(No Model.)

3 Sheets—Sheet 1.

F. CHAPSAL.

RAILWAY BRAKE.

No. 537,562. Patented Apr. 16, 1895.

FIG 2

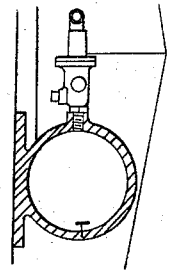


FIG. 1

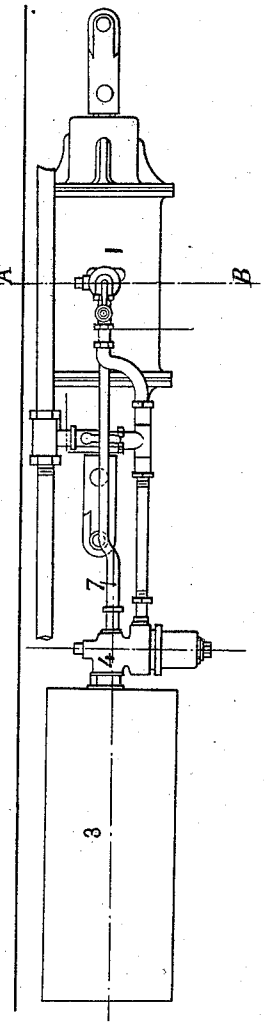
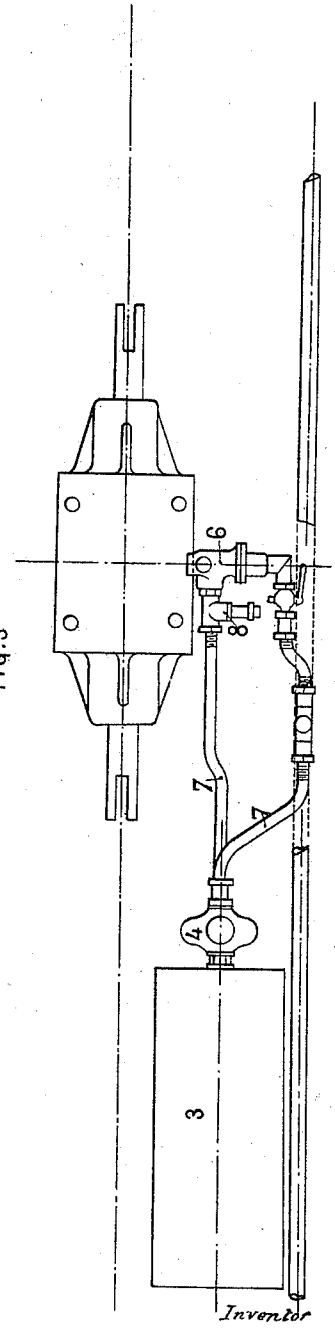


FIG. 3



Witnesses

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F. H. Schott

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(No Model.)

3 Sheets—Sheet 2.

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FIG. 5

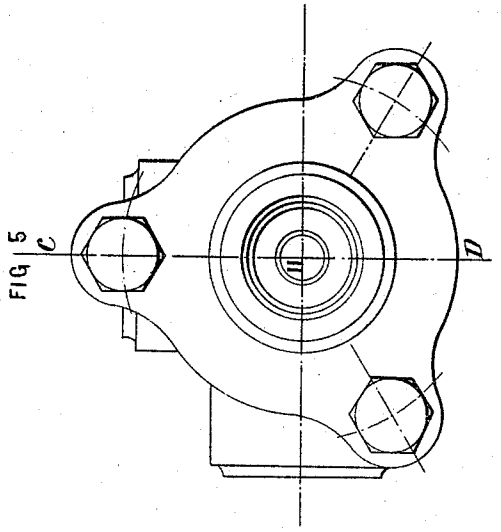
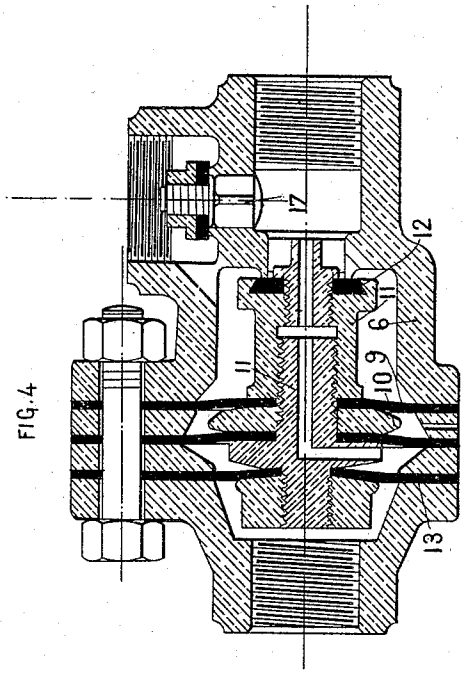


FIG. 4



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(No Model.) 3 Sheets—Sheet 3.

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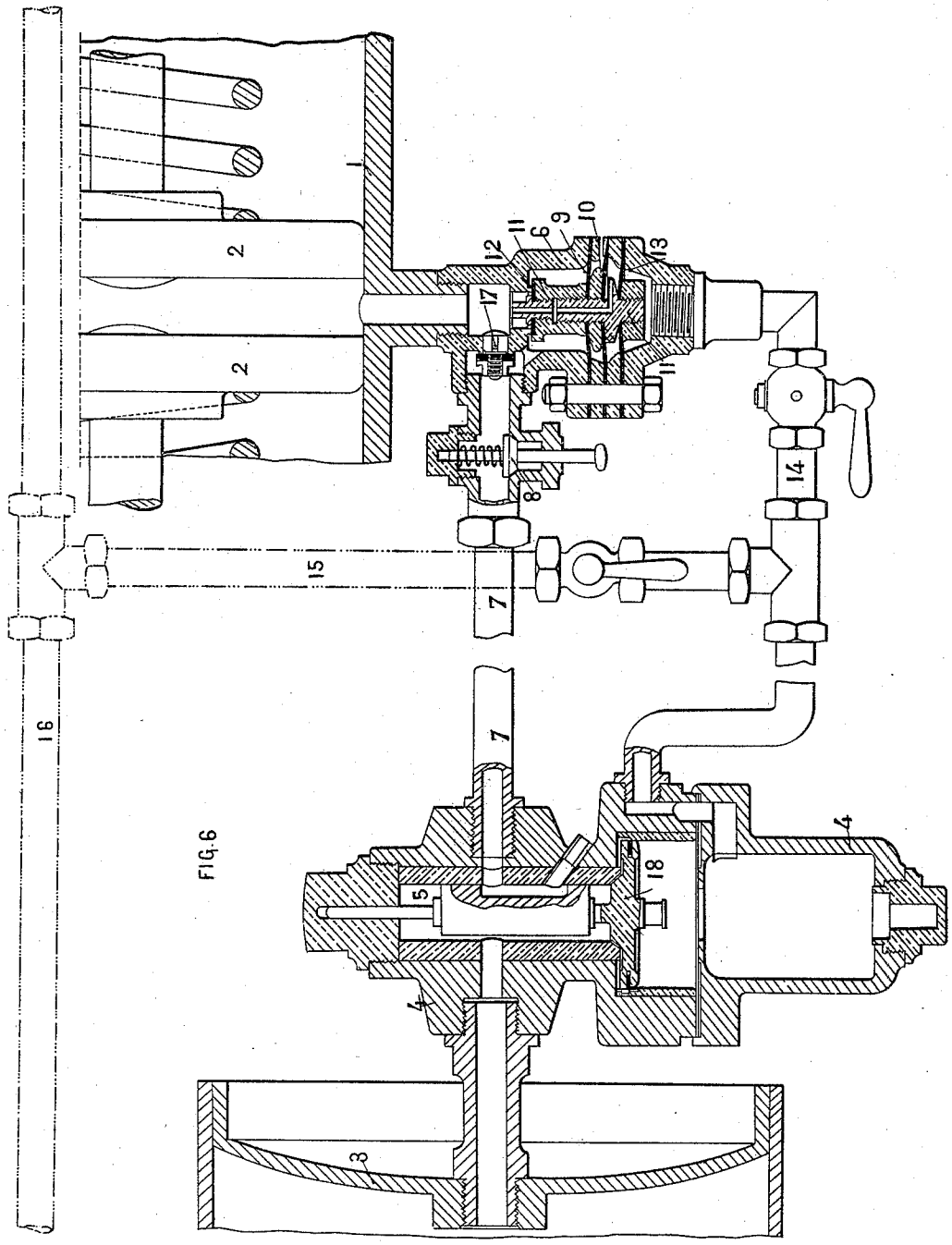

FIG. 6

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UNITED STATES PATENT OFFICE.

FRANÇOIS CHAPSAL, OF PARIS, FRANCE.

RAILWAY-BRAKE.

SPECIFICATION forming part of Letters Patent No. 537,562, dated April 16, 1895.

Application filed August 20, 1894. Serial No. 520,825. (No model.) Patented in France January 4, 1893, No. 226,918.

To all whom it may concern:

Be it known that I, FRANÇOIS CHAPSAL, a citizen of France, and a resident of Paris, in the Department of the Seine, France, have invented a new and useful Improvement in Railway-Brakes, (for which Letters Patent of France, No. 226,918, have been obtained under date of January 4, 1893,) of which the following is a specification.

This invention relates to improvements in automatic compressed air brakes and has for its object to render them adjustable at will and to utilize the working pressure in a very efficient manner.

A continuous automatic brake system working with compressed air to be efficient in operation must be capable of reducing the speed of the train when descending inclines and of effecting a stop at the stations without jerking by means of a gradually increased application of the brakes.

The various systems now in use of continuous brakes working with compressed air do not effectually accomplish this result.

The object of my invention is to construct an improved brake which shall have the same power as the most rapidly acting brakes, by reducing the pressure in the main-pipe or conduit corresponding to the maximum braking effect of these latter brakes, and shall be adjustable from the time at which it is put into operation to the time when it gives the maximum braking effect.

In order that my said invention may be fully understood I shall now proceed more particularly to describe the same and for that purpose shall refer to the several figures on the annexed sheet of drawings the same numerals of reference indicating corresponding parts in all the views.

Figure 1 is an elevation of the operating mechanism of an automatic brake operated by compressed air with a moderator or governor in accordance with my improved system. Fig. 2 is a transverse section of the same made on the line A B Fig. 1. Fig. 3 is a plan thereof. Fig. 4 is a longitudinal section of the moderator or governor taken on the line C D Fig. 5, and Fig. 5 is an end view of the said governor or moderator. Fig. 6 shows in longitudinal section drawn to a larger scale the different parts of the apparatus. In this figure the axis of the moderator or governor is supposed to be parallel to that of the triple valve for the sake of clearness but in use the two axes are arranged at right angles to each other as in Figs. 1 and 3. Either arrangement may be adopted without changing the general working of the apparatus; but it is preferred to use the arrangement shown in Fig. 3 as being most convenient for operating the cocks or taps.

My improved brake like most brakes operated by compressed air has a triple valve or distributing device of any desired construction, an auxiliary reservoir and a brake cylinder, but the arrangement of the different parts of the brake and the use of a special moderator or governor on the brake cylinder allow of a great range of adjustability. A piston or pistons 2 connected to the brake gear according to the arrangement of the latter works or work in the brake cylinder I (Figs. 1, 2, 3 and 6). To an auxiliary reservoir 3 is screwed or otherwise fixed by a strap the casing 4 of a triple valve or distributer which thus is in direct communication with the auxiliary reservoir. A bushing 5 of the triple valve or of the distributer communicates with a moderator or governor 6 by a pipe 7 on which is arranged a blow off valve 8.

The moderator or governor is secured on the brake cylinder 1 and has for its object to produce the adjustability of the brake through a great range of initial pressure and as it constitutes the most important part of my invention its construction and operation will now be more fully described.

Two diaphragms 9 and 10 of different diameters are mounted on a rod 11 of comparatively large diameter and formed of several parts screwed together and hollowed out for part of their length so as to form a passage therein. One end of this rod constitutes a check valve and the other end is fixed to a third diaphragm 13 whose flexible part has an area equal to that of the smallest diaphragm 9 of the two former diaphragms diminished by the area of the seat of the valve 12. The governor or moderator is connected at one of its sides or ends to a main pipe or conduit 16 by a union 14 and a pipe 15 while the other end

is secured on the brake cylinder 1. A valve arranged say at the side 17 and opening outwardly permits of the direct escape of the air from the brake cylinder by the triple valve or by the distributer or it may be by the discharge valve 8.

The following is a description of the working of the various parts of the apparatus.

If the air be compressed in the main pipe or conduit 16 the piston 18 of the triple valve or of the distributer is driven to the inner end of its travel. The air then passes to the auxiliary reservoir and all communication in the direction of the brake cylinder 1 is stopped. If a reduction of pressure be made in the main pipe or conduit 16 the piston of the triple valve or of the distributer moves outward and communication between the auxiliary reservoir 3 and the main pipe or conduit 16 is interrupted while communication between the auxiliary reservoir and the brake cylinder is opened, but the air can then only enter the brake cylinder by passing through the moderator 6.

There are two cases to be considered: first, that in which the brake is applied partially, for instance when descending an incline or when a gradual increased application of the brake is desired for stopping at some prearranged station or the like on the line, and, secondly, when a sudden stop is necessary in case of danger. In the first case, before the brakes have been applied, as the pressure of air in the main pipe or conduit acts alone on the diaphragm 13 of the moderator or governor, the check valve 12 which shuts off communication with the brake cylinder remains on its seat. If a slight reduction of pressure be produced in the main pipe or conduit but sufficient to set in motion the piston of the triple valve or of the distributer, the air in the reservoir 3 will act on the diaphragm 9 of the moderator or governor. The apparatus then moves away from the valve seat since the pressure of the air in the auxiliary reservoir 3 is at this moment greater than that of the air in the main pipe or conduit 16 and the check valve 12 opens leaving a passage for the air from the auxiliary reservoir 3. A certain amount of air then passes at the same time into the brake cylinder 1 and by the central passage in the rod 11 carrying the check valve into the chamber formed between the large diaphragm 10 and the diaphragm 13 of the moderator with the result, well known with differential pistons, that the apparatus is moved in the direction of the large diaphragm by a force equal to the pressure of air in this chamber acting on an area equal to the difference between the area of the large diameter diaphragm 10 and the flexible part of the other said diaphragm 13. This force is added to that which the pressure of the air of the main pipe or conduit exerts on the other side or face of the diaphragm in order to oppose the movement in a contrary direction resulting from the pressure of air in the auxiliary reservoir on the small diaphragm 9. Now if the differences between the surfaces of the large diaphragm 10 and of the diaphragm 13 be equal to $\frac{1}{n}$ of the surface of the diaphragm 13 and we suppose that the pressure in the auxiliary reservoir remains constant at the commencement of the application of the brakes then the equation of equilibrium of the apparatus composed of the valve 12 and the diaphragms connected therewith, taking no account of friction, will be $\delta=\frac{1}{n}f$, δ being the reduction of pressure in the main conduit or pipe and f the resulting pressure in the brake cylinder, *i. e.*, the valve 12 will close (or be in equilibrium and ready to close) when the pressure in the brake cylinder shall equal n times the diminution of pressure produced in the main conduit or pipe, the maximum braking pressure being obtained when such diminution of pressure equals $\frac{1}{n}$ of the pressure in the auxiliary reservoir. Thus by giving different values to n the range of the initial pressure through which the brake will be controlled can be made to vary as desired, every reduction of pressure in the main conduit or pipe giving a pressure equal to n times this reduction of pressure in the brake cylinder until the pressure in the latter will be equal to the pressure corresponding to the expansion of the air in the auxiliary reservoir into the sum of the volumes of this reservoir and of the brake cylinder. In practice, however, the pressure in the auuiliary reservoir does not remain constant at the initial pressure, but diminishes by reason of the escape of the air therefrom into the braking cylinder. Consequently to get the maximum braking effect the reduction in the main conduit must equal the sum obtained by adding the amount of this diminution to $\frac{1}{n}$ of the final pressure in the auxiliary reservoir and brake cylinder.

It will thus be perceived that the valve 12, for controlling the supply of air to the brake cylinder, is self opening under a force which is counteracted by the joint effects of the air pressures in the brake cylinder and main pipe or conduit, respectively. By lightly reducing the main pipe pressure the brakes may be applied gently. By gradually varying the main pipe pressure, the brakes may be applied with gradually changing pressure to any desired extent within (of course) the limits of the air supply. In the second case when a sudden stop is to be made, it is only necessary to produce quickly a large reduction of the pressure in the main conduit, so that the pressure tending to open the valve is opposed entirely or almost so by the less potent pressure within the brake cylinder, and the moderator presents no obstacle to a rapid and heavy increase of the braking pressure.

The moderator or governor which has already been described may be applied without

any alteration of the apparatus to any continuous brake working with compressed air with rapid action in which it is desired to avoid the complete application of the brakes when descending an incline, or the sudden jerks so disagreeable to travelers when stopping at stations if the brake be not gradually applied. When the pressure in the main conduit is restored for relieving or removing the brakes the check valve of the moderator remains closed, because the triple valve or the distributer then places the pipe 7 and consequently also the pressure chamber formed (in part) by the small diaphragm in communication with the outside air, so that the pressure against diaphragm 13 holds the check valve closed, the air of the brake cylinder escaping directly by the side valve 17 hereinbefore referred to.

In the application of the moderator to the brake apparatus, it is an important advantage to have such an arrangement as that the working of the moderator can be started or interrupted without interfering with the ordinary working of the brake apparatus. Thus as shown the union or branch pipe 14 constitutes a main conduit connection for the moderator separate from that for the triple valve or distributer, and is provided with a stop-cock 14′ having a drainage hole 14″ in the casing and a proper hole in the plug or key for allowing the air in the pressure chamber of the diaphragm 13 to escape when the cock is turned to interrupt the connection. Such cocks are well known.

When the working of the moderator is stopped by closing the cock 14′, the air will pass from the auxiliary reservoir into the brake cylinder whenever the triple valve or distributer opens the communication through the pipe 7; for the pressure of the air from the auxiliary reservoir upon the diaphragm 9 (being unopposed by the pressure in the main pipe 16) opens the check valve 12 and keeps it open.

By adjusting the cock 14′ the brakes on the different cars can be adjusted according to the length of the train and the position of the cars therein. Thus by the cocks 14′ the flow of air through the pipes 14 of the different cars can be checked to a degree which corresponds with the nearness of the respective cars to the engine, with the result that when pressure in the main conduit 16 is reduced by the engineer in order to apply the brakes, such reduction reaches the different cars in succession according to their respective distances from the engine, but the reduction in pressure in the moderators being checked by the cocks 14′ in the opposite sense, (that is, being most checked in the cars nearest the engine) the brakes are applied simultaneously (or more nearly so) and violent jolts are avoided.

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

1. The combination with the main conduit, brake cylinder, and auxiliary reservoir, of a triple valve or distributer having pipe connections severally with the said conduit and cylinder and reservoir, and a moderator having a valve to control the pipe connection between the said triple valve or distributer and said brake cylinder and also having three pressure chambers whose movable diaphragms are connected with said valves, one of said pressure chambers communicating with the pipe connection from the said triple valve distributer to the said brake cylinder, a second with the interior of said cylinder, and the third with the main conduit, substantially as described.

2. The combination with the brake cylinder, air-supplying means, and main conduit, of a moderator composed of a valve and three pressure chambers whose movable diaphragms are connected with said valve, one of said chambers being formed between oppositely acting diaphragms of different areas and communicating with the interior of the brake cylinder, a second of said pressure chambers communicating with the air supply pipe for said cylinder, the third communicating with the main conduit, and the diaphragms of the several chambers being arranged so that the pressures in the first and third chambers act with each other and in opposition to the pressure in said second chamber, substantially as described.

3. The combination of the brake cylinder, main conduit, triple valve or distributer, auxiliary reservoir, moderator having a valve to control the pipe connection between the triple valve or distributer and the brake cylinder, and also having a pressure chamber connected with said main conduit independently of said triple valve or distributer, and a stop cock or valve between the said pressure chamber and the main conduit, substantially as described.

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

FRANÇOIS CHAPSAL.

Witnesses:
GEORGES DELOY,
CLYDE SHROPSHIRE.