

(No Model.)

C. T. MAIN.
APPARATUS FOR REGULATING THE EXHAUST FOR CONDENSING ENGINES.
No. 438,272.

Patented Oct. 14, 1890.

Fig. 3.

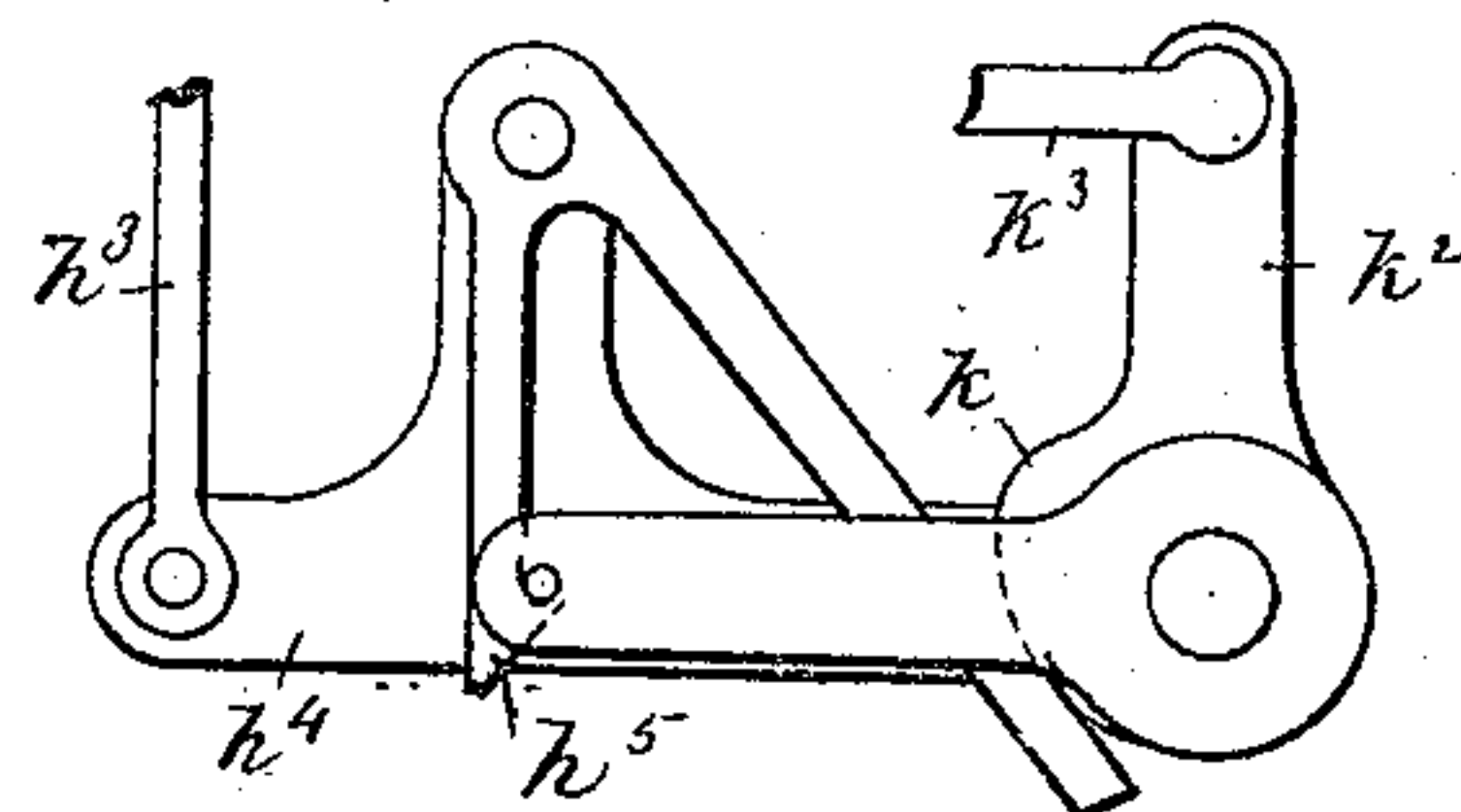
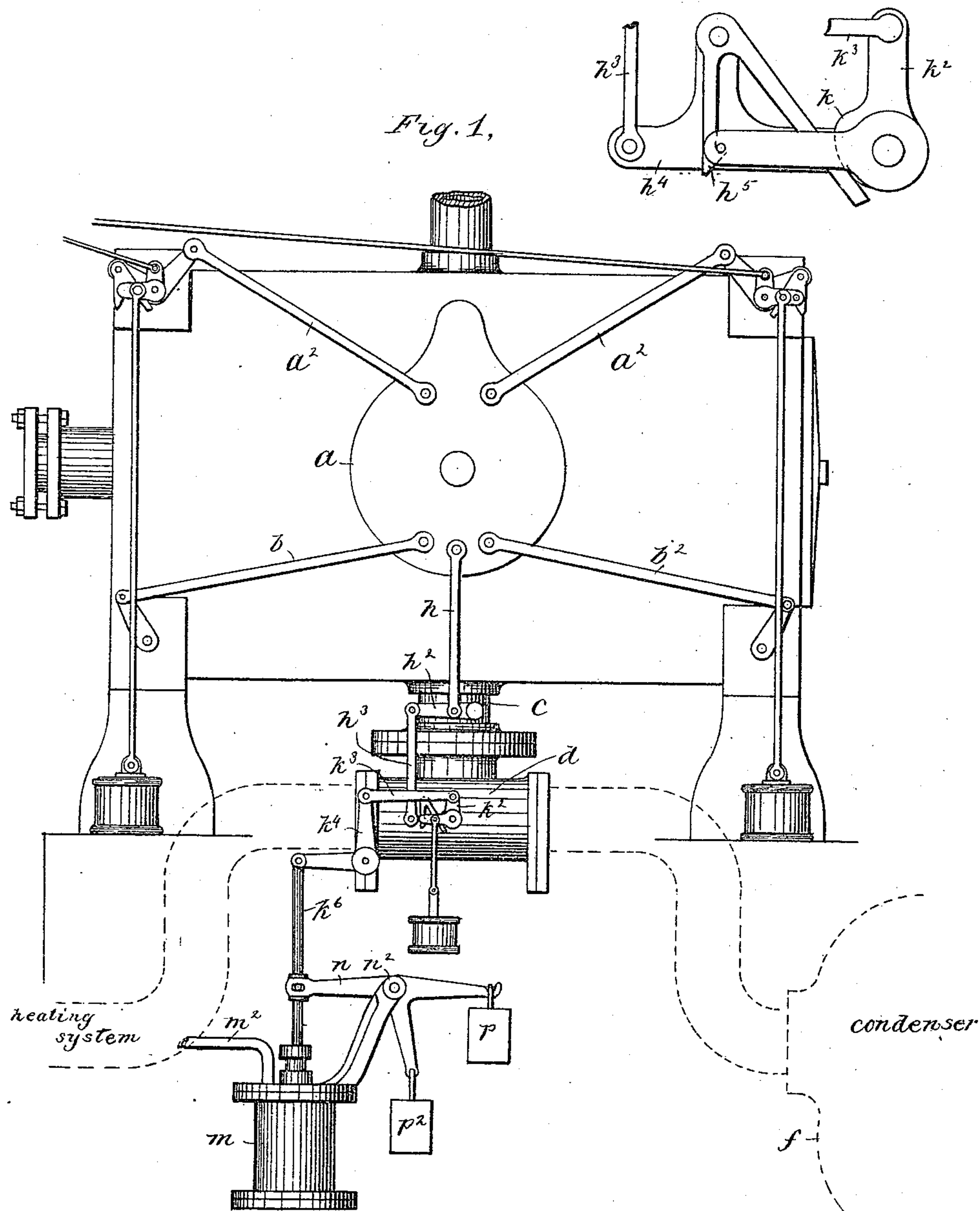
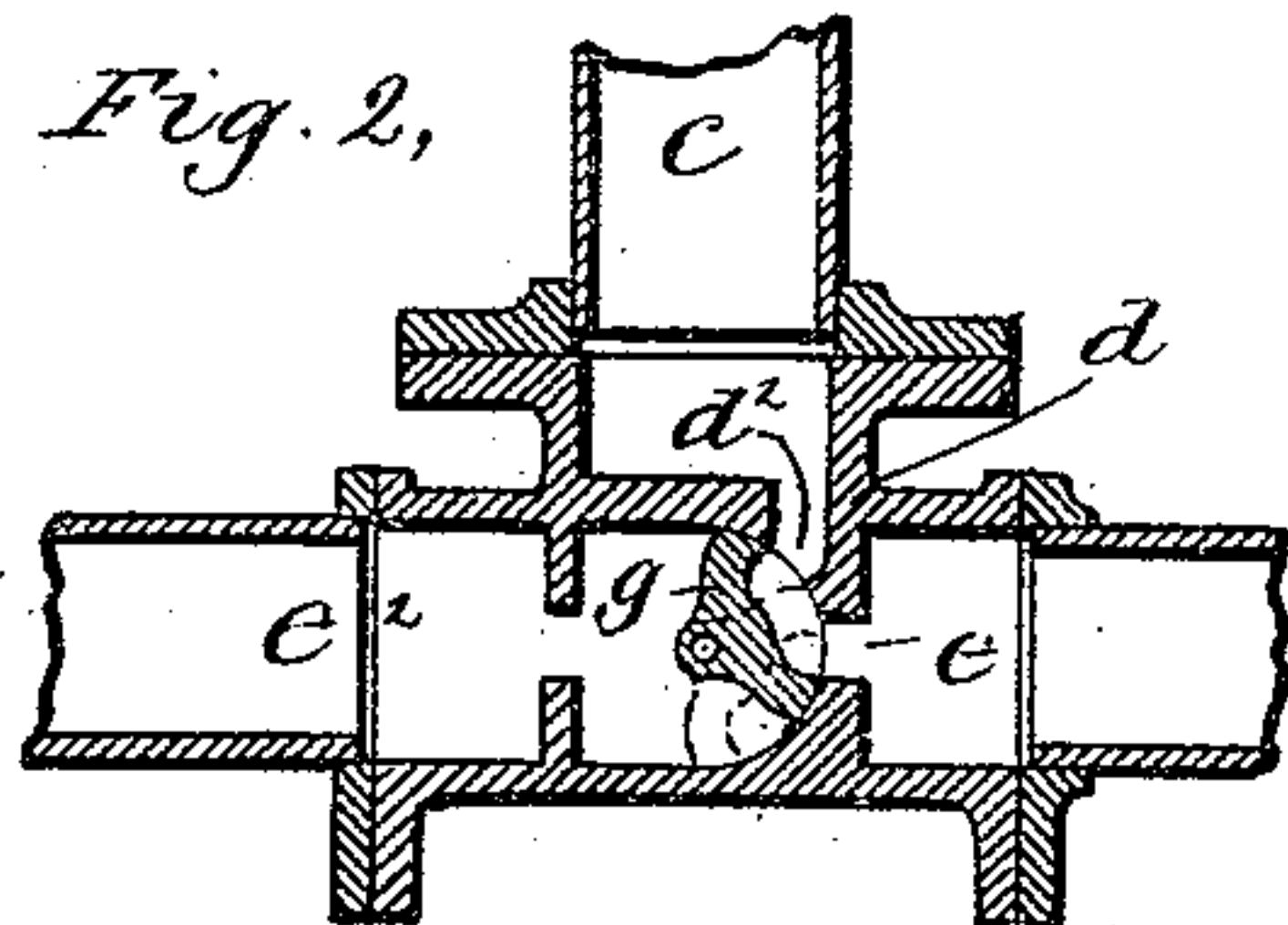


Fig. 2,



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APPARATUS FOR REGULATING THE EXHAUST FOR CONDENSING-ENGINES.

SPECIFICATION forming part of Letters Patent No. 438,272, dated October 14, 1890.

Application filed January 6, 1890. Serial No. 335,961. (No model.)

To all whom it may concern:

Be it known that I, CHARLES T. MAIN, of Lawrence, county of Essex, State of Massachusetts, have invented an Improvement in Apparatus for Regulating the Exhaust for Condensing-Engines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts. In manufacturing and other establishments in which steam is employed for actuating the engine or engines there are generally many uses for steam at a comparatively low pressure, as for heating the building, and for heating and boiling liquids, drying, and other purposes for which the exhaust-steam of the engine may be employed. Usually, however, the entire exhaust of the engine is in excess of what is required for those purposes for which steam at comparatively low pressure may be used, and which will for convenience be referred to hereinafter as the "heating system."

In Letters Patent No. 397,507, dated February 12, 1889, I have shown and described an apparatus to be employed where a portion of the steam exhausted from the high-pressure cylinder of a compound engine is utilized in the heating system and the remainder is used in the low-pressure cylinder of a compound engine.

The object of the present invention is to provide suitable means by which portions of the exhaust-steam of a condensing-engine may be used in the heating system while the remainder is conveyed to the condenser of the engine and there condensed in order to relieve the engine-cylinder of back-pressure, although the invention is equally applicable in case the portion of the exhaust which is not utilized is exhausted directly into the atmosphere. As the back-pressure in the heating system is higher than that in the condenser, or point of final exhaust of the engine, there cannot be direct communication between the heating system and the condenser of final exhaust, but each must be placed in communication with the exhaust-duct of the engine-cylinder during a portion of the time that steam is being exhausted from the cylinder, the other at that time being out

of communication with the exhaust-duct of the engine-cylinder. In order to accomplish this result in accordance with the present invention, the exhaust-duct of the engine-cylinder connects through a suitable valve chamber or chambers with two ducts or delivering branches, one leading to or forming part of the heating system and the other leading to the condenser or forming part of the final exhaust-duct for the steam, and the communication between the exhaust-duct of the engine and the said two branches is controlled by a valve which can place said exhaust-duct in communication with but one of said branches at a time, such valve being actuated by the engine at each stroke, so as to place the heating system in communication with the exhaust-duct of the engine at the beginning of the exhaust, or when the exhaust-steam is at higher pressure, and after said communication has been maintained a sufficient length of time to supply all the steam needed by the heating system said valve is shifted so as to place the exhaust-duct of the engine in communication with the final exhaust, and thereby relieve the piston of the back-pressure of the steam in the heating-system during the remainder of the stroke.

The invention consists, mainly, in means for automatically regulating the operation of said valve in accordance with the pressure in the heating system, so as to maintain the said pressure substantially constant by causing more of the exhaust to pass into the heating system when the consumption of steam in the latter increases and causing less steam to pass into said heating system when the consumption of steam therein diminishes.

The invention also consists in details of construction of the valve and its actuating and controlling mechanism.

Figure 1 is a side elevation of a sufficient portion of an engine to illustrate this invention, the exhaust-controlling devices being shown in elevation; Fig. 2, a longitudinal section of the valve that governs the distribution of the exhaust; and Fig. 3 a detail of the valve-operating mechanism to be referred to.

The invention is shown as applied to an engine having a valve-gear of the Corliss type, in which the several valves are actuated by a

wrist-plate a , which is oscillated at each stroke of the engine, and controls by means of links a^2 the valves that admit steam to the end of the cylinder, and by links b b^2 the valves that control the exhaust from the ends of said cylinder, said exhaust flowing out through the exhaust-duct c , which communicates with a valve-chamber d , (best shown in Fig. 2,) the said valve-chamber having at d^2 an outlet-port from the exhaust-duct c , and also having two outlet-passages or branch ducts e e^2 , the former leading to the usual condenser, (indicated at f , Fig. 1,) and the latter leading to the heating system or appliances, in which the steam exhausted from the engine, and usually at a pressure of a few pounds above that of the atmosphere, is utilized.

The valve g in the valve-chamber d controls communication between the duct c and the branch ducts e e^2 , the said valve when in full-line position, Fig. 2, permitting steam to pass from the exhaust-duct c through the final exhaust-passage e , in this case into the condenser f , and when in the dotted-line position permitting steam to pass from the exhaust-pipe c into the duct e^2 and heating system. The said valve g may be of substantially the construction of the cut-off valves of the Corliss type and operated by a similar trip mechanism, and said valve being moved from the position shown in full lines to that shown in dotted lines, Fig. 2, at the beginning of each stroke of the engine, or at the same time when one of the exhaust-valves operated by one of the links b or b^2 is opened. This movement of the valve g is produced by means of a link h , connected with the wrist-plate a of the engine, and with a rocker-arm h^2 , connected with a link h^3 , with a rocker-arm h^4 , pivoted centrally with the stem of the valve g , by which the latter is oscillated, although not connected directly with the said valve-stem. (See Fig. 3.) The said arm h^4 , however, carries a hook h^5 , that engages with an arm on and turns the valve-stem, and thus oscillates the valve, the said hook being thrown out of engagement with the valve at a given moment by a tripping cam or projection k , carried by an arm k^2 , connected by a link k^3 with a lever k^4 , pivoted at k^5 , and connected by a rod k^6 with the regulating device or governor, which will be hereinafter described. It will be seen that the link h , that operates the valve that controls the path of delivery of the exhaust, is in an intermediate position when the wrist-plate is in an intermediate position, or just at the end of the stroke of the engine-piston, at which moment one of the exhaust-valves has just become wholly closed and the other is just beginning to open, and that the movement of said wrist-plate a from said intermediate position in either direction operates the valve g in the manner last described—that is, moves it from the full to the dotted line position, so as to establish communication between the engine exhaust-duct c and the branch e^2 , leading to the heating system.

It will be convenient to speak of the valve g as controlling the passage to the heating system and as closed in the position shown in full lines and open in the position shown in dotted lines, Fig. 2, and it will be understood that it is normally in the closed position—that is, cutting off the passage of the exhaust to the heating system and permitting the said exhaust to flow to the condenser or usual exhaust-delivery point. The quantity of steam permitted to pass to the heating system will thus depend on the length of time that the valve g is opened during each stroke, and the quantity of steam delivered to the heating system may thus be varied by closing or cutting off the valve g at an earlier point in each stroke, which closing is effected by tripping the catch k^2 , and has substantially the same mode of operation as the closing of the inlet-valves to the engine-cylinder, except that the time of the closing or cut off is regulated in accordance with other variations than that of the speed of the engine, as is the case with the inlet-valves to the engine.

For the purpose of the present invention the cut-off of the valve g should be regulated in accordance with the requirements of the heating system, or with the consumption of steam therefrom, and it will preferably be such as to maintain the pressure of steam constant, or substantially so, in said heating system. In order to attain such result, the regulating device or governor that controls the tripping projection k , and thus governs the time of cut off of the valve g , is regulated in accordance with the pressure in the heating system, and such regulating device may be substantially the same as that shown in my patent hereinbefore referred to, consisting of a cylinder m , containing a piston connected with the rod k^6 , and communicating with the heating system through a pipe m^2 , so that the pressure in said heating system is applied to the upper side of said piston, tending to move the rod k^6 downward in the direction to cause the valve-catch to trip earlier. The said steam-pressure may be balanced by any suitable force, so that when the pressure rises above the normal it will overcome said force and move the rod k^6 downward, and when it falls below the normal it will be insufficient to balance said force, which will move the rod k^6 upward.

As herein shown, the pressure is balanced by a lever n , pivoted at n^2 in a suitable bracket or support and having a substantially horizontal arm and another arm which is substantially vertical below the fulcrum of said lever. The horizontal arm is provided with a weight p and the vertical arm with a weight p^2 , said weight p being adjusted to about balance the normal pressure to be maintained in the heating system, and retaining the same in such position that the valve g supplies about the amount of steam commonly required to maintain such normal pressure. The weight p^2 being vertically below the fulcrum has no

leverage until by the increase in pressure in the heating system the weight p is overbalanced and the weight p^2 is then moved away from beneath the fulcrum and affords an increasing resistance to downward movement of the piston connected with the rod k^6 .

The operation of the parts thus far described is as follows: At each stroke of the engine, just as the cylinder is placed in communication with the exhaust-duct, the valve g is opened, permitting the steam to pass into the heating system and shortly after is closed, so that the remainder of the steam exhausts into the condenser or in the usual manner, the parts being adjusted so that the amount of steam commonly required is delivered into the heating system and a definite determined pressure is maintained therein. If, however, the pressure in the heating system increases slightly, owing to the diminished consumption therefrom, the said pressure acting in the pressure device or cylinder m moves the rod k^6 downward, causes the valve g to cut off communication between the exhaust-duct of the cylinder and the heating system at an earlier moment, so that less steam is supplied to the heating system, and further rise in pressure therein is prevented, thus relieving the heating system from abnormally-high pressure, and also relieving the piston of the engine from unnecessary back-pressure, which would occur if the valve g had a constant operation. On the other hand, if the pressure falls in the heating system, the rod k^6 rises and the valve g cuts off at a later period communication between the exhaust-duct e and the heating system e^2 , so that more steam is supplied to the heating system and the pressure therein prevented from falling farther below the normal. A nearly constant pressure may thus be maintained in the heating system under all conditions of consumption therefrom up to the maximum that the engine can supply without wasting any steam, by providing safety or blow-off valves to relieve overpressure in the heating system, and also without producing unnecessary back-pressure on the engine-piston.

The apparatus herein shown is adapted to be applied to an engine of the Corliss type; but the invention is not limited to the appli-

cation of exhaust-controlling mechanism of the kind described to such engine nor to the specific mechanism employed, as it can be applied to engines of other types and by other mechanism, which will be readily suggested to or devised by those familiar with the mechanical construction, the essential features of the invention consisting in a valve governing the passage of exhaust-steam to one or the other of the two paths, the said valves being actuated by the engine at each exhaust operation thereof, but being controlled as to the time of operation of its movements by the pressure of the steam permitted to pass by or through it to one of said paths.

I claim—

1. The combination of an engine-cylinder having an exhaust-duct and two branch ducts, one leading to the usual final exhaust and the other to a system in which the exhaust-steam is utilized, with a valve controlling communication of said exhaust-duct with said branches, actuating mechanism for said valve, whereby it is operated at each exhaust of the engine, and a governor controlling the operation of said valve in accordance with the pressure of steam in the system in which the exhaust-steam is utilized, substantially as and for the purpose described.

2. The combination of an engine-cylinder having inlet and exhaust valves, and an actuating wrist-plate therefor, an exhaust-duct from said engine, and two ducts branching therefrom, one to the usual place of exhaust and the other to a system in which exhaust-steam is utilized, a cut-off valve controlling the passage of exhaust-steam to the latter branch duct, and connections between it and the wrist-plate, whereby the said valve is opened at each exhaust of the engine, and a governor regulating the cut-off of said valve in accordance with the pressure in the said system in which the exhaust-steam is utilized, substantially as described.

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

CHAS. T. MAIN.

Witnesses:

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