No. 823,315. PATENTED JUNE 12, 1906.

E. B. ALLEN.

AIR SUPPLY APPARATUS FOR AIR BRAKES.

APPLICATION FILED FEB. 13, 1906.

3 SHEETS—SHEET 1.

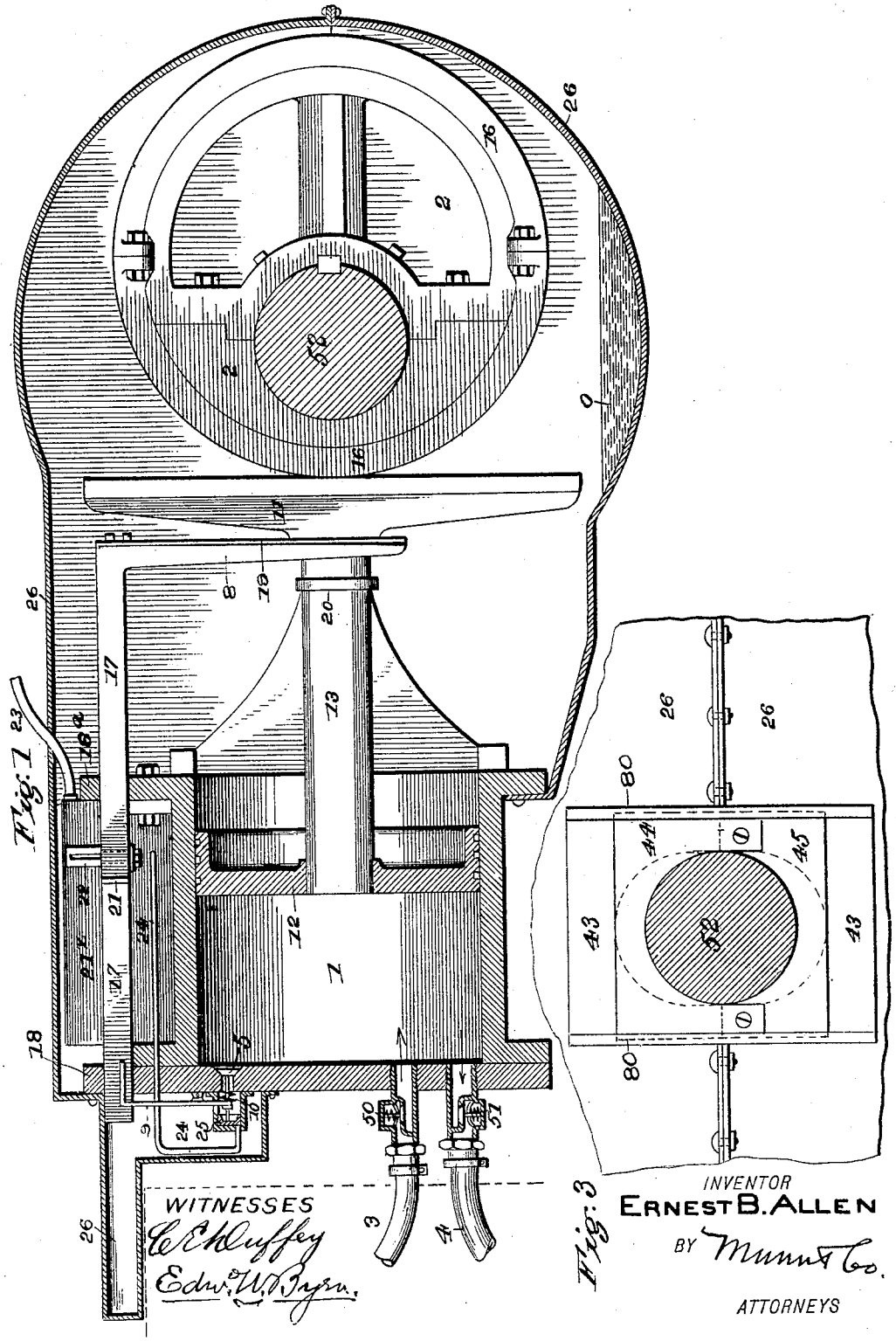

Fig. 1

Fig. 3

WITNESSES

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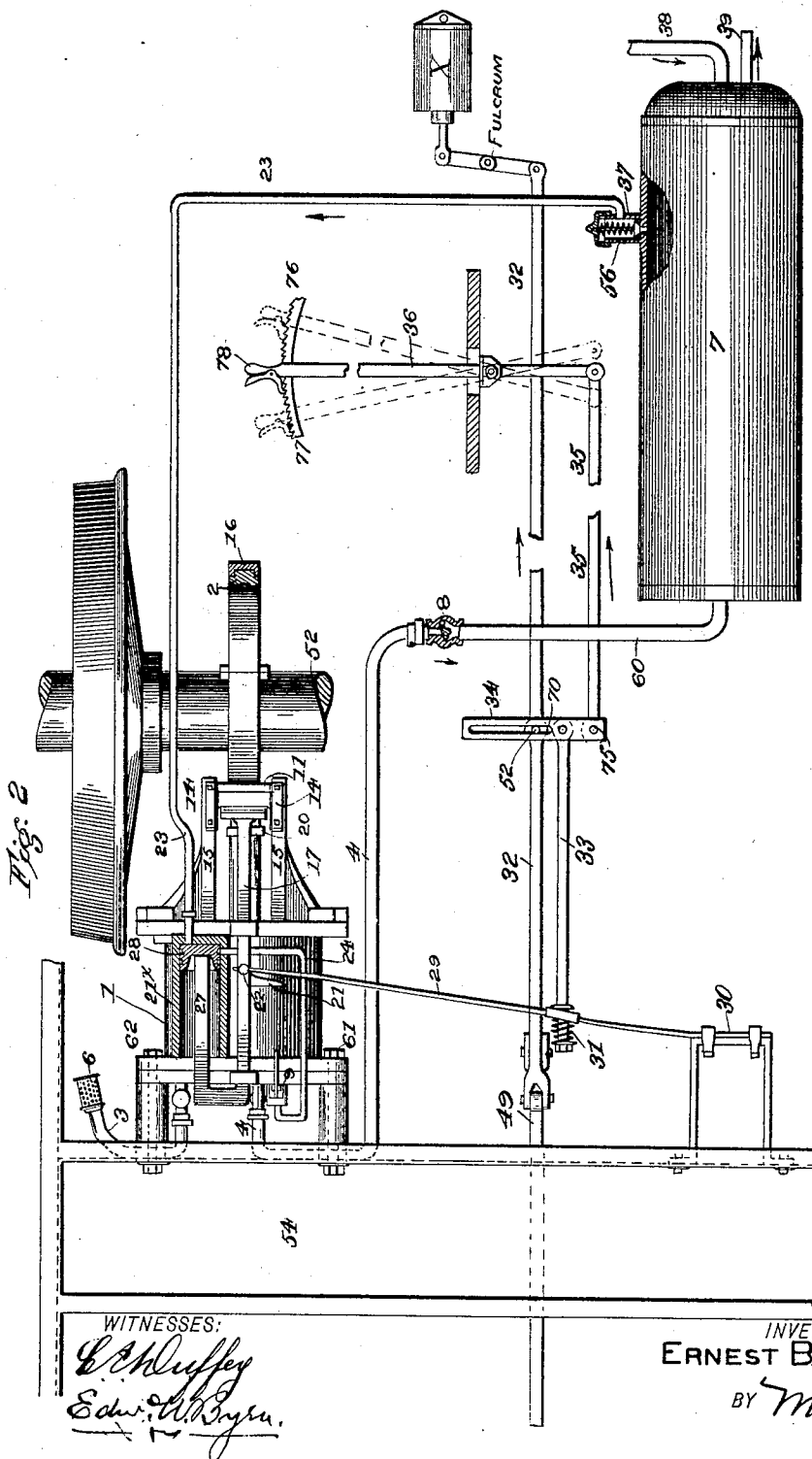

Fig. 2

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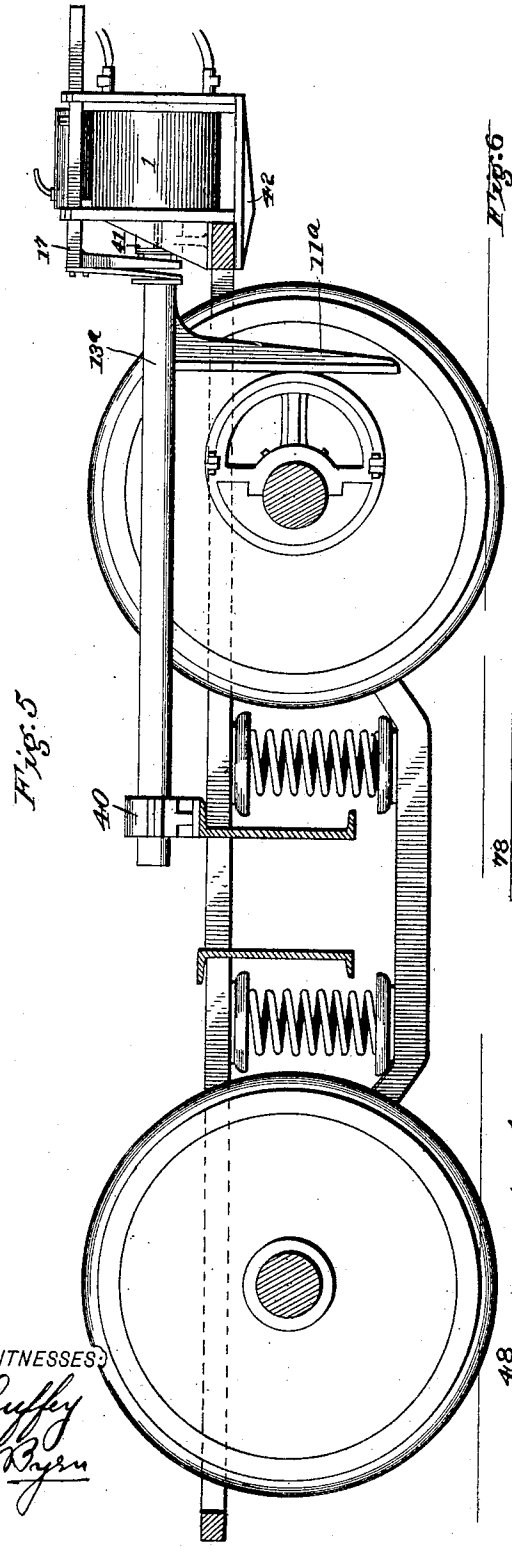

Fig. 5.

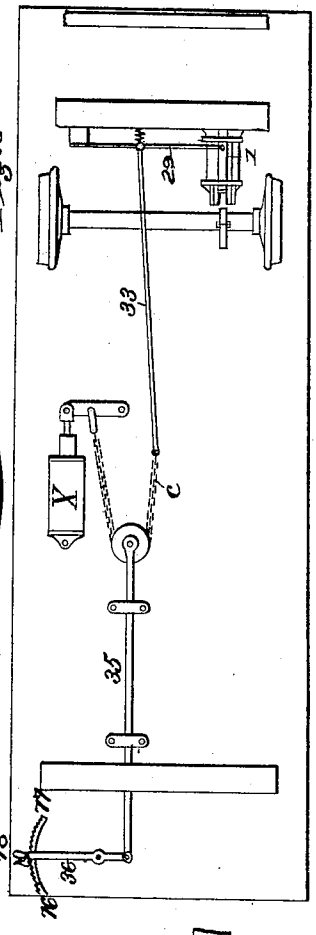

Fig. 6.

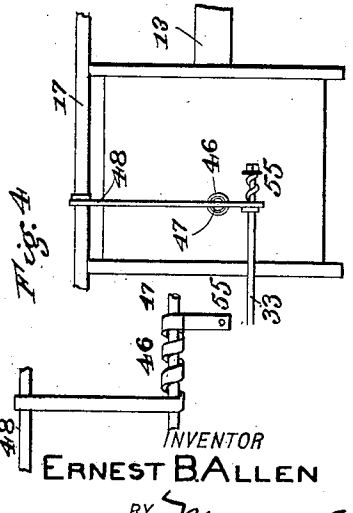

Fig. 4.

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AIR-SUPPLY APPARATUS FOR AIR-BRAKES.

No. 823,315. Specification of Letters Patent. Patented June 12, 1906.

Application filed February 13, 1906. Serial No. 300,852.

To all whom it may concern:

Be it known that I, ERNEST BERNARD ALLEN, a citizen of the United States, residing at Louisville, in the county of Jefferson and State of Kentucky, have invented a new and useful Improvement in Air-Supply Apparatus for Air-Brakes, of which the following is a specification.

My invention is in the nature of an auxiliary air-supply apparatus for supplementing or reinforcing the air-supply in air-brakes and to which I have applied the term of "booster system." After two applications of the brakes on a long freight-train on a heavy downgrade the engine has a good deal of difficulty in recharging the train-line, which difficulty is often the cause of a runaway train. In street-car lines and also suburban trains using air-brakes the very frequent stops deplete the air-pressure, so that it cannot be kept up to the standard, and consequently the quick recurrence of another stop after such depletion of air-pressure finds the system seriously deficient for the work it is intended to do.

My invention is designed to provide for these difficulties by apparatus which not only keeps the air-supply up to its standard pressure at all times, but also utilizes the power in compressing this auxiliary charge as a means for stopping the train, thus securing a double effect, since the power used to oppose the stopping of the train in one instance operates through the booster-pump of my apparatus to supplement or reinforce the pressure in the reservoir for subsequent stops in the application of the air-brakes.

My booster-pump is driven by the axle of a car, and this pump is automatically cut in or started the moment the brakes are applied. Its duties are to pump air to replace the air used in the brake-cylinders during application of brakes, and at the same time it will help stop the car. It is not intended that it shall entirely replace the air-pump on a train of cars where the automatic brake is used, but only to store air in a tank, which when brakes are released is automatically turned into the train-line and insures a quick recharge of the whole train-line, thereby helping the steam air-pump on the engine or the electrically-driven pump to replenish the train-line pressure. The advantage of this booster apparatus used with straight air-brakes, whether storage or motor-driven system, is that my apparatus will put air into the reservoir faster than it can be used. When the booster-pump gets the pressure to standard, it cuts itself out of service automatically even before the brakes have been released. As soon as the pressure drops, however, it cuts in on the next application of the brakes, or it may be cut in by a hand-lever at will. Thus, for instance, if there is a bad leak in the air-brake system pressure can be kept up by pulling a hand-lever, which is situated in the front part of the car, which lever is so connected by a long rod to the booster-pump apparatus as to be able to start the same. When the brakes are released, the booster is immediately thrown out of operation, and there is no machinery whatever connected with the booster, and therefore no drag on the acceleration of the car. The power to run the booster-pump costs nothing, for since it is the result of the momentum of the train it would ordinarily be lost power.

Figure 1 is a vertical section taken longitudinally through the booster-pump and crosswise the axle. Fig. 2 is a plan view, partly in section, of the booster-pump shown connected with the other coöperating parts of my system. Fig. 3 is a detail in side view of a part of the booster-pump casing where it crosses and incloses the car-axle. Fig. 4 are details of a modification of the starting devices for the booster-pump. Fig. 5 is a side view, partly in section, of a changed position of the booster-pump; and Fig. 6 shows diagrammatically a modified means for cutting in the booster-pump by hand at will.

I will first describe the booster-pump, referring more especially to Figs. 1 and 2. It is a single-acting pump, with the open end of its cylinder 1 next to the cam 2 on the car-axle 52. There are three valves in the head of the cylinder—an inwardly-opening suction-valve 50, an outwardly-opening discharge-valve 51, and a small inwardly-opening escape-valve 5. The first two are connected by hoses 3 and 4 to the car-body where the suction-valve hose 3 ends in a strainer 6, Fig. 2, and the discharge-valve hose connects with a pipe 60, leading to the air-reservoir 7. There is a check-valve 8 at the junction of discharge-hose and the pipe leading to the reservoir. The small valve 5 is brought into operation when it is struck or forced open by the small lever 9. At other times it is kept closed by the small spring 10. The duty of this valve 5 is to destroy the air-cushion in the cylinder by allowing the air to escape

from cylinder 1 when the pump is thrown out of action, so that the perpendicular shoe 11 will not drag on the cam of the car-axle. The cylinder is fastened to the bolster 54 of the truck by the two bolts 61 and 62, as shown in Fig. 2, or by some suitable casting or support. The cylinder 1 contains a piston 12 and a piston-rod 13. Attached to the outer end of the piston-rod is a cross-head 14, Fig. 2. (Not shown in Fig. 1.) This cross-head is supported by the two guides 15, Fig. 2, which extend from the open end of the cylinder 1 to within two inches of the axle 52. A perpendicular shoe or plate 11 is fastened to this cross-head to engage the cam. This plate or shoe is about four inches wide and seventeen or eighteen long. The surface of the shoe which engages the cam is perfectly straight and perpendicular, so that as the axle plays up or down in its journal-box the stroke of the pump will not be altered in the least. The cylinder being fastened to the spring-seated truck-bolster will not be subject to such jolts as it would if fastened to the axle. The cam 2 is fastened rigidly to the axle. The steel ring 16 is made in two pieces, as shown in Fig. 1, and bolted together. This ring is about one-sixteenth of an inch larger than the cam 2, so it will slip around the cam. Wear is taken up by liners between the two halves of the ring. This ring serves to give the cam more bearing-surface, because the ring simply rolls down the face of the shoe 11 while the cam turns inside of the ring. When it is desired to work the pump, the shoe 11 is pushed out to meet the cam, as in Figs. 1 and 2. Consequently the air behind the piston 12 is compressed on the instroke. This forcing the piston out to engage the cam is accomplished by the sliding push-rod 17, which is situated on top of the cylinder 1 and slides through the two guide-lugs 18 and 18ª. It has a downwardly-projecting arm on the end next to the cam, the lower end of which is formed as a yoke, which fits around the piston-rod and has a limited longitudinal play thereon. In the position shown the arm is up against the shoe 11. On the front surface of this arm is fastened a flat spring 19, which in Fig. 1 is shown as forced flat against the arm of the push-rod; but when the force acting to cause the push-rod to throw the piston-rod and shoe out against the cam is taken away the spring will cause the arm of the push-rod to move back one and one-half inches with an independent or secondary movement until it strikes the collar 20, Figs. 1 and 2. This extra one and one-half inches back travel will cause a tappet projection 21, Figs. 1 and 2, on the push-rod to strike the small lever 9, and thereby open valve 5. Any air-cushion that may be entrapped behind piston 12 will be allowed to escape, so that it has no tendency to push the piston and shoe outwardly.

As long, though, as the push-rod tends to make the piston-rod follow the cam on the outstroke the arm of said rod will compress spring 19, and the projection 21 on the push-rod will lack an inch and a half of touching the little valve-lever 9. Therefore when the pump is working air cannot escape through the small valve 5, but must go out through discharge-valve 51. When the pump is not in operation, the small valve is opened, because push-rod 17 has one and one-half inches more back travel. It is not only held back by the spring 10, but by the long lever-spring 29, Fig. 2, which is the adjusting device which causes the pump to come into action. This spring is a long flat piece of steel about four feet long, with the fulcrum at 30. It is fastened tight to a casting fastened to the truck-bolster and so inclined that it tends when not in use to throw the push-rod 17 back against the truck-bolster. It is fastened to the push-rod by being run through a slotted stem 22 on top of the rod 17. The power to start the pump is applied at 31, where the rod 33, which pulls the spring-lever 29 into action, is fastened. The bolt at 31 is to take up slack and adjust the length of rod 33. The small coil-spring at 31 is to make the apparatus more flexible and to allow more travel to the rod 33, if necessary. Spring-lever 29 is a lever of the third class, the power being applied between the fulcrum and the weight, (push-rod 17.) A lever of the first class could be used just as well if it suits the construction of the truck or the arrangement of the motors on the truck better—that is, a lever where the power is applied at 30 and the fulcrum at 31 and the weight at 22. In fact, any spring-lever could be used that would give the push-rod 17 a throw of six inches.

The rod 32 is the usual brake-rod which leads to the truck-lever 49, Fig. 2, from the brake-cylinder X. The rod 35 leads to the front of the car or vehicle, where it is fastened to the lever 36. In the drawings lever 36 is in a vertical position and rod 35 is pulled tight; also, the brakes are supposed to be on, and rod 32 is pulled tight in direction shown by arrows. When brakes are released, rod 32 will move three or four inches in the opposite direction from that of the arrow, and the pin 52 will slide over to the far end of slotted lever 34, thereby the tension will be taken from rod 33, and spring-lever 29 will pull back rod 17 and shoe 11 so the pump will stop. Rods 33 and 32 are intended to lie in a vertical plane. In the drawings they are for clearer illustration shown in a horizontal plane, so as to permit the workings of the slotted lever and the rods to be seen. The idea of having the rod 33 above the rod 32 and slotted lever 34 in a vertical position is that when the brakes are applied and rod 32 moves in the direction of the arrow the weight

of rods 33 and 32 will have a tendency of causing the pin 52 in rod 32 to slip into the end 70 of the slot, so that the rod 33 will get nearly as much travel as rod 32. The normal fulcrum of the slotted lever 34 is at 75; but the position of this fulcrum can be changed by the lever 36. In the position in which the lever 36 is now shown the fulcrum is so held that the pump will be pulled into action when the brakes are applied. If the lever 26 is moved into the forward corner 76 of the toothed bar, the pump will not cut in when brakes are applied. If it is pulled back to 77, it will cause the pump to run all the time. Position 78 will cause the pump to cut in whenever the brakes are applied.

When the pump is to be applied to a truck without motors and which has blind axles, a type of spring like that shown in Fig. 4 may be used, so that the pump may be fastened in the center of the bolster. This spring 46, Fig. 4, is a coil-spring, one end of which is fastened to the push-rod 17 at 48, the other end of which is fastened to rod 33 at 55. Rod 33 is same as shown in Fig. 2. This spring is coiled around a stem 47, which is fastened to side of pump-cylinder. A pull of three inches on rod 33 in Fig. 4 will result in a throw six inches forward of the push-rod 17, which will be sufficient to cause push-rod 17 to make the piston of the pump-cylinder follow the cam 2. This arrangement will allow the pump to be set in a line and a vertical plane with the rod 32, which connects with the truck-lever 49 and brake-cylinder.

The pump is protected by gear-casing 26, Fig. 1, which covers all the working parts of the pump and keeps out dirt. The bottom of this casing is to be filled with oil, as shown at *o*. The cam dips in the oil every revolution of the axle and not only splashes oil on the shoe 11, but also on the guides 15 and the end of the pump-cylinder. An oil-cup (not shown) is to be placed on top of the pump-cylinder at a point where the piston 12 finishes its outstroke. The pump and gear-casing both being fastened to the bolster of the truck, allowance must be made for the movement of the axle up and down in the pump-casing, as shown in Fig. 3. Two plates 44 and 45, each with a semicircular hole cut in it, are fastened together around the axle by screws, and as the axle moves up and down these two plates fastened together (which are the same as one now) slide up and down in grooves 80 in plate 43, which is fastened to the gear-casing 26, thus rendering it dust and dirt proof.

In Fig. 2 when the pressure becomes too high in the reservoir 7 the small valve 37 opens, air rushes through pipe 23 and forces piston 28 out, which drives rod 27 (which is a bent extension of push-rod 17, as shown in Fig. 2) back as far as possible, and at the same time the air flows through pipe 24 into small cylinder 25, forcing a small piston in against the stem of valve 5 and opening valve 5, as shown more clearly in Fig. 1. Therefore the air that would otherwise be entrapped behind piston 12 is allowed to escape, and the pressure behind piston 28 is sufficient to hold push-rod back against the resistance of the spring-lever 29, Fig. 2, thereby cutting out the pump.

A small opening 56 is shown in valve 37, which is about one sixty-fourth of an inch in diameter. The object of this small opening is to allow air to gradually escape from cylinders $21^{\times}$ and 25, thereby allowing the pump to be in condition to cut in again in a short while.

Reservoir 7, Fig. 2, is the reservoir into which an electric motor-driven air-compressor is supposed to discharge through pipe 38. Pipe 39 connects with the brake-valve. Therefore the booster system is shown as applied to an electric motor-driven straight air-brake. It must be understood that reservoir 7 belongs to an electric pump. (Not shown.) Valve 37 can be set for any pressure for which it is desired to cut out the booster-pump.

In Fig. 5 the pump is shown as situated on top of the front-truck crossover rod. The piston-rod 13^{a} is shown as extended and works through the two supports 40 and 41. The shoe 11^{a} is fastened to piston-rod, as shown. The object of this arrangement is to get the pump proper out of the way of the motor and any other rigging that may be on truck or when there is not sufficient room to fasten the pump to the bolster. This arrangement only requires about two inches axle-space. The cam and shoe are protected by a casing similar to that in Fig. 1. The pump and working parts on top of it may easily be covered by a suitable casing. The pump-cylinder is supported by steel castings 42, which are fastened to the top bar of the truck. The pump-cylinder 1, push-rod 17, and other arrangements on top of cylinder are the same as those shown in Figs. 1 and 2, the only difference being the extended piston-rod and shoe 11^{a}.

Push-rod 17 is bent in a U-shaped form, as shown in Fig. 2. The part numbered 27 runs into cylinder $21^{\times}$, located above main cylinder, but is not fastened to piston 28, a half-inch of clearance being allowed between end of rod 27 and the cup-shaped piston 28, so that when the pump is working and there is no pressure behind piston 28, rod 27 is free to move in and out of cylinder $21^{\times}$.

In Fig. 6 I show a modified means for connecting the manually-operated lever 36 and the air-brake (cylinder X) to the pump-starting spring-lever 29. The change consists in substituting for the slotted lever 34 of Fig. 2 a pulley *p* and chain *c*, as shown in Fig. 6. The different positions of pulley *p* permits

the automatic cutting in of the booster-pump by the application of the air-brakes or the running of the pump all the time or the cutting out of the pump altogether—*i. e.*, with lever 36 at 78 application of air-brakes pulls on chain *c* and starts pump, with lever 36 at 77 tension is maintained on chains *c* at all times and the pump is kept running constantly irrespective of the position of the piston of the air-brake cylinder, and when lever 36 is at 76 chain *c* is so slackened that even the application of brakes through cylinder X fails to move starting spring-lever 29.

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

1. An air-supply apparatus for air-brakes, comprising a main reservoir for compressed air, a single-acting pump mounted on the truck and having at one end a suction-valve opening inwardly from the atmosphere and an outlet-valve with pipe leading therefrom to the reservoir, a cam fixed to the car-axle, a piston in the pump-cylinder with rod and shoe having a range of adjustment to or from the cam, a slide-rod arranged beside and outside the pump-cylinder and having an arm connected to the piston-rod and shoe and means for adjusting said slide-rod and shoe to contact with the actuating-cam substantially as described.

2. An air-supply apparatus for air-brakes, comprising a main reservoir for compressed air, a single-acting pump mounted on the truck and having at one end a suction-valve opening inwardly from the atmosphere and an outlet-valve with pipe leading therefrom to the reservoir, a cam fixed to the car-axle, a piston in the pump-cylinder with rod and shoe having a range of adjustment to or from the cam, a slide-rod arranged beside and outside the pump-cylinder and having an arm connected to the piston-rod and shoe, a brake-cylinder and brake-rod and means for connecting the same to the slide-rod to cause the latter to project the shoe to contact with the cam by the application of brakes substantially as described.

3. An air-supply apparatus for air-brakes, comprising a main reservoir for compressed air, a pump having at one end a suction-valve opening inwardly from the atmosphere and an outlet-valve with pipe leading therefrom to the reservoir, a cam fixed on the car-axle, a piston in the pump-cylinder with rod and shoe having a range of adjustment to or from the cam, a slide-rod arranged beside and outside the pump-cylinder and having an arm connected to the piston-rod and shoe, a brake-cylinder and brake-rod, a yielding bar connected with the slide-rod, a hand-lever having three positions of adjustment, a pull-rod connecting it with the yielding bar and means connecting the pull-rod with the brake-rod for starting the pump either by the application of brakes, or at will by hand, or for cutting out the pump altogether as described.

4. An air-supply apparatus for air-brakes, comprising a main reservoir for compressed air, a pump having at one end a suction-valve opening inwardly from the atmosphere and an outlet-valve with pipe leading therefrom to the reservoir, a cam fixed on the car-axle, a piston in the pump-cylinder with rod and shoe having a range of adjustment to or from the cam, a slide-rod arranged beside and outside the pump-cylinder and having an arm connected to the piston-rod and shoe, a brake-cylinder and brake-rod, a yielding bar connected to the slide-rod, a hand-lever having three positions of adjustment, a pull-rod made in two parts, one section being connected to the yielding bar and the other section to the hand-lever and a connecting-lever for the adjacent ends of the sectional pull-rod, said connecting-lever having a sliding connection with the brake-rod substantially as described.

5. An air-supply apparatus for air-brakes, comprising a main reservoir for compressed air, a pump having at one end a suction-valve opening inwardly from the atmosphere and an outlet-valve with pipe leading to the reservoir, a cam fixed on the car-axle, a piston in the pump-cylinder with rod and shoe having a range of adjustment to or from the cam, a slide-rod arranged beside and outside the pump-cylinder and having an arm connected to the piston-rod and shoe, a brake-cylinder and brake-rod, a yielding bar connecting to the slide-rod, a hand-lever having three positions of adjustment, a pull-rod connecting therewith and to the yielding bar, means for adjusting the length of the pull-rod and means connecting the pull-rod to the brake-rod substantially as described.

6. An air-supply apparatus for air-brakes comprising a reservoir, an axle-driven pump for pumping air into the reservoir, a cam on the car-axle separated from the pump and a tangential shoe connected to the piston-rod of the pump and having a rectilinear adjustment beyond the stroke of the cam to wholly disconnect the pump parts from the actuating-cam substantially as described.

7. An air-supply apparatus for air-brakes, comprising a reservoir, an axle-driven pump for pumping air into the reservoir, a cam on the car-axle separated from the pump, the pump being provided with a piston-rod and shoe to be acted upon by the cam, an adjusting device for the shoe having a primary and secondary movement, the latter arranged to take the shoe entirely out of range of the cam to prevent dragging thereon as described.

8. An air-supply apparatus for air-brakes, comprising a reservoir, an axle-driven pump connected to the reservoir and having a piston-rod and shoe, a cam on the car-axle detached from the shoe, a slidable adjusting-

rod with arm loosely connected to the piston-rod with a limited longitudinal movement and a spring for giving a secondary and final backward movement to the adjusting-rod.

9. An air-supply apparatus for air-brakes, comprising a reservoir, an axle-driven pump connected to the reservoir and having a piston-rod and shoe, a cam on the axle detached from the shoe, a slidable adjusting-rod with arm loosely connected to the piston-rod with a limited longitudinal play, pneumatic means for moving said rod and shoe away from the cam by an excess of pressure in the reservoir, a spring for giving a final or secondary back movement to said adjusting-bar, an escape-valve from the cylinder and means for opening the escape-valve by the final or secondary movement of the adjusting-rod as described.

10. An air-supply apparatus for air-brakes, comprising a reservoir, an axle-driven pump connected to the reservoir and having a piston-rod and shoe, a cam on the axle detached from the shoe, a slidable adjusting-rod 17 with arm loosely connected to the piston-rod with a limited longitudinal play and having a spring 19, a cylinder $21^{\times}$ with piston 28, a stem 27 connected to adjusting-rod 17 but detached from piston 28, a pipe 23 extending from cylinder $21^{\times}$ to the reservoir and opening into the same through a pressure-valve, a tappet projection 21 on rod 17, a lever 9 arranged to be struck thereby, a valve 5 arranged to be opened by said lever, a cylinder inclosing the valve-stem and having a piston and a pipe 24 extending from the end of this cylinder to the end of cylinder $21^{\times}$.

11. An air-supply apparatus for air-brakes, comprising a reservoir, an axle-driven pump connected to the reservoir and having a piston-rod and shoe, a cam on the axle detached from the shoe, a slidable adjusting-rod 17 with arm loosely connected to the piston-rod with a limited longitudinal play and having a spring 19, a cylinder $21^{\times}$ with loose piston 28, a stem 27 connected to adjusting-bar 17, a tappet projection 21 on slide-rod 17, a lever 9 arranged to be struck thereby, a valve 5 arranged to be opened by said lever, a cylinder inclosing the valve-stem and having a piston, a pipe 24 extending from the end of the cylinder to the end of cylinder $21^{\times}$, a pipe 23 extending from the same end of cylinder $21^{\times}$ to the reservoir, a valve-casing with valve opening outwardly from excess of pressure into pipe 23, a leak-hole being provided in open communication with the pipe 23 to allow the piston of valve 5 and the piston 28 to be restored to their normal positions.

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