(No Model.) 4 Sheets—Sheet 1.

A. S. GOODE.

AUTOMATIC COMPRESSED AIR BRAKE.

No. 353,446. Patented Nov. 30, 1886.

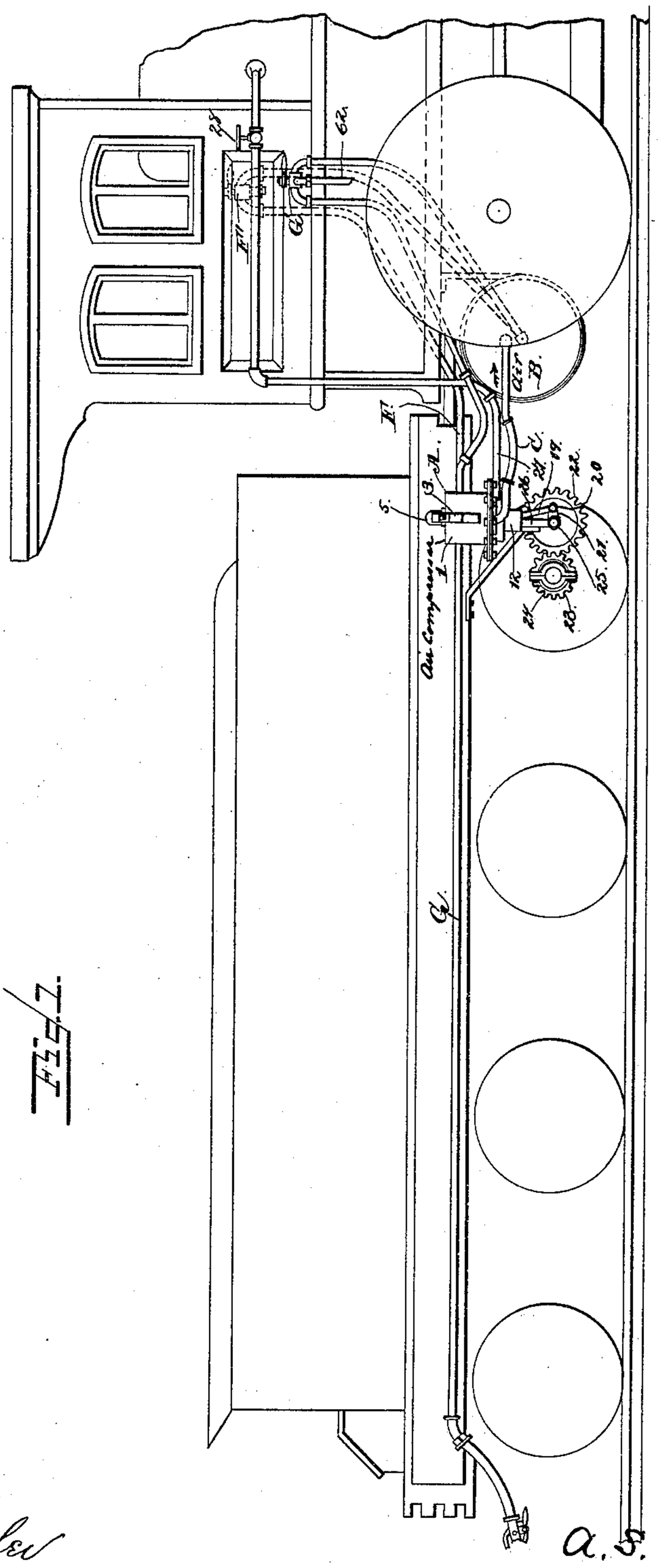

FIG. 1.

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(No Model.) 4 Sheets—Sheet 2.

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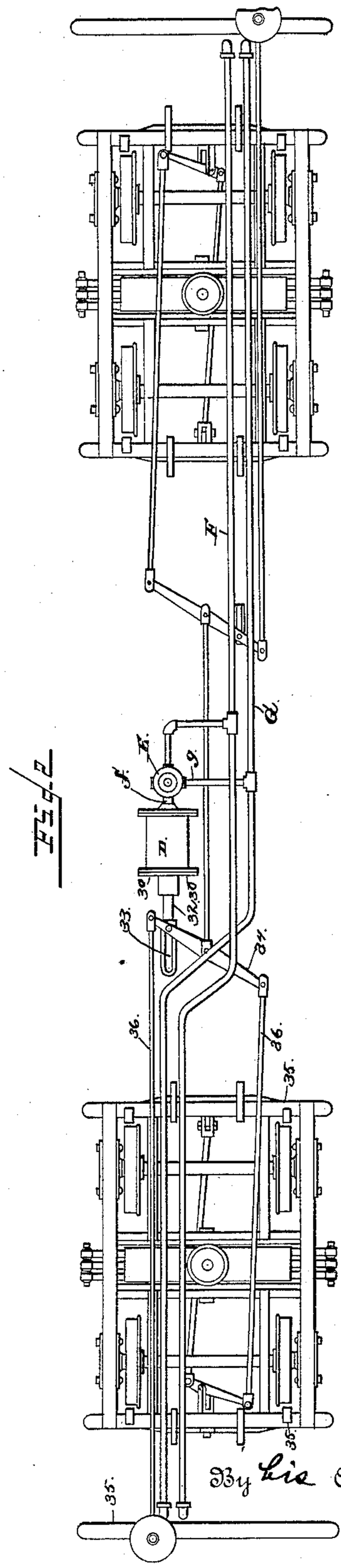

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(No Model.) 4 Sheets—Sheet 3.

A. S. GOODE.

AUTOMATIC COMPRESSED AIR BRAKE.

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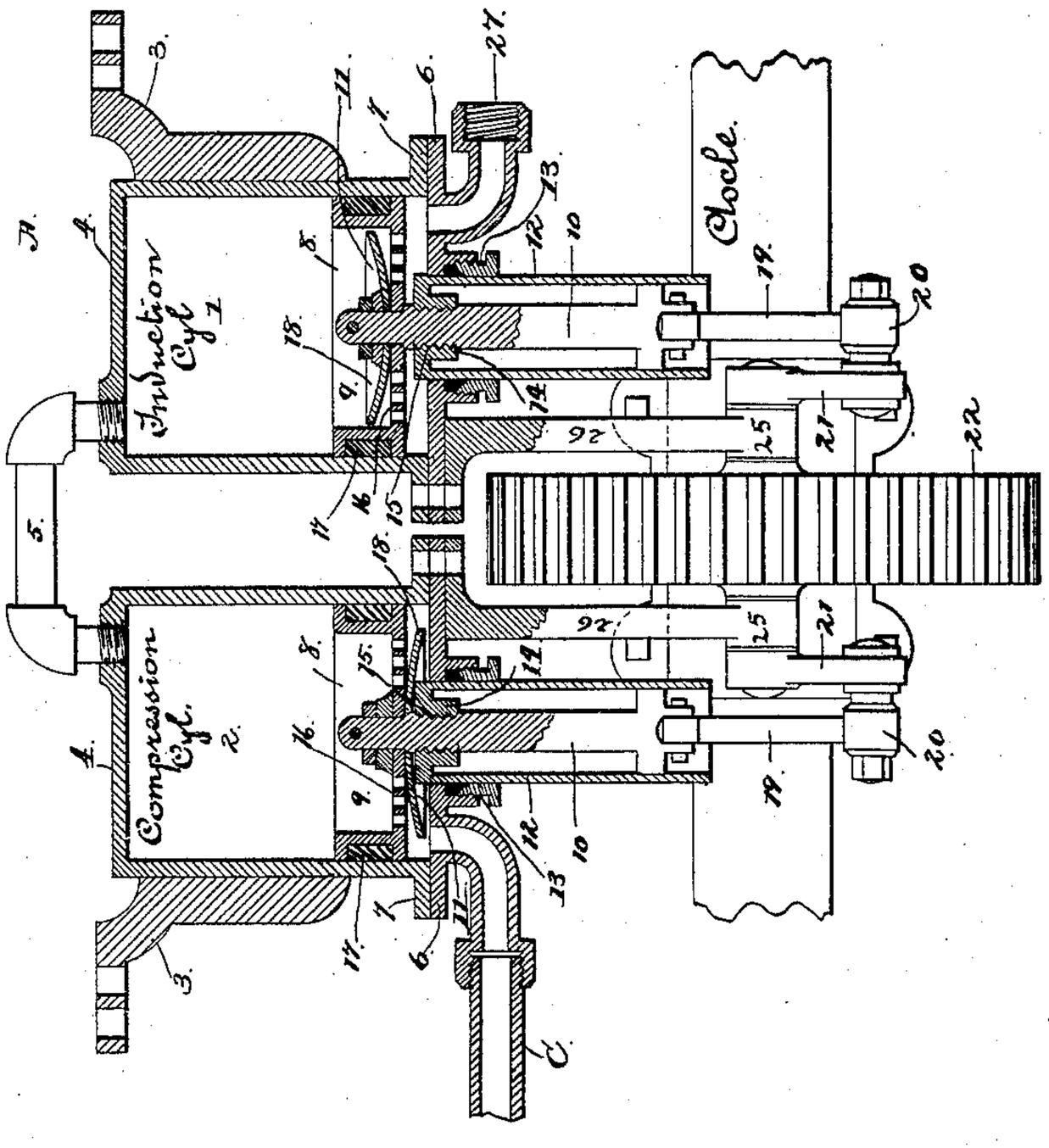

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(No Model.) 4 Sheets—Sheet 4.

A. S. GOODE.

AUTOMATIC COMPRESSED AIR BRAKE.

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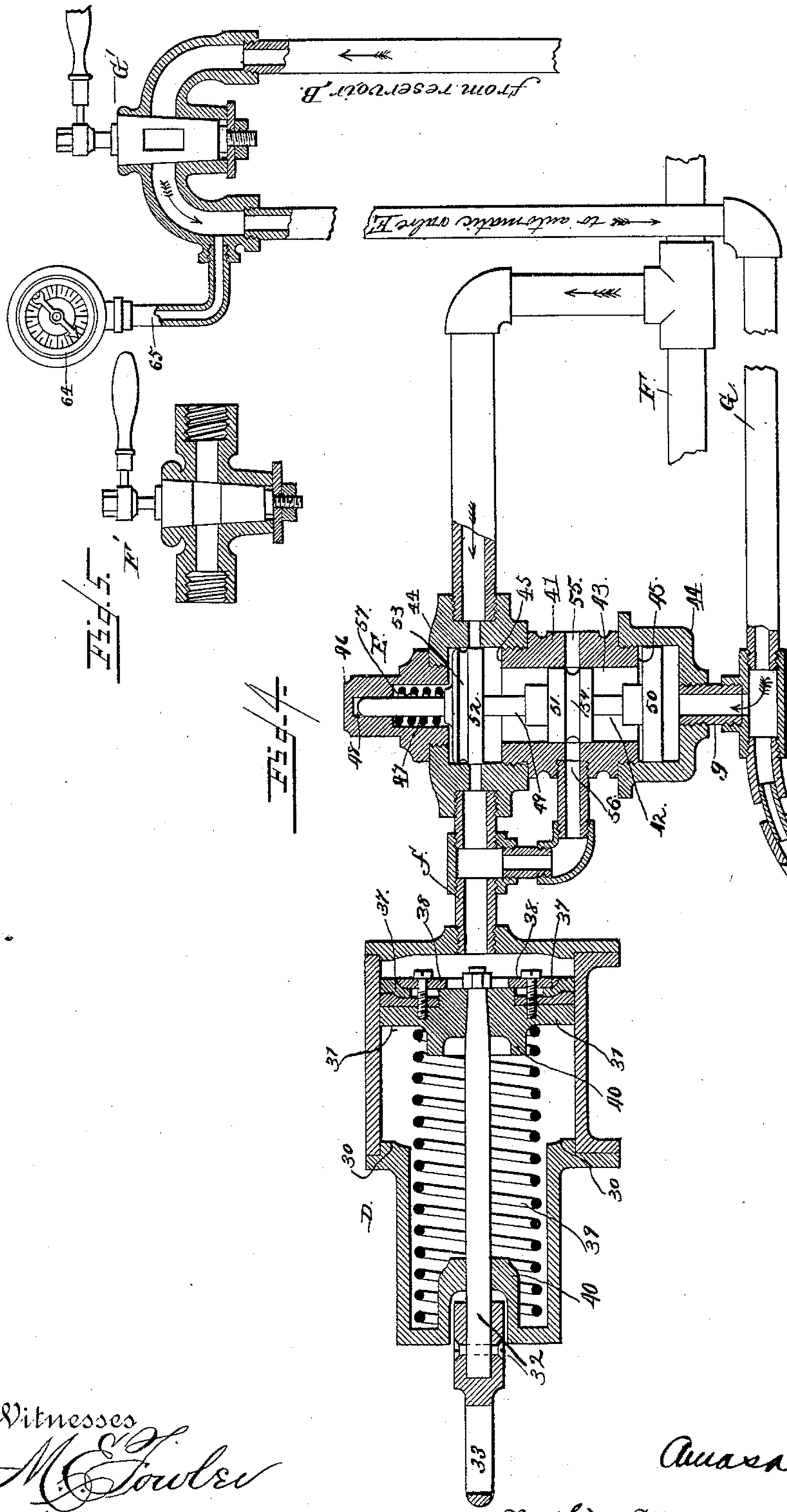

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UNITED STATES PATENT OFFICE.

AMASA SHAKSPERE GOODE, OF OLD FRAME, PENNSYLVANIA.

AUTOMATIC COMPRESSED-AIR BRAKE.

SPECIFICATION forming part of Letters Patent No. 353,446, dated November 30, 1886.

Application filed June 17, 1886. Serial No. 205,459. (No model.)

To all whom it may concern:

Be it known that I, AMASA SHAKSPERE GOODE, a citizen of the United States, residing at Old Frame, in the county of Fayette and State of Pennsylvania, have invented a new and useful Improvement in Automatic Compressed-Air Brakes, of which the following is a specification.

My invention relates to an automatic compressed-air brake; and the novelty consists of peculiar combination of devices, and in the construction and arrangements of the various parts for service, substantially as hereinafter fully set forth, and particularly pointed out in the claims.

The object of my invention is to provide an improved automatic compressed-air brake, in which I employ a brake-cylinder, a valve connected therewith, a supply-tank filled at all times with compressed air, and two independent or separate pipes in communication with the supply-tank and filled with compressed air therefrom, one of said pipes in communication with the brake-cylinder and the other with the valve to the cylinder. The valve to the brake-cylinder normally cuts off communication between the said cylinder and its supply-pipe, and the said valve is normally held or maintained in the position above described by the action or pressure thereon of the air in the supply-pipe to the valve, upon the reduction of which pressure in the supply-pipe to the valve the latter is actuated to reestablish communication between the brake-cylinder and its supply-pipe to instantaneously actuate the brake mechanism and apply the shoes thereof to the car-wheels, whereby I dispense with the employment of independent or auxiliary mechanism to be actuated by steam from the locomotive-boiler to effect the instantaneous operation of the brake devices. The supply-pipes are filled at all times with compressed air from the tank, and they are each provided with an independent cut-off valve that is located in the cab of the locomotive, and within easy reach of the engineer, so that the apparatus is under the direct control of the engineer. By thus having the two pipes intermediate of and in communication with the supply tank or cylinder and the brake-cylinder and the valve thereto a constant supply of compressed air is maintained at all times directly at the brake-cylinder, and in readiness for instant use, so that no time is lost in transmitting the air through pipes; and by the above-described apparatus I am also enabled to dispense with the very inconvenient and objectionable necessity for recharging an auxiliary reservoir when the train is in transit over long grades, and also there are no cylinders to "bleed."

Among other objects of my present invention may be mentioned the following: to provide an improved air-pump or compression apparatus to be actuated from one of the axles of the train by gearing, and which will drive two pistons, one of which works in a single or independent cylinder, into which the air is first admitted and partially compressed, and which, for the sake of convenience, I will term the "induction-cylinder," and the other piston works in another independent cylinder, where the air is again acted on and compressed, and from whence it is discharged into the supply-tank, the induction and compression cylinders being in communication with one another by an intermediate pipe to permit the partially-compressed air to be forced from the induction-cylinder into the compression-cylinder. By this arrangement of the cylinders the pump works with greater ease and is less liable to get out of order, which is a great advantage and very desirable when the fact that the pistons are reciprocated a great number of strokes per minute is taken into consideration; and the power to drive the pump is derived from the locomotive or other part of a moving train without the addition of auxiliary mechanism—such, for instance, as steam-valves.

A further object is to provide an improved automatic brake-cylinder valve which shall not be liable to get out of order, and to serve as a means for discharging the exhaust from the brake-cylinder simultaneously with the restoration of the initial pressure in the supply-pipe to the said valve to cut off the supply of air to the brake-cylinder from the pipe thereto and release the brake mechanism; and, finally, the object of my invention is to improve the various parts of the several devices of my improved air-brake, so that they shall be

simple and strong in construction, as well as durable, and not liable to get out of order and broken.

In the accompanying drawings, which illustrate an automatic compressed-air brake embodying my invention, Figure 1 is a view showing my apparatus applied to a tender and locomotive. Fig. 2 is a bottom plan view of a car, showing the relative arrangement of the brake-cylinder, the automatic valve thereto, the supply-pipes, and the brake-levers and other devices appertaining thereto. Fig. 3 is an enlarged vertical central sectional view through the air pump or compressor with the receiver or supply-tank. Fig. 4 is an enlarged central sectional view through the brake-cylinder, the automatic valve thereto, the supply-pipes to the valves and cylinder, and the cut-off valves in the supply-pipes. Fig. 5 is a detail sectional view of one of the cut-off valves.

Referring to the several drawings, in which similar letters and figures of reference denote corresponding parts in all the figures, A designates the air compressor or pump, which is suspended from the bed of the tender or locomotive, as preferred, and actuated by means of intermediate gearing by power from one of the axles of the tender or locomotive; B, the reservoir or tank into which the compressed air from the compressor is discharged by an intermediate pipe, C; D, the brake-cylinder; E, the automatic valve thereto; F and G, the supply-pipes intermediate of the reservoir or supply-tank and the brake-cylinder and valve thereto, respectively, and F′ and G′ the cut-off valves in the supply-pipes F and G, respectively.

The brake-cylinder and its automatic valve are supported on the bottom of each car of the railroad company adopting or using my improved brake, and all of the cylinders and valves are actuated by the air stored in a single reservoir or supply-tank carried by the locomotive or its tender which draws the train. The brake-cylinder and its valve are connected by a short pipe, *f*, and the supply-pipe F to the cylinder opens into the automatic valve, instead of into the brake-cylinder directly, the short pipe *f* forming a continuation of the supply-pipe F when the valve is actuated to establish communication between the pipe F and the brake-cylinder to actuate the brake-levers, the bars, and the shoes carried by the bars.

The supply-pipe G to the valve E of the brake-cylinder opens into the valve-shell in such a manner that the air therein controls the valve to normally cut off communication between the pipe F and the brake-cylinder, and thus allow the brake-shoes to be released from contact with the car-wheels; and the valves in the supply-pipes are left open for a short time and then closed to maintain a constant supply or pressure of compressed air in said pipes, so that a full supply of air is always at hand directly at the cylinder for instant use, and no time is wasted or lost in transmitting air to the brake-cylinder. When the pressure of the air in the supply-pipe G to the automatic valve of the brake-cylinder is reduced or diminished, the valve is operated to re-establish communication between the supply-pipe F and the brake-cylinder to actuate the piston in the latter and the brake-levers and other appliances, and upon the restoration of the initial pressure in the supply-pipe G to the automatic brake-valve the latter is actuated to disestablish communication between the pipe F and the brake-cylinder to thereby release the brake devices, the exhaust-air from the brake-cylinder escaping through the automatic valve simultaneously with the restoration of the initial pressure in the supply-pipe to the automatic valve to release the brake and adapt the apparatus again for instant use.

Having now given a general idea of the relative arrangement and adaptation of the several mechanisms employed in an automatic compressed-air brake embodying my invention, as well as the mode of operation thereof, I will now proceed to describe in detail the peculiar features of construction and arrangement of the several parts or elements of the hereinbefore, described mechanisms or devices.

Beginning with the air compressor or pump A, 1 and 2 designate the induction and compression cylinders, respectively, which are of substantially the same size and in line with each other. These cylinders are disposed in a vertical or upright position, and are suspended beneath the body of the locomotive-tender by means of bracket-pieces 3, which are suitably connected with the cylinders and are bolted to the tender-bed. The upper ends of the cylinders are closed by heads or caps 4, and through these heads pass the extremities of a connecting-pipe, 5, which is in communication with both cylinders and serves to conduct the air in a partially-compressed state from the induction-cylinder 1 to and into the compression-cylinder 2. The opposite or lower ends of the cylinders 1 and 2 are closed by heads 6, which may be cast in a single piece or separately, and are bolted to lateral flanges 7 of the said cylinders to effectually close the lower ends thereof.

8 designates the pistons for the cylinders, which are constructed substantially alike, and each comprises a head, 9, the rod 10, the valves 11, and the trunk 12. The trunks 12 are in the form of hollow cylinders or tubes, and they work or reciprocate through suitable stuffing-boxes, 13, in the heads 6 of the cylinders 1 and 2; and the said trunks 12 are further provided at their ends with a head, 14, having an interiorly-threaded opening or socket, 15. Through this threaded socket 15 of each of the tubular trunks passes the threaded upper end of the piston 10, which is screwed into the threaded socket to actuate the trunk simultaneously with the piston-rod. The piston-head 9 of each of the pistons is in the form of an annulus or ring, and it carries a perforated plate or disk, 16, at its lower

edges, and the outer periphery of the ring-like piston-head has a circumferential groove or recess in which a packing, 17, of leather or like pliable material, is fitted, and which bears against the inner surface of the cylinder to form an air-tight joint. The extreme upper end of the piston-rod passes through the center of the disk or plate 16 of the piston-head, and it is keyed or otherwise rigidly affixed to the said piston-head and carries the same with it in its reciprocating movements; and between the perforated disk or plate of the piston-head and the head 14 of the tubular trunk is fitted and clamped a valve-disk, 18, of pliable material—such, for instance, as leather or the like. This valve-disk 18 is fitted over the piston-rod and is clamped at its center in place on the rod and carried by the same by means of the perforated disk 16 and the head of the trunk; and at its edges this valve-disk is free to move under the pressure of the air on the same.

The clamping of the valve-disk 18 between the perforated plate 16 of the piston-head and the head of the trunk 14 applies only to the construction shown in the piston for the compression-cylinder of the air compressor or pump; and the valve-disk 18 for the piston-head of the induction-cylinder 1 of the air-compressor is arranged above the perforated plate 16 of the piston-head and is inclosed within the latter, the said valve for the induction-cylinder being held in place on the piston-rod and perforated disk 16 by a washer, nut, or other suitable device fitted on the piston-rod. It will thus be seen that the valve 18 of the induction-cylinder is arranged above the perforated disk 16 of the piston-head, and that it opens inwardly to permit the ingress of air into the same during the downstroke of the pistons, while the valve 18 of the compression-cylinder is arranged below the perforated disk 16 of the piston-head and opens outwardly to allow the air to escape from the compression-cylinder into the reservoir or tank B.

The valves 18, as before described, are of leather or like pliable material and secured at their centers to the piston-rods, and the valves are concavo-convex in form, so that they can be actuated to entirely close or fit over the perforated disks 16 of the piston-heads.

During the upstroke of the pistons the valve 18 in the induction is closed and lies flat against the upper surface of the perforated disk 16 and is forced against the same by the force of the air that is being partially compressed, so that air is permitted to enter the induction-cylinder beneath the piston-head freely, and upon the retrograde movement or downstroke of the pistons the said valve 18 on the piston of the induction-cylinder is forced upwardly to permit the air beneath the piston-head to pass through the perforated disk 16 above the piston-head, to be acted on by the next or succeeding upstroke of the piston.

The operation of the valve 18 in the compression-cylinder is just the reverse to the operation of the valve in the induction-cylinder, the valve in the compression-cylinder being closed during the downstrokes of the pistons, to force the air out of the compression-cylinder from beneath the piston-head, and being opened during the upstroke to allow the compressed air to pass beneath the piston-head, to be forced out of the compression-cylinder during the succeeding downstroke of the piston operating therein. The valves as thus constructed and arranged are simple and durable in construction, thoroughly effective and reliable in operation, and cheap.

To the lower ends of the piston-rods are pivotally connected the upper ends of pitmen 19, and the opposite ends of the pitmen are pivoted on crank-pins 20 of the cranks 21, which are carried by and rigidly secured on the ends of the trunnions or shaft of the spur-gear wheel 22. This gear-wheel 22 meshes with and is rotated by a spur-gear pinion, 23, which is made in two sections, 24, so that they can be easily and readily fitted on an axle of the tender to drive the operating devices or mechanisms of the air-compressor by power direct from one of the rotating parts of a train without the use of steam-valves and other power from the locomotive. The sections 24 of the drive-pinion are bolted together after having been properly adjusted on the axle, and they are then keyed thereto, so that the pinion can be properly fitted in place without interfering with any of the operative parts of the train.

The trunnions or shaft of the spur-gear wheel are journaled in suitable boxes or bearings, 25, formed in the lower free ends of hangers 26, which are bolted or otherwise secured to the bed of the tender, or which depend from the heads 6 of the cylinders 1 and 2. The cranks 21 are arranged in line with each other on the shaft or trunnions of the spur-gear wheel, so that the pistons are reciprocated simultaneously, and the cranks are rigidly secured on the said shaft or trunnions and rotate with the spur-gear wheel. When the train is in motion, the pinion 23 is rotated with the axle by which it is carried and drives the spur-gear wheel, which in turn revolves the cranks and reciprocates the pistons.

The air is admitted through a pipe, 27, which enters the induction-cylinder 1 beneath the piston operating therein, and this pipe enters the cab and has a shut-off valve, 28, located in the cab so as to be within convenient reach of the engineer, thereby providing means whereby the air-compressor can be thrown in and out of use, and is under the direct control of the engineer. The air entering the induction-cylinder is partially compressed by the piston operating therein, and it is then forced into the compression-cylinder, from whence it is passed to the tank under pressure by the pipe C, the tank being charged at all times with air which is compressed to the required pressure. The tank is made sufficiently strong to resist the pressure of the air stored therein, and it is preferably supported on the

locomotive, beneath the foot-board thereof, by straps or any other preferred or suitable appliances.

The brake-cylinder D is suspended from and supported by suitable means that are secured directly to the bottom of the car-body, and one of the ends of the cylinder is reduced or made smaller to form an annular shoulder or abutment, 30, against which the head 31 of a longitudinally-movable piston, 32, abuts or bears to limit the movement of the piston under the pressure or force of the compressed air.

The rod of the piston 32 extends or projects through an opening in the head at the reduced or smaller portion of the brake-cylinder, and the extreme end of the piston-rod is slotted longitudinally, as at 33, through which slot passes a bolt to pivotally connect the piston-rod with a brake-lever, 34, that is connected with the brake-bars 35 at the ends of the car by intermediate rods, 36, which, however, do not form a part of my present invention, and will not therefore be further described herein. The head 31 fits snugly in the brake-cylinder, and it is provided in its front working-face with a packing, 37, of elastic material, that is secured and held in place by a disk or plate, 38, secured by means of screws that pass through the disk, the packing, and into the piston-head, the edges or periphery of the packing lying flush with the periphery of the piston-head. A coiled retractile spring, 39, encircles the rod of the piston 32 and bears at one end against the head of the brake-cylinder, in the reduced portion thereof, and at its opposite end against the rear face of the piston-head to force or expel the latter forward when the air is permitted to escape from the brake-cylindor in releasing the brakes. The ends of the coiled retractile spring 39 fit over projections 40, formed in one of the brake-cylinder heads and the piston-head 31, and by this means the ends of the spring are prevented from displacement, and are thereby retained in their proper relative positions for instant operation.

When the compressed air is admitted to the brake-cylinder to apply the brakes, it enters the cylinder in front of the piston-head and forces the piston therein rearwardly and against the compression of the retractile spring 39, the movement of the piston being limited by the head thereof coming in contact with the abutment in the cylinder; and when the air escapes from the brake-cylinder in releasing the brakes the spring forces the piston and its head forward to their normal position, so as to be in readiness for instant use again.

The automatic valve E to the brake-cylinder is located in close proximity to the said cylinder, and likewise supported on the car-body; and the said valve is in communication with the brake-cylinder by the short intermediate pipe or tube, *f*. The automatic valve comprises a valve shell or cylinder, 41, and a piston, 42, which has a limited longitudinal movement in the valve shell or cylinder. The middle or body 43 of the valve-shell 41 is made of smaller diameter than the ends 44 of the shell, so as to form abutments 45 in the valve-shell, and at one end the valve-shell is further provided with a hollow cap, 46, that is secured directly to the shell by any suitable means, and in communication with one of the enlarged ends 44 thereof, the cap 46 being provided with large and smaller chambers, 47 and 48, respectively, for a purpose presently described.

The piston 42 comprises a rod, 49, which extends longitudinally through the valve-shell, and three heads, 50, 51, and 52. The heads 50 and 52 are located at the ends of of the piston-rod and within the enlarged ends of the valve-shell, to the diameter of which they are equal, or very nearly so, to insure efficiency and accuracy in the working of the valve; and the head 51 is arranged on the rod intermediate of the two end heads and works in the chamber of the body 43 of the valve-shell, the diameter of the head 51 being equal to or a little smaller than the diameter of the middle portion, 43, of said shell.

The supply-pipe G to the automatic valve is in communication with the valve-shell thereof at one end by a short branch pipe, *g*, that enters the shell beneath the piston-head 50; and the supply-pipe F to the brake-cylinder enters the automatic valve-shell in line with or on the same plane as the pipe *f*, instead of entering the brake-cylinder directly.

The piston-head 52 of the piston 42 is provided with a peripheral groove or channel, 53, that is adapted to align with the pipes F *f*, and permit the air to pass from the pipe F, through the valve-shell, the channel 53, and the pipe *f*, into the brake-cylinder, to actuate the piston therein, and consequently the brake-levers and other devices connected therewith. The intermediate head, 51, of the piston 42 is also provided with a peripheral groove or channel, 54, that is adapted to align with a port, 55, on one side of and through the valve-shell, and an escape-pipe, 56, that enters said valve-shell on the opposite side thereof, the other end of the escape-pipe 56 entering the short intermediate pipe, *f*, so as to convey the exhausted air from the brake-cylinder around the channel 54 and the port 55 into the open air, this operation of exhausting the air from the brake-cylinder taking place simultaneously with the restoration of the initial pressure in the pipe G, to actuate the piston 42 and throw or force the channel 53 of the piston 52 out of line or coincidence with the pipes F *f*, and thus disestablish communication between the brake-cylinder and the automatic valve and the pipe F. The piston-rod of the piston 42 is extended beyond the piston-head 52 and into the chambers 47 and 48 of the cap 46 of the valve-shell, and in this chamber 47 is arranged a coiled spring, 57, that bears at one end against the head 52, and at its other end against the wall that divides the larger from the smaller chambers 47 and 48. The extreme end of the pis-

ton-rod works and is guided in the smaller chamber 48 of the cap, and the spring 57 serves to depress the valve when the pressure of air in the pipe G is diminished and impinges with less force on the piston-head 50, and to cause the passage 53 of the piston-head 52 to align with the pipes F *f*. When the brakes are released and in their normal condition, the pressure of air iu the pipe G on the piston-head 50 serves to elevate the piston 42 against the compression of the spring 57, and to cut off communication between the pipes F *f*, by reason of the channel 53 being out of coincidence with said pipes, while the channel 54 of the piston-head 51 registers with the port 55 and the escape-pipe 56, to permit of the escape of air from the cylinder and pipe *f*, the piston in the brake-cylinder being impelled forward by the pressure or force of the spring thereon.

When the initial pressure in the pipe G is reduced or diminished, the spring 57 of the piston 42 forces the latter to descend and cause the channel 53 to register with the pipes F *f*, and thus admit air to the brake-cylinder, to force the piston therein rearwardly against the tension of its spring, and thus instantaneously apply the brakes; and simultaneously with the descent of the piston 42 the channel 54 in the piston-head 51 is forced out of line with the escape port and pipe 55 and 56 to prevent the escape or exhausting of the air from the brake-cylinder.

The air-supply pipes F and G enter the locomotive-cab, and they are provided with valves F′ and G′, respectively. The valve F′ of the supply-pipe F to the brake-cylinder has two ways or openings, so that it can be turned to cut off the communication between the brake-cylinder and the air-reservoir; and the valve G′ has three ways or ports, two of which allow the air from the compressed-air reservoir to pass to the automatic valve, and when one of the ports opens into that section of the pipe G between the valve G′ and the automatic valve, and the remaining port into a pipe, 62, the air from the reservoir or tank is cut off from the automatic valve, and the air in the pipe G escapes through the pipe 62 to reduce or diminish its pressure and actuate the automatic valve to apply the brakes. The pipe 62 thus forms a discharge-pipe, and the valves F′ and G′ are located in the cab of the locomotive, within convenient reach of the engineer, so that the apparatus is directly under his control. The supply-pipe F to the brake-cylinder enters the reservoir or tank B directly, and the pipe G is in communication with the pipe F at a suitable point in the cab of the locomotive, so that the pressure in both of the supply-pipes and in the compressed-air reservoir is precisely the same; and the supply-pipe G has an air-gage, 64, that is supported by a branch pipe, 65, which is in communication with the pipe G at or near the point where the cut-off valve G′ is located therein, the gage 64 being of any approved or preferred pattern and located within the locomotive-cab, to be easily seen by the engineer.

The operation of my improved compressed-air brake may be briefly summarized as follows: The air is compressed by the air-pump A and stored in the reservoir B, to be ready for instant use. The valves in the supply-pipes are turned to fill the pipes with compressed air throughout the entire train and maintain a constant supply of air directly at the cylinders. The air is excluded from the cylinder, which is thus ready for use at all times, and the air enters the automatic valve to actuate the piston therein in the manner hereinbefore described. To apply the brakes, the valve G′ is operated or turned by hand to discharge the air from the pipe G through the discharge-pipe 62, and the pressure of the air in the said pipe G being reduced the automatic valve is operated to re-establish communication between the pipes F *f* and the cylinder to actuate the piston therein and the brake mechanism; and to release the brakes the initial pressure is restored in the pipe G by turning its valve in the proper direction to admit air from the reservoir into the pipe, whereby the automatic valve is operated to cut off communication between the pipe F and the brake-cylinder, and the air is exhausted from the cylinder through the escape-pipe 56, the channel 54, and the escape-port 55, to allow the piston in the brake-cylinder to return to its normal position.

I am aware that various changes in the form and proportion of parts and details of construction can be made in the apparatus herein shown and described as an embodiment of my invention, and hence I do not wish to be confined to the particular and precise details shown.

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

1. In a compressed-air brake, the combination of a brake-cylinder having the piston, the independent pipe-lines normally charged with air of the same degree of compression, an automatic valve intermediate of the brake-cylinder and pipe-lines, and having a piston upon which the air from one of the pipes acts to normally cut off communication between the brake-cylinder and the other pipe, a valve for diminishing the pressure in the pipe to the automatic valve, and a spring for depressing the piston of the automatic valve when the initial pressure in the valve supply-pipe is diminished, and thereby re-establish communication between the brake-cylinder and the air-supply pipe thereto, substantially as described, for the purpose set forth.

2. In a compressed-air brake, the combination of a brake-cylinder having a piston operating therein, an automatic valve in communication with the cylinder and having a piston provided with the heads 50 and 51 at its ends, the head 52 of the piston being provided with

a peripheral channel which aligns with suitable openings in the valve-shell, an air-supply pipe in communication with the automatic valve, beneath the head 50 of the piston therein, to normally elevate the piston, a similar supply-pipe communicating with one of the openings in the automatic valve, and a spring for depressing the piston of the automatic valve when the initial pressure in the valve supply-pipe is reduced, and thereby re-establish communication between the brake-cylinder and the supply-pipe thereto through the passage in the piston-head 52, substantially as described, for the purpose set forth.

3. In a compressed-air brake, the combination of a reservoir or tank and air-pump connected with and driven from an axle or other revolving part of a train, and discharging the air compressed thereby into the tank or reservoir continuously, a brake-cylinder having a reciprocating piston connected by intermediate mechanism with the brake-shoes, an automatic valve, the independent supply-pipes normally charged with air from the reservoir, and both entering the automatic valve, one of the said pipes serving to operate the valve to normally cut off communication between the other supply-pipe and the brake-cylinder, a two-way cut-off valve, F′, communicating with the supply-pipe to the cylinder, and a three-way cut-off valve, G′, in the supply-pipe to the automatic valve, the said three-way valve being adapted to open communication between the reservoir and the automatic valve, or to cut off communication between said reservoir and automatic valve and discharge the air from the automatic valve supply-pipe into the surrounding air, and thereby cut off communication between the automatic valve and reservoir, whereby the initial air-pressure in the valve supply-pipe is reduced to actuate the automatic valve and re-establish communication between the brake-cylinder and its supply-pipe, substantially as described, for the purpose set forth.

4. In a compressed-air brake, the combination of a reservoir or tank, an air-pump connected with and driven by an axle or other revolving part of a train and discharging the air compressed thereby into the tank, a brake-cylinder having a reciprocating piston therein, the independent air-supply pipes normally charged with air of the same degree of compression from the reservoir, an automatic valve comprising a valve-shell having the exhaust-port 55, and the piston operating in the shell and having the heads at its ends, and the channeled middle head, 51, adapted to coincide with the exhaust-port, and an exhaust-pipe intermediate of the brake-cylinder and the automatic valve to conduct the exhaust-air from the brake-cylinder to the automatic valve, the piston of the said automatic valve being operated to cause its channeled head to coincide with the exhaust port and pipe, to permit the air from the brake-cylinder to escape through the valve simultaneously with the restoration of the initial pressure of air in the valve supply-pipe, substantially as described, for the purpose set forth.

5. The combination of a brake-cylinder, a supply-pipe thereto, a valve intermediate of the supply-pipe and having a piston provided with two heads, 50 and 52, the piston-head 52 having a peripheral channel which aligns with the supply-pipe to the cylinder to establish communication between the cylinder and its pipe, an air-supply pipe entering the valve beneath the piston-head 50 to actuate the piston and cut off communication between the cylinder and its pipe, and a reservoir from which the supply of air is drawn for the pipes of the cylinder and valve, substantially as described.

6. The combination of a brake-cylinder, an air-supply pipe thereto, an automatic valve intermediate of the cylinder and its pipe, and comprising a valve-shell having its ends of larger diameter than its middle, and provided with a hollow cap, and a piston having heads working in the enlarged ends of the shell, and with one end extended into the cap thereof, one of said piston-heads, 52, having a peripheral channel adapted to register with the supply-pipe to the cylinder, a spring fitted in the cap and bearing on the piston-head 52, to depress the piston, a supply-pipe to the valve, entering the shell thereof beneath the piston-head 50, and a compressed-air reservoir to supply the pipes to the cylinder and automatic valve at all times, substantially as described.

7. The combination of a brake-cylinder, a compressed-air reservoir, a supply-pipe to the brake-cylinder, an automatic valve intermediate of the brake-cylinder and its supply-pipe, and having a shell provided with an exhaust-port, and a piston working in the shell with heads at its ends, and an intermediate grooved head adapted to coincide with the exhaust-port of the valve-shell, a supply-pipe to the valve, and an exhaust-pipe intermediate of the cylinder and the valve-shell, substantially as described, for the purpose set forth.

8. An air-compressor for automatic air-brakes, comprising the independent induction and compression cylinders normally in communication with each other by an intermediate pipe, the reciprocating pistons operating in the said cylinders and capable of movement in the same direction simultaneously, and each having a fixed perforated head, the inwardly-opening valve affixed centrally to the inner side of the piston-head for the induction-cylinder, and the outwardly-opening valve affixed centrally to the outer side of the piston-head for the compression-cylinder, substantially as described, for the purpose set forth.

9. An air-compressor for automatic car-brakes, comprising the induction and compression cylinders normally in communication with each other by an intermediate pipe, the reciprocating pistons working in the said cylinders, and having the perforated heads, the

valves affixed to opposite sides of the perforated heads of the pistons for the said cylinders, and opening in opposite directions, the trunks connected to the pistons and moving simultaneously therewith, and means operated by one of the revolving parts of a train for moving the pistons simultaneously in the same direction, substantially as described, for the purpose set forth.

10. An air-compressor for use in automatic air-brakes, having an induction-cylinder and a compression-cylinder in communication with each other, in combination with the reciprocating pistons working in the cylinders, the gear-wheel having the cranks, the pitmen intermediate of the cranks and the pistons, and gearing actuated by the axle of one of the cars for rotating the gear-wheel and the cranks carried thereby, substantially as described.

11. In an air-compressor for compressed-air brakes, the combination of an induction-cylinder, with a compression-cylinder in communication with the induction-cylinder, the pistons working in the cylinders, the inwardly-opening valve in the induction-cylinder, an outwardly-opening valve for the compression-cylinder, the cranks for reciprocating the pistons, and gearing for rotating the cranks, actuated by one of the axles of a train, substantially as described.

12. The combination of the induction and compression cylinders in communication with each other, and the pistons working therein, and each comprising a rod, an annular head carrying a perforated disk, and a pliable valve secured to the disk and adapted to alternately conceal and expose the perforations in the disk during the strokes of the piston, substantially as described, for the purpose set forth.

13. The combination of the induction-cylinder having an air-supply pipe entering the head thereof beneath the piston, a compression-cylinder in communication with the induction-cylinder and having an outlet-pipe, a piston working in the induction-cylinder and having an annular piston-head provided with a perforated disk, and an inwardly-opening valve of pliable material carried by the perforated disk, a similar piston working in the compression-cylinder and having an annular head with a perforated disk, and an outwardly-opening valve secured to the perforated disk beneath the same, and means for reciprocating the pistons, substantially as described.

14. The combination of the induction and compression cylinders in communication with each other, the pistons working therein and having the valves, the trunks connected with the pistons and reciprocating therewith, a sectional pinion carried by one of the axles of the train, a hanger, a gear-wheel journaled in the hanger and meshing with the pinion to be driven thereby, the cranks carried by the trunnions or shaft of the gear-wheel, and pitmen intermediate of the cranks and the piston-rods, substantially as described.

15. In an automatic compressed-air brake, the combination of a compressor deriving its motive power from one of the axles of a train, a reservoir or tank into which the air from the compressor is continuously discharged, a brake-cylinder, a supply-pipe thereto and normally filled with compressed air from the reservoir, an automatic valve intermediate of the cylinder and its pipe to normally cut off communication between the cylinder and its pipe and hold the air in check in the latter, a supply-pipe to the valve having free and uninterrupted communication therewith to elevate the same to normally cut off the air from the cylinder, a cut-off valve in the valve supply-pipe to decrease or diminish the pressure in the latter, and a spring to depress the automatic valve when the pressure in the valve supply-pipe is decreased, and open communication between the brake-cylinder and its pipe to actuate the brake devices, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in presence of two witnesses.

AMASA SHAKSPERE GOODE.

Witnesses:

M. P. DAVENPORT,

THOMAS SHUMAN.