No. 649,187. Patented May 8, 1900.

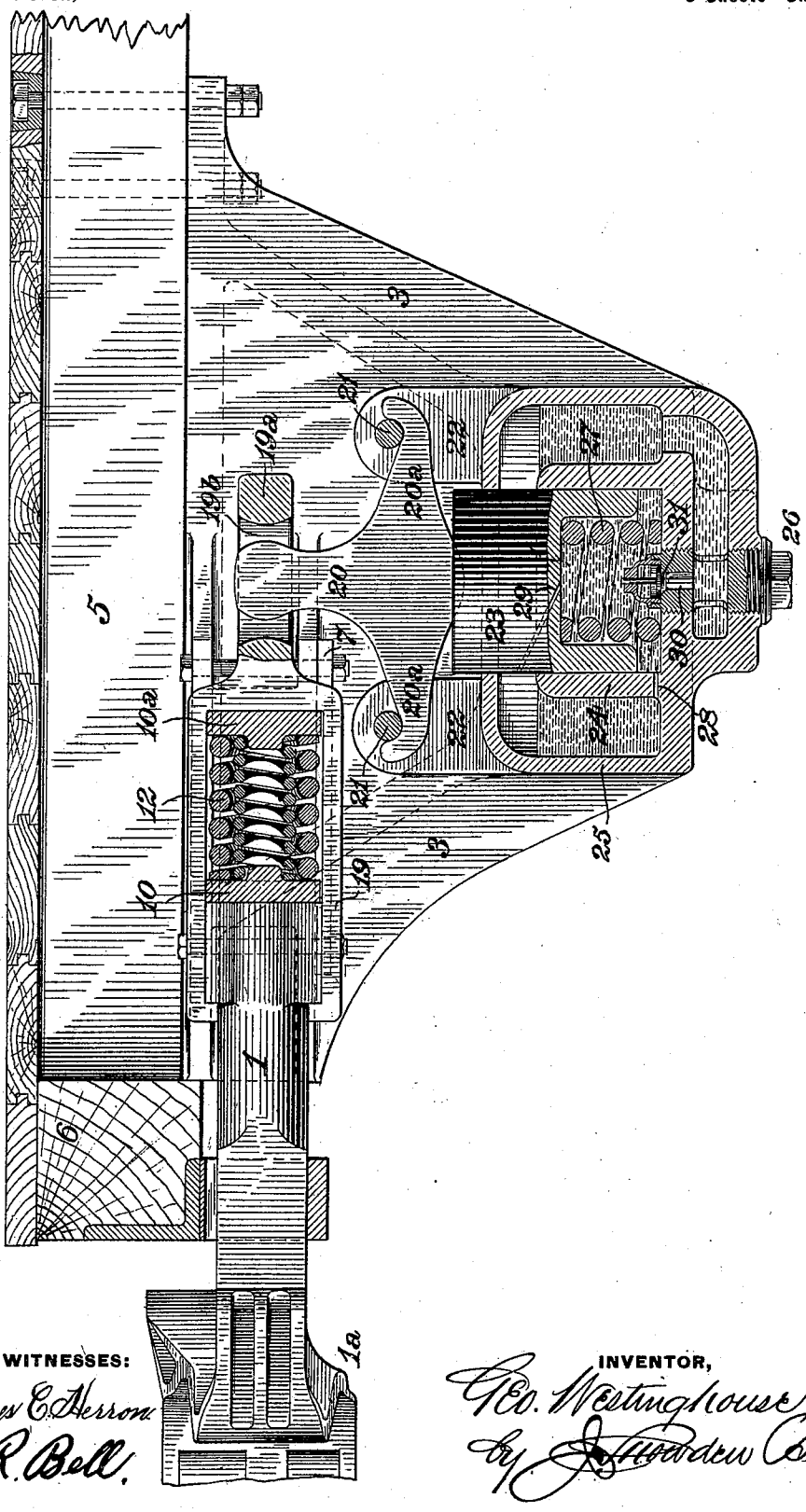
G. WESTINGHOUSE.

DRAW GEAR AND BUFFING APPARATUS.

(Application filed Jan. 23, 1899.)

(No Model.) 5 Sheets—Sheet 1.

Fig. 1.



WITNESSES:

James C. Herron

S. R. Bell.

INVENTOR,

Geo. Westinghouse

by Howard Dell

Att'y

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(No Model.) 5 Sheets—Sheet 2.

Fig. 3.

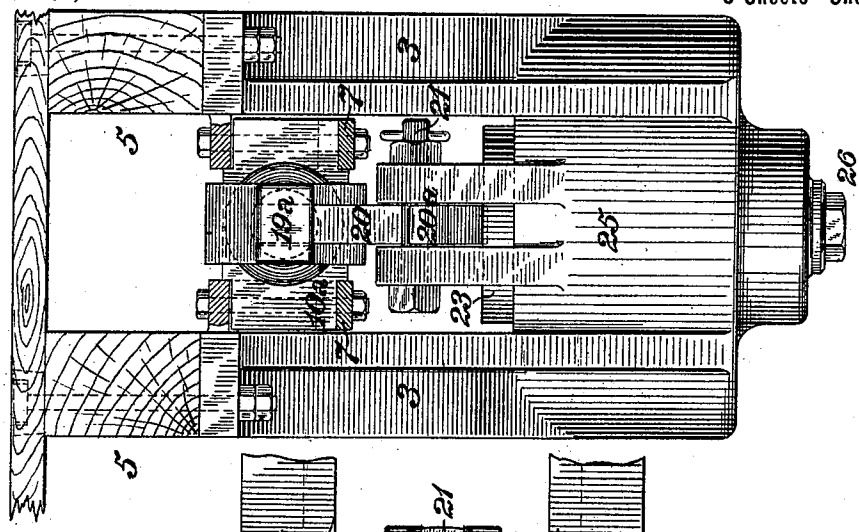
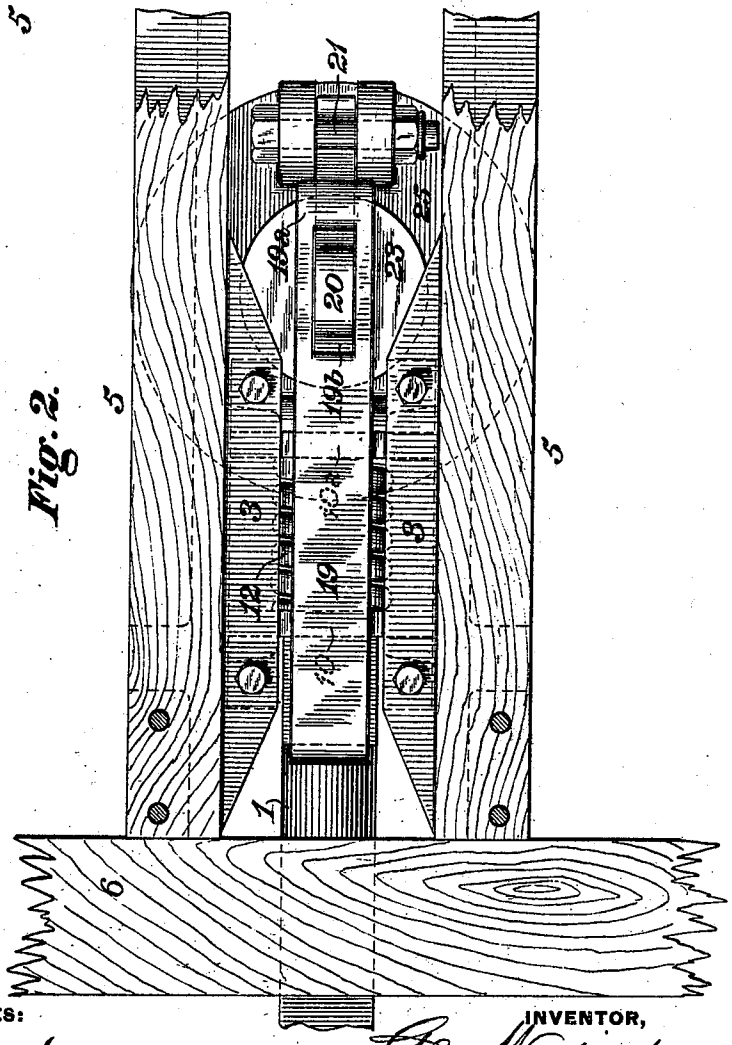


Fig. 2.



WITNESSES:

James C. Herron

S. R. Bell.

INVENTOR,

Geo. Westinghouse

by J. Howden Bell,

Att'y.

No. 649,187. Patented May 8, 1900.

G. WESTINGHOUSE.

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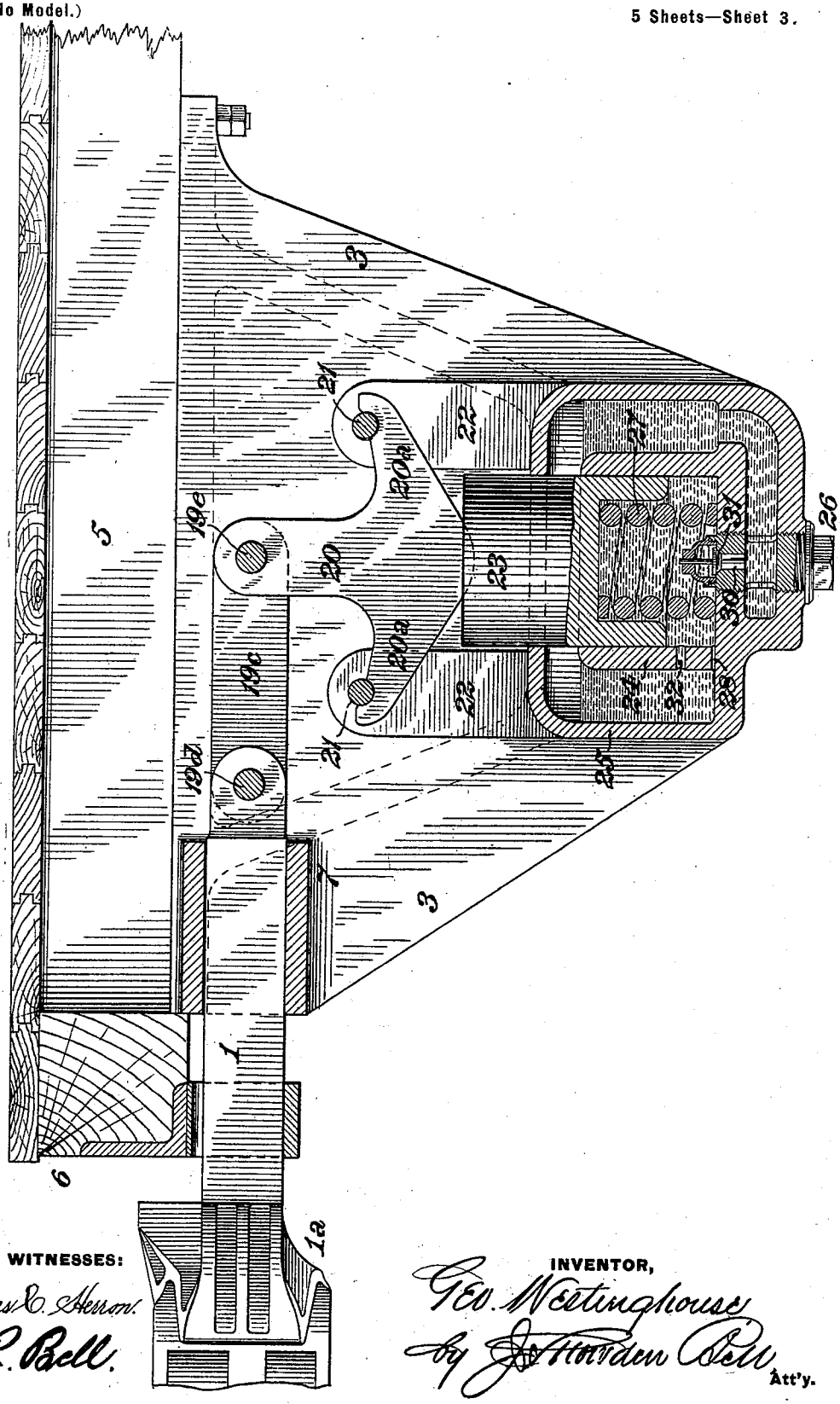
(No Model.) 5 Sheets—Sheet 3.

Fig. 4.



WITNESSES:

James C. Herron.

S. R. Bell.

INVENTOR,

Geo. Westinghouse

by Jas. Howden Bell Att'y.

No. 649,187. Patented May 8, 1900.

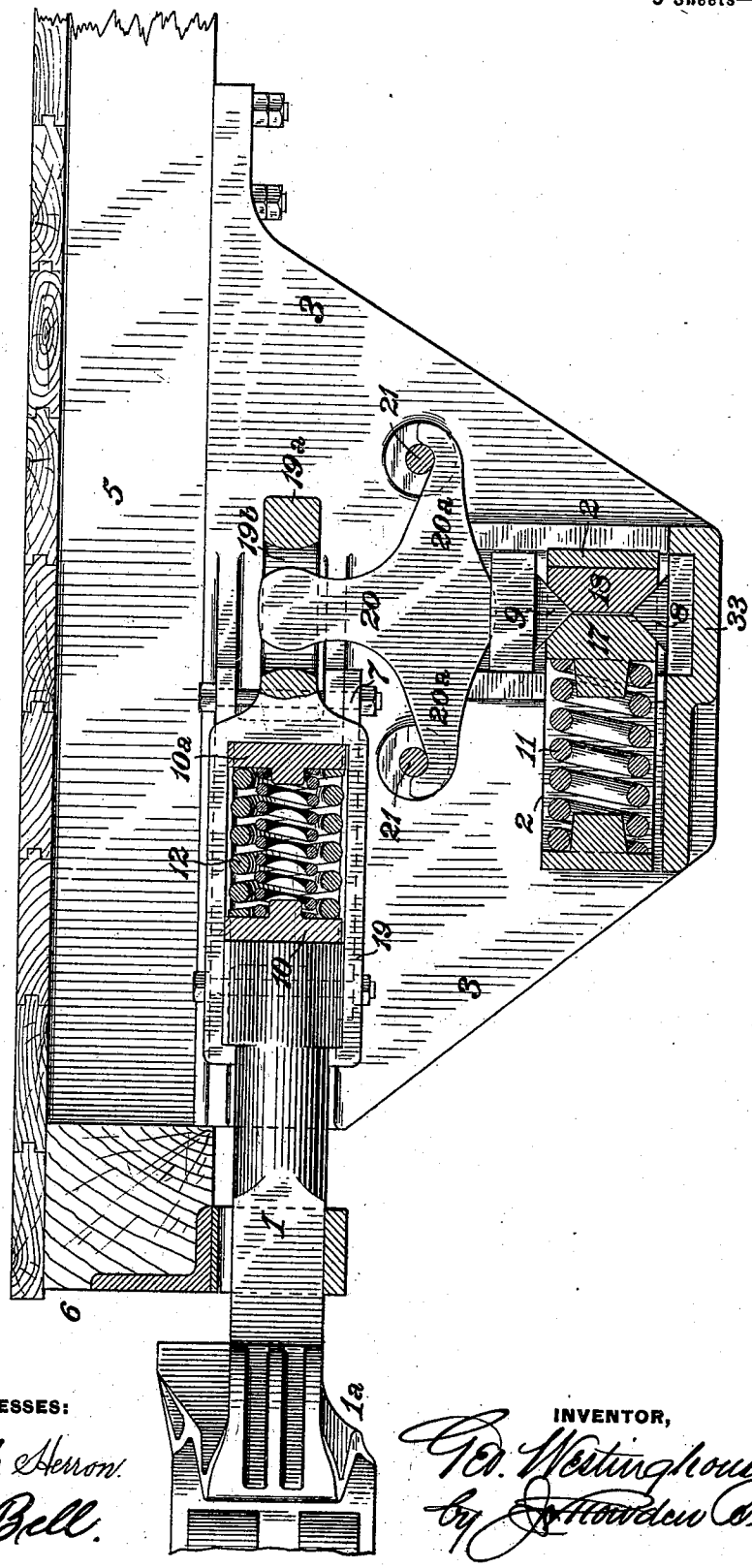
G. WESTINGHOUSE.

DRAW GEAR AND BUFFING APPARATUS.

(Application filed Jan. 23, 1899.)

(No Model.) 5 Sheets—Sheet 4.

Fig. 5.



WITNESSES:

James C. Herron.

S. R. Bell.

INVENTOR,

Geo. Westinghouse

by Howden & Bell

Att'y.

No. 649,187. Patented May 8, 1900.

G. WESTINGHOUSE.

DRAW GEAR AND BUFFING APPARATUS.

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(No Model.) 5 Sheets—Sheet 5.

Fig. 8.

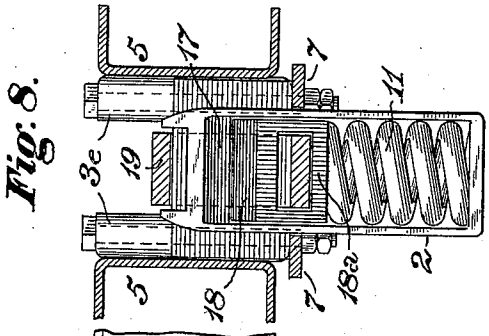


Fig. 6.

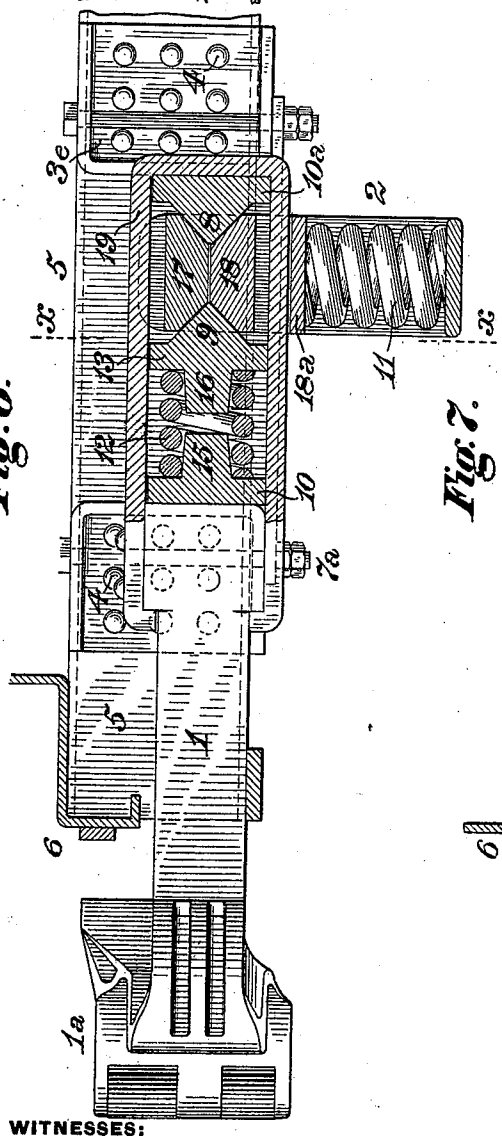
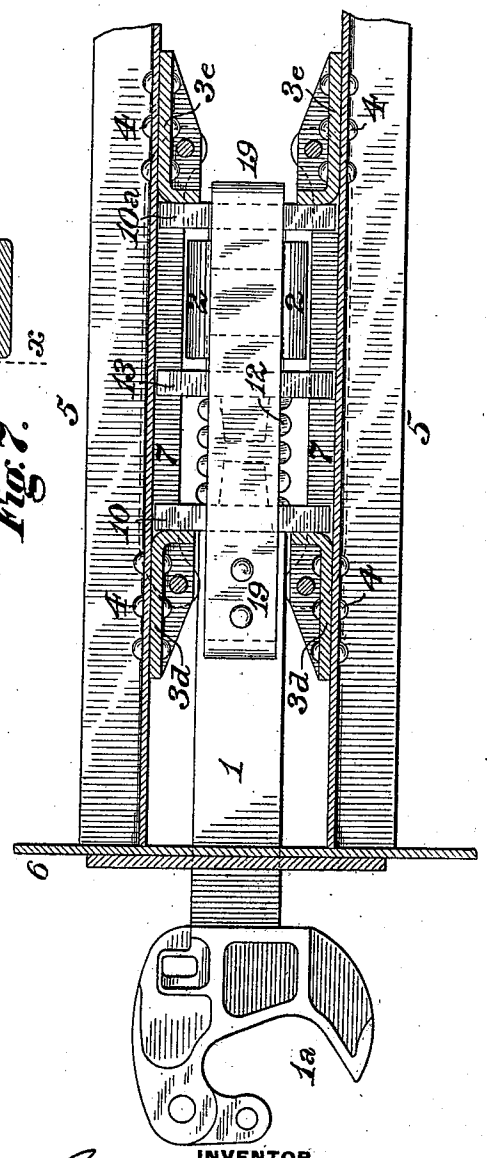


Fig. 7.



WITNESSES:

James C. Herron.

S. R. Bell.

INVENTOR,

Geo. Westinghouse.

by Lyttleton Dell.

Att'y.

UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, OF PITTSBURG, PENNSYLVANIA.

DRAW-GEAR AND BUFFING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 649,187, dated May 8, 1900.

Application filed January 23, 1899. Serial No. 703,201. (No model.)

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a certain new and useful Improvement in Draw-Gear and Buffing Apparatus, of which improvement the following is a specification.

My invention relates to devices for resisting and counteracting the shocks and strains of draft and buffing which are encountered in railroad service; and its object is to provide an apparatus of such general class in which initial or preliminary strains and those which are of comparatively minor force and extent shall be taken up in the different degrees that may be required by a resistance element having a corresponding reactionary capacity, so as to return the parts to normal positions, and comparatively great strains or those within the higher portion of and up to the maximum of the resisting capacity of the apparatus shall be opposed and counteracted by an independent resistance element which is exempted from action and wear during the exertion of preliminary or minor strains.

To this end my invention, generally stated, consists in the combination of a draw-bar, a preliminary resistance element having a reactionary capacity, an independent secondary or final resistance element the action of which is exerted independently of and supplementally to that of the initial resistance element, and connections through which the movement of the draw-bar in either direction under the application of strain imparts such strain when sufficiently great to the secondary resistance element.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a vertical longitudinal central section through a draft and buffing apparatus, illustrating an embodiment of my invention; Fig. 2, a plan or top view of the same; Fig. 3, an end view as seen from the left with the supporting and guide bars of the follower-plates in section; Fig. 4, a longitudinal central section through a draft and buffing apparatus, illustrating a structurally-modified form of my invention; Fig. 5, a similar section illustrating another structurally-modified form; Fig. 6, a view, partly in side elevation and partly in longitudinal central section, illustrating another structurally-modified form; Fig. 7, a plan or top view, partly in section, of the same; and Fig. 8, a transverse section at the line x x of Fig. 6.

In the specific form of my invention which is illustrated in Figs. 1 to 3, inclusive, a draw-bar 1, provided with a suitable coupling-head 1^a, is fitted to move longitudinally within a short range of traverse between the center sills 5 of the frame of a railroad-car, at each end thereof, or, if preferred, between draft-timbers or draw-gear supports of any suitable and approved construction, the outer end of the draw-bar and the connected coupling-head 1^a projecting beyond the end sill 6 in the ordinary manner.

Tractive force and strains of draft and buffing applied to the draw-bar 1 are transmitted therefrom to the car-frame through a resistance mechanism, to be presently described, which is supported by vertical frame-plates 3, of cast or wrought metal, secured to the lower sides of the center sills 5. A U-shaped draft-strap 19 is secured to the inner end of the draw-bar, and a front and a back follower-plate 10 and 10^a, respectively, are fitted freely in the draft-strap against the inner end of the draw-bar and the rear end of the draft-strap, respectively, so that either of said plates may be moved longitudinally therewith or may remain stationary during the movement thereof, as occasion may require. The follower-plates traverse on and, together with the draft-strap and inner end of the draw-bar, are supported by removable rails or bars 7, secured to the frame-plates 3. Inwardly-projecting flanges are formed upon the frame-plates near their upper ends to serve as guides for the tops of the follower-plates. Strains of draft are imparted to the car-frame by the front follower-plate 10, through front draw-bar stops formed upon or fixed to the frame-plates 3, and buffing strains are taken by the car-frame through similar back draw-bar stops, against which the back follower-plate 10^a normally abuts.

Preliminary strains and those which are of comparatively minor force and extent are opposed and counteracted both in draft and buffing by a preliminary resistance element, against which such strains and all other

strains to which the apparatus is subjected initially act. The essential characteristics of the preliminary resistance element are that its capacity of resistance shall be equal to the maximum determined strain which in and of itself it is designed in operation to oppose and that it shall be elastic to such degree that its reactionary capacity shall be substantially equal to the maximum strain which it is designed to oppose. It consists, therefore, of a spring or concurrently-acting plurality of springs, which may be either in the form of properly-disposed elastic bodies of metal or inclosed volumes of elastic fluid, adapted in either case to be subjected to compression by the movements of the draw-bar under applied strains. In the instance shown the preliminary resistance element 12 is applied in the form of two helical springs coiled inside the draft-strap 19 one within the other and abutting at their ends against the front and back follower-plates 10 and 10^a, said springs having a slight initial tension sufficient to hold the follower-plates in position against the draw-bar and the draft-strap, respectively. The springs 12 are compressed either by the back or the front follower-plate, accordingly as the strain applied to the draw-bar is of draft or buffing, and resist said strain to their maximum capacity, transmitting its resultant to the opposite follower-plate and the draw-bar stops against which it abuts.

Strains of draft and buffing which are in excess of the capacity of the preliminary resistance element are opposed and counteracted by a secondary or final resistance element, which is independent of the preliminary resistance element and inactive during the exertion of the function thereof and which acts subsequently and supplementally to the preliminary resistance element. The essential characteristics of the secondary resistance element are that it shall be wholly free from dependence upon the preliminary resistance element, that its capacity of resistance, when superadded to that of the preliminary resistance element, shall be equal to the maximum strain which the draft and buffing apparatus as a whole is designed in operation to oppose, and that it shall be so connected with the draw-bar that the movement of the latter in either direction under the application of strain shall impart such applied strain when sufficiently great to the secondary resistance element subsequently to and independently of the exertion of resistance to such applied strain by the preliminary resistance element. The specific mechanism employed is not in and of itself of the essence of my invention and may be materially varied in the discretion of the constructor without departure therefrom. The secondary resistance element herein exemplified is shown in Figs. 1 to 3, inclusive, as in the form of a hydraulic-pressure device, which is adapted to be actuated by the further traverse of the draw-bar 1 in either direction after the maximum resistance to the springs 12 has been exerted in opposition to draft or buffing strain. To this end a liquid-reservoir 25 for the reception of oil, water, or other incompressible liquid, which is supplied through an opening closed by a removable plug 26, is formed on or secured to the vertical frame-plates 3, below and in rear of the draft-strap 19, said reservoir inclosing an open-topped pressure-cylinder 24, with the bottom of which it communicates by a passage 30, controlled by an upwardly-opening check-valve 31. A release-port 28 of small diameter leads from the lower end of the pressure-cylinder to the liquid-reservoir, and a similar release-port 29 may also be provided in the upper portion of the reservoir to admit of the escape of any air which may be trapped within the cylinder. The pressure-cylinder is fitted with a piston or plunger 23, which passes through an opening in the top of the liquid-reservoir and rests upon a releasing-spring 27, by which it is brought to and supported in normal position. An actuating-lever 20, having the form of an inverted T, abuts at the bottom of its vertical central arm on the top of the piston 23, and its horizontal arms 20^a bear near their ends on pivot-pins 21, fixed in standards 22, projecting above the top of the liquid-reservoir 25. The upper end of the central arm of the actuating-lever 20 normally stands centrally in a longitudinal slot 19^b, formed in an extension 19^a, projecting from the inner or rear end of the draft-strap 19. The length of the slot 19^b is sufficiently greater than the width of the upper end of the lever 20 to admit of the outward and inward movements of the draw-bar which are effected under all draft and buffing strains in preliminary service without bringing the extension of the draft-strap into contact with the lever.

In the operation of a draw-gear and buffing apparatus embodying the essential and characteristic features of my invention, as in the instance hereinabove described, upon the application of draft strain to the draw-bar 1 outward movement is imparted to the connected draft-strap 19 and through the latter to the back follower-plate 10^a, thereby compressing the springs 12 to such degree as will counteract and take up the applied draft strain if within the limit of capacity of the springs 12 and bringing the front follower-plate 10 to a bearing against the front draw-bar stops. If the draft strain is greater than can be resisted by the tension of the springs 12, the continued outward movement of the draw-bar will bring the rear end of the slot 19^b in the extension of the draft-strap into contact with the actuating-lever 20 and rock said lever upon the inner pivot-pin 21 or that which is farthest from the draw-bar, thereby depressing the piston 23 and exerting pressure upon the liquid in the cylinder 24 against the resistance of said liquid in being compelled to pass out of the cylinder into

the reservoir 25 through the small release passage or passages 28 or 28 and 29, as the case may be. The resistance of the liquid will be proportionate to the strain exerted on the actuating-lever 20 and piston 23 by the movement of the draw-bar and the sectional area of the release passage or passages, and upon the release or cessation of draft strain the releasing-spring 27 will return the piston 23 and lever 20 to their normal positions and liquid from the reservoir will raise the check-valve 31 and enter the cylinder 24 coincidently with the upward movement of the piston. The springs 12 will at the same time return the draw-bar and its accessories to the normal positions shown in Figs. 1 and 2.

The operation of the mechanism when the draw-bar is subjected to buffing strain and when released therefrom is the same in all particulars as that above described, except that the strain is applied to the springs 12 by the movement of the front follower-plate 10 and is taken upon the frame through the back draw-bar stops. It will also be obvious that the back follower-plate 10^a will not be moved from its bearing against the back draw-bar stops and that the longitudinal traverse of the draw-bar and its accessories will be outward when under draft strain and inward when under buffing strain. Further, the outer pivot-pin 21 acts as the fulcrum of the actuating-lever 20. In each case, however, resistance to strain is presented preliminarily by the preliminary resisting element and resistance to strain beyond the capacity of the preliminary resistance element is exerted by the secondary resistance element—*i. e.*, the hydraulic-pressure device above described, the same being, as will be seen, wholly independent of the preliminary resistance element and being inactive during the periods in which resistance to strain is exerted by the preliminary resistance element.

The construction shown in Fig. 4 differs structurally from that above described in that the springs 12 are dispensed with and the spring 27 is adapted to perform the function of a preliminary spring for returning the parts to their normal positions. The inner end of the draw-bar 1 is coupled by a pin 19^d to a link or pair of links 19^c, which is or are coupled by a pin 19^e to the central arm of the actuating-lever 20, so that movement of the draw-bar in either direction imparts coincident and corresponding movement to the actuating-lever. The spring 27 is made of proper strength to serve as the preliminary resistance element of the apparatus, and an initial release-port 32 of sufficient capacity to admit of the free discharge of liquid from the pressure-cylinder 24 without imposing resistance to the downward movement of the piston 23 is formed in the wall of said cylinder. The port 32 is located at such distance from the top of the cylinder 24 as to be covered and closed by the piston at or about the period of its downward traverse, in which it has under the action of the strain imparted to it by the draw-bar compressed the spring 27 a sufficient amount for preliminary service. The hydraulic-pressure device in other particulars corresponds with that first described.

In operation strain either of draft or buffing, which is imparted to the draw-bar 1, is transmitted therefrom to the connected actuating-lever 20 and the piston 23 and forces the piston downwardly against the resistance of the spring 27 until it is taken up and counteracted by said spring, if it be within the limit of the capacity thereof, said spring consequently performing the function of the springs 12 of the construction first described. During such traverse of the piston fluid will escape freely from the cylinder 24 through the initial release-port 32, and no hydraulic-pressure resistance will be exerted upon the piston. If the strain upon the draw-bar is greater than that which can be resisted by the tension of the spring 27 in its first or preliminary motion, the continued movement of the draw-bar and piston will close the initial release-port 32 and will thereupon exert pressure upon the liquid in the cylinder 24, the resistance of which will, as in the instance first described, constitute a secondary resistance, by which that of the spring 27 will be supplemented and the full and final strain will be taken up. Upon the release or cessation of strain upon the draw-bar the spring 27 will return all the parts to their normal position and liquid from the reservoir will raise the check-valve and reënter the cylinder in accordance with the upward movement of the piston. The conditions and sequence of action of the preliminary and secondary resistance elements are, as will be readily seen, the same as in the construction first described.

Figs. 5 to 8, inclusive, illustrate applications of my invention embodying the same essential characteristic features, operative principle, and resultant capacity as those before described, but differing structurally therefrom in the particular that the secondary or final resistance element is in the form of a frictional resistance device, the specific construction of which is not claimed as of my invention. The form herein shown is one which has been selected for illustration by reason of its simplicity, and other structural embodiments are equally applicable in the discretion of the constructor.

The construction shown in Fig. 5 is similar to that of Figs. 1 to 3, inclusive, in so far as the structure, relation, and manner of operation of the draw-bar, preliminary resistance element, and actuating-lever are concerned, and these members need not therefore be again in detail described.

The frictional resistance device, which constitutes the secondary or final resistance element, consists of a pair of friction-blocks 17 18 and a spring 11, by which said blocks are held in contact with wedges 8 and 9 with such force as will induce the proper and desired

degree of frictional resistance to their separation. The adjoining vertical faces of the friction-blocks 17 18 are normally in or nearly in contact below the actuating-lever 20 and in or nearly in the vertical central plane thereof, and their upper and lower faces are oppositely inclined relatively one to the other and inwardly inclined relatively to their adjacent vertical faces. One of the friction-blocks, as 18, bears against one end of a horizontal strap or stirrup 2 and the other, as 17, is pressed upon with initial tension by a final spring 11, which bears against the end of the strap 2 opposite that at which the other friction-block is located. Strains of draft and buffing are imparted to the frictional resistance mechanism from the draw-bar 1 and actuating-lever 20 through a wedging device consisting of two wedges 8 and 9, which are interposed between the inclined faces of the friction-blocks 17 18, the inclination of the faces of said wedges corresponding with that of the upper and lower inclined faces of the friction-blocks, against which they are pressed and with which they are maintained in contact by the final spring 11. The lower wedge 8, which is not movable, fits in a suitable recess or abutment 33, which is formed upon or fixed to the frame-plates 3, and the upper movable wedge 9 is interposed between the friction-plates and the actuating-lever 20, the lower central portion of which abuts against its top.

In the operation of the construction strains of draft or buffing within the limit of the capacity of the preliminary resistance element—to wit, the springs 12—are counteracted and taken up by said element, as in the construction shown in Figs. 1 to 3, inclusive, and no resistance is exerted by the frictional resistance mechanism, as the slot 19^b in the extension of the draft-strap permits the traverse of the draw-bar to be made without exerting pressure upon the actuating-lever 20. If the strain applied to the draw-bar is greater than can be resisted by the tension of the springs 12, the continued traverse of the draw-bar will rock the actuating-lever upon one or the other of its pivots 21, and said lever will transmit the applied strain to the wedging device 8 9, which, acting on the friction-blocks 17 18, will effect their movement relatively to the wedging device against their frictional resistance, due to the area of wedging contact-surface and the tension of the final spring 11, until the strain is taken up. Upon the release of draw-bar strain the final spring will return the friction-blocks to their normal position, and the initial spring will return the draw-bar and its accessories to the normal positions shown in Fig. 5. As in the prior instances, the resistances of the preliminary secondary elements are independently and successively exerted.

In the construction shown in Figs. 6 to 8, inclusive, the draw-bar 1 is, as in the instance first described, provided with a coupling-head 1^a, and a U-shaped draft-strap 19 is secured to its inner or rear end. Strains of draft are imparted to the car-frame through front draw-bar stops 3^d, which are preferably, as shown, in the form of stout castings secured by rivets 4 to the metal center sills 5 or to separate draft frames or timbers, if desired, and buffing strains are taken by the car-frame through similar back draw-bar stops 3^e. A front follower-plate 10 fits freely within the draft-strap 19 and against the inner end of the draw-bar 1, and a back follower-plate 10^a fits similarly within the draft-strap and against its rear end. An intermediate follower-plate 13 fits freely within the draft-strap on the front side of a pair of friction-blocks 17 18, which are interposed between it and the back follower-plate 10^a, and will be presently described. The preliminary resistance element is an initial spring 12, which is interposed between and bears against the adjacent faces of the front and intermediate follower-plates 10 and 13, said spring surrounding thrust-blocks 15 and 16, which are formed centrally on said follower-plates, respectively. The ends of the thrust-blocks stand normally at such distance apart as will admit of the compression of the spring 12 to or nearly to its full capacity before said blocks can be brought into contact, and said spring is coiled with a slight initial tension, which is sufficient to maintain the members of the mechanism in their normal positions. The frictional resistance device, which constitutes the secondary or final resistance element, consists, as in the construction shown in Fig. 5, of a pair of friction-blocks 17 18 and a spring 11, by which said blocks are held in contact with wedges 8 and 9 with such force as will induce the proper and desired degree of frictional resistance to their separation. The adjoining lower and upper faces of the friction-blocks 17 18 are normally in or nearly in contact in the horizontal central plane of the draw-bar, and their front and rear faces are oppositely inclined relatively one to the other and inwardly inclined relatively to their adjacent faces. The upper friction-block 17 is formed integral with or may be secured to a substantial strap or stirrup 2, the vertical arms of which pass the lower bar of the draft-strap 19 with sufficient clearance to allow of the interposition of a stirrup 18^a, fixed to or formed integral with the lower friction-block 18. The upper face of the friction-block 17 and the lower face of the friction-block 18 stand normally at such distance from the upper and lower bars, respectively, of the draft-strap 19 as will admit of the degree of vertical traverse of said friction-blocks which is required in the performance of their function of opposing frictional resistance to draft and buffing strains. Strains of draft and buffing are imparted to the frictional resistance mechanism through a wedging device consisting of two wedges 8 and 9, fixed centrally upon the back follower-plate 10^a and the intermediate follower-plate 13, respectively, the in-

clination of the faces of said wedges corresponding with that of the rear and front faces of the friction-blocks 17 18, against which said wedges are pressed and with which they are maintained in contact primarily by the initial spring 12 and by the thrust-blocks 15 16 when sufficient strain has been applied to the draw-bar to overcome the tension of said spring. The end faces of the friction-blocks 17 18 are maintained in contact with those of the wedges 8 and 9 and their movement relatively thereto under the action of draft or buffing strains is resisted by a final spring 11, the tension of which exceeds that of the initial spring 12 unless the weight and area of wedging-contact surface of the friction-blocks, which act in conjunction with said final spring to resist the movement apart of the blocks, are such as, when taken in connection with a final spring of tension equal to or less than that of the initial spring, to present an aggregate resistance greater than the tension of the initial spring. The spring 11 abuts against the stirrup 2, to which, as before stated, the upper friction-block 17 is fixed, and against the stirrup 18^a, to which the lower friction-block 18 is fixed, and consequently the frictional resistance of said friction-blocks to the action of the wedging device, which tends to separate or move them apart when subjected to pressure or strain in either direction from the draw-bar, is a resultant of and proportionate to the tension of the spring 11. It will be obvious that the friction-blocks and the final spring acting thereon might be duplicated, if desired, without variation of operative principle, and it will also be seen that the tension of the spring 11 may be reduced proportionately to increase of weight and area of contact-surface of the friction-blocks.

In the operation of the construction above described upon the application of draft strain to the draw-bar 1 outward movement is imparted to the connected draft-strap 19 and through the latter to the back follower-plate 10^a. The resistance to the movement of the friction-blocks being, as before indicated, greater than the tension of the initial spring 12, the friction-blocks are maintained in normal position by the aggregate resistance, which acts to that end, and said blocks, with their stirrups 2 18^a and the final spring, are moved outwardly by the back follower-plate and in turn move the intermediate follower-plate 13 outwardly, compressing the initial spring 12 to such degree as will counteract and take up the applied draft strain if within the limit of capacity of the initial spring and bringing the front follower-plate 10 to a bearing against the front draw-bar stops 3^d. If the draft strain is greater than can be resisted by the tension of the initial spring, the continued outward movement of the draw-bar, draft-strap, and the back and intermediate follower-plates will cause the thrust-blocks 16 and 15 to abut, and the wedging device 8 9, acting on the friction-blocks 17 18, will force them apart against their frictional resistance due to their weight, area of wedging contact-surface, and the tension of the final spring 11 until the draft strain is taken up. Upon the release of draft strain the final spring will return the friction-blocks to their normal position, and the initial spring will return the draw-bar and its accessories to the normal positions shown in Figs. 6 and 7.

The operation of the mechanism when the draw-bar is subjected to buffing strains and is released therefrom is as above described, except that the strain is applied to the initial spring 12 by the movement of the front follower-plate and is taken upon the frame by the back draw-bar stops 3^e. It will also be obvious that the back follower-plate 10^a will not be moved from its bearing against the back draw-bar stops and that the longitudinal traverse of the draw-bar and its accessories will be outward when under draft strain and inward when under buffing strain. In each case resistance to strain is independently and successively exerted by a preliminary resistance element and an independent secondary resistance element, as in the several constructions before described.

I do not claim the specific frictional resistance mechanism which is herein described and shown, the same not being in and of itself of my invention; neither do I claim specifically either of the several embodiments of my generic invention herein described and shown, in which the secondary resistance element is exemplified in the form of a hydraulic pressure device, said structural embodiments being specifically and in and of themselves the invention of H. Herman Westinghouse and Frank Moore and constituting the subject-matter of a separate application by them, filed March 31, 1899, Serial No. 711,268.

I claim as my invention and desire to secure by Letters Patent—

1. In a draw-gear or buffing apparatus, the combination of a draw-bar, a preliminary resistance element having a reactionary capacity, a separate secondary or final resistance element which is adapted to exert its action independently of and supplementally to that of the preliminary resistance element, and connections from the draw-bar to the secondary resistance element, through which the movement of the draw-bar in either direction under applied strain may impart such strain, when sufficiently great, to the secondary resistance element.

2. In a draw-gear or buffing apparatus, the combination of a draw-bar, a preliminary resistance element having a reactionary capacity, an independent secondary resistance element, means for independently and successively exerting strain upon the preliminary and secondary resistance elements, and connections from the draw-bar to the secondary resistance element, through which the movement of the draw-bar in either direction under applied strain may impart such strain,

when sufficiently great, to the secondary resistance element.

3. In a draw-gear or buffing apparatus, the combination of a draw-bar, a preliminary resistance element, adapted to primarily oppose applied strains, and having a reactionary capacity, a secondary resistance element adapted to independently and supplementally resist applied strains, means for exerting strain upon the preliminary resistance element independently of the action of the secondary resistance element, means for exerting strain upon the secondary resistance element independently of and supplementally to the action of the preliminary resistance element, and connections from the draw-bar to the secondary resistance element through which the movement of the draw-bar in either direction under applied strain may impart such strain, when sufficiently great, to the secondary resistance element.

4. In a draw-gear or buffing apparatus, the combination of a draw-bar, a preliminary resistance element having a reactionary capacity, a secondary or final resistance element which is operatively independent of the preliminary resistance element, means for exerting strain to a determined limit upon the preliminary resistance element without affecting the secondary resistance element, means for exerting strain upon the secondary resistance element independently of and supplementally to the action of the preliminary resistance element, and connections from the draw-bar to the secondary resistance element, through which the movement of the draw-bar in either direction under applied strain may impart such strain, when sufficiently great, to the secondary resistance element.

5. In a draw-gear or buffing apparatus, the combination of a draw-bar, a preliminary resistance element having a reactionary capacity, an independent secondary or final resistance element, means for exerting strain upon the preliminary resistance element to the limit of its capacity without bringing the secondary resistance element into action, means for exerting strain upon the secondary resistance element independently of and supplementally to the action of the preliminary resistance element, and connections from the draw-bar to the secondary resistance element, through which the movement of the draw-bar in either direction under applied strain may impart such strain, when sufficiently great, to the secondary resistance element.

6. In a draw-gear or buffing apparatus, the combination of a draw-bar, a preliminary spring resistance element acted on by movements of the draw-bar through a determined preliminary range of traverse, a secondary resistance element which is inactive during the preliminary traverse of the draw-bar, and connections from the draw-bar to the secondary resistance element, through which the secondary resistance element is acted on by movements of the draw-bar, in either direction, through a further or final range of traverse.

7. In a draw-gear or buffing apparatus, the combination of a draw-bar, a preliminary spring resistance element, a secondary frictional resistance element, means for independently and successively exerting strains upon the spring resistance and frictional resistance elements, and connections from the draw-bar to the frictional resistance element, through which the movement of the draw-bar in either direction under applied strain may impart such strain, when sufficiently great, to the frictional resistance element.

8. In a draw-gear or buffing apparatus, the combination of a draw-bar, an initial spring which preliminarily resists strain applied to the draw-bar, a secondary frictional resistance mechanism which is operatively independent of the initial spring, a final spring acting in opposite direction to the initial spring on the secondary resistance mechanism, and instituting an aggregate final resistance which is greater than the tension of the initial spring, and connections from the draw-bar to the frictional mechanism, through which the movement of the draw-bar in either direction under applied strain may impart such strain, when sufficiently great, to the frictional mechanism.

9. In a draw-gear or buffing apparatus, the combination of a draw-bar, an initial spring, a final spring, a frictional mechanism, means for applying strain to the initial spring throughout the range of its tension without inducing frictional resistance, means for exerting additional resistance to applied strain by the action of the frictional mechanism and final spring when the limit of compression of the initial spring has been attained, and connections from the draw-bar to the frictional mechanism, through which the movement of the draw-bar in either direction under applied strain may impart such strain, when sufficiently great, to the frictional mechanism.

10. In a draw-gear or buffing apparatus, the combination of a draw-bar, follower-plates actuated thereby and having thrust-blocks on their adjacent faces, an initial spring interposed between and bearing on the follower-plates, a wedging device actuated by a follower-plate, a frictional mechanism subject to the action of the wedging device, and a final spring acting on the frictional mechanism in opposition to the action of the wedging device.

11. In a draw-gear or buffing apparatus, the combination of a draw-bar, follower-plates actuated thereby and having wedge-surfaces on their adjacent faces, friction-blocks having inclined end faces abutting against the wedge-surfaces of the follower-plates, an initial spring bearing against one of the follower-plates and against a fixed abutment, and a final spring acting on the friction-blocks in direction to maintain them in contact with the wedge-surfaces.

12. In a draw-gear or buffing apparatus, the combination of a draw-bar, a draft-strap connected thereto, front, back, and intermediate follower-plates fitting freely in the draft-strap, an initial spring interposed between and bearing on the front and intermediate follower-plates, friction-blocks having inclined end faces abutting against wedge-surfaces on the intermediate and back follower-plates, and a final spring, acting on the friction-blocks in direction to maintain them in contact with the wedge-surfaces.

GEO. WESTINGHOUSE.

Witnesses:
J. SNOWDEN BELL,
W. D. UPTEGRAFF.