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CAR STARTER AND BRAKE.

No. 497,551. Patented May 16, 1893.

Fig. 1.

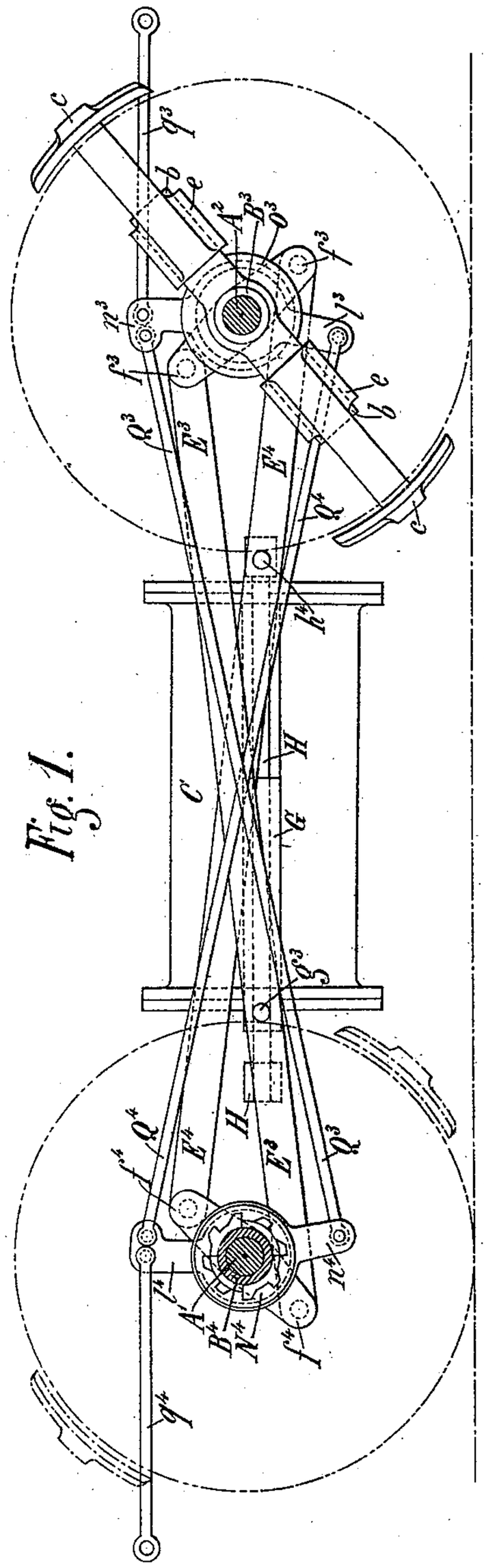

Fig. 7.

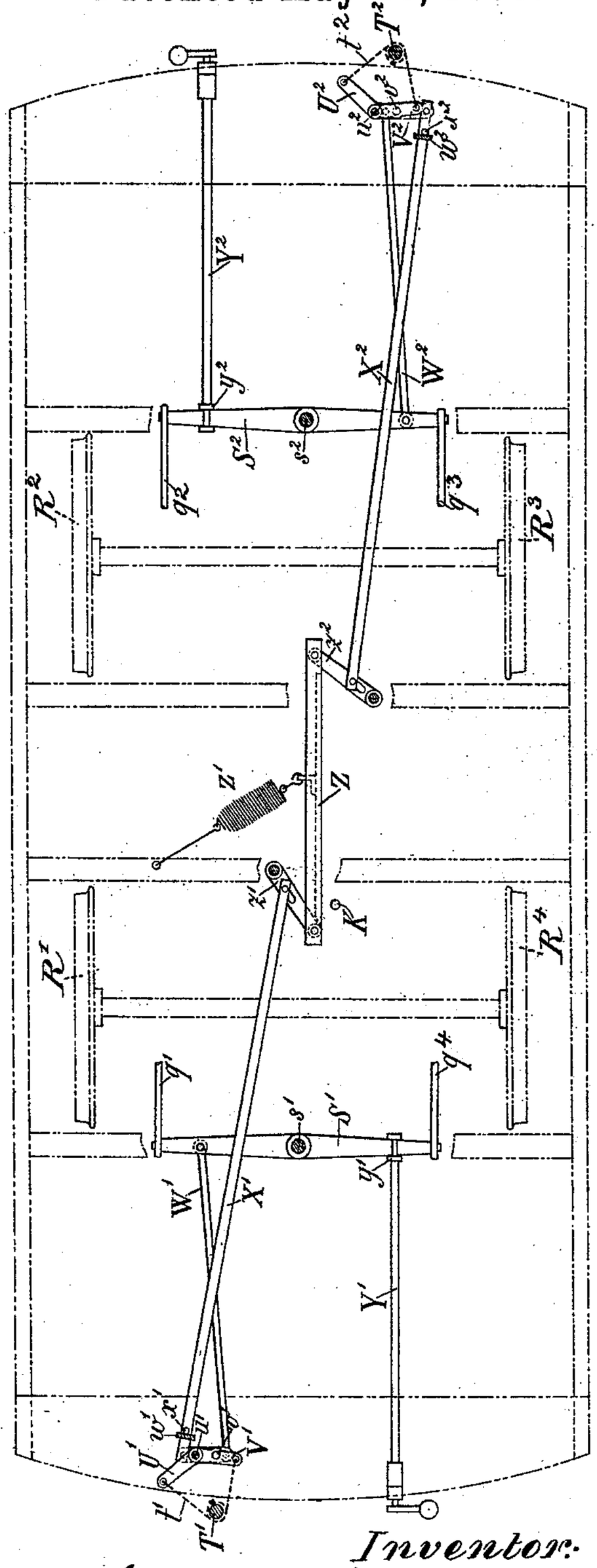

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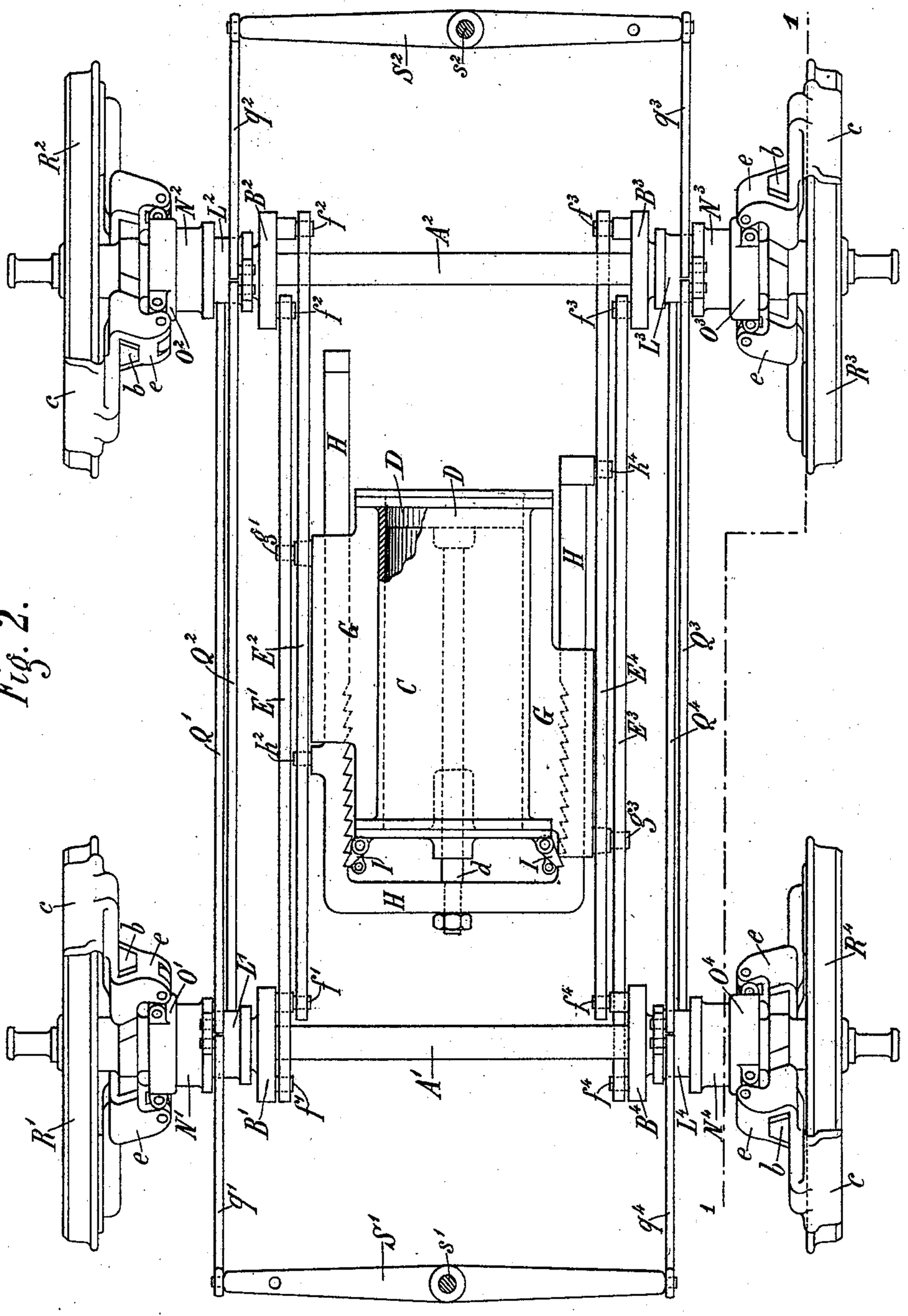
Fig. 2.



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CAR STARTER AND BRAKE.

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Fig. 5.

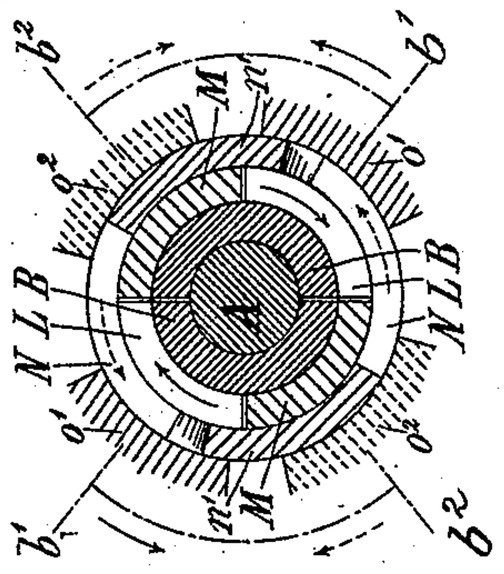

Fig. 6.

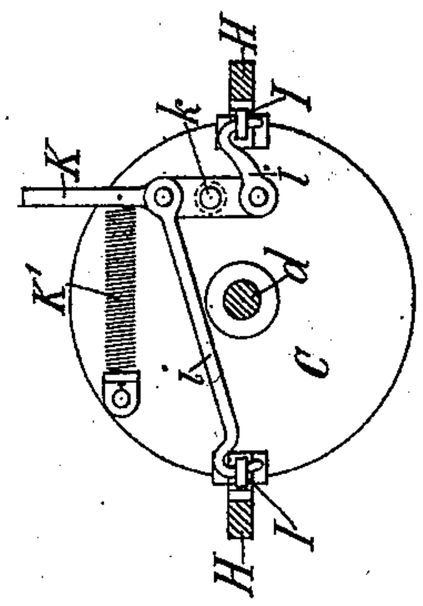

Fig. 4.

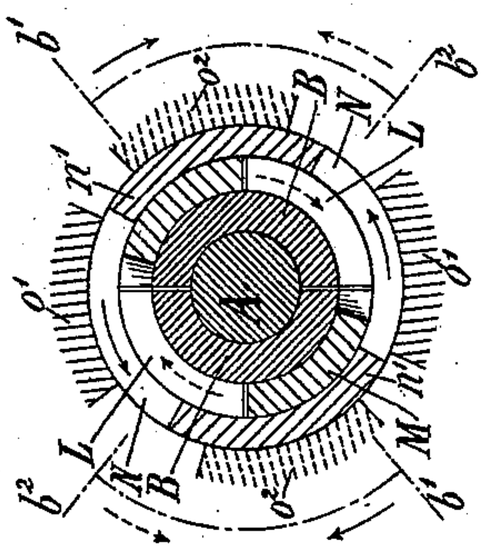

Fig. 3.

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(No Model.) 4 Sheets—Sheet 4.

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CAR STARTER AND BRAKE.

No. 497,551. Patented May 16, 1893.

Fig. 3c

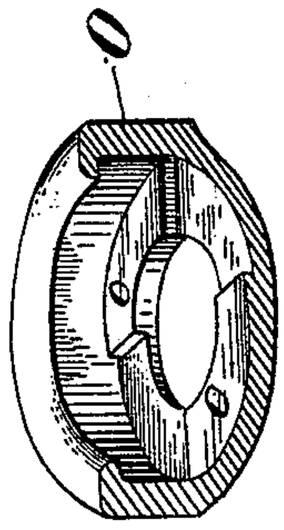


Fig. 3b

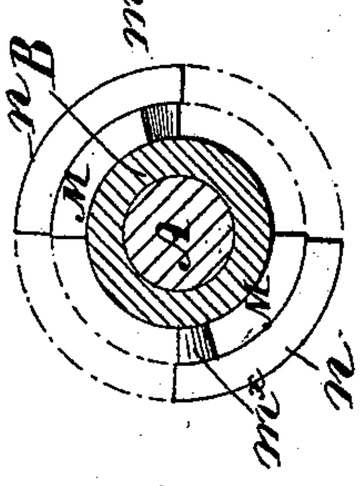


Fig. 3a

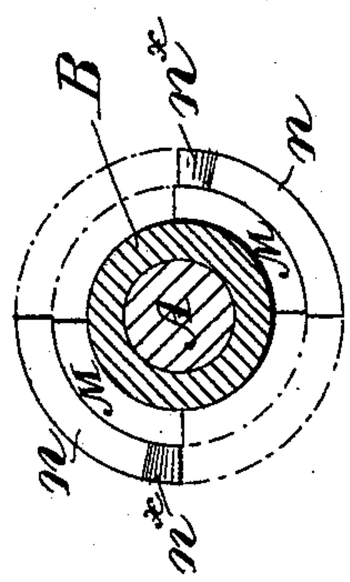
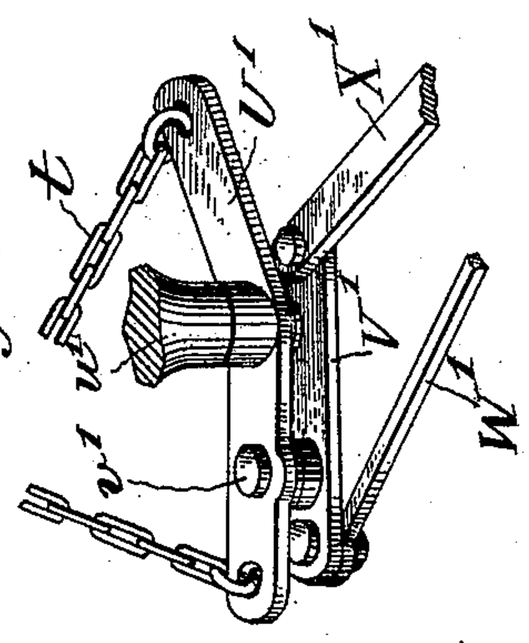


Fig. 2.



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UNITED STATES PATENT OFFICE.

CARLO SACCO, OF TURIN, ITALY.

CAR STARTER AND BRAKE.

SPECIFICATION forming part of Letters Patent No. 497,551, dated May 16, 1893.

Application filed November 11, 1892. Serial No. 451,618. (No model.)

To all whom it may concern:

Be it known that I, CARLO SACCO, a subject of the King of Italy, residing in Turin, Italy, have invented certain new and useful Improvements in Car-Starters or Reaction-Brakes, of which the following is a specification.

This invention relates to the class of devices, especially adapted for horse-cars, whereby the stopping of the car stores up power to be utilized in starting the car or assisting the horses to start it.

The object is to relieve the horses from the increased strain in overcoming the inertia of the car and its load.

In carrying out my invention I connect the brake-shoes which clamp on the wheels with a power accumulator, such as a spring, or preferably an air-compressor, whereby, when the brake-shoes or blocks are set on the wheels in stopping the car, they will be moved about with the wheels and by their movement charge the accumulator and when the car is started, the stored up power will reach on the brake shoes to start the wheels ahead, thus overcoming, or assisting to overcome the inertia of the car. The apparatus is so arranged as to start the car either in the direction it was moving when stopped, or in the opposite direction. This is important in cases where the car, after reaching a terminus starts back again without turning around.

Having stated above the purpose of the invention and in a general way its construction, I will now describe it more particularly with reference to the accompanying drawings, wherein—

Figure 1 is a sectional elevation, in substantially the plane indicated by line 1, 1, in Fig. 2, of the principal part of the apparatus. Fig. 2 is a plan showing the wheels, axles, &c., of a car and my apparatus applied thereto. Fig. 3 is an illustrative sectional view on a larger scale of the brake mechanism, and Figs. 3^a, 3^b and 3^c are detail views of the parts seen in Fig. 3. Figs. 4 and 5 are diagrammatic sectional views designed to aid in illustrating the operation of the device seen in Fig. 3. Fig. 6 is a detached end view of the air cylinder of the accumulator. Fig. 7 is a plan, on the same scale as Figs. 1 and 2, of the controlling mechanism; and Fig. 7^a is a perspective detail view of one of the features seen in Fig. 7.

On one car axle, A′, are fixed the usual flanged track wheels R′ and R^4, and on the other axle, A^2, are fixed the wheels R^2 and R^3. On each axle, between the wheels, are mounted two crank sleeves, those on axle A′ being lettered B′ and B^4, and those on axle A^2, lettered B^2 and B^3. These crank-sleeves may rotate about their respective axles but cannot slide longitudinally thereon. Each sleeve has on it, adjacent to the wheel of the car, two oppositely arranged radial arms, *b*, *b*, and on these arms, are mounted, respectively, sliding carriers, *e*, *e*, connected rigidly to brake shoes, *c*, *c*, which clamp the car wheel on diametrically opposite sides.

On a flange on the inner end (opposite to the arms *b*) of each crank-sleeve are two oppositely arranged crank-pins; those on sleeve B′ are lettered f'; on sleeve B^2, lettered f^2; on sleeve B^3 lettered f^3, and on sleeve B^4 lettered f^4. The crank-pins of each pair are set at right-angles to the arms *b* on the same sleeve. The upper crank-pin f' and lower crank-pin, f^2 are coupled together by a stout connecting-rod E′, and the lower crank-pin f' and upper crank-pin f^2 are coupled by a similar rod E^2. Thus the rods E′ and E^2 cross each other in a vertical plane. In a like manner the upper crank-pin f^3, is coupled to the lower crank-pin f^4 by a stout connecting-rod, E^3, and the lower pin f^3 is coupled to the upper pin f^4, by a similar rod, E^4. On the same axle, the pairs of brake-shoes on one wheel are at right-angles to those on the other, and the same is true with respect to the two wheels at one side of the car.

The apparatus or mechanism for clamping the pair of brake-shoes on the wheel is mounted on the crank-sleeve and will be hereinafter described.

The accumulator is situated between the car-axles and between the pairs, of crossed connecting rods, as seen in Fig. 2, and it comprises a closed cylinder C, with its axis arranged longitudinally a piston, D, therein, a piston-rod, *d*, and a U-shaped yoke, H, which is fixed by its cross-bar to the piston-rod *d* and has slide bearings for its side-bars in guides G on the cylinder C. The accumulator is mounted on and supported solely by

the several connecting-rods E′, E², E³, E⁴. Studs g' and g^3, on opposite sides of the cylinder and also at opposite ends thereof, find bearings, respectively, in the rods E′ and E³, and studs h^2 and h^4, on the yoke H, similarly arranged, find bearings in the respective rods E² and E⁴. Thus the accumulator is supported at four points. When the piston D is displaced in the cylinder C, it compresses the air in front of it and forms a vacuum behind it, thus storing up power like a spring, which it yields again on returning to its normal position. I prefer to close the cylinder at both ends so as to produce both compression and a vacuum, but I do not limit myself to this; either one or the other may be produced alone. The cylinder will be somewhat longer than the travel of the piston. It will be seen by inspection of Figs. 1 and 2 that the cylinder and piston should displace themselves in opposite directions simultaneously and turn two of the crank-sleeves in one direction and two in the other. That is to say, we have here an arrangement for converting the rectilinear movement of the accumulator, into a rotary movement of the wheels, or vice versa, and in such a direction as may be desired according as we set the brakes on two of the wheels or on the other two.

The two side bars of the yoke H have ratchet teeth formed on them, and these teeth are engaged normally by pawls I, as seen in Figs. 2 and 6, mounted on the cylinder C. These pawls prevent the return movement of the piston D until the pawls are disengaged by a mechanism which is seen in Fig. 6. Fulcrumed on the cylinder C at k, is a lever K, which is coupled to the respective pawls, above and below the fulcrum, by links i. The pawls are held in engagement by a spring K′. By moving the lever over to the right, as it is presented in Fig. 6, the pawls will be simultaneously disengaged.

So far as described, the operation is as follows: Suppose the car is moving from left to right, as presented in Figs. 1 and 2. To arrest it, the brake shoes are set on the wheels R′ and R³ so tightly that they will be carried around with the wheels and will turn the crank-sleeves B′ and B³; the former, by means of the rods E′ and E², displaces stud g' to the right and stud h^2 to the left, and the latter, by means of the rods E³ and E⁴, displaces stud g^3 to the right and stud h^4 to the left. Under these conditions the cylinder C will be displaced to the right and the piston D to the left, until the resistance due to the tension of the air in the cylinder suffices to arrest the further rotation of the wheels and cause them to slip which absorbs the remaining *vis viva* of the car and arrests it quickly. The other two crank-sleeves, B² and B⁴, together with the brake-shoes on wheels R² and R⁴, turn in the opposite direction, and freely, about the respective axles and the said wheels. The proportions are such that the brake-shoes are arrested before they turn far enough to strike the track rails. Enlargements at the ends of the side bars of the frame H engage the guides G and limit the movement in case the tension of the air within the cylinder should be insufficient. After the car stops, the brake-shoes are released and the pawls I prevent the piston from returning and maintain the tension in the cylinder.

To utilize the force stored up for starting the car, the brake-shoes are set on the wheels R² and R⁴, and the pawls I disengaged by means that will be hereinafter explained. The tension within the cylinder returns the piston to its first position and its movement is transmitted to the crank-sleeves B² and B⁴, which return to their initial positions and rotate the wheels R² and R⁴, thus setting the car in motion in the same direction in which it was moving when it was stopped. At the same time the crank-sleeves B′ and B³ bring their respective brake-shoes back to their initial positions, but without contact with their respective wheels. The piston having reached the end of the cylinder the car will stop if the brake-shoes in the wheels R² and R⁴ are not released automatically, and this releasing is effected by means which will be hereinafter described. When the car is moving in the opposite direction the operation is analogous to that already described. In this case the brakes of the wheels R² and R⁴ are set for arresting the car and those of the wheels R′ and R³ are set for starting it. It will be observed that after the car has been stopped the apparatus will be in the same position in whatever direction the car may have been moving and we may start the car in the opposite direction if that be desired. The wheels of a street car being usually fixed on the axles, it will be seen that both in starting and stopping the car the traction of all four of the wheels is utilized although the brake-shoes are set only on one wheel on each axle only, those diagonally opposite as shown herein. It will also be observed that if the brake-shoes be set on the wheels with a force insufficient to cause them to move with the wheels and compress the air in the cylinder, the brakes will perform the ordinary functions of brakes and check the momentum or speed of the car in slowing down. This will be useful also in checking the car on down grades.

After what has been described it will be seen that the mechanisms for setting and controlling the brakes should satisfy the following conditions, viz: (*a*) For arresting the car, they must set the brakes on the two diagonally opposite wheels and hold them set as well as to maintain the positions attained by the cylinder and piston, respectively. (*b*) For starting the car, they must set the brakes on the two other wheels but release them when the piston reaches the bottom of the cylinder (in the position seen in Figs. 1 and 2); and when the brakes are set, the pawls I must be held out of engagement during the entire movement of the piston. (*c*) For descending grades,

the brakes may be set with a comparatively light pressure, graduated at will.

The controlling mechanism should be operative from both ends of the car, and so that the operator may stand, by preference, on the front platform and properly control the starting and stopping when the car is moving in that direction; and the control should be effected by a single lever or crank, and with one operation or movement thereof. A mechanism for setting the brakes which will fulfill these conditions is illustrated in Figs. 3, 3ª, 3ᵇ and 3ᶜ, wherein the mechanism is shown partly in plan and partly in horizontal section. The diagrammatic views, Figs. 4 and 5, illustrate its action. The controlling mechanism is seen in Figs 7 and 7ª.

As the elements or parts in Fig. 3 may be taken to illustrate either of the four like mechanisms corresponding to the four wheels of the car, I have used in this view, and generally also in Figs. 4 and 5, the same letters of reference, A, B, R, &c., as in Fig. 3, but have omitted the numerals from the letters as not necessary. On the crank-sleeve B, is collared another sleeve L, capable of turning on the crank-sleeve but incapable of endwise movement thereon. On the sleeve L, exteriorly, there is formed a long-pitched screw and two wide slots wherein slide two non-screw-threaded sectors M. A box-nut N, embraces the screw-threaded sleeve L. Projecting circumferential ribs *m*, on the sectors M, engage corresponding keeper grooves in the nut N, which latter carries these sectors with it in its longitudinal movement along the sleeve L, but the slots *x* in which the sectors M play prevent the latter from rotating with the nut N. On the end of the box-nut N which is next to the wheel R, is collared a ring O, which is capable of turning about the nut N, but is compelled to follow the latter in its endwise movement by a circumferential flange on the nut. The ring O is coupled to the slides *e*, *e*, by means of toggle-links P, P, which are coupled to the slides by pins *e'* and to the ring by pins *o*. The slides *e* are, as before stated, connected to the respective brake-shoes *c*. It will readily be seen by inspection that by rotating the box-nut N (from right to left as seen from above in Fig. 3), or by turning the screw sleeve L in the opposite direction, the ring O will be driven in toward the wheel R and in so moving the inclination of the toggle links will be increased, the slides *e* drawn in and the shoes *c* set on the wheel. By rotating the parts in the opposite direction the toggle links will be shifted and the brake-shoes released. Each screw sleeve L has on it a crank arm *l*, which is pendent, as to the wheels R' and R³ and upright as to wheels R² and R⁴. Likewise, each box-nut N has a crank arm *n*, which is upright as to wheels R' and R³ and pendent as to wheels R² and R⁴. Four oblique, or vertically crossed rods (see Figs. 1 and 2), Q', Q², Q³ and Q⁴ are coupled respectively to the crank arms and connect them; that is, rod Q² couples crank arms *l'* and *l²* and rod Q⁴ couples crank arms *l³* and *l⁴*. Rod Q' couples crank arms *n'* and *n²*, and rod Q³ couples crank arms *n³* and *n⁴*. Four other rods, *q'*, *q²*, *q³*, *q⁴*, connect the respective upright crank arms *n'*, *l⁴*, *l²* and *n³*, with two transversely arranged controlling levers, S' and S², movable horizontally about fulcrum pins *s'* and *s²*, set in the under sides of the respective platforms at the ends of the car. Now if we fix the lever S' and move to the right the upper end of the lever S² (as these parts are represented in Fig. 2) the brakes will be set on the wheels R' and R³ and will arrest the car when moving from left to right. By swinging the lever S² in the other direction the brakes will be set on the wheels R² and R⁴, as is necessary for setting the car in motion in the same direction. By fixing the lever S² and operating the lever S' to the right or left, the brakes will be set on the wheels R² and R⁴ or on the wheels R' and R³; that is, the car will be stopped and started when moving to the left.

The mechanism for automatically releasing the brakes after the car has been started and the stored power has been expended, will now be described with reference to Figs. 3, 3ª, 3ᵇ, 3ᶜ, 4 and 5. The flanged extremity of the box-nut N, (seen in Fig. 3ᶜ) where it engages the hollow in the ring O, (seen in sectional perspective in Fig. 3ᶜ) has two projecting sectors, *n'*, which are always in the same plane with the outer ends of faces of the sectors M. The hollow within the ring O has also two projecting sectors *o'*, which are wide enough, radially, to bear on the ends of both the sectors M and the sectors *n'*, when the brakes are being set.

The diagrams, Figs. 4 and 5, represent schematically the positions of the parts and their functions. A is the axle, and B the crank-sleeve, in section. L represents the end of the screw sleeve; M, M, the sliding sectors, lightly section-lined; *n'*, *n'*, the projecting sectors on the box-nut N, also section-lined; the exterior segments, *o'*, *o'*, represented in full section lines, show in a conventional manner the positions of the sectors on the ring O when the piston D is at the bottom of the cylinder C and the stored power is exhausted, and the segments *o²*, *o²*, in dotted section lines, show the positions of these parts when the piston is at the other end of the cylinder and the air is under tension. The lines *b'*, *b'*, mark the radial positions of the arms *b* and the brake shoes under the first condition named above, and the lines *b²*, *b²*, mark the position of the arms *b* under the last condition named above. The arrows in full lines mark the direction of the movement of the parts when the car is being arrested and the dotted arrows represent the direction of their movement when the car is being started.

Fig. 4 has relation to the parts on the axle A², and Fig. 5, to the parts on axle A'.

As has been said, in the movement to the

left (Figs. 1 and 2), the wheel R^2 serves for stopping the car and the wheel R′ for starting it. In the first case, by inclining the lower end of the lever S′ to the right, the rod q^4 turns the screw sleeve L^4, and its sectors in the direction marked in Fig. 5; the box-nut N^4 is driven toward the wheel R^4 and sets the brake shoes thereon, and these carry around with them their arms from b' to b^2. At the same time the sectors on the ring O^4 will pass from o' toward o^2, still bearing on the sectors n' of the box-nut, and on the sectors M. In bringing the lever S′ back to its place, the brakes are released, but the sectors on the ring O^4 remain in the position o^2. The brake shoes and ring of wheel R′ will make the same movement, but without effect, for the movement given to the box-nut N′ will have moved away the shoes from the wheel. To start the car the lever S′ is moved in the opposite direction; the box-nut N′ turns in the direction indicated by the dotted arrow in Fig. 5, and sets the brake-shoes on the wheel R′. By means of the force stored in the accumulator, the crank sleeve B′, together with its arms, the brake shoes and the ring, turn from b^2 toward b'. During nearly the whole of the movement, the sectors o^2 continue to bear on the sectors M and n', but on nearing o';—that is, the end of its course,—they lose their bearing on the sectors M and n' and register with the recesses between the respective pairs of sectors M and n'; the ring O′ then recoils and releases the brakes, leaving the wheel free to turn. In bringing the lever S′ to its place, the box-nut N′ returns also to the position seen in the drawings, drawing back and moving its sectors n', back of or behind the sectors o' of the ring O′, again. This is permitted by the forming of bevels or inclines on the advancing corners of the sectors n, as seen at $n^\times$ in Fig. 3^a. The apparatus on the other axle is similarly arranged and is represented in Figs. 3^b and 4. As in this particular mechanism the box-nut N comes into play in the stopping of the car and the sectors M, in the starting, these latter will be beveled as seen in Fig. 3^b at $m^\times$. That is to say, in the devices connected with the wheels R^2 and R^4, the sectors M are beveled, and in the corresponding devices connected with the wheels R′ and R^3, the sectors n will be beveled.

It remains to be explained how the operator or car-driver manipulates the levers S′ and S^2, and how the pawls I are disengaged on starting the car. In Fig. 7 the dotted or broken lines represent the principal parts of the platform and running gears of the car, and the controlling mechanism, which is mounted on the car platform, is represented in full lines. The mechanisms at the two ends of the car are analogous but not symmetrical. T′, T^2, are two upright brake-shafts, situated at the respective end-platforms of the car in the usual way. They will be supplied with hand-wheels or cranks at their upper ends as usual. To their lower ends are secured respectively the brake chains t', and t^2. These chains are secured respectively to elbow-levers U′ and U^2, which rock, respectively, on pivots u' and u^2. One arm of each of these elbow levers has fulcrumed on it, (see Fig. 7^a) by the respective pivots v' and v^2, two straight levers, V′ and V^2. To the short arms of these latter are coupled respectively the rods W′ and W^2, which latter are coupled, at their other ends, respectively, to the levers S′ and S^2. To the longer arms are coupled, respectively, rods X′ and X^2, which are connected by slotted couplings at their other ends, respectively to levers z' and z^2, pivoted on the car platform and coupled at their other ends to a floating link or bar Z, the levers being on opposite sides of said bar. The upper end of the lever K (seen in elevation in Fig. 6), in the movement of the cylinder C, moves lengthwise of and along one side of the bar Z. A spring Z′ arranged as clearly shown in Fig. 7, tends to draw the bar Z laterally away from the lever K. Two rock-shafts, Y′ and Y^2 supported in bearings on the platform, serve to arrest the movements of the respective levers S′ and S^2, when they are so turned that keepers, y' and y^2, thereon, embrace the said levers.

The mechanism operates as follows: Suppose that the car is moving from right to left. The lever S′ should be free and the lever S^2 held fast by the keeper or locking device y^2 on the shaft Y^2. To stop the car the driver turns to the right the shaft T′, which, through the chain t', causes the elbow lever U′ to rock or turn in a like direction, and through the latter to carry to the left the pivot v' of the lever V′. The longer arm of this lever V′ cannot follow the movement because of a stud x' of the rod X′ striking against a stop, w', on the car platform. On the contrary, the rod W′ is displaced to the left and swings the lever S′ which sets the brakes on the wheels R^2 and R^4 and through their rotation compresses the air in the cylinder C. For starting the car, the brake-shaft T′ is turned in the opposite direction. The fulcrum pivot v' is moved to the right, thus shifting the lever S′ through the rod W′, which sets the brakes on the wheels R′ and R^3; afterward, if the brake-shaft be further rotated, the rod W′, not moving further, serves as a fulcrum for the lever V′, and the longer arm of the latter pushes the rod X′ to the right, and through it swings to the right the levers z' and z^2, and the bar Z; this latter pushes over the lever K and releases the pawls I. Then the piston D moves back in the cylinder C and sets the car in motion. In the movement of the car to the right, the controlling mechanism at the other end of the car will be employed in a similar manner.

The form and proportions of the mechanisms may be varied to adapt them to different kinds of cars. Some of the mechanical elements ought to be in several pieces instead of integral; for example the sleeves on the axles will best be in halves divided longi-

tudinally so that they may be applied the more readily to axles having the wheels fixed thereon. I have not shown these details in the drawings as they would only tend to obscure.

Having thus described my invention, I claim—

1. A car-starter or reaction brake, comprising crank-sleeves on the axles, brake-shoes carried by the same, means for setting the brake shoes on the wheels, an accumulator, and the crossed connecting rods coupled at their ends to the cranks of the respective crank-sleeves, the elements of the accumulator being coupled to the respective connecting-rods, whereby the rotation of the sleeves is converted into rectilinear movement of the accumulator, or vice versa, substantially as set forth.

2. In a car-starter or reaction brake, the combination to form an accumulator, of a closed cylinder, a piston therein, a piston-rod connected to said piston, and a yoke, the cross-piece of which is connected to the piston-rod, and the slide-bars mounted in guides on the cylinder.

3. In a car-starter or reaction brake, the combination with the crank-sleeve B, the axles, provided with arms *b*, the brake-shoes, the carriers therefor mounted on said arms, the ring O, coupled by links to said carriers, the said links, the screw sleeve L, mounted on the crank sleeve B, the box-nut N, mounted on the sleeve L, and means substantially as described for rotating the sleeves L and B with respect to each other whereby the brake-shoes are set, substantially as set forth.

4. In a car-starter or reaction brake wherein the setting of the brakes serves to compress air in a cylinder, the combination with the accumulator cylinder, its piston and piston-rod, and the yoke H, provided with ratchet teeth, of a pawl I, adapted to engage said teeth normally, disengaging lever K on the cylinder connected with the pawl, the floating bar Z, connected to two levers *z* and adapted, when either lever *z* is moved, to strike and operate the lever K, in whatever position the cylinder may be occupying, the said levers *z*, and means substantially as described for operating said levers from the respective ends of the car, substantially as set forth.

5. In a car-starter or reaction brake, the combination with a brake-shaft, T′, on the car, an elbow lever U′, coupled at each end to the brake-shaft by a chain, the said chains, the levers V′, fulcrumed on one arm, of the lever U′, the lever S′, the rod W′, coupled at one end to one arm of the lever V′, and at the other end to the lever S′, the lever *z*′, the rod X′, coupled at one end to the other arm of the lever V′, and having a slotted connection at its other end with the lever *z*′, the floating bar Z, coupled to the lever *z*′, and a stop device to limit the endwise movement of the rod X′ in one direction, said mechanism serving to enable the operator to operate the mechanism for setting and releasing the brakes and for setting free the piston of the accumulator, substantially as set forth.

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

CARLO SACCO.

Witnesses:

AUG. CARLO FRANCESETTI,

SECONDO TORTA.