(No Model.)

W. B. MASON.

DAMPER REGULATOR.

No. 426,835. Patented Apr. 29, 1890.

Fig. 2,

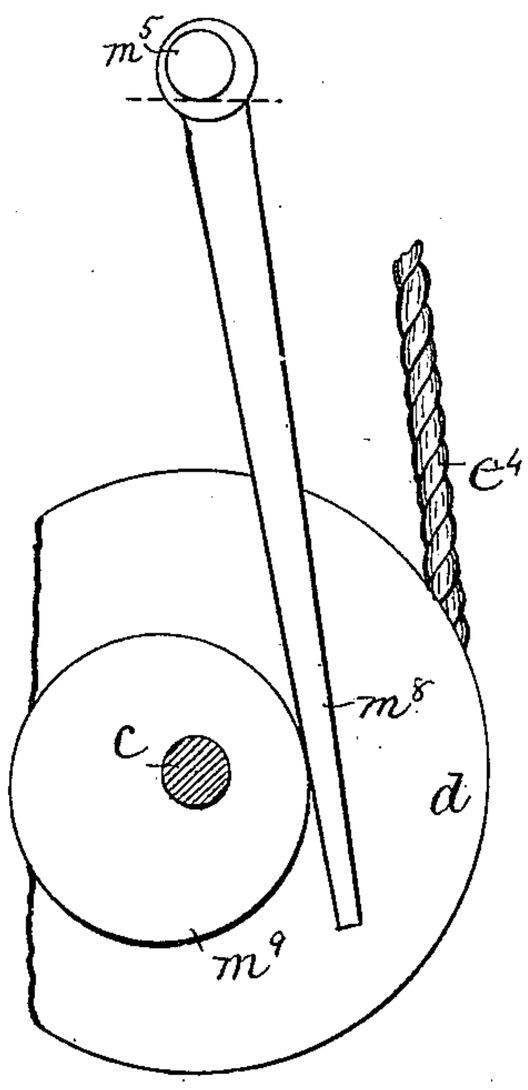
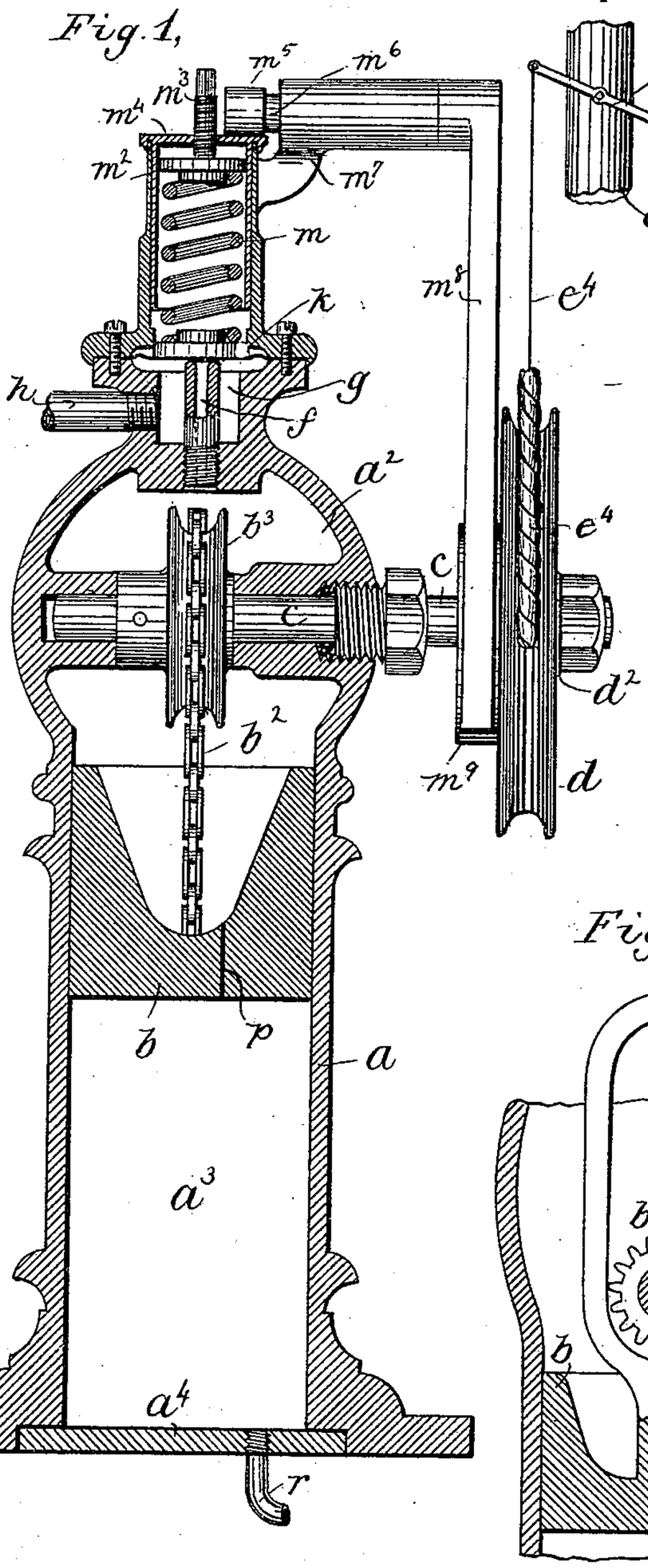


Fig. 1,



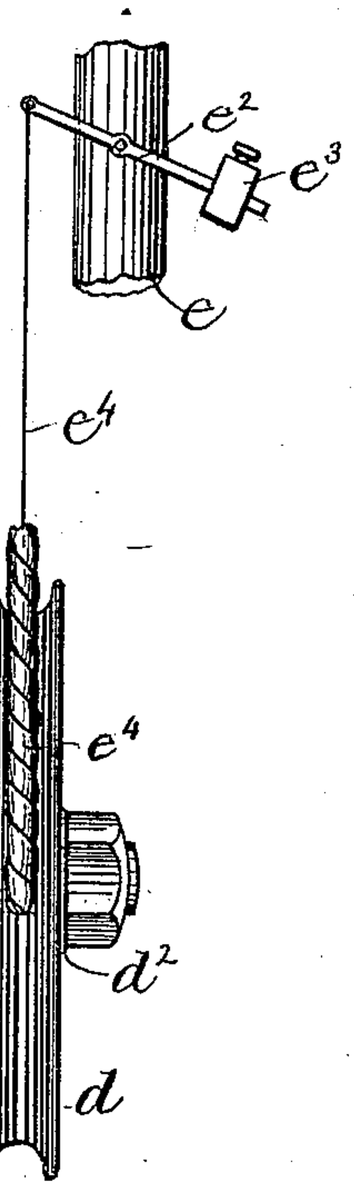
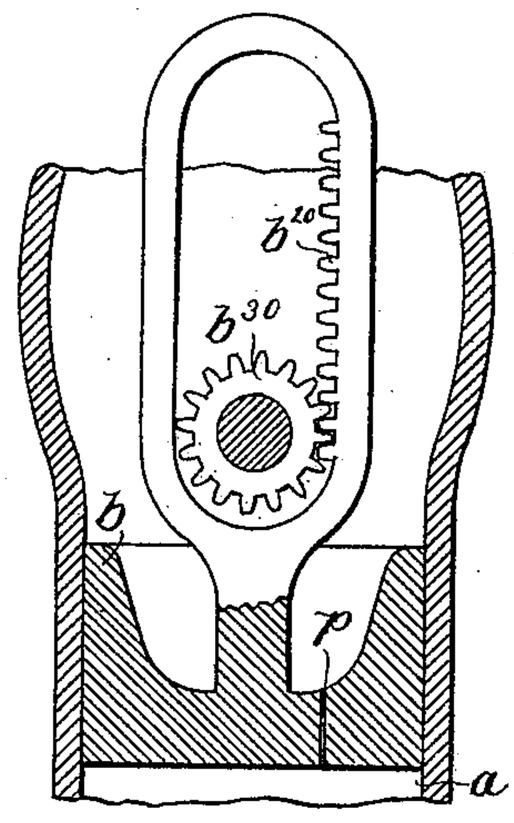


Fig. 3.



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UNITED STATES PATENT OFFICE.

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DAMPER-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 426,835, dated April 29, 1890.

Application filed October 4, 1889. Serial No. 325,975. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM B. MASON, of Boston, county of Suffolk, and State of Massachusetts, have invented an Improvement in Damper-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 a damper-regulator for controlling the operation of the furnace of a steam-generator in accordance with the pressure of the steam produced, thereby checking the fire as the pressure rises above the desired limit and increasing the fire when the pressure falls below the said limit, so that the pressure is automatically maintained substantially constant, only a slight variation from the predetermined point being required to cause the proper change in the condition of the fire to prevent further variation in the pressure of the steam.

The invention is shown embodied in a damper-regulator of that class in which a valve is made responsive to changes in pressure of the steam and controls the action of a motive fluid upon a motor or engine that opens and closes the damper or other draft-regulating device to thereby govern the condition of the fire in the furnace.

While the apparatus is described as controlling the draft of the furnace, it is obvious that it is equally applicable to any means for controlling the fire or heat by which the pressure that it is desired to maintain constant is generated—as, for example, by controlling the admission of the fuel in case a gaseous or liquid fuel is employed—and it is furthermore obvious that the apparatus is not necessarily used to control steam-pressure, as the operation would be the same with other fluids.

The invention consists, mainly, in details of construction of the regulating apparatus, by which it is made compact and at the same time positive and reliable in operation and convenient for attachment to the boiler and furnace or other pressure-generator.

Figure 1 is a vertical longitudinal section of a damper-regulator device embodying this invention; Fig. 2, a detail to be referred to, and Fig. 3 a modification to be referred to.

The instrument comprises a motor consisting of a cylinder a and piston b movable therein, said piston being connected preferably by a flexible connector or chain b^2 with a pulley b^3, fixed upon a shaft c, provided with a pulley d, which may be connected with the damper, slide, or other device that directly controls the fire by which the pressure to be regulated is produced. This connection is illustrated in Fig. 1, in which a portion of the chimney or uptake is represented in small scale at e, the said chimney containing a damper of usual construction, the shaft of which is provided with an operating-arm e^2, one end of which is provided with a weight e^3 or otherwise acted upon with a tendency to open the damper, while the other end of said arm is connected by a cord or other flexible connector e^4 with the pulley d, the end of said cord being fastened to the periphery of the pulley, as indicated at d^2, so that the rotation of the pulley produced by downward movement of the piston b will turn the lever e^2 on its fulcrum, raising the weight e^3 and closing the damper in the chimney e. The shaft c has its bearing in a chamber a^2, formed above the cylinder a and having its interior in communication with one end of said cylinder, the pulley b^3 and chain connector b^2 being contained within the chamber a^2, which may be made, as shown, in the same casting with the cylinder a.

Steam or other actuating fluid is admitted into the chamber a^2, so as to act upon the upper end of the piston b and force the same downward in the cylinder a through the port f, which connects the interior of the chamber a^2 with a space or pressure-chamber g, communicating with the boiler or other source of fluid under pressure through an inlet-pipe h. The space g thus always contains the actuating-fluid under pressure, and the passage of the said fluid through the port f to act on the piston b is controlled by a diaphragm k, which is itself acted upon by a definite controllable force, shown in this instance as derived from a spring m, which tends to hold the diaphragm seated upon a a seat at the end of the port f, and thus to prevent the admission of the actuating-fluid through the port f to the chamber a^2 and cylinder a.

When, as in the present instance, the motor is operated by the fluid the variable press-

ure of which is intended to regulate or govern the operation of the motor, the diaphragm which is exposed to the variable pressure of the fluid may, and in the present case does, itself constitute the valve that controls the admission of fluid to the motor, said diaphragm practically constituting one wall of the pressure-chamber g, so that when the pressure is sufficient to overcome the predetermined force of the spring it raises said diaphragm and thereby opens the port leading to the motor.

The port may be, as shown, formed in a piece of pipe secured in the main casting of the motor and finished at its end to form a suitable seat for the diaphragm, this being a far simpler, less expensive, and more efficient construction than when the diaphragm is employed to move a valve constituting a separate device or part of the apparatus to control the port, as has been heretofore practiced.

The spring m is regulated by a follower m^2, adjustable by a screw m^3, so as to exert a pressure on the diaphragm k sufficient to balance the normal pressure which it is desired to maintain in the fluid, and consequently if the fluid-pressure is below the normal the spring m will overbalance it and will retain the port f closed, preventing the admission of fluid into the cylinder a, so that the piston b and shaft c and pulley d connected therewith will be acted on only by the weight e^3 (see Fig. 1) and will move the said shaft in the direction to open the damper or permit the heat to act with maximum effect in the steam-generator, thus tending to increase the fluid-pressure. When under the action of the heat the fluid-pressure rises to the predetermined amount, its pressure on the diaphragm k just balances that of the spring m, and the slightest increase in pressure will raise the diaphragm and thus open the port f and admit the fluid to the cylinder a, which in acting upon the piston b will move the same and the connected pulley d in the direction to close the damper or otherwise check the application of heat to the generator, so that the pressure will not be further increased, and when the pressure falls below the predetermined amount the admission of fluid will again be cut off by the diaphragm k and permit the weight e^3 to act and again open the damper to increase the heat.

In order to permit the return movement of the piston b under the action of the weight e, it is necessary to exhaust the fluid from the space in the cylinder above the piston. This may be performed in any suitable manner. As herein shown, the piston b is provided with a leak-passage, as indicated at p, Fig. 1, or otherwise made slightly leaky, so as to permit the fluid to pass through the piston into the space a^3 in the cylinder a, below the piston, but more slowly than the fluid is admitted through the port f, so as not to materially diminish the pressure on the piston b when the port f is open. When the port f is closed, however, so that the admission of fluid to the cylinder is cut off, the weight e^3 in moving the piston back will cause the fluid to pass through the piston to the other side thereof, or into the exhaust-chamber a^3, and said fluid acts as a cushion to prevent too sudden movement of the piston when admission of the fluid is cut off. At the next downward movement of the piston b the fluid which was previously exhausted through it into the space a^3 will have to be disposed of, and for this purpose the space a^3 is provided with an exhaust-passage r, which may open directly into the atmosphere, as shown in Fig. 1, or may convey the exhaust-fluid to any desired point.

The exhaust-passage r is shown as made in the end plate a^4 of the cylinder.

With the parts thus far described the opening of the port f on the slight increase of pressure above the normal permits the fluid to act continuously on the piston b, and thus cause the damper or heat-controller to wholly close until the pressure again falls to or slightly below the normal.

It is sometimes desirable to regulate the heat more closely in accordance with the demands to be put upon it in keeping the pressure up to the normal, so that when the pressure rises above the normal the damper, instead of being wholly closed, and thereby producing the greatest possible check upon the fire, will be partially closed, and thus check the fire sufficiently to prevent further increase of pressure, and thereby maintain the fire steady and uniform at about the condition required to maintain the desired pressure instead of maintaining the same by frequently varying the fire from maximum to minimum intensity. In order to accomplish this result, in accordance with this invention means are provided for slightly varying the pressure of the valve-controlling spring m as the damper is moved. In order to accomplish this result the upper portion m^4 of the chamber that incloses the spring m is made movable with relation to the lower portion of the said chamber, and the adjustable support m^3, for the follower m^2, that sustains directly the upper end of the spring m, is connected with the said upper portion m^4 of the spring-chamber. Thus, while the upper portion of the spring-chamber remains in fixed relation to the lower portion, the spring may be adjusted by its follower for any required fluid-pressure to be maintained; but after it is so adjusted a slight movement of the upper portion of the spring-chamber relative to the lower portion will produce a corresponding variation in the pressure of the spring on the diaphragm. To produce such variation in the pressure of the spring, the upper portion of the spring-chamber is acted upon by a cam or eccentric m^5 (see Fig. 2) on an arbor m^6, working in a bracket m^7 from the lower portion of the spring-chamber, the said arbor m^6 being provided with an arm m^8, in proper position to be acted upon by a cam m^9 on the pulley d.

The operation of these parts may be best understood from Fig. 2, and is as follows: When the piston *b* is in its highest position—that is, with the damper wide open, or so as to give the furnace its maximum heat-producing action—the arm m^8 rests against the portion of the cam m^9 nearest the center of the pulley *d*, and the eccentric m^5 is in position to allow the upper part m^4 of the spring-chamber to assume its highest position under the force of the spring *m*, which is then under the least strain possible for the adjustment of the screw m^3 then existing. Then when the fluid-pressure rises, as before described, and overcomes the spring the port *f* is opened, and the fluid begins to move the piston *b*, and thereby turns the pulley *d* to close the damper; but in such movement of the pulley *d* the cam m^9 throws the arm m^8 outward, and thus turns the eccentric m^5, so as to press the upper part m^4 of the spring-chamber downward, thereby slightly increasing the pressure of the spring *m* on the diaphragm, which closes the port *f* and so prevents further movement of the piston *b*. If such partial closing of the damper is sufficient to check the fire so that no further increase in pressure is made, the parts will remain in this position; but if the consumption of steam diminishes or the fire thus checked continues to increase the pressure of the fluid the port *f* will again be opened and a further movement of the piston *b* will ensue, causing further closing of the damper and checking of the fire, and also again slightly increasing the pressure of the spring *m*, and thereby arresting such movement before the damper is wholly closed. By this construction the damper will be caused to assume a position corresponding to the demand on the boiler for steam, the position of the damper varying only slightly from time to time and practically maintaining a substantially uniform fire of such amount as will maintain the normal pressure for the consumption of steam at any time.

It is a great advantage that the piston of the motor having a long range of movement acts directly upon a rotated shaft connected with the damper, as by this construction the damper-regulator may be placed in any convenient position with relation to the boiler and the suitable connections easily made from it to the damper.

In the modification shown in Fig. 3 the connection between the piston *b* and pulley-shaft *c* is made by a rack b^{20} and pinion b^{30}, and the invention is not limited to the specific mechanical construction shown.

The chain-connection represented in Fig. 1 is generally more desirable than the rack-connection shown in Fig. 3, as the latter requires a considerable space in the chamber a^2 above the shaft, which space is not needed in the construction shown in Fig. 1.

Some of the features of construction of the herein-described contrivance are applicable to other apparatus controlled by the variable pressure of a fluid.

I claim—

1. The combination of a cylinder and piston therein and chamber surmounting and communicating with the cylinder, and a rotating shaft or arbor extending from the inside to the outside of said chamber and being operatively connected with said piston at the inside of said chamber, with a diaphragm or piston acted upon at one side by a predetermined force and at the other side by a variable pressure of the fluid, the admission of which to said chamber and cylinder is controlled by said diaphragm, substantially as described.

2. The combination of the cylinder and piston movable therein and chamber surmounting and communicating with the said cylinder, and the rotating shaft extending from the inside to the outside of said chamber and being operatively connected with said piston, said chamber being provided with an inlet-port, and the said cylinder being provided with an exhaust-port, and there being a leak or connecting passage from one to the other side of said piston of less capacity than the inlet-port, and a diaphragm or piston acted upon at one side by a predetermined force, and at the other side by the variable pressure of a fluid, the admission of which to said chamber is controlled by said diaphragm, substantially as and for the purpose described.

3. The combination, with the damper-motor, of a valve controlling the admission of motive fluid thereto, a spring acting on said valve, and a movable support for said spring, and connecting mechanism between said movable spring-support and the damper-motor, as described, whereby the pressure of the spring on the valve is increased in the movement of the motor that closes the damper, substantially as described.

4. The combination of a port or fluid-passage, as *f*, a pressure-chamber around the same, the end of said passage constituting an annulus projecting into the said chamber, and a diaphragm exposed to the pressure of the fluid in said chamber and having a flat portion integral or rigidly connected therewith, co-operating with the annular mouth of the said port, and constituting a valve controlling the admission of fluid from said pressure-chamber into said port, substantially as and for the purpose described.

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

WM. B. MASON.

Witnesses:

JOS. P. LIVERMORE,

M. E. HILL.