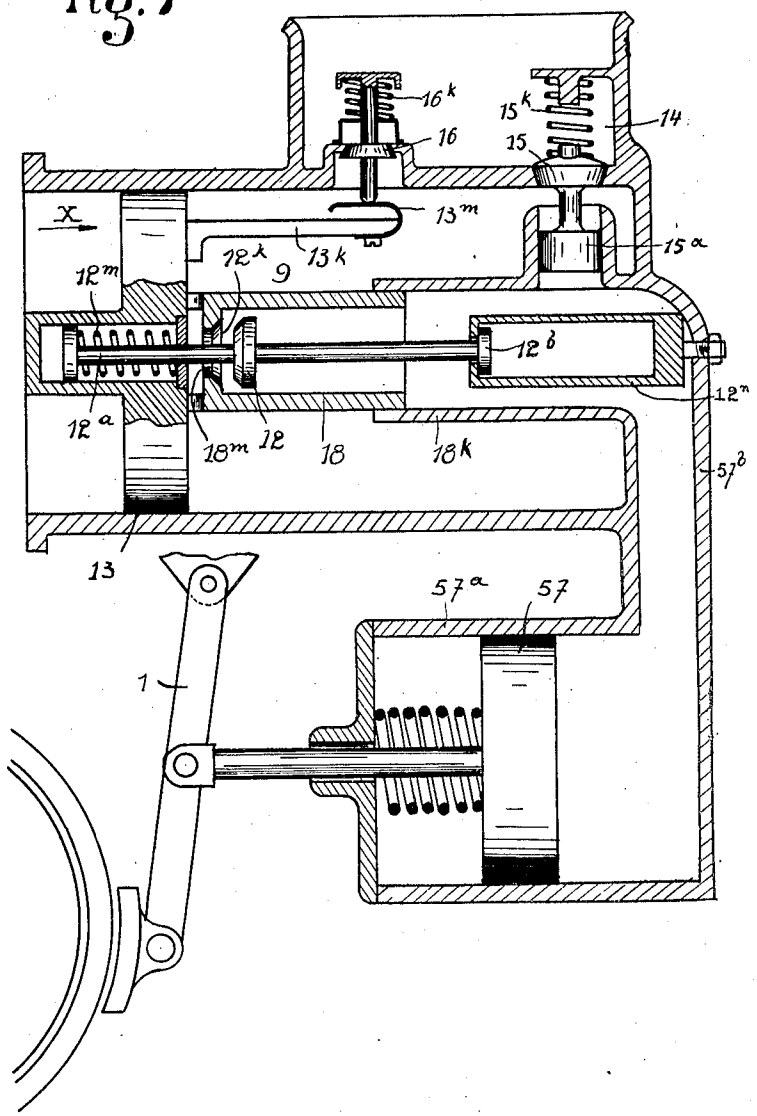
April 16, 1929. H. PIEPER 1,709,150

BRAKE MECHANISM

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Fig. 1



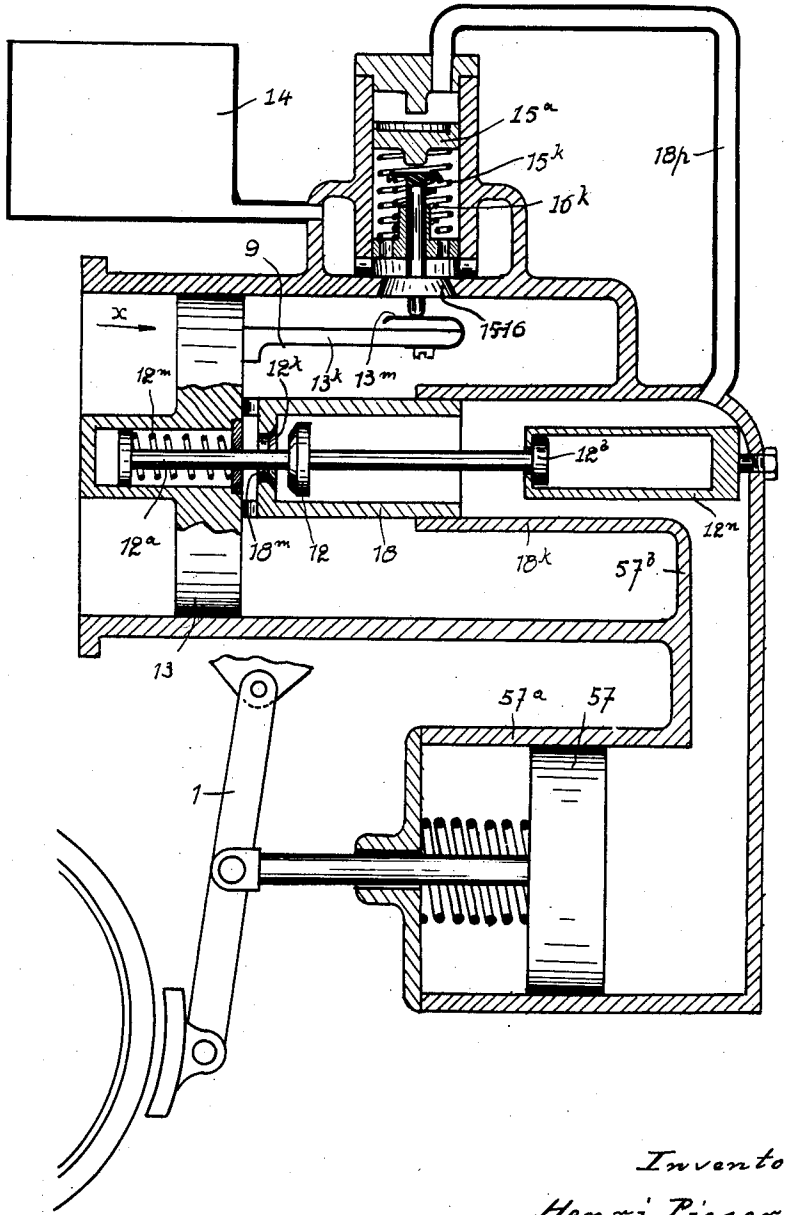
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BRAKE MECHANISM

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Fig. 2



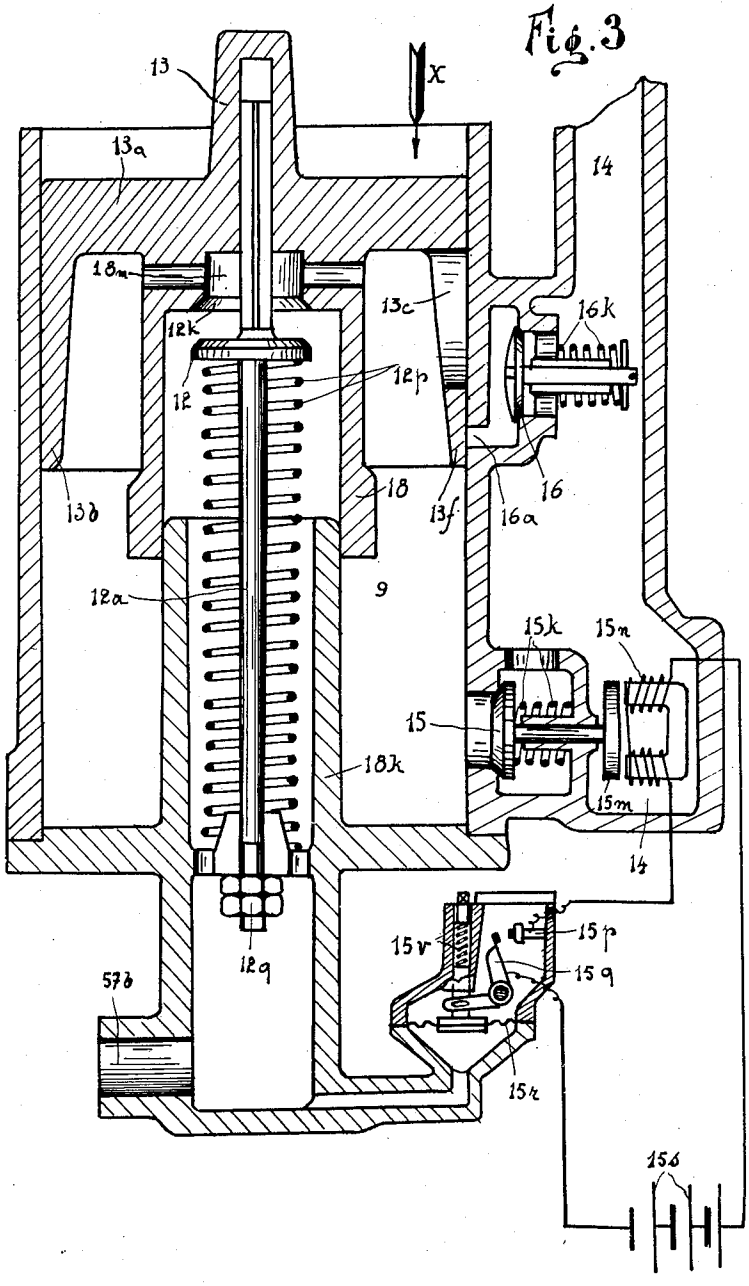
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BRAKE MECHANISM

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Fig. 3



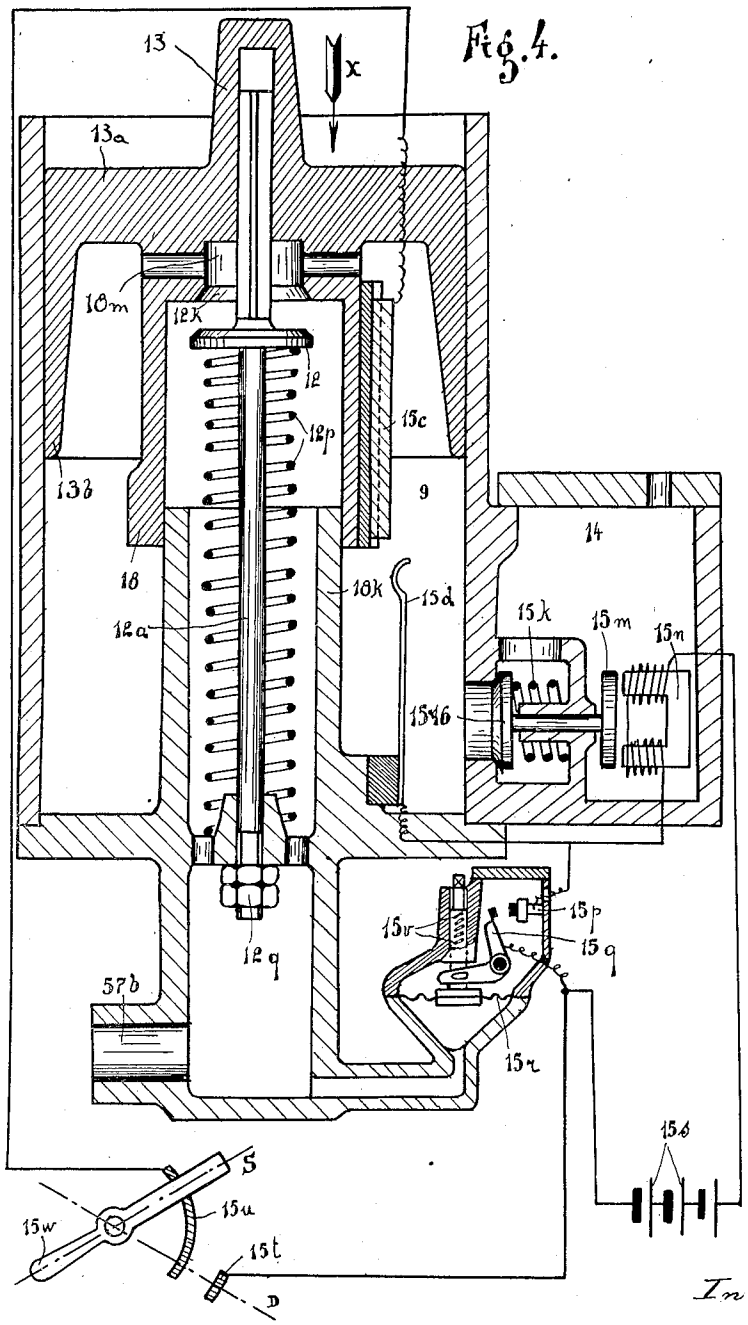
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BRAKE MECHANISM

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Fig. 4.



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Patented Apr. 16, 1929. 1,709,150

UNITED STATES PATENT OFFICE.

HENRI PIEPER, OF BRUSSELS, BELGIUM.

BRAKE MECHANISM.

Application filed January 6, 1928, Serial No. 244,934, and in Belgium January 18, 1927.

The present invention relates to a motive device for working a brake in which the brake levers are connected to a piston movable in a cylinder into which liquid is first forced by two driving pistons, and afterwards by one of them, the other forcing liquid into a reservoir.

According to the invention, the communication between this reservoir and a cylindrical space or chamber wherein the second piston works is governed by a valve gear controlled by the movement of the driving pistons.

The movement of these pistons may be caused for instance by the influence of the variations in pressure which it causes in the spaces or ducts included in the device.

The present invention concerns especially the case in which to actuate the above specified valve gear use is made of the variations of pressure which will occur on the side of the piston attached to the brake levers.

The variations of pressure may act directly or by the intermediary of an electric circuit, or even by pneumatic or hydraulic means etc.

The drawings attached to the present specification represent some examples of different constructions according to the invention.

Fig. 1 is a vertical sectional view of an arrangement in which the valve gear includes two valves.

Fig. 2 is a similar view of a modification in which the valve gear includes one valve only.

Fig. 3 is a sectional view of a further modification in which the valve gear includes two valves, one of which is controlled by an electric circuit.

Fig. 4 shows a modification of Fig. 3 in which the valve gear includes one valve only.

The piston 57 connected to the brake gear represented diagrammatically by a lever 1 fitted with a block arranged to come into contact with a wheel, is movable in a cylinder 57^a communicating by means of a duct 57^b with a cylinder 18^k in which the driving piston 18 is movable, afterwards referred to as the first driving piston. In this piston an opening 18^m is arranged capable of being closed by a valve 12. This opening 18^m provides communication between the cylinder 18^k and a cylindrical space or chamber 9 in which works the second driving piston 13.

To obtain the braking action, the driving pistons 13 and 18 are moved in the direction of the arrow X by suitable means, mechanical, hydraulic, pneumatic or electric. During the first phase, the liquid displaced by the two pistons passes by the duct 57^b into the brake cylinder 57^a.

After a certain length of stroke of the driving pistons, the valve 12 is caused to close on its seating 12^k. This valve 12 is carried by a rod 12^a of which one end enters the piston 13 where it is subjected to the action of a spring 12^m tending to cause a collar 12^b fitted at the other end of said rod 12^a to abut against a member 12^n carried by the frame of the apparatus and projecting into the cylinder 18^k.

At the beginning of the stroke of the piston 13 in the direction of the arrow X the valve 12 remains stationary while the spring 12^m expands progressively.

As long as the liquid compressed in the space or chamber 9 by the movement of the second driving piston 13 does not find any other outlet, the valve 12 remains lifted off its seating so as to allow this liquid to move towards the cylinders 18^k and 57^a.

When, owing to the application of the brake-blocks against the wheels, the pressure rises in these cylinders, the valve 12 will close on to its seating 12^k. This increased pressure also acts on the side of the piston 15^a facing the cylinder 18^k and will displace, said piston, thereby opening the valve 15 which is connected to it and which is interposed between the reservoir 14 and the space 9.

It will be noticed that the side of the piston 15^a facing the space 9 is subjected to the pressure existing in this space and tends to balance the action of this pressure on the valve 15. Said valve 15, which opens towards the reservoir 14, is subjected to the action of a return spring 15^k. The opening of the valve 15, combined with the closing of the valve 12, initiates a second braking phase during which the piston 18 alone forces liquid into the cylinder 57^a; the resistance opposed to the motion of the second driving piston 13 being insignificant, owing to the valve 15 being open.

From the moment when the driving pistons 13 and 18 have assumed a position such that the valve 12 is capable of closing on its seating 12^k, the spindle of the valve 16, opening towards the space or chamber 9, is released from its resilient support 13^m, which normally

keeps it firmly pressed against its seating. This support 13^m is fixed on a carrier 13^k rigidly attached to the driving piston 13.

When the brakes are released, the valve 15 falls on its seating as soon as the pressure on the face of the piston 57 has sufficiently decreased. If at this moment the valve 12 is still closed on its seating, a fall of pressure takes place in the space 9 and the valve 16 opens against the action of its return spring 16^k and allows a certain quantity of the liquid in the reservoir 14 to return to the space 9.

At the moment when the valve 12 leaves its seating, an acceleration takes place in the movement of the piston 57, owing to the fact that the two pistons 13 and 18 aspire liquid simultaneously.

If the piston 57 does not follow this movement, the pressure is lowered in the space or chamber 9 and the valve 16 tends to open. To avoid this disadvantage the valve 16 is forced on to its seating at the moment when the valve 12 itself is forced open by the action of the abutment 12^n against the collar 12^b fixed on the rod 12^a. From this moment, the liquid is exhausted from the cylinder 57^a by the combined action of the two driving pistons 13 and 18, without allowing any liquid to pass from the reservoir 14 into the space 9.

If the play between the blocks and the wheels has increased, this increase will be compensated by the liquid which passes through the opening 18^m from the moment when the valve 12 is capable of closing it.

When the brakes are released, the quantity of liquid which will pass the opening of the valve 16 corresponds to the quantity of liquid which will have passed the opening 18^m to compensate the play which had been produced.

If on the other hand the play diminishes, the pressure will rise in the cylinder 18^k owing to the application of the brake-blocks against the wheels before the valve 12 is enabled to return to its seating. This increase of pressure will cause the valve 15 to open, and will allow the excess liquid to return to the reservoir 14.

In the case of Fig. 2, the functions of the valves 15 and 16 are fulfilled by a single valve 15′, opening towards the space 9. This valve is constantly induced to return to its seating by a return spring 16^k. It can be lifted from said seating either by a fall in pressure occurring in the space 9, or by a positive thrust of a piston 15^s subjected to the pressure in the cylinder 18^k which is transmitted to it by a pipe 18^p. The spring 15^k, which has a certain initial tension, opposes the movement of the piston 15^s that tends to open the valve 15′.

When the brakes are applied the valve 15′ will be positively lifted from its seating when the pressure in the cylinder 18^k will have increased sufficiently to compress the spring 15^k and eventually the resilient support 13^m.

When the brakes are released, the valve 15′ can be lowered from its seating by the fall of pressure which may occur in the space 9. It is automatically returned to its seating by the support 13^m as soon as the valve 12 itself is positively opened.

The working is therefore similar to that of the device represented in Fig. 1.

In the case of Fig. 3, the valve gear, except for a few constructional details, is similar to that of Fig. 1, the same members serving the same purposes in the two cases.

The valve 12 is fixed on a rod 12^a, one end of which enters the piston 13 while the other end is threaded and fitted with a nut and lock-nut 12^q arranged to rest against the frame.

The valve 12 is subjected to the action of a spring 12^p arranged on the rod 12^a between the valve and the inside frame-wall and tends to draw the nut and lock-nut against the frame.

The piston 13 consists of a bottom 13^a and a sleeve 13^b. This sleeve, in which on the side next to the valve 16, an opening 13^c is provided, fulfills the same function as the spring 13^m and the carrier 13^k of Fig. 1.

As soon as the pistons 13 and 18 have moved far enough inward or downward to close the valve 12 on its seating 12^k, the part 13^t of sleeve 13^b which normally maintains the valve 16 closed, passes beyond and uncovers the port 16^a of said valve and puts it into communication with the reservoir 9, by means of the opening 13^c arranged in the sleeve.

Consequently when the brakes are released, the valve 16 cannot open during the period when the valve 12 is positively lifted from its seating.

The pressure in the duct 57^b causes, by means of an electric circuit, the valve 15 to open; such circuit having included in it a source of current 15^s, electro-magnet 15^n and switch 15^p—15^q.

The increased pressure in the duct 57^b acts on the flexible diaphragm 15^r, kept in its normal position by a balanced spring 15^v acting on a rod fixed to the diaphragm. The switch lever 15^q is fitted with a finger which strikes the contact 15^p and closes the electric circuit, thereby energizing magnet 15^n and attracting its armature 15^m, with the result that valve 15 is opened, and the space or chamber 9 and the reservoir 14 are placed in communication.

In the case of Fig. 4, the action of the valves 15 and 16 is accomplished by a single valve 15″. This valve may be lifted from its seating by means of an electric current acting on the electro-magnet 15^n, which latter may be actuated by two different circuits according to the position of the lever 15^w for applying the brakes at S or for releasing them at D.

During the period when the brakes are applied, the lever is in the position S and breaks the electric circuit 15^u—*s*—*t*—*n*—*d*—*c*. During this same period the switch 15^q—15^p alone will actuate the electro-magnet and in the same way as in the preceding case (Fig. 3).

During the period when the brakes are released, the lever 15^w, which is then in contact with the block 15^t, closes the circuit *15s*—*t*—*u*—*n*—*d*—*c* which shunts the switch lever 15^q.

This latter will not function again during the period when the brakes are released (the pressure having fallen in the duct 57^b) but the current will flow through the controlling lever 15^w, contacts 15^u and 15^t, strip 15^c, spring 15^d, electro-magnet 15^n.

The strip 15^c is fixed on the sleeve 13^b of the piston 13 and makes contact with a spring 15^d. These two members are in series with the electro-magnet and the source of current, so that the current will only be interrupted in the electro-magnet 15^n when the strip 15^c has left the spring 15^d.

This breaking of the circuit will cause the positive closure of the valve 15 on its seating; this closing taking place at the moment when the valve 12 opens.

The control lever 15^w can be operated directly by hand, or by means of a pedal; and it is also possible, without departing from the scope of the invention, to place this lever under the control of the brake-controlling device or of a part of the brake rodding by means of, for example, a member secured to said device or to said part which will follow the movement thereof in the direction corresponding to brake setting or releasing.

What I claim is:

1. A motive device for brakes, consisting of brake levers connected to a piston movable in a cylinder into which liquid is injected first by two driving pistons and afterwards by one of them, the second piston then forcing the liquid into a reservoir, a plurality of communications between the reservoir and a space wherein the second piston works, and a valve gear controlling said communications and itself controlled by the displacement of the driving pistons.

2. A motive device for brakes, consisting of brake levers connected to a piston movable in a brake cylinder into which liquid is injected first by two driving pistons and afterwards by one of them, the second piston then forcing the liquid into a reservoir, a communication between the reservoir and a space wherein the second piston works, and a valve controlling said communication and itself controlled by the variations in pressure in the brake cylinder.

3. A motive device for brakes, consisting of brake levers connected to a piston movable in a brake cylinder into which liquid is injected first by two driving pistons and afterwards by one of them, the second piston then forcing the liquid into a reservoir, a communication between the reservoir and a space wherein the second piston works, and a valve controlling said communication and fixed to a movable member, said valve being subjected at one side to the pressure in the brake cylinder and at the other side to the pressure in the aforesaid space.

4. A motive device for brakes consisting of brake levers connected to a piston movable in a brake cylinder into which liquid is injected first by two driving pistons and afterwards by one of them, the second piston then forcing the liquid into a reservoir, and a valve controlling communication between the brake cylinder and a space wherein the second piston works, said valve acting to cut off all communication between the reservoir and the aforesaid space as soon as said valve leaves its seating at the end of the return stroke of the driving pistons.

5. A motive device for brakes consisting of brake levers connected to a piston movable in a cylinder into which liquid is injected first by two driving pistons and afterwards by one of them, the second piston then forcing the liquid into a reservoir, a communication between the reservoir and a space wherein the second piston works, a valve to control said communication, and a resilient thrust device to control said valve supported by a carrier fixed to the second driving piston.

6. A motive device for brakes, consisting of brake levers connected to a piston movable in a brake cylinder into which liquid is injected first by two driving pistons and afterwards by one of them, the second piston then forcing the liquid into a reservoir, a communication between the reservoir and a space wherein the second piston works, a valve to control said communication actuated by an electromagnet, and a switch to control the activity of said magnet actuated by a movable member subjected to the pressure in the brake cylinder.

7. A motive device for brakes, consisting of brake levers connected to a piston movable in a brake cylinder into which liquid is injected first by two driving pistons and afterwards by one of them, the second piston then forcing the liquid into a reservoir, a communication between the reservoir and a space wherein the second piston works, a valve to control said communication actuated by an electro-magnet, a switch to control the activity of said magnet actuated by a movable member subjected to the pressure in the brake cylinder, and a lever for putting the said switch in parallel during the time of releasing the brakes.

In testimony whereof I affix my signature.

HENRI PIEPER.