

# PATENT SPECIFICATION

600,762



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(Under Section 91, sub-sections (2) and (4) of the Patents and Designs Acts, 1907 to 1946, a single Complete Specification was left in respect of this Application and of Application No. 9492/45 and was laid open to inspection on April 16, 1945.)

Index at acceptance:—Class 103(i), E2f3a.

## COMPLETE SPECIFICATION

### Brake-system for Vehicles

We, SOCIETE ANONYME ANDRE CITROEN, a French Body Corporate, of 117—167, Quai de Javel, Paris (Seine Department), France, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

One of the great problems in vehicle braking consists in distributing the braking efforts to the vehicle wheels proportionally to loads for the time being supported by the individual wheels. With a view to solving this problem several brake systems have already been proposed, which involve varying the leverage of the vehicle brake-control means, or fluid pressures acting upon the said means, or directly upon brake-jaws. The variations of the lever arms or fluid pressures in the said brake systems are controlled by relative displacements of the vehicle chassis and the wheels, such displacements being usually a function of the load supported by the wheel or axle under consideration.

The spirit of the invention as hereinafter set forth is different from that of the brake systems above alluded to, in the sense that it is the reaction of suspended parts upon the vehicle chassis that renders it possible to regulate the fluid pressure, employed for transmitting the braking efforts, proportionally to the supported charge.

Consequently, the brake system according to this invention consists in transmitting the effort of reaction of the suspension upon the chassis to a device designed for regulating the fluid pressure employed for transmitting the braking effort proportionally to the said effort, i.e., to the load supported by the vehicle wheel.

For this purpose the resilient suspension member for each wheel acts on a piston which moves in a cylinder communicating through a conduit filled with a suitable fluid with a second cylinder, the

piston of which acts on a free lever forming the connection with the piston of a third cylinder, provided with a balanced valve controlling the admission of the braking fluid; the free lever pivots about one of the generating lines of a roller guided by a plate and mounted at the end of a rod secured to the brake pedal. The amplitude of this pivotal movement is greater or less according to the displacements of the piston transmitting the reaction of the suspension.

These displacements are produced in one direction or the other according as the braking pressure obtained in the utilisation piping leading to the brake is stronger or weaker than that which is necessary, this necessary pressure being proportional, as will hereinafter be shown, on the one hand to the load carried by the wheel, and on the other hand to the force exerted by the driver upon the brake pedal.

Figure 1 diagrammatically shows a brake system embodying the invention. There are shown one single vehicle wheel and one single regulation device hereinafter called a regulator. The suspension in this embodiment is constituted by means of a torsion bar. For the sake of clarity, the regulator is shown on a larger scale than the remainder of the embodiment;

Figures 2 and 3 are diagrammatic representations of a suspension effected by means of laminated springs and by means of helical springs respectively;

Figure 4 shows a suspension effected by means of a fluid.

As shown in Figure 1, the vehicle wheel A is connected with the chassis by means of an arm B fast to a torsion bar C. The bar C has at its end a lever D bearing on a piston E adapted to slide in a cylinder F. The latter is adapted to communicate by means of a small conduit G with a cylinder of small cross-section H forming a part of the regulator and including a

[Price 1/-]

piston J. The space comprised between the pistons E and J is filled with liquid.

The piston J bears on one end of a free lever K, the other end of which bears upon  
5 another piston L. The fulcrum of the lever K is constituted by the generating line of a movable roller M adapted to bear upon the closure plate N.

The piston L when depressed by the  
10 lever K opens a balanced valve O, which is adapted to admit the fluid under pressure and deliver the same towards the point or points of its utilisation, that is to say, towards the cylinder controlling the  
15 brake shoes. By its inverse displacement this piston L enables the fluid to be exhausted.

The conduit P serves for introducing the liquid under pressure, which liquid must  
20 have for its minimum pressure the maximum pressure of utilisation.

The conduit Q serves to connect the regulator with an apparatus of utilisation which, in the example selected, is a cylinder X with its two pistons Y adapted to act upon the brake-jaws Z as in ordinary hydraulic brake-mechanism.

R denotes the release and return conduit for the liquid.

30 Displacements of the roller M are controlled by means of a brake-pedal S, which also controls the regulators for other vehicle wheels. This pedal is brought back to its initial position or position of  
35 rest by means of a spring T. In order to give sensibility to the brake system, i.e., to enable the vehicle driver to have under his foot an exact feeling of the brake-pressure existing in the piping Q that leads to  
40 the cylinder controlling the brake shoes, this pressure is transmitted to a piston U adapted to act in opposition to the efforts imparted to the pedal by the driver, since  
45 the pressure in the cylinder V enclosing the piston U is that existing in the conduit Q with which this cylinder is connected.

The operation of this brake system is as follows:—

50 By construction, the pressure prevailing in the conduit G is proportional to the load supported by the wheel. Therefore the piston J transmits to the lever K an effort proportional to this load. The pedal S  
55 being at rest, the roller M has its centre coinciding with the axis of the piston J; so no effort is transmitted to the piston L. When the roller M is displaced by the driver pressing upon the pedal S, the lever  
60 K, under the action of the force transmitted by the piston J, pivots on a generating line of the roller M and lowers the piston L, which then depresses the balanced valve O. Thus, the fluid under  
65 pressure admitted through the conduit P

can pass into the conduit Q for feeding the brake-means on the wheel.

The valve O undergoes a downward thrust which depends both upon the upward pressure exerted by the piston J  
70 and upon the position of the roller M upon the lever K. When the pressure in the pipe Q reaches a value sufficient to counterbalance this downward thrust, the valve O is raised against its seat, and the  
75 communication between the inlet pipe P and the pipe Q is consequently interrupted.

The pressure in the conduit Q that controls the brake shoes is therefore proportional on the one hand to the vehicle load, as indicated by the pressure in the conduit G, and on the other hand to the operative displacement of the pedal S. As  
80 hereinbefore stated, in order that the driver may have an exact sensation of the pressure transmitted in the piping Q, the latter is connected to a reaction cylinder, in which a piston U transmits to the pedal an antagonistic force strictly proportional  
85 to the braking pressure.

When the brake-pedal is released the roller M returns to its initial position along the axis of the piston J. The lever K then becomes inoperative with respect to  
90 the piston L, and the latter is raised by the pressure existing in the pipe Q. The fluid passes through a central bore provided in the piston L, and escapes therefrom to the return or release conduit R.  
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In the case of the suspension effected by means of helical springs C<sup>1</sup>, these act directly on the piston E of the cylinder F (Figure 3); in the case of laminated springs (Figure 2) the piston E is connected to the shackle links C<sup>11</sup> thereof.  
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In the case of a suspension effected by means of an elastic fluid (e.g. compressed air) or suspension by hydraulic means, as shown in Figure 4, it is sufficient to use  
110 the fluid pressure directly and transmit the same by the aid of a conduit G to the regulator piston J.

The fluid under pressure that serves for brake operations may be supplied through  
115 the medium of storage means, or, in the case of hydraulically operated brakes, by a pump, controlled for example from a tank under vacuum, and adapted to start at the first depression of the brake pedal.  
120

The lay-out shown in Figure 1 is concerned with the brake system for one wheel only. For a vehicle with four wheels the brake system normally has four regulators, simultaneously controlled by  
125 the brake pedal. Four reaction cylinders are also necessary, each with a piston U acting upon the brake pedal.

Practically, the distribution of braking efforts as a function of the loads is quite  
130

adequate when effected as between axles. In this case, the brake system comprises only two regulators (for a four-wheel vehicle) and two reaction cylinders. But the regulators must have two pistons J, located in the same plane as the axis of the roller M in its position of rest. One of the regulators serves to determine the braking pressure for the front wheels and the other for the rear wheels.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A braking device for a vehicle in which the braking effort transmitted to each wheel is automatically proportional to the load supported by the wheel and is also a function of the force exerted upon the brake pedal, characterised by the feature that the force of reaction of the suspension of each wheel upon the under-frame is transmitted hydraulically, through the medium of a piston sliding in a first cylinder serving as a reaction point for the suspension spring, and of a

pipe, to a second cylinder provided with a piston acting upon one end of a free lever, the other end of which acts upon a piston in a third cylinder, provided with a balanced valve controlling the admission and exhaust of a braking fluid furnished by any pump, the said free lever being fulcrummed upon a generatrix of a roller movable throughout the length of the free lever, this roller being mounted on the end of a rod displaced by the brake pedal.

2. A braking device as claimed in Claim 1, wherein the brake pedal is subjected to the joint action of a spring and of a piston which is subjected in its cylinder to the brake-liquid pressure.

3. A braking device as claimed in Claim 1, in which, in the case of a suspension utilising an elastic fluid (compressed air for example) instead of the metal springs usually employed, the pressure of this fluid is exerted directly upon the piston of the second cylinder, transmitting to the latter a pressure proportional to the load supported by the wheel.

Dated this 16th day of April, 1945.

MARKS & CLERK.

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[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1

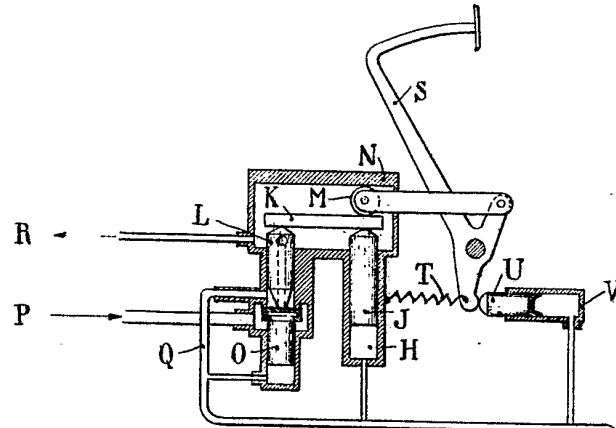


Fig. 3

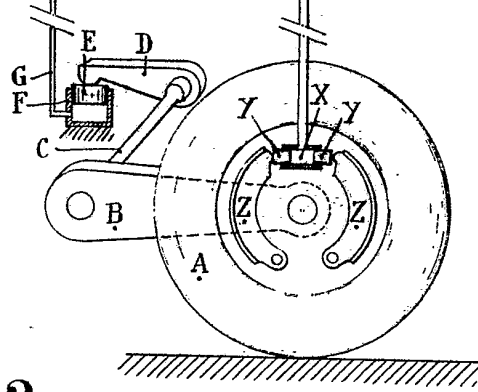
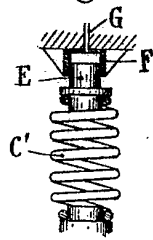


Fig. 2

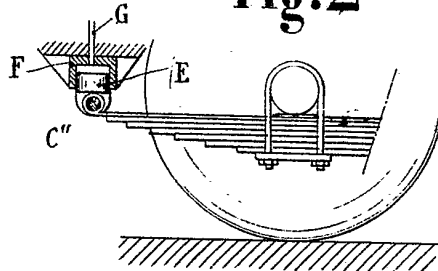


Fig. 4

