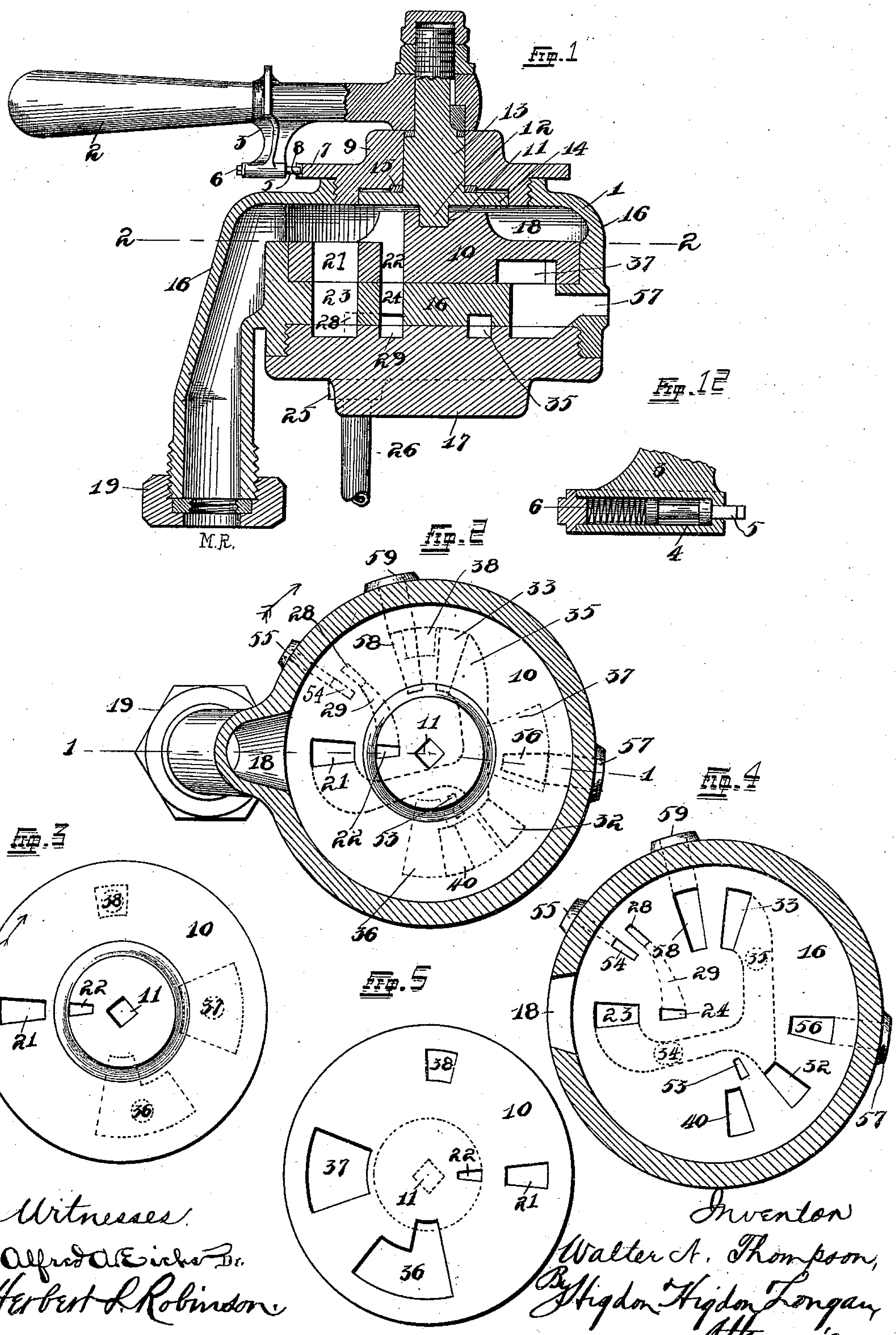
(No Model.) 2 Sheets—Sheet 1.

# W. N. THOMPSON.

## AIR BRAKE CONTROLLING MECHANISM.

No. 545,749. Patented Sept. 3, 1895.




Witnesses.
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(No Model.)

2 Sheets—Sheet 2.

# W. N. THOMPSON.

## AIR BRAKE CONTROLLING MECHANISM.

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Fig. 6

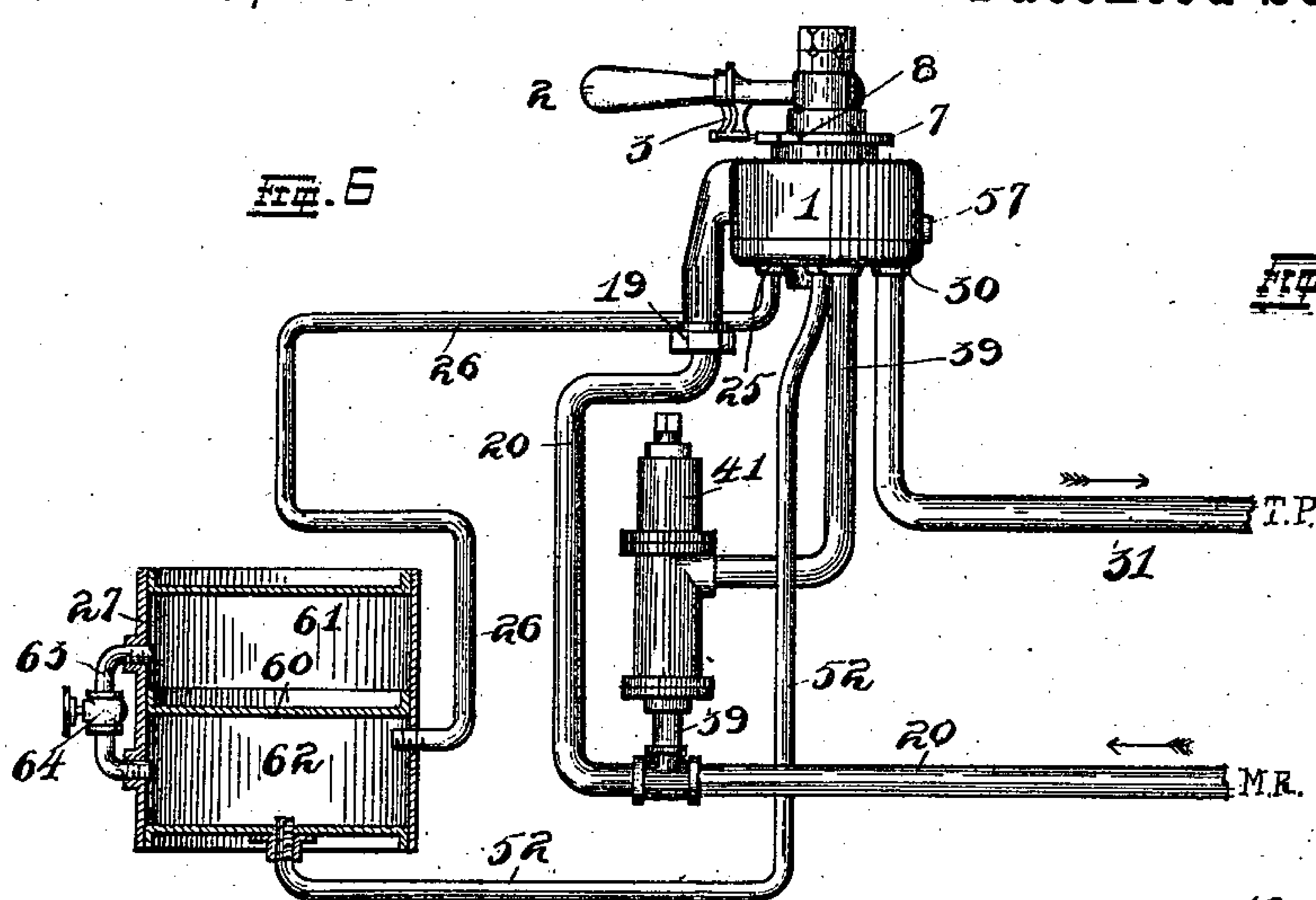



Fig. 11

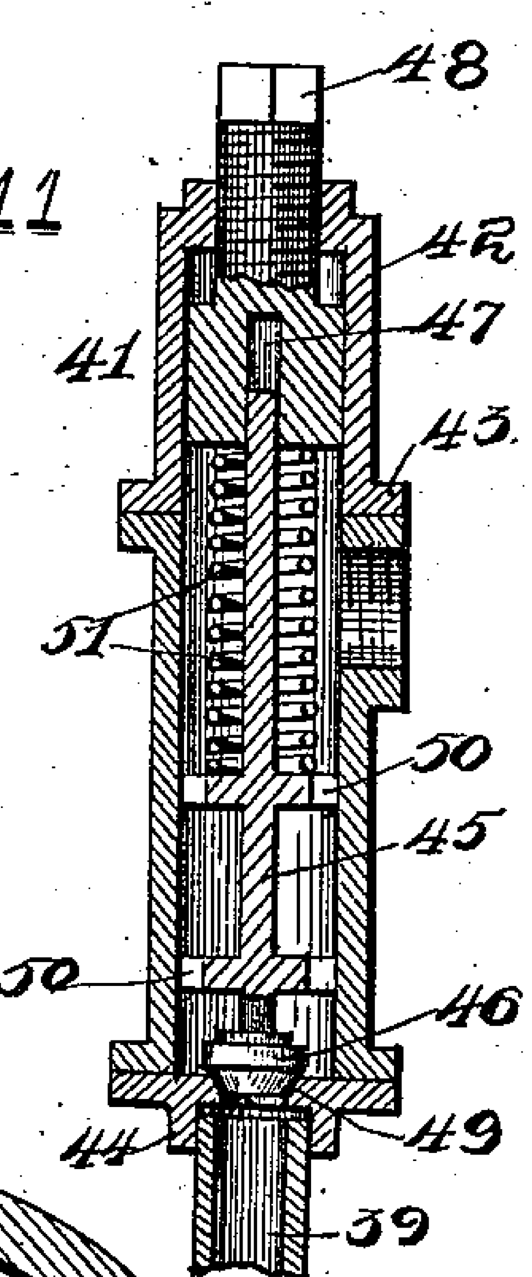


Fig. 7

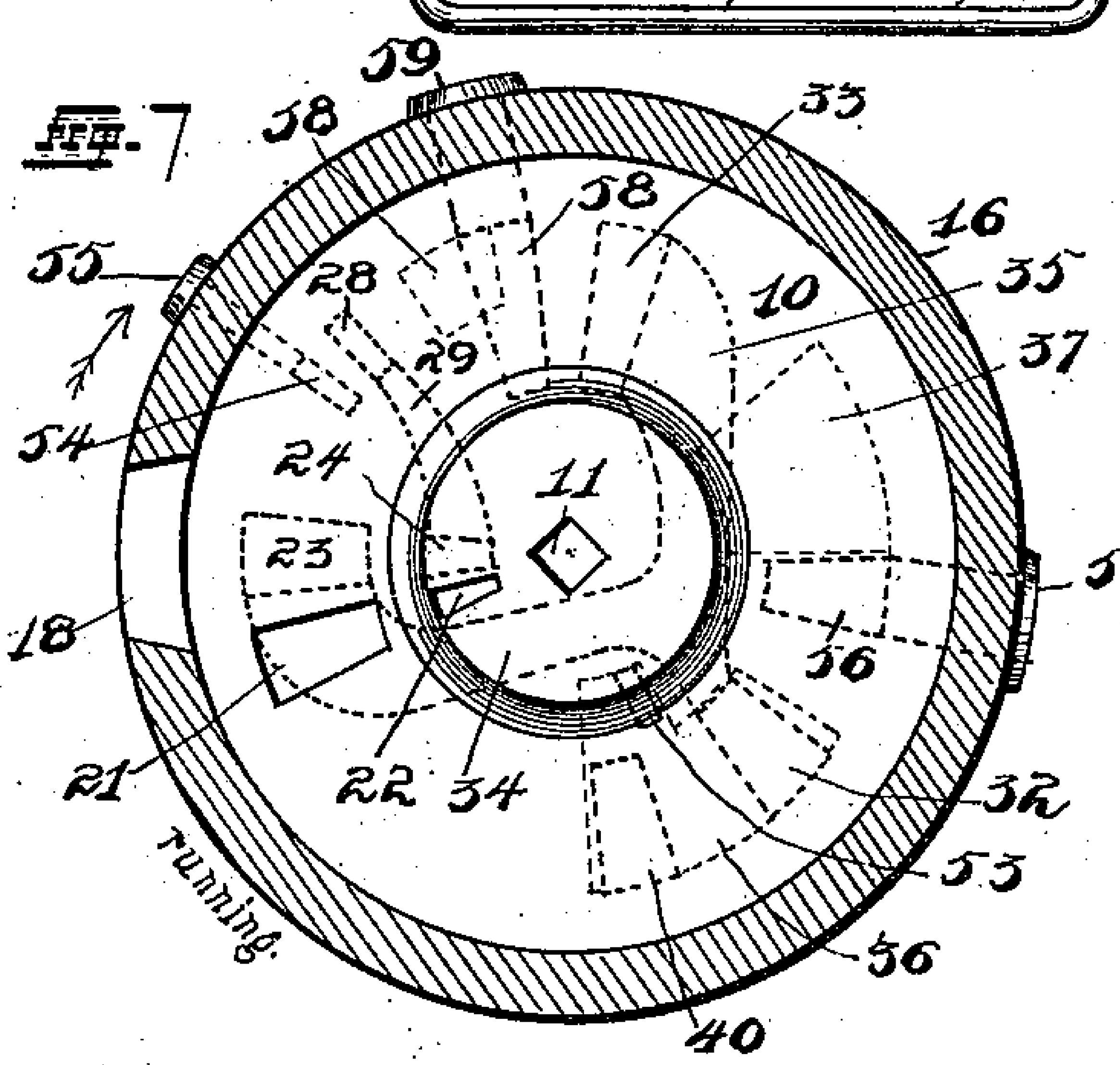



Fig. 8

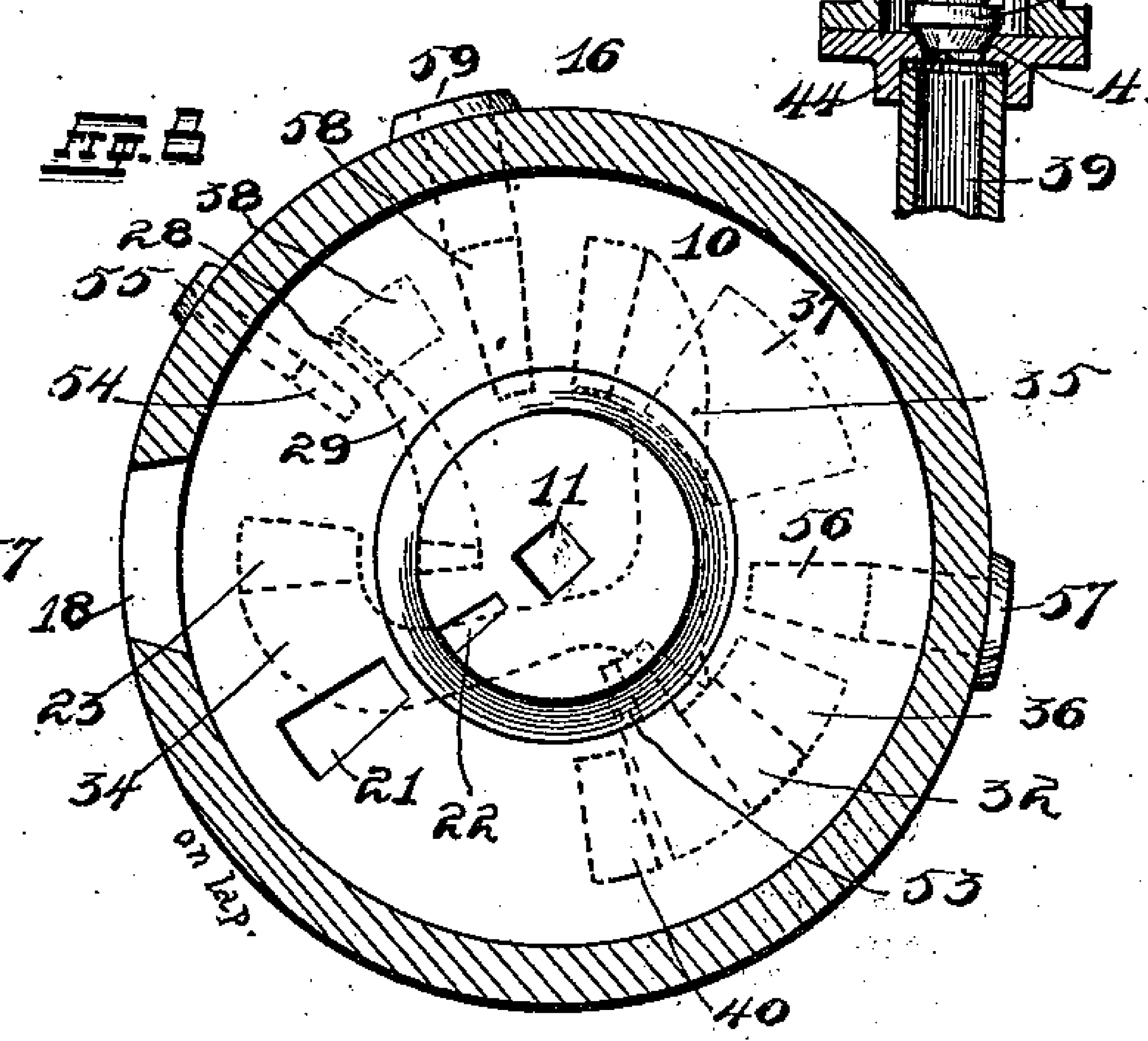



Fig. 9

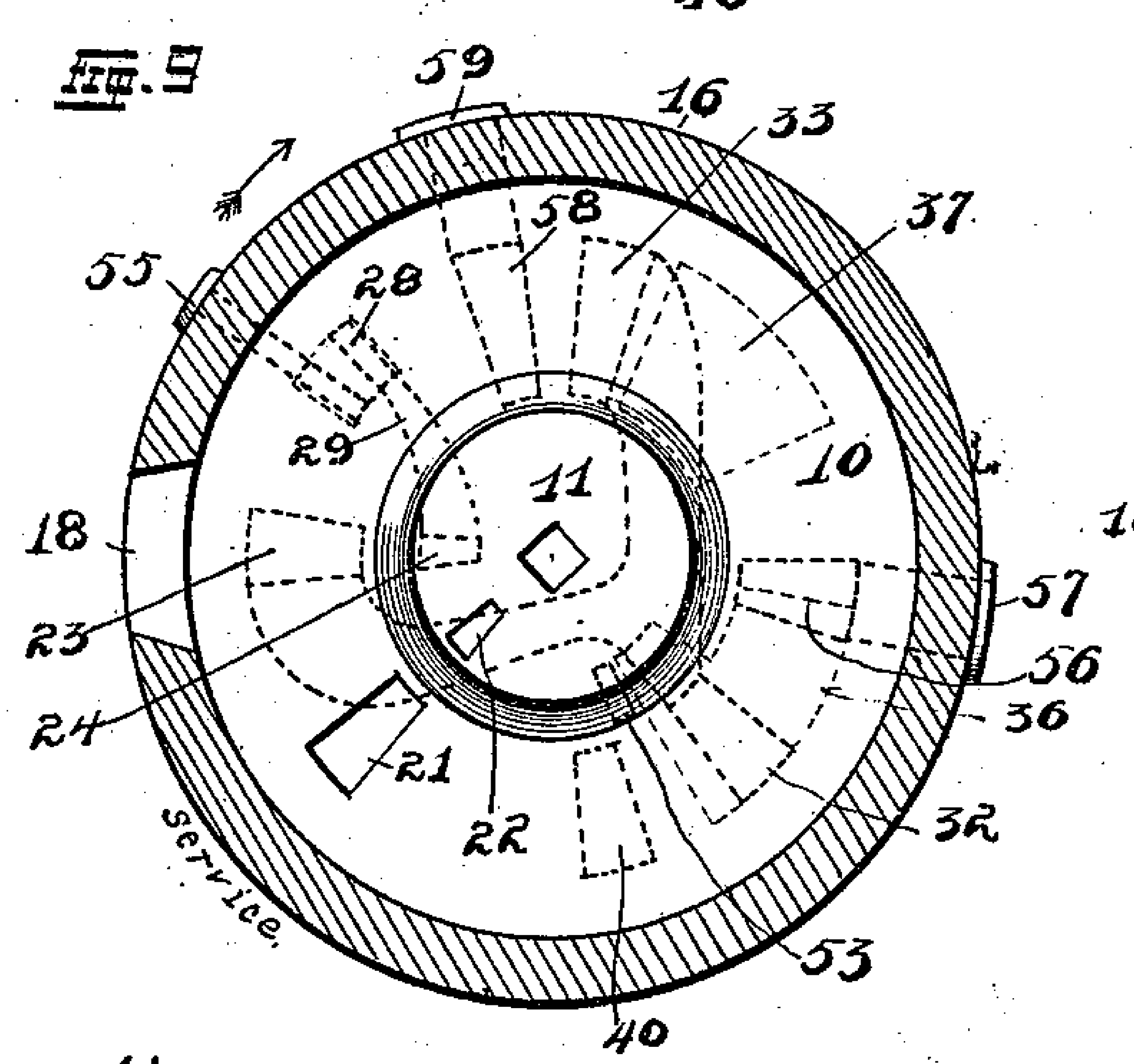
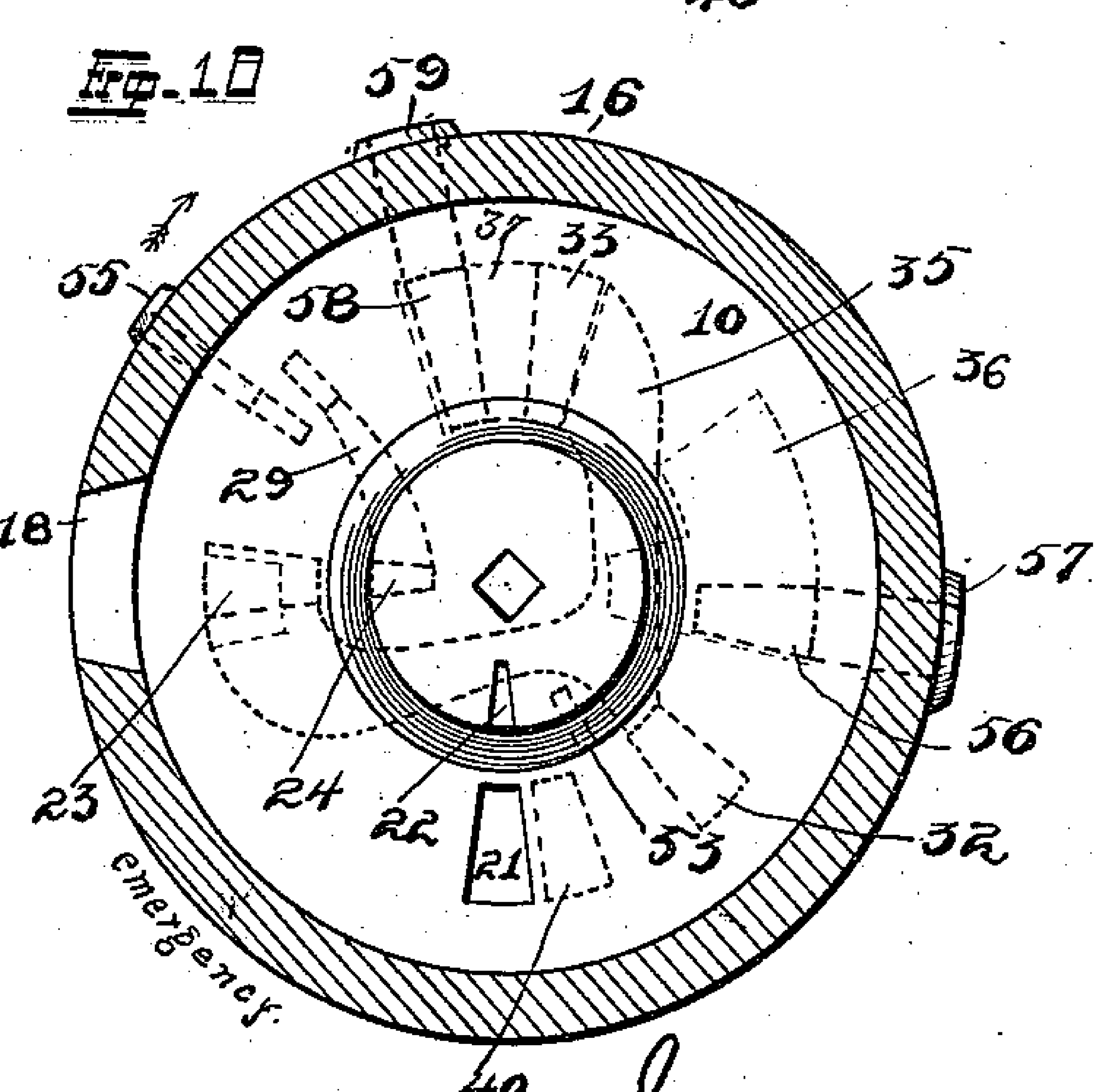



Fig. 10

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# UNITED STATES PATENT OFFICE.

WALTER N. THOMPSON, OF ST. LOUIS, MISSOURI.

## AIR-BRAKE-CONTROLLING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 545,749, dated September 3, 1895.

Application filed March 6, 1893. Serial No. 464,807. (No model.)

*To all whom it may concern:*

Be known that I, WALTER N. THOMPSON, of the city of St. Louis, and State of Missouri, have invented certain new and useful Improvements in an Air-Brake-Controlling Mechanism, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

This invention relates to means for controlling the usual air-brake apparatus; and it consists in a novel combination and arrangement of an engineer's brake-valve, an equalizing-drum connected to receive discharge from the train-pipe of the brake apparatus, and proper connections with the several parts of said brake apparatus.

The invention consists, further, in a novel engineer's valve constructed with ports and having a single port which is used to supply air to the train-pipe, to reduce pressure in the train-pipe, to discharge air into the equalizing-drum, to discharge air into the emergency-port, and to supply air at full main-reservoir pressure to the train-pipe to quickly release brakes.

The invention consists, further, in certain details of construction, to be hereinafter fully described.

In the drawings, Figure 1 is a sectional side elevation of the improved engineer's brake-valve used in carrying out the invention, the section being taken on line 1 1 of Fig. 2. Fig. 2 is a sectional plan view taken on line 2 2 of Fig. 1. Fig. 3 is a top plain view of the rotary or rocking valve removed from its inclosing-shell. Fig. 4 is a sectional plan view similar to Fig. 2, but with the valve removed therefrom. Fig. 5 is a bottom plan view of the rotary or rocking valve removed from its inclosing-shell. Fig. 6 is a sectional side elevation of the operative parts of the invention connected in a sort of diagrammatic manner. Fig. 7 is a sectional plan view similar to Fig. 2, illustrating a certain position of the valve. Fig. 8 is a similar view to the last, illustrating a different position of the valve. Fig. 9 is a similar view to the last, illustrating a still further position of the valve. Fig. 10 is a similar view to the last, illustrating an additional position assumed by the valve during operation. Fig. 11 is a detail sectional elevation of a pressure-reducing valve which may be used in carrying out the invention. Fig. 12 is a detail sectional elevation of a portion of the handle of the engineer's valve and illustrating a spring retaining-dog carried thereby.

Referring again to the drawings, it will be observed that I have limited the illustrations to those parts to which my invention directly pertains—viz., the parts which are to be carried by the engine; and these I have not shown on an engine for the reason that their relative positions thereon will be readily comprehended by those skilled in the art, and for the further reason that the illustration of a full and complete automatic brake system, with locomotive, tender, cars, &c., would needlessly increase the drawings without rendering the invention more comprehensive.

Preliminarily I may remark that in carrying out the operation of my invention there is to be used a complete automatic air-brake system having the usual pump, main reservoir and auxiliary reservoirs, and brake-cylinders and the usual connections.

The essential differences in the construction and mode of operation are as follows: First, I provide an equalizing-drum connected to the train-pipe, and I discharge air into this drum from the train-pipe in making a stop; second, I greatly simplify the construction of the engineer's valve, and, third, I make provision for carrying an abnormally high pressure in the ordinary main reservoir, and I place a reducing-valve in the pipe which supplies air to the engineer's valve (between the main reservoir and the engineer's valve) and use a considerably-reduced pressure in the train-pipe under normal conditions.

1 indicates the outer shell or casing of the engineer's valve, and 2 the handle thereof. This handle is arranged to be moved back and forth, so as to swing in a horizontal plane during operation, similar to the manner in which the handle of the valve in the Westinghouse system and other systems operates. At a point intermediate of its length it is provided with a depending projection 3, having a cavity 4 therein and extending parallel with said handle. This cavity has a closed outer end and an opening in its inner end, and therein is mounted to slide a retaining-dog 5.

A suitable spring 6 is also mounted in this cavity between the closed end thereof and the outer end of said dog, so that the dog will be urged toward the inner end of the cavity and its inner end will normally project through the opening in the end of said cavity and forcibly engage a sector 7, provided with notches 8 for the purpose of holding the handle in any desired adjustment. This sector is formed upon or secured to the edge of the removable cap 9 of the valve-shell 1. This cap is preferably provided with suitable means for removably attaching it to said shell, so that an opening of proper size will be made accessible in the shell for the purpose of cleaning, oiling, &c., the parts contained therein.

10 indicates the rotary or rocking valve. The handle 2 of the valve 10 is connected thereto in any desired manner which will securely but detachably connect such parts. In the present instance I have constructed the upper face of said valve with an angular socket 11, engaged by a correspondingly-shaped projection 12 on the lower end of the valve-stem 13. The handle 2 is fixed upon the upper end of the valve-stem in any known manner which will permit its removal therefrom for cleaning and repair. A tight joint between the valve-stem and the shell 1 may be secured in any known manner, or as here shown, in which the said stem is mounted in an aperture in the cap 9 and is provided with a flange or shoulder 14 adjacent its inner end, and between this shoulder and the under side of said cap is a suitable packing or packing-ring 15, so that the upward or outward pressure of air contained within the shell will tend to press said shoulder toward said cap and compress said packing between the said parts, and thereby form a tight joint during movement and operation of the valve.

16 indicates the valve-seat, which has a flat upper face engaged by the under face of the valve. This seat is made in two separate pieces for convenience in molding and casting it, there being the upper valve-seat proper and the lower portion 17, which latter also acts as the lower cap for the valve-shell. The lower cap 17 is made removable by having its edge provided with screw-threads and being threaded into the shell or otherwise fastened thereto. The construction of these pieces of the valve-seat is such that the different ports and passages register or correspond with like ports or passages in each piece.

18 indicates a chamber above the valve in the shell 1, with which the main reservoir of the system is usually in direct communication by means of coupling 19 and pipe 20.

The valve 10 is constructed with several peculiar features, as is also its seat in the casing or shell. These I will now proceed to describe in a specific manner.

21 and 22 are what I term the "full-release" ports in the valve 10. These ports both pass entirely through the valve in a direct vertical line, and they are adapted to register with correspondingly-shaped ports 23 and 24, formed in the valve-seat 16, when said valve is adjusted to the full-release position, by being rotated in the direction shown by the arrow in Fig. 3, which should be done when it is desired to fully release the brakes. In Figs. 1 and 2 the valve and its seat are shown in relative position for full release. Formed in the lower cap 17 of the shell is a pipe connection 25, in which is secured a pipe 26, leading to the equalizing-drum 27. A port 28 is formed in the valve-seat directly above the pipe connection 25, and is placed in connection with the equalizing-drum by means of said pipe 26. This port 28 in the valve-seat is connected also with the before-mentioned release-port 24 by means of a small horizontal passage 29 extending from one of said ports to the other.

30 indicates the train-pipe connection formed in the under side of the cap 17 and to which the train-pipe 31 is connected. (See Fig. 6.)

32 indicates the train-pipe port, which is formed in the valve-seat directly above the train-pipe connection 30, and which is connected to the train-pipe and to the release-port 23 and emergency-port 33. A passage 34 connects said train-pipe port with said release-port 23. A similar passage 35 connects said train-pipe port with said emergency-port 33. These three last-named ports are normally connected one to the other by means of these passages, as said passages extend horizontally in the valve-seat and merge into each other. Formed in the under face of the valve 10 are three different cavities or depressions in addition to the release-ports above described—viz., a service-cavity 36, an emergency-cavity 37, and a cavity 38, which I will denominate an "equalizing" cavity. These cavities do not extend entirely through. They are so relatively situated that they perform the functions hereinafter mentioned.

39 indicates a feed-pipe connected with a feed-port 40, formed in the valve-seat at a point closely adjacent the train-pipe port 32. This feed-pipe is connected to the pipe 20, so as to receive air from the main reservoir. (Not shown.) I may state that I use in the engineer's valve and the train-pipe a pressure considerably reduced in normal operations of the brake apparatus. In other words, I carry a comparatively high pressure in the main reservoir and reduce the pressure of the air prior to its entrance into the engineer's valve and the train-pipe in running under normal conditions. The normal pressure in the train-pipe is reduced so low that when a very prompt release of the brakes is desired I can bring it about by directing the high pressure of the main reservoir into the train-pipe. In practice I have found it desirable to run under normal conditions with a reduction of about twenty pounds below that of the main reservoir. This reduction may be brought about by the use of any of the well-

known reducing-valves now in the market, or the one which I shall presently describe may be made use of.

41 indicates the reducing-valve, which is placed in the feed-pipe 39 at any point between the engineer's valve and the main reservoir. In the present case I have shown it connected to the feed-pipe 39 and the main-reservoir pipe 20. It consists of an outer shell 42, having two pipe connections 43 and 44, by means of which it is connected to the feed-pipe. Within the shell 42 there is mounted to slide a valve-stem 45, carrying a valve 46 at one end and having its opposite end mounted in a guide-socket 47, which latter is formed in an adjusting-plug 48. The plug 48 is threaded into the upper end of the casing 42, so that it may be screwed farther in or outward. The valve 46 closes downward against a valve-seat 49, so that air entering the valve-casing will tend to lift said valve from its seat. The stem 45 is provided with a number of guiding-arms 50, which extend therefrom and engage the interior of the casing, and thereby guide the valve in its movement. Encircling the upper portion of the stem 45 and located between the plug 48 and the guide-arms 50, so that its upper end bears against said plug and its lower end rests in contact with the said arms, is a coiled spring 51, which normally tends to hold the valve to its seat. By adjusting the plug 48 it will be observed that more or less pressure will be placed upon the valve of the reducing device.

52 indicates a feed-pipe leading from a feed-port 53, formed in the valve-seat 16, to the equalizing-drum 27. It will be observed that the port 53 is located in said valve-seat closely adjacent the feed-port 40 and the train-pipe port 32. This is done so that the service-cavity 36 in the under side of the rocking valve 10 may be made to cover all three of said ports during the operation hereinafter mentioned.

54 indicates an exhaust-port formed in the valve-seat 16, closely adjacent the port 28, and opening direct to the atmosphere by way of a passage 55. This port 54 is thus located near to the port 28 to permit the cavity 38 in the under side of the valve to cover both ports during the operation hereinafter mentioned.

56 indicates a service exhaust-port formed in the valve-seat 16, closely adjacent to the train-pipe port 32, and opening direct to the atmosphere by way of a passage 57. This port is thus located near to the port 32 to permit the emergency-cavity 37 in the under side of the valve 10 to cover both the train-pipe port and the service exhaust-port at the same time during the operation hereinafter mentioned.

58 indicates an additional emergency-port. It is what I term an "emergency" exhaust-port, and it is located in the valve-seat 16, closely adjacent the emergency-port 33, before mentioned. This emergency exhaust-port opens direct to the atmosphere by way of a passage 59. This port is thus located near to the port 33 to permit the emergency-cavity 37 to cover both emergency-ports during the operation hereinafter mentioned. I will explain at this point that in Figs. 2, 7, 8, 9, and 10 I have shown the ports and passages in the valve-seat in heavy dotted lines and the cavities in the valve 10 in lighter dotted lines, so that the several relative positions of such parts may be the more readily discerned.

The equalizing-drum 27 is preferably divided into separate compartments and arranged so that the entire drum may be used, either as a single large compartment or only a portion of the drum may be utilized. I find that this construction produces more satisfactory results, for the reason that in operating a long train of cars a drum of greater capacity is desirable than is necessary in working a shorter train, and I therefore provide an equalizing-drum with compartments. This may be done as follows: The drum 27 is provided with a partition 60, which divides it into two separate compartments 61 and 62, which have no communication with each other except by way of a pipe 63, which connects with the interior of each compartment and connects one with the other. A suitable valve 64 is connected with this pipe 63 for the purpose of placing one compartment in communication with the other or of cutting off the connection between the compartments, as may be required during operation. I may state here that the drum 27 should be located on the engine or tender at such convenient point that the valve 64 will be readily accessible to the engineer. It will be observed that the drum feed-pipe 52 is connected with the compartment 62 and that the drum exhaust-pipe 26 is also connected to this same compartment, so that all ingress and egress of air must be made by way of this single compartment, and so that when the valve 64 is closed all communication between the compartments will be cut off and the capacity of the drum will be limited to the capacity of said single compartment 62. Likewise when the valve 64 is opened the capacity of the drum will be increased exactly to the extent of the capacity of the compartment 61. It is clear that the partition 60 may be so placed in the drum as to divide same into compartments of equal or unequal capacity, as may be preferred by the builder. It is evident that the construction of the engineer's valve which I here show may be modified within the skill of a mechanic without departing from the legitimate scope of my invention.

In carrying out the improved method of controlling the exhaust of air from the train-pipe in automatic brake systems and in the improved method of controlling the release of the brakes in automatic brake systems the specific construction of the engineer's valve may be varied from that which I here show, it being only necessary that such a form of engineer's valve be provided as will do the work herein described.

The operation is as follows: The main reservoir (not shown) is supplied by the usual pump with a comparatively high pressure, and this pressure is maintained by the use of the usual pump-governor. We will now suppose that the parts of the engineer's valve are in what is termed "running position," which, being interpreted, means that relative position of the parts of the valve which they are caused to assume and retain while the engine or train of cars is running along a railroad, making time under normal conditions. This running position is shown clearly in Fig. 7 of the drawings, a close inspection of which will show that the valve 10 has been rotated a slight distance in the direction the reverse of that indicated by the arrow and that it has been removed from the position in which it is shown in Figs. 1 and 2, this latter position being what is known as "full-release." In this running position it will be observed that both the release-ports 23 and 24 in the valve-seat are closed, for the reason that the valve completely covers them. Therefore the main-reservoir pressure in the chamber above the valve is cut off from the train-pipe 31 and the passages 34 and 35 in said valve-seat. It will be observed, however, that the feed-port 40, which is connected to the main-reservoir feed-pipe 20 by way of the reducing-valve 41 and feed-pipe 39, stands uncovered, or, rather, the service-cavity 36 in the under side of the valve stands over said port 40. It also stands over the train-pipe port 32 and the drum feed-port 53, so that the reduced-pressure air from the main reservoir is being fed or discharged into the said train-pipe and the said drum feed-pipe. It will be observed, further, from this that when the parts of the engineer's valve are in running position I feed the train-pipe and the equalizing-drum simultaneously with air reduced to a pressure below that of the main reservoir. This reduced pressure I have found to be amply sufficient for making all stops. The next position I will refer to will be what I term "on lap." This is clearly shown in Fig. 8. In this position the feed-ports are all closed, with the result usually brought about when the well-known Westinghouse engineer's valve occupies the position of "lap" or "on lap." I will next refer to what is known as "service-stop," which is shown in Fig. 9. In this position the valve 10 has been rotated still farther in a direction the reverse of that of the arrow. Here the feed-port 40 is closed; so also is the drum feed-port 53. The service-cavity 36 in the valve has been moved farther around until it covers not only the train-pipe ports 32, but it partially covers the service exhaust-port 56, permitting the air in the train-pipe to flow outward, more or less suddenly, through said port 56 and passage 57 to the atmosphere, with the usual effect of applying the brakes of the engine and train, said brakes operating in the usual manner. Simultaneous with the exhaust of air from the train-pipe an exhaust of air also takes place from the equalizing-drum 27, for the reason that with the valve in this service-stop position the equalizing-cavity 38 in said valve is located over both of the ports 28 and 54 in the valve-seat, and air from the drum passes up through pipe 26 to the port 28, and as it cannot make its exit through the passage 29 and release-port 24 it passes up into the said equalizing-cavity and into the port 54 and is discharged into the atmosphere through the exhaust-opening 55. This exhaust from the drum is continued until one or both of the ports 28 and 54 is (or are) closed by movement of the valve; but so long as the valve remains in the service-stop position this exhaust from the drum continues. The drum is thus exhausted to make room in it for air from the train-pipe, as is presently described. This is not all of the method of controlling the exhaust of air from the train-pipe in making a service stop. An important step in such method has yet to be described. It is this: The valve should not be permitted to remain in this last-described position but a very short time—a moment or two—and then it should be moved in a reverse direction (with the arrow) a short distance, until the exhaust-port 56 to the atmosphere is closed, and until the feed-port 53 to the drum is opened and placed in communication with the service-cavity 36 in the valve and with the train-pipe port 32 in the valve-seat; but the valve should not be moved so far in such direction as to bring the said service-cavity over the feed-port 40. The proper position of the valve can readily be determined by the operator by observing the effects on the movement of the train, and by observing the position of the valve-handle in its relation to the notched sector 7. This slight reverse movement of the valve, as has just been described, permits instantaneous discharge of the air from the train-pipe into the service-cavity 36 of the valve, and thence direct into the drum feed-port 53, and through the drum feed-pipe 52 to the drum. This step in the method may be termed but a continuation of the exhaust from the train-pipe, which was previously begun by exhausting the air to the atmosphere. An explanation of the value of this step in the method may here be made: From actual experience in handling the well-known form of engineer's valve and brake apparatus, I have discovered that if the exhaust from the train-pipe be quite sudden and continued sufficiently long in the atmosphere to make a stop, the rapidly-moving air in the train-pipe acquires a very high momentum in making its exit, and that if this momentum be abruptly checked by closing the exhaust-port to the atmosphere, which is done in the ordinary engineer's valve, the brakes will be unevenly applied and released on different cars of the train. For instance, if the exhaust to the atmosphere be long continued at the engineer's valve, in applying the brakes of a long train of cars the above-mentioned momentum of the air in the train-pipe acts to exhaust the air at the rear end of the train to a greater degree—a considerably greater degree—than it is exhausted at points nearer the engine, and this has the effect of applying the brakes on the rear cars of the train more forcibly than on those nearer the engine, causing a certain amount of trouble and expense, as is fully understood by those skilled in the use of such devices. Likewise when the exhaust to the atmosphere is suddenly stopped, as it is in the ordinary engineer's valve in releasing the brakes, the momentum or rather the inertia of the air rushing out of the train-pipe and being suddenly stopped accumulates a greater pressure in the train-pipe at points near the engine than at points adjacent the rear end of the train, and this has the effect of causing the brakes to be unevenly released or held applied.

My improved method of controlling the exhaust of air from the train-pipe obviates these difficulties, as I have found. In my method the exhaust of air from the train-pipe, in applying the brakes, is begun by exhausting into the atmosphere, but is continued and completed in the drum 27, so that the exhaust from the train-pipe is not suddenly stopped but continues into the drum until the pressure in said drum equals the pressure in the train-pipe, or until some other movement of the valve interrupts such action. This prevents or rather counteracts the momentum and inertia above described, and renders the operation of the brakes more certain, prompt, and reliable, avoiding flattened wheels and other similar disadvantages of the ordinary method. I may further state that the drum 27 is fed with air while the train-pipe is being fed, and such feed is cut off and a discharge-port from the drum is opened while a reduction in the train-pipe pressure is being made. Said drum receives a flow of air from the train-pipe when the exhaust-port of the train-pipe is closed. A sudden stoppage of the flow of air from the train-pipe in making a stop is prevented for the reason that in the reverse movement of the valve above described the service-cavity thereof reaches and communicates with the drum feed-port 53 prior to the closing of the exhaust-port 56. During the service stop, just described, the emergency-ports 33 and 58 remain closed of course.

I will now describe the position of the parts in making what is known as an "emergency-stop." (See Fig. 10). Here it will be seen that the valve 10 has been moved still farther in the direction opposite the arrow, so that the emergency-cavity 37 in the valve is brought directly over both of the emergency-ports 33 and 58 in the valve-seat, and show that there is a very large passage opened from the train-pipe port 32 by way of horizontal passage 35, emergency 33, emergency-cavity 37, emergency port 58, and exhaust-passage 59 to the atmosphere. This will bring about a quick stop.

I will now proceed to describe what is known as the "release" operation, having reference especially to Figs. 1 and 2. In releasing the brakes after a stop, or after any application of them, the operator throws the handle 2 of the engineer's valve in the direction indicated by the arrow until it occupies the position shown in Figs. 1 and 6. This will place the release-ports 21 and 22 of the valve 10 in such a position that they will register with the corresponding ports 23 and 24 in the valve-seat 16, and the air from the main reservoir, under high pressure, will then pass through pipe 20, around the reducing-valve 41, through coupling 19 into the chamber 18 above the valve, down through the ports 21, 22, 23, and 24 into the valve-seat, and thence into the passages 29 and 34 in the valve-seat. From the passage 34 the high-pressure air from the main reservoir rushes into the train-pipe port 32 and into the train-pipe 31 with the improved result of quickly releasing the brakes throughout the train. It is clear that the brakes will thus be released a great deal quicker than if the normal pressure in the train-pipe was used for the purpose, as it is well known that air under a high pressure will flow more quickly through a pipe than will air under a less pressure. Simultaneous with the flow of high-pressure air through the train-pipe in making a release a flow of high-pressure air also takes place through the short horizontal passage 29 in the valve-seat to the drum-port 28, and by way of pipe 26 to the drum 27, to be exhausted prior to making another stop.

What I claim is—

In an automatic fluid-pressure brake system, the combination of a closed drum divided into separate compartments, a main reservoir, a brake-cylinder, an engineer's valve connections for discharging air from the train-pipe of the system into all of said compartments, and connections for exhausting air from all of said compartments of the drum through the engineer's valve, substantially as and for the purpose herein specified.

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

WALTER N. THOMPSON.

Witnesses:
HERBERT L. ROBINSON,
JNO. C. HIGDON.