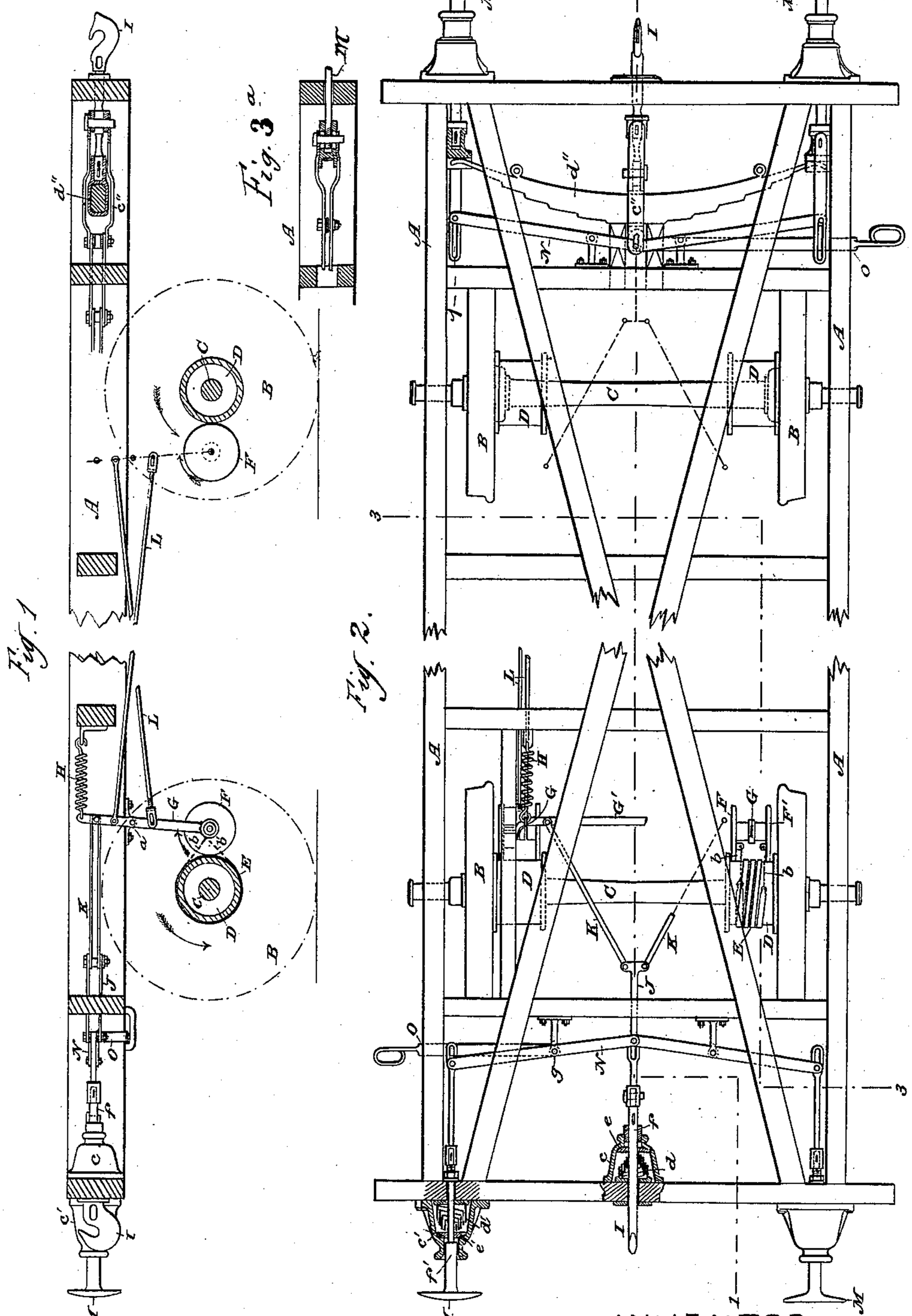
(No Model.) 5 Sheets—Sheet 1.

P. A. GAMBARO.

CAR BRAKE.

No. 336,911. Patented Mar. 2, 1886.



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J. Moulin

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Paul Arthur Gambaro

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Fig. 3.

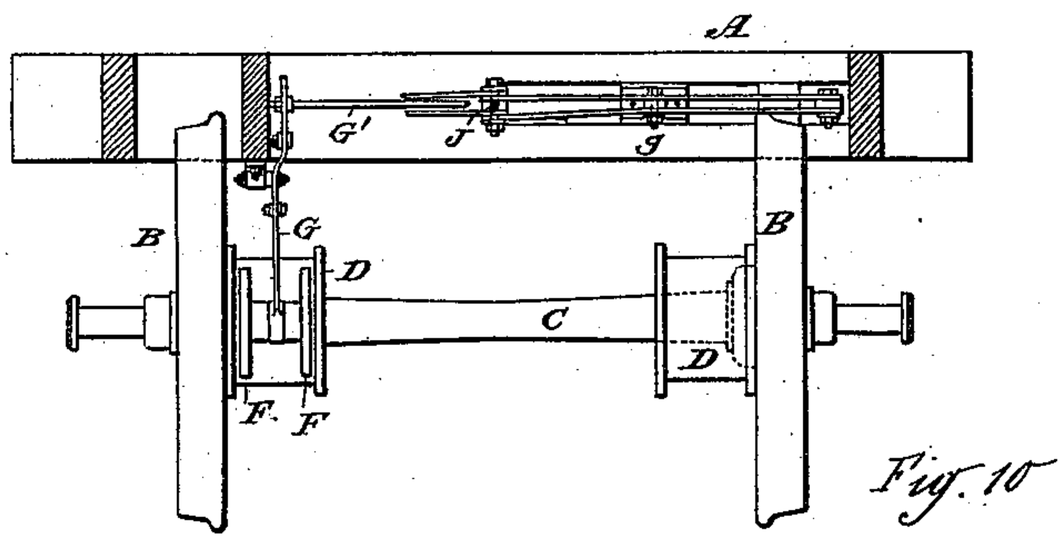


Fig. 10

Fig. 4

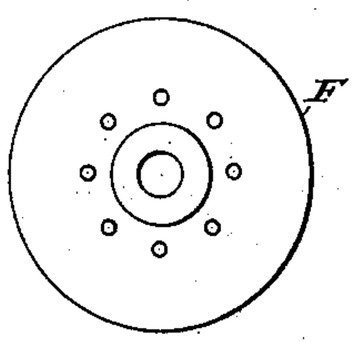
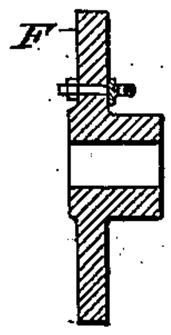


Fig. 6

Fig. 5



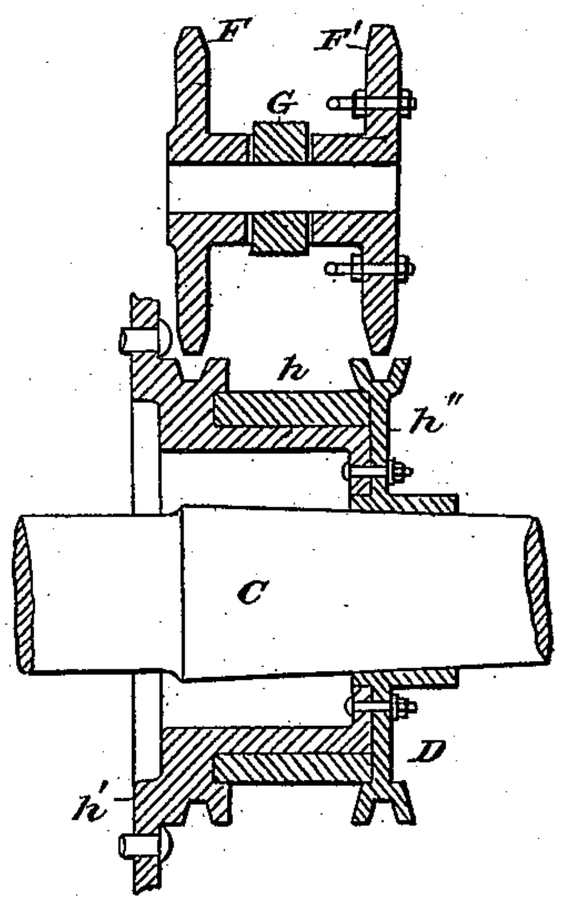


Fig. 9

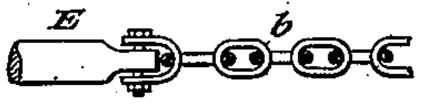


Fig. 7

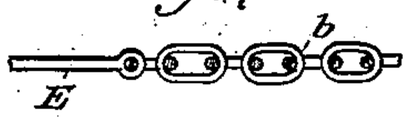
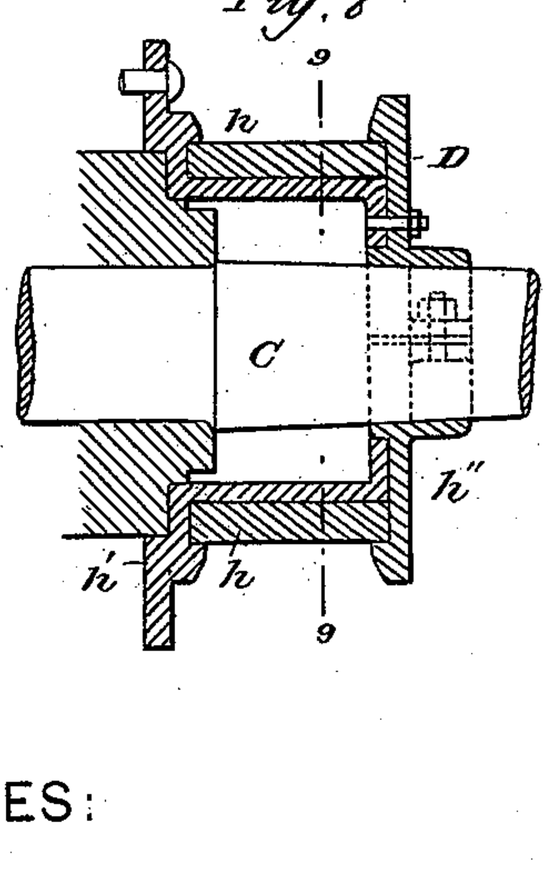


Fig. 8



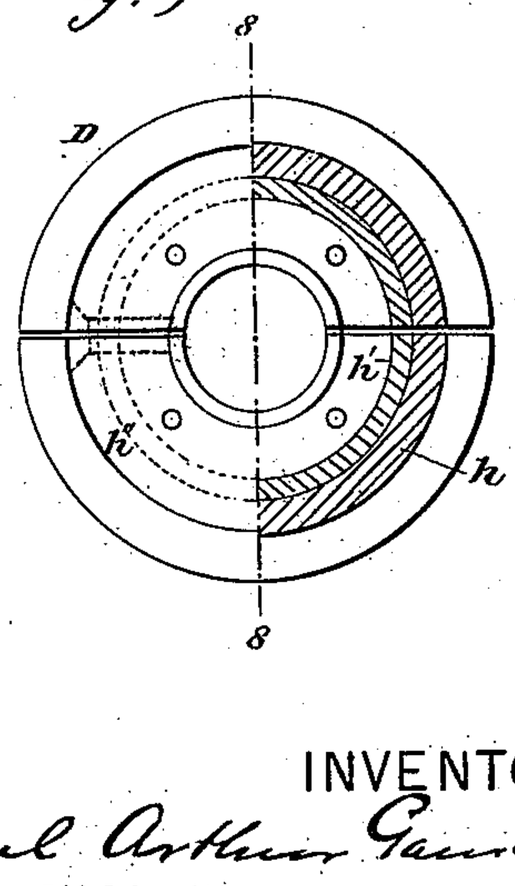


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Fig. 13

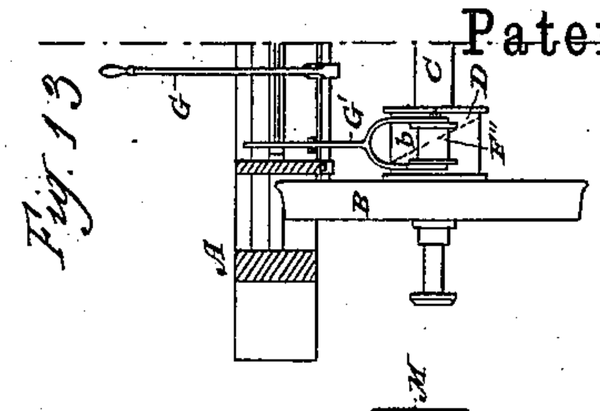

Fig. 12

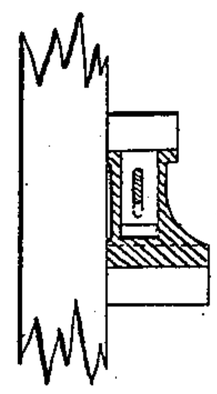

Fig. 11

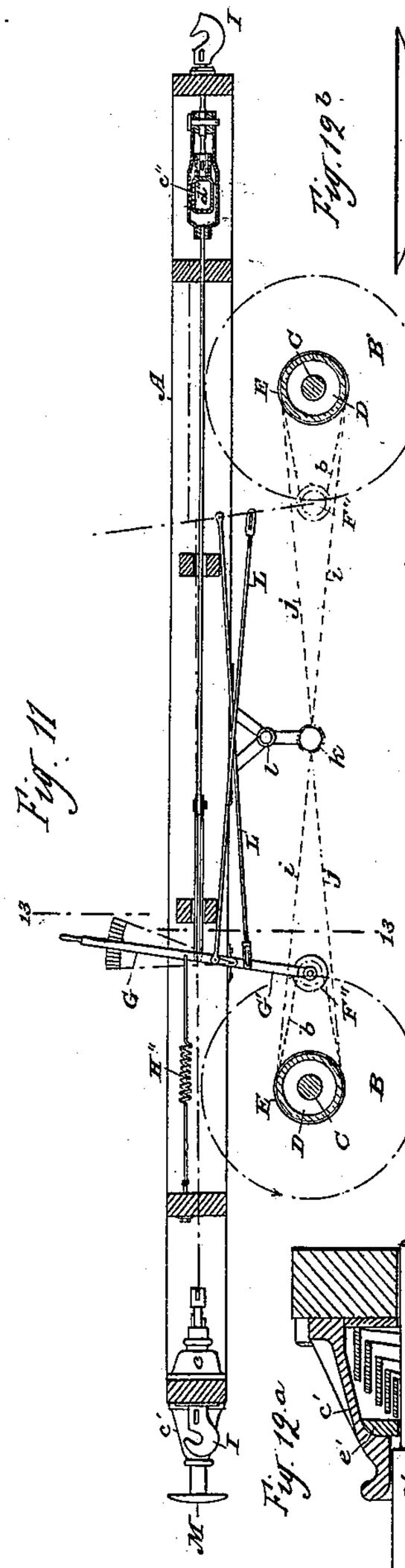

Fig. 12a

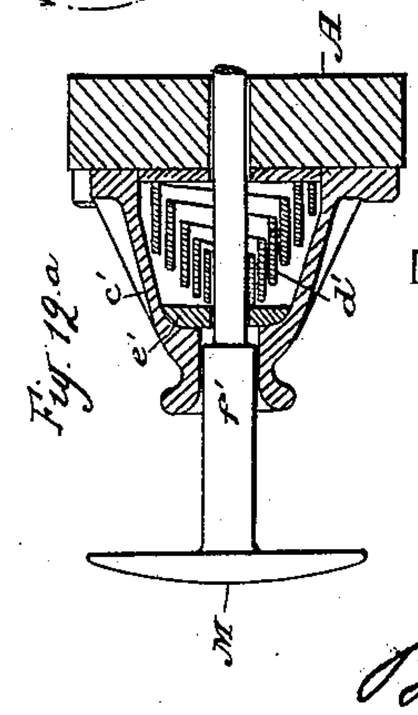

Fig. 10

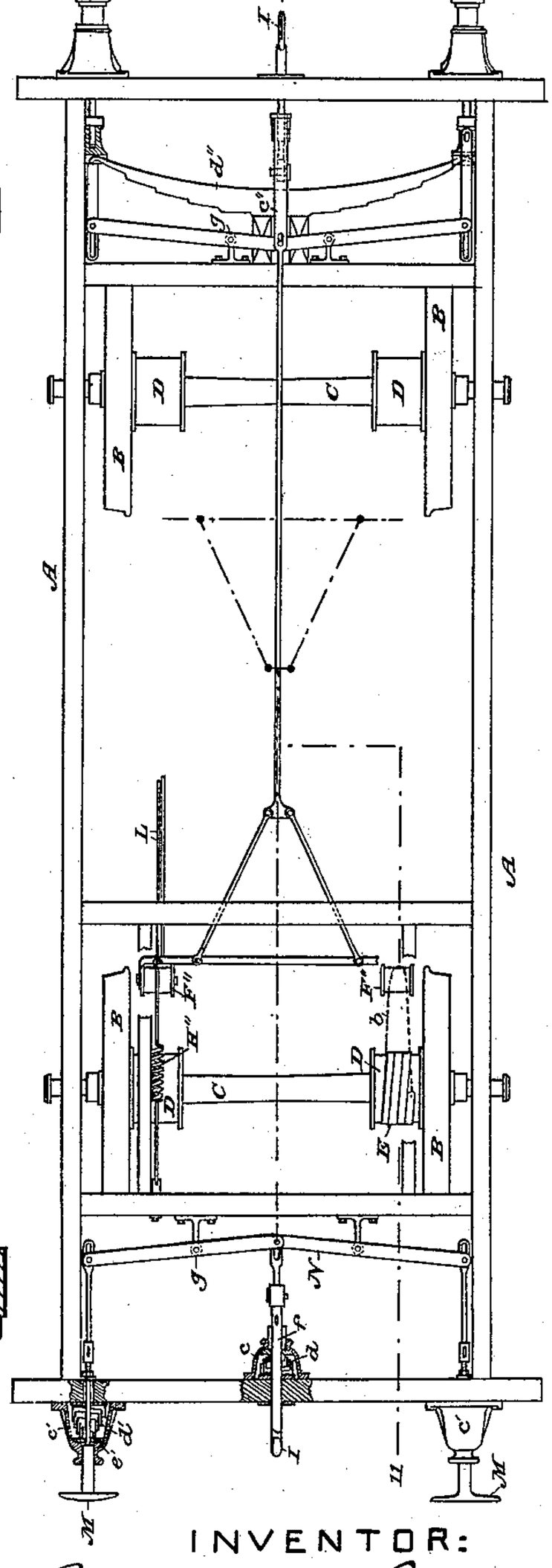

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Fig. 14.

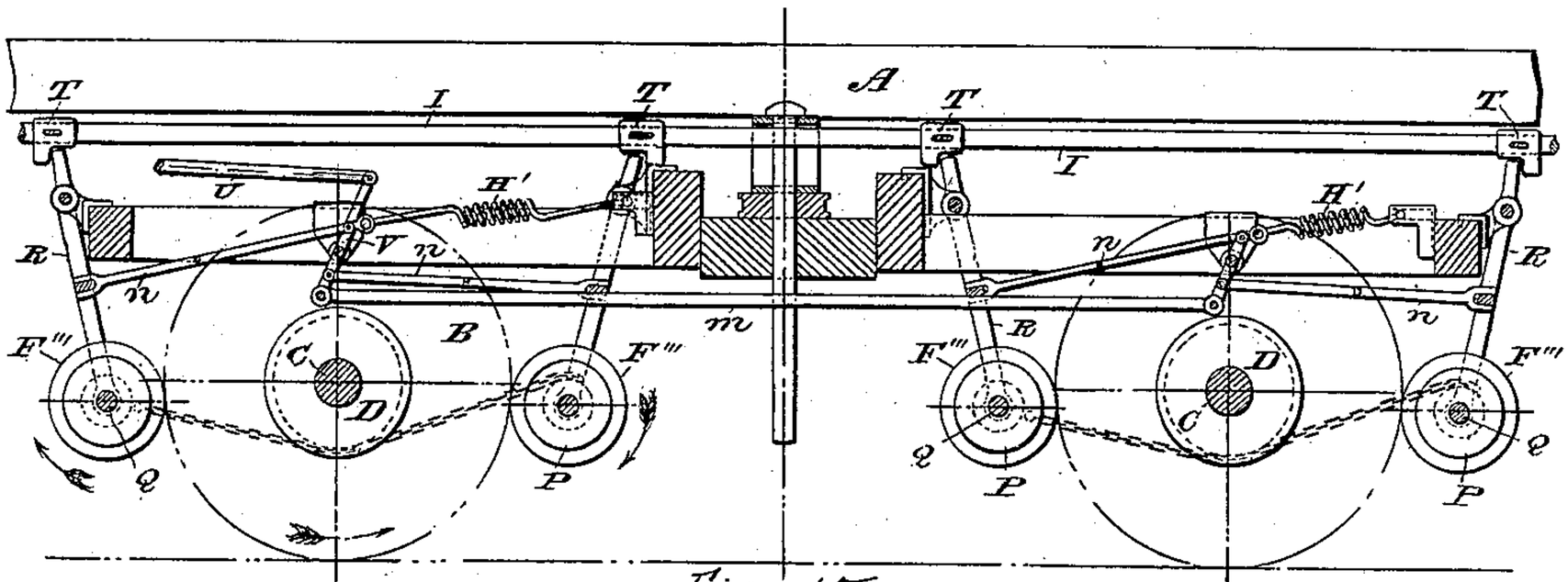


Fig. 15

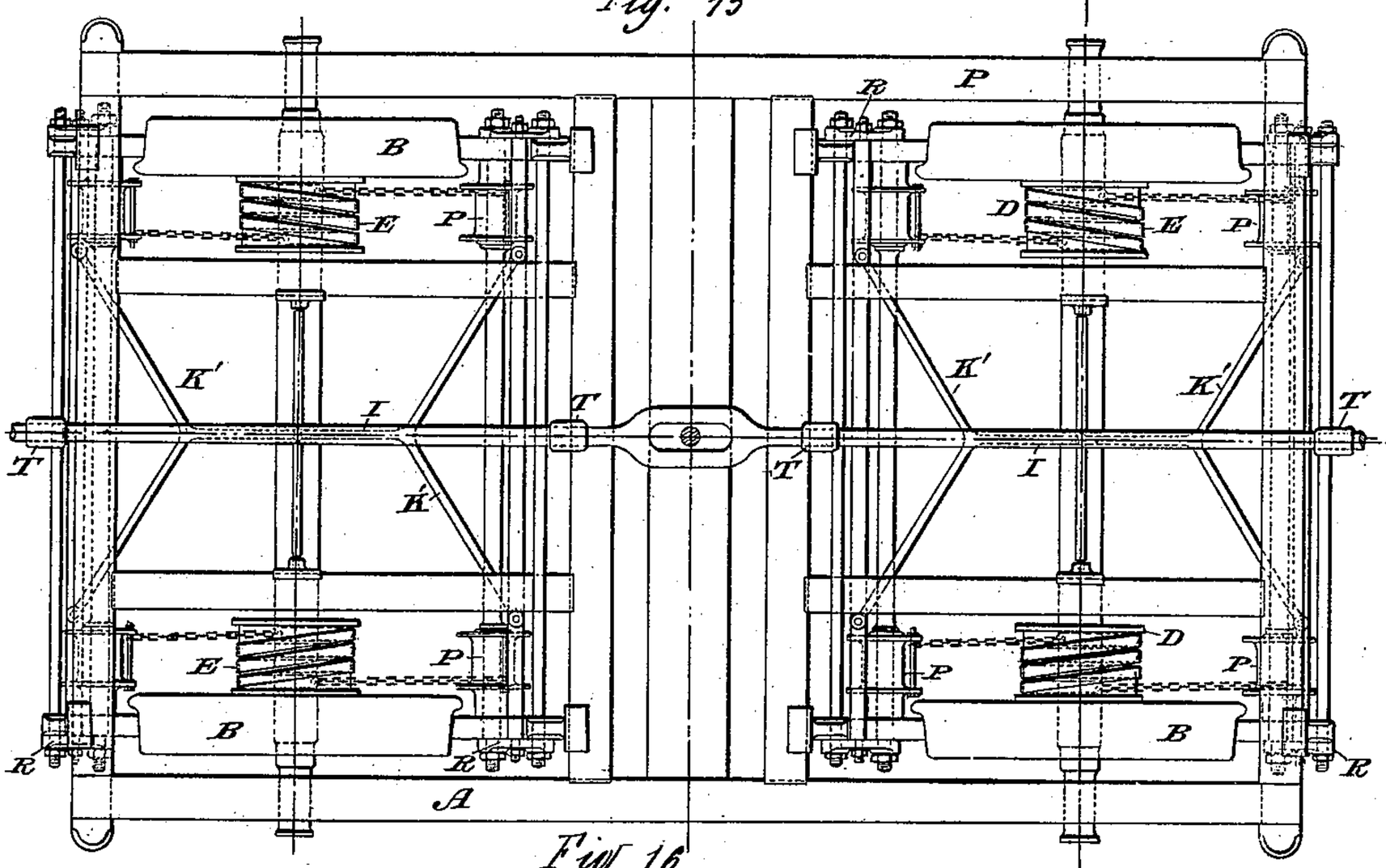
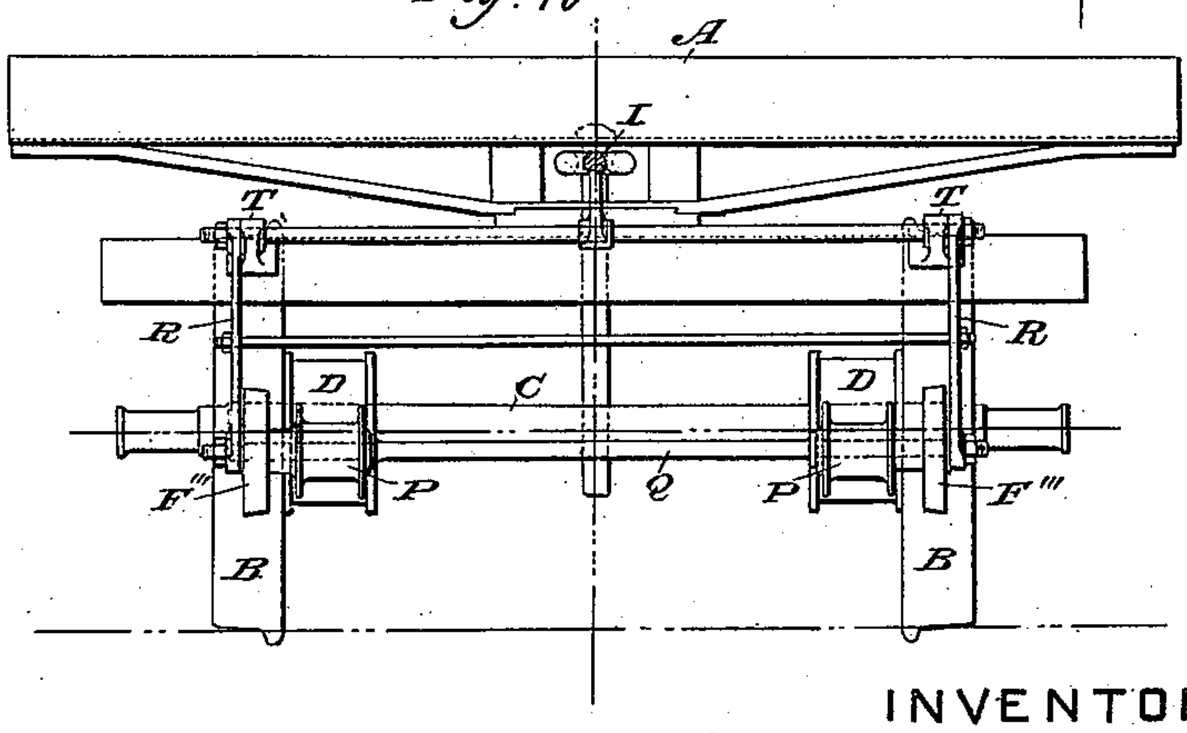


Fig. 16



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CAR BRAKE.

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Fig. 17

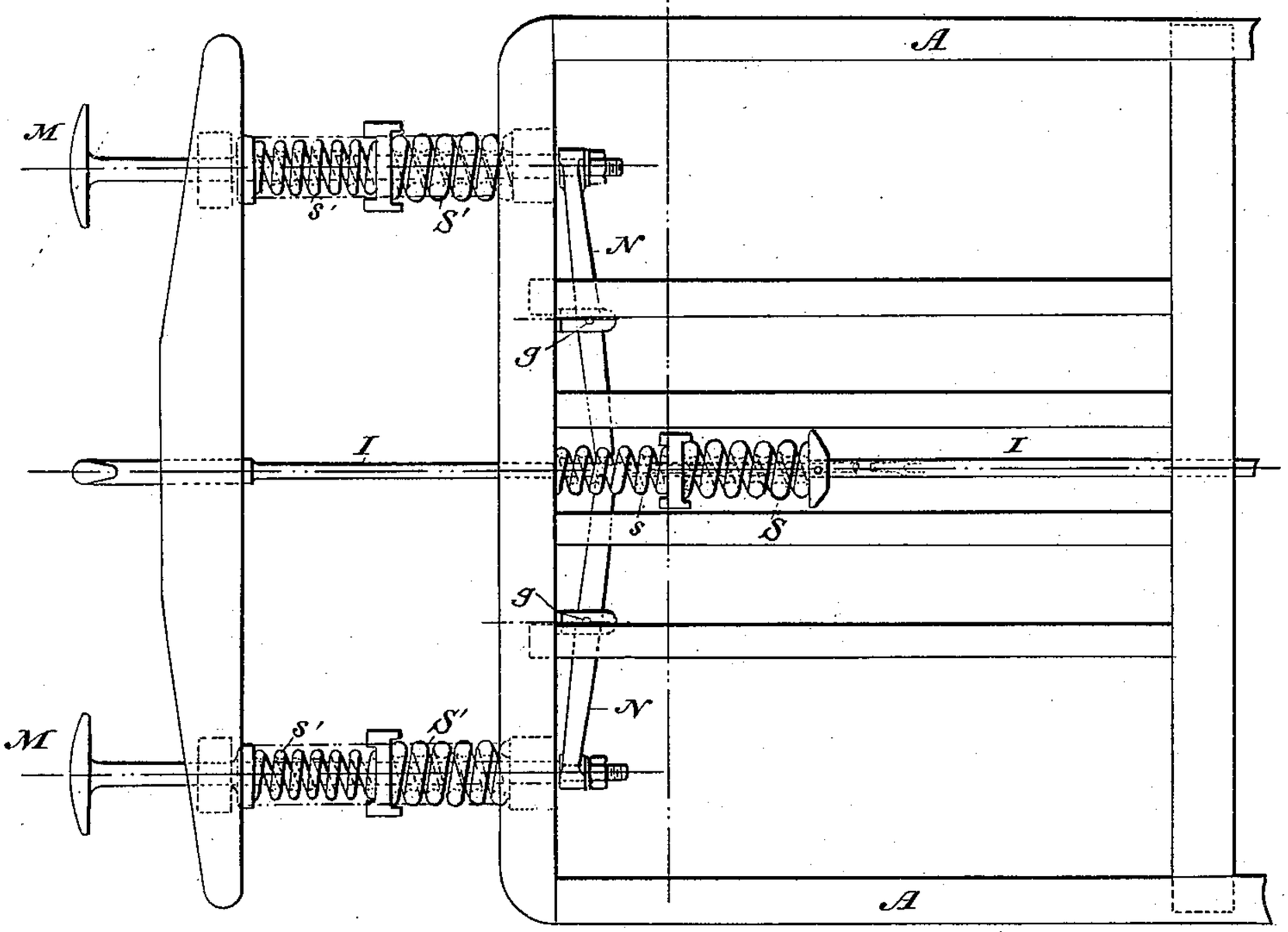

Fig. 18

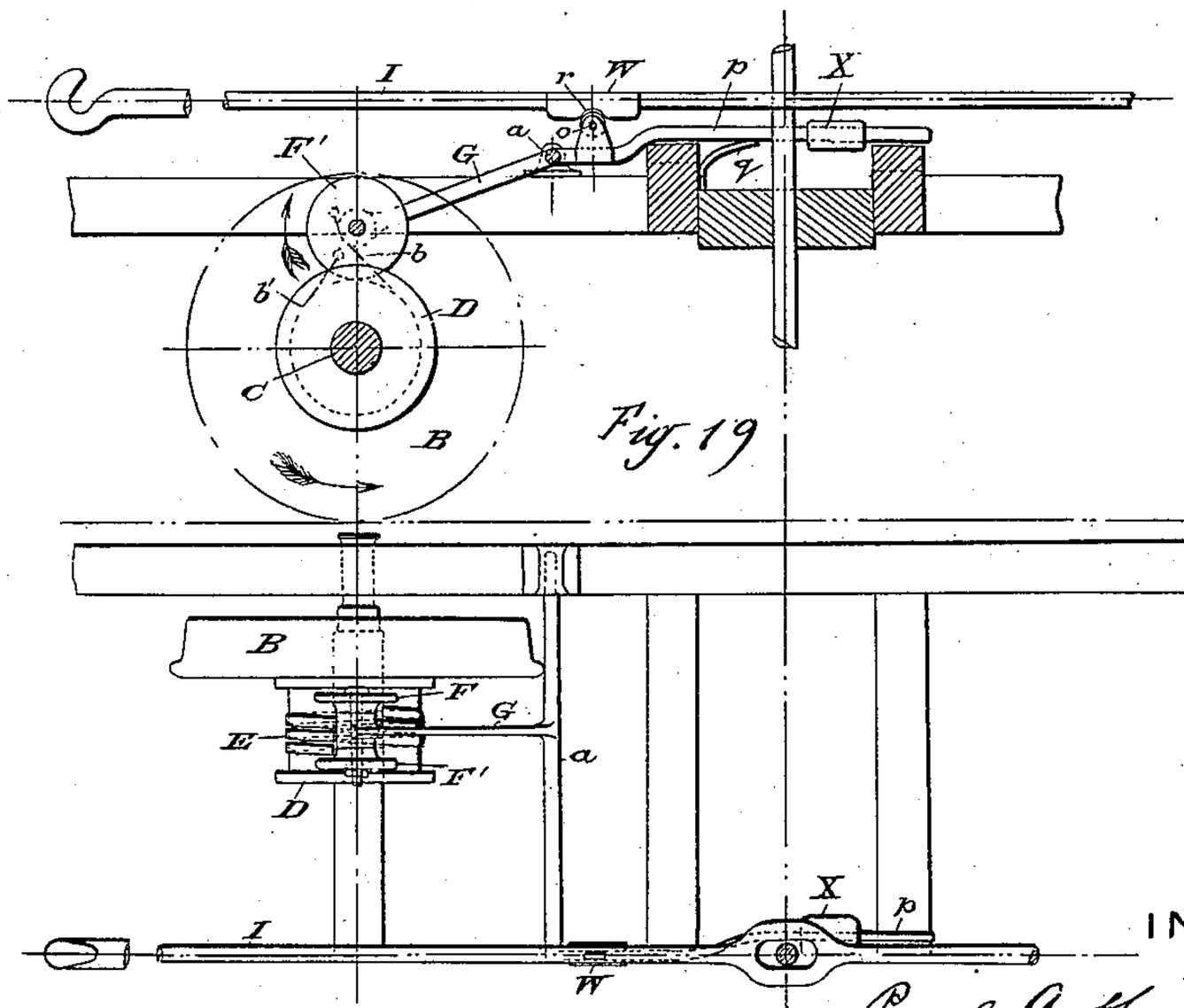

Fig. 19

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UNITED STATES PATENT OFFICE.

PAUL ARTHUR GAMBARO, OF PARIS, FRANCE.

CAR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 336,911, dated March 2, 1886.

Application filed December 14, 1885. Serial No. 185,549. (No model.) Patented in France February 16, 1884, No. 160,378; in Belgium February 23, 1884, No. 64,255; in England February 23, 1884, No. 3,834; in Germany March 9, 1884, No. 29,959; in Luxemburg March 10, 1884, No. 366, and in Austria-Hungary October 10, 1884, No. 29,197 and No. 45,922.

To all whom it may concern:

Be it known that I, PAUL ARTHUR GAMBARO, a citizen of the French Republic, and a resident of Paris, France, have invented certain Improvements in Car-Brakes, (on which patents have been granted in the following countries: In France, No. 160,378, dated February 16, 1884; in Belgium, No. 64,255, dated February 23, 1884; in Germany, No. 29,959, dated March 9, 1884; in England, No. 3,834, dated February 23, 1884; in Luxemburg, No. 366, dated March 10, 1884, and in Austria-Hungary, No. 29,197 and No. 45,922, dated October 10, 1884,) of which the following is a specification.

My invention relates to brakes primarily for railway and tram cars; and the object is to effect the braking without the application of shoes to the wheel-treads.

The principal feature of my invention is the employment of an elastic helix which embraces a drum fixed on the car axle or wheel, and which may be drawn by suitable mechanism, operated either automatically or non-automatically, until the helical band is caused to inwrap and embrace the drum tightly enough to produce the proper amount of friction to effect the braking.

In the accompanying drawings I have shown several modes of applying and controlling my brake, all of which will be hereinafter fully described.

In these drawings, Figures 1 to 10 illustrate the application of my brake to a car of the French pattern. Fig. 1 is a longitudinal view or elevation, taken substantially in the plane indicated by line 1 1 in Fig. 2, of the platform and running-gear of a car provided with my brake. Fig. 2 is a plan of the same. In these two views the right-hand or rear end of the car is shown as provided with cushion-springs for the draw-bar and bumpers constructed differently from those at the left-hand or front end. Fig. 3 is a transverse vertical section taken substantially in the plane indicated by line 3 3 in Fig. 2. Fig. 3ª is an illustrative sectional view of one of the buffer-connections. Figs. 4 and 5 are respectively an elevation and diametrical section of one of the friction-wheels that bear on the axle-drum. Figs. 6 and 7 are two views showing the attachment of the windlass-chain to the helical strap of the brake. Fig. 8 is an axial section of the axle-drum, and Fig. 9 is as to the left half an end elevation of said drum, and as to right half a transverse section of same on line 9 9 in Fig. 8. Fig. 10 is an axial sectional view of the axle-drum and friction-wheels. This view illustrates a slight variation in construction that will be hereinafter explained. Figs. 11 to 13 illustrate a slightly modified application of my brake to a car. Fig. 11 is a longitudinal section taken substantially in the plane indicated by line 11 11 in Fig. 12. Fig. 12 is a plan. Fig. 12ª is an enlarged sectional view illustrating the mounting of the buffer and its spring, as shown at the left hand in Fig. 12, also in Fig. 2. Fig. 12ᵇ is an enlarged sectional view illustrating the construction of the spring-holder of the buffer, as shown at the right hand in Fig. 12, also in Fig. 2. Fig. 13 is one-half of a transverse section taken substantially on line 13 13 in Fig. 11. Figs. 14, 15, and 16 illustrate the application of my brake to a car-truck of the American pattern. Fig. 14 is a longitudinal section. Fig. 15 is a plan or bottom view, and Fig. 16 an end elevation. Fig. 17, 18, and 19 illustrate further modifications that will be hereinafter described.

Like letters of reference designate like or corresponding parts in all the figures.

The principle of operation of my brake is as follows: An elastic band, usually of steel, is made to encircle a drum fixed on the car-axle; but normally the elasticity of the band or helix allows it to expand and stand free of the drum, so that it will exert no friction on the drum when the latter rotates within it. If, however, a strain is put upon the end of the helical band, it will be caused to contract and close on the drum and press thereon with a force corresponding to the strain. Thus any degree of braking-friction desired may be applied to the axle to retard or prevent its rotation. As soon as the strain is relaxed, the elasticity of

the helix will cause it to again expand, so as not to press upon the drum, and the latter is free to rotate.

Referring now to Figs. 1, 2, 3, and 3ª, I will proceed to describe my invention as applied to a car. Let A represent the platform of a railway-car, B B the wheels, and C C the axles. D is a drum or barrel fixed on the axle, and E is the elastic band wound helically around the same. In this construction the brakes are controlled to some extent, as will be explained, by the draw-bar and buffers. The draw-bar is not continuous, and each draw-bar operates independently on the brakes.

Referring, for further illustration, to Figs. 4, 5, 6, 7, 8, 9, and 10, F F′ are two friction-wheels, which are fixed on an axle mounted rotatively in the lower end of a lever, G, fulcrumed at *a* on the car-frame. To the respective wheels F F′, which have elongated bosses, Figs. 4, 5, and 10, are attached the chains or flexible connections *b b′*, which are connected to the ends of the elastic band E. A spring, H, connected at one end to the upper end of lever G and at the other end to the car-body, tends at all times to keep the wheels F F′ pressed into frictional contact with the drum D. When the car is moving toward the left in Fig. 1, and the car-wheels and friction-wheels are rotating in the direction of the arrows, the chains *b b′* will be wound upon the bosses of the friction-wheels to an extent sufficient to cause the band E to embrace the drum D with a force commensurate to the strength of spring H and the leverage with which it acts.

In order that the brakes may not be set when the car is under traction—that is, when there is a pulling strain on the draw-bar—I provide the means I will now describe, referring first to the left-hand end of Figs. 1 and 2, and incidentally to Fig. 12ª. The draw-bar I passes through a box, *c*, in which is placed a cushion-spring, *d*. Loose on the draw-bar is a washer-plate, *e*, which rests against a shoulder on the box, and serves as an abutment for one end of spring *d*. On the draw-bar is a sleeve, *f*, which may play through the inner contracted end of the spring-box, and which is compelled to move longitudinally with the draw-bar by a key behind said sleeve. Normally there is a space between the sleeve *f* and the washer plate *e* of from ten to twenty millimeters, and the pull on the draw-bar does not begin to compress the cushion-spring until the draw-bar has moved out longitudinally to this extent. To the inner end of the draw-bar is coupled a bar or compensator, J, and to the inner end of this compensator are coupled two bars, K K, which extend back, and are connected or coupled at their other ends to the two levers G G at opposite ends of the car-axle or to a tie or cross-bar, G′, connecting them. So far as the use of two drums D, levers G, &c., for each axle is concerned, this is a mere duplication, and need not be particularly considered. Where two sets are used, as indicated in Fig. 2, two bars K will be required to connect the two levers G to the draw-bar. For simplicity of description, I will refer to but one set. It will be observed that the spring H tends to retract the draw-bar I and press the wheels F F′ into frictional contact with drum D, and that the first movement of the draw-bar will be to distend spring H and draw the wheels F F′ out of contact with the drum. The spring H offers only a resistance of about ten kilograms. Whatever the movement of the draw-bar may be before the cushion-spring begins to offer resistance to the draft, it is very little, and there will be no appreciable shock when the sleeve *f* comes in contact with the washer *e*. While there is traction on the draw-bar the brake will be free; but if there is a cessation of the draft or traction on the draw-bar it comes back to its original position with the aid, first, of the cushion-spring and afterward of the spring H. The wheels F F′ will be pressed against the drum D, and the latter will rotate said wheels, wind up the chains *b b′*, and cause the band E to tightly embrace the drum.

In Figs. 4 and 5 one of the friction-wheels is shown detached and enlarged. The holes in it are designed to receive suitable eyebolts for the attachment of one of the chains *b* or *b′*, as the case may be. The use of two wheels has the advantages that the space between them spans the space occupied by the spirally-wound band E on the drum and gives an even bearing. One chain is attached to each wheel. No matter in which direction the drum rotates, the chains will be wound upon the wheels.

As before stated, the draw-bar is not continuous, but the draft on either bar will set the brakes on both axles. This is effected through the medium of the connecting-rods or draft-rods L L. (Seen best in Fig. 1.) These rods cross each other, and connect the lever G at one axle of the car with the corresponding lever at the other axle, the lower couplings of the rods to the levers being slotted, so that one rod will not interfere with the operation of the other. This will be readily understood.

In order that the coming together of the buffers may remove or release the brakes, the buffer M is provided with a spring-box, *c′*, a cushion-spring, *d′*, a washer-plate, *e′*, and a shoulder, *f′*, corresponding to the similar parts connected with the draw-bar I, only, of course, arranged to operate inversely. To the inner prolonged end of the buffer is coupled a lever, N, fulcrumed at *g*, the other end of which lever is coupled to the compensator J, as clearly shown in Fig. 2. Each buffer is similarly connected to the compensator, and the levers N are coupled with slotted connections in order that the buffer and draw-bar may act independently on the brake, and not interfere.

In order that the brakes may be thrown off by hand, I provide a lever, O, which is arranged under lever N, fulcrumed at the same point, *g*, and connected to the compensator K. Thus the brakes may be thrown off independ-

ently by the draw-bar, by the buffers, and by hand.

At the right-hand end of the car in Figs. 1 and 2 I have shown a modified arrangement wherein the ordinary elliptical cushion-spring, *d''*, is employed in lieu of the volute springs *d* and *d'* shown at the left hand.

In order to get the required movement of the draw-bar before the cushion-spring comes into play, the bar is given some play in the holder *c''* of the spring *d''* by means of a slot in the said holder, and a key which passes through the draw-bar and engages said slot. The required play of the buffer is effected by similar means, as indicated in Figs. 1, 2, and 3ª.

Figs. 8 and 9 show, detached, the drum D, and illustrate the details of its construction. The drum is made in halves, so as to be readily applied to the axle, and the frictional surface *h* is made of soft cast-iron. This surface is in the form of two half-cylinders, the ends of which are housed in grooves in the body *h'* and cap *h''* of the drum. I usually bolt the drum to the car-wheel, instead of to the axle.

Fig. 10 simply shows grooves in which the edges of the wheels F F' bear. This somewhat increases the frictional contact.

Figs. 11, 12, and 13 show an application of my brake, which will now be described. This form of the brake is automatic, with direct command and with a limited predetermined braking-power. The general construction and arrangement of the draw-bar, buffers, cushions, springs, drums D, and elastic band E are the same as in Figs. 1, 2, and 3. The means for effecting the braking is somewhat modified. In the lower ends of levers G' are mounted pulleys F'', around which pass the bights of chains *b''*, connected with the elastic band E. The chain *b''* is connected at its ends to the ends of the band. To the lever, above its fulcrum, is attached a spring, H', which tends to draw the pulley F'' away from the drum D, and thus put tension on the band E and cause it to frictionally embrace the drum.

To prevent the drums in their rotation from carrying around with them the bands E, to the end of said bands are coupled chains *i i' j j'*, which are brought to and attached to a suspender, *k*, pivoted at *l* to the car-body. This device keeps the bands properly in place on the drums at all times. Normally the brake is closed; but it may be thrown off by hand by means of a handle, G'', attached to lever G'. The levers G' are also connected to the draw-bar and buffers in a manner substantially the same as that shown in Figs. 1 and 2. It will be seen that in this construction the action of the lever G' is direct on the band E, and does not act through the intermediary of friction-wheels, as in the construction first described.

Figs. 14, 15, 16, 17, 18, and 19 show the application of the foregoing principles to trucks similar to those in use on American railway-cars. The drums D are fixed to the wheels. The elastic steel bands E are mounted on these drums, as before described. Each of the two extremities of the elastic band E is provided with a chain which is capable of being wound on a barrel, P, fixed on the same shaft, Q, with a friction-wheel, F'''. The shafts Q are mounted in the ends of swinging levers R R, the wheels F''' being in the planes of the car-wheels B. A spring, H', connects the levers R R to the car-body, and by its tension keeps the wheels F''' drawn into frictional contact with the wheel-treads. The rotation of the car-wheels under these conditions rotates the wheels F''', winds up the chains which connect the barrels P with the ends of the band E, and tends to tighten the band E on the drum D. This tension is put on both ends of the band E. It is immaterial in which direction the car moves, the brakes will be set the same.

In this application of the brake it is controlled by the following-described mechanism: Let us suppose that the car is moving in the direction indicated by the arrow on the car-wheel B at the left hand in Fig. 14. The draw-bar I (see the plan view, Fig. 17, which shows the end of the car-platform) is provided with two cushion-springs of very different tension, S being the stronger and *s* the weaker. Suppose that the spring *s* is compressed under the effort necessary to move the friction-wheels F''' out of contact with the car-wheel treads, and that this effort is inferior to that necessary to draw the empty car. On the other hand, the elements of this spring *s* are such that the movement of the draw-bar corresponding to this compression may be sufficient to draw the friction-wheels out of contact by the intermediation of the suspended levers R R and the connecting-rods *m* and *n*, arranged as shown in Fig. 14.

The tappets T T on the continuous draw-bar engage the ends of the levers R R, as clearly seen in Fig. 14, and the movement of the draw-bar is thus made to operate the connected levers through the intermediary of the rods *m n*. It may be remarked that all these movements of command are brought into the axis of the car by means of bridle-rods K', and that if Figs. 14 and 15 represent one of the two trucks or bogies of the same car the movements of the connecting-rods *m n* may be transmitted to the similar mechanism on the other truck by rods supported at their middles. It will be sufficient to attach these rods at any suitable point above or below the fulcrums of the levers R R in such a manner that it is not indispensable to provide for their opration a continuous draw-bar. When the cars come together, and the buffers M are driven in, they act to release the brakes in a manner similar to that described with reference to Figs. 1 and 2. In Fig. 17 the construction is shown. Each buffer M has two cushion-springs, S' *s'*, of unequal strength, similar to the springs S *s* of the draw-bar. The buffer communicates its motion to a bar, U, through a horizontal lever, N, which is fulcrumed at

g. This bar U is seen in Fig. 14, and it is arranged directly under the draw-bar.

It will be seen by reference to Fig. 14 that V is a rocking lever mounted on the truck-frame, and that the bar U is coupled to its upper end by a slotted connection. To the lever V is coupled the rods *n*, which connect it with the levers R R above and below the fulcrum, and the rod *m*, which connects this rock-lever with its neighbor at the other end of the truck. The spring H′ is connected to the rocking lever V, and acts through it on the two levers R R.

I make the barrels P as small diametrically as is practicable, and the wheels F‴ as large diametrically as is practicable. This is in order that I may obtain all the advantage of leverage possible.

In lieu of arranging the wheels F‴ to come into peripheral contact with the car-wheels, it will be practicable to arrange them to contact with surface of the drum D, as in the first-described constructions. In Figs. 18 and 19 (the former of which is a sectional elevation and the latter a plan) I have shown this arrangement. The two friction-wheels F F′ are mounted on the same axis, which is rotatively mounted in a pendent lever, G. If the direction of rotation is that indicated by the arrows in Fig. 18, the chain *b*, connected with the free end of the elastic band E, will be bound on the boss of wheel F′, in frictional contact with the drum, while the other wheel, F, by its bearings on the drum becomes, in a sense, a fixed point of resistance by reason of the tension of the chain *b*′. The contraction of the band E is thus effected, and the more energetically it acts on the drum the greater will be the pressure of the wheels F F′ on the drum. Consequently this latter pressure will increase more and more and draw the band E tighter and tighter. This arrangement produces a more energetic braking effect than the preceding. The setting and throwing off of the brakes are effected by moving the wheels F F′ into and out of contact with the drum D through the medium of the lever G. The required movement of this lever is effected easily by means of a lever, *o*, which connects the levers G of the two opposite brake devices on the same axle, which bar is acted on by a cam, W, on the draw-bar I. On the end of the lever, or what is the same, on an arm, *p*, branching from the tie-bar *o*, is a counter-weight, X, and under said arm is a retracting-spring, *q*. The cam W acts on a friction-bowl, *r*, on the bar *o*. When the draw-bar is in repose, as in Fig. 18, the friction-wheels rest on the drum by virtue of their gravity; but the endwise movement of the draw-bar causes the cam W to depress the lever back of the fulcrum *a*, and thus lift said wheels out of contact. It will be understood that the expansion of the band E normally is such that this slight movement of the friction-wheels out of contact will not suffice to contract the band on the drum, and the same may be said of the similar constructions shown in Figs. 1 and 14. The friction-wheels might of course contact with the ends instead of with the convex surfaces of the drums.

I have described my brake as applied to railway-cars; but it may be applied to all constructions where brakes are required.

I do not wish to limit myself to the precise construction and arrangement herein shown, as these may be varied to some extent without materially departing from my invention.

I am aware that it is not new to apply a chain to a drum by winding the same spirally around the drum, the same to serve as a brake by applying a pulling strain to one end of the chain, the other end being fixed. My elastic band frees itself from the drum, when the strain is removed from it, by its own elasticity, and stands free and out of contact with the surface of the drum, as has been explained, thus avoiding chafing and wear which would otherwise result.

Having thus described my invention, I claim—

1. The combination, with a rotatively-mounted shaft or drum, the speed of which is to be regulated by a brake, of an elastic helicoidal band encompassing such rotatively-mounted part, but having, when not under tension, an internal diameter a little greater than that of the part it encompasses, whereby the said brake may be set by pulling on the ends of said bar, and thus contracting it, as set forth.

2. The combination, with a rotatively-mounted part—as a drum, for example—of an elastic spiral or helicoidal band encompassing said rotating part, and mechanism, substantially as described, for applying a pulling strain to the ends of said elastic band, whereby it is made to contract and tightly embrace the said rotating part, substantially as set forth.

3. The combination, with a rotatively-mounted part—as a drum, for example—of an elastic spiral or helical band encompassing said rotating part, two friction-wheels fixed on a common shaft and connected, respectively, by chains or other flexible connectors with the ends of said elastic band, and means, substantially as described, for putting said friction-wheels into peripheral contact with the rotating part, substantially as set forth.

4. The combination, in a car-brake, of a drum, D, fixed to the car-wheel, either directly or indirectly, as described, an elastic spiral or helicoidal band, E, encompassing said drum, two friction-wheels on the same axis, connected, respectively, with the ends of band E, a lever, G, which carries the said friction-wheels, and which is fulcrumed on the car-frame, a spring, H, which holds the friction-wheels in peripheral contact with the drum D, and means, substantially as described, whereby the said friction-wheels are moved out of contact with the drum through the medium of the draw-bar, as set forth.

5. The combination, in a car-brake, of the drum D, attached directly or indirectly to

the car-wheel, and rotating in unison therewith, the spiral elastic band E, encompassing said drum, the friction-wheels F F′, mounted rotatively in the pendent end of a lever, G, and connected, respectively, to the ends of the band E, as described, the said lever G fulcrumed on the car-frame, the spring H, connected to a fixed point at one end and to the lever G, as described, whereby it tends to draw the wheels F F′ into peripheral contact with the drum, the draw-bar I, connected directly or indirectly to the lever G, as described, and provided with a collar or shoulder, *f*, the cushion-spring *d*, its box *c*, and the washer-plate *e*, all arranged substantially as described, whereby the draw-bar is caused in its longitudinal movement to act against the tension of spring H, to release the brake before it acts to compress the cushion-spring, substantially as set forth.

6. The combination, with the draw-bar I and the braking mechanism, constructed substantially as described, of shouldered buffer M, the cushion-spring *d′*, its box *c′*, and washer-plate *e′*, and the lever N, fulcrumed at *g*, and provided with slotted connections to the draw-bar and buffer, substantially as and for the purposes set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

PAUL ARTHUR GAMBARO.

Witnesses:
EDWARD P. MACLEAN,
AMAND RITTER.