(No Model.) 3 Sheets—Sheet 1.

C. R. JAMES.

FLUID PRESSURE BRAKE.

No. 539,619. Patented May 21, 1895.

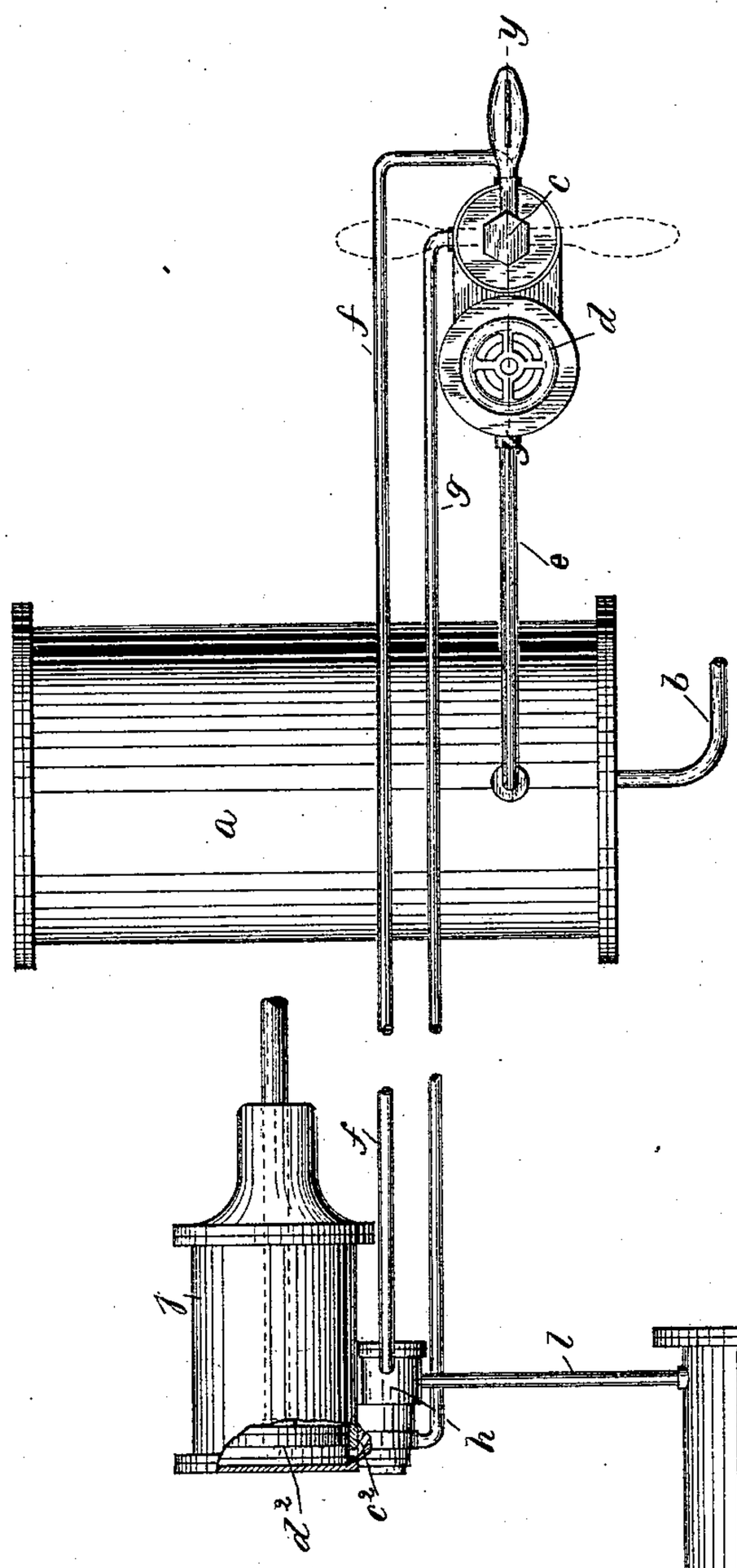

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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FLUID PRESSURE BRAKE.

No. 539,619. Patented May 21, 1895.

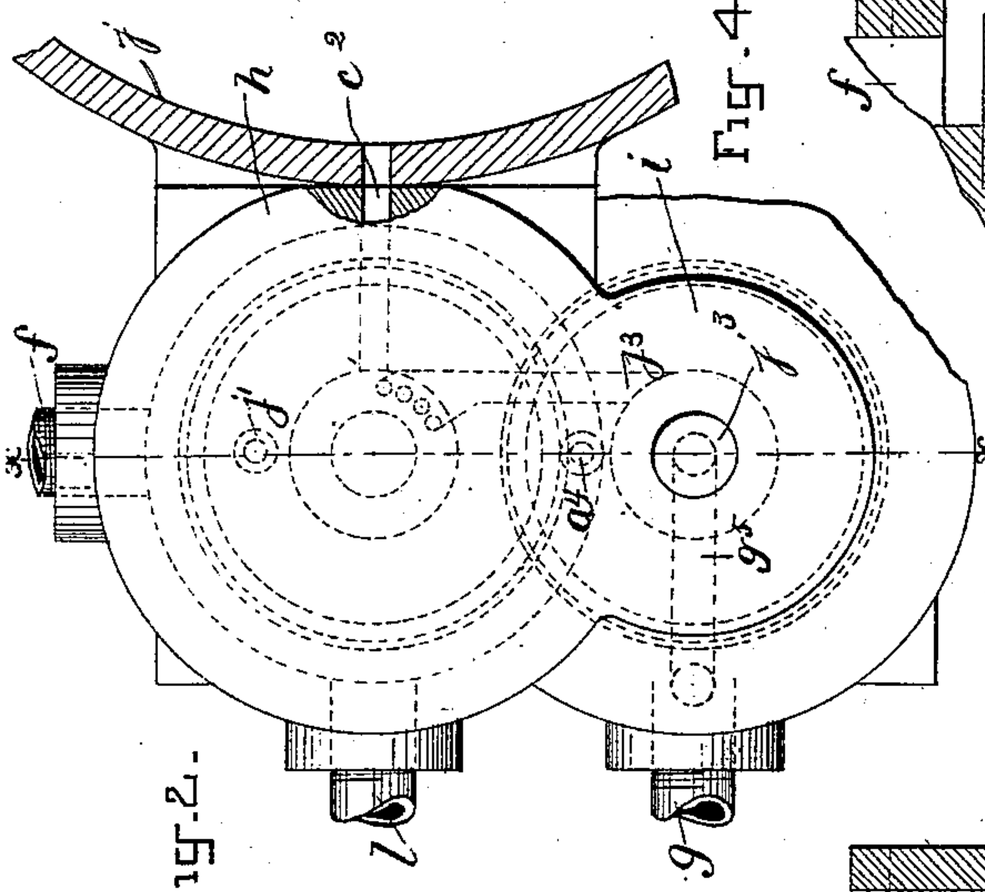

Fig. 2.

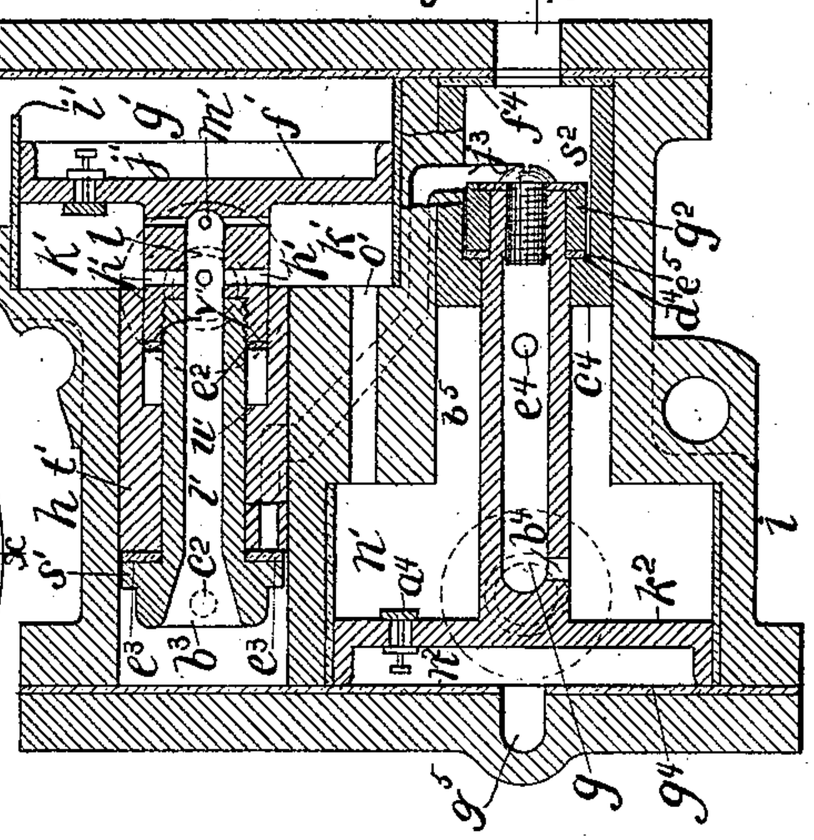

Fig. 4.

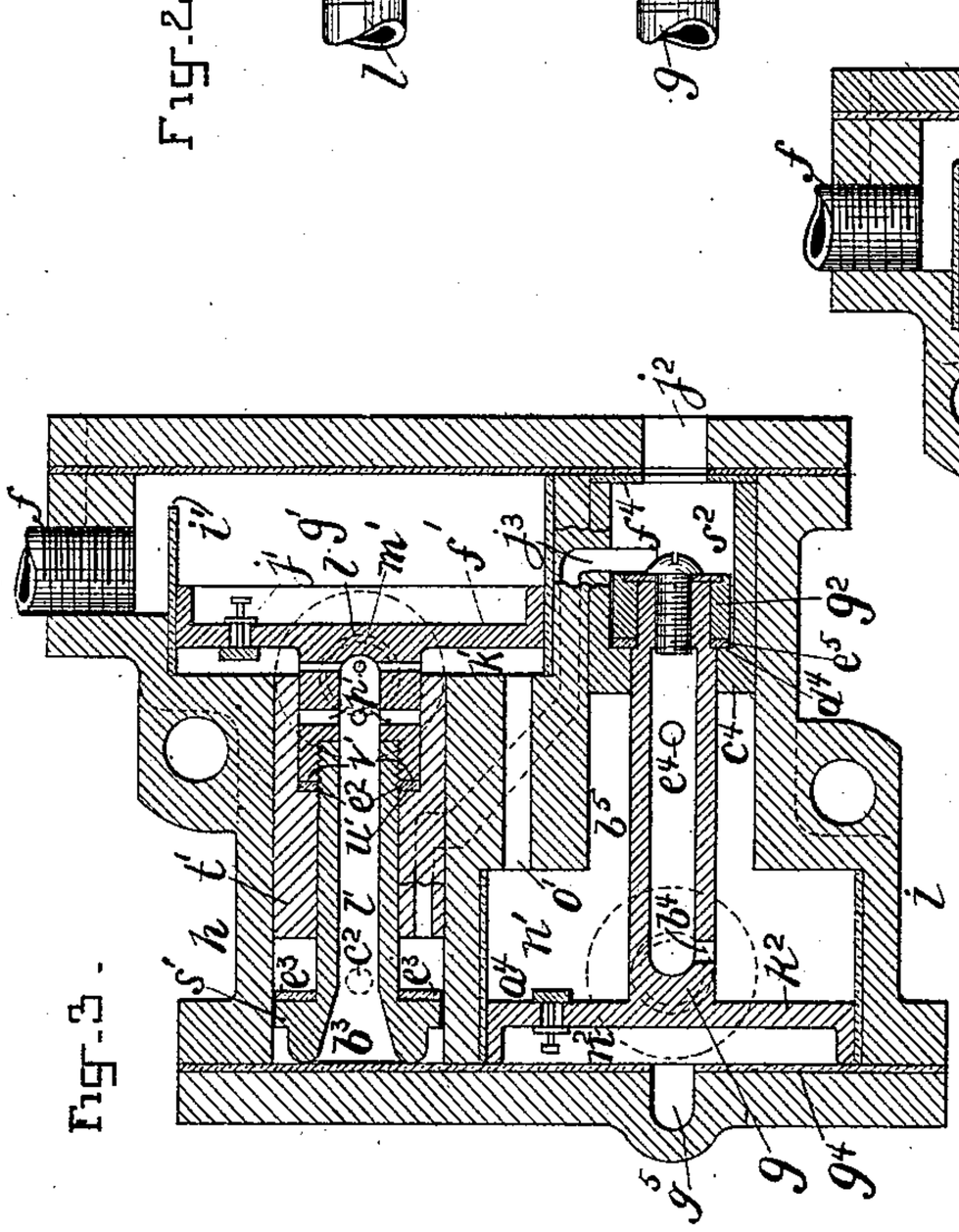

Fig. 3.

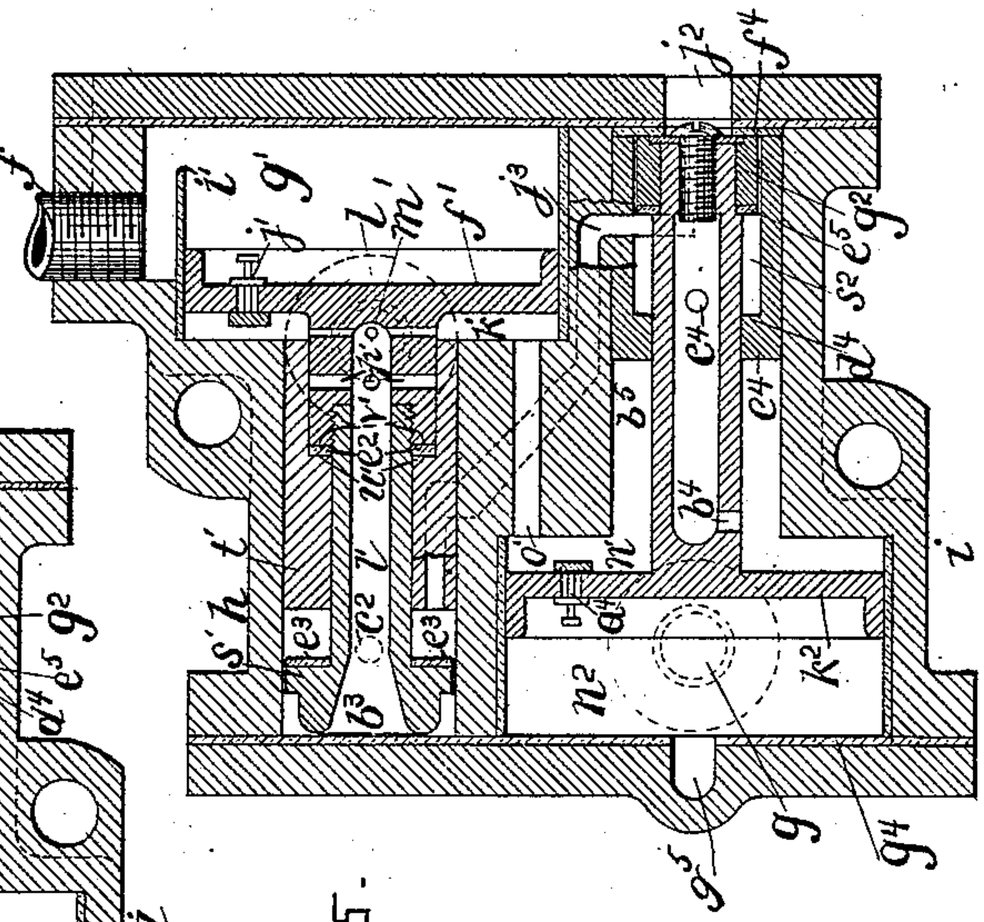

Fig. 5.

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FLUID PRESSURE BRAKE.

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Fig. 6.

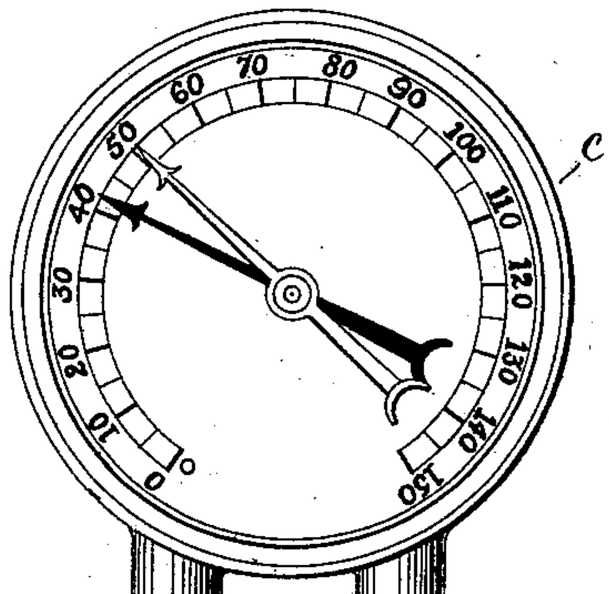


Fig. 8.

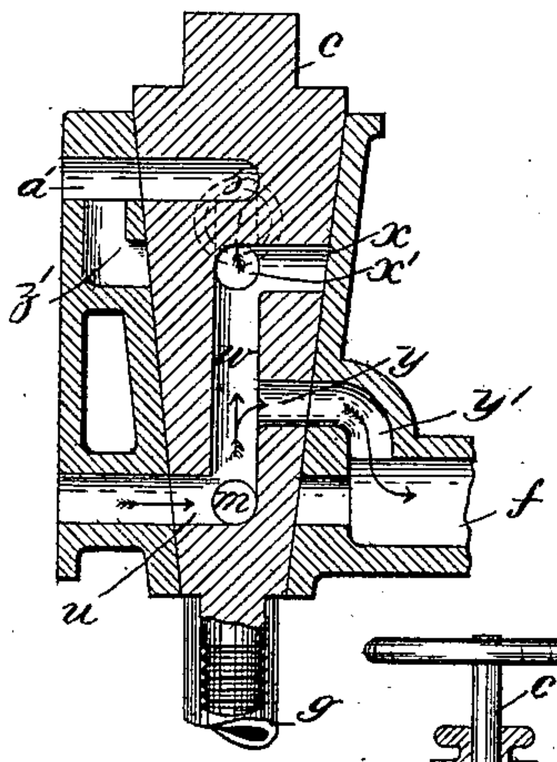
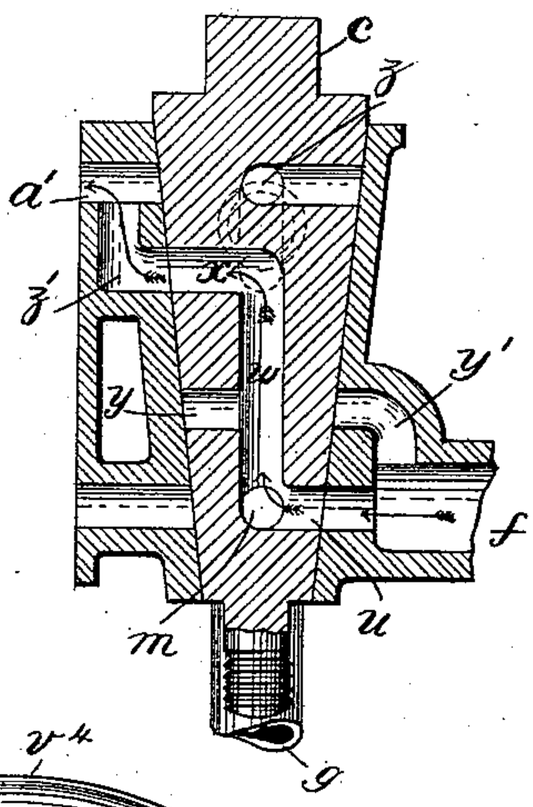


Fig. 7.



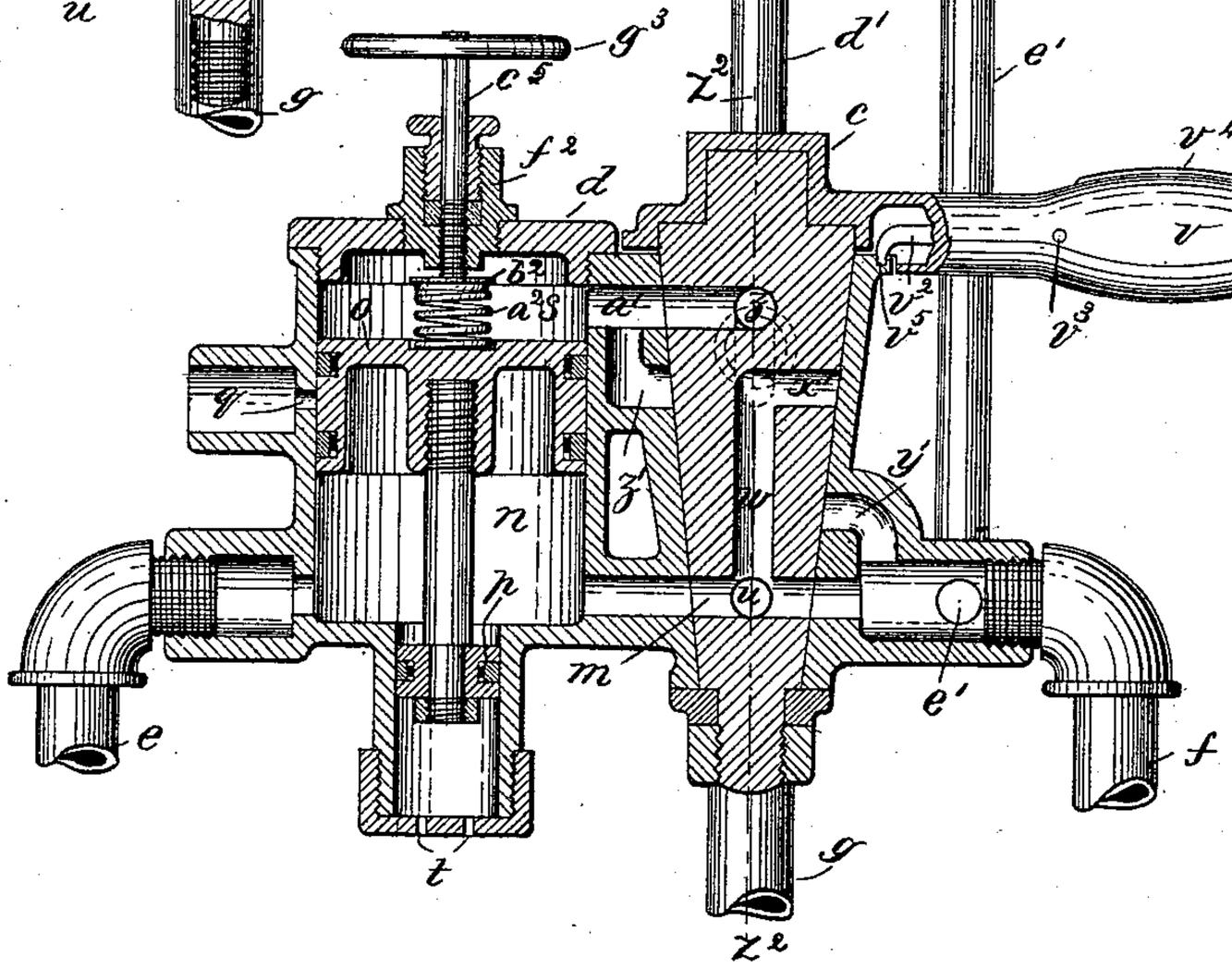
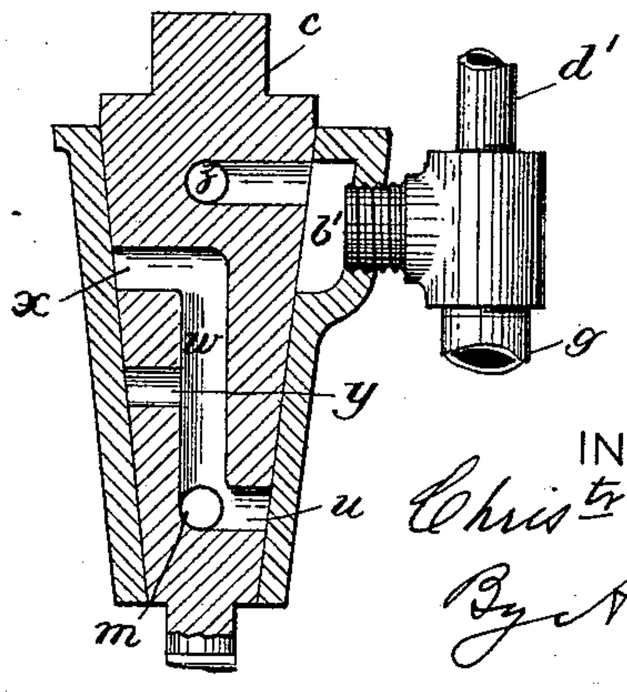


Fig. 9.



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UNITED STATES PATENT OFFICE.

CHRISTOPHER R. JAMES, OF JERSEY CITY, NEW JERSEY.

FLUID-PRESSURE BRAKE.

SPECIFICATION forming part of Letters Patent No. 539,619, dated May 21, 1895.

Application filed August 10, 1893. Serial No. 482,833. (No model.)

To all whom it may concern:

Be it known that I, CHRISTOPHER R. JAMES, a subject of the Queen of Great Britain, and a resident of Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Fluid-Pressure Brakes, of which the following is a specification.

My invention relates generally to the piston valves of fluid pressure brakes and consists essentially of means for more effectually preventing the escape of the fluid when closed, for better control of the brakes than the pistons alone afford, it being impractical to pack the faces of the pistons so as to be sufficiently free to act promptly without considerable leakage.

My invention also consists of improvements in the duplex brake valves adapted to facilitate the application of direct pressure to the brake through both the main and secondary train pipes in a system adapted for either automatic or direct application of pressure, and it consists in an improvement of the auxiliary piston valve of the engineer's controlling valve, whereby it is designed to effect more prompt and reliable action than as heretofore made all as hereinafter fully described reference being made to the accompanying drawings, in which—

Figure 1 is a general plan view of the main reservoir usually carried on the locomotive, engineer's controlling-valve, and the auxiliary reservoir and brake-cylinder of a car, with the pipe connections, part of the brake-cylinder being broken out to show the port through which the fluid flows in and out and part of the brake-piston. Fig. 2 is an end elevation of the duplex brake-valve and section of part of the brake-cylinder. Fig. 3 is a central longitudinal sectional elevation through the duplex brake-valve on line x x, Fig. 2, showing both the valves in their normal positions. Fig. 4 is a similar section showing the main valve open for the application of the pressure from the auxiliary reservoir by the so-called "automatic action." Fig. 5 is also a similar section showing the secondary valve open for the application of direct pressure through both the main and secondary train-pipes. Fig. 6 is a sectional elevation of the engineer's controlling-valve on line y y, Fig. 1. Fig. 7 is a section of the several-way cock of the engineer's controlling-valve on the same line as Fig. 6, but showing the cock shifted to the position for applying the pressure to the brake-cylinders by the automatic action and through the main brake-valve, as in Fig. 4. Fig. 8 is a section of the cock in the same plane when shifted to the position for applying direct pressure to the brake-cylinder through both of the train-pipes and through the secondary brake-valve, as in Fig. 5. Fig. 9 is a section of the cock on line z^2 z^2 of Fig. 6.

For illustration and application of my invention in this case I represent substantially the same engineer's controlling valve and duplex brake valves as are shown and claimed in my Letters Patent No. 524,990, dated August 21, 1894, the description of which I now repeat substantially as in that application with such changes as are necessary to point out the improvements, and I limit my claims in the present case to the said improvements.

The main reservoir usually carried under the foot plate of the locomotive is represented at a, Fig. 1. It is supplied with air through the pipe b, from the compressor.

The engineer's controlling valve consists of the several way cock c, and the auxiliary piston valve d, thereto to which air is supplied from the main reservoir a, through the pipe e.

f is the main train pipe, and g, the secondary train pipe.

The duplex brake valve consists of the primary piston valve h, and the secondary piston valve i, to which the main and secondary train pipes communicate respectively.

j, represents the brake cylinder and k, represents the auxiliary reservoir on the car between which and the primary brake valve h, there is communication by the pipe l.

The cock c has the straight way passage m, through it parallel with the handle v. When the cock is in the middle position, Figs. 1 and 6, said passage m opens direct communication from the main reservoir a, into the main train pipe f, the inlet to said passage being through chamber n, of the auxiliary piston valve d, between the large piston o, and the small piston p, of said valve, the former being to open and close the exhaust passage q, to the chamber s, and the latter being on its other side open to the atmosphere at t, to cause piston o to

descend when pressure is equal in chambers n and s, and thereby open said exhaust q. The cock c, also has the branch passage u, communicating with passage m, at ninety degrees thereto and to the right of the handle. It also has the longitudinal central passage w, one end of which connects with the straight way passage m, and the other end has an issue x, at the side of the cock opposite to the branch u, also issue x' in the direction of the handle, and midway of the passage w, is a branch y, opening through the side of the cock said issue x and branch y being in the same plane as branch u. There is also the right angle passage z, above the upper extremity of the central passage w, one issue of which is at the side opposite the handle and communicates with chamber s through passage a' when the cock is in the middle position, and the other issue is at the right hand side thereof and communicates at the same time with the secondary train pipe g. There is a chamber b' in the cock case through which issue x' communicates with the pipe g, when the handle is shifted to the right. There is also a passage y' in the case making communication between main train pipe f, and branch y, of the cock when the cock is shifted to the right hand, and also a passage z' making communication between issue x of the cock and passage a' when the cock is shifted to the left. Branch u, communicates with the main train pipe f, when the cock is shifted to the left, and with chamber n when the cock is shifted to the right.

The main train pipe f is in communication with the gage c' through the pipe e', and the secondary pipe g is in communication with said gage through the pipe d'.

The improvement of the engineer's controlling valve claimed in this case includes the auxiliary piston valve attachment to the several way cock for limiting the exhaust of the train pipes, also the coiled spring a^2, placed centrally on piston o, and between it and the disk b^2, carried on the inner end of an adjusting screw c^5 entering the case of piston valve d through the head of a stuffing box f^2, and having a hand wheel g^3, for adjusting it to vary the tension of the spring, the purpose of which latter improvement will be explained farther on.

The main brake valve has the large piston f' in the chamber g' to which air is admitted from the controlling valve through port i' by the main train pipe f.

The piston f' has several small valves j' permitting air to pass through it into the chamber k' which is in communitation with the auxiliary reservoir k through the pipe l. This chamber k' is also in communication with the interior of the hollow stem l' of the valve through the small ports m' admitting a limited quantity of air and said chamber k, is also in communication with the chamber n' of the secondary brake valve i, through the passage o'. At p' there are other larger ports opening into the interior of the hollow stem l'. This hollow stem l' communicates through the opening b^3, in its end with the case in which the stem works. At c^2 is a port admitting air from the case in which said stem l' works into and exhausting it from the brake cylinder j, behind the brake piston b^2, therein, which port is controlled for admitting and exhausting the air by the piston s' of said stem l' when the main valve is used for automatic action only. The said stem l' is fitted in a bushing t' of the valve case having a shoulder u' whereon a corresponding shoulder v' of the stem having the elastic packing e^2 comes to rest when the valve opens the brake cylinder to exhaust, and effectually prevents waste of air from the main train pipe and the auxiliary reservoir. The piston s' has a like shoulder fitted with elastic packing e^3, which takes effect on the end of the bushing t', next thereto and effectually prevents escape of air from the brake cylinder when said cylinder is charged through the main brake valve.

The secondary brake valve has a large piston k^2 to which air is admitted in chamber n^2, through secondary train pipe g, and passage g^5, and a small piston g^2, working in chamber s^2, which is in communication with chamber n' or with exhaust port j^2, according as piston g^2, is shifted to one side or the other of port j^3, said piston being shifted to the right of said port by air admitted under the large piston k^2, through the secondary train pipe g, and to the left by the pressure of air normally acting on the other side through passage o' from chamber k' of the main valve. Port j^3 is in communication through the end of bushing t' with the case in which piston s' of the main valve works, for exhausting the air from the brake cylinder when the main brake valve is used, and for both inlet and exhaust when the secondary brake valve is used. The piston k^2 also has small valves a^4 admitting a limited amount of air through it from chamber n^2, into chamber n' and the stem b^5 has the passage b^4—e^4 admitting air from chamber n^2, into chamber s^2 when the valve is shifted to the right for controlling the brake. See Fig. 5.

The chamber s^2 for the small piston of the secondary valve is formed in a bushing c^4, in the valve case in which is a shoulder d^4, on which the piston g^2 fitted with an elastic packing e^5, closes when the valve comes to rest in the normal position for effectually preventing waste of air. At the other end of said piston chamber s^2 is another like packing f^4, against which the other end of piston g^2, closes in like manner to hold the air effectively when it is shifted to admit direct air to the brake cylinder. A like packing g^4, is applied to the heads of both valve cases against which the pistons k^2 and s' close when the valves are in the normal position and effectually cut off escape of air.

The operation is as follows: The cock c, being set in the middle position as repre-

sented in Figs. 1 and 6 air from the main reservoir *a*, enters through chamber *n* of the auxiliary piston valve *d*, and the straight way passage of the cock *c*, directly to chamber *g'* of the main brake valve *h* through main train pipe *f*, and taking effect on piston *f'*, shifts said valve to its normal position, Figs. 3 and 5, opening exhaust port c^2, and permitting the air to escape from the brake cylinder through exhaust ports j^2, j^3, for the release of the brakes, the secondary train pipe *g*, being partially exhausted through cock *c* and valve *d* at the moment of setting the cock in the middle position, so that the secondary valve returns to normal position leaving exhaust ports j^2, j^3, open. At the same time valves *j'* open and admit air to chamber *k'* and thence to the auxiliary reservoir *k* through the pipe *l* and the hollow stem of said valve fills also, through ports *m'* ready for admitting air to the brake cylinder again. When the brakes are to be again applied the maximum pressure then shows on the gage by the hand represented in white both pipes *d'* and *e'* then being open thereto. The secondary train pipe is only partially exhausted as above stated because when the pressure falls in chamber *s*, to a certain extent it is overbalanced by the pressure under piston *o*, which then rises and cuts off further exhaust.

Owing to the very rapid waste of the compressed air through very slight openings of escape, it is very important to economize as much as possible in the waste of air for effecting the partial exhaust through secondary train pipe *g*, and owing to the great difficulty if not impossibility of proportioning the pistons *o* and *p* to effect the exhaust of the secondary train pipe *g* with certainty but without too much waste, I have adopted the plan of making them in such proportions that piston *o* will not be overbalanced quite sufficiently by the air on the side of chamber *s*, for such action as will effect the movement of the secondary brake valve, and reinforcing it with the spring a^2, and adjusting stem c^5 before described, so that when set up for action such additional pressure may be thereby added to the piston as will cause it to act and then permit it to close again promptly when the secondary valve has shifted.

To apply the brakes with moderate effect the cock *c*, is shifted to the left hand from the middle position which shuts off the supply of air through the main pipe and opens said pipe to chamber *s* of the auxiliary piston valve *d*, through passages *u*, *w* and *x* as seen in Fig. 7. The back pressure on piston *o*, depresses it and opens exhaust port *q* through which the air pressure is so reduced in chamber *g'* of main brake valve *h*, that air from the reservoir *k* taking effect on the other side of piston *f'* and closing valve *j'* shifts the valve to the right, opening brake cylinder port c^2 to air from the hollow stem of the valve which, being supplied through small ports *m'* takes moderate effect, but a little later ports *p'* open into chamber *k'* admitting a larger supply with greater effect in applying the brakes. The reduction of pressure in the main train pipe and chamber *g'* is then indicated by the change of the pointer of the gage *c'* as indicated in black in Fig. 6, communication being then through pipe *e'*. In this condition the air pressure is reduced in reservoir *k*, by the amount admitted to the brake cylinder so that when another application of maximum force may be required as often happens in cases of emergency it cannot be had, the main train pipe being shut off. To overcome this difficulty and enable full pressure to be instantly let on to both the auxiliary reservoir and the brake piston after first application as above described, and also for application of maximum force in the first place when required, the secondary brake valve and the secondary train pipe have been provided, and the cock of the engineer's valve has been constructed and arranged in relation thereto as before described, the operations of which are as follows:—Whether the cock *c* be in the middle position or in the left hand position as last described, it is shifted to the right hand position in which position both the main train pipe *f*, and the secondary train pipe are open as will be seen in Fig. 8, the one through passages *u*, *w*, *y* and *y'* and the other through passages *u*, *w* and *x'* and chamber *b'* of the cock case. The valve *h* is therefore opened to air under direct pressure from the main reservoir, and the auxiliary reservoir is replenished under like pressure the air entering through valves *j'*, chamber *k'* and pipe *l*. At the same time air of full pressure enters chamber n^2, through secondary train pipe *g* behind the large piston k^2, of secondary brake valve *i*, and shifts it so as to close exhausts j^3 and j^2 by piston g^2 and open communication with the brake cylinder for air of full pressure both from the auxiliary reservoir *k* and the main train pipe, and besides these two sources of direct air pressure, I have now provided piston k^2 with a series of small valves a^4, which also at the same time admit direct air through the secondary train pipe, the small valves in piston k^2 and the passage $e^4\,b^4$; thus applying maximum force at will. Return of the cock *g* to the middle position opens secondary train pipe *g*, through passages *z*, *a'* to chamber *s* wherein the back pressure of the air on piston *o* of the auxiliary valve depresses it and opens exhaust port *q*, causing, by escape through said port, such reduction of pressure in chamber n^2, that valves a^4 are closed and the secondary valve is shifted back by pressure in chamber *n'* so that piston g^2 opens the brake cylinder to exhaust through ports j^3, j^2. When this takes place further reduction of pressure and waste of air from chambers n^2 and *s* are prevented by piston *o* of the auxiliary valve *d* being overbalanced in chamber *n* so as to close exhaust port *q*.

The lever *v* has the usual spring latch v^2,

within it pivoted at v^3 to lock it in position by engaging in stop holes v^5, part of said latch protruding at v^4 to be depressed when the handle is grasped by the engineer to release the cock preparatory to shifting it.

It will be seen that after the application of maximum force with direct action of air of the main reservoir through the instrumentality of the secondary brake valve as above described, and when through the checking of the train the maximum force is no longer needed the lesser force by the air of the auxiliary reservoir alone may be again applied through the primary valve alone as in the first instance. It will also be seen that when a car fitted with my improved duplex brake valve is connected in a train of cars having the automatic system only, in which the secondary brake valve cannot be used for lack of the secondary train pipe and the contrivances of the engineer's controlling valve therefor, the elastic packing of the secondary brake valve will effectually prevent loss of air through said valve and thus render its presence in the automatic system wholly unobjectionable.

I claim—

1. The combination with the primary valve having the large and small pistons connected by the intermediate hollow and laterally perforated stem admitting air from between the pistons to the brake cylinder, of the packed shoulders of the stem between the lateral perforations and the small piston, and adapted to prevent leak along the stem when the valve is in the normal position substantially as described.

2. The combination with the primary valve having the large and small pistons connected by the intermediate hollow stem admitting air from between the pistons to the brake cylinder, of the case shoulder having the exhaust port, and the packed shoulder of the small piston seating on said case shoulder when said small piston opens the brake port to admit the air substantially as described.

3. The combination with the brake cylinder port, of the primary valve having the large and small pistons connected by the intermediate hollow stem admitting air from between the pistons to the brake cylinder, said small piston of the primary valve controlling said port, the shoulder of the case of the valve stem having the exhaust port, the elastic packing of the case on the side of the piston controlling the inlet of air to the cylinder port and the elastic packing on the side of said piston controlling the exhaust substantially as described.

4. The combination with the brake cylinder port, of the piston valve for controlling said port, having the axial inlet passage to the brake cylinder adapted to be normally closed by the end wall of the case, the exhaust port in the shoulder of the case on the other side of the piston adapted to be closed by said piston when admitting air to the cylinder, said end of the valve case and the piston having elastic packings for the respective sides of the piston substantially as described.

5. The combination with the primary valve of the secondary valve subject to be opened by direct pressure through the secondary train pipe, and having the large and the small pistons in separate chambers, and the passage through the stem communicating between said chambers when said valve is opened by said pressure from the secondary train pipe, said primary and secondary valves having communication through the port j^3 substantially as described.

6. The combination with the primary valve, of the secondary valve having the valves in the larger piston subject to be opened by direct pressure through the secondary train pipe, and the passage through the stem communicating with the chamber for the small piston of the valve, when the valve is shifted by such pressure, said primary and secondary valves having communication through the port j^3 substantially as described.

7. In the engineer's controlling valve the combination with the several way cock controlling the train pipes, of the auxiliary piston valve adapted to limit the exhaust from the train pipes, said valve having the large piston subject on one side to the air supply for the brakes, and on the other side to the train pipe exhaust and controlling the same, said valve also having the small piston subject on one side to the air supply for the brakes, and on the other side open to the atmosphere substantially as described.

Signed at New York city, in the county and State of New York, this 5th day of July, A. D. 1893.

CHRISTOPHER R. JAMES.

Witnesses:
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S. H. MORGAN.