No. 860,640. PATENTED JULY 23, 1907.

L. J. CRECELIUS.

HYDRAULIC BRAKE GEAR.

APPLICATION FILED OCT. 8, 1906.

4 SHEETS—SHEET 1.

Fig. 1.

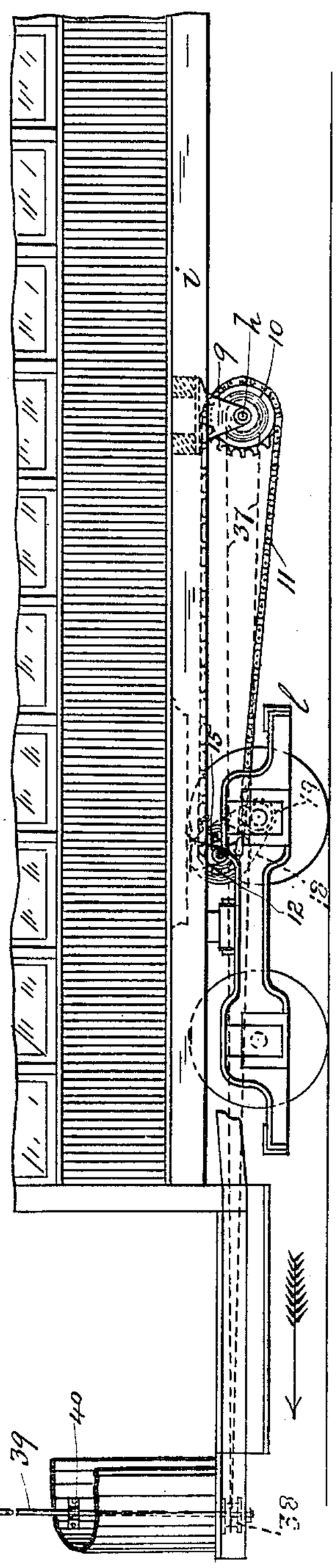
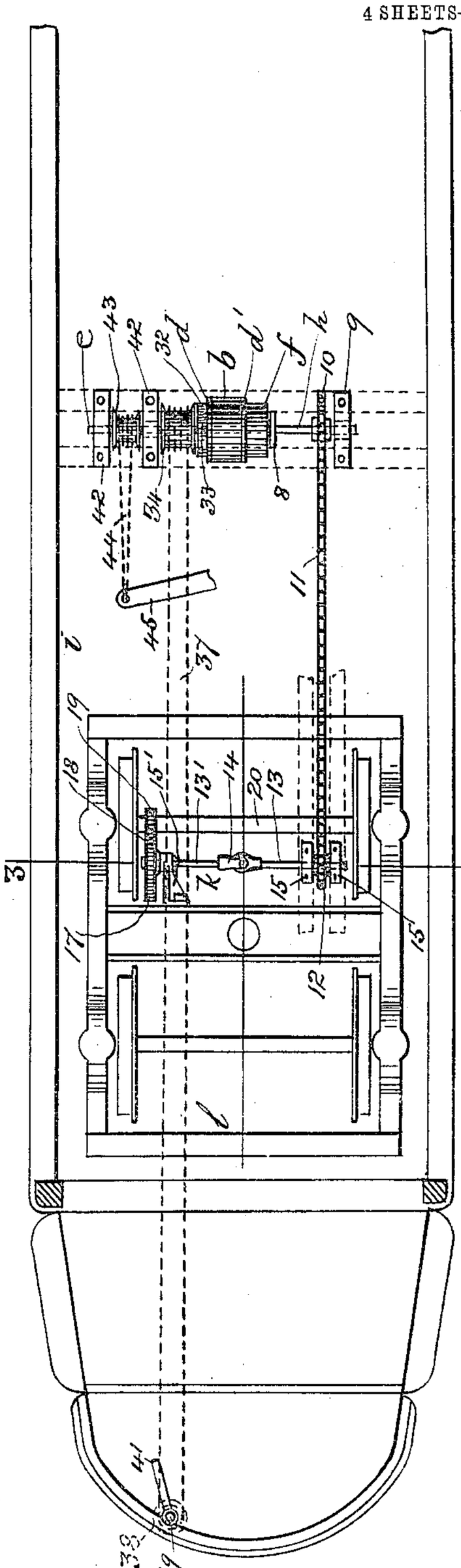


Fig. 2.



WITNESSES.
J. W. Benbow
M. D. Whitcomb

INVENTOR
Louis J. Crecelius
By Edward W. Furrell
His Atty

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4 SHEETS—SHEET 2.

Fig. 3.

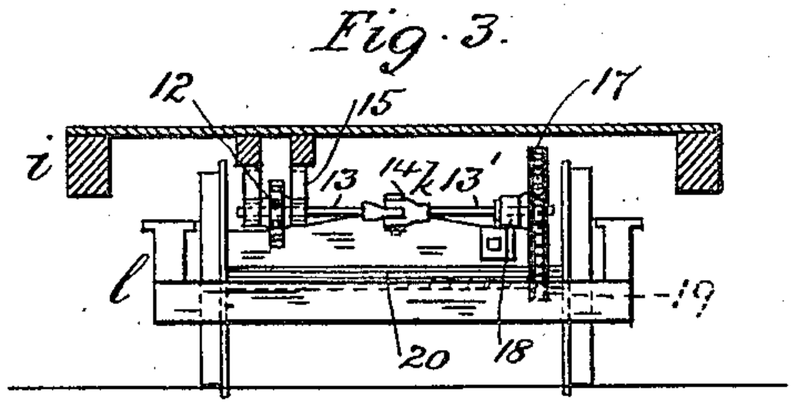


Fig. 4.

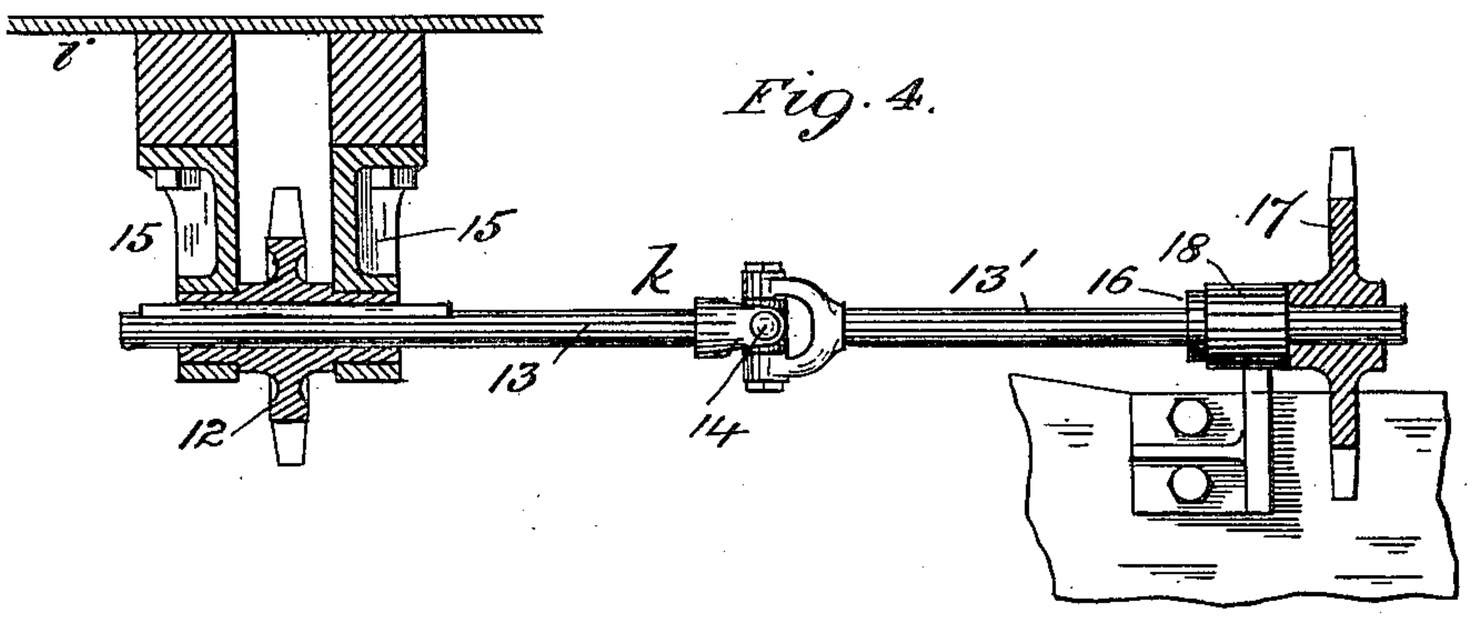
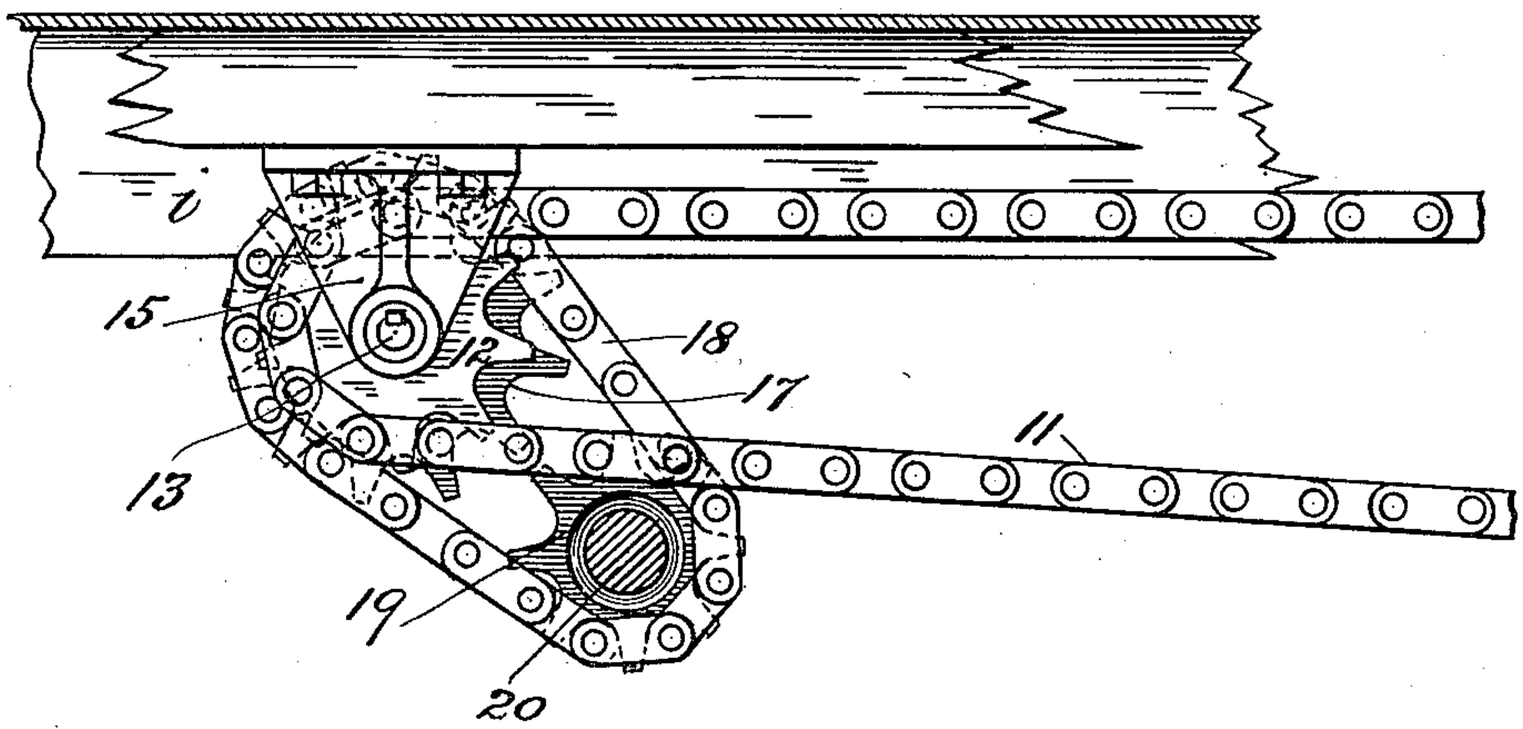


Fig. 5



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4 SHEETS—SHEET 3.

Fig. 6.

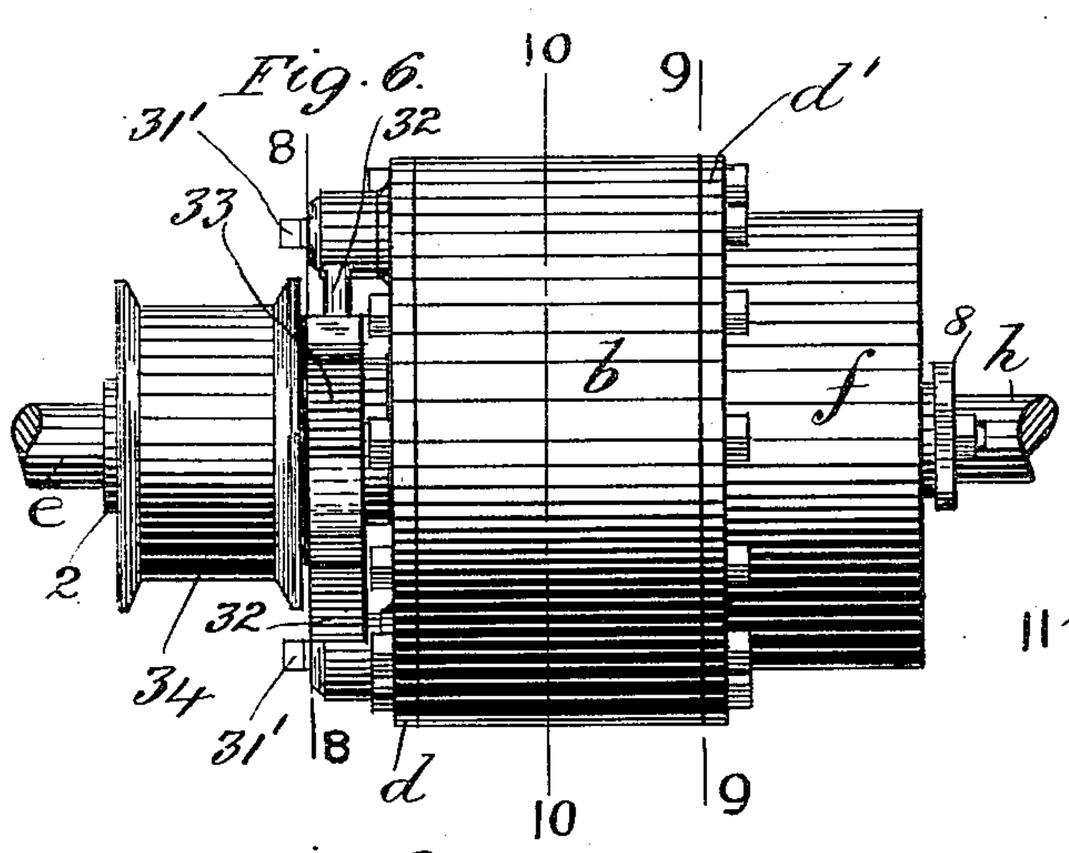


Fig. 7.

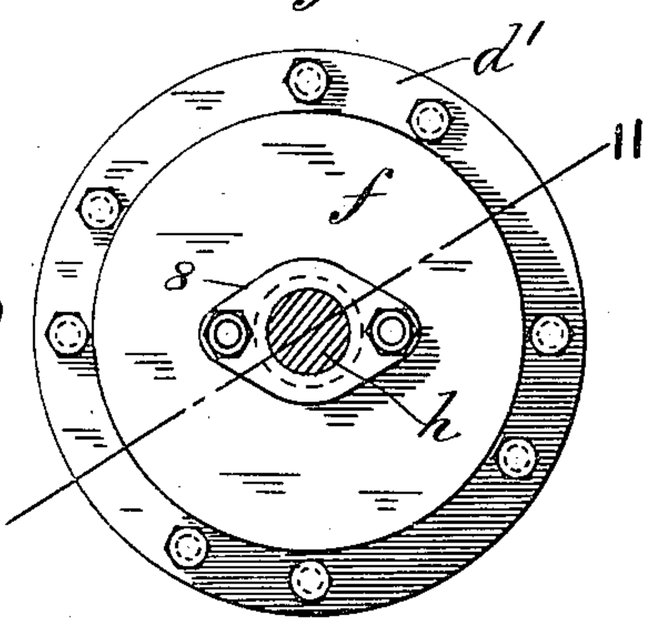


Fig. 8.

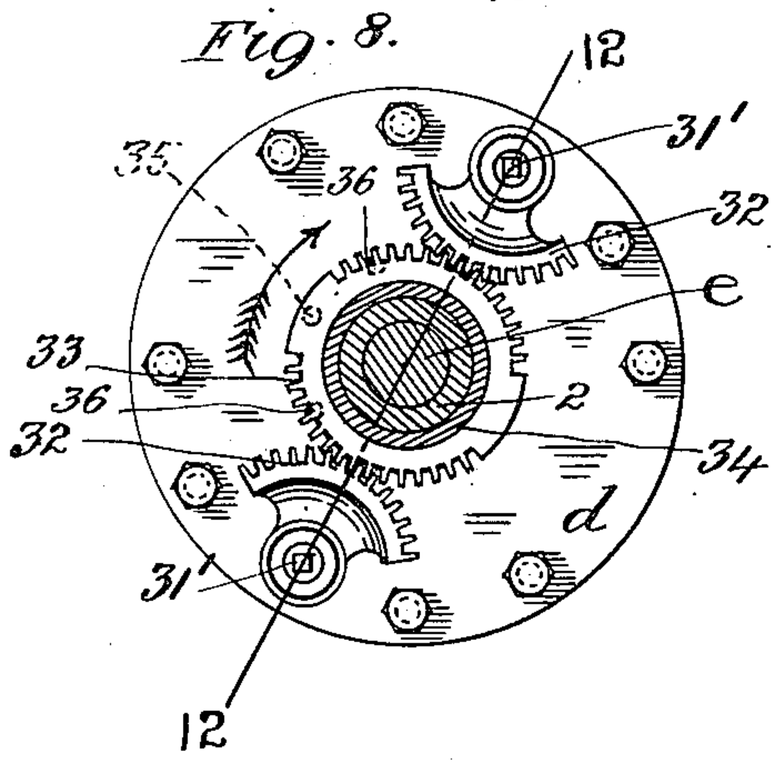


Fig. 9.

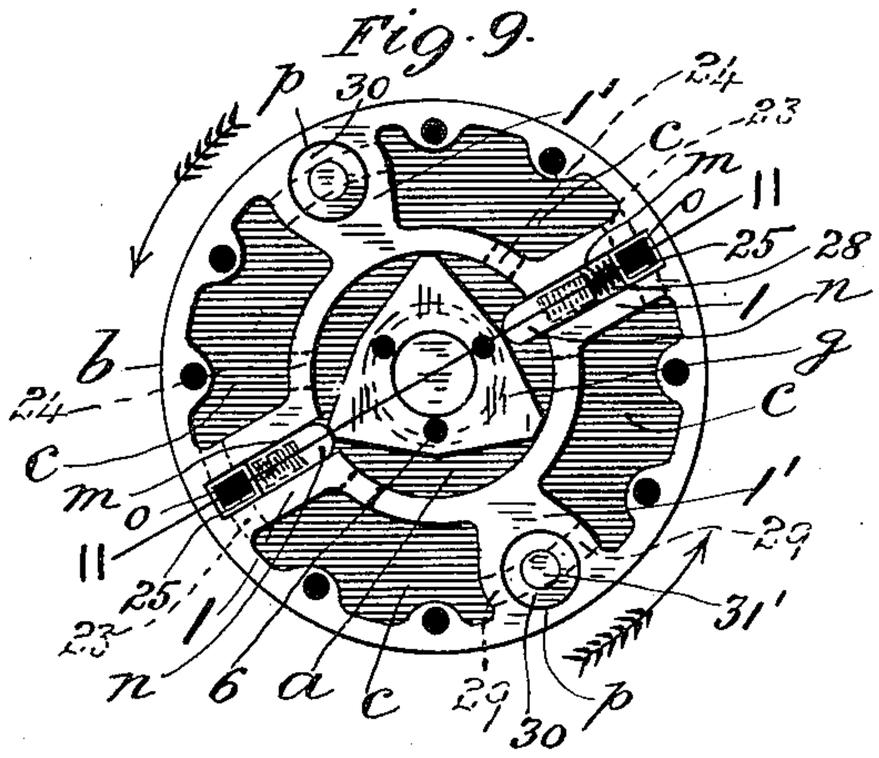


Fig. 10.

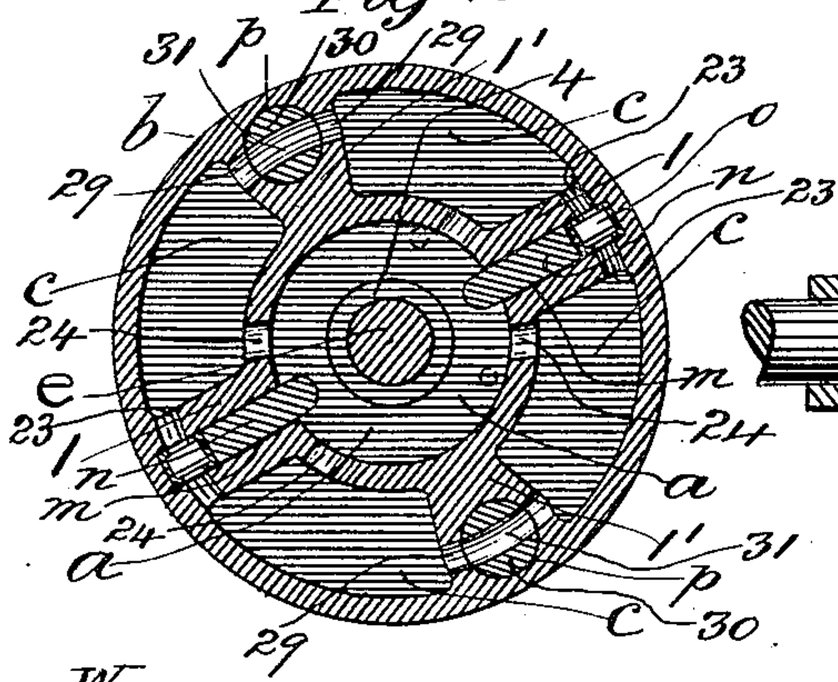
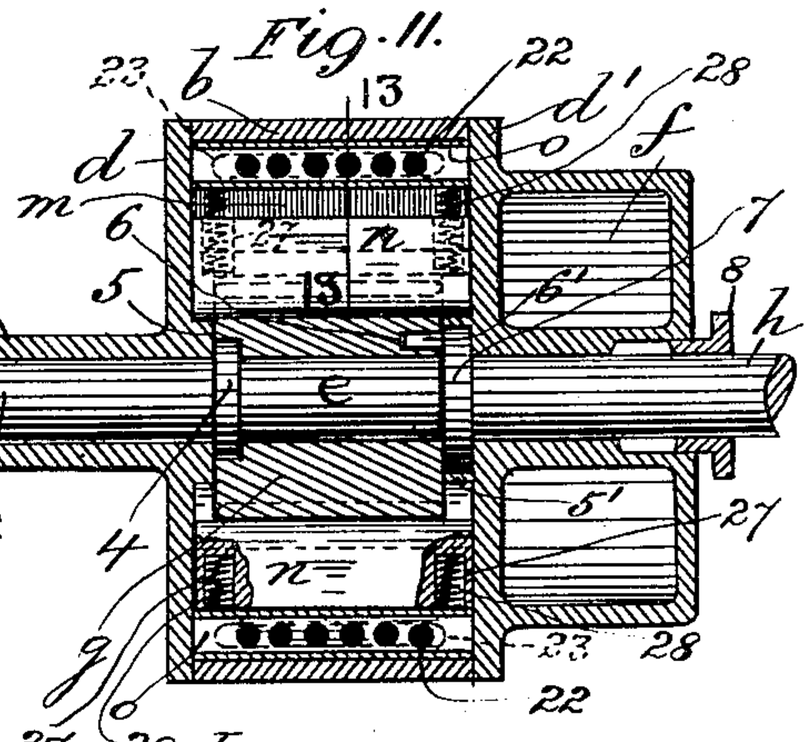


Fig. 11.



WITNESSES

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HYDRAULIC BRAKE GEAR.

APPLICATION FILED OCT. 8, 1906.

4 SHEETS—SHEET 4.

Fig. 12.

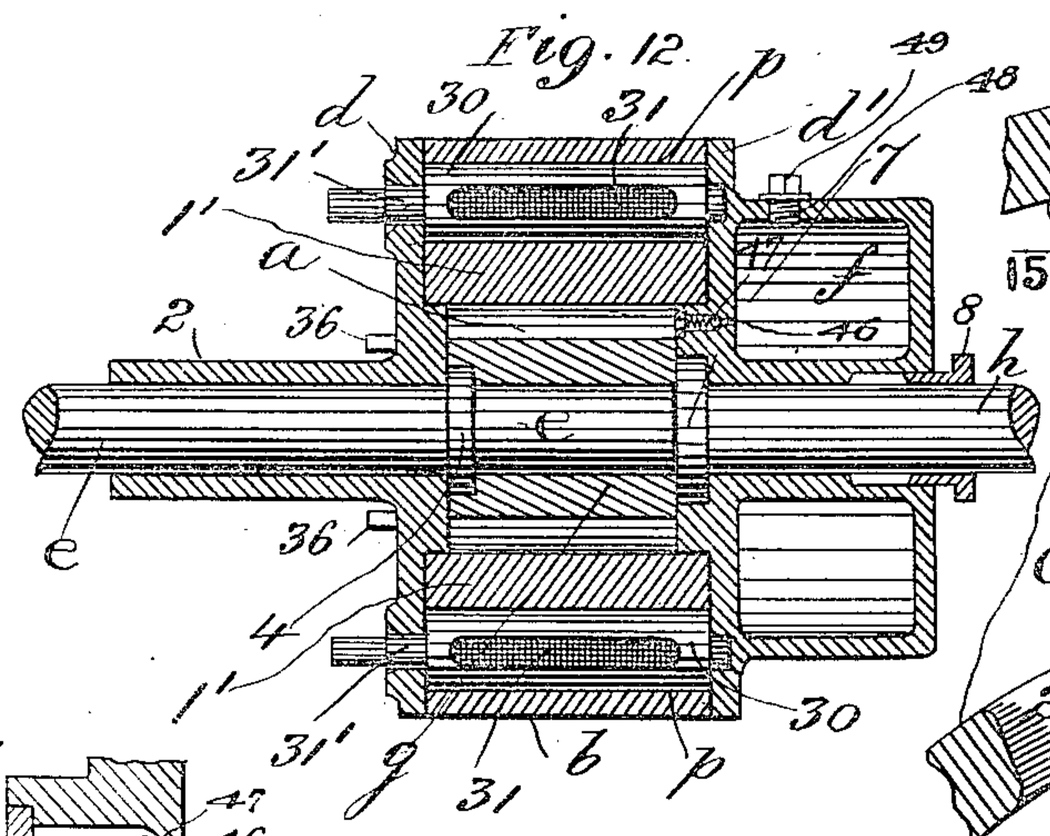


Fig. 13.

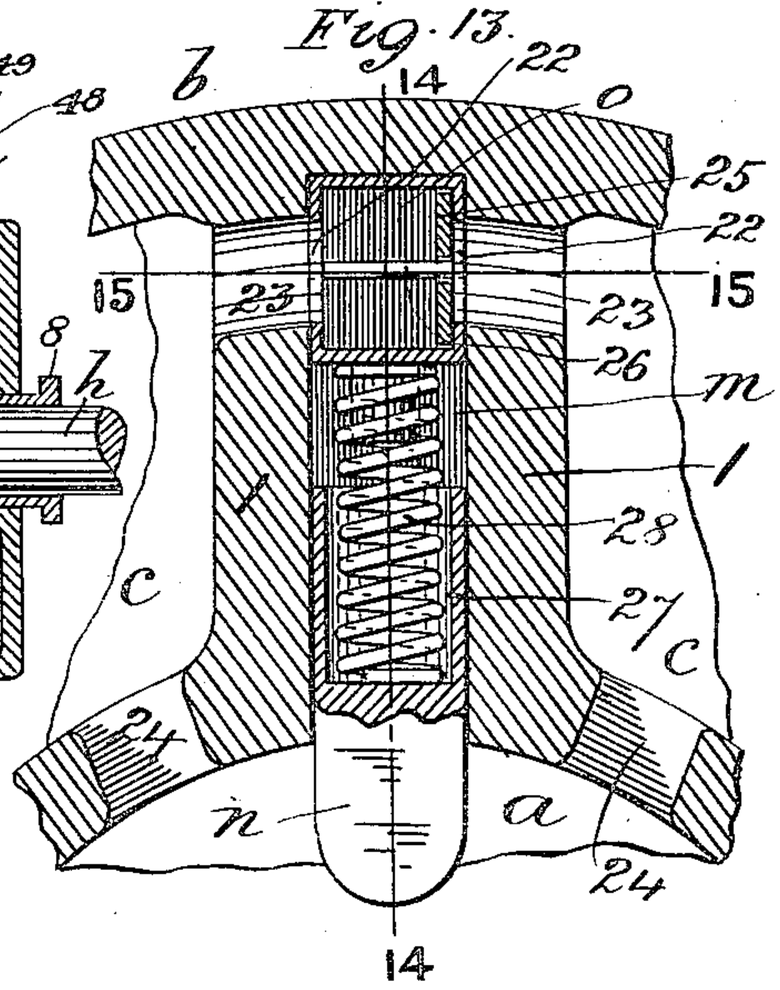


Fig. 16.

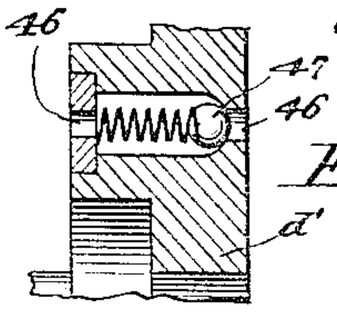


Fig. 14.

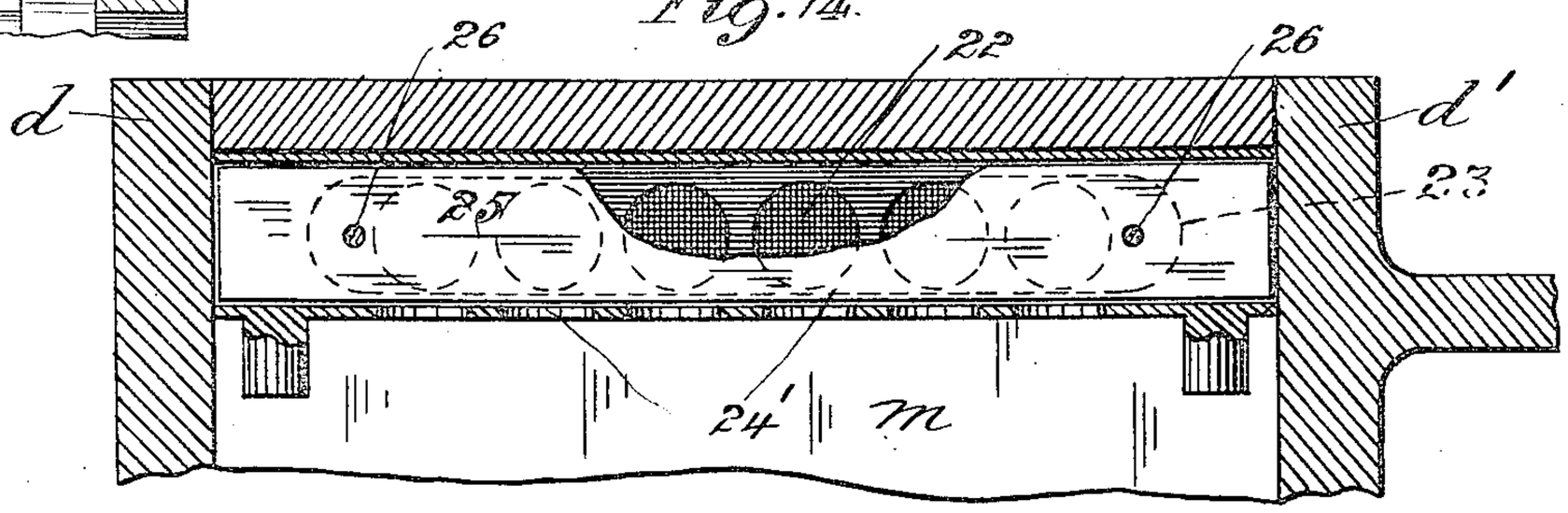
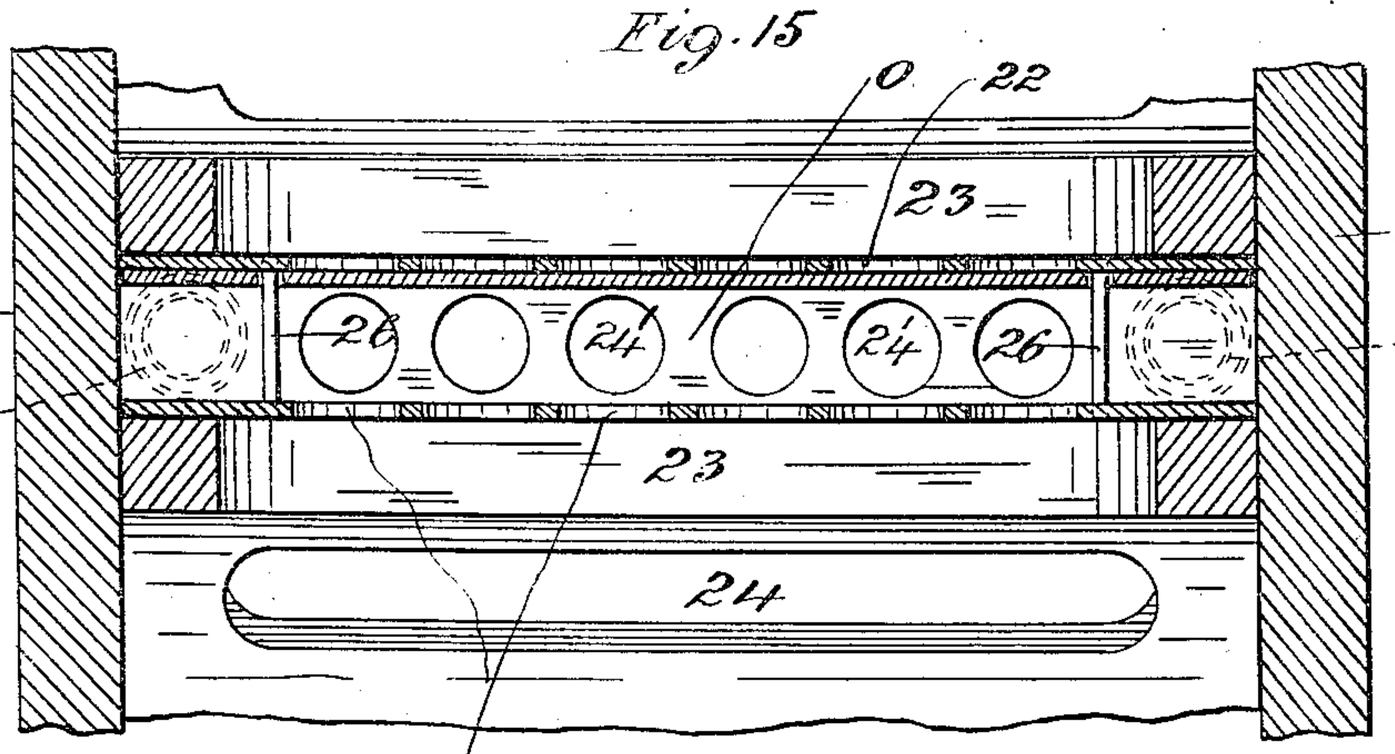


Fig. 15



WITNESSES

J. M. Benbow

M. D. Whitcomb

INVENTOR

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By Edward W. Farrell

His Atty

UNITED STATES PATENT OFFICE.

LOUIS J. CRECELIUS, OF ST. LOUIS, MISSOURI.

HYDRAULIC BRAKE-GEAR.

No. 860,640. Specification of Letters Patent. Patented July 23, 1907.

Application filed October 8, 1906. Serial No. 338,033.

To all whom it may concern:

Be it known that I, LOUIS J. CRECELIUS, a citizen of the United States, residing at St. Louis and State of Missouri, have invented a new and useful Improvement in Hydraulic Brake-Gear, of which the following is a specification.

My invention relates to mechanism by which the incompressibility of water or other suitable liquid is utilized for applying brakes to the wheels of a railroad car, or for retarding and stopping the momentum of any other moving object or machine, and has for its object to provide a positive and reliable self-contained power brake-gear applicable at all times without the expense of generating and storing power for the purpose as with the air and analogous brakes in present use.

My invention consists principally in a preferably triangular-shaped piston adapted to be rotated within a cylinder containing liquid, by a central rod or shaft which is driven by the moving object or mechanism to which the brake is applied, the piston being peripherally in water-tight contact at all times with the preferably rounded edges of two opposite abutments, adapted to be reciprocated in pockets formed through the cylinder wall and communicating at each side respectively with a chamber having an opening therefrom into the cylinder, the chambers at each side of the pockets having a passage-way into each other which is opened or closed by a valve controlled by the operator, and the said cylinder communicating with a supply tank for the liquid, combined with other features of novelty the whole operating so that when the said passage-ways are opened by the valves during the normal revolution of the piston and its shaft in either direction, the liquid in the spaces between the piston and the surrounding wall of the cylinder at each side of the abutments circulates freely to and from the said spaces through the corresponding chambers, but when, for applying the brakes the said passage-ways are closed by the valves the circulation of the liquid through the said chambers is prevented and the piston consequently locked by the incompressibility of the liquid thereby confined between the piston with its abutments and each of the said chambers, and its revolution transmitted to means by which the brakes are applied to the car wheels as hereinafter more particularly described and claimed, reference being had to the accompanying drawing forming part of this specification, whereon,

Figure 1, is a side elevation of the end and adjacent portion of a street railroad car (broken away) showing a preferable manner of applying my improved hydraulic brake-gear thereto; Fig. 2, a top plan thereof omitting the car body; Fig. 3, a cross section through the car under-frame on line 3—3 in Fig. 2, showing the combined parts of the brake-gear thereat in longitudinal elevation; Fig. 4, a sectional view to enlarged scale of the said parts corresponding to Fig. 3, and Fig. 5, an end view thereof as seen from the side of the car corresponding to Fig. 1; Fig. 6, a longitudinal elevation of the hydraulic apparatus comprising the main parts, or prime mover of the brake-gear; Fig. 7 a right hand end elevation thereof; Fig. 8, a vertical transverse section through same on line 8—8 in Fig. 6, showing the valve operating parts thereof; Fig. 9, a face view of the cylinder and combined internal parts of the apparatus on line 9—9 in Fig. 6, with the right hand cover thereof removed; Fig. 10, a vertical transverse section through the same on line 10—10 in Fig. 6 omitting the piston forming a part thereof; Fig. 11, a longitudinal section through the apparatus on line 11—11 in Fig. 9; Fig. 12, a similar view to Fig. 11 on line 12—12 in Fig. 8, omitting the valve operating mechanism; Fig. 13, a vertical transverse section to enlarged scale through the cylinder wall (broken away) on line 13—13 in Fig. 11, showing a pocket therein for one of the abutments and combined valve-box forming parts of the apparatus; Fig. 14, a vertical longitudinal section through the valve-box on line 14—14 in Fig. 13, and Fig. 15, a horizontal section through the pocket and valve-box on line 15—15 in Fig. 13, and Fig. 16 a detached view to enlarged scale of the check-valve forming part of the apparatus, and seen in Fig. 12.

Like letters and numerals of reference denote like parts in all the figures.

Referring particularly to Figs. 6 to 15, *a* represents a cylinder having outer radially projecting arms 1, 1′, arranged preferably at right angles to each other and uniting with the inside of a preferably cylindrical casing *b* which is concentric with the cylinder *a* at a suitable distance therefrom, the ends of the cylinder *a* being flush with the corresponding ends of the casing *b* and arms 1, 1′, whereby the annular space between the cylinder *a* and casing *b* is divided into four preferably equal compartments *c* (hereinafter called "chambers") the whole being closed at one end by a cover *d* and at the other end by a cover *d′*, the cover *d* having an outer central hub or sleeve 2 and mounted therewith on a shaft *e* to which it is fixed, the shaft *e* being axially alined to the longitudinal center-line of the cylinder *a* into which it extends and is preferably formed therein with a collar 4 adapted to bear against the face of a hub 5 on the cover *d*.

On the cover *d′* is an outer projecting closed box or tank *f* which is preferably concentric with the casing *b* and adapted to contain a suitable liquid, preferably oil, for maintaining a supply thereof to the cylinder *a* and chambers *c* as hereinafter more particularly referred to.

On the shaft *e* within the cylinder *a* is axially mounted longitudinally and loosely, a piston *g*, which is preferably of an equilateral triangular (or otherwise eccentric) shape in cross section, whereby a corre-

sponding series of circular segmental spaces are formed between it and the surrounding wall of the cylinder *a*, the angular edges of the piston *g* bearing against the said wall at all times, and each side of the piston *g* in lieu of being straight, preferably diverging from the said edges respectively, to the longitudinal middle line of the said side as seen particularly in Fig. 9, but I do not limit myself to the particular number or shape of the sides as described as these may be varied without affecting the principle of my invention, as found suitable in practice.

The piston *g*, in the assembled position of the parts, bears at one end against the hub 5 of the cover *d* and at its other end against a similar hub 5′ on the cover *d′*, and in this end of the piston *g* are preferably formed circular holes or recesses 6 which are engaged by corresponding pins 6′ projecting from the face of the head 7 of a circular rod or shaft *h* which is axial with the shaft *e* and piston *g* from which it projects through the cover *d′* and through a stuffing-box 8 in the tank *f* to the outside of the latter where it is mounted in the present case, in a bearing 9 (see Figs. 1 and 2) fixed to the under-frame *i* of the car, and on the shaft *h* adjacent to the bearing 9, is fixed a sprocket wheel 10 which with the shaft *h* and piston *g* is normally rotated by a sprocket chain 11 (Figs. 1 to 5) driven by a sprocket wheel 12 which is feathered on a shaft *k* divided into two parts 13, 13′, united to each other by a universal joint 14, the part 13 having the sprocket wheel 12, being mounted in bearings 15 (one on each side of the wheel 12) fixed to the car underframe *i*, and the other part 13′ in a bearing 15′ fixed to the bolster or other convenient part of the car truck *l*.

On the part 13′ of the shaft *k* at one side of the bearing 15′ is a collar 16, and on the other side is fixed a sprocket wheel 17 which is rotated by a sprocket chain 18 driven by a sprocket wheel 19 fixed on the axle 20 of the car truck *l*. By dividing the shaft *k* as described any deviation from the alinement thereof due to the relatively different positions of the car-body and truck when rounding curves, is taken up by the part 13 which is free to slide longitudinally through the bearings 15 and sprocket wheel 12. Moreover, the sprocket chain 18 of the wheels 17 and 19 is adjusted with sufficient slack to compensate for the usual varying level of the axle 20 to which the sprocket wheel 19 is fixed.

In the cylinder *a* of the hydraulic apparatus hereinbefore partly described, are formed two opposite rectangular shaped pockets *m* (see particularly Fig. 13) which extend radially to the cylinder *a*, for a suitable distance through the arms 1, and preferably for the entire length of the latter between the covers *d* and *d′*. Through the opening into the cylinder *a* and adjacent part of each pocket *m* in water tight contact with its walls, is adapted to slide a plate (hereinafter termed abutment) *n* having its outer edge preferably semicircular and adapted to be engaged by the triangular peripheral surface of the piston *g* at all times. Within the pocket *m* at a suitable distance from the inner edge of the abutment *n* is fixed a valve-box *o* which is preferably square in cross section extending the full length of the pocket *m* between the covers *d* and *d′* which form the ends of the box *o* as seen particularly in Fig. 14 and 15. Through each side of the valve-box *o* are openings (preferably circular) 22 which register with passage-ways (preferably rectangular extending the entire series of openings 22) 23 formed respectively through each side wall of the pocket *m* into the corresponding chamber *c* from which is a passage-way 24 into the cylinder *a* through its surrounding wall adjacent to the pocket *m*, openings 24′ being also formed through the wall of the box *o* adjacent to its said sides into the pocket *m* between the said wall and the abutment *n*.

In the valve box *o* is arranged a movable plate 25 which is adapted to bear flatwise against either side of the box *o* and thereby close the corresponding openings 22 therethrough, the plate 25 being mounted loosely on pins 26 extending across the box *o* for the purpose hereinafter described.

In the inner edge of each abutment *n* opposite to the valve-box *o* are circular recesses 27 for receiving the spiral (or other) springs 28 which bear at their outer ends against the valve box *o* and thereby force the abutment *n* toward the cylinder *a* so that its rounded edge bears against the piston *g* at all times.

In the arms 1′ are formed two correspondingly opposite circular valve-boxes *p* which extend longitudinally between the covers *d* and *d′* and from each valve-box *p* through each side of the arm 1′ is a passage-way 29 into the corresponding adjacent chamber *c*. In each valve-box *p* is fitted a circular plug or valve 30 having an opening 31 therethrough which on a partial rotation of the valve 30 by its stem or shank 31′ in either direction, is adapted to register with, or be removed from, and so close the passage-way 29, in a similar manner to an ordinary two-way cock.

To the outer end of the shank 31′ of each valve 30, which projects through the cover *d′* is fixed a toothed sector 32 which is engaged by a toothed wheel 33 fixed to or formed on the side of a pulley 34 and mounted loosely therewith on the hub or sleeve 2 of the cover *d*, the toothed wheel 33 having a pin 35 (indicated by dotted lines in Fig. 8) projecting from its inner side and adapted to engage with either of the two pins 36 (Figs. 8 and 12) which project from the cover *d* for limiting the rotary movement of the toothed wheel 33 and sectors 32 beyond the amount necessary for opening and closing the valve 30.

To the periphery of the pulley 34 is fixed a chain 37 which is wound from its fixed point around the pulley 34 and its two parts thence extended, in the present case, to the end of the car where they are similarly wound around and fixed to a pulley 38 on the lower end of an upright rod 39 having suitable bearings 40 and an operating lever or handle 41 controlled by the operator.

On the shaft *e* which is mounted in suitable bearings 42 secured to the underframe *i* of the car is fixed, preferably between and in proximity to the bearings 42, a second pulley 43 having a chain 44 fixed thereto in a similar manner to the chain 37 on the pulley 34, the two parts of the chain 44 extending to the end of the brake lever 45 to which they are fixed in any suitable manner, one part of the chain 44 being taut and the other part slack in either direction of the rotation of the pulley 43, the brake lever 45 being similar in construction and connected with the appliances for operating the brake shoes of the car wheels in the same manner as in the ordinary air brake or analogous system and therefore needing no further description.

Through the cover *d'* and its hub 5' is an opening 46 from the supply tank *f* into the cylinder *a*, the opening 46 being normally closed by a check valve 47 (see particularly Fig. 16) which when, owing to leakage or otherwise, the volume of liquid in the cylinder *a* is diminished, is opened by the suction induced by the action of the piston *g* and thereby causes liquid to enter the cylinder *a* from the tank *f* for compensating the waste therein, the tank *f* being filled initially through an opening 48 in the wall thereof which is closed by a plug 49.

It is to be understood that I do not limit myself to the particular arrangement of the driving gear described between the car wheels and the shaft *h* of the piston *g*, as any other arrangement of mechanism whereby the revolution of the said wheels or other moving object is transmitted to the shaft *h* may be used, and furthermore the supply tank *f* in lieu of forming part of the cover *d'* as described may be separate and the liquid supplied therefrom to the cylinder *a* by piping or other suitable means.

In operation, assuming that the spaces in the cylinder *a* around the piston *g* and the chambers *c* are filled with the liquid from the supply tank *f*, the valves 30 between the chambers *c* being open as shown, and that the piston *g* with its shaft *h* is revolving in the direction of the arrow shown in Fig. 9 in obedience to the driving mechanism between it and the wheels of the car traveling in the direction of the arrow shown in Fig. 1, the liquid within the cylinder *a* and chambers *c* on each side of the abutments *n* circulates freely to and from the piston *g* through the said chambers without resistance to the revolution of the piston *g* and without affecting the brakes.

For applying the brakes the operator on the car, by rotating the rod 39 and pulley 38 in one direction pulls on one part of the chain 37 and in so doing partially rotates the pulley 34 with the toothed wheel 33 in the direction of the arrow shown in Fig. 8, which throws over the toothed sector 32 and valves 30 so as to close the passage-way 29 and thereby stop the circulation of the liquid through the corresponding chambers *c*, whereby owing to the incompressibility of the liquid between the piston *g* with its abutments *n* and the respective chambers *c*, the piston *g* is locked clutch-wise with the casing *b* and shaft *e* which is thereby caused to revolve with the piston *g* and shaft *h* and in so doing the correspondingly rotated pulley 43 on the shaft *e* pulls on the corresponding part of the chain 44 and throwing over the brake-lever 45 applies the brakes to the car wheels.

It is essential for the proper operation of the hydraulic apparatus when applying the brakes, that the abutments *n* are held in close contact with the piston *g* to prevent the escape of liquid between the same, otherwise the piston *g* would revolve without the necessary resistance thereto: To insure this contact, on the valves 30 being closed the pressure of the liquid in the chambers *c* at one side of the abutment *n* (according to the direction of rotation of the piston *g*) forces the plates 25 against the opposite side of their valve-boxes *o*, or so as to close the openings 22 thereat into the chambers *c* at the other side of the abutment *n*, thereby concentrating the pressure of the liquid against the inner edge of the abutment *n* and so aiding the springs 28 in holding the engaging edges of the abutment *n* with the piston *g* in positive contact therewith.

On rotating the rod 39 and pulley 38 in the opposite direction the other part of the chain 37 is pulled and thereby rotates the pulley 34 with the toothed wheel 33 in the opposite direction, or so as to open the valves 30 and thereby release the shaft *e* from the action of the piston *g* which allows the brake to be removed from the car wheels, the piston *g* being again free to revolve without resistance from the liquid which freely circulates as before.

What I claim as my invention and desire to secure by Letters Patent is:

1. In hydraulic brake-gear, the combination of a cylinder having a cover at each end and containing liquid, and having two opposite pockets opening radially therefrom, a suitably shaped piston fitted within the cylinder and axially mounted loosely on a shaft fixed in and projecting through one of the said covers in axial alinement with the cylinder and piston, a pulley fixed on the said shaft, a chain connecting the pulley circumferentially with a brake-lever, a shaft projecting through the other said cover and adapted to rotate the said piston, bearings for the said shafts, two opposite abutments slidable in the said pockets, means for holding the abutments constantly edgewise against the piston, the said pockets having an opening through each side thereof, respectively, into a chamber carried by and having an opening into the cylinder, the said chamber containing liquid, and the said chambers on each side of the abutments having a passage-way into each other, a valve adapted to open and close each of the said passage-ways, means for opening and closing the said valves by hand, means for rotating the said shaft in engagement with the piston, by the moving object to which the brake is to be applied, and for supplying the said cylinder and chambers with liquid, substantially as described.

2. In hydraulic brake-gear, the combination of a cylinder closed at each end and containing liquid, and having two opposite pockets opening radially therefrom, a suitably shaped piston fitted within the cylinder, a shaft projecting through one end of the cylinder and adapted to rotate the said piston, a bearing for the said shaft, two opposite abutments slidable in the said pockets and adapted to bear constantly edgewise against the piston, the said pockets having an opening through each side thereof respectively into a chamber carried by, and having an opening into the cylinder, the said chamber containing liquid, and the said chambers on each side of the abutments having a passage-way into each other, a valve adapted to open and close the said passage-ways respectively, means for closing the said valves by hand, a box within each of the said pockets, having an opening through each side registering with the said opening through the corresponding side of the pocket, a plate movable flatwise across the said box and adapted to close the said opening through either side thereof, and means for rotating the said shaft, substantially as described and for the purpose set forth.

3. In hydraulic brake-gear for a car, the combination of a cylinder closed at each end and containing liquid, and having two opposite pockets opening radially therefrom, a suitably shaped piston fitted within the cylinder and axially mounted loosely on a shaft fixed in, and projecting through one end of and in axial alinement with, the cylinder and piston, a pulley fixed on the said shaft, a chain connecting the pulley circumferentially with the brake-lever, a shaft projecting through the other end of the cylinder and adapted to rotate the said piston, bearings for the said shafts, two opposite abutments slidable in the said pockets, means for holding the abutments constantly edgewise against the piston, the said pockets having an opening through each side thereof respectively, into a chamber carried by, and having an opening into the cylinder, the said chamber containing liquid, and the said chambers on each side of the abutments, having a passage-way into each other, a valve adapted to open and close each of the said passage-ways, means for opening and clos-

ing the said valves by hand from the car, a sprocket wheel fixed on the said shaft in engagement with the piston, a shaft mounted on the car and divided into two parts united to each other by a universal joint, a suitable bearing for each of the said parts fixed respectively, to the underframe and truck of the car, a sprocket wheel fixed on the said part carried by the underframe, a chain connecting the said sprocket wheels, a sprocket wheel fixed on the other said part, a sprocket wheel fixed on the axle of the car, and a sprocket chain connecting the last mentioned wheels, substantially as described.

4. In hydraulic brake-gear of the character described, the combination of a cylinder closed at each end and containing liquid, a piston within the cylinder, a shaft projecting from the piston through a stuffing-box in one end of the cylinder and adapted to rotate the said piston, a tank containing liquid and having an opening therefrom into the cylinder, and a check-valve adapted to open and close the said opening, substantially as described and for the purpose set forth.

5. In hydraulic brake-gear, a cylinder adapted to rotate in suitable bearings and connected with a brake, the said cylinder containing liquid, a suitably shaped piston adapted to be rotated within the cylinder independently of or conjointly therewith by the moving object to which the brake is to be applied and means for allowing or stopping the circulation of the said liquid to and from the piston when rotating, substantially as described.

In testimony whereof, I have hereunto signed my name to this specification in the presence of two subscribing witnesses.

LOUIS J. CRECELIUS.

Witnesses:
MARY D. WHITCOMB,
EDWARD W. FARRELL.