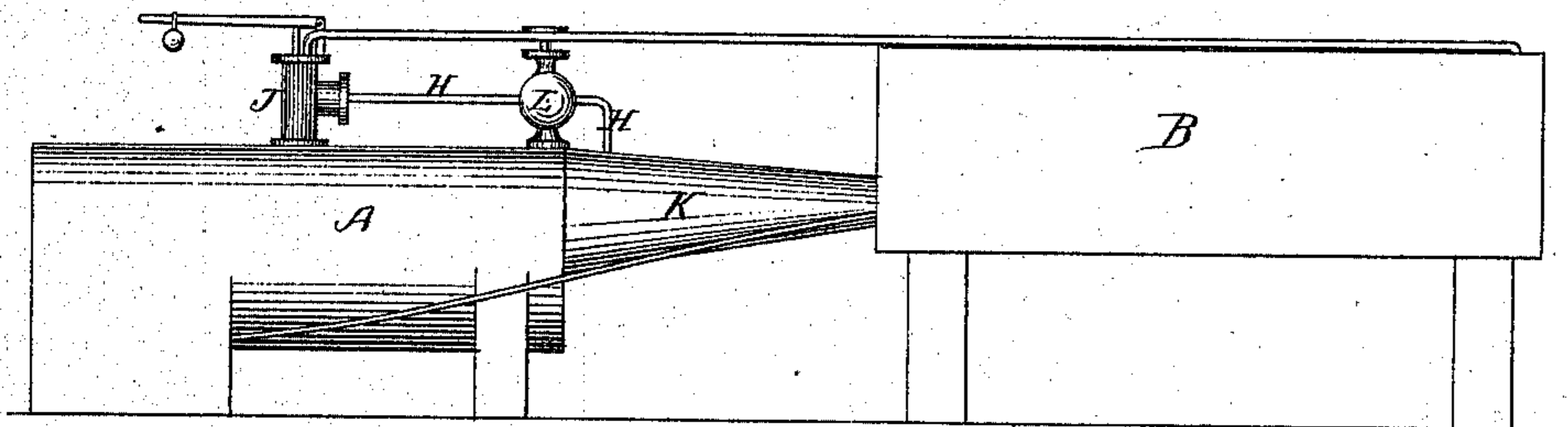


*J. Howarth,*  
*Evaporating Pan.*

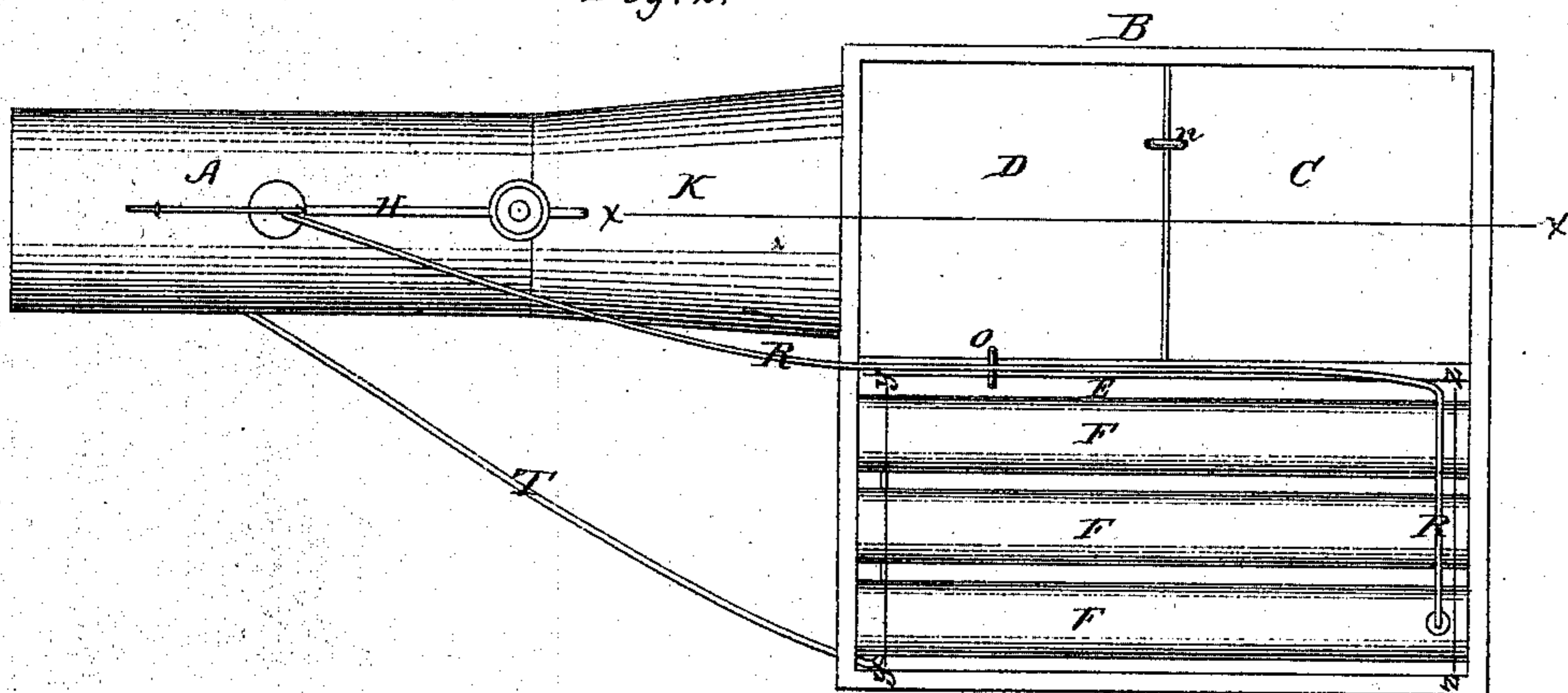
*No. 112,348.*

*Patented Mar. 7. 1871.*

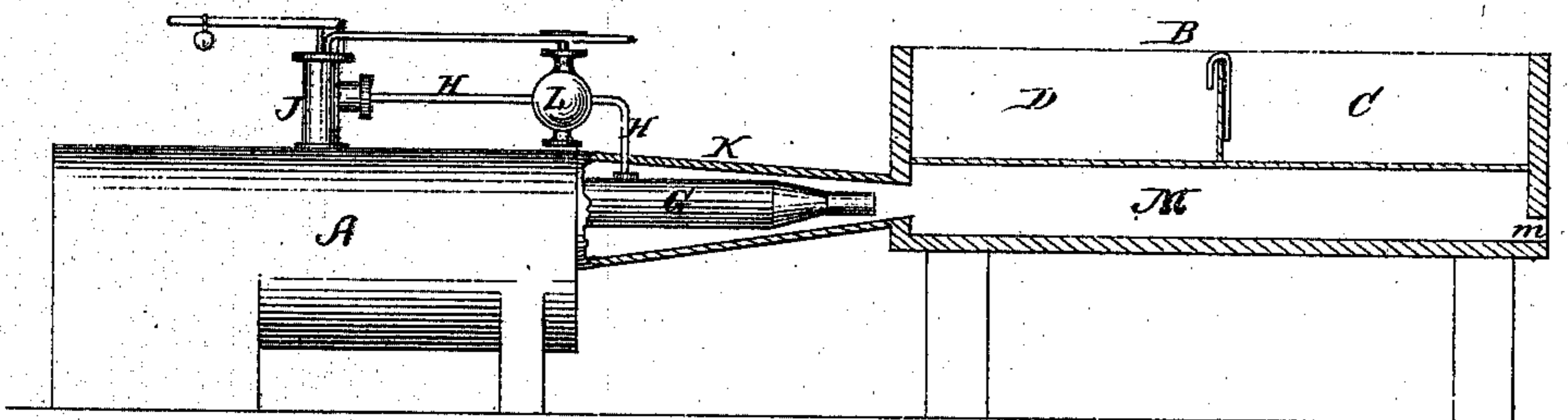
*Fig. 1.*



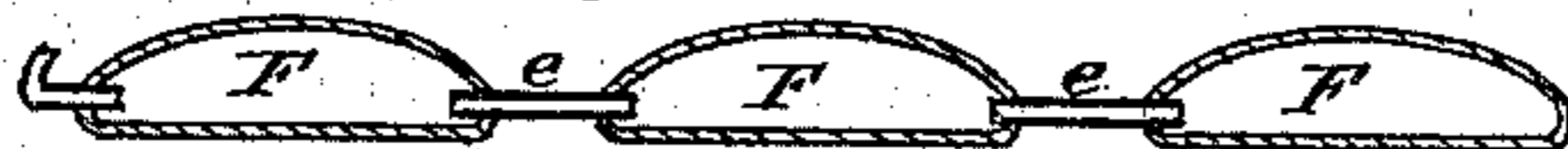
*Fig. 2.*



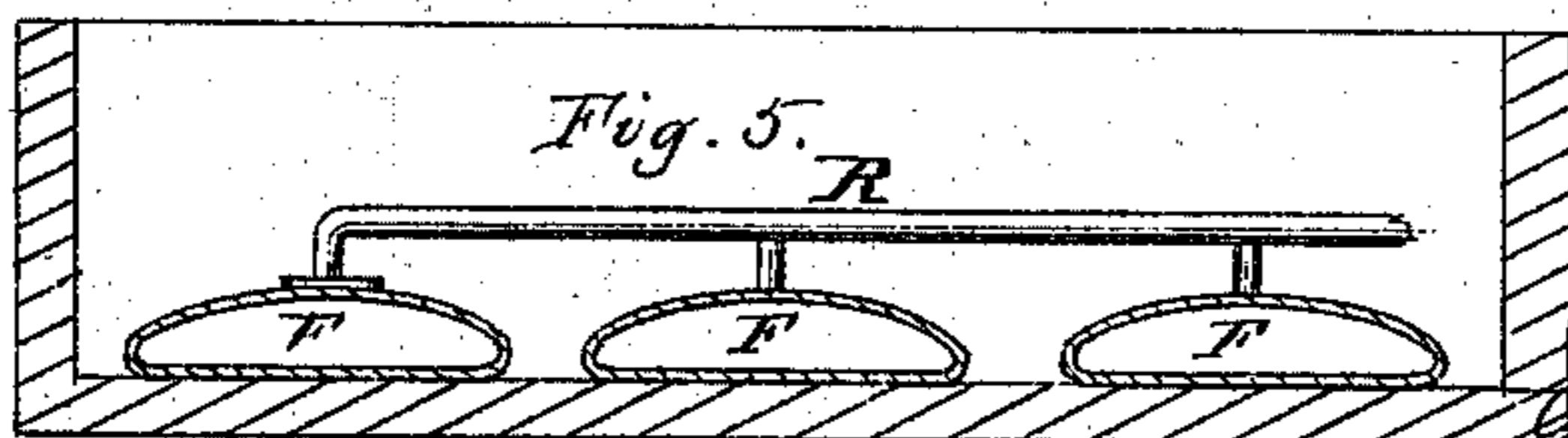
*Fig. 3.*



*Fig. 4.*



*Fig. 5.*



WITNESSES.

*C. F. Fromm.*  
*L. P. Hayden*

INVENTOR.

*John Howarth*  
*by Carroll D. Wright*  
*Attorney.*

# UNITED STATES PATENT OFFICE.

JOHN HOWARTH, OF SALEM, MASSACHUSETTS.

## IMPROVEMENT IN APPARATUS FOR EVAPORATING AND CONCENTRATING LIQUIDS.

Specification forming part of Letters Patent No. **112,348**, dated March 7, 1871; antedated March 1, 1871.

I, JOHN HOWARTH, of Salem, in the county of Essex and State of Massachusetts, have invented certain Improvements in Apparatus for Evaporating and Concentrating Liquids, of which the following is a specification:

Figure 1 is a side elevation of my invention. Fig. 2 is a plan view of the same. Fig. 3 is a side elevation with a section through line *xx*, Fig. 2; and Figs. 4 and 5 are sections through lines *yy* and *zz*, Fig. 2.

The object of this invention is to concentrate and evaporate liquids like brine, alum in solution, ammonia, &c., for crystallization; and it consists of a suitable tank, divided into three compartments, under two of which is a flue or passage communicating with a flue from the smoke-box of a boiler-furnace, while in the other are three or more horizontal pipes, all connected at the ends by transverse tubes, and receiving steam from a boiler by means of a suitable pipe, which steam, after circulating through said tubes, is returned in a condensed form to the boiler.

It also consists of a steam-injector placed in the flue from the smoke-box, by means of which the products of combustion from the furnace are drawn and forced through the passage under the tank and mingled with the steam.

The details of construction and method of operation will be more fully described hereinafter.

In the drawing, A represents a steam-boiler over a suitable furnace. B is a shallow tank, of any suitable material, divided into three compartments, C D E.

K represents a tapering case or flue leading from the smoke-box of boiler A to the tank B, and containing one of my injectors, G, (patented March 1, 1870,) which latter is supplied with steam from the boiler A by pipe H and valves L and J. The case or flue K opens into a passage, M, under the divisions C D of tank B. Said passage runs directly through tank B and opens at the opposite end of the same, as shown at *m*, Fig. 3.

F F F represent parallel tubes or heaters running along the bottom of division E of tank B. Said tubes are of the semi-elliptic shape in cross-section shown in Figs. 4 and 5, and

are connected at their inner ends by the shorter tubes *e*.

R represents an induction-pipe leading from the boiler A to the outer ends of pipes F, with which ends it is connected, as shown in Fig. 5. T represents an eduction-pipe leading from the inner end of one of the pipes F to a point in the boiler below the water-mark.

*n* represents a siphon-pipe, connecting divisions C and D, and O is a similar pipe, connecting divisions D and E.

### Operation.

The fluid to be concentrated is placed in a cold state in the division C of tank B, from whence it afterward flows through pipe *n* into division D. Steam being admitted to injector G through pipe H, it will be forced violently through the flue K and passage M, thereby exhausting the smoke-box of the boiler and causing the heated products of combustion to rush through the flue K and passage M around injector K, mingling with the steam and superheating it, and heating the fluid in divisions C D, that in division D receiving the most heat, being nearest the boiler and furnace.

The fluid being heated in division D to the utmost capacity of the latter, it is transferred, through pipe O, to the compartment E and on the pipes F, which are heated by the steam from pipe R. In this division the temperature of the fluid receives its highest degree, and its volatile portions are evaporated and the liquid sufficiently concentrated to be drawn off for crystallization.

After the steam from pipe R has circulated through the pipes F and become condensed it is returned through pipe T to the boiler, the pipes F being in all cases above the high-water line.

The use of steam in connection with the heated products of combustion has the important advantage of keeping the surfaces of the flues and passages through which it passes perfectly clean, preventing the accumulation of soot, especially when bituminous coal is used.

The injector in all cases keeps up a strong blast without relying on a chimney, except in first starting the fire to get up steam. After this is done the chimney-flue is closed by a

damper and all the gases are drawn through the injector, and can be forced in any direction and to any reasonable distance required.

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

1. The combination of tank B, injector K, and boiler A, substantially as described.

2. The combination of pipes or heaters F, connected as shown, pipes R T, and boiler A, substantially as described.

3. The combination of tank B, having divisions C, D, and E, connected by siphon-pipes *n o*, heaters F, and pipes R T.

4. The mode of utilizing the condensed steam used to charge the heaters F F by returning the same to the boiler after it has done

its work, by the means substantially as described.

5. The mode of employing the waste products of combustion by means of injector K in the partial evaporation of liquids in pans or divisions C and D, and completing the evaporation in the division E by the employment of the balance of steam generated through heaters F, substantially as set forth.

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

JOHN HOWARTH.

Witnesses:

CARROLL D. WRIGHT,  
CHARLES F. BROWN.