

(No Model.)

A. G. PAUL.
AUTOMATIC VALVE.

No. 563,879.

Patented July 14, 1896.

Fig. 1,

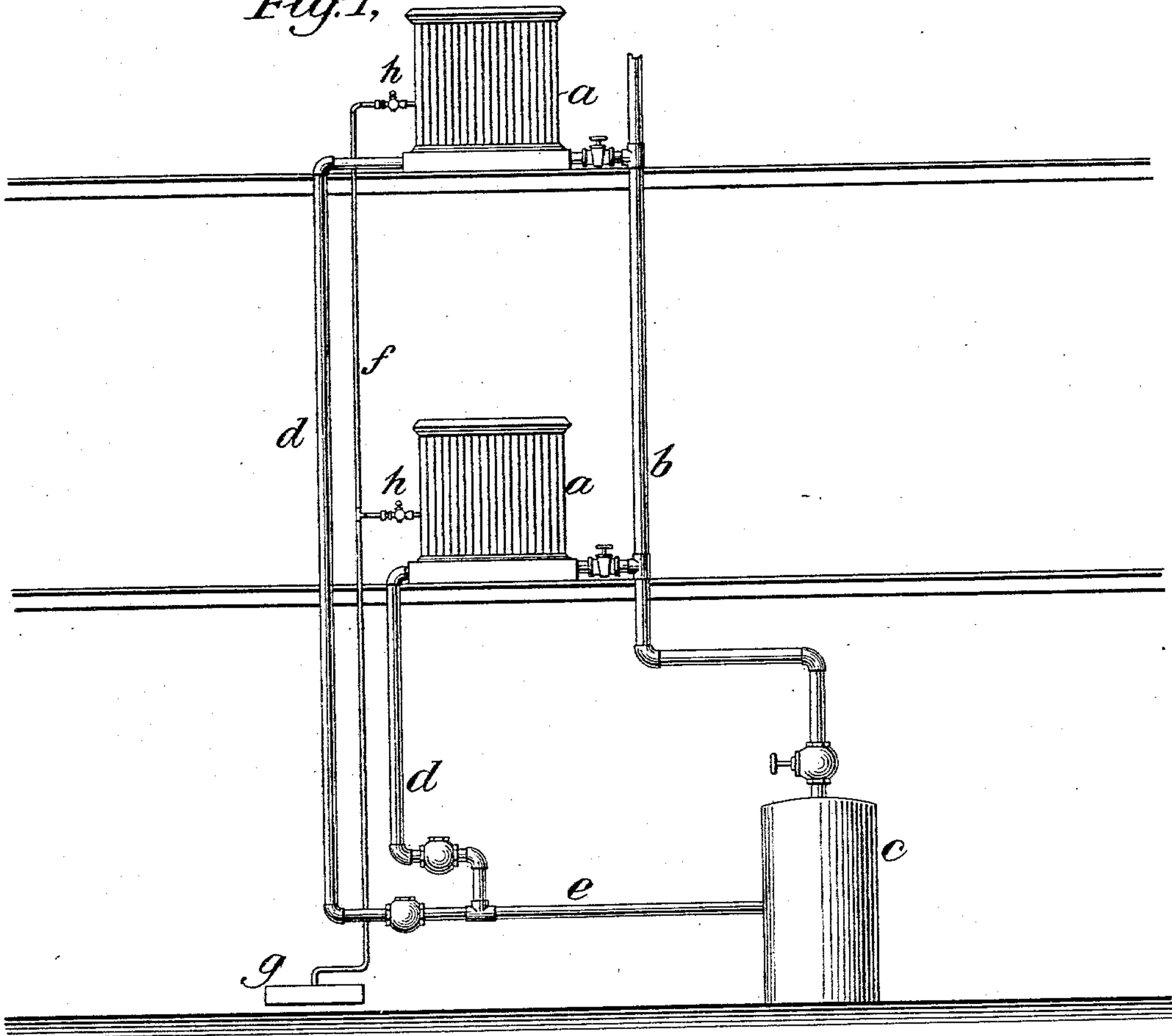


Fig. 2,

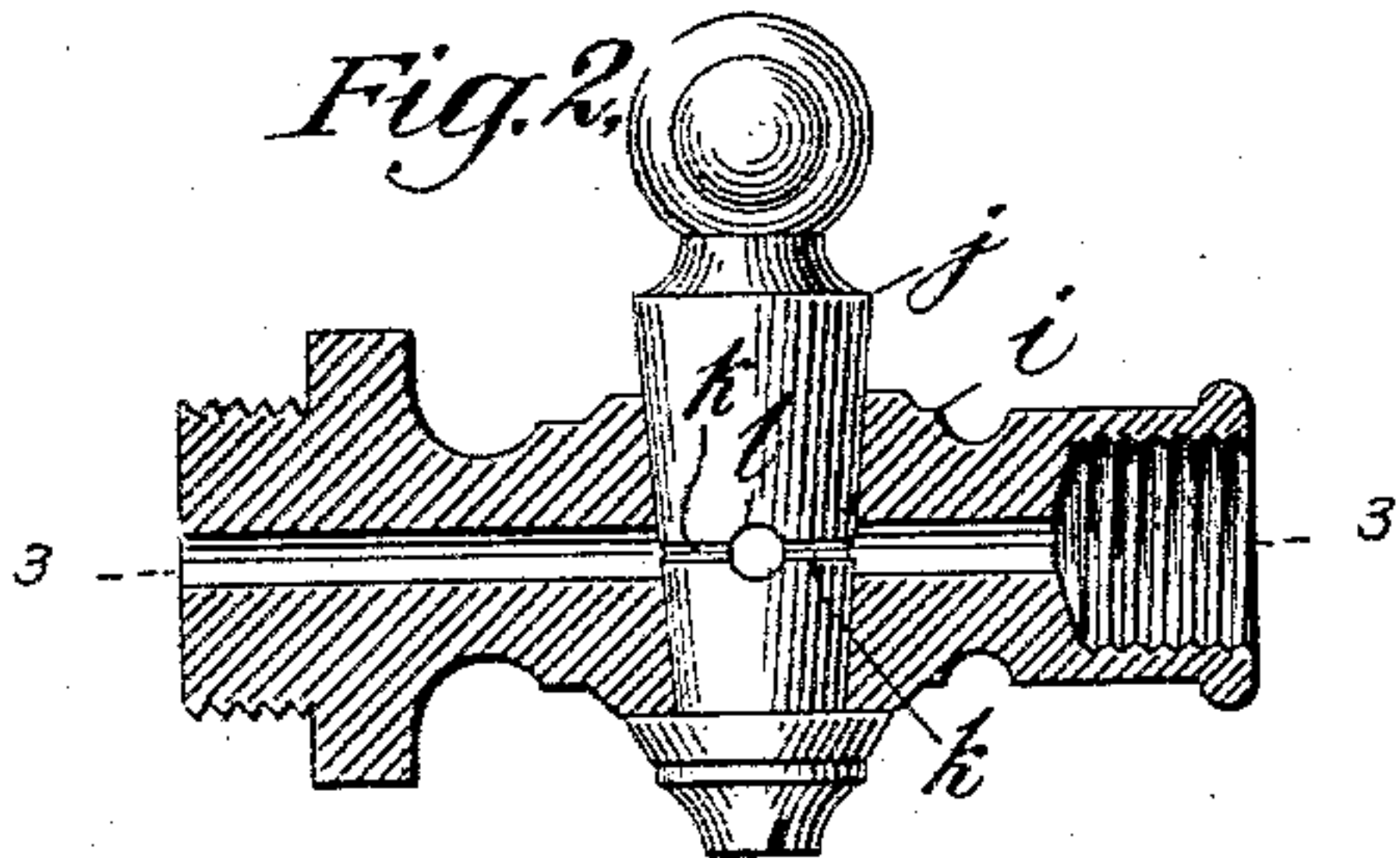


Fig. 3,

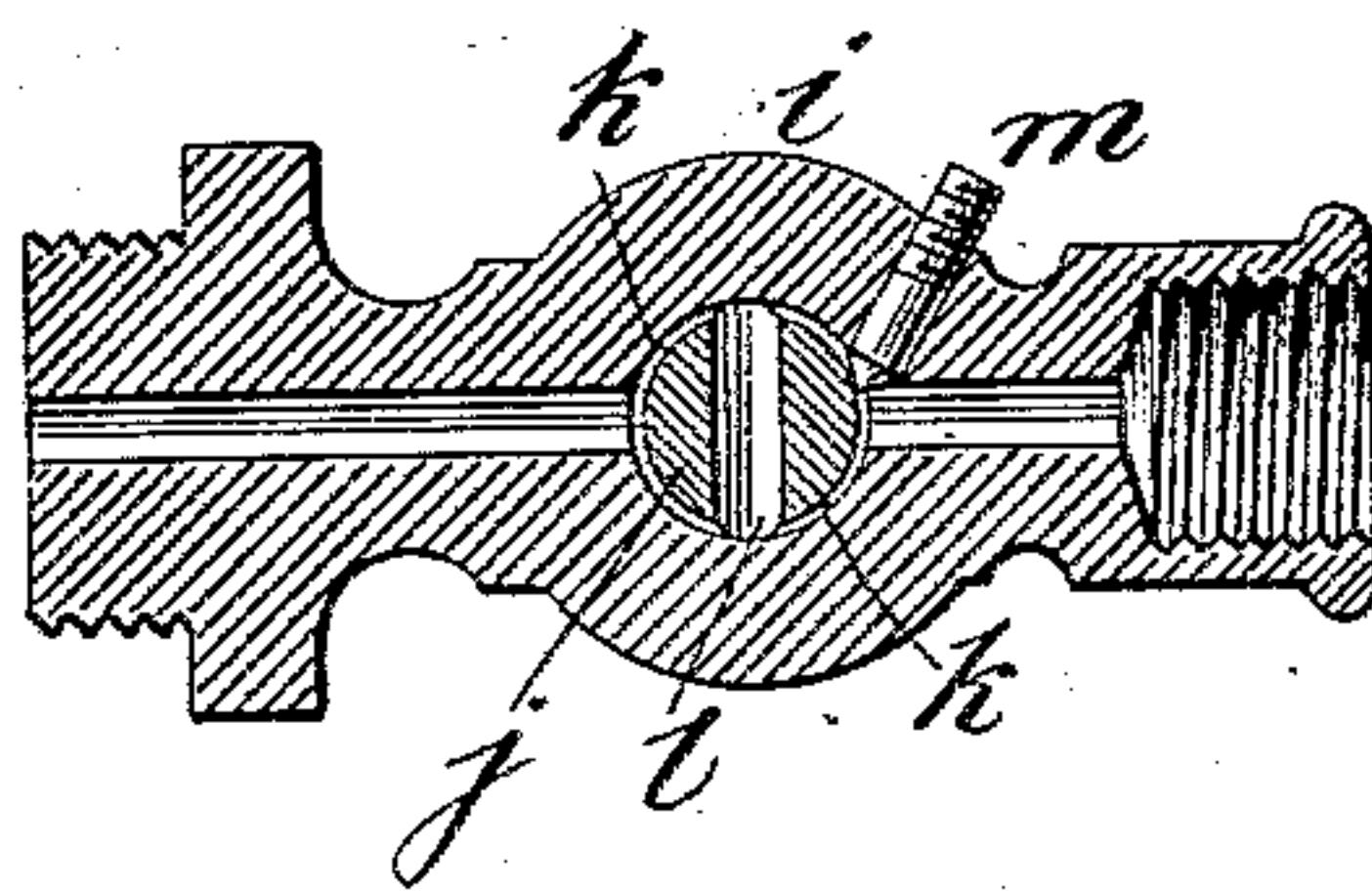
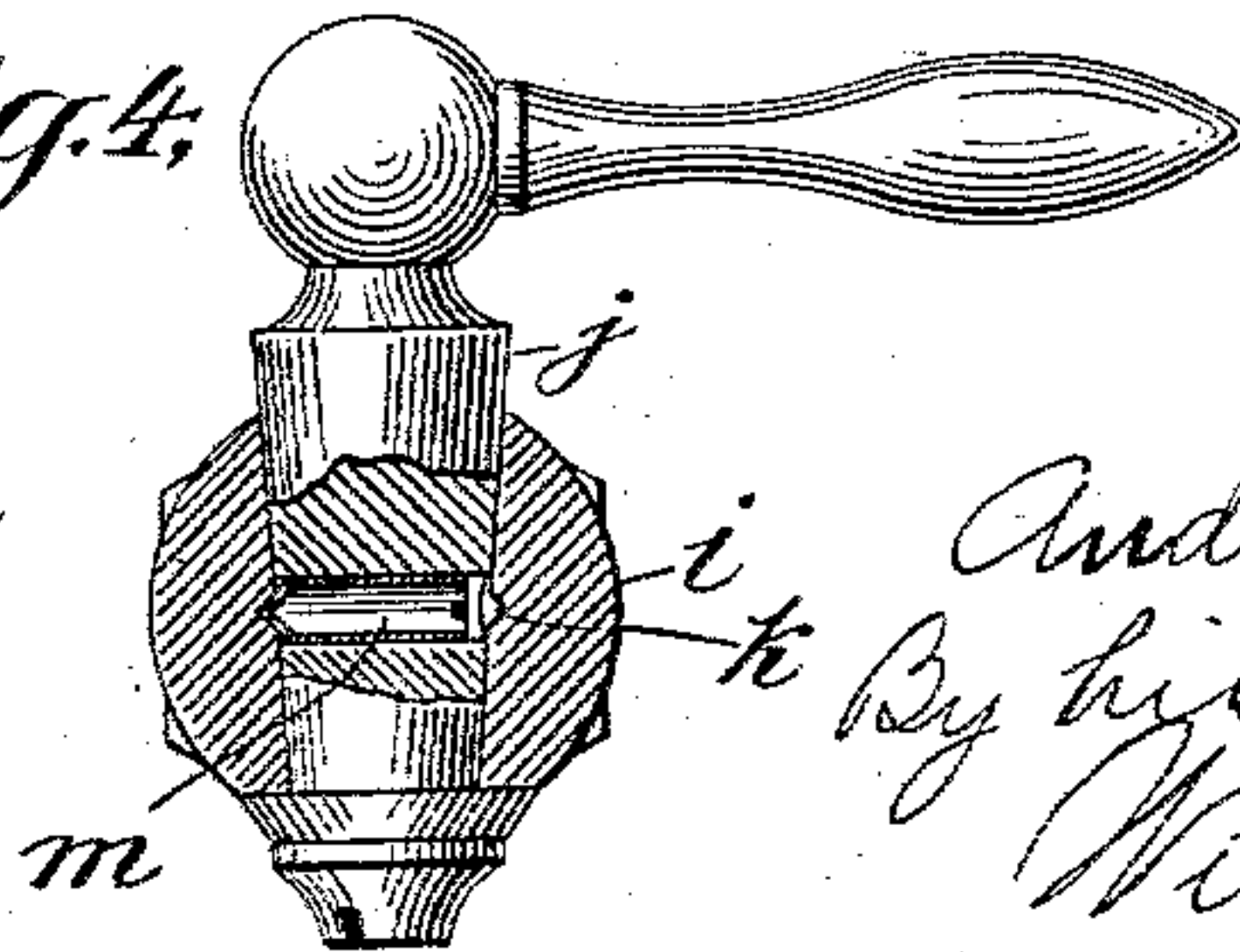


Fig. 4,



Witnesses:-

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Fig. 5,

Inventor:

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UNITED STATES PATENT OFFICE.

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AUTOMATIC VALVE.

SPECIFICATION forming part of Letters Patent No. 563,879, dated July 14, 1896.

Application filed March 28, 1895. Serial No. 543,469. (No model.)

To all whom it may concern:

Be it known that I, ANDREW G. PAUL, a citizen of the United States, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Automatic Valve for Permitting the Escape of Air from Heating Systems while Preventing the Escape of the Vapor or Water of Condensation, of which the following is a full, clear, and exact specification, reference being had to the accompanying drawings, which form a part hereof.

My invention relates to an improvement in automatic valves, and is especially applicable for use in connection with steam-heating systems provided with air-pipes where it is desirable to remove the air from the radiators of the system without causing any considerable loss of steam.

My improved valve is also adapted for use in connection with devices for removing the water of condensation from the cylinders of drying-machines, such, for example, as is shown in United States Letters Patent No. 526,734, granted to me on October 2, 1894, and with other devices for transferring liquids.

The object of my invention is to automatically control the passage of air, vapor, or water through the air-pipe or escape-pipe so as to permit the air to escape while preventing the escape of the vapor and the water, or so as to permit the air and vapor to escape while preventing the escape of water.

My improvement is fully illustrated in the accompanying drawings, in which—

Figure 1 represents an ordinary steam-heating system on the double-pipe plan provided with an air-pipe and an exhauster at the end of the air-pipe, the air-pipe being suitably connected with the two radiators shown and being provided with my improved valves. Fig. 2 is a longitudinal section of my valve, taken through the middle of the escape-passage. Fig. 3 is a longitudinal sectional view on the line 3 3 of Fig. 2. Fig. 4 shows a second modification of my improvement. Fig. 5 represents the cleaning-pin.

Similar letters indicate similar parts in the different figures.

Referring to the drawings, *a a* represent ordinary steam-radiators.

b is the steam-supply pipe leading to the radiators from the boiler *c*.

d d are the return-pipes leading from the radiators to the common return-main *e*, which conveys the water of condensation back to the boiler.

Suitable valves are provided on the branches of the supply-pipe, and suitable check-valves are placed at the lower ends of the various returns.

f is an air-pipe connected with the radiators and provided at its lower end with the exhauster *g*.

h represents my improved valve, which is placed on each branch of the air-pipe near the radiator.

i represents the valve-casing. This casing is provided with a central passage-way, and is also provided at its ends with suitable means for attaching it to the apparatus with which it is to be connected.

j is a removable plug located in the casing and extending across the passage therein, and provided with a suitable handle. This plug is held in place by any usual means.

k k are two capillary ducts extending around the periphery of the plug and connecting the passage-way on one side of the plug with the passage-way on the other side of the plug. These ducts are of considerable length. In the two forms shown in the drawings the outer walls of the ducts are formed by the valve-casing. In the form shown in Fig. 2 the duct is formed by making a groove in the surface of the plug *j*. In the form shown in Fig. 4 the duct is formed by making a groove in the surface of the casing surrounding the plug. I have found in practice that a satisfactory valve is produced by making these capillary ducts about five-eighths of an inch in length and from a thirty-second to a sixty-fourth of an inch in diameter. *l* is an opening or passage through the center of the plug, adapted, when the plug is turned into the proper position, to register with the passage in the casing. The purpose of this opening *l* is to enable the valve to be cleaned if it should become clogged with dirt.

m is a cleaning pin or scraper. When the capillary ducts are formed in the face of the plug, as in Figs. 2 and 3, the cleaning-pin is inserted through the casing of the valve, as shown in Fig. 3, so that when it is screwed in its pointed end will project into the ducts. The cleaning-pin is provided with a screw-thread which takes into the screw-thread in the casing, enabling the pin to be screwed out or in. This pin is preferably made to project into the ducts at a point where these ducts open into the main passage-way of the valve. The object of this construction is to cause the dirt which is scraped out of the duct by the cleaning-pin to be collected in the line of the main passage-way, as a result of which it will be forced out of the valve by the current passing through the same.

Where the capillary ducts are made in the wall of the casing, as in Fig. 4, the cleaning-pin can be inserted in the opening or passage *l* of the plug, the screw-thread of the pin engaging with a screw-thread in the opening of the plug. In this form of the invention the cleaning-pin is made hollow, with openings at its pointed end, so that when the plug is turned to bring the opening *l* in line with the main passage of the valve the cleaning-pin will not materially obstruct the current flowing through the valve. The flat end of the cleaning-pin is provided with a screw-slot, into which a screw-driver may be inserted to screw the cleaning-pin into the desired position.

The operation of my improved valve in connection with such a heating system is as follows: When the system is started, the valve-plug may be turned so as to bring its central opening *l* in line with the main passage of the valve. The exhauster being in operation, the air will be quickly drawn out from the radiator through this large passage. As soon as the air has been exhausted and the steam begins to pass through the valve (which will be indicated by the air-pipes becoming hot at that point) the plug is turned to the position shown in Fig. 2. The steam enters the capillary ducts and passes along the same with a speed dependent partly upon the difference between the pressure in the radiator and the pressure in the air-pipe on the other side of the valve. Owing to the length of the capillary duct and its extremely small diameter or cross-section the condensing-surface of the duct is very large as compared with its cross-sectional area, or as compared with the size of the current of steam passing through it. In consequence of this the steam will be rapidly condensed and the water of condensation will gather in the duct until a globule of water has been formed sufficient to fill the duct. This water acts as a valve and substantially closes the duct and prevents or greatly retards the passage of steam through the duct. By reason of the small size of the duct its walls or sides exert a sort of capillary attraction upon the water of condensation and tend to

prevent it from being forced through the duct into the air-pipe. The escape of steam through the valve is thus substantially prevented. When air begins to collect again in the radiator or in the valve-passage near the plug, the condensation in the duct ceases, and whatever water of condensation may have been formed therein escapes slowly from the duct either back into the radiator or into the air-pipe. As soon as the duct has been partly or wholly freed from this water of condensation the air escapes through the duct until the steam again flows into the duct, when the operation already explained is repeated.

If any of the passages of the valve become clogged with dirt, the cleaning-pin is screwed into operative position and the valve-plug turned entirely around, and the projecting point of the pin scrapes out the ducts. By bringing the opening *l* of the plug in line with the main passage of the valve a full current is established through the valve, which will force out the dirt or other obstructing matter.

In the form shown in Figs. 4 and 5 when it becomes necessary to clean the valve it is disconnected at one end from the escape-pipe and the opening *l* of the plug is brought in line with the main passage of the valve, and by means of any suitable small screw-driver inserted through this passage-way at the disconnected end the cleaning-pin is screwed farther through the plug, so that its point projects into the ducts. The plug is then turned entirely around, as a result of which the ducts are scraped out. The cleaning-pin is then screwed back into its former position, so that its point no longer projects beyond the sides of the plug, and the valve is connected as before with the escape-pipe. The valve is now ready for use again.

My invention therefore provides means for automatically permitting the escape of air while substantially preventing the escape of steam. This prevention of the escape of steam increases the economy of the system by saving the heating vehicle from waste.

My invention is simple in construction and reliable in operation, and is not liable to get out of order. Furthermore, it is not liable to be injured by being subjected to great variations of pressure and temperature.

When my invention is employed in connection with the escape-pipe of an apparatus for discharging the water from drying-machines, such as is shown in my prior patent, No. 526,734, above referred to, or in connection with other devices for transferring liquids in which it is necessary to remove from the discharge-pipe not merely the air, but also the steam or vapor contained therein, the capillary duct is made larger in diameter, so as to decrease the ratio between the surface of the duct and its sectional area or the size of the current passing through it. The condensing-surface of the ducts is thereby reduced in proportion to the volume of vapor passing through them, and this is done sufficiently to

prevent the condensation of any large portion of the steam in the ducts. In consequence of this change or modification the air and vapor or steam will readily pass through the ducts. When, however, the water enters the inner passage of the valve and reaches the ducts, the passage of the water through the ducts will be substantially prevented by reason of the capillary action of the ducts.

Even where my invention is used in connection with steam-heating systems to permit the escape of air but to prevent the escape of steam, the dimensions of the different parts of the valve may be somewhat varied so long as the essential features of construction and operation are retained.

What I claim as new, and desire to secure by Letters Patent, is—

1. An automatic valve comprising a valve-casing having a passage therethrough, a movable plug located in said casing and across the passage, and one or more capillary ducts leading from the passage on one side of the plug to the passage on the other side of the plug, substantially as set forth.

2. An automatic valve comprising a valve-casing having a passage therethrough, a movable plug located in said casing and across the passage, and one or more curved capillary ducts leading from the passage on one side of the plug to the passage on the other side of the plug, substantially as set forth.

3. An automatic valve comprising a valve-casing having a passage therethrough, a movable plug located in said casing and across the passage, and one or more capillary ducts of considerable length, each duct having a large contact-surface as compared with its sectional area, and leading from the passage on one side of the plug to the passage on the other side of the plug, substantially as set forth.

4. An automatic valve comprising a valve-casing having a passage therethrough, a movable plug located in said casing and across the passage, and one or more curved capillary ducts of considerable length, each duct having a large contact-surface as compared with its sectional area, and leading from the passage on one side of the plug to the passage on the other side of the plug, substantially as set forth.

5. An automatic valve comprising a valve-casing having a passage therethrough, a movable plug located in said casing and across the passage, and one or more curved capillary ducts between the casing and the plug of considerable length, each duct having a large contact-surface as compared with its sectional area, and leading from the passage on one side of the plug to the passage on the other side of the plug, substantially as set forth.

6. An automatic valve comprising a valve-casing having a passage therethrough, a movable plug located in said casing and across the passage, and one or more capillary ducts of considerable length, each duct having a large

contact-surface as compared with its sectional area, and leading from the passage on one side of the plug to the passage on the other side of the plug, and a large opening through the plug adapted to be brought into line with the main passage of the valve for cleaning purposes, substantially as set forth.

7. An automatic valve comprising a valve-casing having a passage therethrough, a movable plug located in said casing and across the passage, and one or more capillary ducts of considerable length, each duct having a large contact-surface as compared with its sectional area, and leading from the passage on one side of the plug to the passage on the other side of the plug, and a cleaning-pin adapted to project into the duct or ducts, substantially as set forth.

8. An automatic valve comprising a valve-casing having a passage therethrough, a movable plug located in said casing and across the passage, and one or more curved capillary ducts between the casing and the plug of considerable length, each duct having a large contact-surface as compared with its sectional area, and leading from the passage on one side of the plug to the passage on the other side of the plug, and a large opening through the plug adapted to be brought into line with the main passage of the valve for cleaning purposes, and a hollow cleaning-pin fitting the large opening in the plug and adjustable therein and adapted to project into the duct or ducts, substantially as set forth.

9. An automatic valve to permit the escape of air from a heating system while preventing the escape of steam, comprising a valve-casing having a passage therethrough, a movable plug located in said casing and across the passage, and one or more condensing capillary ducts of considerable length, each duct having a large condensing-surface as compared with its sectional area, and connecting the passage on one side of the plug with the passage on the other side of the plug, substantially as set forth.

10. An automatic valve to permit the escape of air from a heating system while preventing the escape of steam, comprising a valve-casing having a passage therethrough, a movable plug located in said casing and across the passage, and one or more condensing capillary ducts of considerable length, each duct having a large condensing-surface as compared with its sectional area, and connecting the passage on one side of the plug with the passage on the other side of the plug, and a large opening through the plug adapted to be brought into line with the main passage of the valve for cleaning purposes, substantially as set forth.

11. The combination with a steam-heating system, which is provided with radiators, supply and return pipes, an air-pipe in addition to the supply and return pipes, and an exhaustor for drawing air from the system through the air-pipe, of an automatic valve

on the air-pipe, comprising a valve-casing having a passage therethrough, a movable plug located in said casing and across the passage, and one or more condensing capillary
5 ducts of considerable length, each duct having a large condensing-surface as compared with its sectional area, and connecting the passage on one side of the plug with the passage on the other side of the plug, and a large

opening through the plug adapted to be brought into line with the main passage of the valve for cleaning purposes, substantially as set forth.

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