(No Model.) 3 Sheets—Sheet 1.

G. S. LEE.

AIR BRAKE.

No. 557,513. Patented Mar. 31, 1896.

Fig. 1

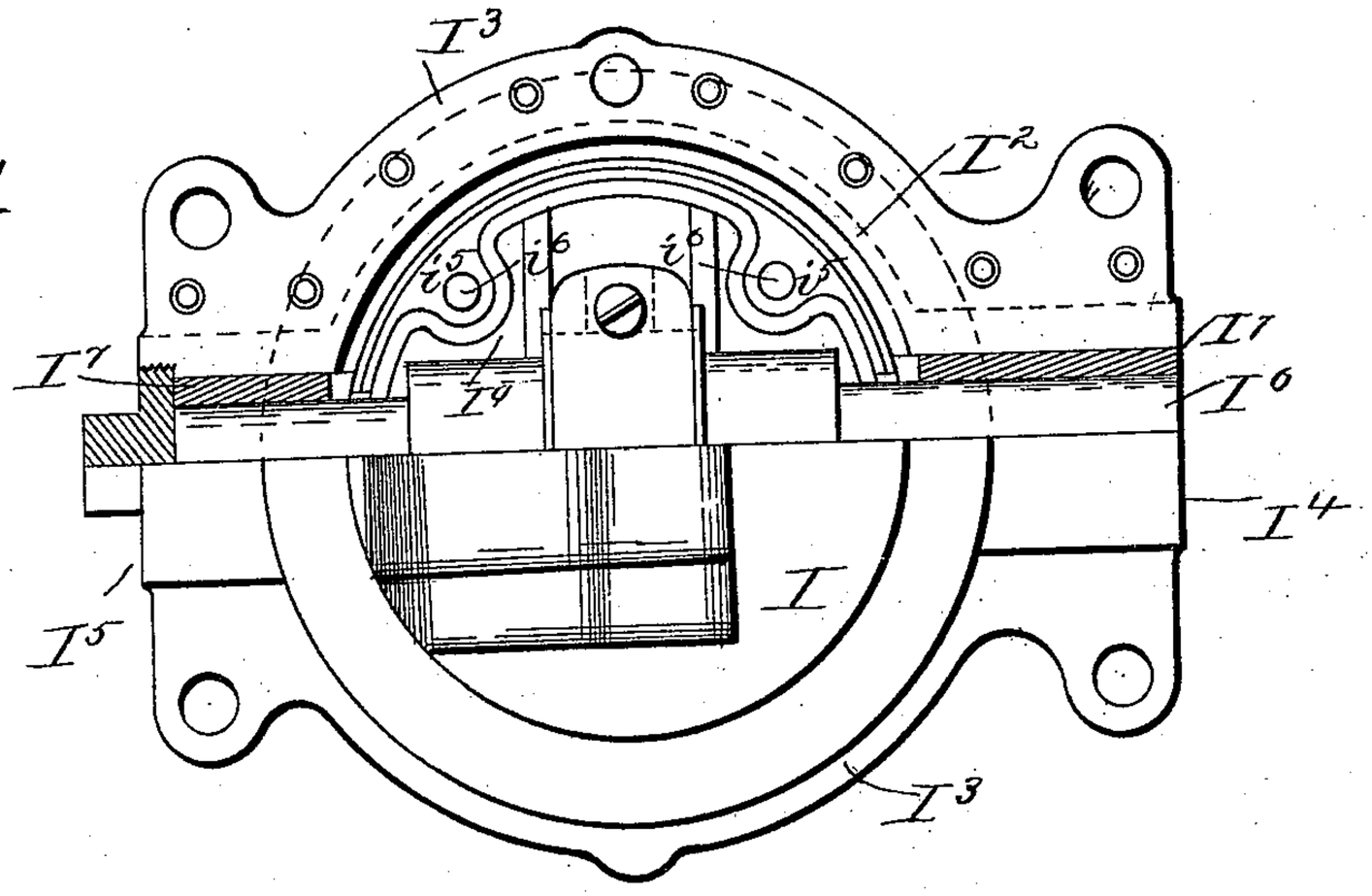


Fig. 2.

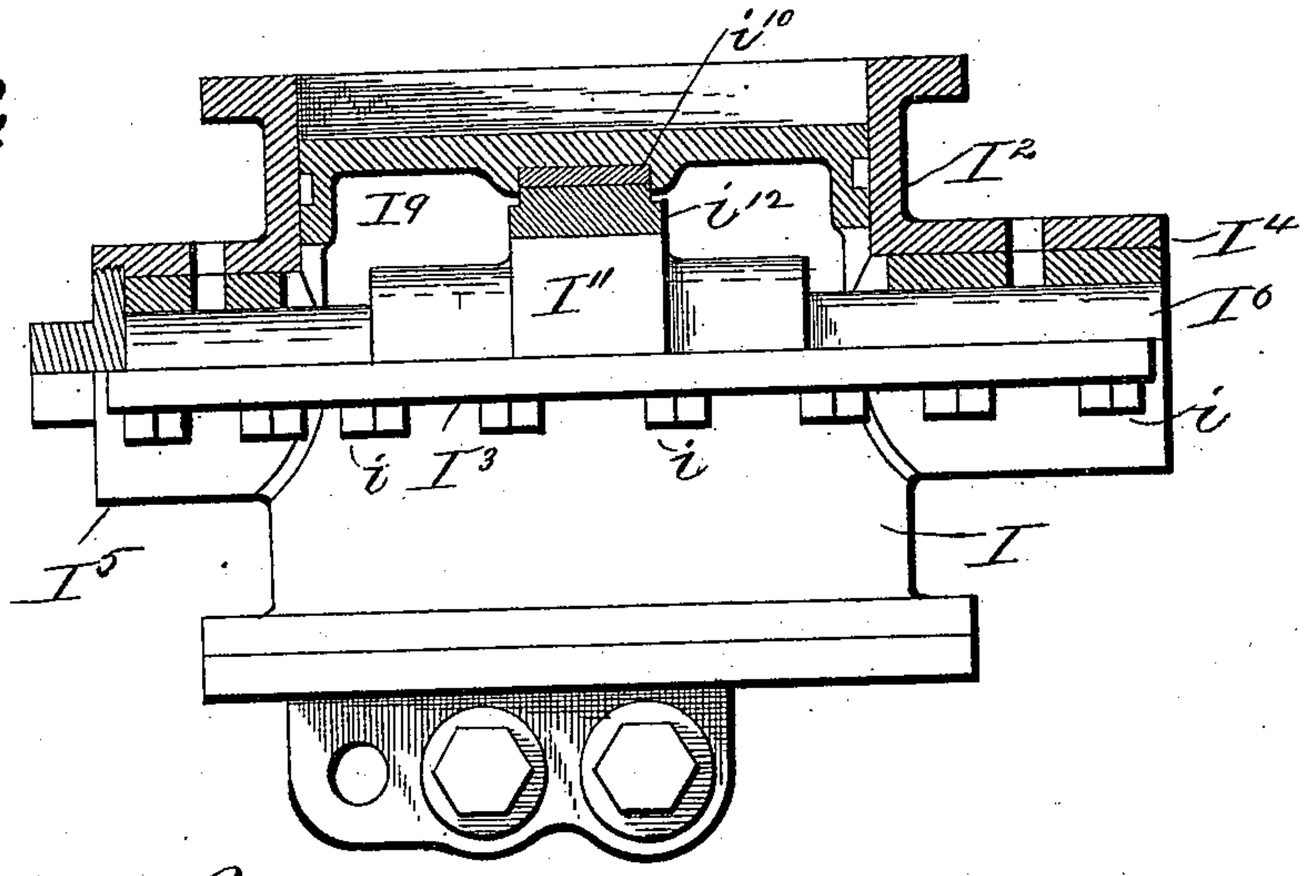
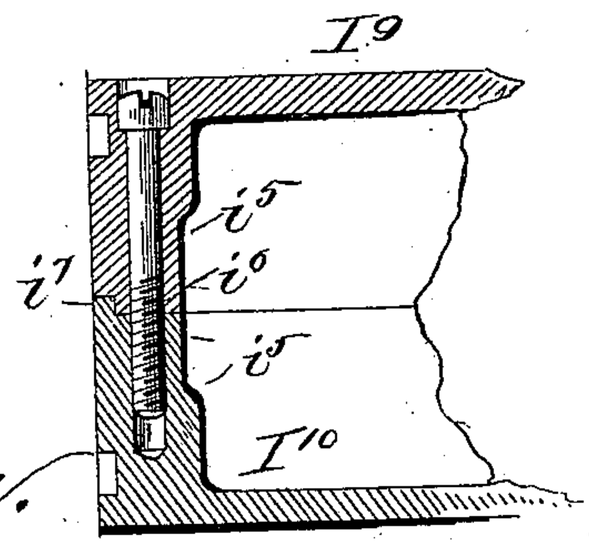


Fig. 3



Witnesses:

J. B. McGirr.

Dance.

Inventor:

George S. Lee

by Connolly Bros

atty

(No Model.)

3 Sheets—Sheet 2.

G. S. LEE.

AIR BRAKE.

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Fig. 4

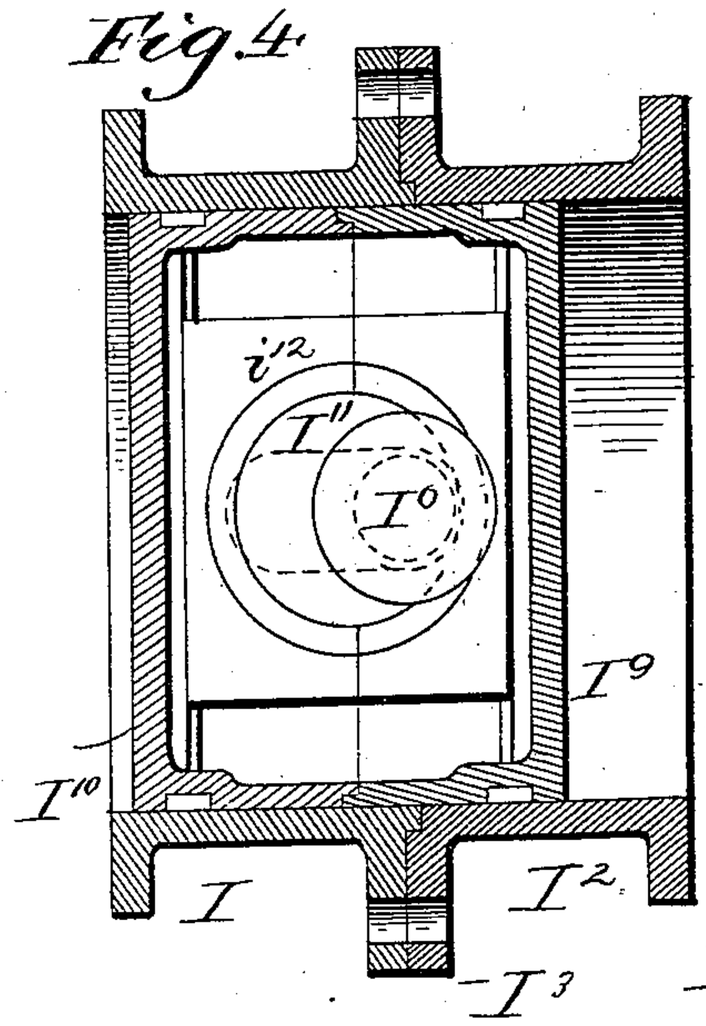


Fig. 5

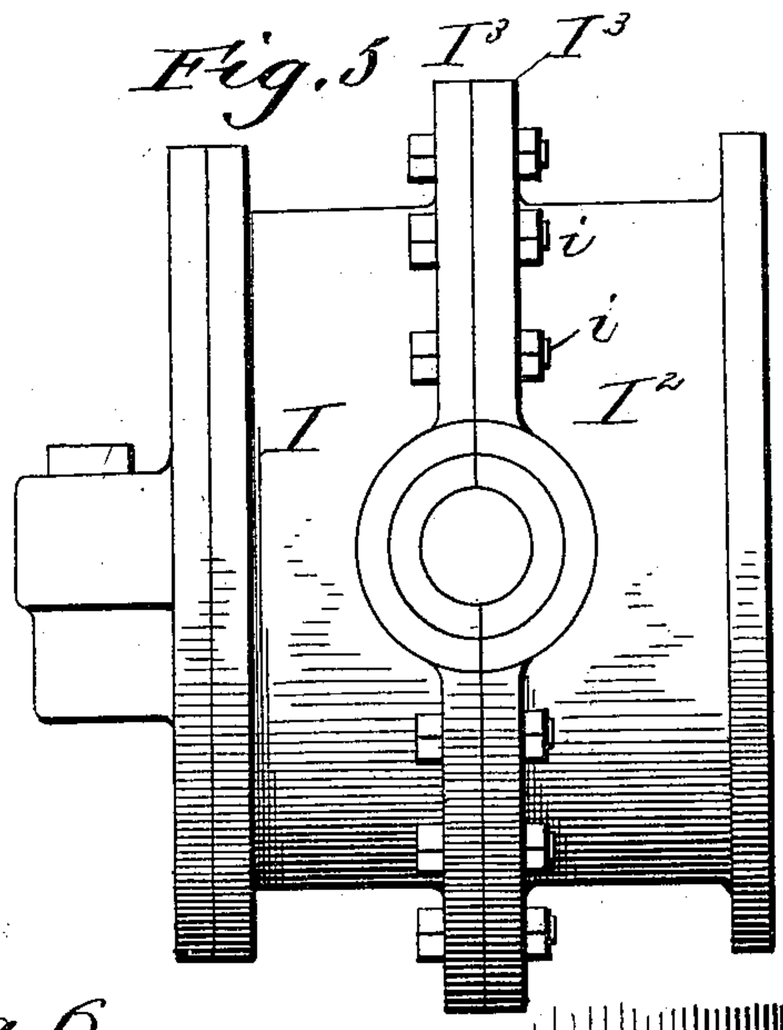
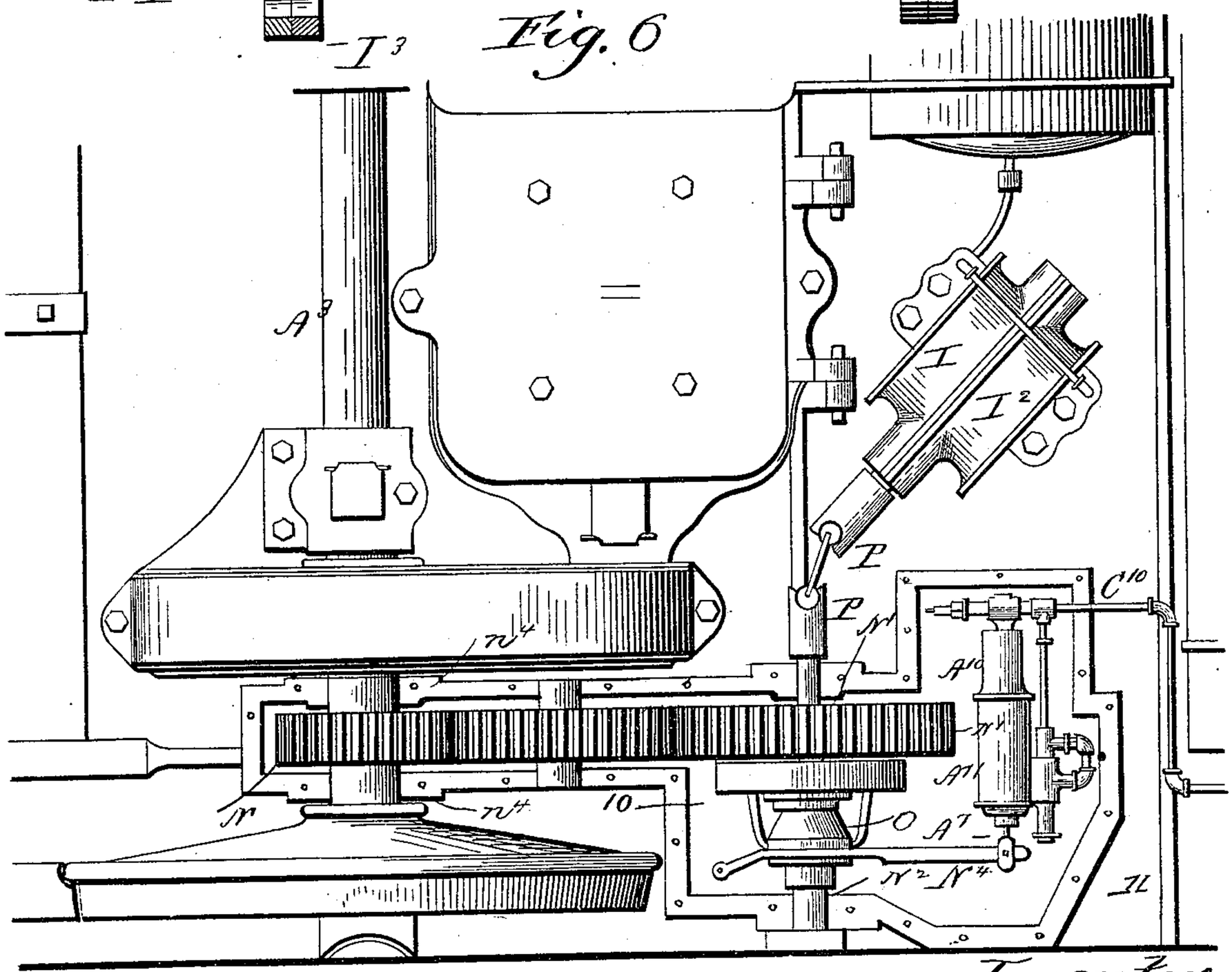


Fig. 6



Witnesses:

J. B. McGirr.

D. Lowe.

Inventor:

George S. Lee

by Connell Bro

atty

(No Model.) 3 Sheets—Sheet 3.

G. S. LEE.

AIR BRAKE.

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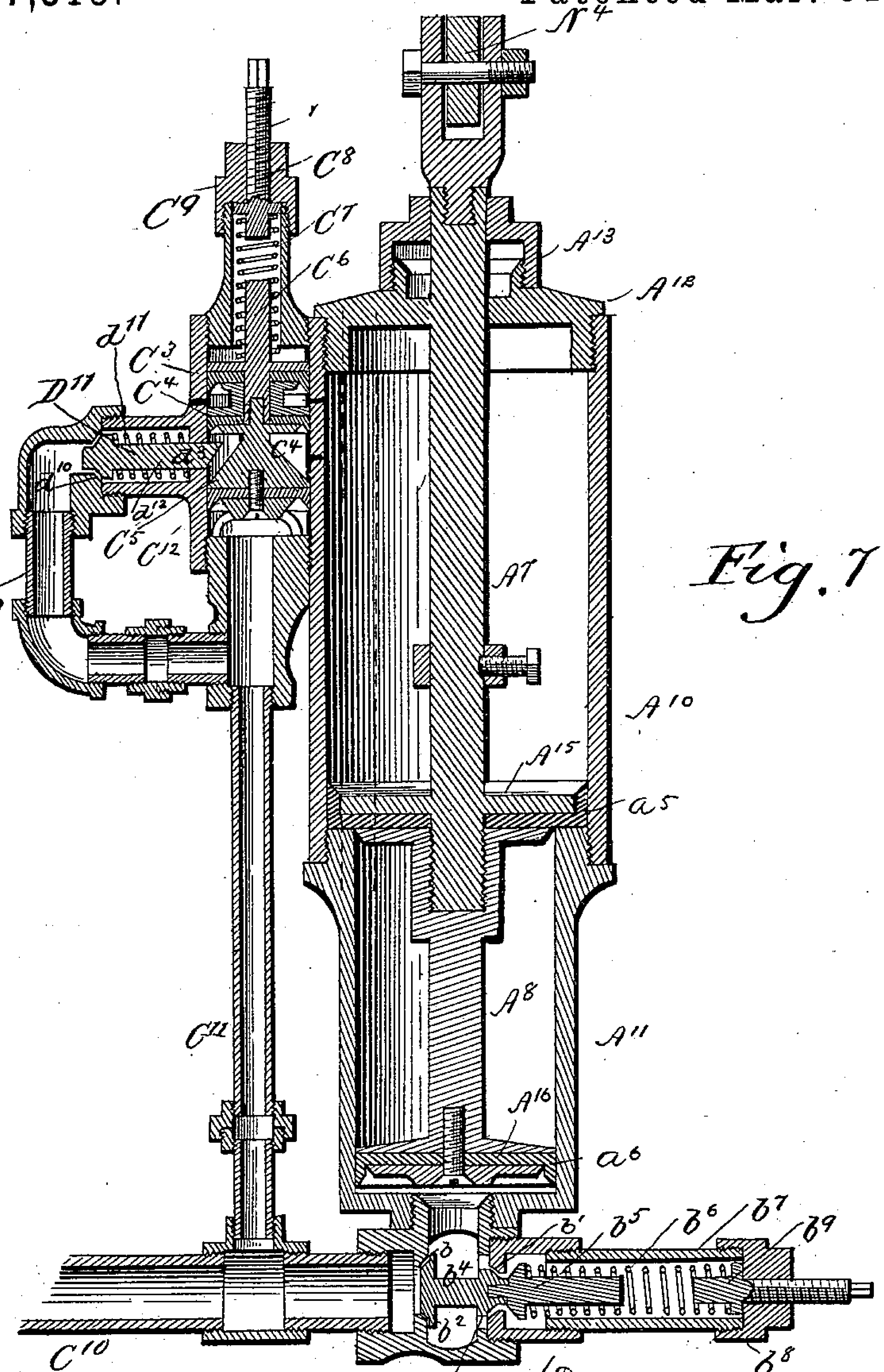
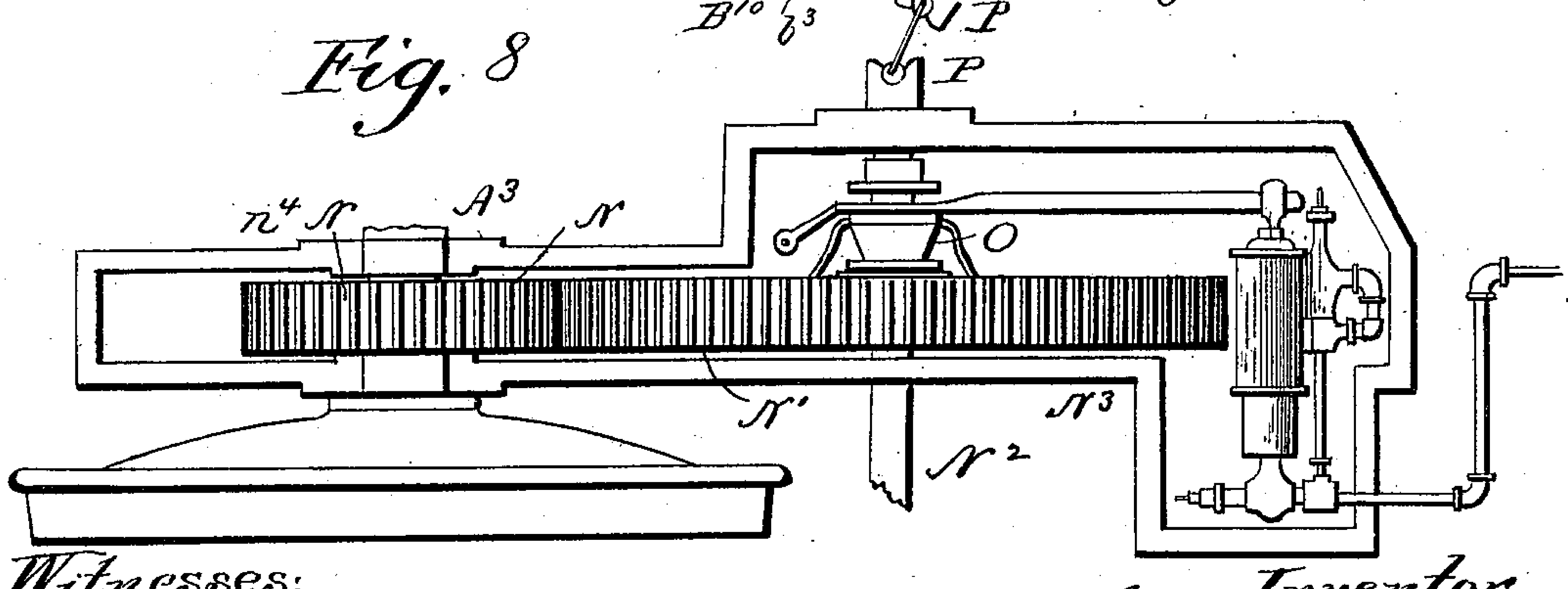


Fig. 7

Fig. 8



Witnesses:

Inventor:
George S. Lee
by Connolly Bros
attys.

UNITED STATES PATENT OFFICE.

GEORGE S. LEE, OF HAWTHORNE, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE NATIONAL AIR-BRAKE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 557,513, dated March 31, 1896.

Application filed December 23, 1895. Serial No. 573,016. (No model.)

To all whom it may concern:

Be it known that I, GEORGE S. LEE, a citizen of the United States, residing at Hawthorne, in the county of Passaic and State of New Jersey, have invented certain new and useful Improvements in Air-Brakes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has relation to air-brakes which are especially designed and adapted for use on cable and electric railways, and has for its object the provision of certain improvements in the air compressor or pump and in the mechanism by which the pump-piston is operated from one of the axles of the car.

The devices forming the subject of the present application are included in another application filed by me of even date herewith, in which the entire brake system is described and illustrated.

My present invention consists in the novel construction and combination of parts hereinafter described and claimed, having special reference to the compressor and its operating mechanism.

In the accompanying drawings, Figure 1 is an end view, partly in section, of the compressor-pump. Fig. 2 is a plan view, partly in section, of the same. Fig. 3 is a central horizontal sectional view of part of the piston. Fig. 4 is a vertical central sectional view of the pump without the cylinder-heads. Fig. 5 is a side view of the pump. Fig. 6 is an under side plan view of the pump, pump-operating mechanism, and automatic governor mounted on a motor-car. Fig. 7 is a central horizontal section of the automatic governor. Fig. 8 is a plan view of pump-operating gearing for radial cars.

The air compressor or pump comprises a pump cylinder or casing, a reciprocating piston, and a rotary piston-shaft on which is mounted an eccentric and an eccentric-yoke to impart from the rotary shaft to the piston the required reciprocating motion, the piston-shaft being rotated from one of the axles of the car through the medium of the gearing and connected mechanism hereinafter described.

The casing or cylinder of the compressor consists of two substantially similar flanged and interiorly-turned castings I I^2, secured together by bolts *i i* through flanges I^3 and having half-boxes I^4 I^5 at right angles to the axis of the cylinder to form bearings for the piston-shaft I^6, which turns in suitable brasses I^7, fitted in the boxes I^4 I^5, and extends out through one of the boxes to connect with the driving mechanism.

The pump or compressor casing is connected by an air-supply pipe with the air-reservoir, from which another pipe C^{10} leads to the cylindrical chamber A^{10} A^{11} of the automatic governor, which is mounted in a casing surrounding the pump-driving mechanism. This chamber is adapted to receive the pistons A^{15} A^{16}, the rod A^7 A^8 of which extends out through the head of the chamber A^{11}. The other head of the cylinder is provided with an air-inlet port, to which is connected the air-conducting pipe C^{10}, leading from the air-reservoir.

The compressor-piston, which constitutes one of the main features of my invention, consists of two cylindrical disks or heads I^9 I^{10}, having projecting from their inner faces the bored bosses i^5 i^5, through which pass the bolts i^6 i^6, connecting the two heads together and leaving a space between their inner faces for the play of the eccentric and eccentric-yoke by which the piston is reciprocated. The bosses i^5 i^5 are formed with matching rabbets or offset shoulders i^7. The inner faces of the heads I^9 I^{10} are channeled or grooved at i^{10} to afford guidance to the eccentric-yoke i^{12}, the latter being a rectangular collar made in two half-sections bolted together and bored out centrally to afford a bearing for the eccentric I″, which is keyed or turned solidly upon the piston-shaft. A shim of steel is fitted in each groove i^{10} to afford a slide bearing for the yoke and to take up all wear, being cheaply replaced when desired. As the piston-shaft rotates the eccentric imparts to the yoke a "four-motion" action, which alternately thrusts the piston positively in opposite directions. The cylinder and piston

of the pump are so constructed that the stroke of the piston will be very short; but the latter is of much greater area than usual, its diameter being greater than the length of the pump-cylinder. At each stroke therefore a large supply of free air is taken in, and in this way the pump has an extra large compressing capacity under a slow motion of the piston. This is obviously a great advantage, as the strain, wear, and tear are reduced to a minimum and heating of journals avoided.

The pump is made with as few parts as possible, for the purpose of obtaining strength and durability, and is made short, so as to economize space under the car. The cylinder-heads are provided with suitable suction and discharge valves, which need not be specifically described.

The piston of the compression-pump is operated from one of the axles of the car, which is designated A^3 in the drawings, and I shall now describe the mechanism through which the piston is so operated and in connection therewith the construction and operation of the automatic governor, which, it may be generally stated, is to automatically disconnect the pump from the pump-operating mechanism when the pressure in the reservoir reaches its desired maximum and to reconnect the pump-piston and its operating mechanism at any desired minimum pressure.

Pump-operating mechanism.—To the axle A^3 of a four "radial" car a toothed pinion N is keyed, and such pinion engages with a large toothed wheel N′, mounted loosely on a shaft N^2, having its bearings in a suspension-frame N^3, &c., which is securely bolted at one end to the boxes n^4, mounted on the axle on either side of the pinion N. Upon the shaft N^2 is mounted a slide clutch member O, which is held in rotative connection with the shaft N^2. When the clutch member O is in pressure contact with the wheel N′, the latter communicates motion to the spindle N^2 through the clutch, and the spindle in turn communicates motion to the rotary shaft of the pump-piston through the universal shaft connection P P, &c. This arrangement is shown in Fig. 8. When the car is a four-wheeled car, an additional idle gear-wheel is used, as shown in Fig. 6.

Any suitable form of flexible shaft connection may be employed, but I prefer using what is known as the "Mannesman" flexible coupling. (Shown and described in Letters Patent No. 545,085, dated August 27, 1895.)

Now, it will be understood that while the car is running and the gearing is in active operative connection with the pump-piston the latter is continually compressing air and storing the same under increasing pressure in the reservoir. When, however, the desired maximum pressure is attained, the automatic governor operates, as hereinafter described, admitting the air under full pressure to the automatic governor, which then actuates the lever N^4 and through the latter disengages the clutch member O from the wheel N′ and allows the gears N N′ to rotate independently of their connections with the pump-piston, which latter becomes inactive. The lever N^4 is connected to suitable manually-operative mechanism, so that in the event of a failure of the automatic governor to work and upon the observance by the motorman of an abnormal increase of pressure the clutch member O may be mechanically withdrawn and in this way the operation of the pump arrested.

The manner and means of supporting the suspension-frame and its connections at their forward end will depend in a large measure upon the structure of the car. When the brake is attached to a radial car, I attach to the bottom of the car above the cylinder a segmental rail and support the suspension-frame upon this rail by means of a wheeled hanger, which will allow the car-body to turn and move laterally without disturbing the position of the suspension-frame relative to the other connected parts.

The gears or other pump-driving mechanism are inclosed within a suitable casing 10, which is supported at one end upon the axle of the car by suitable bearings, while the other end is suspended from the floor of the car or supported upon the channel-bearings 11 in such a manner as to yield and adapt itself to the forward and backward play of the axle carrying the motor.

Automatic governor.—A^{10} A^{11} designate hollow cylindrical members secured together by a screw-coupling and constituting a cylinder larger at one end than the other, the larger section A^{10} having its end closed by a head A^{12}, provided with a stuffing-box A^{13}, through which passes a piston-rod carrying two pistons A^{15} and A^{16}, the former fitting and working in the larger part A^{10} of the cylinder, while the latter fits and works in the smaller part A^{11}. The piston-rod is formed in two sections A^7 A^8, attached together by a screw-coupling, and the piston A^{15} is formed integral with the section A^7, while the piston A^{16} is integral with the section A^8. Suitable packing a^5 a^6 is applied to the respective pistons, which move simultaneously as an integral structure. A lever N^4 is pivotally connected to the end of the piston-rod A^7 and is also connected to and by its movement serves to connect and disconnect the clutch, which is interposed between the axle of the car and the pump. Upon the end of the cylinder is secured a valve-chamber B^{10}, having two valve-seats b b' and valves b^2 b^3 formed on a stem b^4, the valves seating oppositely to one another, so that as one is closed the other is opened. The stem b^4 extends beyond the valve b^3 and is socketed to receive the end of a follower b^5, which is carried by a compression-spring b^6, contained in a casing b^7, the other end of spring b^6 bearing on a flanged

screw-plug b^9, which screws through the head b^8 of the casing b^7, and by means of which the tension of the spring b^6 is regulated.

A pipe C^{10} leads from the valve-chamber to a compressed-air reservoir, and a branch pipe C^{11} leads from the pipe C^{10} to a chamber C^{12}, containing pressure-regulating valves arranged on the side of the section A^{10} of the cylinder. This chamber C^{12} is cylindrical in cross-section and contains three piston-valves C^3 C^4 C^5, mounted on a sectional stem C^6, and the stem and valves are pressed toward the end of the chamber into which the pipe C^{11} enters by a compression-spring C^7, that bears against the valve C^3 and at the other end bears against a flanged screw-plug C^8, that screws through the head C^9 of the chamber and serves as a means for adjusting the tension of the spring. A by-pass pipe D^{10} is connected with the chamber C^{12} above and below the valve C^5, and a valve D^{11} is arranged in said by-pass pipe, being pressed against its seat d^{10} by a compression-spring d^{11}, and the stem d^{12} of the valve projects into the chamber above the valve C^5, a beveled surface d^3 on the end of the stem contacting with a beveled surface c^4 on the valve C^5 and serving to close the valve D^{11} when the valve C^5 is moved by the pressure of air in pipe C^{11}.

Operation: When by the rotation of the car-axle and consequent operation of the pump the pressure in the air-reservoir has reached a maximum of, say, fifty-one pounds, the valve b^2 will be opened against the pressure of spring b^6, which has been regulated by means of the screw-plug b^9, to exert a closing pressure of fifty pounds on the valve b^2, and the air will enter under the piston A^6 and will force up the piston-rod A^7 A^8 and operate the lever N^4 to throw out of engagement the clutch that connects the driving-axle and pump, thereby stopping the pump. Prior, however, to this operation and after a pressure of thirty-six pounds has been gained the air will have entered the chamber C^{12} through pipe C^{11} and forcing up the valves C^3 C^4 C^5 will have closed the valve D^{11} in the by-pass pipe D^{10} and opened a port f^{10}, leading from the cylinder A^{10} to the space in the chamber C^{12} between the valves C^3 and C^4, from which space there is a free passage to the open air through a port f^{11}. When the pump is stopped at fifty-pounds pressure by the movement of piston-rod A^7 A^8 and pivoted lever N^4, the pump will remain inactive until the air-pressure has been reduced sufficiently to allow the spring C^7, which has been regulated to exert a pressure of thirty-five pounds, to push down the stem C^6 and open the valve D^{11} of the by-pass pipe D^{10} and allow air to enter the cylinder A^{10} above the piston A^{15} through a port f^3, whereby the piston is depressed to its seat on the end of cylinder-section A^{11} and the pump is set in motion by the downward pull of the piston-rod A^7 on the lever N^4.

The foregoing operations are repeated automatically from time to time as the pressure in the air-reservoir reaches the maximum or minimum, and thus the proper and safe pressure requisite for efficient operation is constantly preserved.

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

1. In air-brake systems, the combination with a compressor-pump and gearing for driving the same from the car-axle, of a piston-shaft connecting the pump-piston and gearing and made in sections connected together by a universal coupling, substantially as described.

2. A compressor-pump for air-brakes, consisting of a cylinder having a bore of uniform diameter throughout its length, with air inlet and outlet valves, a hollow cylindrical piston composed of two cylindrical recessed heads, bolted together and formed with diametrical ways on their inner faces, a shaft passing laterally through said cylinder and piston, and having an eccentric mounted or formed thereon, and a rectangular sliding yoke embracing said eccentric and sliding in said ways, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE S. LEE.

Witnesses:
THOMAS A. CONNOLLY,
ANTHONY A. CONNOLLY.