G. WESTINGHOUSE. Jr.

Automatic Brake-Regulator.

No. 214,337. Patented April 15, 1879.

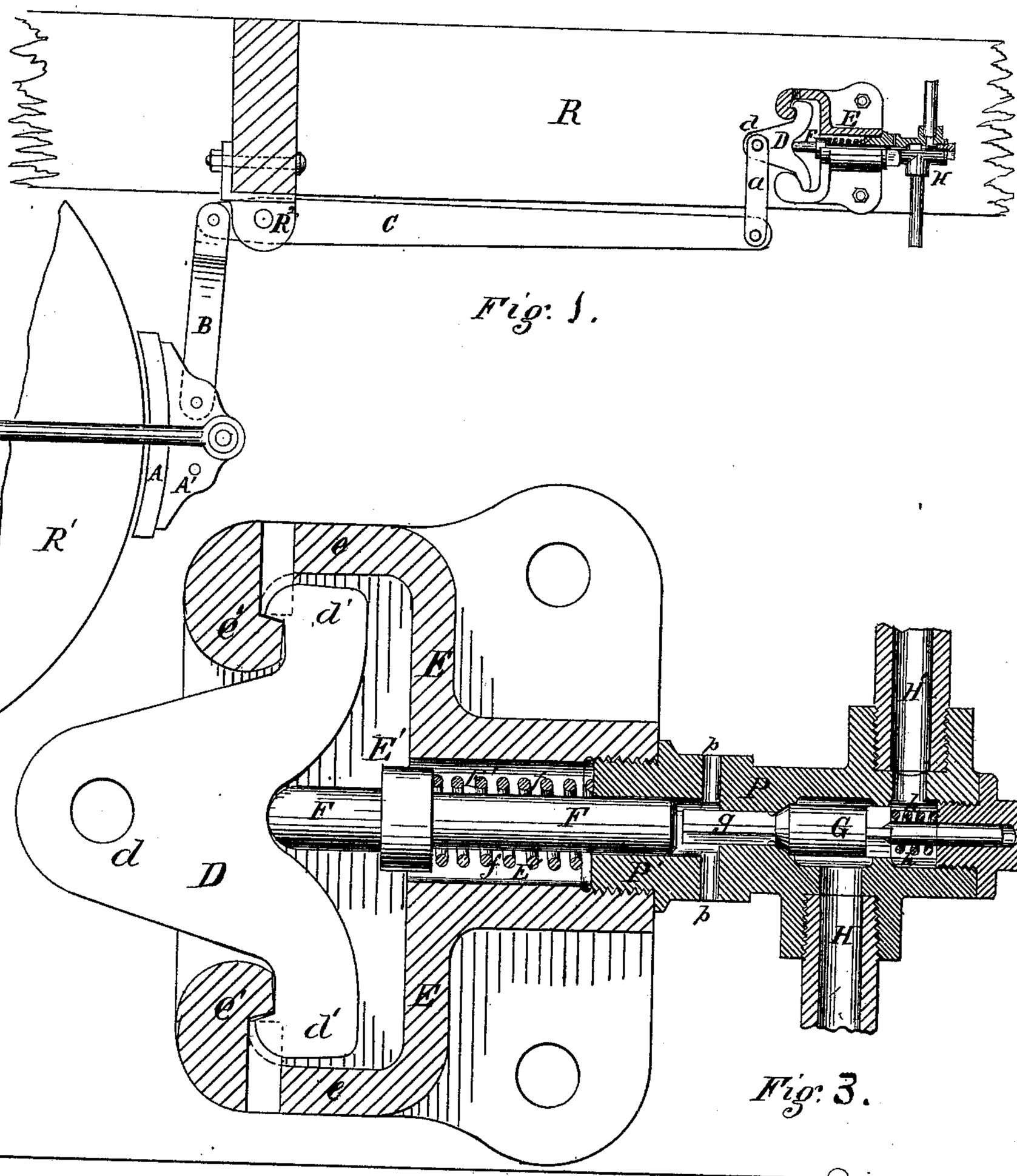

Fig: 1.

Fig: 3.

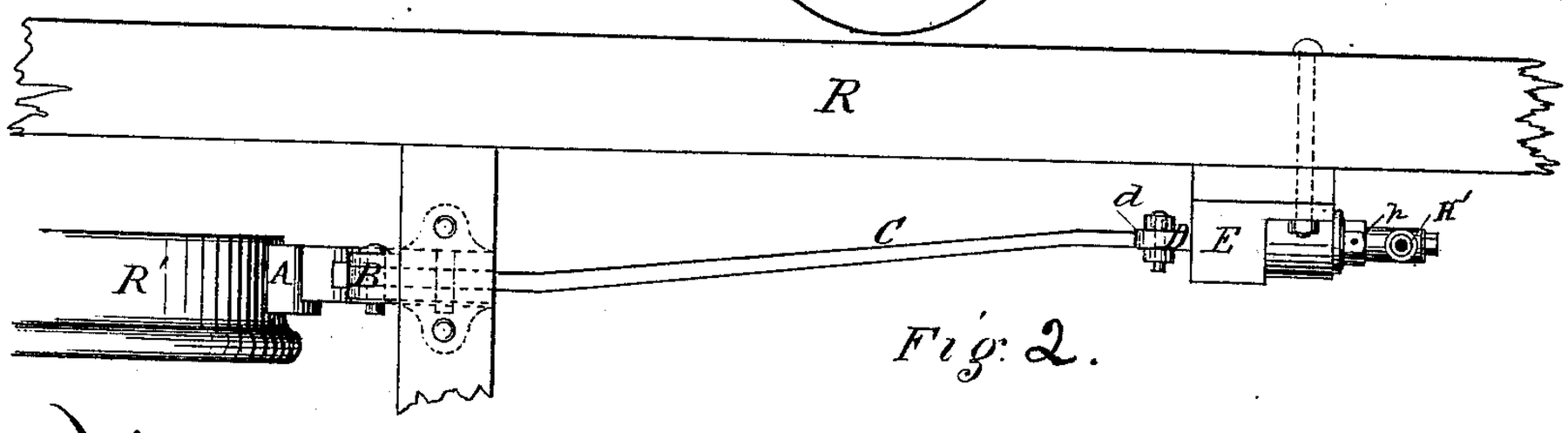

Fig: 2.

Witnesses
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GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

IMPROVEMENT IN AUTOMATIC BRAKE-REGULATORS.

Specification forming part of Letters Patent No. **214,337**, dated April 15, 1879; application filed March 10, 1879.

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, Jr., of Pittsburg, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Automatic Brake-Regulators; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—like letters indicating like parts—

Figure 1 is a side elevation of so much of a car-brake mechanism as is necessary to illustrate my present improvement. Fig. 2 is a plan view of the same; and Fig. 3 is a longitudinal section to an enlarged scale of the regulating-valve which I employ, and the apparatus for working it.

In operating my various systems of brakes upon railways, I have frequently observed that the amount of pressure required to be exerted against the brake-shoes varied to a great extent according to speed, state of the rail, (whether dry or wet or greasy,) and of the kind of material in the shoes.

To ascertain if possible the laws governing the action of the various forces brought into play by the use of brakes, I had made a special brake-vehicle fitted with self-recording apparatus to register at each instant, first, the force with which the wheels were pressed by the brake-shoe; second, the amount of resistance or drag between the shoes and wheels; third, the weight with which the wheels pressed the rails; fourth, the exact rate of speed of the vehicle; fifth, the rate of rotation of the braked wheels.

With this special vehicle and recording apparatus over three hundred sets of diagrams were obtained. From these diagrams it was found among many other important things, first, that the friction between the shoes and wheels varied greatly, being very little at high speeds and gradually increasing as the train decreased in speed; second, that if more than a sufficient force were applied to the shoes the wheels would suddenly cease to rotate and continue sliding upon the rails until the brake force was almost entirely released; third, that the retarding effect with the wheels sliding upon the rails was less than one-third ($\frac{1}{3}$) of that obtainable if the wheels were prevented from sliding; fourth, that on the same kind of rails, whatever the speed of the train, the wheels began to slide when the friction between the shoes and wheels reached a certain percentage of the load of the wheels upon the rails, and that this percentage was nearly constant upon all conditions of rails if sand were used; fifth, that the friction between the brake-shoes and wheels, with the train running at a uniform speed, lessened very considerably, according to the length of time the shoes were in contact with the wheels.

These various facts rendered it desirable, in order to secure the very best results, to provide a great brake force at high speed, and to automatically regulate this force against the shoes by the friction or drag of the shoes.

The object of my present improvement is to vary the pressure of the brake-shoes against the car-wheels with the varying speed of the train by the automatic action of the wheel or wheels acting as a drag, and thereby moving to a greater or less extent a regulating-valve, which shall, to the extent of such opening, vary the operative fluid-pressure according to the requirements.

A portion of the frame of a car-body is represented at R, and R^1 shows a portion of one of the wheels.

The brake-shoe A, attached to any suitable brake-block or carrier, A′, is suspended by a link, B, from one end of a lever, C, which latter is fulcrumed by a stirrup, R^2, to some convenient part of or attachment to the car-body.

The opposite end of the lever C is connected by a link, *a*, to one arm, *d*, of a three-armed lever, D.

The ends of the other two arms, *d′ d′*, of this lever are arranged back of or bear against fixed fulcra of any suitable construction, one such being represented by the block E, in which the arms *e* extend out far enough to make room for the operation of the lever-arms *d′* inside and back of the inwardly-projecting lugs *e′*, which give the fulcra desired.

The regulating-valve G is arranged in a valve-case, P, which latter connects by a port

and pipe, H, with the pipe leading to the brake-cylinder, and by the port H′ with the main brake-pipe or other source of supply from which the operative fluid-pressure is taken to apply the brakes.

The valve G is held to its seat partly by such fluid-pressure, and, if necessary, partly by a spring, *h*. Escape-ports are shown at *p*.

The valve G is of such form that when it is moved far enough to allow air to escape from the pipe H, it, at the same time, cuts off the supply from its source. If the valve G again seats more fluid may enter to increase or keep up the pressure in the cylinder.

A hollow screw-stem, P′, affords means of connecting the valve-case P with a chamber, E′, in the block E.

Between the lever D and the end of the stem *g* of the regulating-valve G, I interpose a stem, F, which is held over against or toward the lever D by means of a spring, *f*.

When the brakes are applied by fluid-pressure acting in the brake-cylinder, the valve G being closed, the wheel, by the friction of the brake-shoe upon it, tends to drag the brake-shoe and block along with it, and so to move the adjacent end of the lever C upward or downward, according as the wheel is revolved in one direction or the other. This action, communicated through the link *a* to the triple lever D, tends to make it move on the end of the one or the other of its arms *d′* as a fulcrum, and to press forward the stem F in opposition to the spring.

When the effective pressure of the brake-shoe on the car-wheel has become so great that the dragging force thus transmitted to the stem F is sufficient to overcome the pressure of the spring or springs, and also the fluid-pressure on the valve G, the valve is opened and the air or other fluid escapes from the brake-cylinder, thus reducing the pressure therein, and consequently reducing the force with which the brake-shoe is pressed against the wheel. When this force is sufficiently reduced so as to lessen sufficiently the dragging effect of the wheel on the shoe, the valve G automatically closes wholly or in part, as the case may be.

As a result of this construction the amount or degree of air or other fluid pressure brought to bear on the car-wheels is automatically varied or regulated according to the varying speed of the train, so that a retarding force, approximately uniform, is brought to bear on the wheels at all times when the brakes are applied.

In fitting up or adjusting the apparatus, provision should be made for the application of a certain amount of brake-power before the dragging effect or function of the car-wheel begins to open the valve. The amount of force thus brought into action to resist the dragging tendency of the car-wheel will vary under different conditions of leverage, pressure, adhesion of shoes and wheels, slipperiness of the rail, &c.; but the effect of these forces is so well known and understood that the skilled mechanic will have no difficulty in making proper provision for the element referred to by the use of a spring or springs having the proper degree of elasticity or resistance to compression, or by the use of an adjustable bearing at one end of one of the springs; and as the fluid-pressure on the valve G also acts against the dragging force of the car-wheels, such force may be varied also by charging the pipe H with a greater or less pressure than that employed in the cylinder.

In the experiments alluded to it was found that the friction or retarding force varied from fifteen per cent. to twenty-five per cent. of the weight of load upon the braked wheels.

I therefore have found it advisable to make the spring *f* to resist an action of ten per cent. of the load of the wheel upon which the operating-shoe is attached, and to make the valve G of such an area that with a high pressure an additional ten per cent. may be obtained.

When the rails are slippery the pressure is reduced, and the total retarding force is reduced at the same time to a point below that required to cause the wheels to slide; but in any case the adjustments ought to be such that with the fluid-pressure employed the regulating-valve should be opened before the traction of the wheel on the rail is broken, so that in no case shall the wheels be caused to slide.

Various modifications or changes may be made in the construction and arrangement of the devices which utilize and transmit the dragging effect or friction of a rotating car-wheel to a valve which communicates with the fluid-pressure conduits or receptacles, as also in the valve itself and its connections, without any substantial departure from the proper scope of my invention, and all such changes or modifications as leave the mode of operation and function substantially the same are hereby included herein. For example, the kind or class of valve may be changed, as also the number of intermediate levers, the direction in which the leverage acts along with the direction of the movement or throw of the valve, &c., and such like changes may be made to adapt the apparatus to a like use where the brakes are actuated by a vacuum or partial vacuum instead of by a previously-generated or stored-up fluid under compression; and for the purposes of the present case vacuum-brakes are herein included in the class of fluid-pressure brakes, and the vacuum-pipes and chambers are included within the term "fluid-pressure conduits or receptacles," they being in the operations described mechanical equivalents each of the other.

I am aware that it is not new to arrange a valve in the branch pipe leading from the brake-pipe to the brake-cylinder, with such means of adjustment that the train-men may, by varying such adjustment, increase or lessen the effective air-pressure according to the

weight of the car or condition of the track; but I am not aware of any previous knowledge or use of any means by which the car-wheels themselves shall, by their varying speed of rotation, automatically regulate the supply of fluid-pressure to the brake-cylinders.

I claim herein as my invention—

1. In fluid-pressure brake apparatus, the method of varying the pressure of the brake-shoes on the wheels by causing the wheel to operate as a drag on the shoe, and by a suitable connection thence to a valve to effect automatically a variation in the fluid-pressure with the varying speed of the wheel, substantially as set forth.

2. The combination of a car-wheel, a brake-shoe having a short range of motion in the general direction of the length of its operative face, a valve the port of which communicates with the fluid-pressure conduits or receptacles, and a suitable system of interposed levers for transmitting the dragging effect of the wheel to the valve, substantially as and for the purposes set forth.

3. A three-armed lever, D, in combination with block E, as a device for transmitting, in the manner substantially as described, the dragging effect of the car-wheel to the valve, whichever way the wheel may be revolving.

4. A valve-case and valve having a port and pipe connection, H, with the fluid-pressure conduits or receptacles, in combination with a tripping apparatus operated by the drag of the car-wheel on the brake-shoe, whereby, when the pressure of the shoe on the wheel becomes too great, the valve will be automatically opened and the fluid-pressure lessened, substantially as set forth.

5. The combination of spring-valve G, port and pipe H, stem F, block E, tripping-lever D, and suitable lever-connections thence to the brake-shoe, substantially as and for the purposes set forth.

6. The combination of car-wheel, brake-shoe, link B, lever C, link *a*, tripping-lever D, block E, stem F, spring-valve G, and ports H and *p*, substantially as set forth.

In testimony whereof I have hereunto set my hand.

GEORGE WESTINGHOUSE, JR.

Witnesses:

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