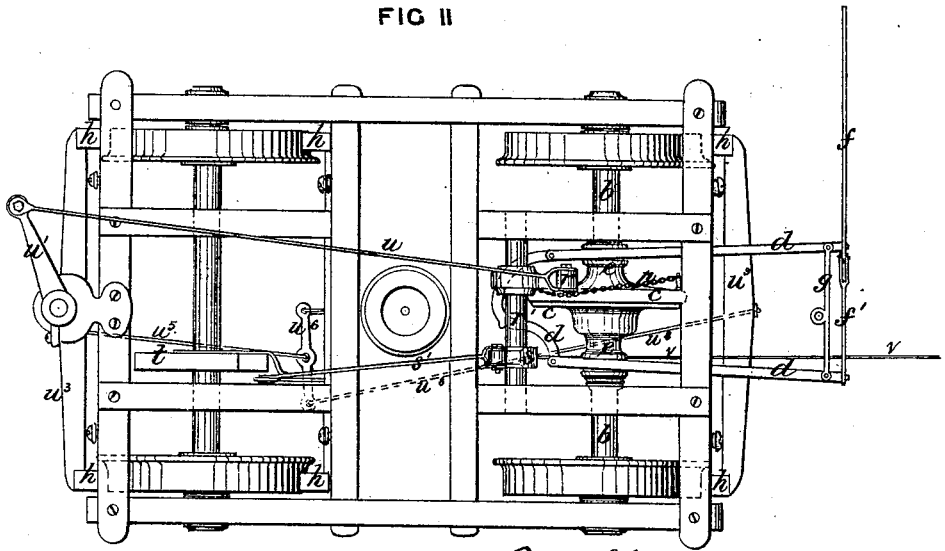


FIG II



WITNESSES

John E. Laing.

J. A. Rutherford

N. H. Ward INVENTOR

W. H. WARD.

Friction Power-Brake.

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FIG IX

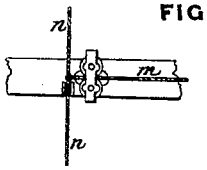


FIG VIII

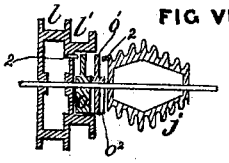


FIG III

FIG X

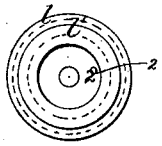
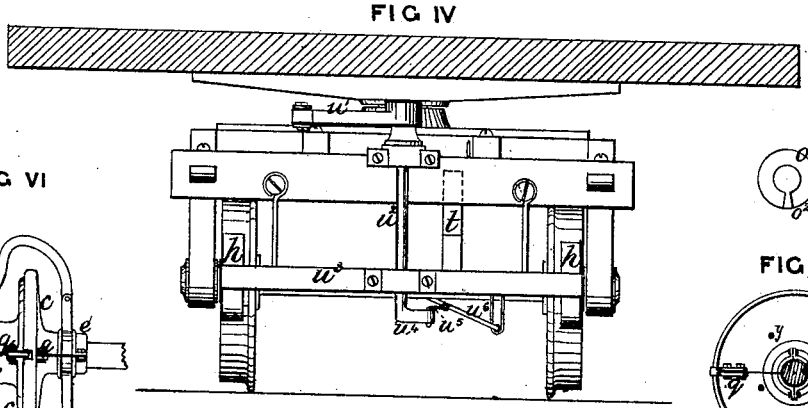


FIG IV



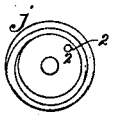
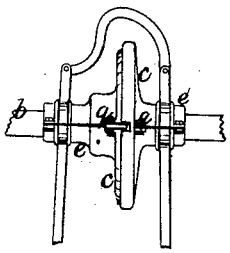


FIG VI



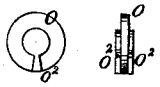


FIG VII

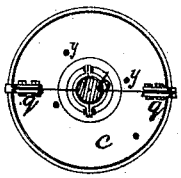
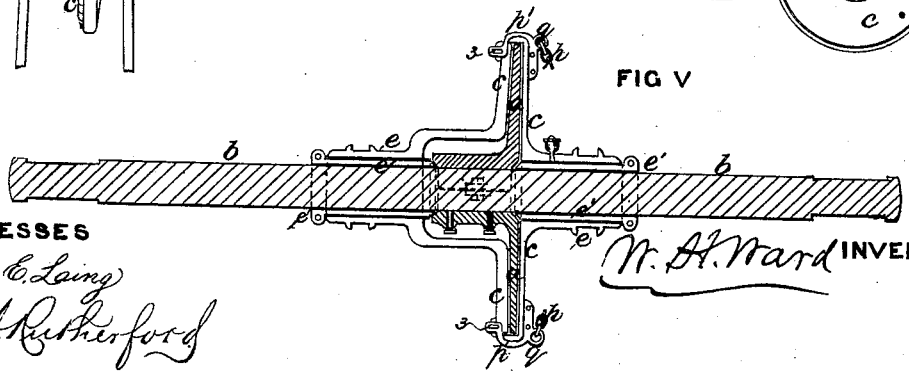


FIG V



WITNESSES

John C. Laing

J. A. Rutherford

W. H. Ward INVENTOR

UNITED STATES PATENT OFFICE.

WILLIAM H. WARD, OF AUBURN, NEW YORK.

IMPROVEMENT IN FRICTION POWER-BRAKES.

Specification forming part of Letters Patent No. **167,044**, dated August 24, 1875; application filed January 28, 1875.

To all whom it may concern:

Be it known that I, WILLIAM H. WARD, of Auburn, in the county of Cayuga and State of New York, have invented certain new and useful Improvements in Friction Power-Brakes; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawing, and to the letters of reference marked thereon, which form a part of this specification.

The object of my invention is to utilize the momentum of the car or train to apply the brakes whenever required. This is effected by the employment of friction-disks, arranged to embrace a revolving axle-disk, and having a sliding movement toward and from said axle-disk, and a partial rotary movement therewith, in order that, at the moment the sliding disks are brought in contact with the revolving disk, the force of the moving car or train is brought into requisition to apply the brakes on all the wheels, and thereby stop itself.

The usual bell-cord connects with the sliding disks by a novel construction and combination of lever devices, which, by pulling said bell-cord, makes the contact of the disks, and thereby brings into action the force of the moving car or train.

The sliding movement of the friction-disks is effected by joint-lever connections with the bell-cord through the medium of branch lines and a combined pulley device with weighted winding and unwinding cords.

The partial rotary movement of the friction-disks is effected by their contact with the revolving axle-disk, while chain-connections from the partial rotary disks are caused to operate an armed rock-shaft on the same truck, and, through connecting-rods, instantly apply all the brakes in such manner that in proportion to the force exerted by the outer disks upon the faces of the revolving disks, so will be an increase of friction force of the brakes upon the wheels.

The disk chain-connections are such as to allow the disks to partially rotate in the direction the car or train may be moving.

The brakes are applied by pulling in and during the holding of the bell-cord, and are released whenever the cord is allowed its freedom or let go, and by the action of a counter-weight connected with the rock-shaft arms.

The employment of this device for brake force derived from the momentum of the car or train to stop itself effectually dispenses with all the platform hand-brakes as now in use.

In the accompanying drawings, Figure 1 represents a vertical longitudinal section of a portion of a railway-carriage and a four-wheel truck embracing my invention; Fig. 2, a top view of the truck, showing the brake and its connections; Fig. 3, a cross-section, showing the inner end of the truck and brake devices in elevation; Fig. 4, an elevation of the outer end of the truck; Fig. 5, a longitudinal section of the axle and the friction-disks on an enlarged scale; Fig. 6, an elevation of the same and the levers for bringing the disks together and separating them from the rotating axle-disk; Fig. 7, an end view of the same, and Fig. 8 a section of the pulley and cone winding device for the weight which puts the disks in contact through the action of the bell-cord and its connections.

The drawings show my improved brake as applied to a single truck, and from which connections are made to the other truck of the car.

The trucks are of any approved pattern in use.

The braking device consists, primarily, of three friction-disks—a revolving disk, *a*, fixed to any one of the truck-axles *b*, and movable disks *c c*, arranged for action on each side of the axle-disk, so that when these parts are in contact the friction of their four face-surfaces will constitute a sufficient power derived from the momentum of the moving car or train to apply the brakes. The disks *c c* are mounted loosely upon the axle, and have only a slight movement thereon toward and from the revolving disk, which movement is imparted to them by means of yoke-levers *d d*, having suitable collar-bearings upon ends *e e* of said disks, and are united at their outer ends by a joint-lever, *f*, connecting with the bell-cord. The yoke-levers *d d*, while having their bearings upon the disk-hubs, are supported at their work

ends by a triangular suspending-spring, g, the object of which is to press open, and also retain in position, the levers d d, and move the disks c c from the disk a when the brake-shoes h are free. The joint-lever is of two parts, f and f^1, united by a lap-joint, f^2, Fig. 3, the action whereof, when the part f is raised, is like that of a toggle-joint, to force the levers and the disks c c, which carry them, together, and apply the faces of these disks to the revolving disk. This joint-lever stands across the truck, and the free end of the part f is connected, by a rod, f^3, to a weighted cord, i, passing up into the car behind the casing at any suitable point, and over a double cone-pulley, j, Fig. 8, at the top of the car, Figs. 1 and 3, said cord being provided with a hollow weight, k, Fig. 10, the object of which is to raise the joint-lever f whenever the weight is allowed to descend. The friction of the double cone is such as to exert upon the levers d a variable force, as will be presently described. In connection with this double cone-pulley there is combined a separate double pulley, l l', Fig. 8, for a weighted branch-line connection, m m^1, with the bell-cord n of the car or train, Figs. 3 and 9. These separate pulleys are on the same spindle, and each has motion independent of the other, but are made to rotate in the same direction by one or more loose washers, o o^1, having a rib projection, o^2, on the opposite faces, for engaging with projections 2 2 on the inner faces of the pulley l' and the double cone j, for the purpose of unwinding the branch line m, and wind up the weight m^1, which operation winds the cord i on one end of the cone, to raise the work end of the lever f, and close the disks c c upon the disk a, and unwinds the weight k, which maintains the frictional contact of the disks with greater or less force.

The arrangement of the loose washers o o^1 between the pulleys and their pin-connections 2 2 is to allow of the pulleys l l' to turn independently of the cone-pulley, and so compensate for whatever slack there may be between the cars composing the train, so that when the bell-cord is pulled toward the engine the brakes may be instantly applied.

The weight-box k is hollow, (see Fig. 10,) and of sufficient weight to produce force enough on the friction-disks c c to lock the wheels of an empty or light car; but when the car or cars are loaded, the brake or train man opens the casing of the weight-boxes, and adds to the weights whatever he may think necessary to cause the disks c c to work with a sufficient increase of force upon the revolving disk a, and by this means graduate the force of the brakes on each car agreeable to its requirements.

This arrangement of branch lines and weighted cords also tends to keep the bell-cord n always free from slack, so that the least pull thereof toward the engine will operate the pulley and weight-lines that move the lever f, which, by its lap-joint connection, draws the levers d d in contact with the revolving disk a, and by such contact causes the outer disks to have a limited movement in the same direction with said disk.

This partial rotation of the disks c c is governed by a branched chain-connection, p, Figs. 1, 2, and 3, secured to the outer side of one or both of the disks c, at the circumference thereof, and diametrically opposite each other, by suitable lugs q. The other end of said chain, or rather its center, is connected to an arm, r, on a rock-shaft, r', mounted upon the truck-frame. The partial rotation of the disks c c will draw either branch of the chain p with it and pull down the rock-shaft arm r, which operation applies the brakes by means of a rod, u, extending from said arm r to a horizontal arm, u^1, upon a crank-rod, u^2, at the end of the truck opposite the friction-power disks. The lower end of this crank-rod has its bearing in the brake-bar u^3, and has a crank-arm, u^4, on its lower end, from which a rod, u^5, extends, and connects with the center of an arm, u^6, pivoted to the inner brake-bar u^7, while the brake-bar u^9 is connected by a rod, u^8, with the arm u^6, whereby all the brake-bars of said truck are connected with the friction-power disks.

The crank-rod u^1 may be connected with the cross-arm s instead of the arm r, as may be desired.

A cross-arm, s, extends from the rock-shaft r', and a rod, s', connects said arm with a counter-weight, t, which pulls up the chain-arm r and releases the brakes, and keeps them from the wheels when the bell-cord is free. Now, as the disks c c must turn together to have the same partial rotary movement, they are connected by strong yokes p', crossing the disks at their circumference, provision being made by slots 3 in the yoke ends for the necessary sliding movement of the disks toward and from the disk a. (See Fig. 5.)

To protect the axle from the wearing action of the sliding and partial rotary movement of the disks c c, their hubs e are fitted upon sleeves e' e', which form the bearings for said disks; and for convenience of application, the disks and sleeves are made in half-sections, and are either riveted or bolted together.

The disks c c are provided with suitable holes y through their surfaces or sides, for the purpose of admitting air and dust during the movement of the train, so that when they are brought in contact with the revolving disk a, their friction-faces may be cleansed from whatever refuse oil may have wasted upon their faces during the run between stops.

It is deemed only necessary to use one set of friction-disks to each car, and in such case the connection is made from the truck having the friction-disks with the truck at the other end of the car by a rod, v, Fig. 1, connecting with a crank-arm corresponding to that of u^1 on a crank-rod. The crank-arms u^1 and u^4 are placed at angles of about one-sixth radius, whether upon the same or oppo-

site sides of their rod, and the action of these crank-arms, in connection with the arms on the rock-shaft r', is such as to produce the greatest amount of power upon the brake-bars. The rod v, Figs. 1 and 2, connecting with the truck at the other end of the car, may be made to connect with intermediate armed rock-shafts, corresponding to that of r', (shown in Fig. 1,) in trucks provided with six or more wheels, and thereby effectually apply brakes to each wheel of the truck. This arrangement of friction, hand, and power brake is applicable to trucks of any number of wheels.

Now, as the chains p allow the disks $c\,c$ to turn a certain distance in either direction, the moment they are brought in contact with the revolving disk the brakes are put on, and in proportion to the lever force exerted upon said outer disks, so will be that of the friction-power to apply the brakes with a corresponding increase of force upon the wheels. This result is produced by the weighted cone and pulley connections—that is to say, whenever the bell-cord n is pulled toward the engine, the branch cords m are also drawn, in consequence of their being tied to the bell-cord, in a forward direction, which turns the pulley l' to wind up the weight m^1, and allow the weight k to descend by the unwinding of its connecting-cord from a reduced to a greater diameter of the cone, while the other or lever end of the weight-connecting cord is connected to the lever-rod f^3, and correspondingly winds up the said rod and lever-cord from a greater to a less diameter, so that as the weight unwinds to an increase of leverage, the other or lever end of the cord winds to a decrease of leverage, thereby causing a continual increase of force all the while the weight descends, or is allowed to descend; and when it ceases to descend the bell-cord may be drawn forward for two or more turns of the pulley j, or to a stop at the end of the rear car, temporarily fixed by the train-man, and when the cord is so pulled to said stop by the engineer, he then knows all the brakes are set, agreeable to the force allowed by the train-man to each car of the train, respectively. This winding and unwinding for slack between the cone-pulley j and the branch-line pulley m is to compensate for the slack between the cars in long trains, and hence the intermediate washers $o\,o^1$.

It is desirable to have some means to enable the engineer to apply the brakes on the rear car of his train, so as to keep the train stiff when rounding curves and on down-grades. This is effectually accomplished by the train-man tying the branch cord m sufficiently short on the bell-cord of the last car to apply the brakes to this last or rear car without affecting any of the others, which at once takes out all slack (if any) between the cars, and allows his train to brake up firm, while the doubling or the usual jamming up of the cars, when suddenly braked, often displaces the slack ones from the rails; but when on a down-grade, or rounding a curve, the engineer pulls in enough of the bell-cord to apply the brakes on the rear car agreeable to his wishes without disturbing the brake arrangement of any other car of the train. The object of the double cone-pulley j is to cause the brakes to be applied by an increased force, for as the brake weight-cord unwinds toward the center or large diameter of the cone, it correspondingly winds the lever-branch toward the end or small diameter of the cone, and thereby exerts an increase of force upon the joint-lever f, and under this action the farther the weight k descends the greater will be the force exerted upon the friction-faces of the disks, and so increase the force upon the brakes. The object is to control the amount of force required on the brakes at the time by a greater or less pull of the bell-cord. The branch line m from the bell-cord has a few turns upon the pulley l', while the weight-cord m^2 winds and unwinds from the pulley l, so that the winding of the one controls the unwinding of the other, and vice versa.

It is often found desirable to partially set the brakes when the cars are not in use, or when standing upon grades, and for this purpose hooks w are secured to the bottom of the platform or car in positions to be hooked into an adjustable clamp-slide, x, to hold the levers $f\,f^1$ up to apply the brakes with sufficient force to hold the cars in place. The position of the hook is such that when hooked with the rod f^3 it will be inclined in order to allow its being automatically unhooked by a pull of the bell-cord, as the hook w releases itself when the rod f^3 is raised. The clamp-slide x is made adjustable upon the rod f^3, to compensate for the wear of the brake-shoes, and is provided with a set-screw to secure it in position. As the braking force of the friction-disks is applied directly to the axle b, only one brake-bar is required for the wheels of that axle.

It is not new to operate friction power-brakes by the momentum of the train, nor to employ the train-cord to operate braking mechanism; nor to the use of friction-disks upon the truck-axles to apply the braking force by a sliding movement of said disks to bring them in contact with an axle-revolving disk, and such elements of a friction power-brake are not claimed, broadly, in this patent.

I claim—

1. The disks $a\,c\,c$ on one of the axles of each car, combined with the brake-connecting devices, for applying and releasing the brakes of its own truck and those of the corresponding truck at the other end of the car, substantially as set forth.

2. The combination, in a friction power-brake, of the rotating axle-disk a and the disks $c\,c$ with the yoke-levers $d\,d$, their connecting joint-levers $f\,f^1$, and the bell-cord n, whereby the disks $c\,c$ are forced against the rotating

disk a to make the frictional contact, substantially as set forth.

3. The combination, with friction brake-disks $a\ c\ c$, levers $d\ d\ f\ f^1$, and the bell-cord n, of the chain p and the armed rock-shaft $r\ r'$, connecting with the brake-bars, whereby the outer disks are allowed a partial rotation with the axle-disk, to put on and hold the brakes until the bell-cord is allowed its freedom, all substantially as set forth.

4. The combination, with the train-cord n and the branch lines m, of the double and cone pulleys $l\ l'\ j$, weights $k\ m^1$, and the jointed levers connecting with the friction-disks, whereby the friction-disks are put into operation through the medium of the train-cord, and held in operation until said cord is released, as described.

5. The double cone-pulley j, in combination with the hollow weight k, cord i, and the lever devices of the friction-disks, substantially as set forth.

6. The combination, with the pulleys $l\ l'\ j$, of the loose washers $o\ o$ and the projections o^2 o^2 and 2 2 on the washers and pulleys, whereby the pulleys $l\ l'$ may have an independent motion to compensate for any slack in the train-cord, as described.

7. The combination, with the disks $c\ c$ and the axle-disk a, of the slotted connecting-yokes p', whereby the disks $c\ c$ are secured to each other, to insure their simultaneous partial rotation with the disk a, substantially as and for the purpose set forth.

8. The combination, with disks $c\ c$, having both a sliding and partial rotary motion in relation to the axle-disk a, of the bearing-sleeves $e'\ e'$, as and for the purpose set forth.

9. The combination, with the friction-disks $c\ c$ and the levers $d\ d$, of the double spring g, for suspending and opening the levers, as and for the purpose set forth.

10. The combination, with the adjustable clamp x on the rod f^3, the joint-lever $f\ f^1$, and the friction-disks, of the hook w, substantially as and for the purpose set forth.

11. The combination, with the friction-disks $c\ c$, chain-connection p, and the armed rock-shaft $r\ r'$, connecting with the brake devices, of the arm s, rod s', and counter-weight t, as and for the purpose described.

12. The combination, with the friction-disks $c\ c$, chain p, connected on opposite sides of center of the disk, armed rock-shaft $r\ r'$, and rod u, with the double-cranked rod $u^1\ u^2\ u^4$ and the rods u^5 and u^8, connecting the brake-bars, as and for the purpose set forth.

13. The combination, with each car, of the graduating-weights $k\ m^1$, their cords $i\ m^2$, pulleys $l\ l'\ j$, and the branch line m, whereby a loaded car may receive a greater amount of brake force by increasing the weights, substantially as set forth.

14. The combination of the truck-wheels, the rod u, double crank-rods u^1, u^2, and u^4, and the rod u^5, connecting the double brake-bars w^3 and w^7 of the wheels of one axle, whereby the brakes are applied to the opposite sides of the wheels of one axle of each truck, substantially as set forth.

15. The disks $c\ c$, provided with the air and dust holes y, as and for the purpose set forth.

16. The branch line m, in combination with the pulleys $l\ l'\ j$, weights $k\ m^1$, and the braking devices, whereby each car is provided with its own means for applying the brakes without regard to the bell-cord or platform-brakes, substantially as set forth.

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

W. H. WARD.

Witnesses:
A. E. H. JOHNSON,
J. W. HAMILTON JOHNSON.