No. 661,111. Patented Nov. 6, 1900.

J. SHOUREK.

AIR BRAKE.

(Application filed Nov. 20, 1899.)

(No Model.) 6 Sheets—Sheet 1.

Fig. 1.

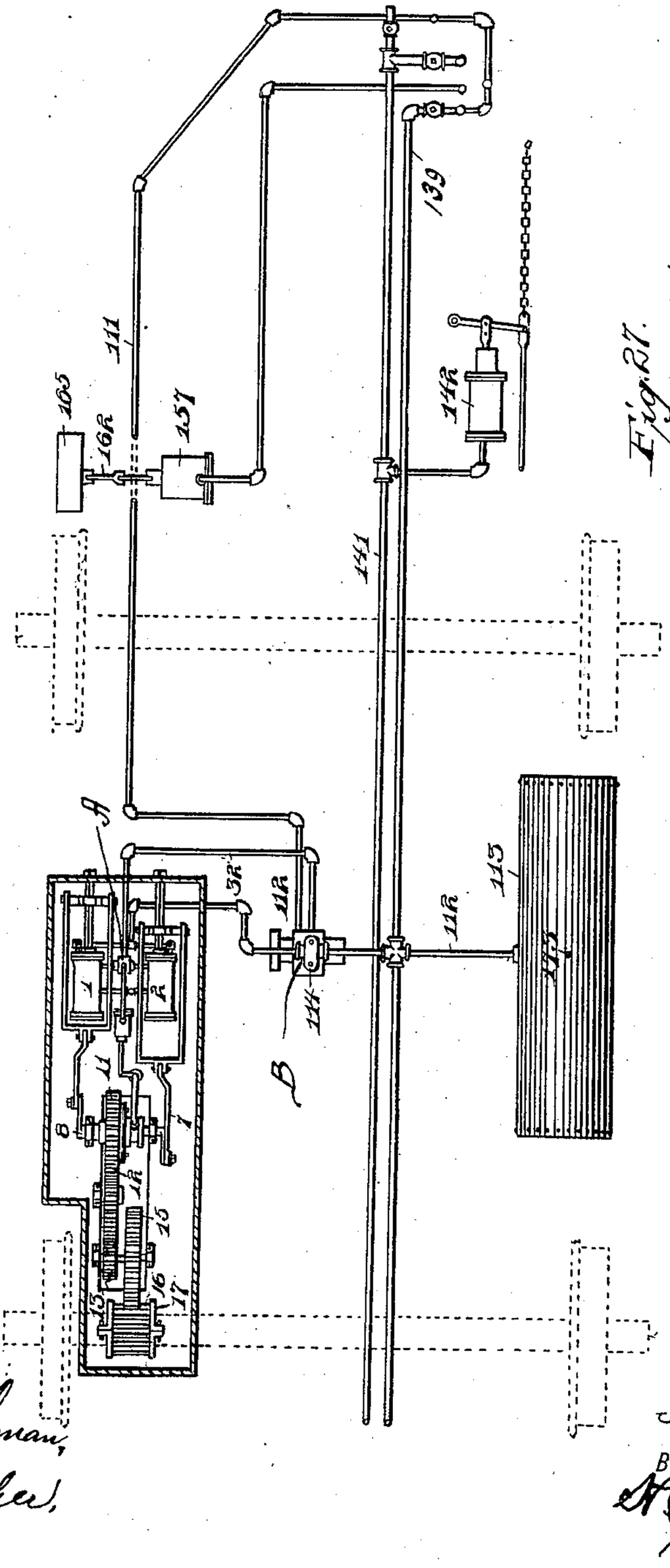
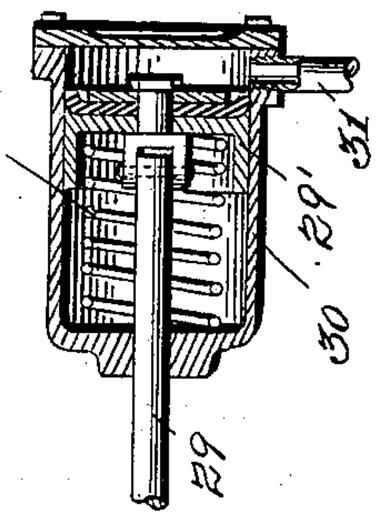


Fig. 2.



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6 Sheets—Sheet 2.

Fig. 3.

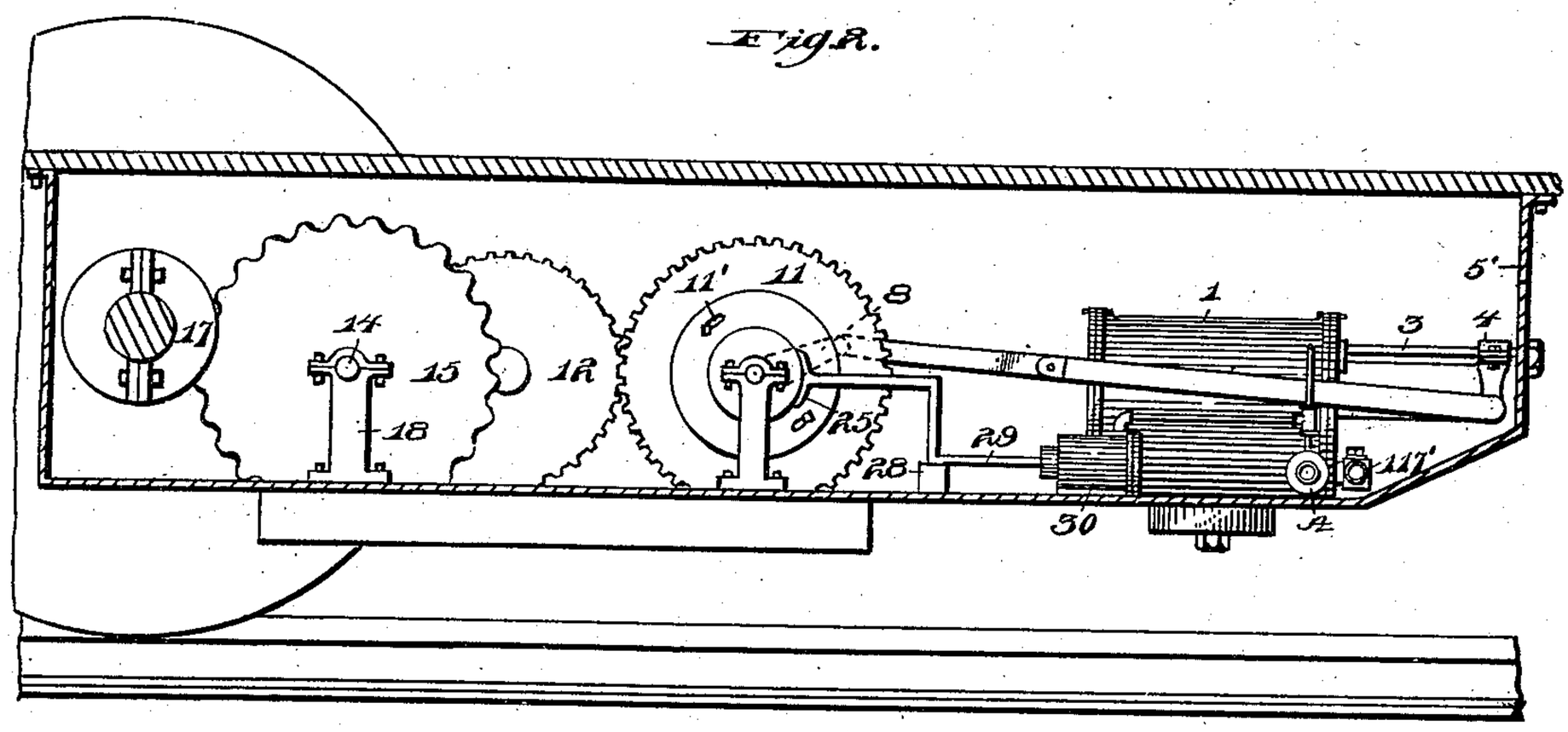

Fig. 4.

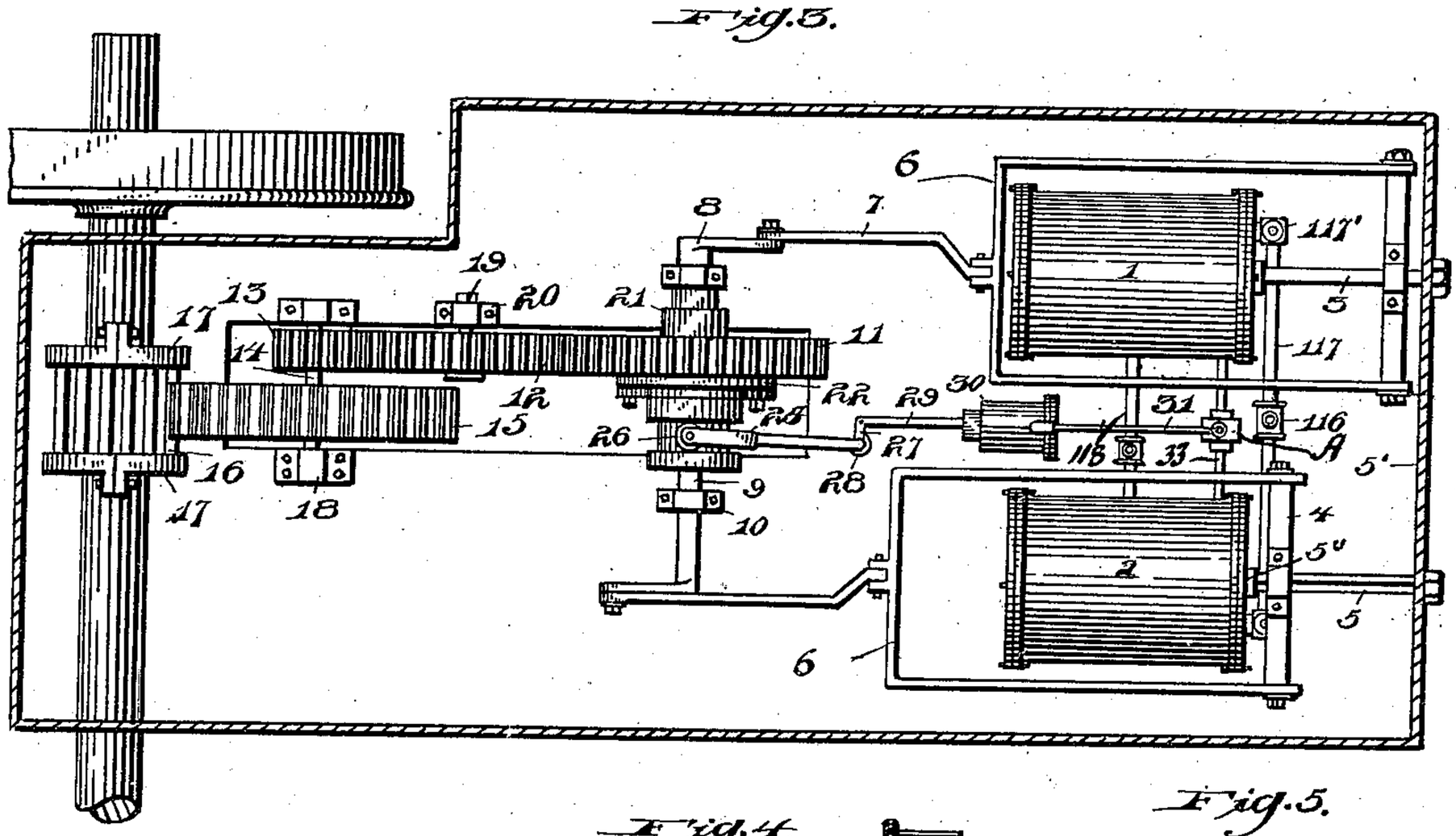

Fig. 5.

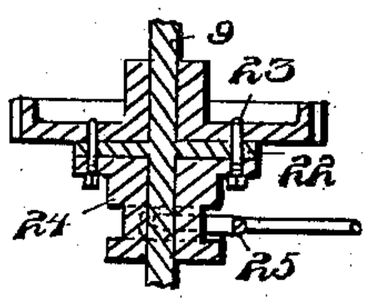

Fig. 4.

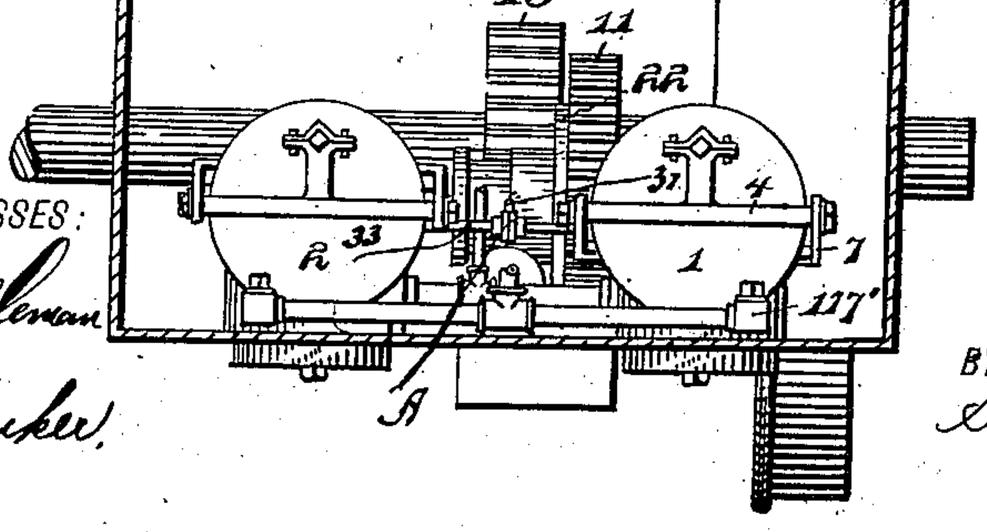

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Fig. 6.

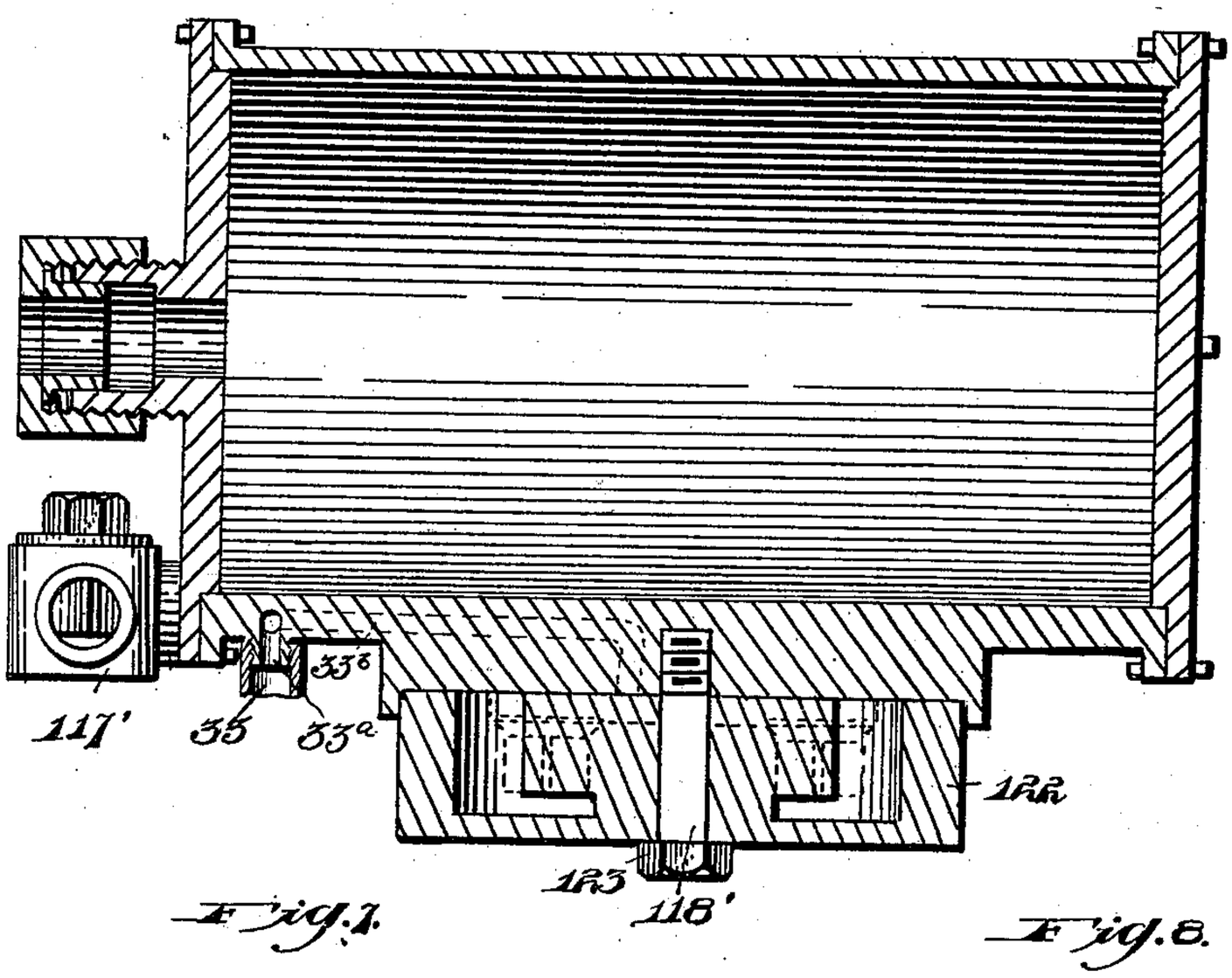


Fig. 7. Fig. 8.

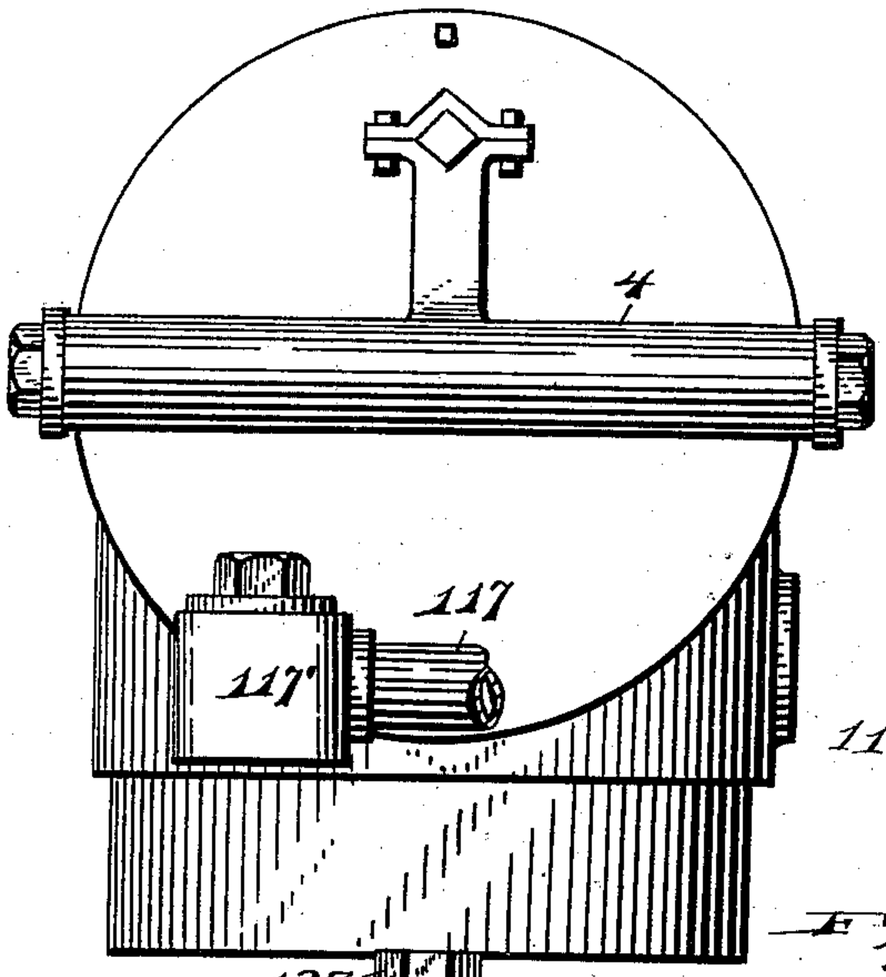
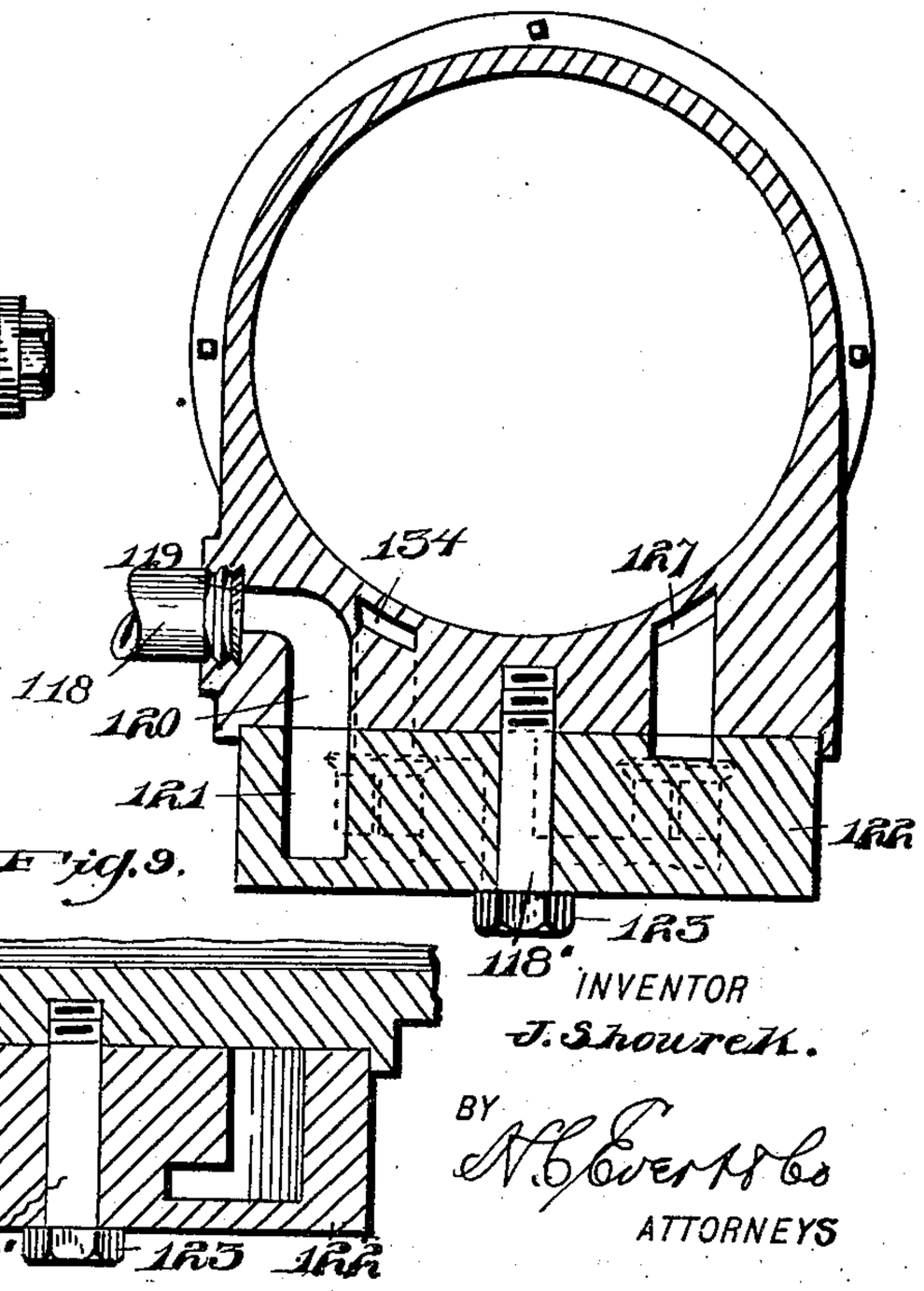


Fig. 9.



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(No Model.) 6 Sheets—Sheet 4.

Fig. 10.

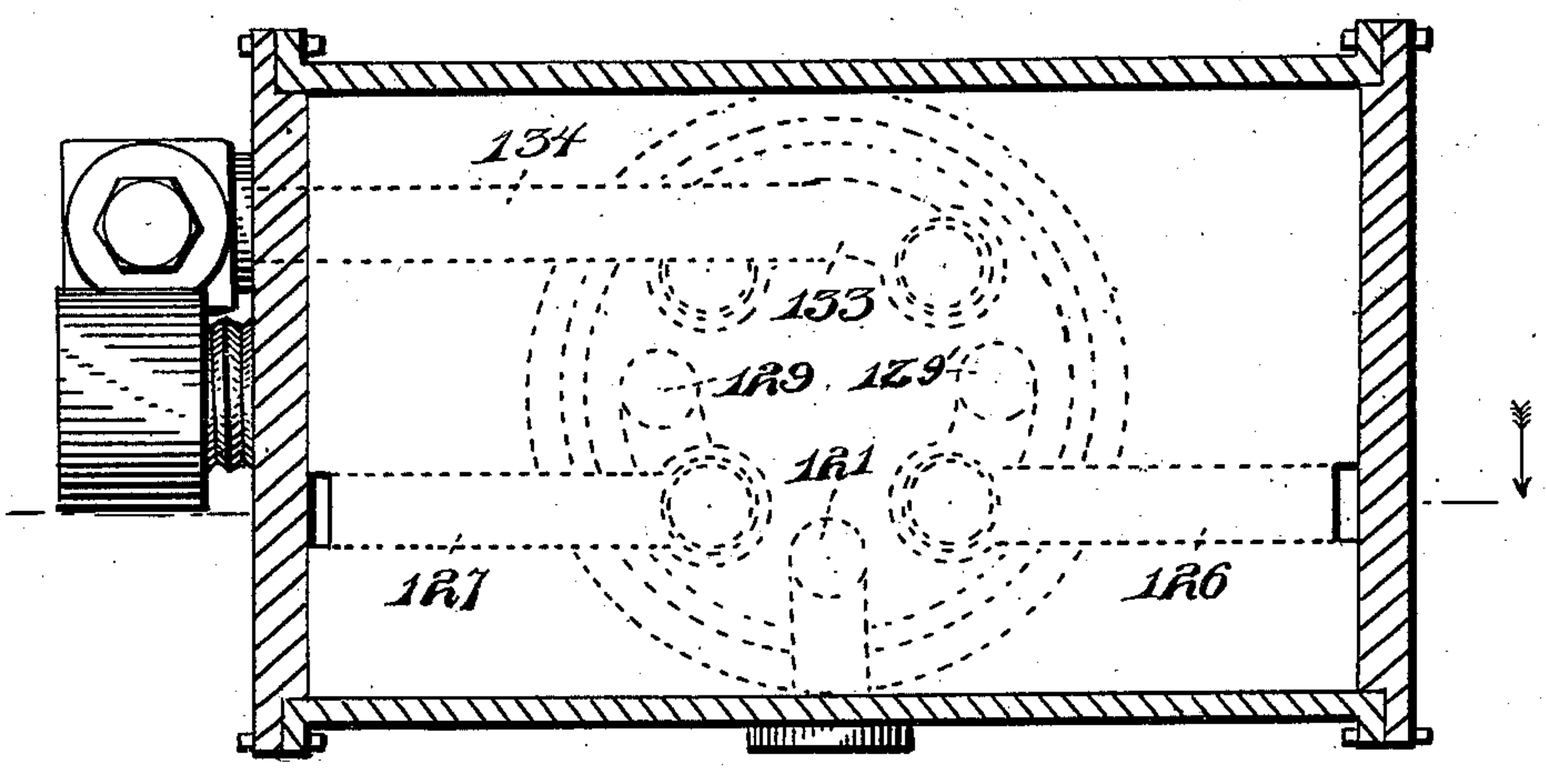


Fig. 11.

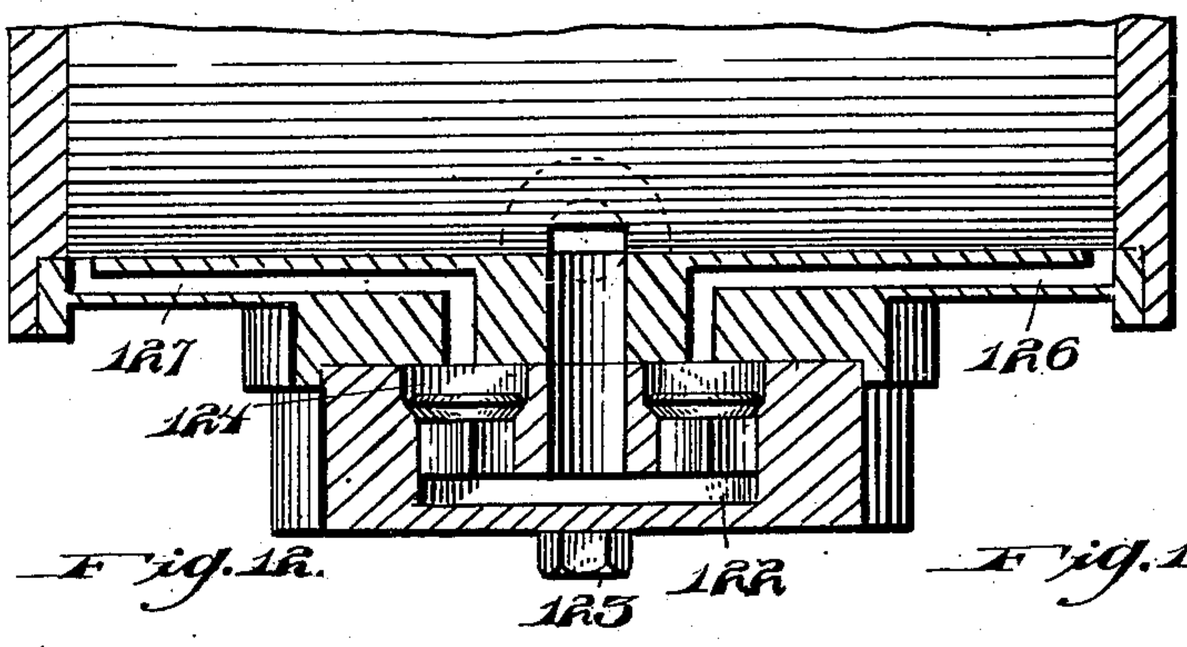


Fig. 12. Fig. 13.

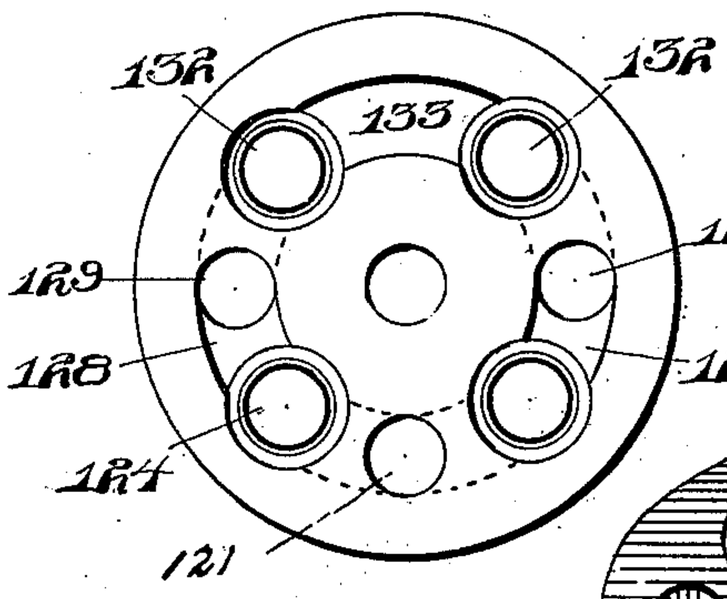
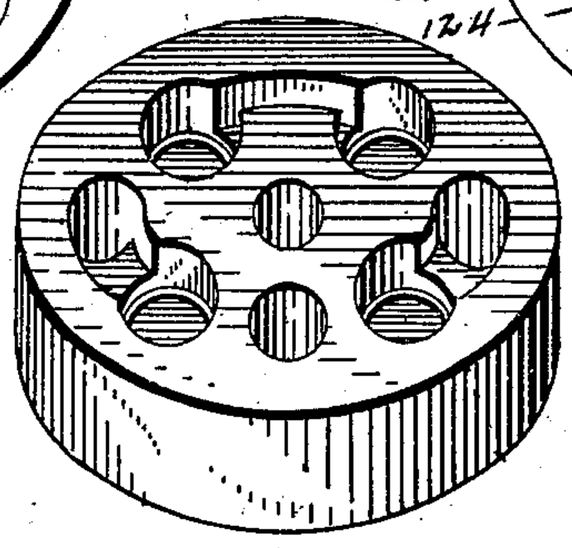
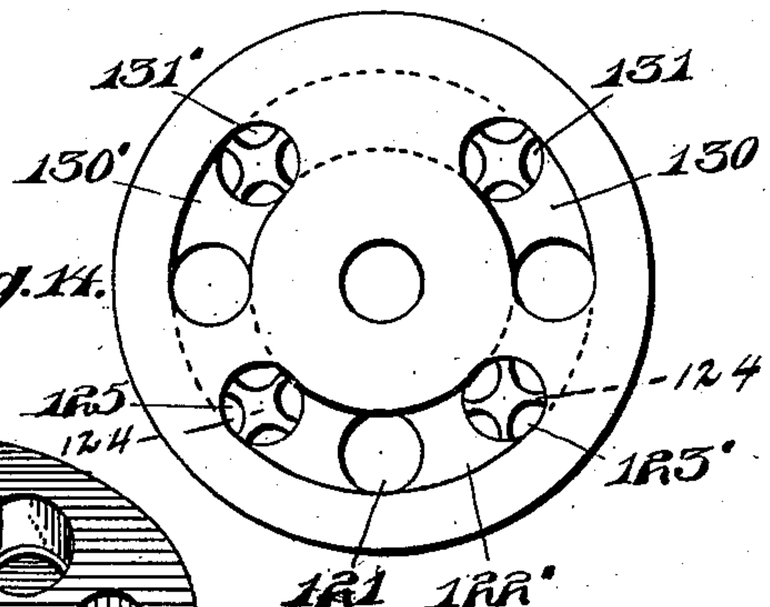


Fig. 14.





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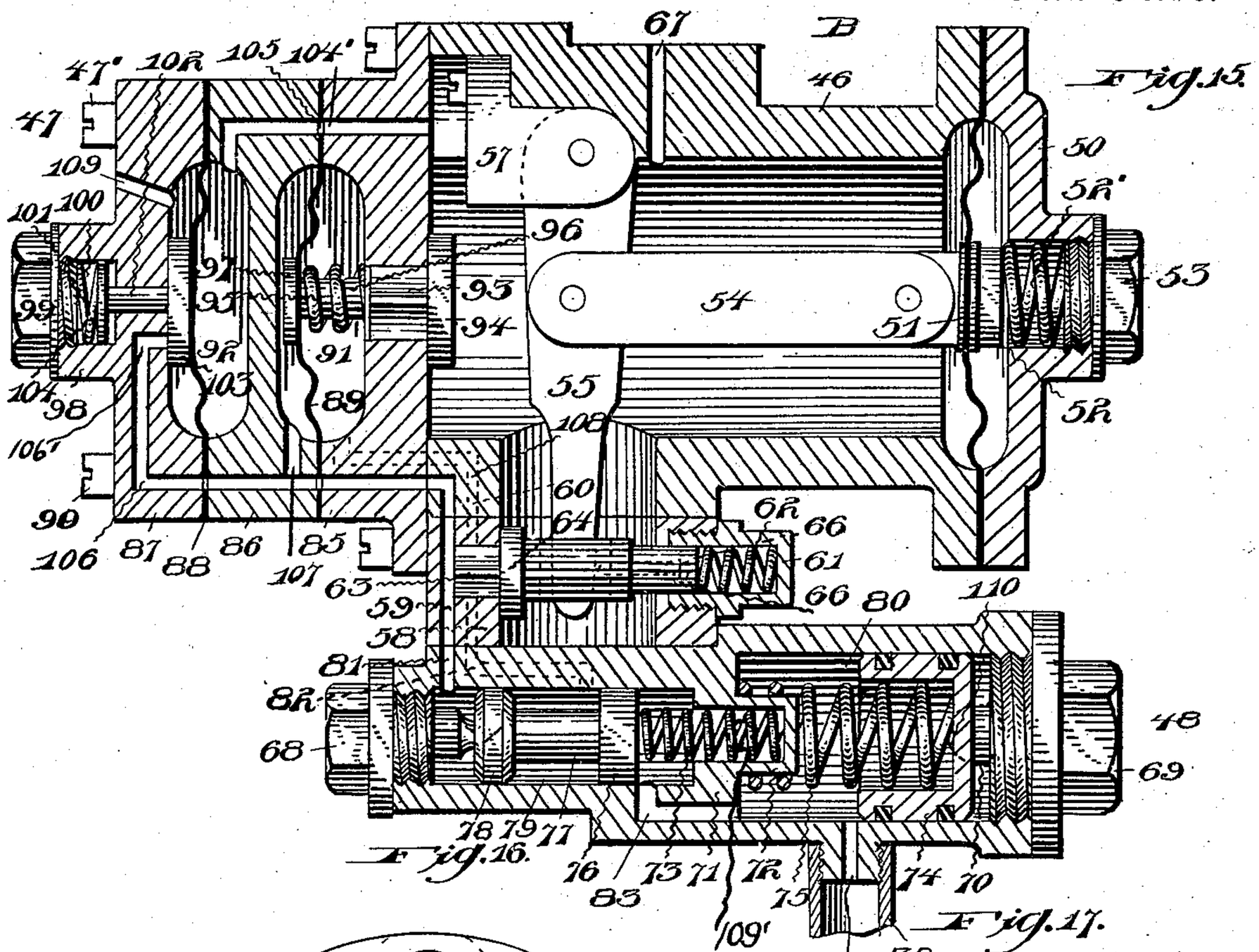
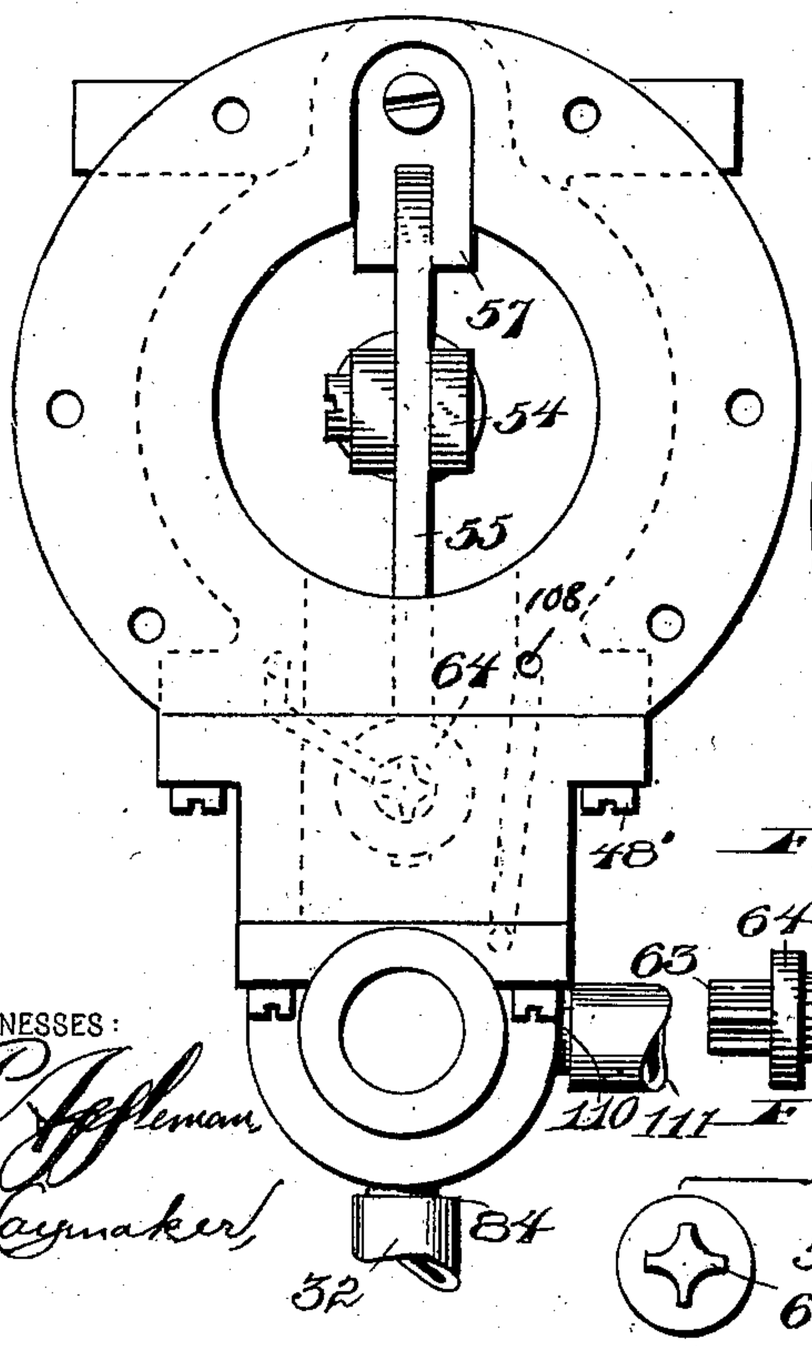
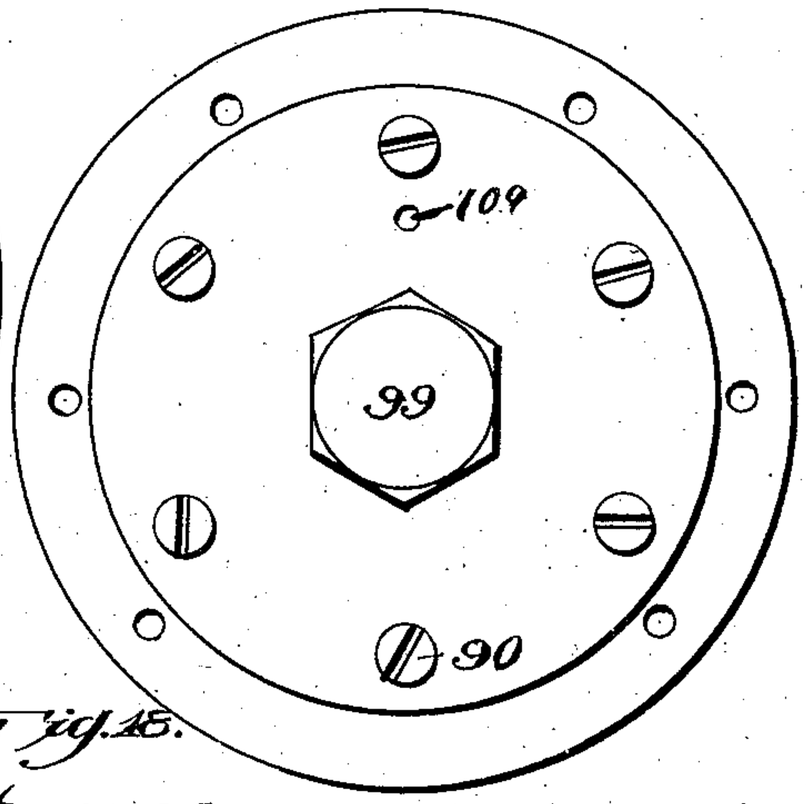
(No Model.) 6 Sheets—Sheet 5.

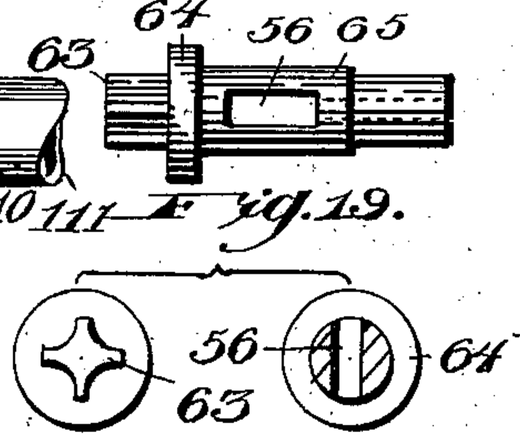




F fig. 18.



F fig. 15.



F fig. 19.

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No. 661,111. Patented Nov. 6. 1900.

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(Application filed Nov. 20, 1899.)

(No Model.) 6 Sheets—Sheet 6.

Fig. 20.

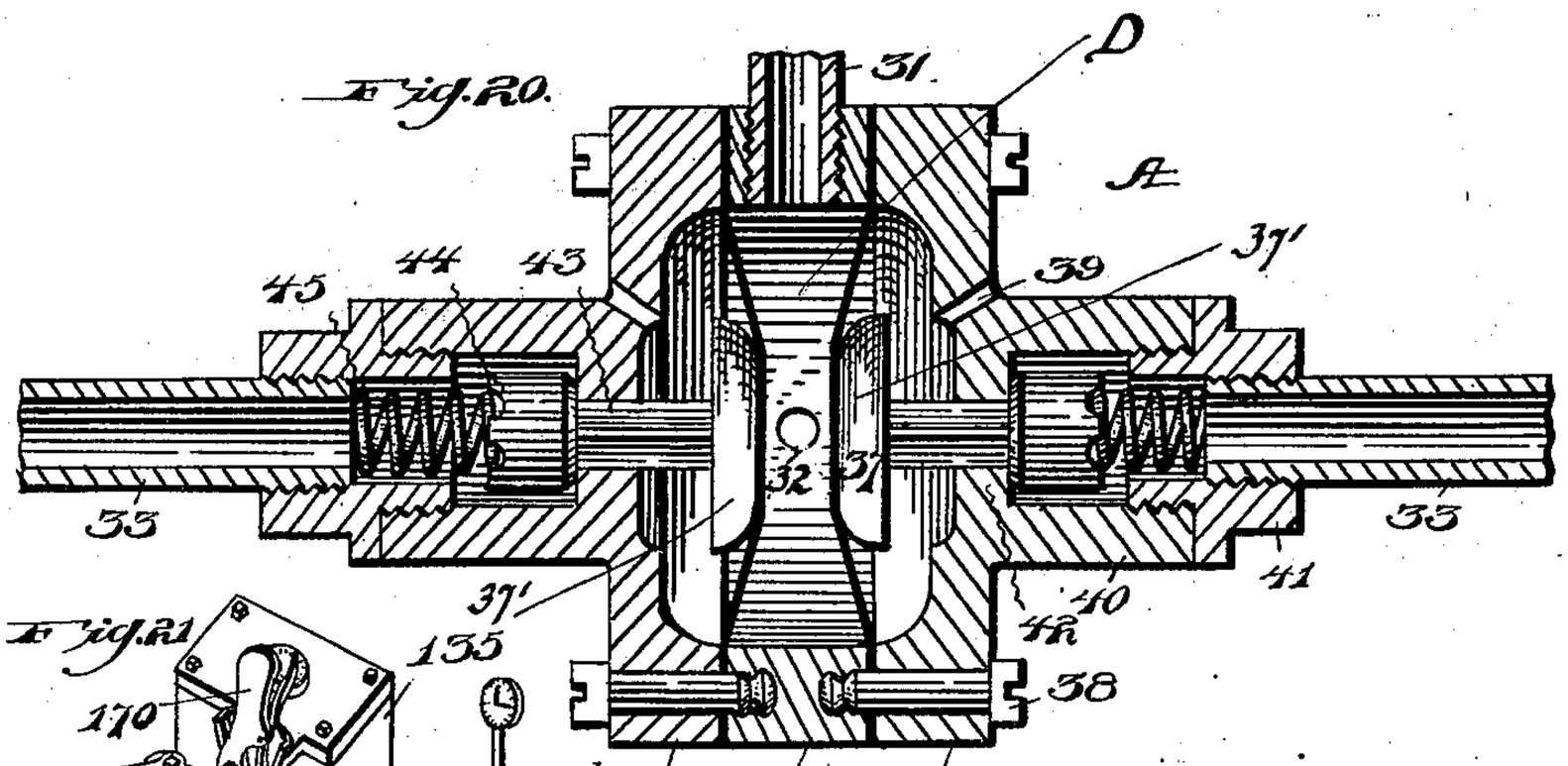

Fig. 21.

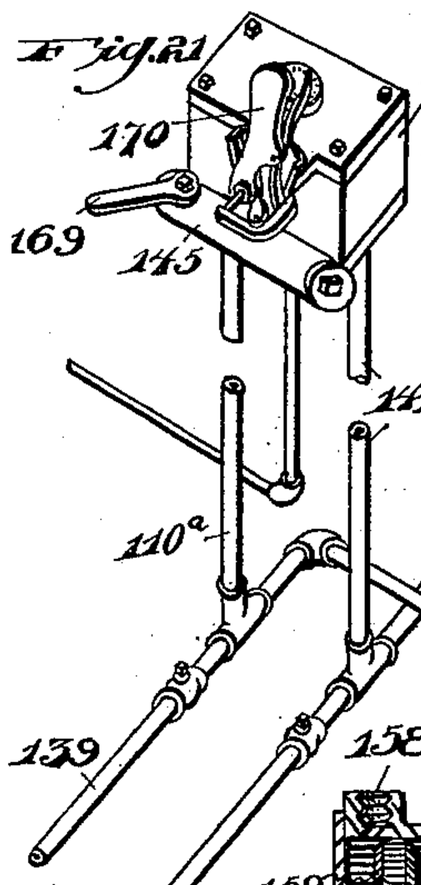

Fig. 22.

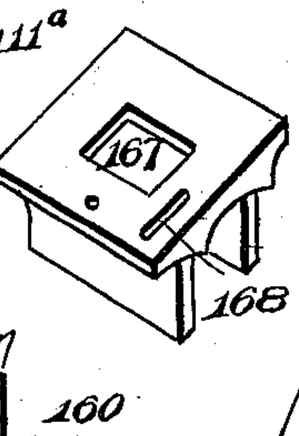

Fig. 23.

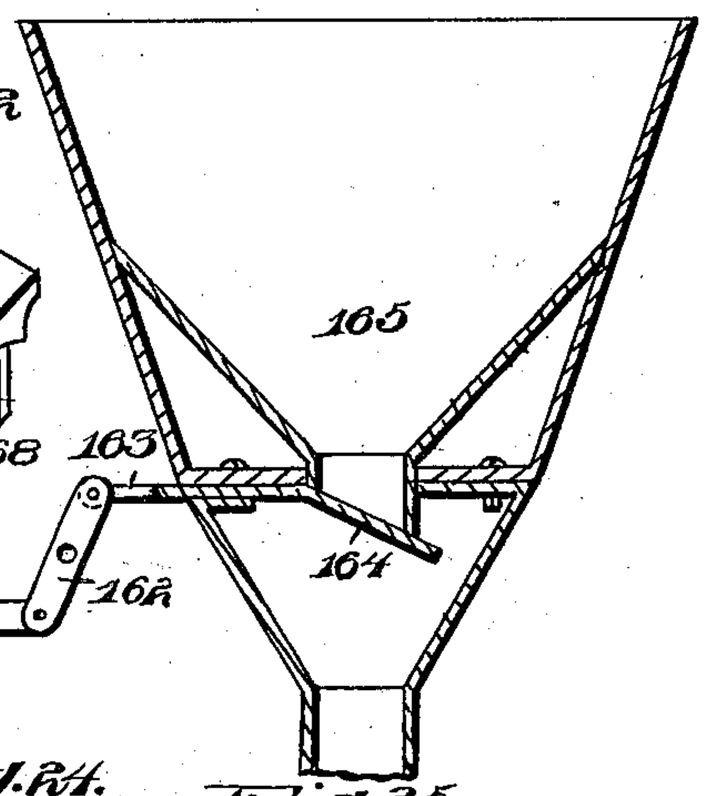

Fig. 24.

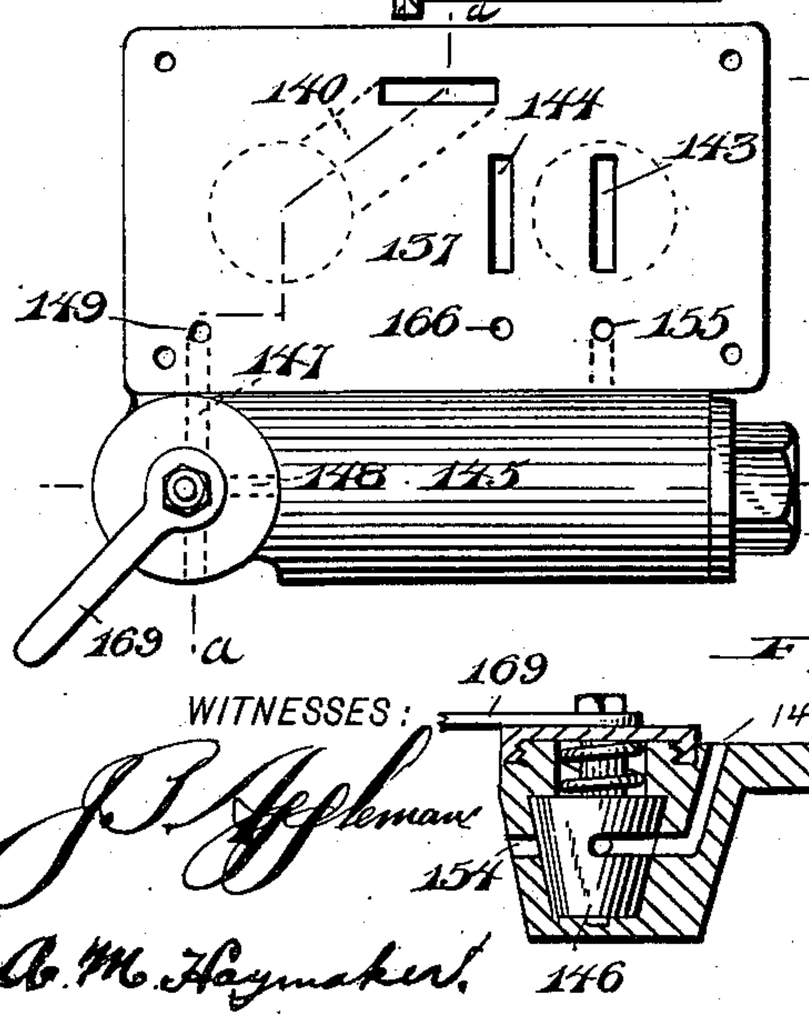

Fig. 25.

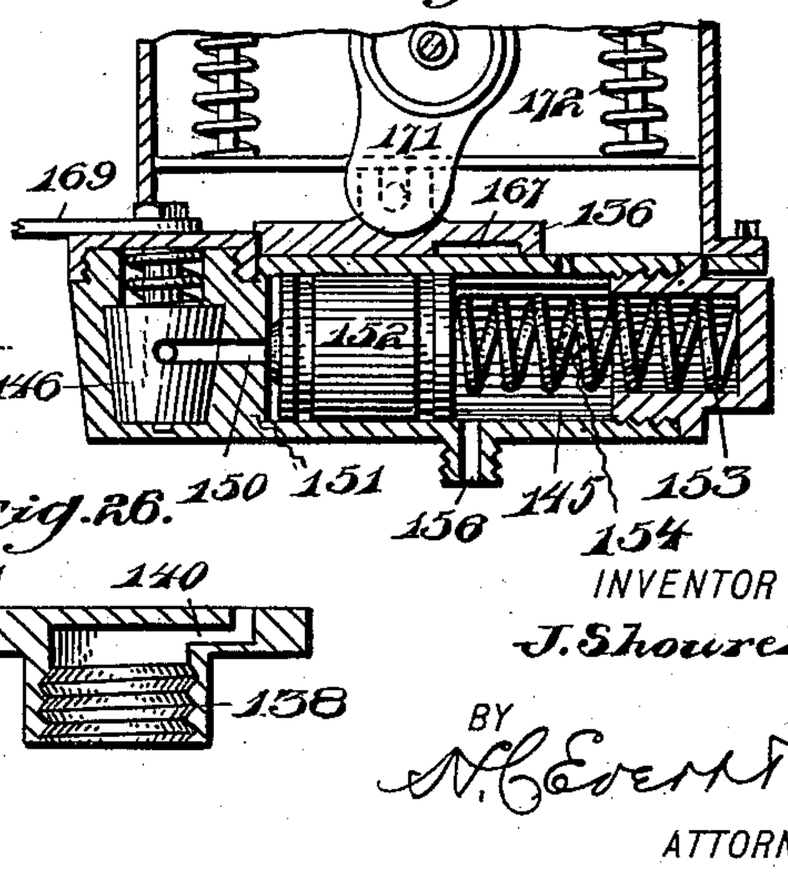

Fig. 26.

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UNITED STATES PATENT OFFICE.

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AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 661,111, dated November 6, 1900.

Application filed November 20, 1899. Serial No. 737,712. (No model.)

To all whom it may concern:

Be it known that I, JOHN SHOUREK, a citizen of the United States of America, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Air-Brakes, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to certain new and useful improvements in air-brakes, and is particularly adapted for use upon street-cars.

One object of my invention is to construct a brake of this character with means for automatically discontinuing the compression of air when a predetermined point has been reached in the air-reservoir.

A further object of my invention is to provide a brake of this character with means for automatically operating a sanding device.

My invention finally consists in the novel construction, combination, and arrangement of parts to be hereinafter more fully described, and specifically pointed out in the claims.

In describing the invention in detail reference is had to the accompanying drawings, forming a part of this specification, and wherein like characters of reference indicate corresponding parts throughout the several views, in which—

Figure 1 is a top plan view of my improved air-brake. Fig. 2 is a side view thereof, showing the operating means for the compression-cylinders. Fig. 3 is a top plan view of a portion of my improved brake, showing the arrangement of the air-compression cylinders, operating means therefor, and the clutch mechanism for discontinuing or continuing the operation of the air-compression cylinders. Fig. 4 is an end view of the same. Fig. 5 is a longitudinal sectional view of the clutch. Fig. 6 is a vertical sectional view of one of the air-compression cylinders. Fig. 7 is an end view thereof. Fig. 8 is a cross-sectional view thereof. Fig. 9 is a cross-sectional view of the suction-valve casing. Fig. 10 is a longitudinal sectional view of one of the compression-cylinders. Fig. 11 is a longitudinal sectional view thereof and the suction-valve casing, showing a pair of suction-valves arranged therein. Fig. 12 is a top plan view of the suction-valve casing. Fig. 13 is an inverted plan view thereof with the bottom removed. Fig. 14 is a perspective view thereof. Fig. 15 is a vertical sectional view of the pressure-regulating valve mechanism. Fig. 16 is an end view thereof with the exhaust-valve casing removed. Fig. 17 is an end view of the regulating-valve. Fig. 18 is a side view of the main valve-head of the pressure-regulating valve mechanism. Fig. 19 is an end and sectional view of the same. Fig. 20 is a cross-sectional view of the reducing-valve mechanism and its connections. Fig. 21 is a perspective view of the brake-valve casing and its connections. Fig. 22 is an inverted perspective view of the brake-valve. Fig. 23 is a vertical sectional view of the sand-operating cylinder and its connection to the said receptacle. Fig. 24 is a top plan view of the bottom of the brake-valve casing and the cylinder carrying means for operating the sand-cylinder. Fig. 25 is a vertical sectional view thereof and a portion of the brake-valve casing, showing the mechanism for operating the sand-cylinder. Fig. 26 is a cross-sectional view thereof on the line *a a* of Fig. 24. Fig. 27 is a longitudinal sectional view of the clutch-operating cylinder.

Referring to the drawings by reference characters, 1 and 2 indicate the air-pumps or compression-cylinders, each provided with a suitable piston (not shown) connected to the piston-rods 3. The outer end of each of the piston-rods 3 is secured to a cross-head 4, which operates upon the guides 5, suitably connected at one end to the casing 5′, surrounding the cylinders and other parts of the brake mechanism, which may be suspended from the underneath face of the car in any desirable manner. The opposite ends of the guides 5 are secured to the air-pumps or compression-cylinders, as at 5″.

The ends of each of the cross-heads 4 are suitably connected to a yoke 6, to which the one end of a connecting-rod 7 is attached. The opposite ends of the rods 7 are each connected to a crank-arm 8, mounted upon or formed integral with the shaft 9, supported by the standards 10, mounted upon the bottom of the casing 5′.

Loosely mounted upon the shaft 9 is the gear-wheel 11, meshing with the gear 12, which in turn meshes with the pinion 13, carried by

the shaft 14. The shaft 14 also carries the sprocket-wheel 15, which is adapted to mesh with the sprocket-pinion 16, mounted upon the car-axle between the collars 17.

The shaft 14 is journaled in the standards 18 and the shaft 19 for the gear-wheel 12′ in the standard 20, both of these standards being supported upon the bottom of the casing 5′.

The shaft 9 has rigidly secured thereon the collars 21 and 22, between which the gear-wheel 11 revolves. The collar 22 is provided with a pair of openings, through which the clutch-pins 23 of the clutch-sleeve 24 operate and engage in a pair of slots 11′, formed in the gear-wheel 11. The clutch-sleeve 24 is provided with an annular groove in which engages the ends of the clutch-operating arm 25, and these ends are each provided with the friction-rollers 26.

The clutch-arm 25 is connected to the crank-arm 27, which is mounted upon the shaft 28, and the crank-arm 27 is or may be formed integral with the piston-rod 29, suitably secured to the cup-shaped piston-head 29′ of the clutch-operating cylinder 30, having arranged therein the coiled spring 30′, which surrounds the rod 29 and engages within the piston 29′. This cylinder 30 is connected by means of the pipe 31 to the port 31′ of the reducing-valve mechanism A, the reducing-valve being connected to the pressure-regulating valve B by means of the pipe 32 and to the compression-cylinders by the pipes 33.

The reducing-valve mechanism A consists of a casing formed of two sections 34 35, between which is arranged the sleeve 36, provided at each side with the diaphragm 37, forming an air-chamber D between the same, and the one face of the diaphragms are adapted to be engaged by the piston-head 37′, the sleeve, diaphragms, and sections being secured together by means of the screws 38.

39 indicates an exhaust-port arranged in each of the sections of the main-valve casing for the compression-cylinders.

Each section of the reducing-valve casing upon its outer face has formed integral therewith a tubular extension 40, in which is secured the hollow interiorly and exteriorly screw-threaded plug 41, the outer end of each of these plugs being secured to one of the pipes 33, which are connected to the union 33^a, registering with the discharge-port 33^b of the compression-cylinders. Each of the sections is further provided with a partition 42, having an opening arranged therein to allow of the operation therethrough of the fluted stem or spindle 43 of the piston-heads 37′. The partitions 42 upon their outer faces form valve-seats for the exhaust-valves 44 of the compression-cylinders. These valves are connected to the fluted spindles or stems and are held normally in engagement with their valve-seats by means of the coiled springs 45, arranged in each of the screw-plugs 41.

The pressure-regulating valve mechanism consists of the main-valve casing 46, the exhaust-valve casing 47, suitably secured to one end thereof, as at 47′, and the auxiliary-valve casing 48, secured to the casing 46, as at 48′.

The main-valve casing 46 is provided with the head 50, between which and the sides of the casing is secured the diaphragm 51. This diaphragm 51 has the clamp 52 secured thereto and extending through the same, and one side of the clamp 51 is adapted to engage the coil-spring 52′, the tension of which is regulated by means of the plug 53, operating through an opening in the head 50 of the main-valve casing, and the opposite side of the clamp 52 is pivotally connected to one end of the link 54, while the opposite end of the link 54 is pivotally connected to the operating-lever 55. The lower end of the lever 55 operates within a slot 56, formed in the regulating-valve, while the upper end of the lever thereof is pivotally connected to the bearing 57, secured to the inner face of the main-valve casing 46.

The main-valve casing 46 has suitably connected thereto a tubular extension 58, in which operates the regulating-valve. This extension is provided with the air-passage 59, auxiliary air-passage 60, (see dotted lines,) and a recess in its outer side to receive a hollow screw-threaded plug 61, carrying a coil-spring 62. The extension 58 is further provided with an opening registering with the air-passage 59 and through which operates the fluted spindle 63, connected to one face of the regulating-valve 64. The inner face of the extension 58 at the opening for the spindle 63 forms a valve-seat for the regulating-valve 64. The opposite face of the regulating-valve 64 is formed integral with the valve-stem, consisting of the larger section 65, provided with the slot 56, and the smaller section 66, operating through an opening in the tubular extension 58 into the hollow plug 61 and against the spring 62. The section 66 has a screw 66′ arranged therein for adjusting the stay of the end of the lever within the slot 56. (See dotted lines.) It will be evident that the action of the spring 62 is to keep the regulating-valve 64 normally in engagement with the valve-seat and preventing the admission of air to the passage 59.

67 indicates an inlet-opening for the main-valve casing.

The auxiliary-valve casing 48 consists of a tubular extension of two different diameters and opened at each end of the extension—the smaller end closed by the screw-threaded plug 68 and the larger end by the plug 69. Each of the plugs is provided on its inner face with an inwardly-extending lug 70.

The casing 48 is provided with a partition 71, having the sleeve 72 formed integral with one side thereof and within which is arranged a coiled spring 73. Mounted in the large portion of the casing 48 is a cup-shaped piston 74, the movement of the same in one direction being arrested by the lug 70 of the plug 69.

75 indicates a coil-spring having a portion thereof arranged in the piston 74 and its opposite end surrounding the sleeve 72. The position of the cup-shaped piston 74 can be limited by the plug 69, the spring 75 operating against the piston and retaining the same in its position. Arranged within the smaller portion of the casing 48 is a piston 76, operating against the spring 73.

77 indicates a stem formed integral at one end with the piston 76 and at its opposite end with a head 78, adapted to be engaged by the lug 70 of the plug 68 for limiting the travel of the piston 76.

The partition 71 divides the casing into the chambers 79 and 80. The chamber 79 is provided with the inlet 81, registering with the passage 59, and the inlet air-passage 82, (see dotted lines,) registering with the air-passage 60.

83 indicates an outlet-port for the chamber 79 and opens into the chamber 80, and 84 denotes the outlet for the chamber 80, which is connected to the reducing-valve by means of the pipe 32. (See Fig. 1.)

The exhaust-valve casing consists of the sections 85, 86, and 87, having arranged between the same the diaphragms 88 and 89, which are secured together by means of the bolts 90, and formed between the sections 85 and 86 is an air-chamber 91, divided by the diaphragm 88, and a like chamber 92 is arranged between the sections 86 and 87, divided by the diaphragm 89. The section 86 is provided with an inlet-opening for the chamber 91 and in which operates the spindle 93 of the supply-valve 94, normally held in contact with its seat formed in one face of the section 85 by means of the diaphragm 89 and the coiled spring 95, mounted on the stem 96, formed integral with the spindle 93 at one end and at its opposite end connected to the diaphragm 89 by the clamp 97. The section 87 is provided with an outwardly-extending sleeve 98, closed by means of the plug 99 and forming a chamber 100, within which is mounted the coiled spring 101. Arranged between the chambers 92 and 100 is an opening through which operates a valve-stem 102, having an exhaust-valve 103, connected to the one end extending into the chamber 92 and its opposite end secured to a head 104, adapted to be engaged by the coil-spring 101 in the chamber 100. The exhaust-valve 103 is adapted to be held normally in engagement with the inner face of the section 87 by means of the diaphragm 88. The upper portion of the section 85 and 86 is provided with an air-passage 104′ for establishing communication between the chamber 92 (back of the diaphragm 88) and the interior of the main-valve casing 46. The diaphragm 89 has arranged therein an opening 105, which registers with the passage 104′ to allow an uninterrupted passage of air to the chamber 92. The lower portions of the sections 85, 86, and 87 are each provided with an air-passage 106 in alinement and which registers at one end with the passage 59 and at the opposite end with the inlet air-passage 106′, formed in the section 87 and which opens into the chamber 92 at the front of the diaphragm 88 and is normally closed by the exhaust-valve 103. The section 86 is provided with an air-port 107 for establishing communication between the chamber 91 (at the front of the diaphragm 89) and the passage 106, and the chamber 91 also communicates with the passage 60 by means of the air-passage 108, (see dotted lines,) arranged in the section 85 and which registers at one end with the passage 60.

109 indicates an exhaust-port arranged in the section 87.

109′ denotes an exhaust-port in the casing 48 for the clutch-cylinder 30 and reducing-valve mechanism A.

110 indicates an opening arranged in the auxiliary-valve casing, which is connected by means of the pipe 111 to the brake-valve casing to allow of the discontinuing of the operation of the clutch by the motorman, air being passed from the feed-pipe 110^a to a pipe connection 111^a by means of the cut-off 110^b to the auxiliary-valve casing and into the reducing-valve.

The regulating-valve mechanism is connected to the supply-pipe 112 for the reservoir 113 by means of the union 114, provided with a suitable port registering with the inlet-opening 67 in the main-valve casing of the regulating-valve. The supply-pipe 112 is connected to the compression-cylinders by means of the union 116, connecting the same to the auxiliary supply-pipe 117, connected at each end to one end of each of the compression-cylinders by the connection 117′, provided with a suitable check-valve. (Not shown.)

Secured to one side of the compression-cylinders is the suction-pipe 118, as at 119, and which communicates with an air-inlet passage 120, registering with the air-port 121 in the suction-valve casing 122. The suction-valve casing 122 is secured to the underneath face of each of the compression-cylinders, as at 123, and consists of a suitable casting provided with the vertical port 121, registering with the air-passage 120. The vertical port 121 communicates at its lower end by the passage 122′ with the lower end of the vertical ports 123′, each having arranged at its upper end the suction-valve 124, provided with the fluted spindle or stem 125. The upper end of one of the vertical ports 123′ communicates with the air-passage 126 for the forward end of the cylinder, while the upper of the other vertical port 123′ communicates with the air-passage 127 for the rear end of the cylinder. This permits of the air being supplied alternately to the cylinder on the forward and backward stroke of the piston. The upper ends of the ports 123 123′ communicate by the passages 128 and 128′ with the ports 129 129′, which in turn communicate

by the passages 130 130′ with the ports 131 131′, having the outlet-valves 132 arranged in the upper ends thereof. The ports 131 131′ are connected together by the passage 133, which communicates with 134 (shown in dotted lines) to the connection 117′.

135 indicates the brake-valve casing, within which operates the brake-valve 136. The bottom 137 of the casing 135 is provided with an annular flange 138, to which is secured the branch 139 of the feed-pipe 110ª, which is connected by means of the air-passage 140 to the interior of the casing. The bottom 137 is also provided with a similar flange, (not shown,) to which is connected the supply-pipe 141 for the brake-cylinder 142.

143 indicates an outlet-opening for the air from the casing 135 to the supply-pipe 141.

144 indicates the exhaust-opening for the brake-cylinder 142.

Secured to the outer end of the bottom 137 is a tubular casing 145, provided at one end with the three-way cock 146, having the ports 147 148 registering with the port 149, arranged in the bottom 137, and with the port 150 in the partition 151 of the casing 145. The port 150 communicates with the piston-chamber of the casing 145, within which operates the piston 152, which is held normally against the end of the port 150 by means of the spring 153.

154 indicates an exhaust-port for the casing 145, which communicates with the port 149. (See dotted lines, Fig. 24.) The bottom 137 is also provided with a port 155, which opens into the casing 145 back of the piston 152.

156 indicates an outlet for the casing 145 and which is connected to the sand-operating cylinder 157 at the inlet 158 thereof. Within the cylinder 157 is arranged a piston 159, connected to the piston-rod 160, which extends outwardly through the head of the cylinder and has mounted thereon and abutting against the piston a coil-spring 161. The outer end of the piston-rod is connected to one end of a suitably-supported lever 162, and the opposite end of the lever 162 is connected to the rod 163, carrying a closure-plate 164 for the sand-receptacle 165.

166 indicates the exhaust for the casing 145 and sand-cylinder.

167 indicates the exhaust-recess in the brake-valve for the brake-cylinder, and 168 a like recess for the casing 145 and sand-cylinder.

169 indicates a handle for operating the three-way cock 146, 170 the brake operating-lever, 171 the valve-stem for the brake-valve, 172 a cushioning device for the main brake-valve, and 173 a safety-valve in the air-reservoir.

The operation of my improved brake is as follows: The clutch-pins engaging the gear-wheel mounted on the shaft 9 the same will rotate, operating the yokes and the piston within the compression-chambers. Air is fed thereto through the suction-pipe 118, through the passages 120, ports 121, passages 122′, ports 123′ 123′ past the suction-valves 124 into the passages 126 127 into the cylinder. Upon the air being compressed in the forward end of the cylinder the piston will cause the same to flow back through the passage 126, closing the suction-valve 124 through the passage 128′, port 129′, elevating the valve 132, passages 133 134 into the connections 117′, auxiliary supply-pipe 117, pipe 112 to the reservoir 113. The air from the opposite end of the cylinder will flow back through the air-passage 127, closing the suction-valve 124 through the passage 128, port 129, elevating the valve 132, passages 133 134 into the connection 117′, auxiliary supply-pipe 117, pipe 112 to the reservoir 113. During the passage of the air through the pipe 112 the same will pass through the opening in the union 114 and opening 67 into the main-valve casing 46 of the pressure-regulating mechanism B. When a predetermined pressure has been obtained, the continual operation of the pumps will increase the pressure within the casing 46, causing the operation of the diaphragm 51 and moving the lever 55, removing the valve 64 from its seat, allowing the air to pass to the chamber 91 and operate against the diaphragm 89, moving the valve 94 from its seat and allowing the air to pass into the chamber 91 at the front of the diaphragms, and be discharged therefrom through the opening 108 and 60 into the auxiliary-valve casing 48 and operate the piston 76, permitting the air to pass through the passage 83, outward through the port 84, through the pipe 32, and into the reducing-valve mechanism A. Attention is also called to the fact that when the valve 64 is moved from its seat the air will also pass downwardly in the passage 59 against the head 78 of the piston 76 and assist in the operation thereof. Attention is also called to the fact that the air will always bear against one face of the diaphragm 88 in the chamber 92. When the pressure in the chamber 92 is overcome by the tension of the spring 101, the exhaust-valve 103 is moved from the opening 106 and allows for the exhaust from the auxiliary-valve casing 48 to pass into the chamber 92 and exhausted therefrom through the port 109. The air passing through the port 84 into the reducing-valve mechanism through the pipe 32 into the chamber D will expand the diaphragms, moving the piston-heads 37′, causing thereby the valves 44 to be forced away from their seat, allowing the exhaust of pressure from the compression-cylinders through the discharge-ports and thence through the pipes 33 into the reducing-valve mechanism and then passing into the atmosphere through the ports 39. The air from the chamber D will pass through the pipe 32 into the clutch-operating cylinder 30, operating the piston therein and moving the clutch-arms, causing the same to laterally move the clutch-sleeve and the pins 23 from engage-

ment with the gear-wheel 11, discontinuing the operation of the compression-cylinder. When the pressure back of the piston in the cylinder 30 is reduced, the clutch-sleeve slides upon the shaft 9 and the clutch-pins 23 engage the gear-wheel 11, locking the same to the shaft 9 and causing the operation of the compression-cylinders.

It will be observed that the discontinuing of the operation of the compression-cylinder can be obtained by turning the cut-off 110[b] in the branch from the pipe 139, allowing pressure to pass therefrom into the pipe 111[a], from there into the larger part of the auxiliary-valve casing through the inlet 110, arranged therein, moving the piston 74 and allowing the pressure to pass through the outlet 84 into the reducing-valve mechanism operating the valves therein, and then passing into the cylinder 30, operating the piston therein and causing the removal of the clutch mechanism from its engagement with the gear-wheel 11 and discontinue the operation of the pumps.

The operation of the means for the sand-receptacle is as follows: Pressure passes from the brake-valve casing through the port arranged in the bottom thereof, thence through the ports arranged in the three-way cock in the tubular extension 145, through the passage 150, against the piston 152, forcing the same back in the casing 145, and allowing the pressure to pass through the outlet 156 in the sand-cylinder 157, operating the piston therein, causing the lever 162 to operate and remove the closure-plate from the discharge-opening of the sand-receptacle. The release of the piston 152 is affected by means of turning the cock 146 in an opposite direction, so that the ports therein will register with the passage 150 and exhaust-port 154, the pressure exhausting to the atmosphere through the port 154. The sand-receptacle is also operated by the brake-valve when it opens the port 155 in the bottom of the brake-valve casing and allowing the pressure to pass from the brake-valve casing into the casing 145, thence outward through the port 156, into the sand-cylinder operating the piston in the manner as heretofore referred to. The exhaust from the sand-cylinder and casing 145 is obtained through the medium of the ports 155 and 166, the same being connected to the exhaust-recesses arranged in the brake-valve, as shown. It will be evident that the tension of the spring 101 in the chamber 100 of the exhaust-valve mechanism of the pressure-regulating valve is set at a less tension than the spring 52, arranged in the head of the main-valve casing of the pressure-regulating mechanism, and it will also be observed that pressure will also be normally within the main-valve casing of the pressure-regulating mechanism. This is obtained through the medium of the upper face of the reservoir registering with the union-connecting the same to the pipe 112.

Particular attention is called to the fact that the operation of the sand-cylinder can be obtained by means of the motorman turning the handle 169, or in case of emergency stop of the brake by means of the brake-valve, as heretofore stated, passing the pressure through the ports in the bottom of the brake-valve casing into the casing 145, through which it is passed to the sand-receptacle 157. Attention is also called to the arrangement of the suction-valves and outlet-valves arranged in the suction-valve casing for the alternately supplying of air to both ends of the cylinders and discharging the air to the reservoir through the inlet-port for the air arranged in the cylinders, these inlet-ports being connected to a single outlet-passage. Attention is further called to the fact that pressure operating in the sand-cylinder can be exhausted therefrom without exhausting pressure from the brake-cylinder. This is obtained by moving the brake-valve lever in a vertical position and connecting the ports 155 and 166 by the recess 168, arranged in the lower face of the brake-valve, as heretofore stated, and it will also be observed that when the brake-valve lever is brought to a vertical position for exhausting the pressure from the sand-cylinder pressure will be retained in the brake-cylinder. Attention is also called to the fact that the tension of the diaphragms 51 and 88 can be regulated, respectively, by the plugs 53 and 99.

It is thought the many advantages of my improved construction in air-brakes can be readily understood from the foregoing description, taken in connection with the accompanying drawings, and it will be noted that various changes may be made in the details of construction without departing from the general spirit of my invention.

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

1. In an air-brake, a pair of pumps or compression-cylinders, operating means therefor, a suction-valve mechanism connected to each of the said cylinders and adapted to supply air alternately to each end of said cylinders, a reservoir, connections between said reservoir and said cylinders, a pressure-regulating valve mechanism in communication with said connection, and means connected to said mechanism adapted to pass pressure for discontinuing and continuing the operation of the pumps, substantially as set forth.

2. In an air-brake, a pair of pumps or compression-cylinders, operating means therefor, a reservoir, connections between said reservoir and said cylinders, a pressure-regulating valve mechanism in communication with said connection, a reducing-valve connected to said pressure-regulating valve mechanism, connections between said reducing-valve and said cylinders for exhausting the pressure therefrom when pressure is passed from the regulating to the reducing valve mechanism,

and means connected to said reducing-valve for discontinuing and continuing the operation of the operating means for the pumps or compression-cylinders, substantially as set forth.

3. In an air-pump, a pair of pumps or compression-cylinders, operating means therefor, a reservoir, connection between said reservoir and said cylinders, a pressure-regulating valve mechanism in communication with said connection, a reducing-valve connected to said pressure-regulating valve mechanism, connections between said releasing-valve and said cylinders for exhausting the pressure therefrom when pressure is passed from the regulating to the reducing valve mechanism, a clutch-operating cylinder connected to said reducing-valve, and means connected to said clutch-operating cylinder for discontinuing and continuing the operation of the operating means for said pumps, substantially as set forth.

4. In an air-brake, a reducing-valve consisting of a pair of sections having a sleeve arranged between the same, a diaphragm arranged between each of the said sections and the said sleeve and forming thereby an air-chamber provided with a suitable inlet and outlet, a piston-head operating against the inner face of each of the said diaphragms, a tubular extension formed integral with the outer face of each of the said sections, a valve operating therein, connections between said valve and said piston-head, a spring arranged in each of the said sections and adapted to engage said valve, a connection between said extension and one of the air-pumps or compression-cylinders, and each of said sections provided with an exhaust for the said pumps or compression-cylinders, substantially as set forth.

5. In an air-brake, a pressure-regulating valve mechanism consisting of a main-valve casing having a valve suitably arranged and operating therein, an exhaust-valve casing in communication with said main-valve casing and having an exhaust-valve suitably arranged and operating therein, and further provided with a supply-valve connected thereto and operating in the said main-valve casing, in communication with said main and exhaust valve casings and an auxiliary-valve casing having a piston arranged therein and adapted when operated to pass pressure therefrom, substantially as described.

6. In an air-brake, a pressure-regulating valve mechanism consisting of a main-valve casing having a valve arranged therein and connected to a diaphragm, an exhaust-valve casing having an exhaust-valve operating therein and connected to a diaphragm, a supply-valve arranged in said exhaust-valve casing operated by a diaphragm and operating in the main-valve casing, an auxiliary-valve casing having a spring-actuated piston suitably arranged and operating therein, said exhaust-valve casing provided with an air port or passage for passing pressure from said main-valve casing thereto, substantially as set forth.

7. In an air-brake, a pressure-regulating valve mechanism consisting of a main-valve casing having a valve suitably arranged and operating therein, an exhaust-valve casing having an exhaust-valve suitably arranged and operating therein and a supply-valve connected thereto and operating in the main-valve casing, an auxiliary-valve casing provided with a spring-actuated piston, said main-valve casing provided with a series of ports or passages to permit of the passage of pressure to said auxiliary and exhaust valve casing when said valve in the main-valve casing is operated causing thereby the operation of said exhaust and supply valves and said spring-actuated piston, substantially as set forth.

8. In an air-brake, a pressure-regulating valve mechanism consisting of a main-valve casing having a valve suitably arranged and operating therein, an exhaust-valve casing having an exhaust-valve suitably arranged and operating therein and a supply-valve connected thereto and operating in the main-valve casing, said main-valve casing provided with air ports or passages for passing pressure to said auxiliary and exhaust valve casings, and said auxiliary-valve casing provided with air ports or passages registering with the said ports or passages of the main-valve casing for passing pressure thereto, substantially as set forth.

9. In an air-brake, a pressure-regulating valve mechanism consisting of a main-valve casing having a valve suitably arranged and operating therein, an exhaust-valve casing having an exhaust-valve suitably arranged and operating therein and a supply-valve connected thereto and operating in the main-valve casing, said main-valve casing provided with air ports or passages for passing pressure to said auxiliary and exhaust valve casings, said auxiliary-valve casing provided with air ports or passages registering with said ports or passages in the main-valve casing, and said exhaust-valve casing provided with ports or passages adapted to communicate with the ports or passages of the main-valve casing, substantially as set forth.

10. In an air-brake, a pressure-regulating valve mechanism consisting of a main-valve casing, an exhaust-valve casing and an auxiliary-valve casing, said main-valve casing having a diaphragm suitably arranged therein, a tension-spring operating against the inner face thereof, a link connected to said diaphragm, an operating-lever pivotally connected to said lever and having its upper end pivotally connected to a suitable bearing, a spring-actuated pressure-valve arranged in said casing and provided with an opening in which operates the other end of the said le-

ver, and a series of ports or passages arranged in said main-valve casing, substantially as set forth.

11. In an air-brake, a pressure-regulating valve mechanism consisting of a main-valve casing provided with a series of air ports or passages and suitable valve mechanism, an auxiliary-valve casing, and an exhaust-valve casing consisting of a series of sections suitably connected together and forming air-chambers 91, 92, a diaphragm secured to each of the said sections and extending through each of the said air-chambers, a supply-valve connected to the diaphragm of the chamber 91, an exhaust-valve engaged by the diaphragm in the chamber 92, said sections further provided with air-passages communicating with main-valve casing and the chamber 92, said sections also provided with air-passages communicating with the air-passages of the main-valve casing, and further provided with a suitable exhaust-port, substantially as set forth.

12. In an air-brake, a pressure-regulating valve mechanism consisting of a main-valve casing provided with a series of ports or passages and a suitable valve mechanism, an exhaust-valve casing provided with suitable valve mechanism and with ports or passages for establishing communication between the same and said main-valve casing, an auxiliary-valve casing consisting of a tubular casing of two different diameters, and divided by a partition into two chambers closed at the outer end by a cap, a spring-actuated piston arranged in the smaller of the said chambers, a spring-actuated piston arranged in the larger of said chambers, said tubular casing provided with a series of ports or air-passages registering with the ports of the main-valve casing for passing pressure to the smaller of said chambers, means for establishing communication between the two chambers, and said larger chamber provided with a suitable inlet 110 and outlet 84, substantially as set forth.

13. In an air-brake, a pressure-regulating mechanism consisting of a main-valve casing provided with a series of air-ports and a suitable valve mechanism, an exhaust-valve casing provided with suitable valve mechanism, and with ports or air-passages for establishing communication between the same and the main-valve casing, an auxiliary-valve casing provided with suitable piston and valve mechanism and with ports or air-passages for establishing communication between the main and exhaust valve casings and further provided with inlet 110 and outlet 84, substantially as set forth.

14. In an air-brake, a pair of pumps or compression-cylinders, operating means therefor, a suction-pipe connected to each of the said cylinders, a suction-valve mechanism connected to the bottom of each of the said pumps or cylinders and in communication with each end thereof and with the said suction-pipe, a reservoir, connections between said reservoir and said cylinders, a pressure-regulating valve mechanism in communication with said connection, a brake-valve casing, connections between said casing and said reservoir, connections between said brake-valve-casing connections and said pressure-regulating mechanism for passing pressure thereto, and means connected to said pressure-regulating mechanism adapted to pass pressure for discontinuing and continuing the operation of the operating means for said cylinders, substantially as set forth.

15. In an air-brake, a pair of pumps or compression-cylinders, operating means therefor, a suction-valve mechanism in communication with each end of said pumps or cylinders, a reservoir, connections between said reservoir and said cylinders, a pressure-regulating valve mechanism in communication with said connection, a brake-valve casing, connections between said casing and said reservoir, connections between said brake-valve-casing connections and said pressure-regulating mechanism for passing pressure thereto, a reducing-valve mechanism connected to said pressure-regulating mechanism, and means connected to said reducing-valve for discontinuing and continuing the operation of the operating means for the said cylinder, substantially as set forth.

16. In an air-brake, a pair of pumps or compression-cylinders, operating means therefor, a reservoir, connections between said reservoir and said cylinders, a pressure-regulating valve mechanism in communication with the said connection, a brake-valve casing, connections between said casing and said reservoir, connections between said brake-valve casing connections and said pressure-regulating mechanism for passing pressure thereto, a reducing-valve mechanism connected to said pressure-regulating valve mechanism, connections between said reducing-valve mechanism and said cylinders, means connected to said reducing-valve mechanism for discontinuing the compression of air by said cylinders, and means arranged in said reducing-valve for exhausting the air from the said cylinders, substantially as set forth.

17. In an air-brake, a pair of pumps or compression-cylinders, operating means therefor, a suction-pipe connected to each end of one of said cylinders, a suction-valve casing in communication with said suction-pipe and provided with a port 121, passages 122 122′, ports 123′ 123′, valves 124, passages 128 128′, ports 129, 129′, passages 130 130′, ports 131 131′, valves 132, and passage 133, said cylinders provided with ports 126 127 communicating with ports 123′ 123′ when the valves 124 are opened, and with passages 128 128′ when the valves 124 are closed, said cylinder further provided with a passage 134 communicating with passage 133, a reservoir, and means for connecting said reservoir and passage 134, substantially as set forth.

18. In an air-brake, a pair of pumps or compression-cylinders, operating means therefor, a suction-pipe connected to said cylinders, a suction-valve casing in communication with said suction-pipe, said casing provided with inlet and outlet ports in communication with the interior of the said cylinder, a suction-valve arranged in said casing, an outlet-valve arranged to said casing, a reservoir, connections between said reservoir and said casing, a reducing-valve mechanism in communication with said connection, a brake-valve casing, connection between said reservoir or said brake-valve casing, connections between said connections and pressure-regulating mechanism for passing pressure thereto, means connected to said regulating mechanism for discontinuing the operation of the operating means for the cylinders, a brake-cylinder connected to said brake-valve casing, and means connected to said casing adapted to pass pressure for operating a sand-receptacle, substantially as set forth.

19. In an air-brake, a reservoir, a brake-valve casing having a brake-valve suitably operating therein, connection between said reservoir and brake-valve, a brake-cylinder, connections between said cylinder and said brake-valve casing, a tubular casing connected to said brake-valve casing, a two-way cock arranged in said tubular casing, said brake-valve casing provided with a port for establishing communication between the same and the tubular casing through the medium of the said cock, a piston arranged in said tubular casing, a sand-cylinder communicating with said tubular casing, and means in the said cylinder adapted to be operated by pressure passed through said brake-valve casing from said tubular casing for operating the sand-receptacle, substantially as set forth.

20. In an air-brake, a pair of pumps or compression-cylinders provided with suitable operating means, a suction-valve mechanism suitably connected to each of the said cylinders, a reservoir, connections between said reservoir and said cylinders, a pressure-regulating mechanism, a branch connecting said regulating mechanism to said connection between said reservoir and brake-valve casing, and means arranged in said branch adapted when operated to pass pressure through said regulating-cylinder for discontinuing the operation of the operating means for the compression-cylinders, substantially as set forth.

21. In an air-brake, a pair of pumps or compression-cylinders, operating means therefor, a suction-valve mechanism connected to each of the said pumps or compression-cylinders, a reservoir, a pressure-regulating valve mechanism provided with a main valve, an exhaust-valve, a supply-valve, and a spring-actuated piston, a connection between said pumps, reservoir and pressure-regulating valve mechanism, a reducing-valve mechanism, connection between said reducing and regulating valve mechanism, connections between said pumps and said reducing-valve mechanism, and means connected to said reducing-valve mechanism for discontinuing the operation of said pumps when pressure is passed from the regulating-valve to the reducing-valve mechanism, substantially as described.

22. In an air-brake, a pair of pumps or compression-cylinders, operating means therefor, a suction-valve mechanism connected to each of the said pumps or compression-cylinders, a reservoir, a pressure-regulating valve mechanism provided with a main valve, an exhaust-valve, a supply-valve, and a spring-actuated piston, a connection between said pumps, reservoir and pressure-regulating valve mechanism, a reducing-valve mechanism, connections between said reducing and regulating valve mechanism, connections between said pumps and said reducing-valve mechanism, a brake-cylinder, connections between said cylinder and said reservoir, connections between said connections and said pressure-regulating valve mechanism, a cut-off arranged in said last-named connections, and means connected to said reducing-valve mechanism for discontinuing the operation of said pumps when pressure is passed by opening said cut-off through said pressure-regulating valve mechanism to the reducing-valve mechanism, substantially as described.

23. In an air-brake, a pair of pumps or compression-cylinders, operating means therefor, a suction-valve mechanism connected to each of the said pumps or compression-cylinders, a reservoir, a pressure-regulating valve mechanism provided with a main, exhaust and supply valves and spring-actuated piston, a connection between said pumps, reservoir and pressure-regulating valve mechanism, a reducing-valve mechanism, connections between said reducing and regulating valve mechanism, connections between said pumps and said reducing-valve mechanism, a brake-cylinder, connections between said cylinder and said reservoir, connections between said connections and said pressure-regulating valve mechanism, a cut-off arranged in said last-named connections, a cylinder 30 connected to said reducing-valve mechanism, a clutch mechanism connected to said cylinder and adapted when pressure is passed to the reducing-valve mechanism to discontinue the operation of said pump.

24. In an air-brake, a reservoir, means for supplying pressure thereto, a brake-valve casing, connections between said reservoir and brake-valve casing, a brake-cylinder, connections between said casing and said cylinder, a brake-valve arranged in said casing and adapted to pass to and exhaust pressure from said cylinder, a sand-receptacle, connections between said receptacle and brake-valve casing adapted when operated by a passage of pressure to operate said sand-receptacle, and said brake-valve further provided with means for exhausting said pressure from the

sand-receptacle connections without exhausting pressure from the brake-valve casing or brake-cylinder.

25. In an air-brake, a pair of pumps or compression-cylinders, operating means therefor, a suction-valve mechanism connected to each of said pumps or cylinders, a reservoir connected to the said cylinders, a brake-valve casing suitably connected to said reservoir, a brake-cylinder suitably connected to said brake-valve casing, a brake-valve operating in the said casing and adapted to pass and exhaust pressure from said brake-cylinder, a sand-receptacle, a tubular casing secured to said valve-casing and provided with means operated by a passage of pressure for operating said sand-receptacle, and said brake-valve further provided with means for exhausting said passage of pressure without exhausting pressure from the brake-valve casing and cylinder, substantially as described.

26. In an air-brake, a pair of pumps or compression-cylinders, operating means therefor, a suction-valve mechanism connected to each of said pumps or cylinders, a reservoir connected to the said cylinders, a brake-valve casing suitably connected to said reservoir, a brake-cylinder suitably connected to said brake-valve casing, a brake-valve operating in the said casing and adapted to pass and exhaust pressure from said brake-cylinder, a sand-receptacle, a tubular casing secured to said brake-valve casing, a sand-cylinder connected to said sand-receptacle and said tubular casing, means arranged in said tubular casing operated by a passage of pressure for passing pressure to operate said sand-cylinder causing the operation of said sand-receptacle, means arranged in said tubular casing for passing pressure thereto from the brake-valve casing, and means for exhausting the said passage of pressure from the brake-valve casing and brake-cylinder, substantially as described.

27. In an air-brake, a brake-valve casing connected to a suitable source of pressure-supply, a sand-receptacle connected to said casing, means for passing pressure to operate said receptacle, and a brake-valve operating in said casing and so arranged when operated as to exhaust the pressure passed to operate the sand-receptacle without exhausting pressure from the brake-valve casing, substantially as described.

28. In an air-brake, a brake-valve casing connected to a suitable source of pressure-supply and to the brake-cylinder, a sand-receptacle, operating means therefor connected to said casing and adapted to be operated by a passage of pressure, means for passing pressure to operate said operating means, and a brake-valve operating in said casing and so arranged when operated as to exhaust the pressure passed to operate the sand-receptacle without exhausting the pressure from the brake-valve casing, substantially as described.

29. In an air-brake, a brake-valve casing connected to a suitable source of pressure-supply and to the brake-cylinder, a sand-receptacle, a sand-cylinder connected thereto, a tubular casing connected to said cylinder and said valve-casing, means arranged in said tubular casing when operated adapted to pass pressure to operate said cylinder causing the operation of the sand-receptacle, means for passing pressure for operating said operating means in said tubular casing, and a brake-valve operating in said casing for passing pressure to the brake-cylinder and so arranged as to exhaust the pressure passed for operating the sand-receptacle without exhausting the pressure from the brake-cylinder and valve-casing.

30. In an air-brake, a pair of pumps or compression-cylinders, operating means therefor, a suction-valve mechanism connected to each of the said pumps or cylinders, a reservoir, connections between said reservoir and said cylinders, a pressure-regulating-valve mechanism in communication with said connections, a brake-valve casing, connections between said casing and said reservoir, connections between said brake-valve-casing connections and said pressure-regulating mechanism for passing pressure thereto, a reducing-valve mechanism connected to said pressure-regulating-valve mechanism, connections between said reducing-valve mechanism and said cylinders, means connected to said reducing-valve mechanism for discontinuing the compression of air by the said cylinders, and means arranged in said reducing-valve mechanism for exhausting the air from the said cylinders, substantially as described.

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

JOHN SHOUREK.

Witnesses:

JOHN NOLAND,

WILLIAM E. MINOR.