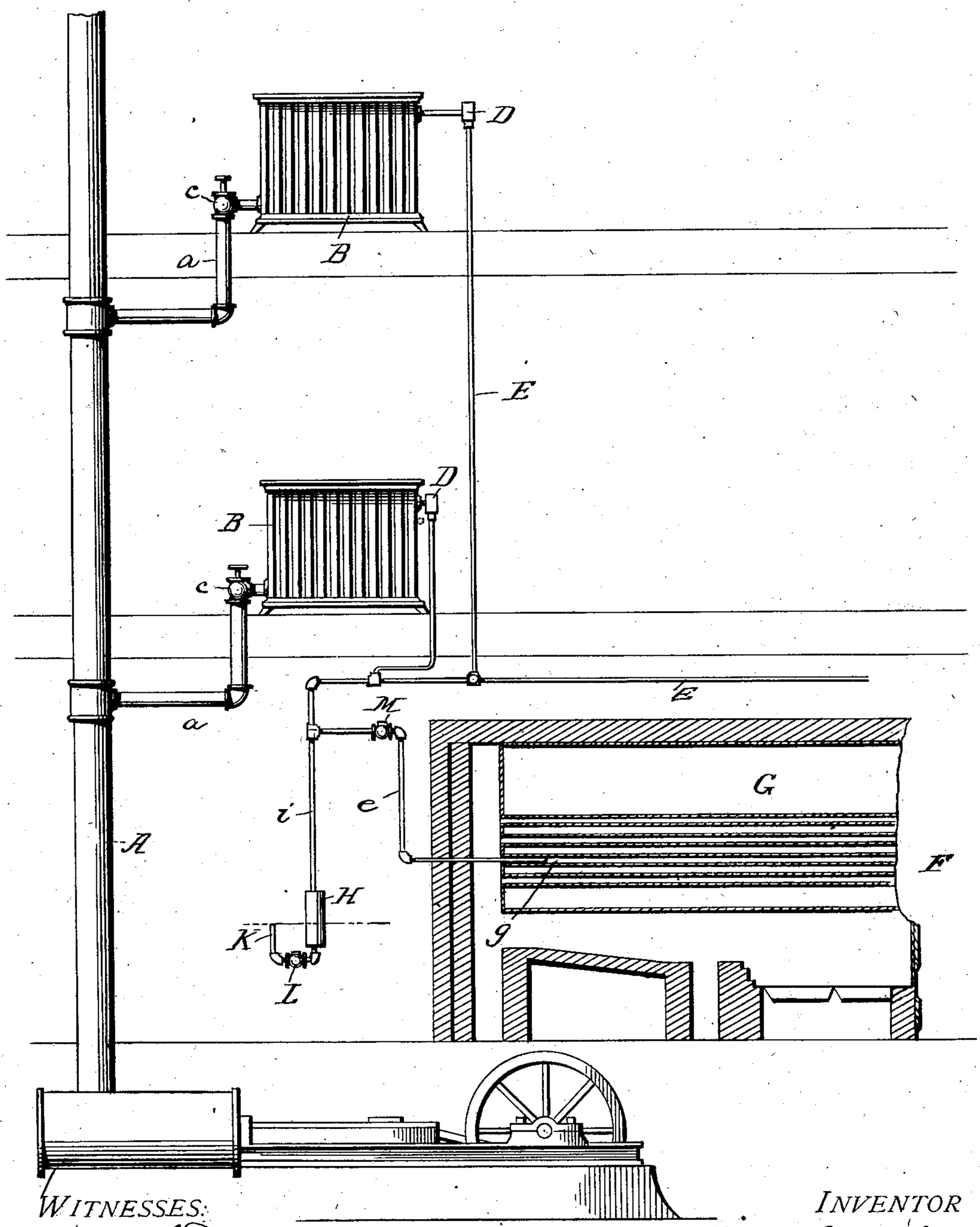
No. 729,390. PATENTED MAY 26, 1903.

A. M. McGONAGLE.

STEAM HEATING SYSTEM.

APPLICATION FILED JUNE 19, 1902.

NO MODEL.



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UNITED STATES PATENT OFFICE.

ARTHUR McGONAGLE, OF EAST ORANGE, NEW JERSEY, ASSIGNOR OF ONE-HALF TO THOMPSON-STARRETT COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

STEAM-HEATING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 729,390, dated May 26, 1903.

Application filed June 19, 1902. Serial No. 112,346. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR McGONAGLE, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Steam-Heating Systems, of which the following is a specification.

My invention relates to steam-heating systems in which exhaust-steam or low-pressure steam is employed. It is particularly adapted for use in those systems using the exhaust-steam from an engine, and has for its object to cause the circulation of the steam through the heating apparatus at atmospheric pressure, so as not to cause any back pressure upon the piston of the steam-engine from which the exhaust-steam is taken.

The invention consists in certain improvements in the apparatus whereby a partial vacuum is maintained in an air pipe or conduit connected with the radiators to which this steam is delivered, as will be hereinafter pointed out.

The accompanying drawing is a diagrammatic view, partly in elevation and partly in section, of an apparatus embodying my improvements.

I have shown my invention applied to a single-pipe steam-heating system—that is, one in which the same pipe serves both to convey the steam to the radiators and also as the return-pipe for the water of condensation. The invention is, however, applicable to other steam-heating systems.

In the drawing, A represents a steam-pipe adapted to receive and conduct the steam which is used throughout the system, in the present instance being supposed to receive the exhaust-steam from a steam-engine. From this branch pipes *a* lead to the radiators B. At each of the radiators there is a suitable valve *c*, by means of which the flow of steam to the radiator is controlled.

D indicates an air-valve. This may be of any suitable construction, though I prefer to use an automatic air-valve—that is, one which closes automatically when steam begins to pass the valve.

There is connected with each radiator a pipe or air-conduit, (designated E,) in which is maintained a partial vacuum. I prefer that such pipe should be connected with the radiators through the air-valve D, and have indicated this connection in the drawing. In order to maintain a partial vacuum within the line of pipe E and to do so without resorting to the use of an apparatus which requires power to operate it or the services and attention of an attendant, I connect the pipe E with the combustion-chamber of a furnace, which may be the one which is used in connection with the boiler that supplies steam for the engine or may be any other furnace in which a constant fire is maintained whenever the heating-steam is to be used.

e indicates the pipe connecting the air pipe or line E with the combustion-chamber of a furnace F. It is well understood that the barometric pressure within a furnace is lower than the barometric pressure outside thereof, so that if the open end of the pipe *e* extends into such combustion-chamber there will be an entraining effect upon the contents of the pipe E, causing a reduction of the pressure therein, and consequently a reduction of the pressure within the radiators so long as the automatic air-valves are open. It will be understood that this will cause a very rapid withdrawal of the air from a radiator whenever steam is turned thereon, and that the steam passes into the radiator at atmospheric pressure or below instead of having to be forced into the radiator by raising the pressure of the steam in the supply-pipe above that of the atmosphere. In order that the entraining effect upon the contents of the pipe E may be increased, I prefer to insert the open or free end of the pipe *e* into one of the fire-tubes *g* of the boiler G, which is situated in the furnace F. As more or less steam will be carried over and beyond the radiators and into the air pipe or line E and will condense therein, I provide a chamber H for receiving the water of condensation and connect the same with the line E by a drain-pipe *i*. The chamber is provided with an escape-pipe K, which is so shaped as to provide a water seal in the lower portion of the chamber. A check-valve,

opening outward or toward the discharge end of the pipe K, is situated therein and is designated L. I likewise prefer to place a check-valve M in the connecting-pipe *e*, such valve being arranged to open toward the furnace.

With this description of the apparatus I may proceed to describe its operation. If one of the valves *c* be opened, the steam rapidly passes in and fills the radiator, the air formerly contained in the radiator readily passing out through the automatic air-valve and into the air-line E. This ready withdrawal of the air from the radiator is facilitated by the partial vacuum maintained in the line by reason of its connection with the combustion-chamber of the furnace, as has already been explained. As soon as the air is entirely exhausted from the radiator the air-valve closes, but this does not take place until a more or less large amount of steam has passed on into the pipe. As the steam condenses and flows into the collecting-chamber H the pressure within the air-line E is further reduced, and as soon as the pressure in such line becomes lower than the pressure within the combustion-chamber of the furnace the check-valve M closes, holding the vacuum which has been produced. The check-valve L prevents the entrance of any air into the line E through the collecting-chamber H. When sufficient water has accumulated in the chamber to cause it to rise above the level of the water seal, the water will be discharged, but under no circumstances can there be a backflow of air through the discharge-pipe K.

It will be seen that I provide a line of piping connected with the several radiators of the system in which is maintained a partial vacuum, and that such vacuum is maintained without the use of apparatus requiring the expenditure of available motive force, such as steam or electricity, which has heretofore been used to drive exhausting fans connected with such air-line, but avail myself of the reduced pressure which is constantly available where a furnace is employed. It will also be observed that I connect with the air-line E two exhausting or pressure-reducing means, one being the constantly-acting furnace and the other the more or less intermittently-acting means whereby the condensation of any steam which may pass into the air-line is made available for further reducing the pressure within the line, and that these two means are so connected that the one which will at the time produce the greatest reduction of pressure will be the one which is in operation. This I insure by placing the check-valve in the pipe *e* and so constructing the apparatus that no backflow of air into the receiving vessel H or drip-pipe can take place.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a steam-heating system, the combination of the radiators, an air-pipe connected with the radiators, and a furnace into the combustion-chamber of which an open end of the air-pipe leads whereby a partial vacuum is maintained in such pipe, substantially as set forth.

2. In a steam-heating system, the combination of a radiator, an air-valve connected therewith, an air-pipe connected with the air-valve, and a furnace into which the air-pipe leads, substantially as set forth.

3. In a steam-heating system, the combination of a radiator, an air-valve applied thereto, an air-pipe connected with the air-valve, a furnace into the combustion-chamber of which the air-pipe leads, and a check-valve in the air-pipe to prevent backflow from the furnace, substantially as set forth.

4. In a steam-heating system, the combination of a radiator, an air-pipe connected therewith, a furnace for producing a reduced pressure in the air-pipe, a check-valve arranged to prevent backflow through the said pipe, and a drain-pipe for the water of condensation which may collect in the air-pipe, substantially as set forth.

5. In a steam-heating system, the combination of a radiator, an air-valve connected therewith, an air-pipe connected with the air-valve, a furnace into the combustion-chamber of which the air-pipe enters, and means for closing the air-pipe against the admission of air or gases except through the air-valve, substantially as set forth.

6. In a steam-heating system, the combination of a radiator, an air-pipe connected therewith, a furnace into the combustion-chamber of which the air-pipe extends whereby the pressure in said pipe is reduced, means for causing a further reduction of the pressure by the condensation of any steam which may pass into the air-pipe, and a check-valve which prevents backflow from the furnace into the air-pipe, substantially as set forth.

7. In a steam-heating system, the combination of a radiator, an air-pipe connected therewith, a furnace for causing a reduced pressure within the air-pipe, a drain-pipe for the water of condensation which may collect in the air-pipe, a check-valve for preventing backflow from the furnace, and means for preventing backflow of air through the drain-pipe, substantially as set forth.

8. In a steam-heating system, the combination with a fire-tube boiler, of a radiator, and an air-pipe connected with the radiator, and having its open end extended into one of the fire-tubes of the said boiler, substantially as set forth.

9. In a steam-heating system, the combination of a radiator, an air-valve connected therewith, an air-pipe connected with the air-valve and having its open end extending into the combustion-chamber of a furnace, a check-valve in the air-pipe arranged near the furnace, a drain-pipe connected with the air-pipe, and an enlarged collecting-chamber for the

water of condensation at the end of the drain-pipe, a discharge-pipe from the collecting-chamber arranged to form a water seal, and a check-valve in the said discharge-pipe, substantially as set forth.

10. In a steam-heating system, the combination with a steam-engine and a steam-boiler furnace, of a series of steam-radiators, steam-pipe connections leading from the exhaust-port of the engine to the radiators, air-valves connected with the radiators, and an air-pipe line connected with the air-valves of the radiators having its open end leading into the combustion-chamber of the steam-boiler furnace, substantially as set forth.

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Witnesses:
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