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E. G. SHORTT & J. E. NORMAND.

MECHANISM FOR OPERATING AIR BRAKES.

No. 538,546. Patented Apr. 30, 1895.

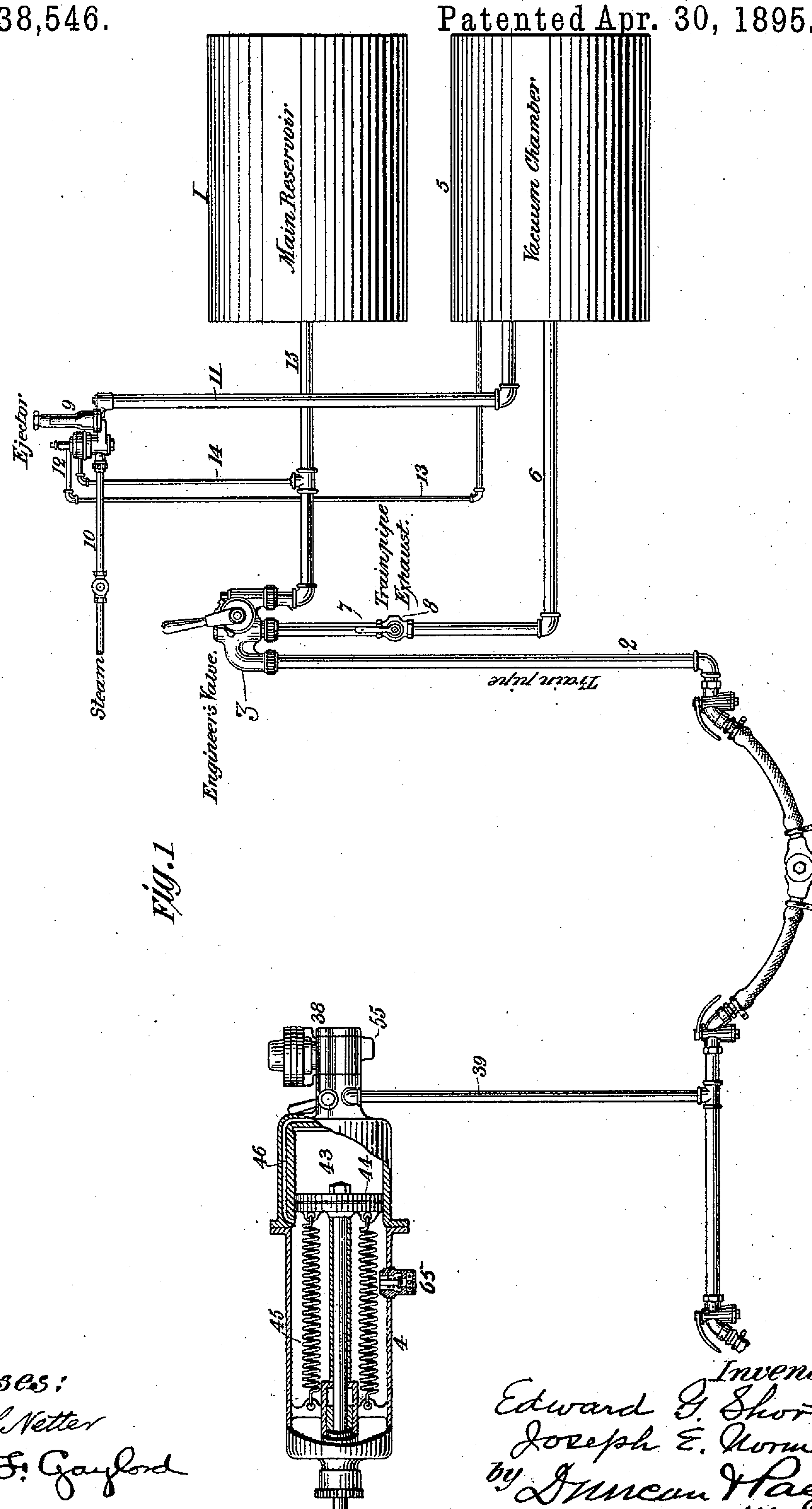

Fig. 1

Witnesses:
Raphael Netter
Robt. F. Gaylord

Inventors.
Edward G. Shortt,
Joseph E. Normand,
by Duncan & Page
Attorneys

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Fig. 2

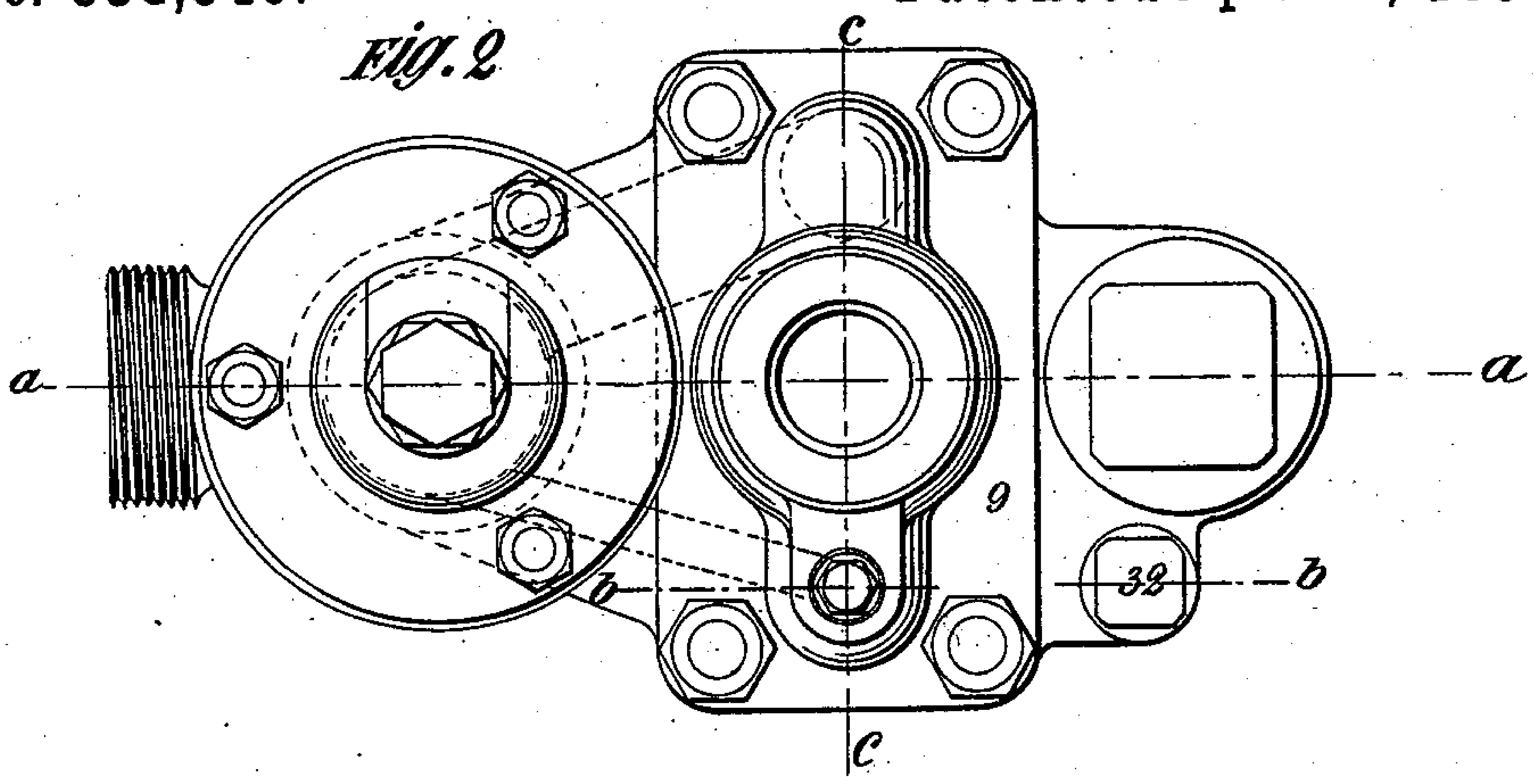
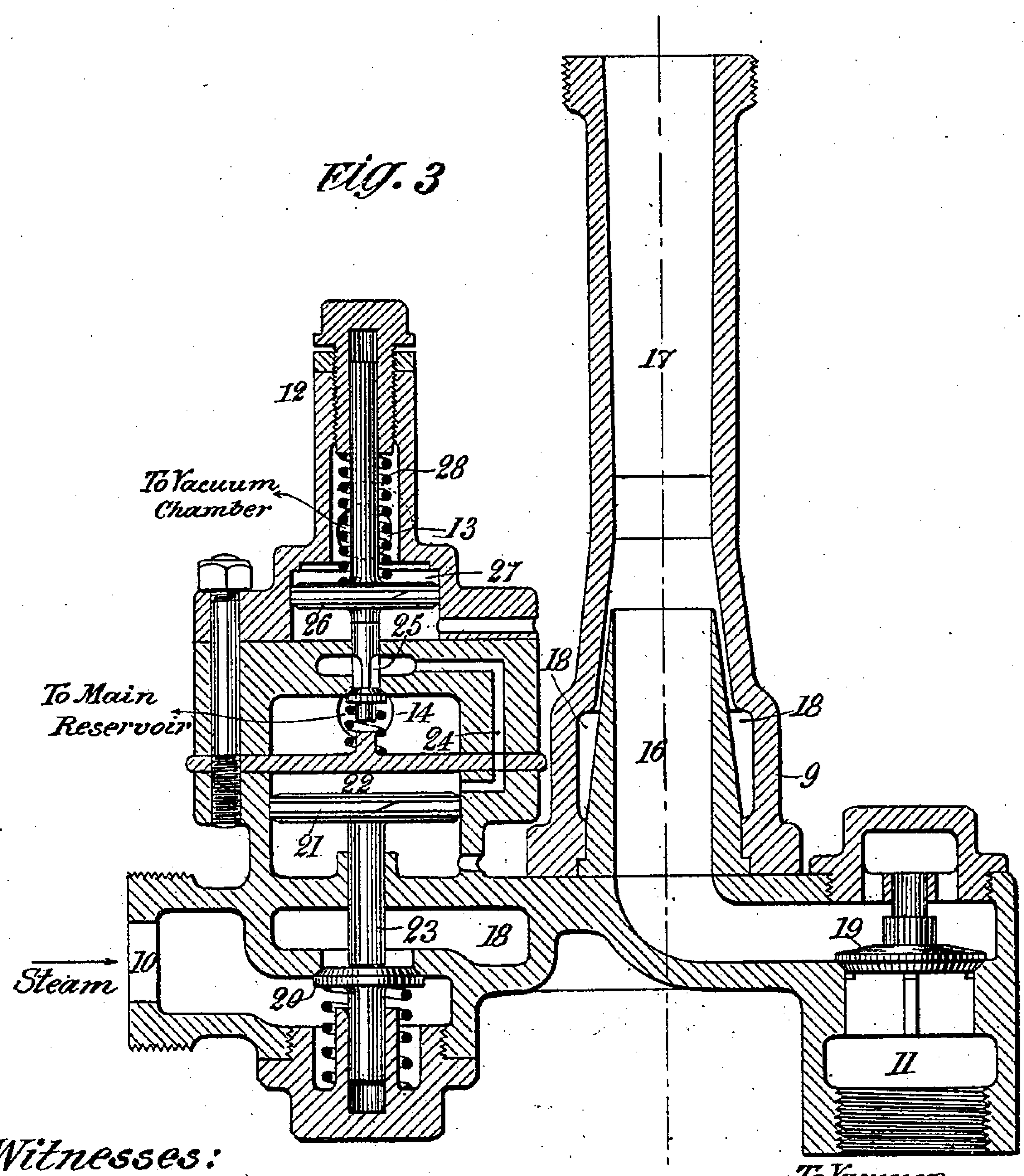


Fig. 3



Witnesses:
Raphaël Netter
Robt. F. Gaylord.

Inventors:
Edward G. Shortt,
Joseph E. Normand,
by Duncan & Page,
Attorneys.

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Fig. 4

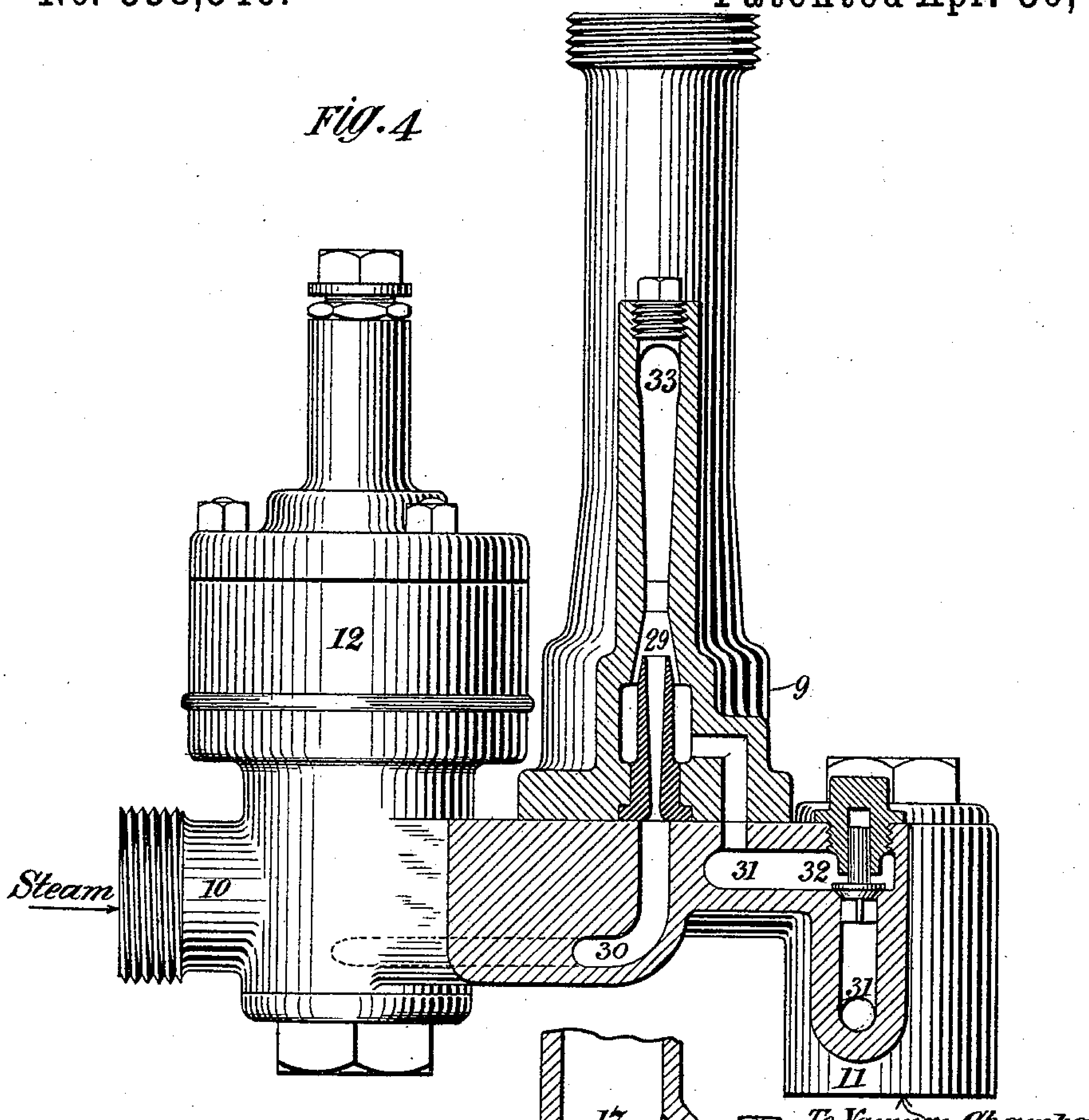
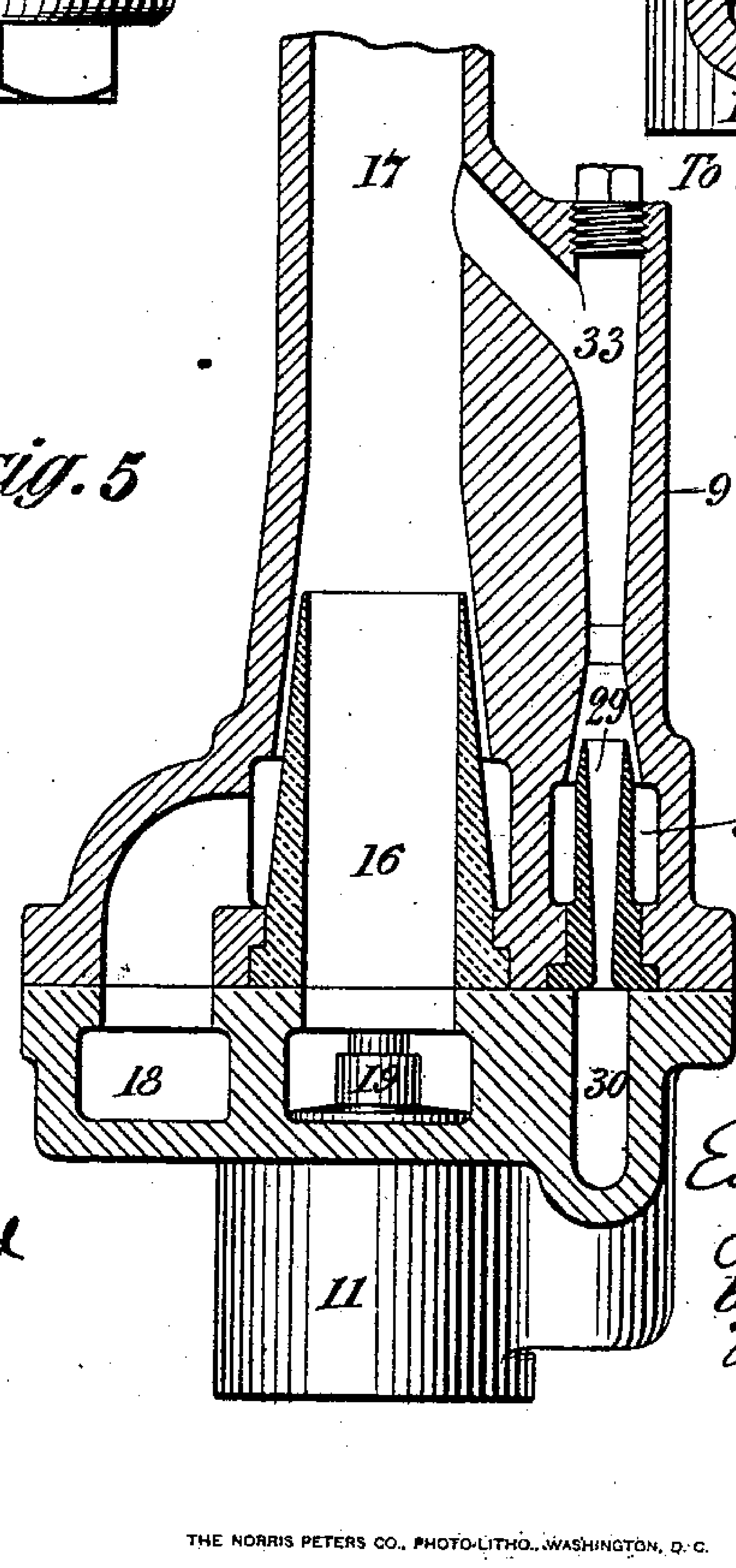


Fig. 5



Witnesses:
Raphaël Netter
Robt. F. Gaylord

Inventors:
Edward G. Shortt,
Joseph E. Normand,
by Duncan & Page,
Attorneys.

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E. G. SHORTT & J. E. NORMAND.

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Fig. 7

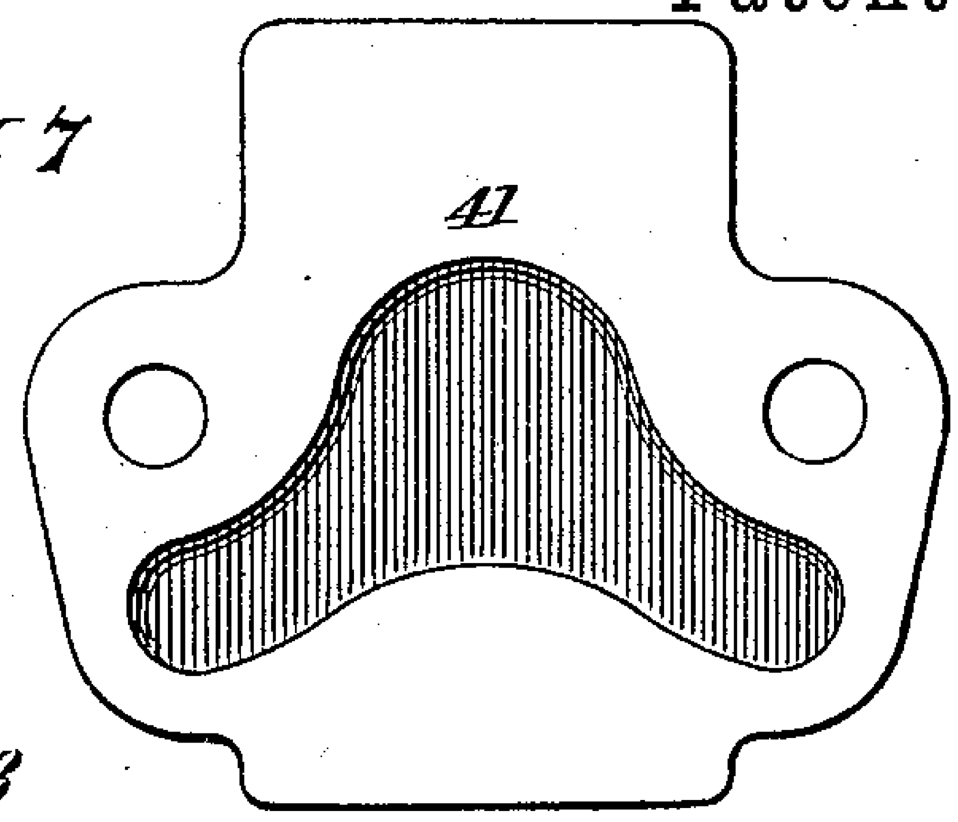


Fig. 8

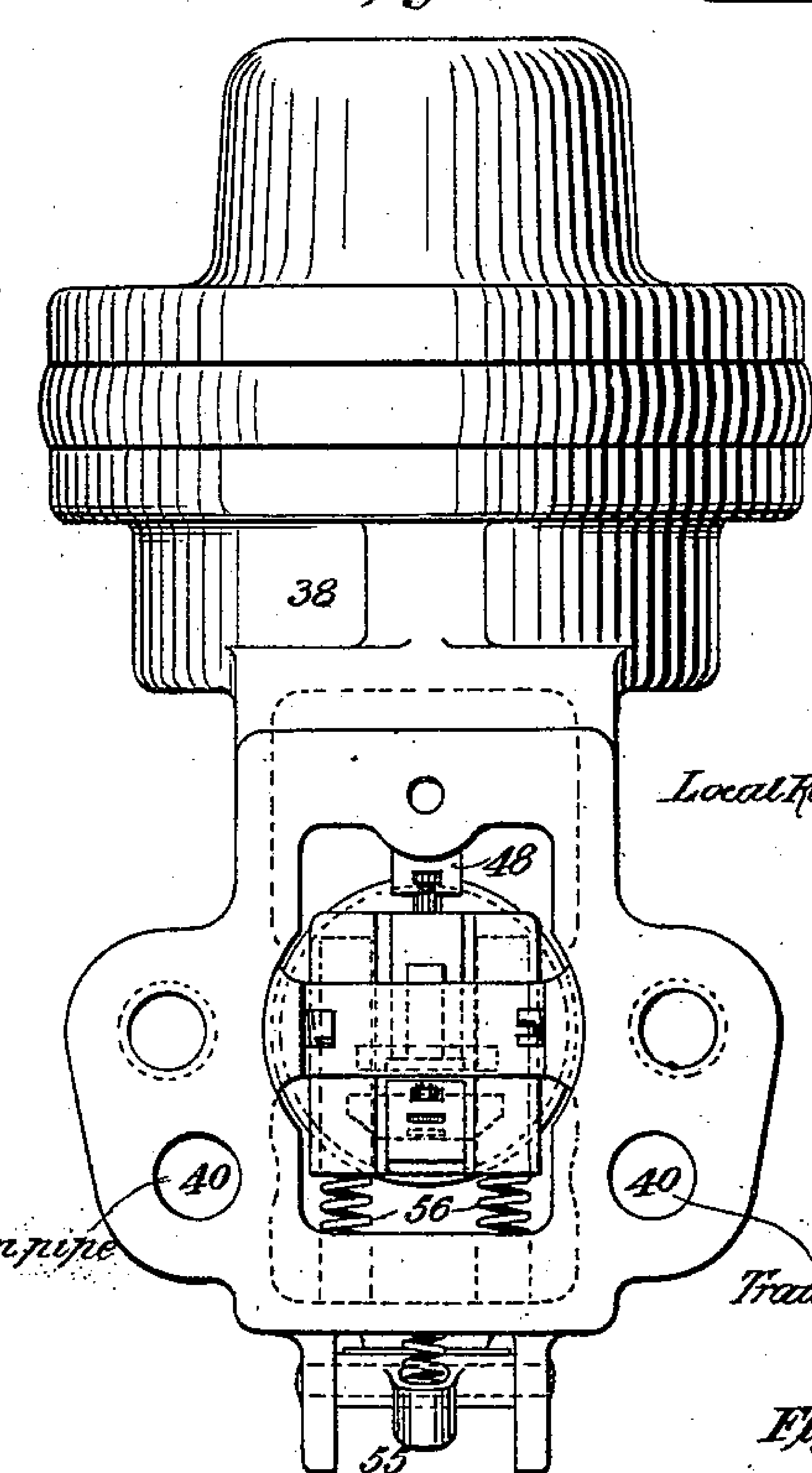


Fig. 6

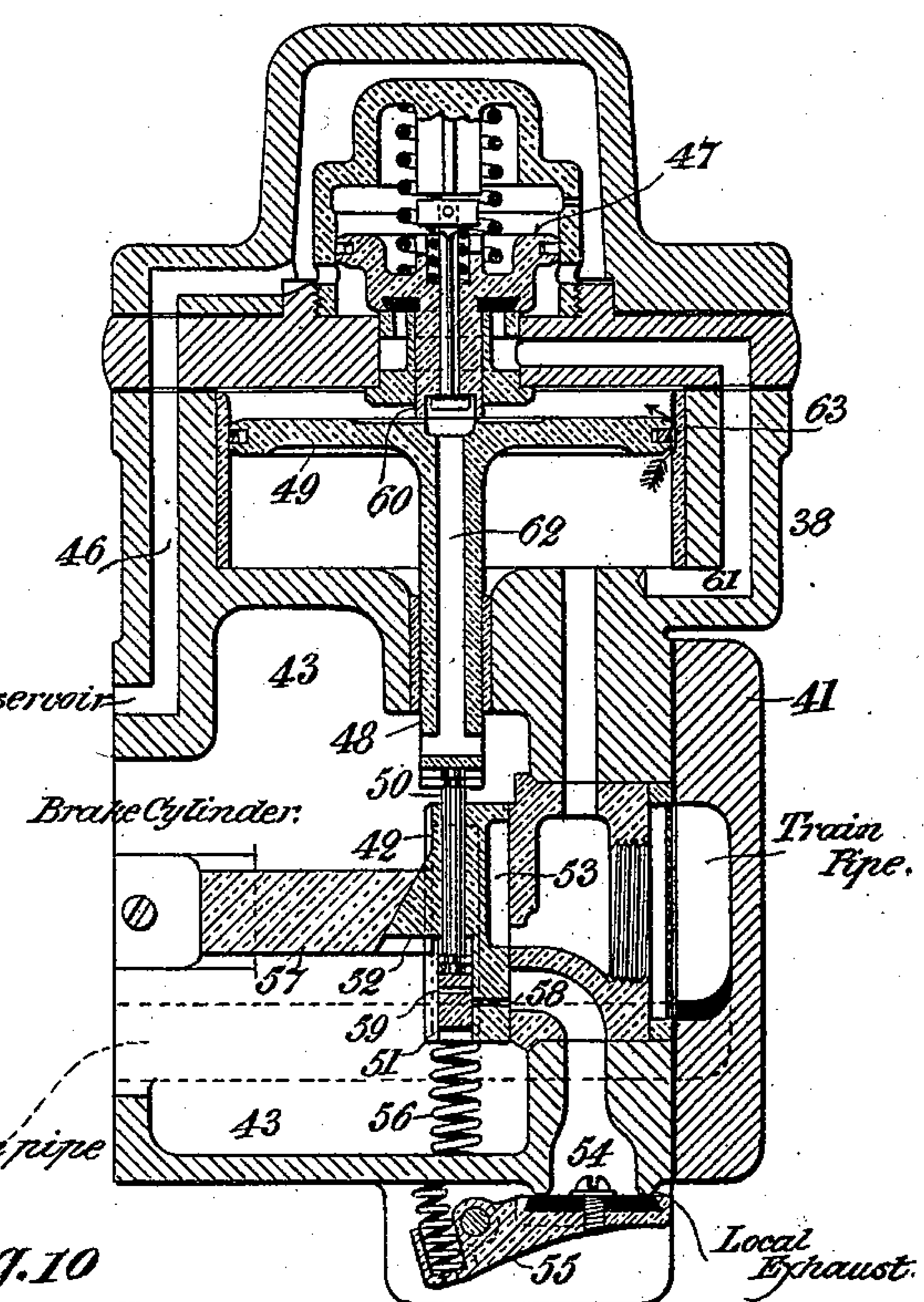


Fig. 9

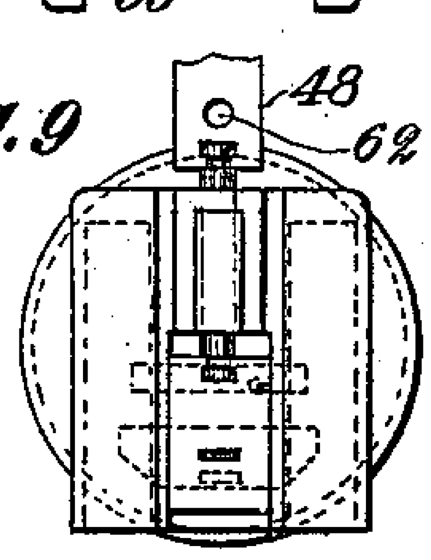


Fig. 10

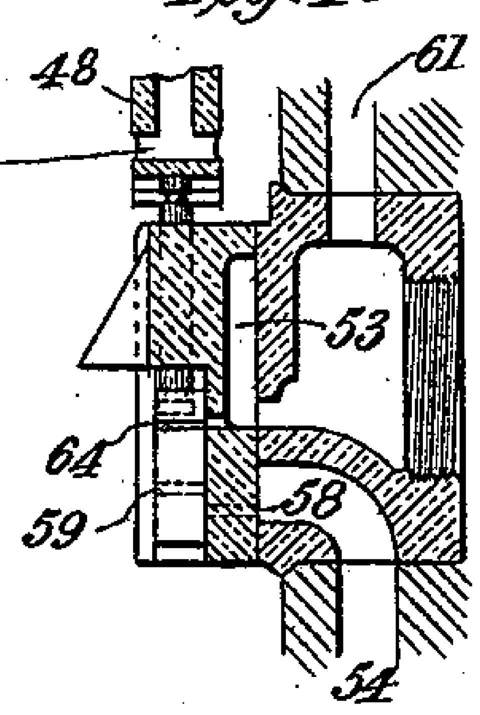
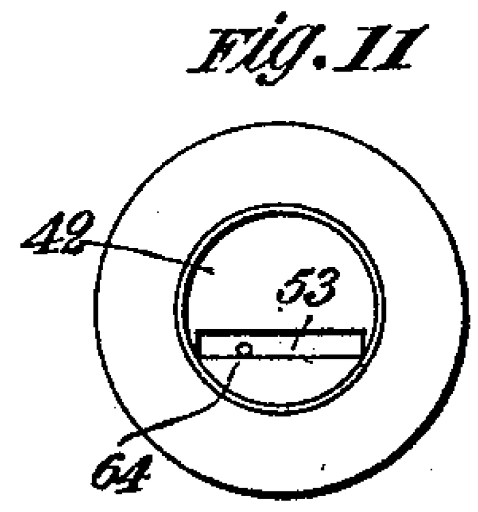


Fig. 11



WITNESSES:

Raphaël Netter
Robt. F. Gaylord

INVENTORS:
Edward G. Shortt,
Joseph E. Normand,
BY
Duncan & Page,
ATTORNEYS

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E. G. SHORTT & J. E. NORMAND.

MECHANISM FOR OPERATING AIR BRAKES.

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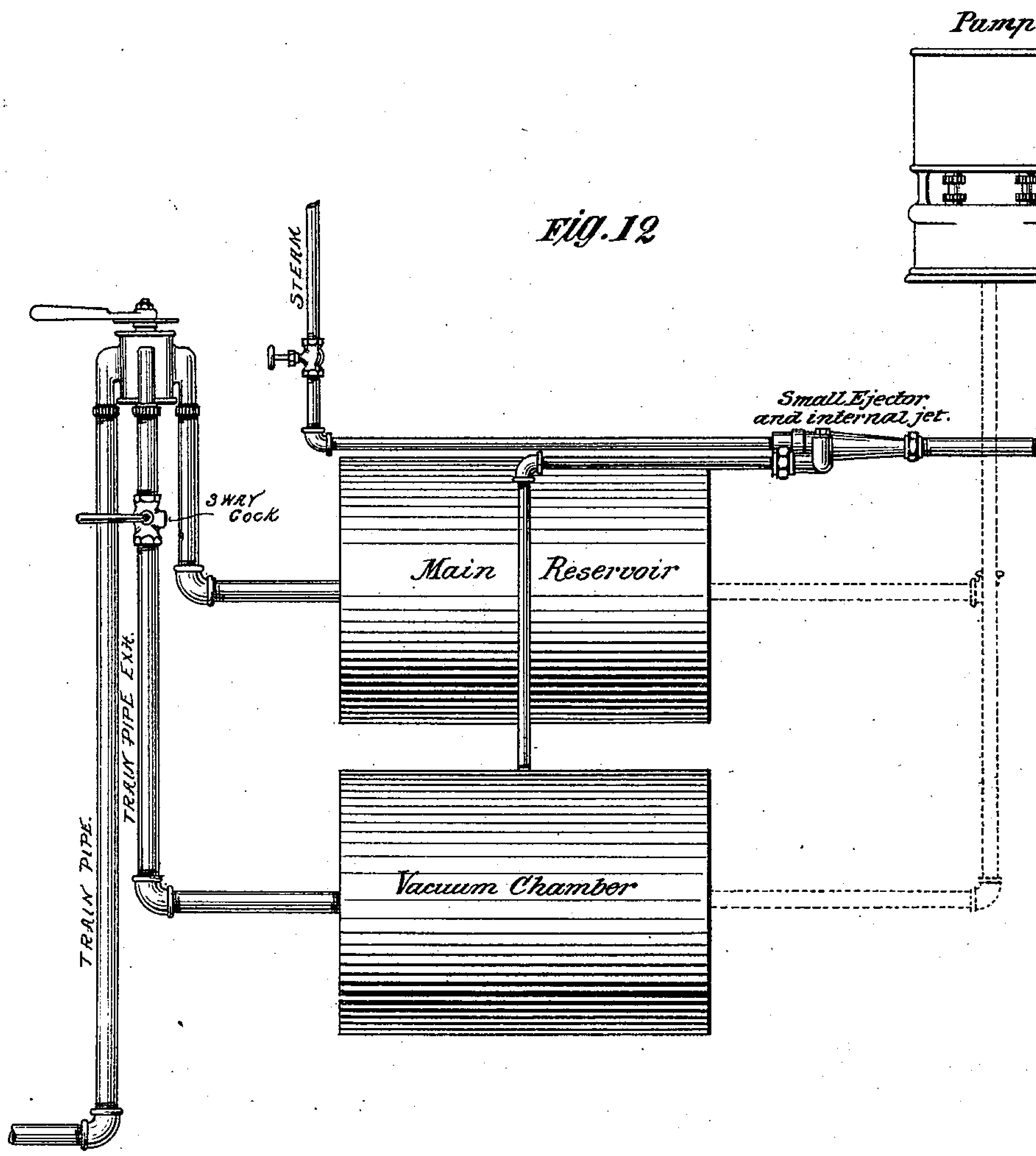
Fig. 12



WITNESSES:
Raphaël Netter
Robt. F. Gaylord

INVENTORS,
Edward G. Shortt,
Joseph E. Normand,
BY
Duncan & Page,
ATTORNEYS

UNITED STATES PATENT OFFICE.

EDWARD G. SHORTT, OF CARTHAGE, AND JOSEPH ELIE NORMAND, OF WATERTOWN, ASSIGNORS TO CHARLES GOODWIN EMERY, OF NEW YORK, N. Y.

MECHANISM FOR OPERATING AIR-BRAKES.

SPECIFICATION forming part of Letters Patent No. 538,546, dated April 30, 1895.

Application filed September 17, 1894. Serial No. 523,234. (No model.)

To all whom it may concern:

Be it known that we, EDWARD G. SHORTT, of Carthage, and JOSEPH ELIE NORMAND, of Watertown, in the county of Jefferson, State of New York, have invented certain new and useful Improvements in Mechanism for Operating Air-Brakes, of which the following is a description, reference being had to the accompanying drawings.

The invention relates generally to fluid brake mechanism, and particularly to automatic fluid-brake mechanism.

The object of the invention is to provide means for increasing the efficiency of fluid-brake mechanism.

More particularly, it is the object of the invention to so construct and work a fluid brake mechanism that the brake shoes will be operated by the force of a stored fluid at greater than atmospheric pressure, and by the force of vacuum or atmospheric pressure applied with the same comparative rapidity as the stored pressure.

The invention consists in operating the brake shoe mechanism by applying thereto a stored fluid under greater than atmospheric pressure, and by also removing atmospheric resistance therefrom to increase the effective pressure of the stored fluid (or by adding atmospheric pressure thereto to augment the stored pressure) by the action of a previously formed or maintained vacuum.

The invention also consists of a brake-shoe actuating mechanism, a reservoir normally stored with a fluid under greater than atmospheric pressure, a vacuum chamber normally exhausted to below atmospheric pressure, and means for connecting said mechanism with said reservoir and chamber so that the mechanism will be operated upon by the stored and by atmospheric pressure.

The invention consists of further and other mechanism the novel features of which will be particularly pointed out in the claims to follow the description thereof.

The preferable form of mechanism embodying our invention consists of a brake-shoe actuating piston, (partition or diaphragm) and cylinder, a reservoir for containing the motive fluid under pressure and connected to the cylinder at one side of said piston, and a vacuum chamber adapted to be connected to said cylinder at the other side of said piston, whereby the force of the stored fluid upon the piston is augmented by the removal of the atmospheric pressure thereon.

We are aware that it has been variously proposed to avail of atmospheric pressure or the absence thereof in conjunction with a stored pressure, for applying the brake shoes in a fluid brake system, but in all such cases known to us, the atmospheric pressure was, when needed, effected mechanically, as by starting up a pump or ejector. A vacuum thus formed will at best produce only a slow and gradual atmospheric braking effect, as is evidenced by the well known slow action of vacuum brakes—which also are limited to trains of a few cars, and in no case has braking power so produced been effected rapidly enough to be of any essential avail for augmenting or adding to the braking force of a storage pressure, and especially in emergency cases.

By our method, a vacuum is maintained, and the parts to be acted upon by atmospheric pressure are connected with the vacuum when its action is required, and thus the atmopheric or vacuum braking action is as quickly realized, the different pressures being considered, as is the braking action of the stored fluid.

Referring to the drawings accompanying this description, Figure 1 is a general diagrammatic view of one form of air-brake mechanism adapted to carry out and embody the herein-described improvements. Fig. 2 is a plan view of the ejector or vacuum-creating mechanism. Fig. 3 is an elevation view of the same, in central vertical section, on the plane *a a* of Fig. 2. Fig. 4 is a vertical section of the same on plane *b b*. Fig. 5 is a vertical section on plane *c c*. Fig. 6 is a central vertical section through the valve mechanism of the brake-cylinder and local reservoir. Fig. 7 shows the inside face of a cap-plate of the casing of this valve mechanism. Fig. 8 is an elevation view of the casing of this mechanism as the same is viewed from the left of Fig. 6. Figs. 9, 10, and 11 are respectively rear, cross-section, and front views of the local exhaust-valve and valve-seat. Fig. 12 is a modification of the arrangement of the parts on the locomotive, which figure will be more particularly explained in the following description.

Referring to the views in detail, and first to Figs. 1 and 2, 1 represents the main reservoir; 2, the train pipe; 3, the engineer's valve, and 4 one of the brake cylinders of an equilibrio brake piston system. These parts are connected up in the usual manner, and may be of various constructions, and we do not therefore limit ourselves to any particular form thereof.

5 represents the vacuum chamber, which is of any suitable air-tight construction, and is to be located in any proper position, preferably on or near the locomotive.

6 is a pipe that connects the vacuum chamber with the train pipe exhaust port of the engineer's valve, a three-way cock 7 being provided whereby the exhaust can be directed to the atmosphere through the external exhaust port 8, the pipe 6 being at the same time closed, or such external port can be closed by the cock and the pipe 6 opened as between the engineer's valve and the vacuum chamber.

9 is an ejector mechanism, connected to a source of steam by pipe 10, the vacuum tank by exhaust pipe 11, while the ejector controlling mechanism 12 is connected by pipe 13 with the vacuum chamber, and by pipe 14 with the main reservoir through pipe 15 between the main reservoir and the engineer's valve.

Figs. 2 to 5 illustrate in detail the ejector, where 16 is the air exhaust nozzle directly connected to the vacuum chamber by pipe 11, and 17 is the steam nozzle connected to steam pipe 10 by the passage 18, check valve 19 being provided to prevent the entrance of external air to the vacuum chamber, and 20 is a spring seated valve acting to control the flow of steam to the ejector. The piston 21 moves operatively air tight in chamber 22, its under face being acted on by external air, its stem 23 resting upon or being otherwise operatively attached to steam valve 20, and the chamber 22 having communication through passage 24 and the pipe 14 with the main reservoir, a spring seated valve 25 being provided which normally holds such passage closed under reservoir pressure. Piston 26 rests upon valve 25, the chamber 27 in which it moves being in communication through pipe 13 with the vacuum chamber, and a spring 28 is employed to counteract or very nearly so the atmospheric pressure acting on the under face of the piston. Assuming now that the pressure in vacuum chamber be suddenly increased, as by exhausting the train pipe thereto, such increase of pressure will be immediately felt above piston 26 and with the pressure of spring 28 will force down this piston, push valve 25 from its seat, and thereby establish reservoir pressure on the piston 21 to push the steam valve 20 into open position, which results in steam issuing from the steam nozzle and acting to exhaust the vacuum chamber. As the pressure in vacuum chamber becomes lowered, atmospheric pressure will finally raise piston 26 and permit valve 25 to close, the air in chamber 22 leaking by piston 21 and allowing the steam valve to close.

To compensate for leaks, and to insure the maintenance of a vacuum, or a pressure less than atmospheric pressure, in the vacuum chamber, we provide a small ejector 29, Figs. 4 and 5 which it is designed shall be kept constantly running. This ejector is connected with steam pipe 10 by the duct 30, and with the exhaust passage 11 by duct 31, in which is located the check valve 32 operating to prevent the inrush of external air to the vacuum chamber, and the exhaust duct 33 leads from this ejector to the main exhaust passage 17.

This mechanism acts automatically to preserve a vacuum in the vacuum chamber, or to preserve a suitably reduced pressure—below atmospheric pressure—adapted to effect the peculiar results demanded thereof.

Various other forms of this mechanism are possible, but it is preferred to use some form of automatic mechanism, and that it shall be sensitive to a few pounds of variation of pressure in the vacuum chamber, and have an exhaust capacity equal to creating in a few minutes a sufficiently operative reduced pressure or vacuum in the vacuum chamber.

In Fig. 12 we illustrate a pump for exhausting the vacuum chamber, which also may charge the main reservoir. In this case too the ejector is brought into action by opening the valve of the steam pipe by hand, which ejector is of the common and well-known form used with vacuum brake mechanism and contains the usual small internal jet acting to maintain a running vacuum exhaust.

Referring now to Fig. 1 and Figs. 6 to 11, which illustrate the valve mechanism located at and controlling the action of exhaust from the train pipe and brake cylinder, as well as the supply to the local reservoir, and from the same to the train-pipe and brake cylinder, 38 represents the casing of such valve; 39, the train-pipe branch which enters and communicates with the train-pipe spaces 40 extending along opposite sides of the casing and combining through the grooved cap plate 41 with the space in front of exhaust slide-valve 42, the space 43 on the opposite side of which valve is the brake cylinder space, 44, Fig. 1, being the brake operating piston, 45, the local reservoir, and 46 a passage from such reservoir to the reservoir valve mechanism 47. Slide valve 42 is connected to the piston rod 48 of piston 49 by the rod 50 engaging such piston rod and the graduation slide valve 51 lying upon the main slide valve and having a vertical play upwardly thereon limited by the seating projection 52 on the main valve and through which said rod has free passage.

and then increase, and again reduce and increase this added braking force indefinitely. In practical effect, the braking forces are those of a storage and of a vacuum system, with the range of variation or graduation of pressure of a vacuum system. During the time of the use of the vacuum braking force, the main reservoir of the storage system is not drawn from, and the storage pump can be running to charge the same if necessary. In case of the necessity of braking when the storage system has been partially exhausted, and so cannot operate at maximum efficiency, the vacuum pressure can be availed of to effect the additional power needed, and long and repeated graduations may be had, during the time of which the storage system may be resupplied. In event of the storage system becoming disabled as to the air pump or main reservoir, the local reservoirs will be put to communication with the external air by the valves 65 (Fig. 1), and the system can be worked by the vacuum mechanism.

Many other advantages, due to thus compounding the storage and vacuum mechanisms, can be mentioned, but we believe the foregoing sufficiently explains and emphasizes the importance of the features of invention.

We desire to call attention to the fact, that, in the operation of the equilibrio brake-piston shown, the final or vacuum pressure exerted thereon is in effect the action of the atmospheric air originally in the local reservoir. Hence it is producing the same result in substantially the same way to increase reservoir pressure action by availing of the original atmospheric pressure therein or to ignore such pressure and avail of direct atmospheric pressure.

What is claimed as new is—

1. In combination in a fluid brake mechanism and with a brake piston or other brake actuating device thereof, a reservoir normally containing air stored under greater than atmospheric pressure, a chamber normally exhausted of air to below atmospheric pressure, and mechanism acting to operatively apply the reservoir air pressure to said brake actuating device and to operatively connect said chamber to said brake actuating device to effect a brake application action thereof.

2. In combination in a fluid brake mechanism and with a brake piston or other brake actuating device, a reservoir normally containing air stored under greater than atmospheric pressure, mechanism for applying said reservoir air upon said piston to produce a brake application action thereof, a chamber normally exhausted of air to below atmospheric pressure, and mechanism acting to operatively connect said chamber to said brake actuating device, whereby to increase the brake application action of the reservoir air.

3. In combination in a fluid-brake mechanism, separate chambers adapted to contain a fluid at greater than atmospheric pressure, a brake-actuating piston or similar partition arranged between and separating said chambers, and a vacuum chamber operating to effect the reduction of fluid pressure in one of said chambers to below atmospheric pressure.

4. In combination, in an air brake mechanism, a piston and cylinder or similar brake-actuating mechanism, a reservoir connected to said cylinder at one side of said piston and adapted to contain and exert a stored fluid pressure on one face of the piston, and a vacuum chamber adapted to be put to communication with said cylinder at the other side of the piston and operating to exhaust the pressure fluid from that end of the cylinder to below atmospheric pressure.

5. In combination in an air brake mechanism, a piston and cylinder or similar brake-actuating mechanism, a reservoir connected to said cylinder at one side of said piston and adapted to contain and exert a stored fluid pressure on one face of the piston, and vacuum-producing and maintaining mechanism connected with the train pipe and operating to exhaust the fluid pressure from the brake cylinder to below atmospheric pressure.

6. In combination in a fluid brake mechanism, separate chambers adapted to contain a fluid at greater than atmospheric pressure and provided with means for charging the same, a brake actuating piston or partition arranged between and separating said chambers, and a vacuum chamber adapted to be openly connected with one of said vacuum piston chambers and operating to effect the reduction of fluid pressure in such chamber to below atmospheric pressure.

7. In combination in a fluid brake mechanism, separate chambers adapted to contain a fluid at greater than atmospheric pressure, a brake-actuating piston or partition arranged between and separating said chambers, mechanism for charging said chambers by causing the pressure fluid to pass from one to the other, and a vacuum-maintaining exhaust mechanism operating to effect the reduction of fluid pressure in one of said chambers to below atmospheric pressure.

8. In combination with an equilibrio brake-piston air brake system, a vacuum-producing mechanism having a vacuum chamber, normally exhausted of air to below atmospheric pressure; and means for putting said chamber to communication with the train pipe for the purpose of exhausting the same to below atmospheric pressure.

9. In combination with an equilibrio brake-piston air brake system, an automatic vacuum-producing mechanism having a vacuum chamber normally exhausted of air to below atmospheric pressure, and means for putting said chamber to communication with the train pipe for the purpose of exhausting the same to below atmospheric pressure.

10. In combination in a fluid brake mechanism and with an engineer's valve the train pipe and a brake piston and cylinder, of a lo-

53 is a passage cut in the main slide valve and of such extent as upon proper downward movement of the valve to put the train pipe space and the brake cylinder space to joint communication with the exterior exhaust passage 54, which is provided with a spring seated valve 55 normally holding this passage closed as against the ingress of atmospheric air, but adapted to freely open to permit train-pipe and brake cylinder exhaust.

The main slide valve is held to it seat, as shown in Fig. 6, by the vertically-acting springs 56 and by the bevel seating projection 52 extending backwardly therefrom, which in this position bears against the fixed and similarly beveled bridge-piece 57. Piston rod 48 has a play relatively to the main slide valve by the amount necessary to bring the graduation ports 58 and 59, cut through respectively the large and the small slide valves, into communication, or to bring piston 49 into contact with the stem 60 of the reservoir valve 47, and further movement vertically of this piston would result in either moving the slide valve downwardly to put the brake cylinder and train pipe to connection with the exhaust passage 54, or upwardly to lift the reservoir valve from its seat and put the reservoir to communication with the train-pipe through passage 61 and with the brake-cylinder through passage 62, for the purposes of release and recharge of the system, as after a full application of the brakes. A small groove 63 in the walls surrounding the slide valve piston and passing the piston from below to above when in the position of Fig. 6, permits supply for any possible leakage from the brake cylinder; or such a supply passage may be cut through the main slide valve as shown at 64 Figs. 10 and 11.

The operation of the system as a whole will now be plain.

Assuming that the vacuum chamber is exhausted to the full extent deemed practicable, that the small ejector is continually acting to maintain the vacuum in the vacuum chamber, that the main reservoir, train pipe, the local reservoirs and brake cylinders are fully charged, that the brake pistons are thereby in equilibrium as between the opposed pressures of reservoir and train pipe, and that the three-way cock is at position of atmospheric exhaust, the various braking actions are as follows: For service application, a slight reduction of train pipe pressure will cause the graduation valve to descend and put the graduation passages 58 and 59 into position to slowly exhaust the brake cylinder, and the exhaust of cylinder pressure to below the train pipe pressure will cause this valve to be returned to running position and to cut off any further exhaust from the cylinder. A strong reduction of train pipe pressure will cause the stem of the slide-valve actuating piston to come forcibly in contact with the main valve and push the same down as far as the piston can descend, which will effect full and free communication of the train pipe and the brake cylinder with external air through the passage 53, this passage having such an extent that when the valve is in the lower or exhaust position it will open into the cylinder space and thus put the cylinder space into open communication with the exhaust passage 54 as well as with the train pipe space, whereupon the full application of the brakes will be produced and with the utmost of local reservoir pressure. Obviously, a recharge of the train pipe in part or whole will effect a corresponding partial or complete release of the brakes. If after a full application, it be desired to have a greater braking pressure, the engineer will, while his valve is still at position of full application, turn the three-way cock and put the train pipe to communication with the vacuum chamber. Thereupon, the air in the train pipe will expand into the vacuum space, and the braking effect of the local reservoir pressure will be correspondingly augmented.

It is to be noted that the sudden exhaust, when the train pipe is connected with the vacuum chamber, from under the brake cylinder valve piston will cause the same to descend to full application position, thus effecting free communication between the brake cylinder and the train pipe, and thereby permitting a free exhaust of the brake cylinder through the train pipe into the vacuum chamber. Simultaneously with or immediately following this further train pipe reduction, the main ejector will be put into operation to exhaust from the vacuum chamber the train pipe air admitted thereto.

It is also to be noted that the vacuum exhaust increases the seating pressure upon the local exterior exhaust valves which act to prevent the ingress of atmospheric air.

It will appear that we provide for availing of a vacuum or atmospheric braking force in addition to the full power of an automatic air storage system, and this without adding to the storage system in the essential respects of size, complexity of construction and the practicable limit of stored pressure; and further and essentially the added power can be applied with all the rapidity, comparatively, of the stored power. The peculiar characteristics of the improvements particularly adapt them to use on high speed trains, where it is desirable to have a braking power that can be regulated during application to conform to reduction in speed of the train and thereby prevent sliding of the car wheels. With this mechanism and method, the added braking force is an important percentage of the total braking force and affords a margin within which the desired braking reduction can be effected for trains running at the highest speeds. In this connection it is to be understood that the amount of the added or vacuum braking power is wholly within the control of the engineer; for when the total braking force of the storage pressure has been applied, the engineer by his three-way cock can reduce, cal reservoir adapted to apply a stored pressure upon the face of said piston opposite the train-pipe space, valve mechanism for locally exhausting train pipe air from said cylinder, a vacuum chamber adapted to be put to communication with train-pipe space, and a valve for closing the local exhaust against atmospheric air.

11. In combination in an air brake mechanism, a balance brake piston and its cylinder, a local reservoir communicating with one end of said cylinder and a train pipe connected to the other end thereof, an engineer's valve controlling said train pipe, and a vacuum-maintaining and exhausting mechanism adapted to be put to communication with the train-pipe exhaust port of said valve and for exhausting the fluid pressure from the train pipe and the end of the brake cylinder connected thereto.

12. In combination in a brake mechanism, and with a balance brake piston and cylinder provided with a local reservoir connected to one side thereof and a train pipe and main reservoir connected to the other side thereof, an engineer's valve controlling the train pipe and its connection to the main reservoir, and a vacuum chamber adapted to be put to communication with and for exhausting the train pipe.

13. In combination with the vacuum chamber, the steam-actuated air-ejector and a valve controlling the admission of steam thereto, a piston balanced or held inoperative between vacuum chamber pressure and an exterior pressure and adapted upon variations of the vacuum pressure to open said steam valve.

14. In combination with a vacuum chamber, the steam air-ejector and a valve controlling the admission of steam thereto, and a piston controlled by vacuum chamber pressure and adapted upon variation of such pressure to act to open the steam valve.

EDWARD G. SHORTT.
JOSEPH ELIE NORMAND.

Witnesses:
H. B. EDMONDS,
ROBT. F. GAYLORD.