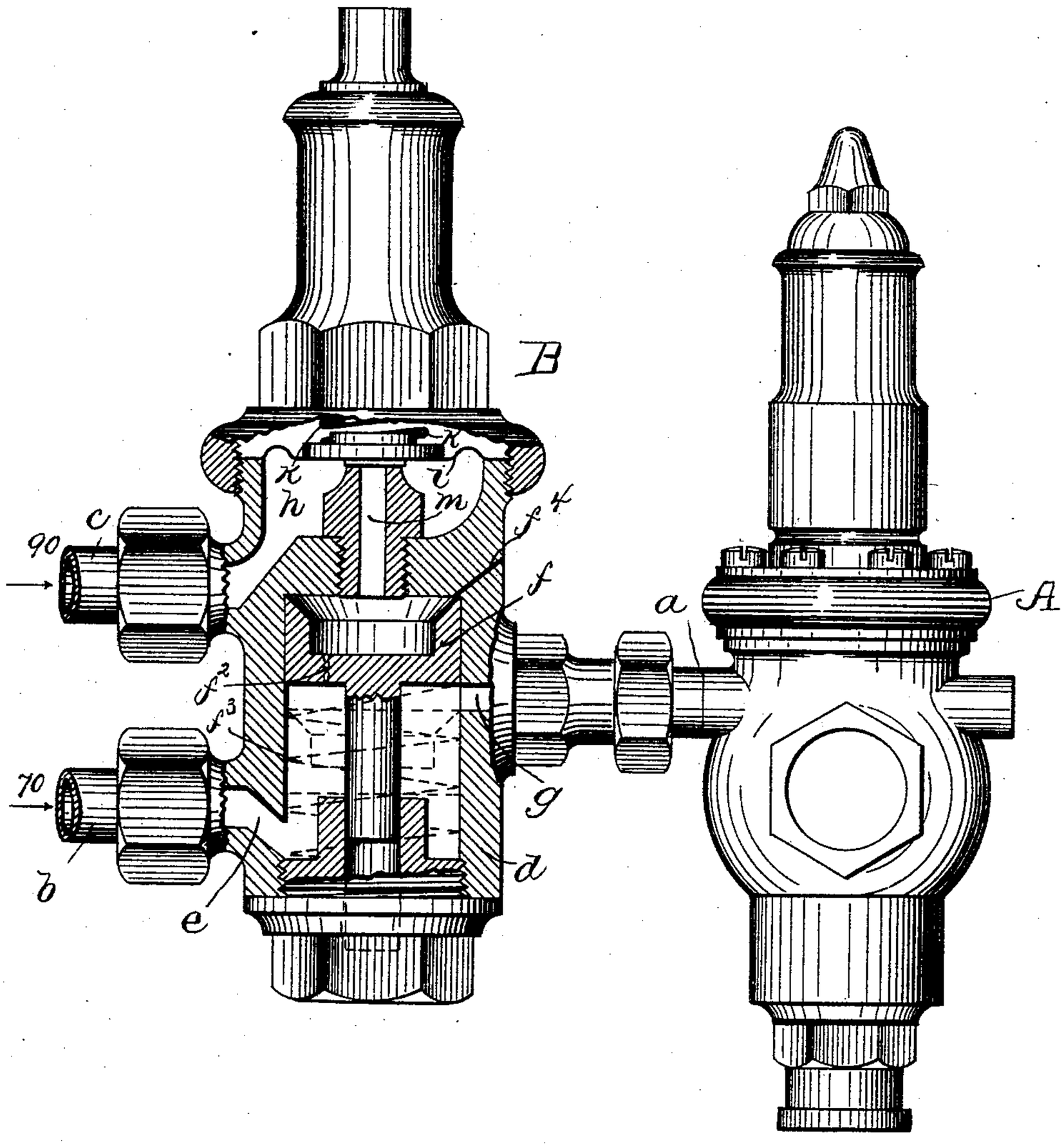
(No Model.)

W. B. MASON.

FLUID PRESSURE REGULATOR.

No. 481,579. Patented Aug. 30, 1892.



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UNITED STATES PATENT OFFICE.

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FLUID-PRESSURE REGULATOR.

SPECIFICATION forming part of Letters Patent No. 481,579, dated August 30, 1892.

Application filed November 14, 1891. Serial No. 411,900. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM B. MASON, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Fluid-Pressure Regulators, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention relates to an apparatus for regulating fluid-pressure, and is especially applicable in cases where there are two different pressures which may under certain circumstances be called upon to regulate the apparatus.

The invention is applicable, for example, to a pressure-regulator for governing the operation of the force-pump employed in air-brake apparatus for railway-trains, and for convenience will be herein described as employed in connection with an air-brake apparatus, although the invention is applicable to other apparatus in which analogous conditions may exist.

In air-brake apparatus as commonly used a force-pump actuated by steam from the locomotive-boiler compresses air into a tank or reservoir, from which the air is delivered to the train-pipe so as to control and actuate the brake mechanism on the cars. Usually a reducing valve or instrument of some kind is introduced between the reservoir and train-pipe, so that the normal pressure in the former is considerably higher than in the latter, the pressures being, for example, ninety pounds in the reservoir and seventy pounds in the train-pipe, and these being the maximum pressures that it is intended to carry. The admission of steam to actuate the air-pump may be controlled by any fluid-pressure-regulating device, which causes the actuating steam to be admitted when the pressure to be maintained falls below the normal amount and cuts off the steam when the pressure rises above the normal amount, such a pressure-regulating device being shown, for example, in Letters Patent No. 367,536, granted to me August 2, 1887. Any other efficient regulating device may, however, be employed in connection with the apparatus forming the subject of this invention. When such a regulator is employed in connection with air-brake apparatus, the pressure-chamber that receives the pressure by which the air-pump or engine is to be controlled is commonly connected with the train-pipe, so that although the pump is forcing air into the reservoir the operation of the pump depends upon the rise and fall of pressure in the train-pipe, the pump being set in operation, for example, when the train-pipe pressure falls below seventy pounds and being stopped or checked when by the continued action of the pump the pressure is again brought up to seventy pounds. As the reservoir and train-pipe are so connected as to maintain a definite relation between their pressures, it is obvious that under normal conditions the controlling of the pump by the train-pipe pressure will also control the reservoir-pressure, as the train-pipe pressure will not fall below the normal without also causing the reservoir-pressure to fall below the normal, and it will be brought up to the normal only by forcing air into the reservoir sufficiently to bring the pressure therein up to the normal amount for the reservoir-pressure. There are, however, certain conditions in the use of the brakes under which the normal communication between the reservoir and train-pipe is changed, this being the case when the brakes are applied, so that although the pressure admitted to the pressure-chamber of the regulator from the train-pipe is below the normal, thus causing the force-pump to run, the reservoir-pressure may be carried above its normal amount without correspondingly raising the train-pipe pressure, and it sometimes happens that where the brakes remain applied for a considerable length of time—as, for example, when the train is running a long distance on a downgrade—the pump may continue operating until the reservoir-pressure is carried considerably above its normal amount, and when in the subsequent operation of the brakes the train-pipe is again connected with the reservoir the pressure in the train-pipe will be carried above its normal amount and will cause the brakes to be applied too severely at their next operation, and thus make the car-wheels slip on the rails.

The object of the present invention is to provide what may be called a "secondary

regulator" controlled by the reservoir-pressure, which is called into operation only when the reservoir-pressure rises above its normal amount, and which when so operated permits the reservoir-pressure, instead of the train-pipe pressure, to control the main or primary regulator, and thus immediately cause the stopping of the pump until the reservoir-pressure is again lowered to or below its normal amount and the main regulator thereby placed under control of the train-pipe pressure again.

The secondary regulator forming the subject of this invention comprises a valve that co-operates with the inlet to the pressure-chamber of the main-pump pressure-regulator and controls the connection of said inlet with pressure-pipes communicating with the sources of different pressures—for example, with the train-pipe and with the reservoir of the air-brake apparatus. When the higher pressure is not above its normal amount, the valve is in such position as to connect the main regulator with the source of the lower pressure—that is, with the train-pipe—and the main regulator operates exactly the same as if the secondary regulator were not used. If, however, the lower or train-pipe pressure should remain below normal, and thus through its control of the main regulator cause the force-pump to continue to act, while the higher or reservoir pressure should by such continued action of the pump rise above its normal amount, the said reservoir-pressure upon passing above the normal predetermined amount will by its action in a pressure-chamber of the secondary regulator cause the controlling-valve of the latter to be shifted in such manner that the communication between the train-pipe and the primary or main regulator will be cut off, and communication between the reservoir and the primary or main regulator will be established, when the high pressure thus introduced into the pressure-chamber of the main regulator will immediately cause the pump to cease acting, and this condition will remain until the higher pressure is again brought back to the normal, when the secondary regulator will return to the normal condition, placing the main regulator under control of the lower or train-pipe pressure.

The drawing shows mainly in longitudinal vertical section a secondary regulator embodying this invention, to be employed in connection with a primary regulator, which is shown in elevation.

The primary or main regulator A may be of any suitable or usual construction, and need not be herein described, as its specific construction forms no part of this invention.

A suitable regulator to be employed in carrying out this invention is shown in Letters Patent No. 367,536, dated August 2, 1887, which may be referred to for an understanding of such regulator apparatus if need be.

The main regulator A, of whatever specific construction it may be, has an inlet-passage *a* to a pressure-chamber, which receives the pressure in accordance with which said regulator is operated, the internal construction being such that when the pressure in the pressure-chamber rises above a predetermined normal—say seventy pounds—it causes the regulator-valve to be closed and the force-pump or other device that is the source of said pressure to cease operating, and when, on the other hand, the pressure introduced through the pipe *a* to the pressure-chamber of the regulator falls below the predetermined normal it causes the valve of the regulator to be opened and the force-pump or apparatus that produced the pressure to be set in operation, thus tending to raise the said pressure again, and by these means the regulator so operates as to maintain substantially uniform pressure in the space that communicates through the inlet-pipe *a* with the pressure-chamber of said regulator.

When it may be necessary in operation of the apparatus to control the operation of the regulator A in accordance with two different pressures that are maintained by the pump or apparatus controlled by said regulator, the secondary regulator B, forming the subject of this invention, is employed. The said regulator B is provided with two inlet-passages *b c*, connected with the spaces in which the two pressures are to be maintained, each as nearly constant as possible, the said pipe *b* being, for example, connected with the train-pipe of an air-brake apparatus in which the pressure is to be maintained at seventy pounds, as indicated by the figure "70," opposite the pipe *b*, while the pipe *c* is connected with the reservoir in which the maximum pressure to be maintained is ninety pounds, as indicated by the figure "90," it being understood that in this apparatus the lower or train-pipe pressure is derived from the reservoir containing the higher pressure, in which latter the higher pressure is maintained by the pump or apparatus controlled by the main regulator A. The said lower-pressure inlet *b* communicates with a valve-shell *d* through a port *e*, the said shell *d* containing a valve *f*, (shown as a piston working therein and controlling communication through the port *g* with the inlet *a* to the pressure-chamber of the main regulator.) When the valve *f* is in normal position, as indicated in full lines, communication is afforded through the ports *e* and *g* of the valve-chamber between the low-pressure inlet *b* to the secondary regulator and the inlet *a* to the pressure-chamber of the main regulator, while communication between the high-pressure inlet *c* and the main regulator A is cut off. The said high-pressure inlet *c* communicates with a pressure-chamber *h* in the secondary regulator, where it acts upon a movable valve-controller (shown as a diaphragm *i*) in opposition to the force of a spring *k*, which is set to overbalance the maximum pressure intended

to be carried in the reservoir or part communicating with the pipe *c*. The said diaphragm *i* is provided with or constitutes a controlling-valve governing a port *m*, leading into the main-valve chamber *d* at the opposite end to that which communicates with the port *e*. Thus if the pressure from the pipe *c* in the chamber *h* rises above the predetermined maximum it lifts the controlling-valve and places the port *m* in communication with the pipe *c*, thus admitting fluid under high pressure to act upon the upper end of the piston *f*, which is subjected at its lower end only to the lower pressure from the pipe *b*. The difference in pressure at the two ends of the valve or piston *f* is sufficient to move the said piston to the dotted-line position, in which movement it closes communication between the lower-pressure inlet *b* and the port *g* and places the port *g* in communication with the upper part of the valve-chamber, and consequently through the port *m* with the high-pressure pipe *c*. The higher pressure from the pipe *c* is thus admitted through the pressure-chamber and ports *m* and *g* to the inlet-pipe *a* of the main regulator A, and thus operates the said main regulator in such manner as to cause the pump or pressure-producing apparatus to cease operating, so that the pressure in the pipe *c* will not be further raised. As soon as the pressure in the pipe *c* falls below the maximum the secondary valve closes the port *m* and thus relieves the upper surface of the piston *f* from the pressure, and said piston, being exposed to the pressure from the pipe *b*, is moved back to its original full-line position. To effect this return movement of the piston *f*, it might be fitted sufficiently loose in the valve-chamber or provided with a slight passage, as indicated in dotted lines at f^2, sufficient to allow the fluid in the valve-chamber *d* above the piston to pass through the same, or, in other words, to equalize the pressure as soon as the admission of fluid through the port *m* is cut off, in which case a light spring, as shown in dotted lines at f^3, would be provided to move the piston toward the full-line position when the pressure thereon was thus equalized. When the port *m* is open, the difference in pressure at the two ends of the piston is sufficient to overcome the force of such a spring, and the slight leakage through or around the piston would not disturb this difference in pressure, as it is not sufficient to materially raise the pressure in the train-pipe or parts communicating with the pipe *b*.

Instead of providing for leakage past the piston and using the spring, a small escape-passage f^4 may be made from the upper part of the valve-cylinder *d* to the atmosphere, so that when the high pressure is cut off from entering at the port *m* the air will escape from above the piston, permitting it to be moved by the lower pressure. The piston itself prevents the air from escaping through the passage f^4 from the end part of the valve-chamber and low-pressure inlet *b*, and although the air will escape when the port *m* is opened the amount will be so slight as not to be objectionable, especially as it is only under abnormal conditions that the port *m* is open, and usually said port is open only during a very small portion of the time that the apparatus is in use.

The operation is as follows: Normally the pressure of seventy pounds is maintained in the pipe *b* and ninety pounds in the pipe *c*, and the pipe *b* is in communication with the inlet *a* to the pressure-chamber of the main regulator, and thus operates to check the increase of pressure above the normal and to cause pressure to be added when it falls below the normal in the usual manner. In other words, under the usual conditions when the pressure is below seventy pounds in the pipe *b* the air-pump will be runing, forcing air into the reservoir, from which it will enter the train-pipe, thus tending to raise the pressure in the train-pipe until the matter again arrives at seventy pounds, when the pump will again be stopped. In case, however, the train-pipe should not be drawing pressure from the reservoir, the train-pipe pressure might fall below seventy pounds, and the pump thus be caused to force air into the reservoir, which, since it does not pass into the train-pipe for the time being, would not immediately raise the train-pipe pressure, and consequently the pump would continue operating until the reservoir-pressure was considerably above the normal if communication between the reservoir and train-pipe should be cut off for any considerable period of time. Under such circumstances, as soon as the reservoir-pressure rises slightly above the normal it will open the secondary valve in the secondary regulator and thus admit the fluid under higher pressure through the port *m* into the main-valve chamber *d* of the secondary regulator, causing it to operate the valve *f* in such manner as to admit the higher pressure to the pressure-chamber of the main regulator, when such higher pressure would immediately operate the main regulator, so as to cause the air-pump to cease operating, and these conditions will be maintained until the pressure is again drawn down from the reservoir by communication with the train-pipe, when the valve *f* would be restored to its normal condition and the train-pipe pressure placed in control of the main regulator. A secondary controlling-instrument of this kind is wholly independent of the working parts of the main regulator, and consequently may be made as a separate instrument and applied in connection with any regulator that needs to be controlled at times by pressures from different sources.

I claim—

A secondary regulator for controlling a

fluid-pressure-regulating instrument, said secondary regulator comprising a valve-shell having passages communicating with different sources of fluid-pressure, and a main valve governing the communication between said passages, respectively, and the pressure-inlet to the main regulator, combined with a pressure-chamber and secondary valve therein controlled by pressure from one of said inlets and governing the operation of the said main valve, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WM. B. MASON.

Witnesses:
M. E. HILL,
JOS. P. LIVERMORE.