(No Model.)

2 Sheets—Sheet 1.

J. B. KUNDSEN.

AIR BRAKE MECHANISM.

No. 525,686.

Patented Sept. 4, 1894.

Fig. 1.

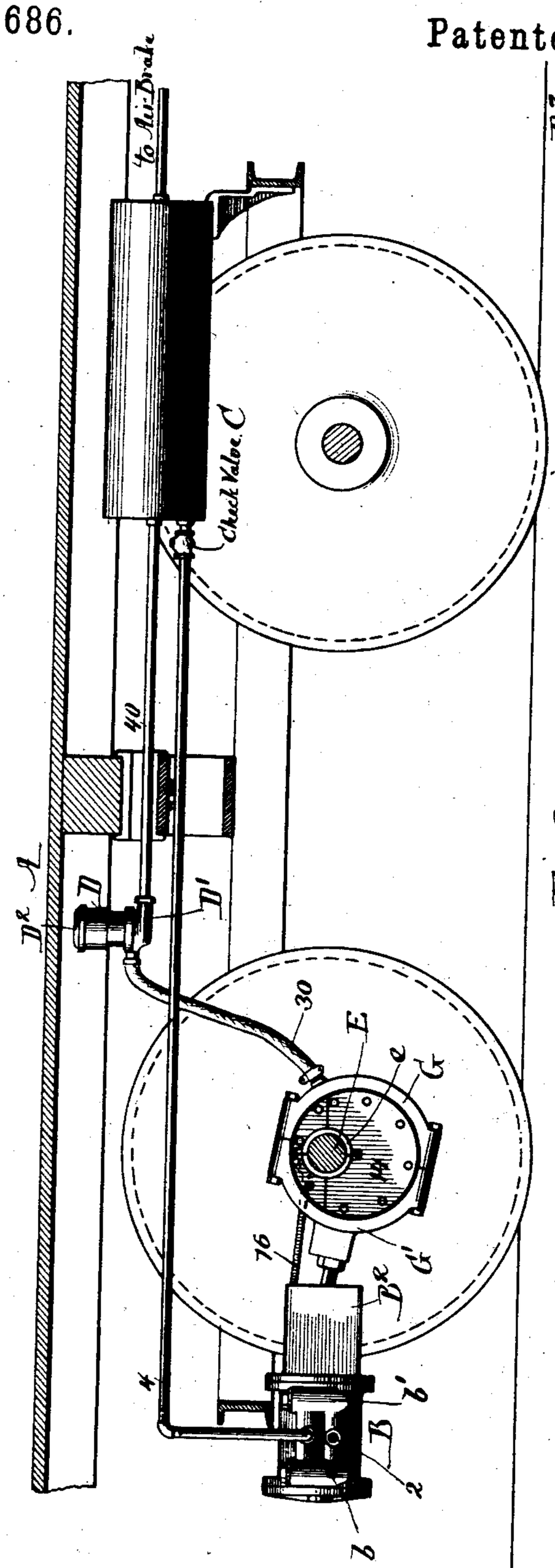


Fig. 3.

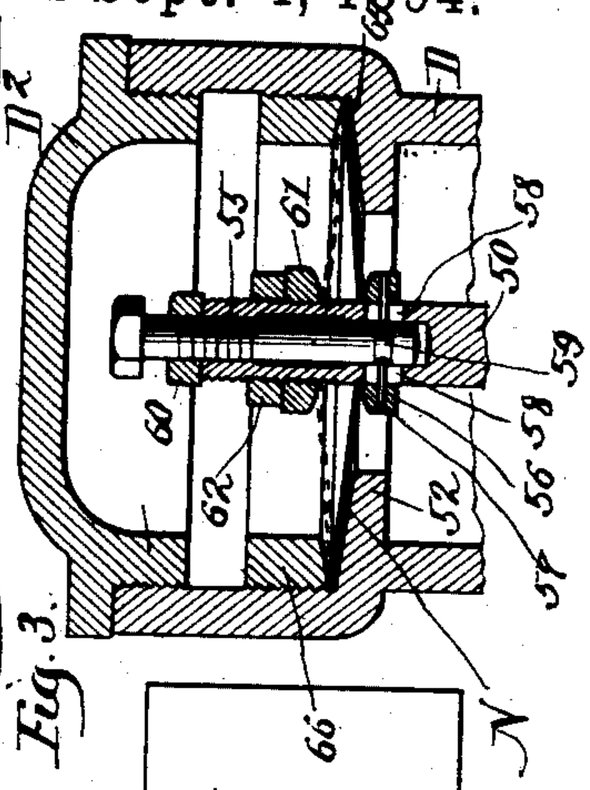
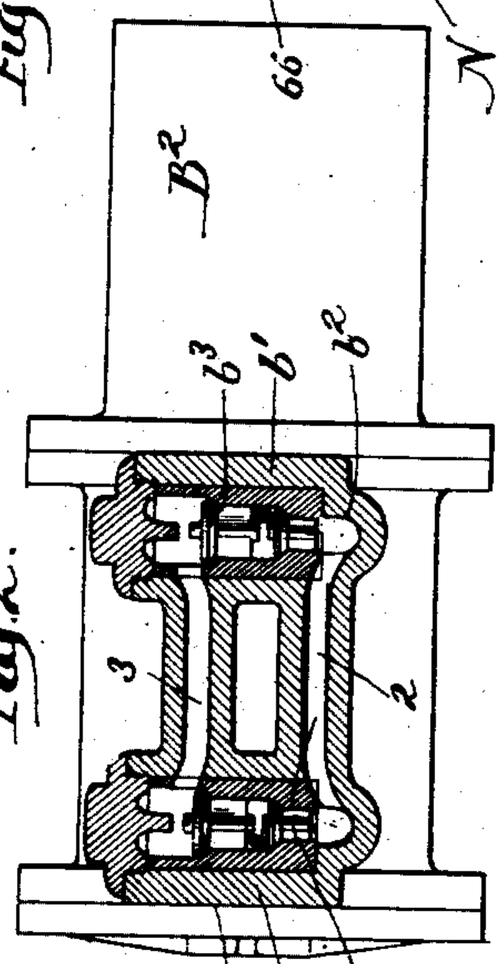


Fig. 2.



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(No Model.)

2 Sheets—Sheet 2.

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AIR BRAKE MECHANISM.

No. 525,686.

Patented Sept. 4, 1894.

Fig. 6.

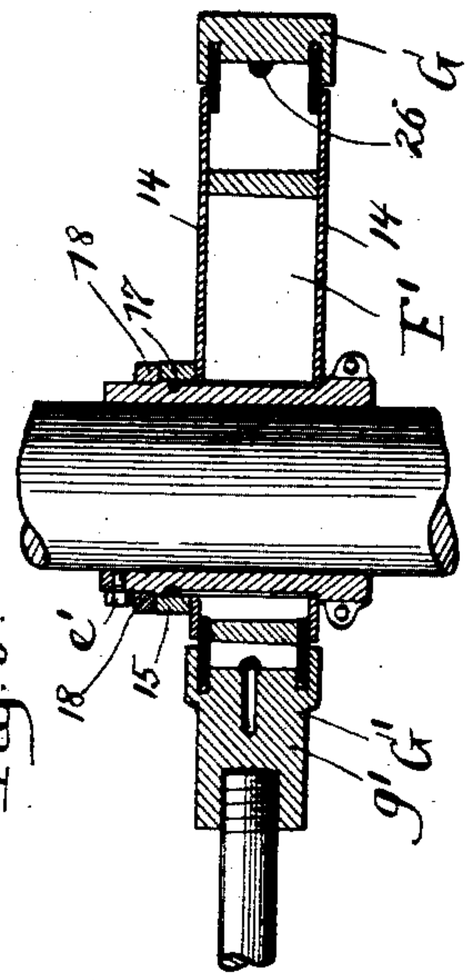
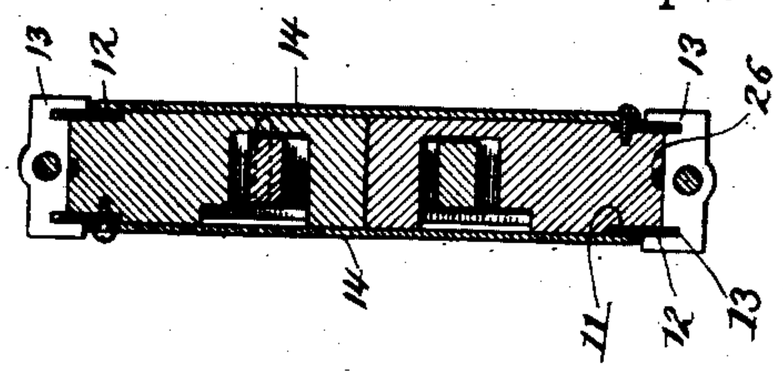


Fig. 7.



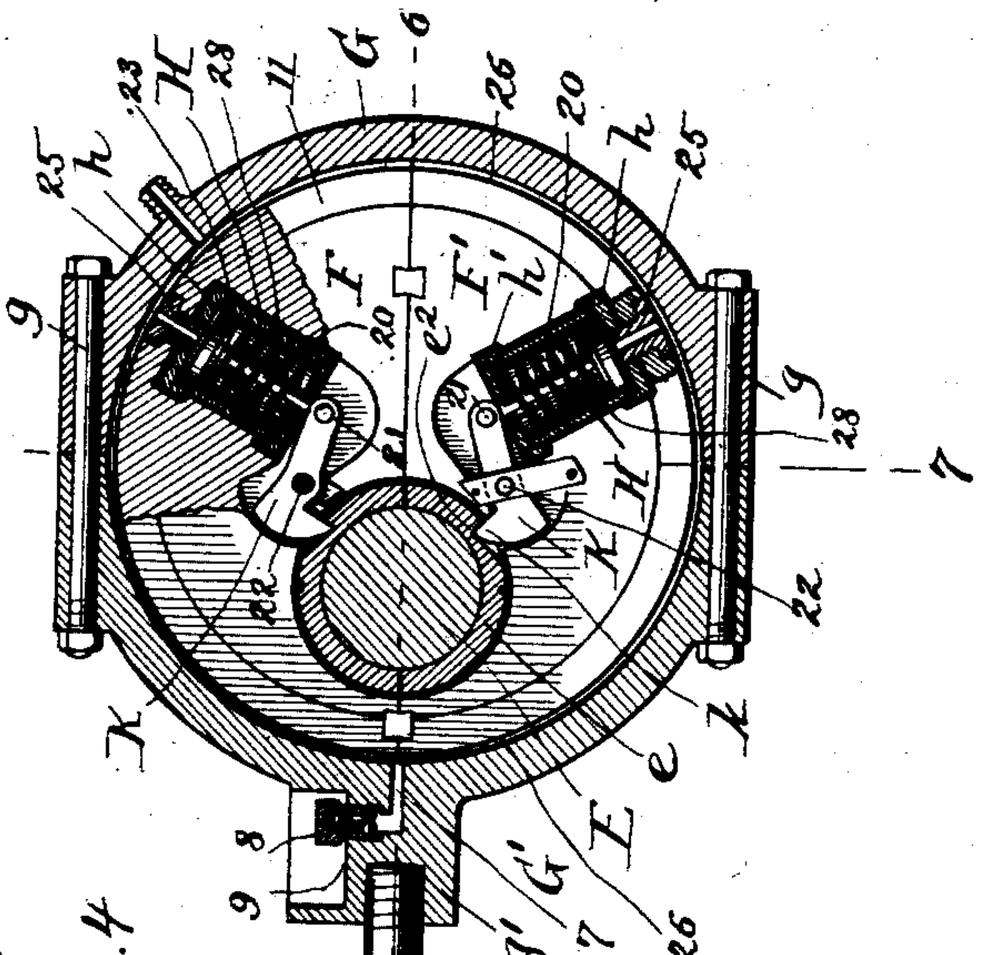


Fig. 5.

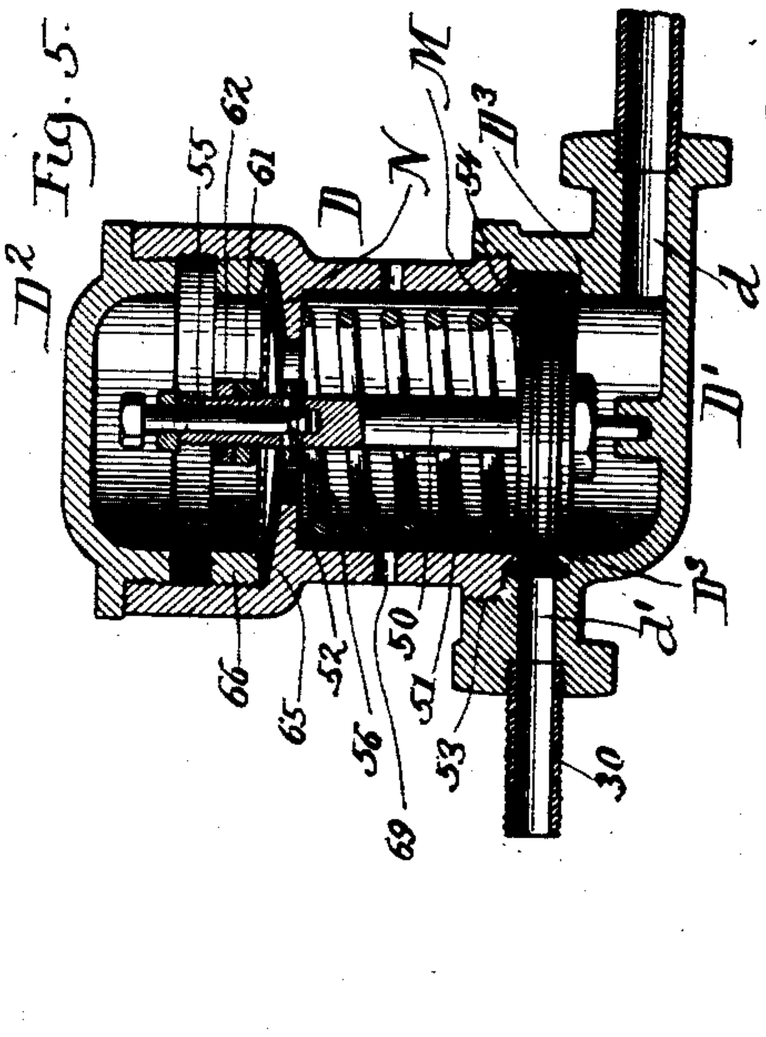


Fig. 4.

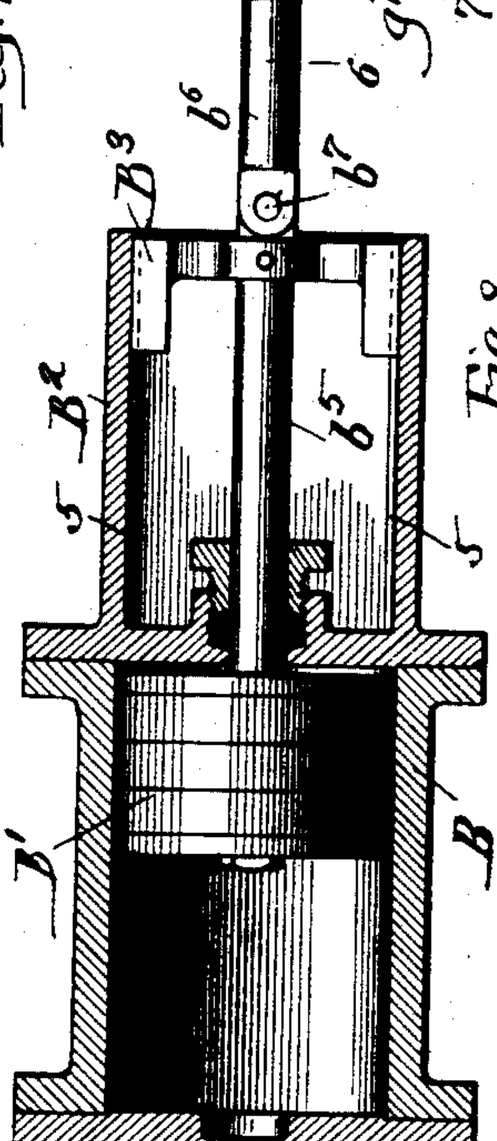
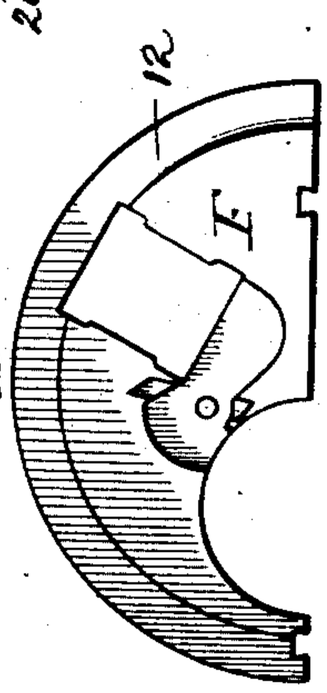


Fig. 8.



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UNITED STATES PATENT OFFICE.

JACOB B. KNUDSEN, OF FERNWOOD, ILLINOIS.

AIR-BRAKE MECHANISM.

SPECIFICATION forming part of Letters Patent No. 525,686, dated September 4, 1894.

Application filed July 17, 1893. Serial No. 480,698. (No model.)

To all whom it may concern:

Be it known that I, JACOB B. KNUDSEN, a citizen of the United States, residing at Fernwood, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Air-Brake Mechanism for Railway-Cars, of which I do declare the following to be a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

The present invention is more particularly directed to the improvement of that class of air-brake mechanism designed for use in connection with street-railway cars, and more especially does it relate to the type of air-brake mechanism in which the compression of the air within the reservoir from which the air supply is delivered for controlling the brakes, is effected by means of a pump driven from the axle of the car wheels.

The object of my present invention is first to provide improved means for operating the pump and second, to provide an improved construction of valve for controlling the pump operating mechanism.

These objects of invention I have accomplished by the novel features of construction hereinafter described, illustrated in the accompanying drawings, and particularly defined in the claims at the end of this specification.

Figure 1 is a view showing my improved air-brake mechanism applied to a car, the air-brake mechanism being shown in elevation and parts of the car being shown in section. Fig. 2 is a side view of the air compression pump, the valve chest being shown in section. Fig. 3 is an enlarged central sectional view of the upper portion of the valve for controlling the pump operating mechanism. Fig. 4 is a vertical, longitudinal, central sectional view of the compression pump and parts for operating the same, parts being shown in elevation. Fig. 5 is a central, vertical sectional view of my improved valve for controlling the pump operating mechanism. Fig. 6 is a horizontal sectional view taken at line 6—6 of Fig. 4. Fig. 7 is a vertical sectional view taken at line 7—7, Fig. 4. Fig. 8 is a detail view in side elevation of one of the sections of the eccentric.

Beneath the floor A of the car is suitably sustained the pump B, the reservoir C for the compressed air and the casing D of my improved valve. The pump B is preferably a double acting pump having valve chambers b and b' within each of which are held the valves b^2 and b^3. The valve b^2 controls the admission of air to the pump cylinder through the admission port 2, as the piston B′ of the pump recedes therefrom, and the valve b^3 controls the passage of air from the pump through the channel 3 that leads to a pipe 4 which connects the pump B with the compressed air reservoir C. By reference more particularly to Figs. 1 and 2 of the drawings, it will be seen that when the pump piston B′ is operated, in manner to be presently defined, the valve b^2 within each of the valve casings will open as the piston B′ recedes therefrom, while the valve b^3 will be correspondingly closed, and air will thus be admitted to the pump cylinder; while upon the reverse strokes of the piston B′ the valve b^2 will close and the valve b^3 will open in order to permit the air to be forced by the piston from the pump cylinder into the reservoir C. The air channel 3 from each of the valve casings b and b' at opposite ends of the pump cylinder connect with the pipe 4 that leads to the reservoir C. Preferably the pump B is provided with an extension B^2 that is furnished with grooves 5 to receive the sliding cross head B^3 that is connected to the piston rod b^5 of the pump.

Upon one of the axles E of the car is mounted my improved mechanism for actuating the piston B′ of the pump, which mechanism will be next described: On the axle E is fitted a sleeve e formed of sections that is held in place on the axle by suitable set-screws e' and on this sleeve e is mounted in manner free to revolve, the eccentric that is preferably formed of the sections F and F′. About the periphery of the eccentric sections F and F′ fit the sections G and G′ of the eccentric yoke, these sections G and G′ being suitably connected together by through-bolts as at g. The yoke section G′ is formed with a boss g' that is threaded to receive the pitman b^6 that is pivoted as at b^7 to the end of the piston rod b^5 and within this boss g' is preferably formed a channel 7 through which

oil will be admitted to the periphery of the eccentric to lubricate the same. Preferably the channel 7 is controlled by a spring actuated puppet valve 8 located within a chamber 9 at the mouth of the channel 7. The sections F and F′ of the eccentric are duplicates of each other and each of these sections is formed adjacent its periphery and upon each side with the annual rabbet 11 to receive a packing ring 12 of leather, sheet-brass or the like, the rings 12 projecting beyond the periphery of the eccentric and entering annular grooves 13 formed in the inner face of the eccentric yoke. The packing rings 12 are held in place by means of side plates 14 that are bolted to the faces of the eccentric sections F and F′. Upon the sleeve *e* is preferably mounted a loose collar 15 suitably sustained by a bracket 16, this collar being formed with a feed hole leading to a channel 17 to admit oil between the eccentric sections and the periphery of the collar *e*, and out-side the ring 15 is secured a ring 18 that serves to hold the ring 15 in place, the ring 18 being fixed to the collar *e*. Each of the sections F and F′ of the eccentric is formed with spaces to receive the casing or cylinder H and the dogs or pawls K. The cylinders H have their ends closed by the caps *h* and *h′* and through the cap *h′* passes a rod 20 one end of which is pivotally connected as at 21 to a pawl or dog K that is journaled upon a pin 22, and the opposite end of the rod 20 carries a piston 23 that fills the upper end of the cylinder H, this piston 23 being forced normally outward by the coil spring 28 within the casing. The free end *k* of each of the dogs or pawls K is arranged to engage with a notch e^2 formed in the periphery of the collar *e* in order to lock the eccentric to the collar in manner to be presently defined. The cap *h* of each of the cylinders H is connected by a short pipe 25 with an annular channel 26 that is formed around the periphery of the sections F and F′ of the eccentric, although manifestly this channel 26 might be formed upon the inner face of the eccentric yoke. The channel 26 connects with the reservoir by a suitable pipe 30, preferably of flexible material, that admits air from the reservoir when the maximum pressure of the reservoir has been reached and it is desired to throw the pump temporarily out of action. When the dogs or pawls K are in engagement with the collar *e* as shown in Fig. 4, of the drawings, it is manifest that the eccentric sections F and F′ will be driven by the car axle E and will impart movement through the eccentric yoke to the piston of the pump B, thereby forcing air into the reservoir C. When, however, a maximum pressure of air within the reservoir occurs, compressed air will be admitted (by valve mechanism to be presently described), to the annular channel 26 of the eccentric and from such channel the air will pass by the short pipes 25 to the cylinders H and will force inward the pistons 23, thereby causing the rods 20 to rock the pawls K about their pivot points, until their free ends *k* pass from engagement with the ring *e*. As soon, however, as the pressure of air within the reservoir C has been sufficiently reduced, the springs 28 will force outward the pistons 23 and will again throw the free ends *k* of the pawls K into engagement with the notches e^2 of the ring *e* and cause the eccentric to again partake of the movement of the car axle E.

The improved valve mechanism whereby compressed air will be admitted from the reservoir C to the eccentric in order to operate the dogs or pawls K in manner before defined, will next be described, although I do not wish to be understood as claiming in this application said improved valve mechanism, as the same affords the subject-matter of an application filed by me November 20, 1893, Serial No. 491,489. The casing D of this valve mechanism has a base D′ that is formed with the port *d* that connects to the pipe 40 leading to the reservoir C and is formed also with a port *d′* that connects with the pipe 30 leading to the eccentric yoke and the interior of the base D′ is formed with a raised seat D^3 whereon will rest the valve M that controls the passage of air from the reservoir to the channel 26 of the eccentric. The valve M is carried upon the end of the valve stem 50 that is encircled by a coiled spring 51 that serves to give a downward pressure to the valve, this spring 51 bearing against the valve at one end and at its opposite and against the interior shoulder 54 of the casing. The casing D is preferably connected to its base D′ by the threaded joint 53 and the lower end of the casing is formed with an annular projecting seat 54 against which the valve M will close when forced upward, by the passage of air from the reservoir C. The stem 50 is preferably hollow at its upper end and is screw-threaded to receive a spindle 55 which is connected to a washer 56 that encircles the stem 50 and serves to limit the downward movement of the diaphragm N. The connection between the spindle 55 and the washer 56 is preferably effected by pins 57 (see Fig. 3), that pass through the slots 58 formed in the stem 50 and into an annular groove 59 formed adjacent the end of the spindle 55, the ends of the pins 57 entering the washer 56. Hence it will be seen that as the spindle 55 is turned, the washer 56 will be raised or lowered and the position of the spindle can be fixed as desired, by means of a stay-nut 60 that encircles the spindle 55 and can be jammed against the upper end of the stem 50. The exterior of the stem 50 is also screw-threaded to receive the adjusting nut 61 and its jam-nut 62, the nut 61 serving to determine the upward movement of the diaphragm N. This diaphragm N is preferably held in place between the shoulder 65 formed upon the interior of the casing D and a threaded ring 66 within the threaded upper part of the casing, and preferably the top of the casing is closed by a cap D^2 having

a threaded portion to engage the upper end of the casing. The side walls of the casing D are formed with vent holes 69, the purpose of which will presently appear. The valve M which controls the passage of air from the reservoir C to the channel 26 of the eccentric, is held normally against its seat D^3 not only by the spring 51, but also by the pressure of the diaphragm N. Thus for example, if the maximum pressure of the reservoir C is to be forty pounds, the spring 51 may exert the pressure of thirty pounds and the diaphragm N, a pressure of ten pounds, upon the valve M. Inasmuch however, as the diaphragm N is concavo-convex, it is obvious that as soon as the pressure within the reservoir passes the limit of forty pounds, and lifts the valve M, the diaphragm N will be forced from the position shown by full lines, to the position shown by dotted lines in Fig. 3 and consequently the ten pounds of pressure in downward direction due to the diaphragm will be instantly relieved and the diaphragm, being in the position shown in dotted lines will then exert a pressure of ten pounds tending to hold the valve M in its raised position. Hence it will be seen that while forty pounds of pressure is required to raise the valve M from its seat in order to permit the passage of air from the reservoir C to the channel 26 of the eccentric, in order to throw the eccentric and the pump out of action, it is manifest that inasmuch as the diaphragm N in its raised position will exert a pressure of ten pounds in upward direction against the pressure of thirty pounds of the spring 51 in downward direction, the valve M will remain open until pressure of air within the reservoir C is below twenty pounds.

If no provision were made for holding the valve M open as above described, there would be danger of slight variations of pressure within the cylinder C causing a slight passage of air from the cylinder to the eccentric and the dogs or pawls K would be constantly raised or lowered in an indeterminate manner causing their ends to wear against the shoulders of the notches e^2 formed in the periphery of the collar *e*. By providing means, however, whereby the maximum pressure within the reservoir C positively lifts the valve M which remains in raised position until there is a material decrease in the pressure within the reservoir all such danger of an irregular action of the dogs or pawls K is avoided. It will be understood of course, that a suitable pipe will lead from the reservoir C to the valve mechanism that controls the brakes of the car, but as this valve mechanism forms no part of my invention, I have not deemed it necessary to illustrate the same.

From the foregoing description, it will be seen that when the dogs or pawls K are in engagement with the sleeves *e*, the rotation of the car axle E will cause the eccentric and its yoke to drive the piston B′ of the air pump B, thereby forcing air into the reservoir C. As soon as a maximum pressure of air within the reservoir is attained, and it is desired to throw the pump out of action, the valve M will be lifted from its seat and air will then pass from the reservoir C through the base D′ of the valve casing and through the pipe 30 to the annular channel 26 of the eccentric, and from this channel the air will pass through the short pipes 25 into the casing H and will force inward the pistons 23 against the springs 28, thereby throwing the pawls or dogs K out of engagement with the sleeves *e* and hence causing the axle E to no longer operate the eccentric or the pump. Compressed air may now be withdrawn from the reservoir C to operate the car brakes, until the pressure of air within the reservoir is so far reduced (say to twenty pounds), that the spring 51 shall force downward the valve M and the diaphragm N and thus prevent the further admission of air from the reservoir to the channel 26 of the eccentric. When the valve M is thus closed, the air within the channel 26 of the eccentric, and within the casings H will escape through pipe 30 into the casing D and will pass thence through port 69, thus permitting the springs 28 to force outward the pistons 23 and again cause the dogs or pawls K to lock the eccentric to the rotating ring *e* of the axle E. My object in providing adjusting devices upon opposite sides of the diaphragm N is to enable this diaphragm to be set so that it will quickly spring past its center point from either direction.

It will be seen that the spring 51 and the spring acting plate or diaphragm N together constitute a differential spring mechanism for controlling the valve M, since a different degree of spring pressure is exerted upon the valve M for holding it in closed position, than for retaining it in its open position. While I prefer that the diaphragm or plate N can be so arranged as to serve to resist the downward movement of the valve M, it is manifest that such arrangement is not necessary, as the spring plate or diaphragm N could simply be thrown out of action upon the upward movement of the valve.

My object in forming the eccentric and its yoke and the collar *e* of sections is to permit these parts to be readily placed upon the car axle, but if desired, each of these parts might be made in a single piece.

The details of construction above set out may be modified within wide limits without departing from the spirit of the invention. Thus for example, instead of employing the collar *e* in which are formed the notches e^2, this collar might be dispensed with and the notches formed directly in the axle E. So too, without departing from the broad scope of my invention the clutch mechanism carried by the eccentric and serving to connect it with the car axle may be varied and if de-

sired, a single clutch device, such for example, as one of the dogs or pawls K might be used.

So far as I am aware, my invention presents the first instance of a pump actuated by an eccentric or other rotary body driven from the car axle and provided with clutch mechanism by means of which it can be thrown into and out of engagment with said axle; and presents the first instance also in which a clutch mechanism actuated by a pressure of air within the reservoir, such air pressure being controlled by a valve provided with differential spring mechanism serving to insure the retention of the valve in open position until the pressure within the reservoir has materially decreased.

In prior devices so far as I am aware, the clutch mechanism (by which term I mean any means serving to throw the pump into and out of action), has usually served simply to disengage the pump piston rod from the eccentric, while allowing the eccentric and its yoke to be constantly driven, which is seriously objectionable; and in such prior devices, the valve mechanism that serves to control the clutch mechanism was not furnished with differentially operating springs and consequently did not allow the pressure within the reservoir to be materially decreased before the pump was again set in operation.

Having thus described the invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In air-brake mechanism, the combination with a pump, a reservoir and a car-axle of a rotary body driven by said axle and serving to actuate said pump, a clutch mechanism for effecting the engagement of said body with the axle, and means for automatically releasing said clutch mechanism to permit said axle to rotate independently of said body, substantially as described.

2. In air-brake mechanism, the combination with a pump, a reservoir and an axle of an eccentric driven by said axle, and serving to actuate said pump a clutch for effecting the engagement of said eccentric with the axle and a suitable connection between the reservoir and the clutch whereby said clutch may be released by the pressure within said reservoir, substantially as described.

3. In air-brake mechanism, the combination with a pump, a reservoir and an axle of an eccentric mounted upon said axle and serving to actuate said pump, a spring actuated clutch carried by said eccentric for connecting with the axle, a piston for operating said clutch and suitable means for admitting air from the reservoir to the casing of said piston in order to throw said clutch out of action, substantially as described.

4. In air-brake mechanism, the combination with a pump, a reservoir and an axle of an eccentric mounted upon said axle and serving to actuate said pump, and provided with a groove or channel for the passage of air, clutch mechanism carried by said eccentric and adapted to connect the same with the axle, a piston for operating said clutch mechanism, the casing of said piston being connected with the air channel or groove of the eccentric, and a yoke for said eccentric connected with the pump, substantially as described.

5. In air-brake mechanism, the combination with a pump, and with the car-axle of an eccentric mounted upon said axle for operating the pump, a yoke for said eccentric, connected to the pump piston and a clutch mechanism for throwing said eccentric into and out of engagement with the axle, and means for operating said clutch mechanism to release the eccentric from the axle, substantially as described.

6. In air-brake mechanism, the combination with a pump, a reservoir and an axle of an eccentric mounted upon said axle and provided with pawls or dogs for effecting its engagement therewith, and provided also with spring actuated pistons for releasing said pawls or dogs and with a suitable channel or passage for admitting air to the casings of said pistons, a yoke for said eccentric connected with the pump piston, and a pipe connecting the reservoir with the passage or channel of the eccentric whereby air may be admitted to operate the pistons that control the pawls or dogs, substantially as described.

7. In air-brake mechanism, the combination with a pump, a reservoir and an axle of an eccentric mounted upon said axle and serving to actuate said pump, and provided with a peripheral groove for the passage of air, pawls or dogs (one or more), carried by said eccentric for causing said eccentric to rotate with the axle, a spring actuated piston for controlling said pawls or dogs, casings or cylinders for said pistons connected with the passage or channel of the eccentric and a pipe leading from the eccentric yoke to the reservoir, whereby air may be admitted from said reservoir to the passage or channel of the eccentric in order to operate the pawls or dogs, substantially as described.

8. In air-brake mechanism, the combination with a pump, a reservoir and an axle of an eccentric mounted upon said axle and serving to actuate said pump, and provided with pivoted dogs or pawls for causing the engagement of the eccentric with the axle, spring actuated pistons connected with said pawls or dogs, a yoke for said eccentric connected with the pump piston, an annular passage for air being formed between said yoke and said eccentric, said annular passage being connected with the casing of said pistons, and a pipe connected with the port formed in the yoke and leading to the reservoir whereby air may be admitted from the reservoir to operate the pistons carried by the eccentric, substantially as described.

9. In air-brake mechanism, the combination

with a pump, a reservoir, and an axle of an eccentric for operating said pump provided with clutch mechanism for affecting its engagement with the axle and provided with an annular channel or groove for compressed air, a yoke for said eccentric having annular grooves in its inner face, packing rings attached to the eccentric and projecting into the annular grooves of the yoke, suitable pistons (one or more), for operating the clutch mechanism of the eccentric, the casings or cylinders of said pistons being connected with the annular groove of the eccentric, and a pipe for admitting air from the reservoir to the annular groove of the eccentric, substantially as described.

10. In air-brake mechanism, the combination with a pump, a reservoir and a car axle and means for driving the pump from the car axle, and with a clutch mechanism for causing the pump to be operated by said car axle, of the valve or piston for controlling said clutch mechanism, and differentially operating spring mechanism for controlling said valve or piston, substantially as described.

11. In air-brake mechanism, the combination with a pump, a reservoir, a car axle and means for operating the pump from said car axle and with a clutch mechanism for bringing said pump mechanism into action, of means whereby said clutch mechanism may be actuated by the compressed air in the reservoir a valve for controlling the flow of compressed air to operate said clutch mechanism, and differentially operating spring mechanism for said valve, substantially as described.

12. In air-brake mechanism, the combination with a pump, a reservoir, a car axle and means for operating said pump from the car axle, of clutch mechanism for throwing said pump operating mechanism into action, pistons (one or more), for controlling said clutch mechanism, suitable air pipes and channels whereby air is admitted from the reservoir to operate said clutch pistons and a valve serving to control the flow of air from said reservoir to the clutch pistons, said valve being provided with differential spring mechanism whereby the valve will be raised by a pre-determined pressure of air within the reservoir, but will remain open until said pressure is materially reduced, substantially as described.

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