

(No Model.)

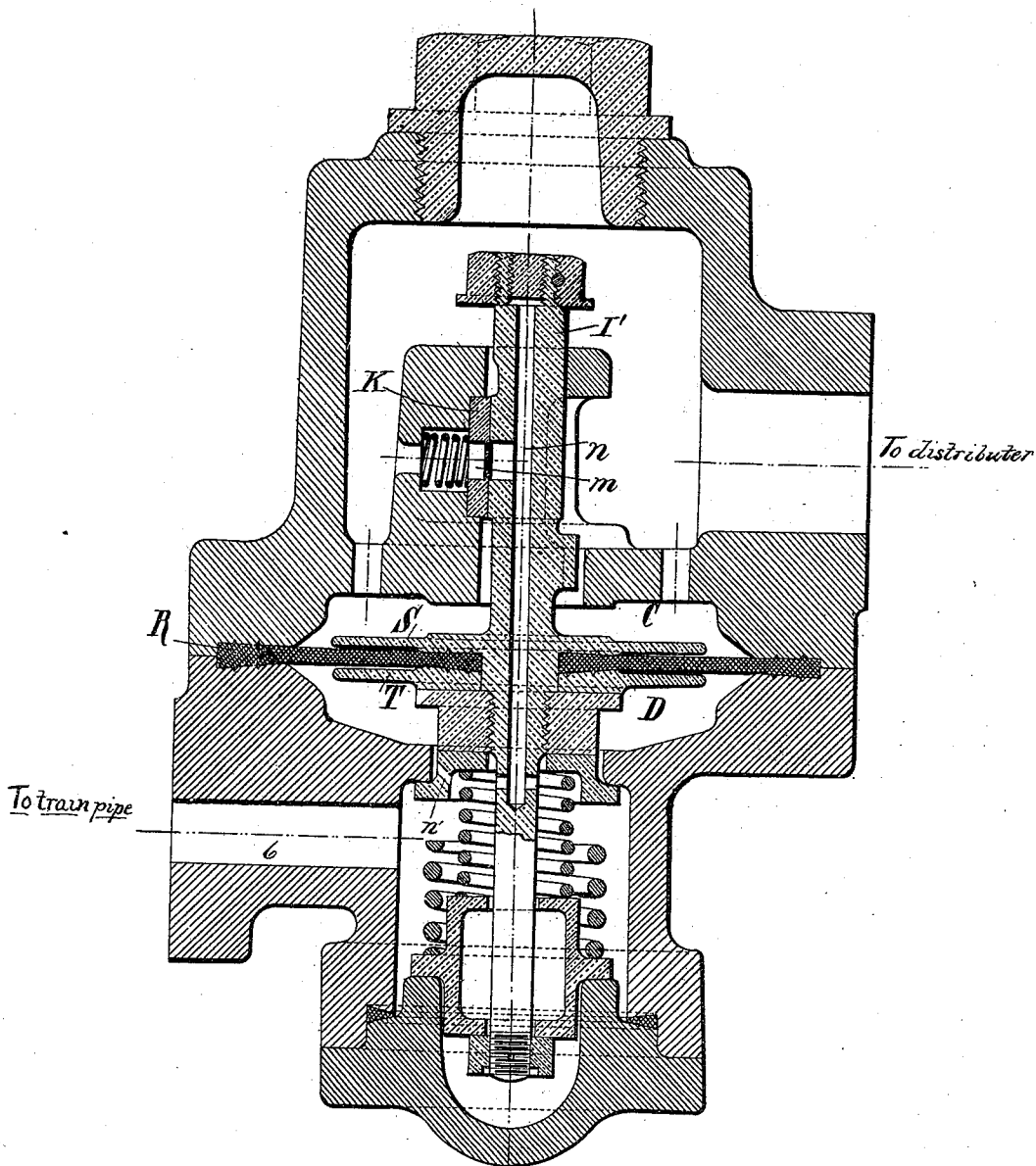
6 Sheets—Sheet 1.

M. L. E. DUVAL.
REGULATOR FOR AIR BRAKES.

No. 510,870.

Patented Dec. 12, 1893.

FIG. 1.



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(No Model.)

6 Sheets—Sheet 2.

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FIG. 2

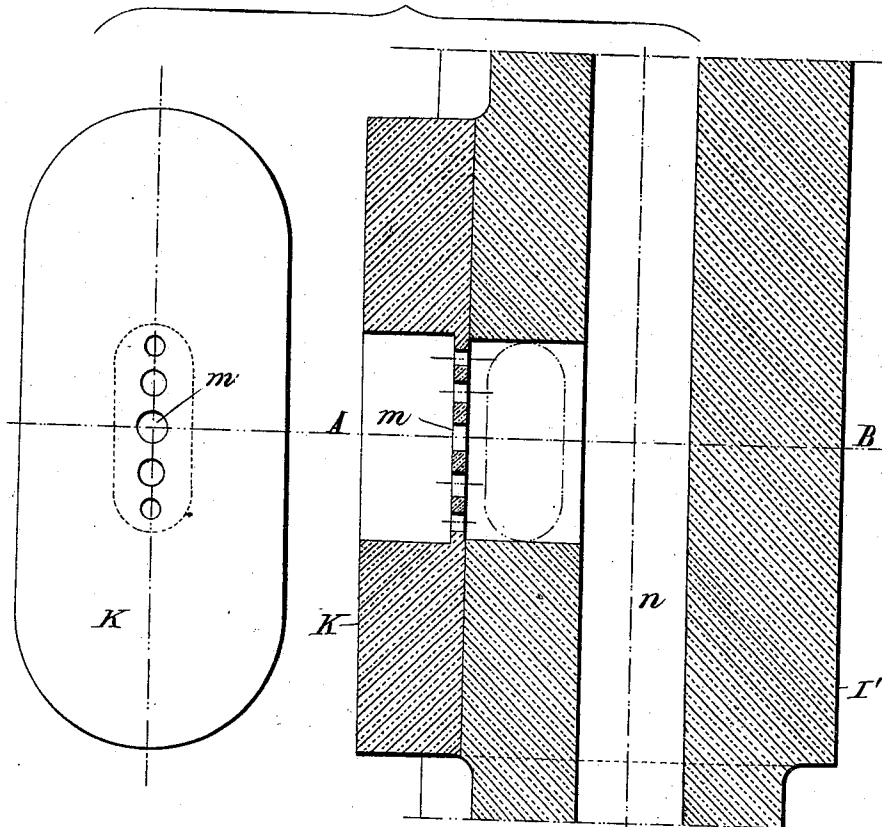
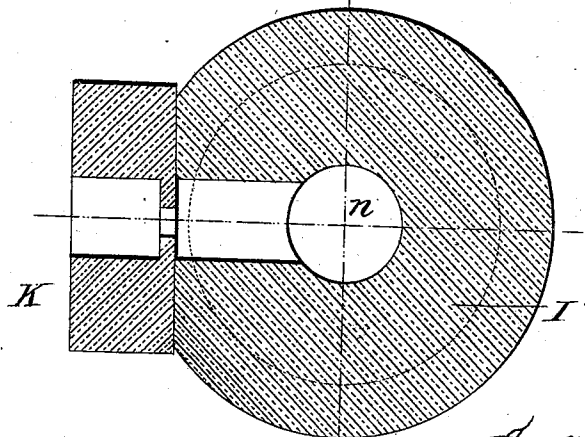


FIG. 3



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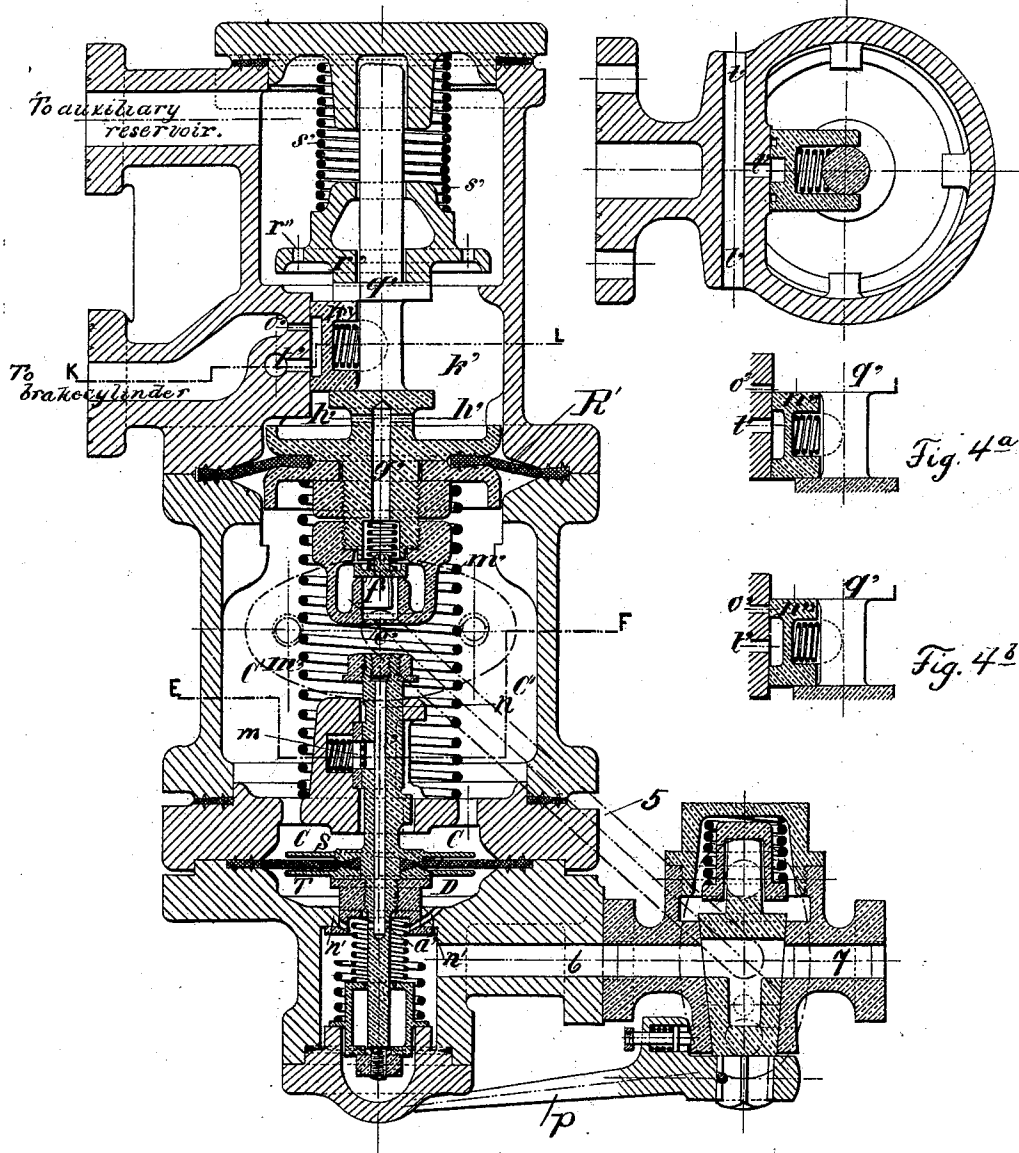
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FIG. 4.

FIG. 5.



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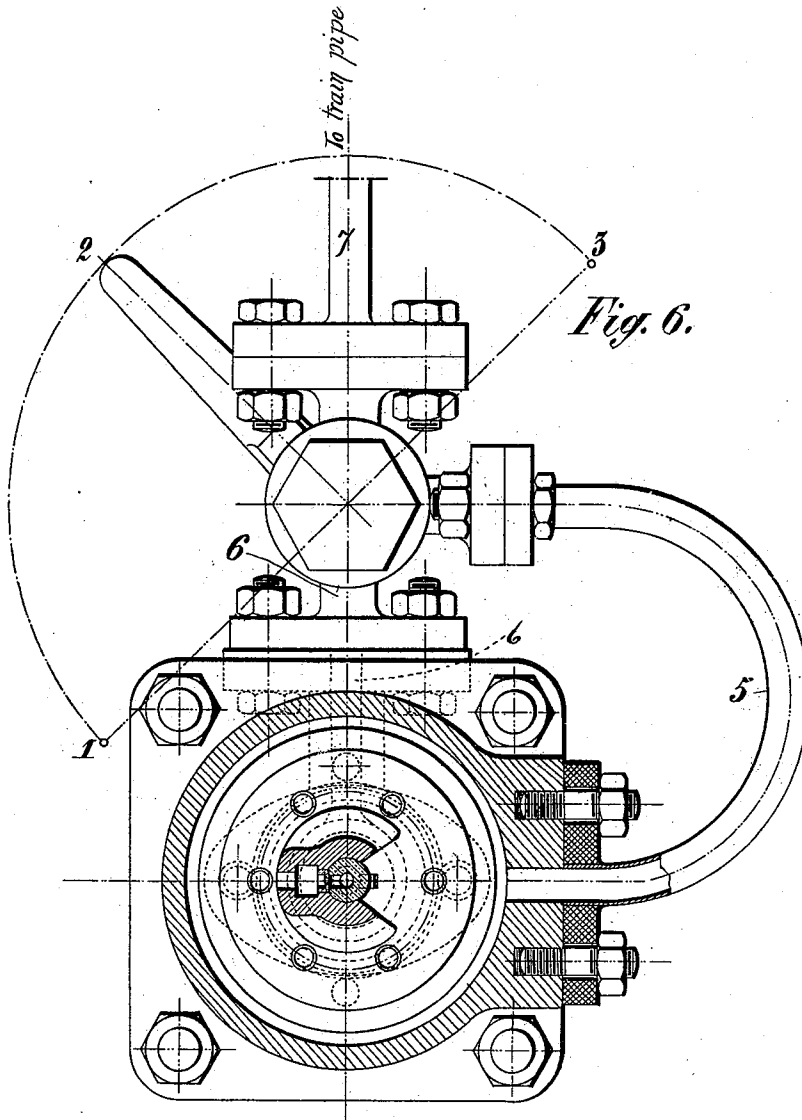
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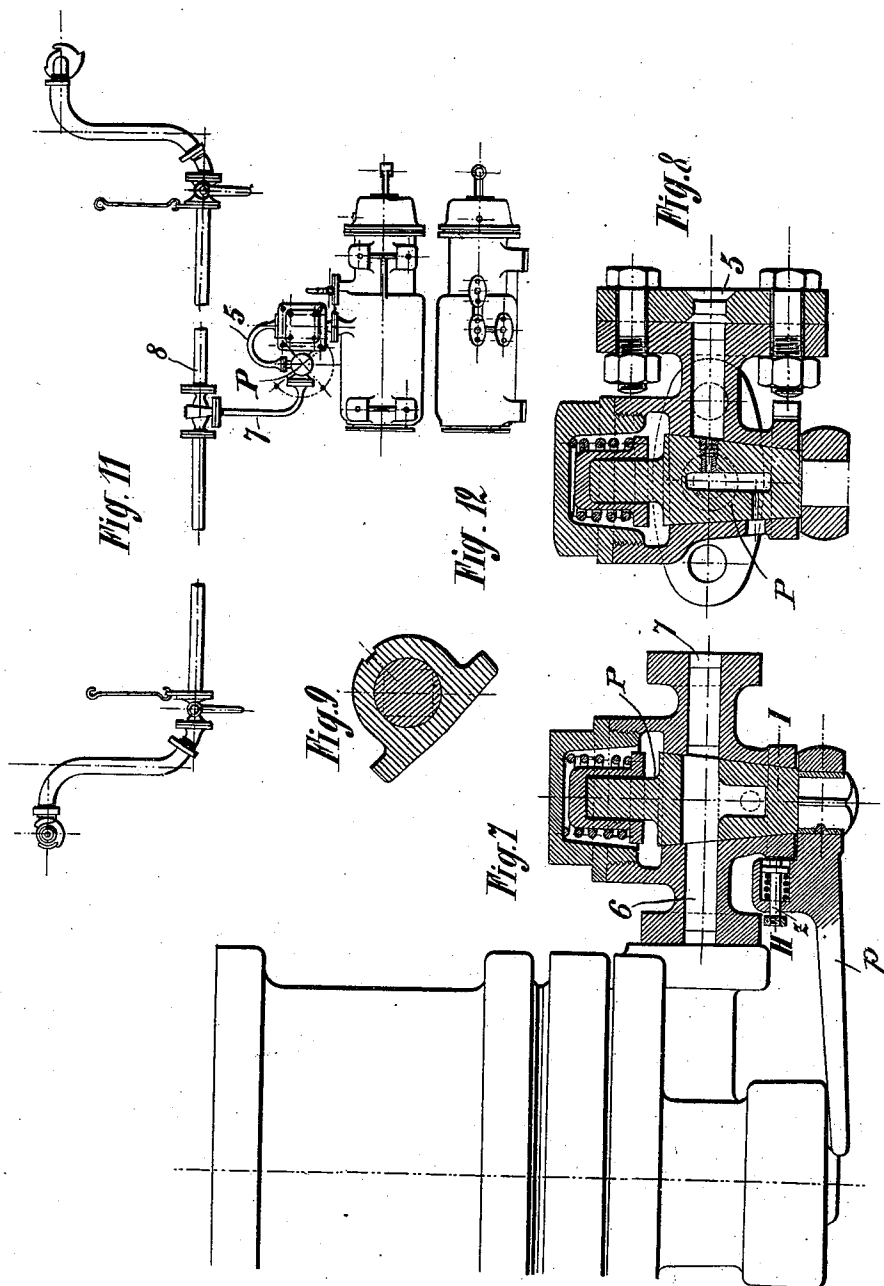
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M. L. E. DUVAL.
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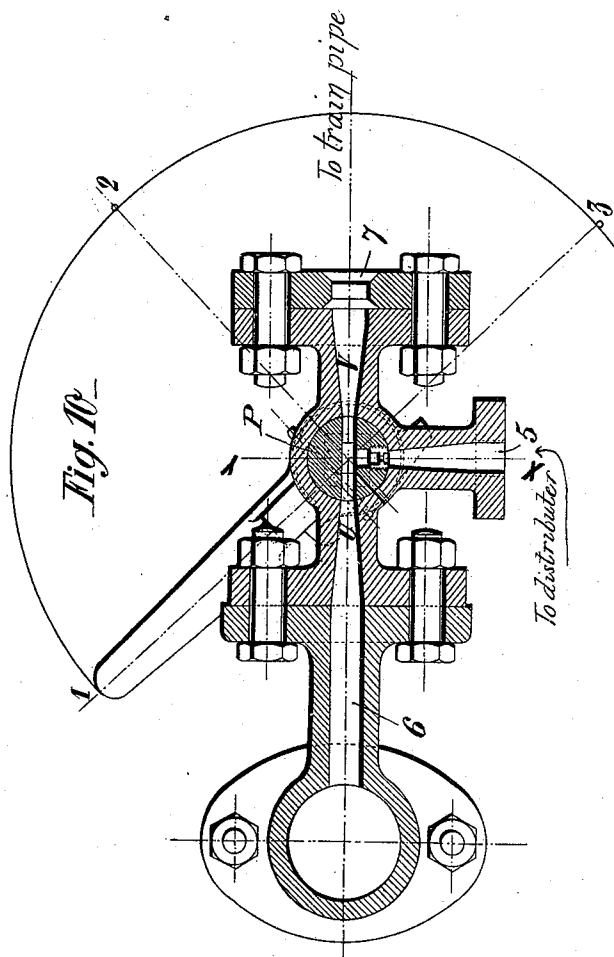
(No Model.)

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M. L. E. DUVAL.
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UNITED STATES PATENT OFFICE.

MARTIN LEONARD EDMOND DUVAL, OF PARIS, FRANCE, ASSIGNOR TO THE
FIVES LILLE COMPANY, OF SAME PLACE.

REGULATOR FOR AIR-BRAKES.

SPECIFICATION forming part of Letters Patent No. 510,870, dated December 12, 1893.

Application filed February 25, 1893. Serial No. 463,734. (No model.) Patented in France May 13, 1892, No. 215,409.

To all whom it may concern:

Be it known that I, MARTIN LEONARD EDMOND DUVAL, of Paris, France, have invented certain new and useful Improvements in Regulators for Air-Brakes, which have been patented in France by addition of May 13, 1892, to Letters Patent No. 215,409, dated August 8, 1891, and which are fully described in the following specification.

The present invention relates to improvements in regulators for air-brakes, usually located between the train-pipe and the distributor or triple-valve whereby the simultaneous operation of all the brakes of a train is insured. These regulators usually have two chambers connected by a passage of variable sectional area, one chamber communicating with the distributor or triple-valve and the other with the train-pipe, connections being provided whereby the sectional area of said passage may be regulated, so that upon the reduction of the pressure in the train-pipe caused by the engineer operating the manipulating cock the said sectional area will be increased in proportion to the distance between the regulator (or its connection with the train pipe) and the manipulating cock.

In Letters-Patent No. 486,703, granted November 22, 1892, I have indicated two arrangements for varying the section of the air passage from one chamber of the regulator to the other. In one of the arrangements the partial closing of the orifice is obtained by means of a rod having a groove of varying sectional area, placed opposite a slide valve and connected to a diaphragm or piston, the two chambers being in that case in communication by means of passages through the rod itself. In the second arrangement the partial closing is produced by means of a cylindrical rod of small diameter, having also a groove of varying sectional area and moving with slight friction in an aperture which acts as a guide, the communication being effected by means of an outside pipe, or by interior lateral conduits.

The present invention has for its object, first, a new arrangement, which like the previous ones allows of simultaneous action in the application of the brakes, but of a more simple character; second, the application of

the regulator to a distributor or triple valve of the Wenger or similar air-brake systems.

The accompanying drawings represent the new arrangement as applied to the Wenger brake.

Figure 1 is a vertical section of the regulator. Figs. 2 and 3 are enlarged sections illustrating in detail the slide and parts of the central rod, Fig. 3, being a section on line A—B (Fig. 2). Fig. 4, is a section of a Wenger distributor, having my regulator applied. Figs. 4^a and 4^b are details of the admission valve of the Wenger apparatus. Figs. 5 and 6 are cross-sections of the same distributor, on lines K L and E F respectively. Figs. 7 and 8 are vertical sections of the controlling cock, on lines U V and X Y respectively, of Fig. 10. Fig. 9, is a horizontal section of the same on line H—I (Fig. 7). Fig. 10 is a horizontal section through the controlling cock, and passages leading thereto. Figs. 11 and 12 illustrate the general arrangement of the braking apparatus.

In many brake-appliances in use, the communication between the distributor of each brake apparatus and the main conduit is effected by a pipe or orifice of uniform section, and for this reason the brakes nearest the engine come into action before those at a greater distance. This difficulty may be overcome or diminished by automatically retarding the action of the appliances nearest the engine by a partial closing of the orifice or pipe leading to the distributor or triple-valve, and on the other hand, advancing the action of those more remote by giving said orifices an initial section relatively large. On this principle is based the operation of the system explained in my patent above mentioned, and which is designed to maintain the supply of air practically constant, whatever be the variation of pressure during the operation between the air of the distributor and that of the main conduit. The invention described in said patent consists in a device interposed between the main conduit and the distributor, which automatically adjusts the size of the orifice through which the air passes to and from the same, in such manner that the size of the orifice or passage is diminished in inverse ratio to the degree of fluctuation of

pressure. Thus in the brakes most remote from the engine, where the change of pressure in setting or releasing the brakes is minimum, the size of the passage or orifice is the greatest, thus compensating for the diminution of the change of pressure. The passage or orifice is formed in part by a movable piece, whose position with respect to the fixed piece forming the other part of the orifice is regulated by an actuating device—such as a flexible diaphragm or piston—moved in one direction or the other by variations in pressure on the opposite sides thereof. This principle may obviously be embodied in many different forms of construction, one form being described in my Patent No. 486,703, hereinbefore referred to.

The new arrangement represented in the drawings differs from those described in my prior patent principally in the substitution for the groove in rod I' of a series of apertures *m* in the stationary valve K. These apertures are of different diameters, the largest being in the middle (Fig. 2). The communication between the upper chamber C and lower chamber D is by a passage *n* in the body of the rod I', the air reaching chamber D from the train-pipe by a passage *n'* (Fig. 1), as in my former patent. In the normal position corresponding to equilibrium of pressure between the chambers C, D the communication from one chamber to the other is established by the total sectional area of all the apertures; whereas the lowering or lifting of the central rod I' which occurs during the operation of the brakes, effects a reduction of the sectional area of the passage by closing more or less the apertures *m* according to the extent of movement of the rod. It will be readily understood that in this way the same results—viz: retarding the action of the brake-appliances nearest the engine by a partial closing of the orifice or pipe leading to the distributor or triple-valve, and on the other hand advancing the action of those more remote by giving said orifices an initial section relatively large—are produced as with the groove of varying cross section. The apertures might all have the same diameter, but better results are obtained by making them of different diameters, as shown in Fig. 2 so as to obtain greater variation of section of the apertures without increasing too much the course of movement of the rod. Fig. 1 shows also a particular arrangement of the diaphragm R. This diaphragm is flat when in its normal position, being held between two disks S and T, which support it when, in consequence of a sudden fall of pressure in the train pipe, it must stand for a time the whole pressure of the air acting on the upper chamber C of the regulator. In the central portion the diaphragm is clamped between these two disks, but toward the edges of the disks it is cut away forming narrow spaces between it and the diaphragm, to facilitate the movement of the latter.

Figs. 4, 6, 8, 9, 10, 11 and 12 illustrate the application of the regulator to the Wenger air-brake, and to a special type of controlling cock, as will be explained hereinafter. In this application the regulator differs from that above described in details of slight importance. It is however to be noted that the regulator being an integral part of the distributor, or triple valve the piping between the two parts of the apparatus is dispensed with and the upper chamber C of the regulator is in direct communication with chamber C' of the distributor. The piston with its packing commonly used in the Wenger system is replaced by a diaphragm R' (Fig. 4) avoiding friction and giving greater sensibility to the apparatus, and avoiding the necessity of lubrication. The controlling cock P (Figs. 6, 7, 8 and 10) is placed at the junction of a passage 5 leading from the chamber C', a passage 6 (Fig. 10) leading from the lower chamber D of the regulator, and a passage 7 leading from the train pipe 8 (Fig. 11). The cock has a triple action. First, by putting the key *p* of the cock in position No. 2 (Figs. 6 and 10) the brake-cylinder is cut off entirely from the train-pipe thereby throwing the brake-cylinder out of operative connection. Second, when placed in position No. 3 it establishes communication between the lower chamber D of the regulator, and the train-pipe, and in that case the regulator operates to control the area of the communicating passage between the chamber D and chamber C' as hereinbefore fully described to vary the sectional area of the communicating passage from the train-pipe to the distributor or triple-valve in proportion to the fall of pressure in the train-pipe at the point of communication. Third, the cock being placed in position No. 1, allows the simultaneous connection of chambers C and D with the train pipe. This third arrangement is utilized only when the trains are composed of a small number of vehicles, and it is not desired to control the operation of the brakes by the regulator, as for example passenger trains. It admits of quick action because the two chambers having two communicating passages, the distributing slide is more promptly opened to give admission of air to the brake-cylinder.

I will now describe the operation of the regulator in combination with a distributor or triple-valve of the Wenger type, reference being made particularly to Figs. 4, 4^a, 4^b and 5. The air from the main conduit arrives by passage 6 into the lower part of the distributor and passes through orifices *a'*, apertures *m*, finally entering upper chamber *k'* through orifice *e'*, valve *f'* and channels *g'* and *h'*. In the normal condition of the brake apparatus the air from the main conduit or train-pipe fills all the chambers of the distributor and the auxiliary reservoir, the air passing to the latter through the passage marked "To the auxiliary reservoir" Fig. 4. Each brake-apparatus is thus supplied with air at the

same pressure as the air in the train pipe, the parts of each apparatus assuming the positions shown in Fig. 4. Under these conditions to apply the brakes, a certain quantity of air in the general conduit or train-pipe is allowed to escape in the usual manner, the depression is transmitted to chamber C' through the variable apertures *m* of the regulator, and the upper diaphragm R' falls, producing the compression of spring *m'*, and carrying with it the air-admission valve *n* which opens the orifice *o'* admitting air to the brake-cylinder through the passage marked "To brake cylinder," and causing the application of the brakes in the well known manner. The admission valve then occupies the position shown in Fig. 4^a. The passage of air from the auxiliary reservoir through openings *r''* in disk *r'* and orifice *o'* causes the diminution of pressure in the reservoir and the maintaining spring *m'* reacts, causing the diaphragm to rise, and consequently the admission valve also, until the moment when the collar *q'* meets washer *r'* which is held down by spring *s'*, whose force is less than that of spring *m'*. The valve stops in this position, as shown in Fig. 4^b and maintains the application of the brake, all communication being then cut off between the brake cylinder, reservoir and atmosphere. To release the brakes it is necessary to raise the pressure in the train pipe and chamber C' of the Wenger distributor, which is accomplished by the engineer closing the maneuvering cock. The air in the train pipe resumes its normal pressure and the additional pressure under diaphragm R' lifts central rod and valve *r'* compressing spring *s'*, to its primitive condition, shifting the admission valve to the position shown in Fig. 4 allowing air in the brake cylinder to escape through orifices *o' t'* thereby releasing the pressure on the brakes. It will be understood that the force or quickness of application of the brakes depends on the depression in the train-pipe. It is hardly necessary to state that during the action of the brakes, valve *f'* is kept closed by slight difference of pressure between chamber C' and the reservoir, and that all communication is cut off between train pipe and air reservoir. As soon as the release takes place

the air in the general conduit goes to the auxiliary reservoir to replace that expended during the preceding operation, by passing as we have said before, through orifices *a' m*, *e'*, valve *f'*, passages *g'* and *h'*.

Great utility of action can be realized on short trains because the fall of pressure in a short train pipe is practically simultaneous from end to end thereof. By the peculiar arrangement of the controlling cock, the brake-action may be effected as rapidly as desirable for short trains, and be moderated for long trains, so as to obtain simultaneous action upon all the vehicles. The extreme position of the key *p* is regulated by means of a pin *z* acting against suitably placed stops on the casing of the cock.

Figs. 11 and 12 show the general arrangement of a brake-cylinder with distributor and regulator connected with a train pipe.

What I claim as my invention is—

1. The combination with the distributor and train-pipe of the automatic regulator comprising two communicating chambers, and means for automatically varying the area of the communicating passage, as the pressure in the train-pipe fluctuates and a three-way cock, acting in one position to cut off the distributor and regulator, in another to connect one chamber of the regulator with the train-pipe, and in another to connect both chambers directly with the train pipe, as and for the purpose set forth.

2. The combination with a distributor of the Wenger or analogous type, of an automatic regulator having its upper chamber opening directly into the pressure chamber of said distributor, and its lower chamber also communicating therewith by a contracted passage of variable area, and a regulating slide or rod acting automatically to vary the area of said passage as the pressure in the train pipe fluctuates, substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

MARTIN LEONARD EDMOND DUVAL.

Witnesses:

ROBT. M. HOOPER,
JEAN VICTOR BARBANCE.